# SEDAR

Southeast Data, Assessment, and Review

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## SEDAR 28

# **Gulf of Mexico Spanish Mackerel**

Stock Assessment Report

April 2013

SEDAR
4055 Faber Place Drive, Suite 201
North Charleston, SC 29405

Please cite this document as:

SEDAR. 2013. SEDAR 28 – Gulf of Mexico Spanish Mackerel Stock Assessment Report. SEDAR, North Charleston SC. 712 pp. Available online at:

http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=28

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# Section I: Introduction

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# 1. Introduction

## 1.1 SEDAR Process Description

SouthEast Data, Assessment, and Review (SEDAR) is a cooperative Fishery Management Council process initiated in 2002 to improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and US Caribbean. The improved stock assessments from the SEDAR process provide higher quality information to address fishery management issues. SEDAR emphasizes constituent and stakeholder participation in assessment development, transparency in the assessment process, and a rigorous and independent scientific review of completed stock assessments.

SEDAR is managed by the Caribbean, Gulf of Mexico, and South Atlantic Regional Fishery Management Councils in coordination with NOAA Fisheries and the Atlantic and Gulf States Marine Fisheries Commissions. Oversight is provided by a Steering Committee composed of NOAA Fisheries representatives: Southeast Fisheries Science Center Director and the Southeast Regional Administrator; Regional Council representatives: Executive Directors and Chairs of the South Atlantic, Gulf of Mexico, and Caribbean Fishery Management Councils; and Interstate Commission representatives: Executive Directors of the Atlantic States and Gulf States Marine Fisheries Commissions.

SEDAR is organized around three workshops. First is the Data Workshop, during which fisheries, monitoring, and life history data are reviewed and compiled. Second is the Assessment process, which is conducted via a workshop and a series of webinars, during which assessment models are developed and the population model parameters are estimated using the information provided from the Data Workshop. Third and final is the Review Workshop, during which independent experts review the input data, assessment methods, and assessment products. The completed assessment, including the reports of all three workshops and all supporting documentation, is then forwarded to the Council SSC for certification as 'appropriate for management' and development of specific management recommendations.

SEDAR workshops are public meetings organized by SEDAR staff and the lead Council. Workshop participants are drawn from state and federal agencies, non-government organizations, Council members, Council advisors, and the fishing industry with a goal of including a broad range of disciplines and perspectives. All participants are expected to contribute to the process by preparing working papers, contributing, providing assessment analyses, and completing the workshop report.

SEDAR Review Workshop Panels typically consist of a chair, three reviewers appointed by the Center for Independent Experts (CIE), and one or more SSC representatives appointed by each council having jurisdiction over the stocks assessed. The Gulf stocks of Spanish mackerel and cobia in SEDAR 28 were reviewed through the CIE desk review process, wherein three reviewers received all stock assessment materials and generated individual summary reports of their findings with respect to the terms of reference.

# 2. Gulf of Mexico Spanish Mackerel Management History:

## 2.1. Fishery Management Plan and Amendments

The following summary describes only those management actions that likely affect Spanish mackerel fisheries and harvest.

*Original GMFMC FMP*:

The Fishery Management Plan for Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic (FMP) and Environmental Assessment (EA), approved in 1982 and implemented by regulations effective in February of 1983, treated king and Spanish mackerel each as one U.S. stock. Allocations were established for recreational and commercial fisheries, and the commercial allocation was divided between net and hook-and-line fishermen.

*GMFMC FMP Amendments affecting Spanish mackerel*:

| Description of Action | FMP/Amendment | Effective Date |
|---|---|---|
| Recognized two migratory groups for Gulf Spanish mackerel | CMP FMP Amendment 2 | 1987 |
| Reallocated catch equally between recreational and commercial fishermen | CMP FMP Amendment 4 | 1989 |
| Revised fishing year for Gulf group Spanish mackerel to April - March, made GMFMC responsible for pre-season changes to TAC and bag limits | CMP FMP Amendment 5 | 1990 |
| Increased income requirement for Gulf Spanish mackerel permit to 25% of earned income or $10,000 from commercial sale | CMP FMP Amendment 8 | 1998 |
| Marine reserve establishment at Tortugas North and Tortugas South off Key West, FL | CMP FMP Amendment 13 | 2002 |

*GMFMC Regulatory Amendments:*

**May 1987**:
TAC for Gulf group Spanish mackerel was set at 2.5 MP with a commercial quota of 1.4 MP and recreational allocation for 1.1 MP. The bag limit for Spanish mackerel was set at 3 fish.

**May 1988**:
The TAC for Gulf group Spanish mackerel was increased to 5.0 MP allocated 43% to recreational sector and 57% to commercial sector. The Spanish mackerel bag limit was set at 4 fish off Florida and 10 fish off AL-TX.

**May 1989**:
The TAC for Gulf group Spanish mackerel was increased to 5.25 MP. The allocation ratio between commercial (57%) and recreational (43%) remained unchanged as did the bag limit.

**May 1990**:
The TAC (5.25 MP) for Gulf group Spanish mackerel was unchanged. The bag limits for Spanish mackerel were changed to 4 fish off FL, 3 fish off TX, and 10 Fish off AL-LA at the request of the states.

**May 1991**:
The TAC for Gulf group Spanish mackerel was increased to 8.6 MP and the bag limit modified to 3 fish off TX, 5 fish off FL, and 10 fish off AL-LA. The amendment also set the overfishing thresholds at 30% SPR (SSBR).

**May 1992**:
The TAC for Gulf group Spanish mackerel remained at 8.6 MP. The bag limits were increased to 7 fish off TX, and 10 fish off FL-LA.

**May 1996**:
TAC for Gulf group Spanish mackerel was reduced to 7.0 MP and bag limits were maintained.

**July 1999**:
The TAC for Gulf group Spanish was changed from 7.0 million pounds to 9.1 million pounds, and the bag limit for Gulf group Spanish was increased from 10 to 15 fish per person per day.

**May 2003**:
The 2003 regulatory amendment, implemented on May 14, 2003, establishes definitions of maximum sustainable yield (MSY), optimum yield (OY), the overfishing threshold, and the overfished condition for Cobia and Gulf group king and Spanish mackerel.

## 2.2. Management Program Specifications

**Table 2.2.1. General Management Information**

Gulf of Mexico

| | |
|---|---|
| Species | Spanish mackerel |
| Management Unit | Southeastern US |
| Management Unit Definition | All waters Dade/Monroe county to Texas within Gulf of Mexico Fishery Management Council Boundaries |
| Management Entity | Gulf of Mexico Fishery Management Council |
| Management Contacts<br>SERO / Council | Ryan Rindone<br>Sue Gerhart |
| Current stock exploitation status | Not undergoing overfishing/not overfished |
| Current stock biomass status | 17.96 trillion eggs (2003 Gulf MSAP Report) |

**Table 2.2.2. Specific Management Criteria**

| Criteria | Gulf of Mexico - Current (2002/03) | | Gulf of Mexico - Proposed | |
|---|---|---|---|---|
| | Definition | Value | Definition | Value |
| MSST | $(1\text{-}M)*SSB_{MSY}$ | 13.40 trillion eggs | $(1\text{-}M)*SSB_{MSY}$ | SEDAR 28 |
| MFMT | $F_{MSY}$ | Not specified | $F_{MSY}$ | SEDAR 28 |
| MSY | Yield at $F_{MSY}$ | Not Specified | Yield at $F_{MSY}$ | SEDAR 28 |
| $F_{MSY}$ | $F_{30\%SPR}$ | Not specified | $F_{MSY}$ | SEDAR 28 |
| OY | Equil. Yield @ 75% of $F_{30\%SPR}$ | Not Specified | Equil. Yield @ 75% of $F_{30\%SPR}$ | SEDAR 28 |
| $F_{OY}$ | 75% of $F_{30\%SPR}$ | 0.40 | $F_{OY}$ = 65%,75%, 85% $F_{MSY}$ | SEDAR 28 |
| M | n/a | 0.30 | M | SEDAR 28 |

NOTE: “Proposed” columns are for indicating any definitions that may exist in FMPs or amendments that are currently under development and should therefore be evaluated in the current assessment. “Current” is those definitions in place now. Please clarify whether landings parameters are ‘landings’ or ‘catch’ (Landings + Discard). If ‘landings’, please indicate how discards are addressed.

**Table 2.2.3. Stock projection information**.

Gulf of Mexico

| Requested Information | Value |
|---|---|
| First Year of Management | 2013 |
| Projection Criteria during interim years should be based on (e.g., exploitation or harvest) | Fixed Exploitation |
| Projection criteria values for interim years should be determined from (e.g., terminal year, avg of X years) | Average of previous 3 years |

*Fixed Exploitation would be $F=F_{MSY}$ (or $F<F_{MSY}$) that would rebuild overfished stock to $B_{MSY}$ in the allowable timeframe. Modified Exploitation would be allow for adjustment in $F<=F_{MSY}$, which would allow for the largest landings that would rebuild the stock to $B_{MSY}$ in the allowable timeframe. Fixed harvest would be maximum fixed harvest with $F<=F_{MSY}$ that would allow the stock to rebuild to $B_{MSY}$ in the allowable timeframe.

Projections:

Project future stock conditions and develop rebuilding schedules if warranted, including estimated generation time. Develop stock projections in accordance with the following:

A) If stock is overfished:

$F=0$, $F_{Current}$, $F_{MSY}$, $F_{OY}$ ($F_{OY}$=65%, 75%, 85% $F_{MSY}$)
$F=F_{Rebuild}$ (max that permits rebuild in allowed time)

B) If stock is undergoing overfishing:

$F = F_{Current}, F_{MSY}, F_{OY}$

C) If stock is neither overfished nor undergoing overfishing:

$F = F_{Current}, F_{MSY}, F_{OY}$

D) If data limitations preclude classic projections (i.e. A, B, C above), explore alternate models to provide management advice

**Table 2.2.4. Quota Calculation Details**

If the stock is managed by quota, please provide the following information

| | |
|---|---|
| Current Quota Value | 9.1 mp |
| Next Scheduled Quota Change | Not specified |
| Annual or averaged quota ? | Annual |
| If averaged, number of years to average | n/a |
| Does the quota include bycatch/discard ? | Not specified |

## 2.3. Management and Regulatory Timeline

The following tables provide a timeline of Federal management actions by fishery.

**Table 2.3.1. Annual Commercial Spanish Mackerel Regulatory Summary**

| | Fishing Year | Size Limit | Possession Limit | Open date | Close date | Other |
|---|---|---|---|---|---|---|
| 1983 | Calendar Year | None | None set | | | |
| 1984 | " | " | " | | | |
| 1985 | " | " | " | | | |
| 1986 | " | " | " | | | |
| 1987 | " | ' | quota of 1.40 MP | | | |
| 1988 | " | " | quota of 2.85 MP | | | |
| 1989 | " | " | quota of 2.99 MP | | | |
| 1990 | " | " | " | | | |
| 1991 | " | " | quota of 4.90 MP | | | |
| 1992 | " | " | " | | | |
| 1993 | April 1 - March 31 | 12" Fork Length | None | April 1 | March 31 | |
| 1994 | " | " | " | " | " | |
| 1995 | " | " | " | " | " | |
| 1996 | " | " | quota of 3.99 MP | " | " | |
| 1997 | " | " | " | " | " | |
| 1998 | " | " | " | " | " | |
| 1999 | " | " | quota of 5.187 MP | " | " | |
| 2000 | " | " | " | " | " | |
| 2001 | " | " | " | " | " | |
| 2002 | " | " | " | " | " | |
| 2003 | " | " | " | " | " | |
| 2004 | " | " | " | " | " | |
| 2005 | " | " | " | " | " | |
| 2006 | " | " | " | " | " | |
| 2007 | " | " | " | " | " | |
| 2008 | " | " | " | " | " | |
| 2009 | " | " | " | " | " | |
| 2010 | " | " | " | " | " | |
| 2011 | " | " | " | " | " | |

**Table 2.3.2. Annual Recreational Spanish Mackerel Regulatory Summary**

| | Fishing Year | Size Limit | Bag Limit | Open date | Close date | Other |
|---|---|---|---|---|---|---|
| 1983 | Calendar Year | Not specified | 3 fish/person/day | " | " | |
| 1984 | " | " | " | " | " | |
| 1985 | " | " | " | " | " | |
| 1986 | " | " | " | " | " | |
| 1987 | " | " | " | " | " | |
| 1988 | " | " | FL: 4 fish/person/day<br>AL-TX: 10 fish/person/day | " | " | |
| 1989 | " | " | " | " | " | |
| 1990 | " | " | FL: 4 fish/person/day<br>AL-LA: 10 fish/person/day<br>TX: 3 fish/person/day | " | " | |
| 1991 | " | " | FL: 5 fish/person/day<br>AL-LA: 10 fish/person/day<br>TX: 3 fish/person/day | " | " | |
| 1992 | " | " | FL-LA: 10 fish/person/day<br>TX: 7 fish/person/day | " | " | |
| 1993 | April 1 - March 31 | 12" Fork Length | " | April 1 | March 31 | |
| 1994 | " | " | " | " | " | |
| 1995 | " | " | " | " | " | |
| 1996 | " | " | " | " | " | |
| 1997 | " | " | " | " | " | |
| 1998 | " | " | " | " | " | |
| 1999 | " | " | All: 15 fish/person/day | " | " | |
| 2000 | " | " | " | " | " | |
| 2001 | " | " | " | " | " | |
| 2002 | " | " | " | " | " | |
| 2003 | " | " | " | " | " | |
| 2004 | " | " | " | " | " | |
| 2005 | " | " | " | " | " | |
| 2006 | " | " | " | " | " | |
| 2007 | " | " | " | " | " | |
| 2008 | " | " | " | " | " | |
| 2009 | " | " | " | " | " | |
| 2010 | " | " | " | " | " | |
| 2011 | " | " | " | " | " | |

## 3. Assessment History and Review

Full stock assessments of the Gulf of Mexico Spanish mackerel were conducted by Powers et al. (1996), Legault et al. (1998) and the Sustainable Fisheries Division (2003).

Historically, the Mackerel Stock Assessment Panel (MSAP) met regularly to oversee and review these assessments and to provide advice to the SAFMC and GMFMC. The most recent full stock assessment for Gulf of Mexico Spanish mackerel was conducted in 2003 through the Mackerel Stock Assessment Panel (MSAP), which included data through the 2001/2002 fishing year and presented projections through 2002/2003 (Sustainable Fisheries Division 2003). The model used in the 2003 assessment was an age based virtual population analysis procedure (Ortiz et al. 2002) calibrated to standardized fishery specific abundance indices. Uncertainty was incorporated into model estimates using a mixed Monte Carlo Bootstrap approach that accounted for variability in natural mortality, abundance indices, and estimated catch at age inputs. Based on MSAP recommendations, the Councils adopted $F_{30\%SPR}$ as the maximum fishing mortality threshold (MFMT). The proxy for maximum sustainable yield (MSY) for a given stock is computed as the long-term yield at $F_{30\%SPR}$ when the stock is at equilibrium. Following the Technical Guidelines, the MSAP recommended adopting $(1.0 - M)*B_{MSY}$ as the minimum stock size threshold (MSST) for all four migratory groups, which has been accepted by both councils.

The 2003 stock assessment indicated that the median estimate of $F/F_{MSY}$ for Gulf Spanish mackerel was 0.53 in fishing year 2002/03 and the percentage of estimated $F_{2002/03}/F_{MSY}$ greater than 1.0 was 9% (n = 44 of 500 bootstraps). Based on the acceptable risk level chosen by the GMFMC, that there should be no greater than a 50% probability that current F exceeds MFMT, the MSAP's estimation is that overfishing was not occurring in 2002/03 for Gulf Spanish mackerel.

The median estimate of $B_{2003}/B_{MSY}$ for Gulf Spanish mackerel was 1.34 and the estimated percentage of $B_{2003}$ less than MSST was 3% (n = 16 of 500 bootstraps). Based on the acceptable risk level chosen by the GMFMC, that there should be no greater than a 50% probability that current B is less than MSST, the MSAP's estimation is that Gulf Spanish mackerel were not overfished in 2002/03. Estimated spawning stock size continued to increase in 2002/2003.

<u>References Cited</u>:

Legault, C.M., N. Cummings and P. Phares. 1998. Stock assessment analyses on Atlantic migratory group king mackerel, Gulf of Mexico migratory group king mackerel, Atlantic migratory group Spanish mackerel, and Gulf of Mexico migratory group Spanish mackerel. NMFS SEFSC Miami Sustainable Fisheries Division Contribution MIA-97/98-15.

Ortiz, M., G. P. Scott, N. J. Cummings, and P. Phares. 2002. Stock Assessment Analyses on Gulf of Mexico King Mackerel. SFD Contrib. SFD-01/02-161, 56 pp.

Powers, J.E., N. Cummings, and P. Phares. 1996. Stock assessment analyses on Gulf of Mexico migratory group Spanish mackerel, and Atlantic migratory group Spanish mackerel. NMFS SEFSC Miami Sustainable Fisheries Division Contribution MIA-95/96-11.

Powers, J.E. and V.R. Restrepo. 1992. Additional options for age-sequenced analysis. ICCAT Coll. Vol. Sci. Pap. 39:540-553.

Restrepo, V.R. 1996. FADAPT 3.0 A Guide. University of Miami, Cooperative Unit for Fisheries Research and Education (CUFER), Miami, FL. December 2012 South Atlantic Spanish mackerel.

Sustainable Fisheries Division. 2003. Stock assessment analyses on Spanish and king mackerel stocks. NMFS SEFSC Miami Sustainable Fisheries Division Contribution SFD-2003-0008, 147 pp.

# 4. Regional Maps

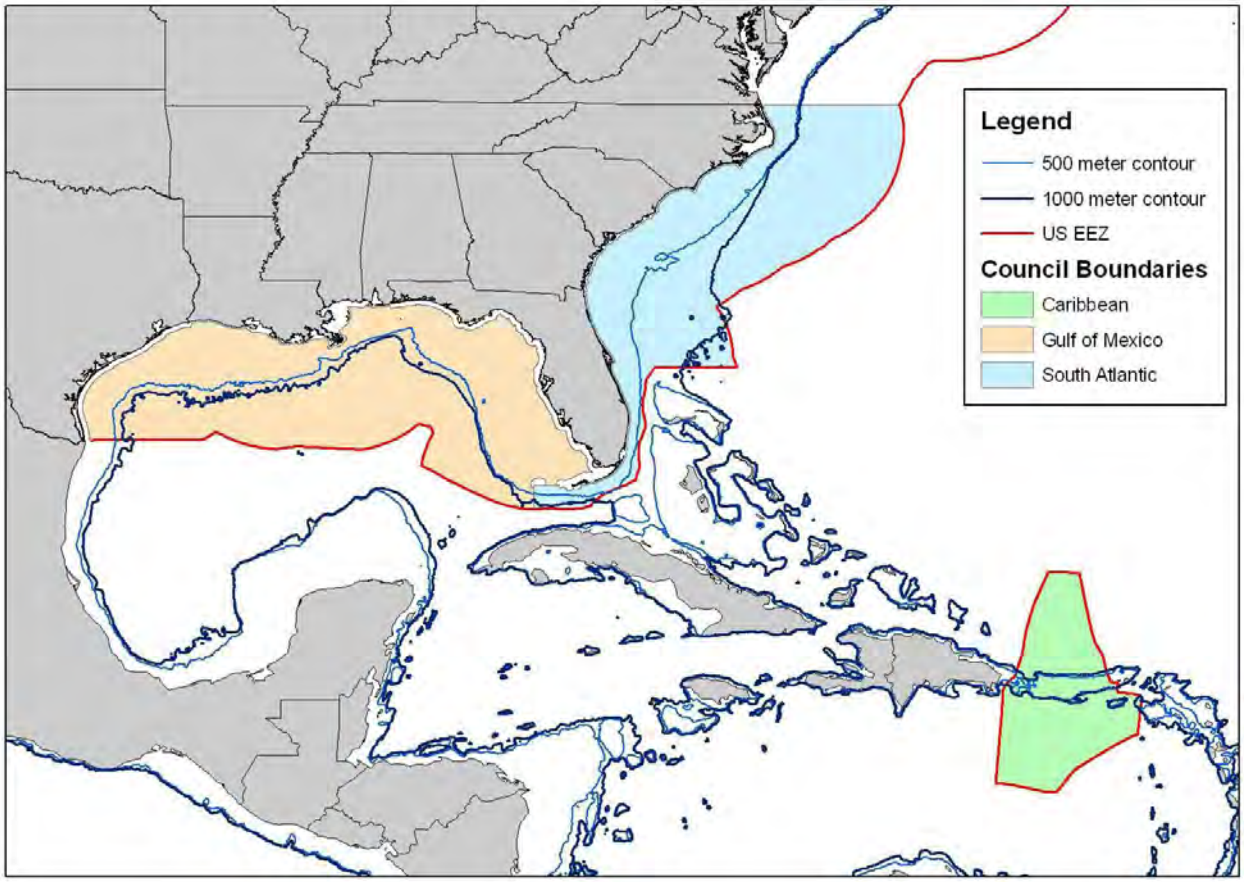


Figure 4.1: South Atlantic, Gulf of Mexico, and Caribbean Fishery Management Council boundaries, and United States EEZ.

## 5. Assessment Summary Report

The Assessment Summary Report provides a broad but concise view of the 2012 Gulf of Mexico Spanish mackerel (*Scomberomorus maculatus*) stock assessment (SEDAR 28). It recapitulates: (a) the information available to and prepared by the Data Workshop (DW); (b) the application of those data, development and execution of assessment models, and identification of a preferred model configuration by the Assessment Workshop (AW); and (c) the findings and advice determined during the CIE desk review performed in lieu of an in-person Review Workshop.

**Executive Summary**

The Gulf of Mexico Spanish mackerel stock assessment presented by the SEDAR 28 Assessment Workshop (AW) Panel was provided as a desk review to three reviewers from the Center for Independent Experts (CIE) with outputs and results. Each reviewer conducted an evaluation of the material and produced an independent review report. The modeling environment used was Stock Synthesis (SS) (Methot 2010) version 3.24h (beta). No clear status determination can be made from the assessment, as the independent reviewers differed on the appropriateness of the assessment for making such determinations.

**Stock Status and Determination Criteria**

Due to a lack of consensus amongst the CIE reviewers responsible for evaluating the assessment, point estimates of population benchmarks cannot be provided at this time. A phase plot of the recommended preferred base model run from the AW Panel (SS Model Run #3) and associated sensitivities analyses is provided in Figure 5.7.

**Stock Identification and Management Unit**

The Atlantic and Gulf of Mexico stocks were split along SAFMC/GMFMC jurisdictions. The Atlantic stock consists of all fish caught south of highway US 1 through the Florida Keys, northward along the east coast of Florida to Maine. Based on electrophoresis studies, spawning locations, stock distribution patterns, and catch history, Amendment 2 to the Coastal Pelagics FMP designated two groups of Spanish mackerel. For SEDAR 28 it was agreed that fish landed north of US Highway 1 in Monroe County Florida were part of the Gulf of Mexico stock and fish landed south of US Highway 1 were part of the Atlantic stock. This reflects a change from SEDAR 17 where data were split at the Dade-Monroe County line. This change was recommended as the oceanographic split and most efficient for splitting commercial data. It was acknowledged by the SEDAR 28 DW Panel that there was little biological evidence for either the Council Boundary or Dade-Monroe County line as the stock division.

**Assessment Methods**

The primary assessment model selected for the Gulf of Mexico Spanish mackerel stock evaluation assessment was Stock Synthesis (Methot 2010) version 3.24h (beta). Stock Synthesis has been widely used and tested for assessment evaluations, particularly in the US west coast NMFS centers (Methot 2010). Descriptions of SS algorithms and options are available in the SS user's manual (Methot 2010) and at the NOAA Fisheries Toolbox website (http://nft.nefsc.noaa.gov/). During the course of the SEDAR 28 assessment the lead analysts collaborated frequently with the model developer (Rick Methot, personal communication) on a variety of model issues, but particularly on the handling of discards in the model.

The r4ss software (www.cran.r-project.org/web/packages/**r4ss**/index.html) was utilized extensively to develop various graphics for SS outputs and also was used to summarize various SS output files and to initially conduct parametric bootstrapping.

The "Fishery Simulation" Graphics User Interface (GUI) tool developed by Lee et al. (2012) (see https://fisherysimulation.codeplex.com/) was used to characterize uncertainty in final model estimates and projections of future caches for a variety of alternative scenarios recommended by the Assessment Panel (AP). This tool is based on parametric bootstrap analyses used with SS (Methot 2011). Applications of the method to fisheries evaluations using SS are described in Lee et al. 2011, Piner et al. 2011, and Lee et al. 2012.

**Assessment Data**

The SS model was fitted to landings, discards, length composition, conditional age-length observations, and indices of abundance. These categories of data included: annual landings (metric tons), directed fishery discards (recreational and commercial fractions entered as super periods), shrimp fishery bycatch (dead discards as numbers in 1,000s ), and standardized indices of relative abundance (recreational (MRFSS), commercial line gear fishery (FWC Vertical line fishery), SEAMAP Independent fishery trawl survey, and a time series of estimated shrimping effort (shrimp fishery)) (Figure 5.4). Although annual estimates of release mortality were not available, some information was available to characterize relative amounts of dead discards from directed commercial line gear and all recreational mode fisheries as described in the SEDAR 28 DW report.

**Release Mortality**

The SEDAR 28 DW Panel noted that "Commercial discards and shrimp bycatch are based on estimated encounter rates and effort. In years when multi-year averages are used to compute encounter rates, these estimates do not account for year-specific age structure, nor do these estimates account for variability in seasonal movements between areas in the Spanish mackerel stock". In addition, the SEDAR 28 DW Panel noted that other factors contributing to uncertainty in commercial discards were from low coverage of the logbook survey. Shrimp fishery discards in particular had low encounter rates of Spanish mackerel, thus estimation was hampered by dealing with a large number of "zero" observations. These concerns provide additional support to the use of super periods in the SS model to characterize the magnitude of removals. The discard mortality rate in the base model was assumed to be 20% for the recreational and 10% for the commercial fisheries as recommended by the DW Panel. The preferred base model as chosen by the AW Panel (SS Model Run #3) was not sensitive to increasing discard mortality rates to 40% for the recreational fishery or to 20% for the commercial fishery.

**Catch Trends**

The Spanish mackerel directed fishery has been dominated primarily by the recreational fleet in recent years. Recreational landings peaked in both the mid 1980s and the early 2000s, and have since declined. Prior to the 1980s, the commercial gill net fishery was a substantial source of directed fishery mortality. Commercial gill netting and vertical line fishing peaked around 1970, then decreased rapidly after. Bycatch from the shrimp fishery increased from the 1950s through the early 1990s, and has since declined in recent years (Figure 5.5).

**Fishing Mortality Trends**

Exploitation rate was used as the proxy for annual fishing mortality rate. Predicted annual fishing mortality estimates show flat and low levels of F through the late 1940s. Between the early 1950s and continuing through the mid 1980s, steady increasing trends in F are predicted. Since the mid 1980s estimated total annual F for respective fleets has continued to decline (Figures 5.1, 5.9).

**Stock Abundance and Biomass Trends**

Spawning biomass (Figure 5.2) and total biomass (Figure 5.3) show steady trends from the late 1880s through the early 1940s. Substantial declines in biomass are evident beginning in the late 1940s and continuing through the late 1980s. Increases in total and spawning stock biomass are predicted by SS beginning in the late 1990s (also see Figure 5.8).

**Scientific Uncertainty**

Estimated standard errors from the bootstrap analysis are generally low for most parameters estimated in the stock assessment, indicating that precision of parameters estimated is reasonable. Annual estimated asymptotic errors for the annual recruitment deviations ranged from 0.05 to 0.11 over the time series. In general, many of the standard errors associated with selectivity parameters had standard errors larger than 0.25.

Stock Synthesis provides for characterizing the uncertainty in important model parameters through an internal procedure (profiling). Through this procedure the model is implemented multiple times, fixing the parameter of interest to some assumed value. Profiling of steepness and virgin stock level (R0), and the recruitment standard deviation (∑R SS parameter) was conducted because of the concerns around estimating steepness. Results did not indicate any major deviance from the input value specified for the ∑R parameter (0.7), thus this model parameter value was not further adjusted. Bootstrapping results show that SS had difficulties in estimating steepness for the Gulf of Mexico Spanish mackerel stock. The model-estimated steepness was 0.52; the bootstrap summary estimated a range of steepness from about 0.4 to 1.0, hitting the upper bound on about 37% of the bootstrap runs. The SEDAR 28 AP thought that a steepness of around 0.5 was not reasonable for this species.

Key model output quantities were examined including: 1) total biomass (virgin, current biomass); 2) spawning biomass (virgin, current); and 3) recruitment (virgin, current). The trend results suggested that the model was insensitive to input assumptions regarding the level of natural mortality at age. The exception, however, is for the low natural mortality level scenario (M = 0.27) which results in higher levels of virgin biomass. Estimated virgin total and virgin recruitment for the scenarios assuming the low value of the range suggested a very different level of virgin biomass than either for the Run 3 model input value (0.38 into the Lorenzen function) or for the model assuming the high end of the range (0.49) input into the Lorenzen function. Neither varying the input level of M from the initial base level (0.38) nor changing the scaling reference age from age 4 to age 3 altered the SS estimated current stock status from that of the Run 3 model relative to SPR30%.

When either reweighting of indices or length or age composition data were incorporated into the model, little change in resulting estimates of biomass or recruitment of Spawning Potential Ratio (SPR) were predicted. Exclusion of individual indices of abundance (MRFS, FWC Trip Ticket, SEAMAP Survey) from the model also did not alter the perception of current stock status from Run 3 relative to SPR30%, and neither did increasing the level of discard mortality from 10% to 20% for the commercial vertical line fishery or from 20% to 40% for the recreational fishery.

**Significant Assessment Modifications**

The greatest change from the 2003 MSAP assessment for Gulf of Mexico Spanish mackerel was the transition to Stock Synthesis from the previously used age based virtual population analysis. Additional diagnostics were also performed, including retrospective analyses, likelihood profiling, and jittering exercises. The jittering and profiling exercises were used to diagnose the model stability and ability to reach a similar solution on parameter estimates over varying inputs.

Discards were incorporated into the assessment using the SS super period method. This is a departure from previous stock evaluations for this species as to the approach in which discards have been analytically incorporated into the population model, for both the shrimp bycatch fishery and the directed fishery.

**Sources of Information**

The contents of this summary report were taken from the SEDAR 28 Gulf of Mexico Spanish mackerel data, assessment, and CIE review reports.

**Figures**

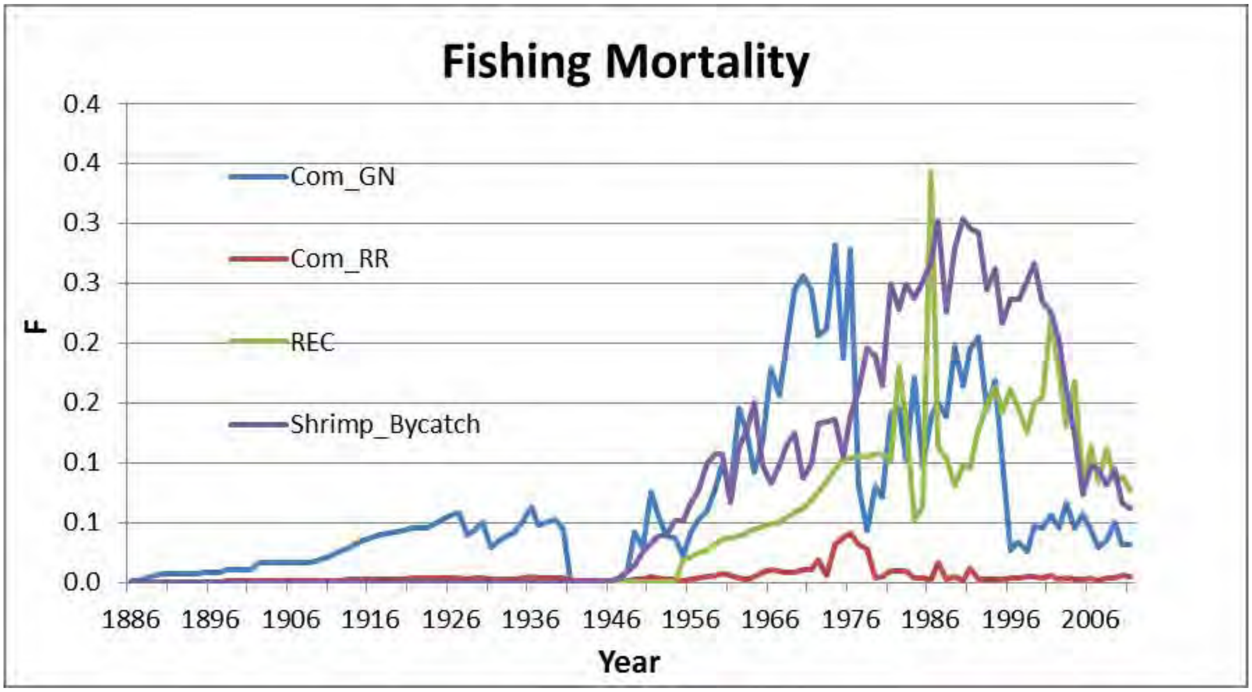


Figure 5.1. Fleet-specific continuous fishing mortality (AW Panel Preferred SS Model Run #3: M = 0.38 $y^{-1}$, steepness = 0.8).

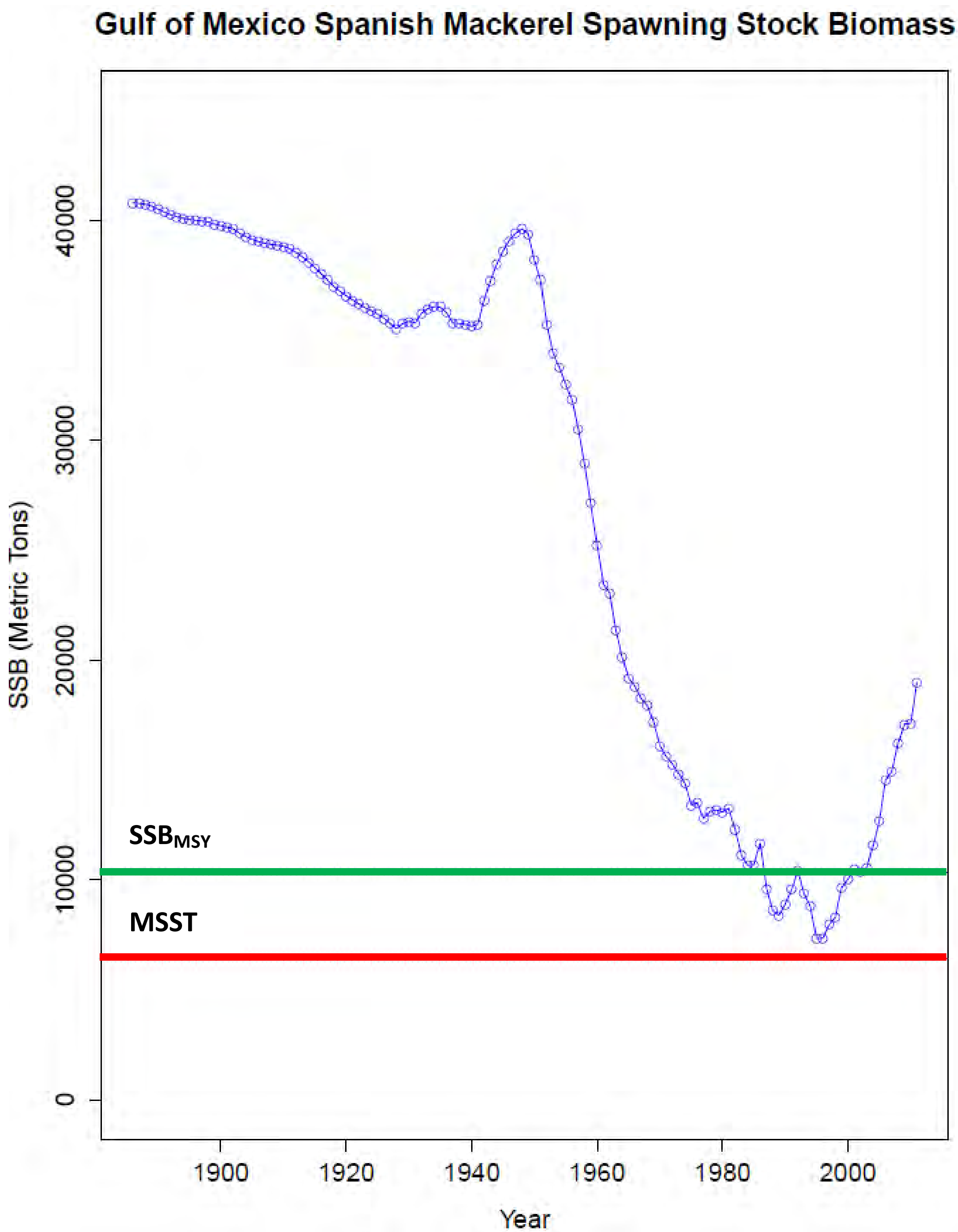


Figure 5.2. SS predicted spawning biomass for Gulf of Mexico Spanish mackerel from SS for AW Panel Preferred SS Model Run #3 (steepness = 0.8 and M = 0.38). Units are in metric tons whole weight. The green line indicates $SSB_{MSY}$, and the red line indicates MSST.

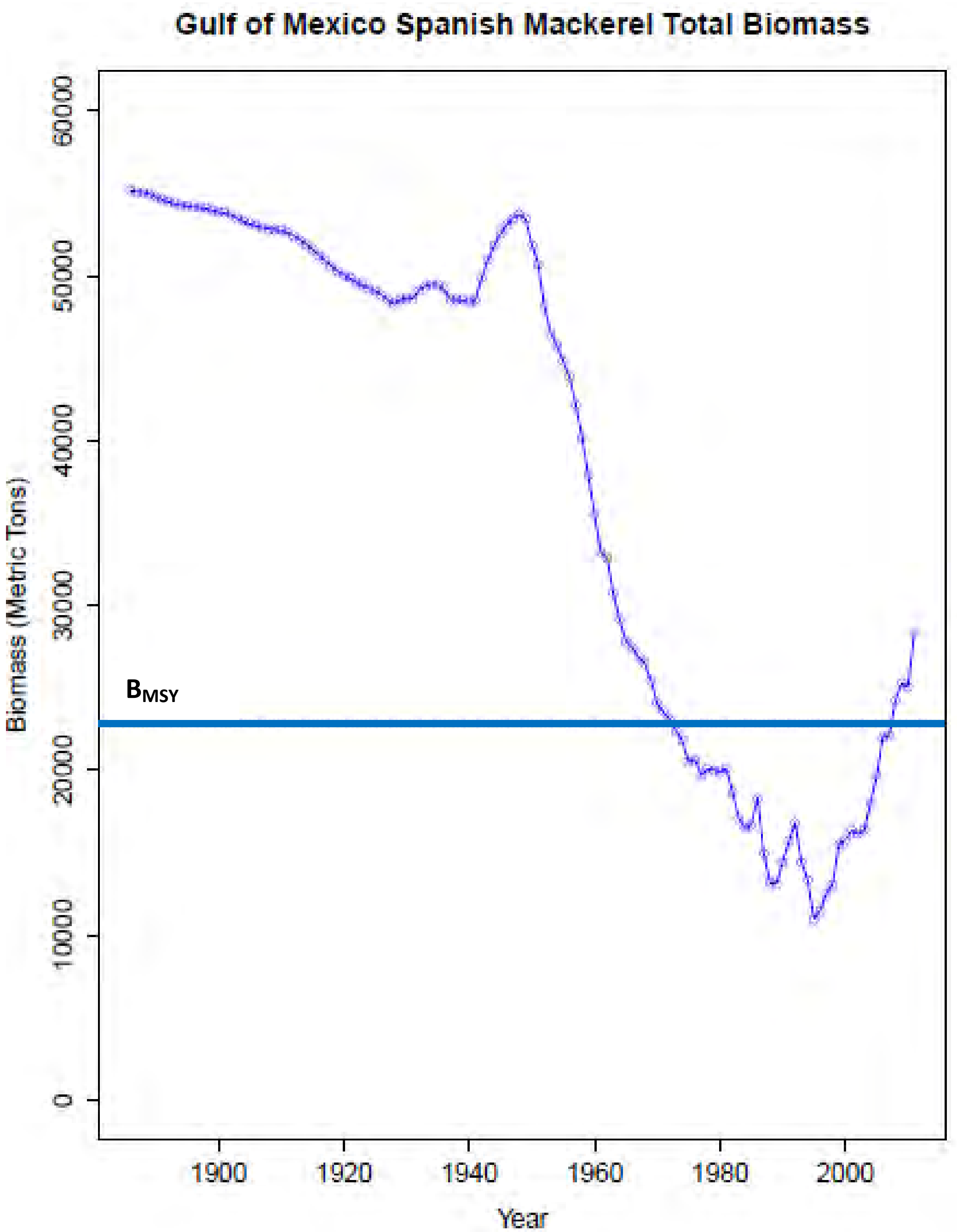


Figure 5.3. SS predicted total biomass for Gulf of Mexico Spanish mackerel for AW Panel Preferred SS Model Run #3 (steepness =0.8 and M = 0.38). Units are in metric tons whole weight. The blue line indicates projected $B_{MSY}$.

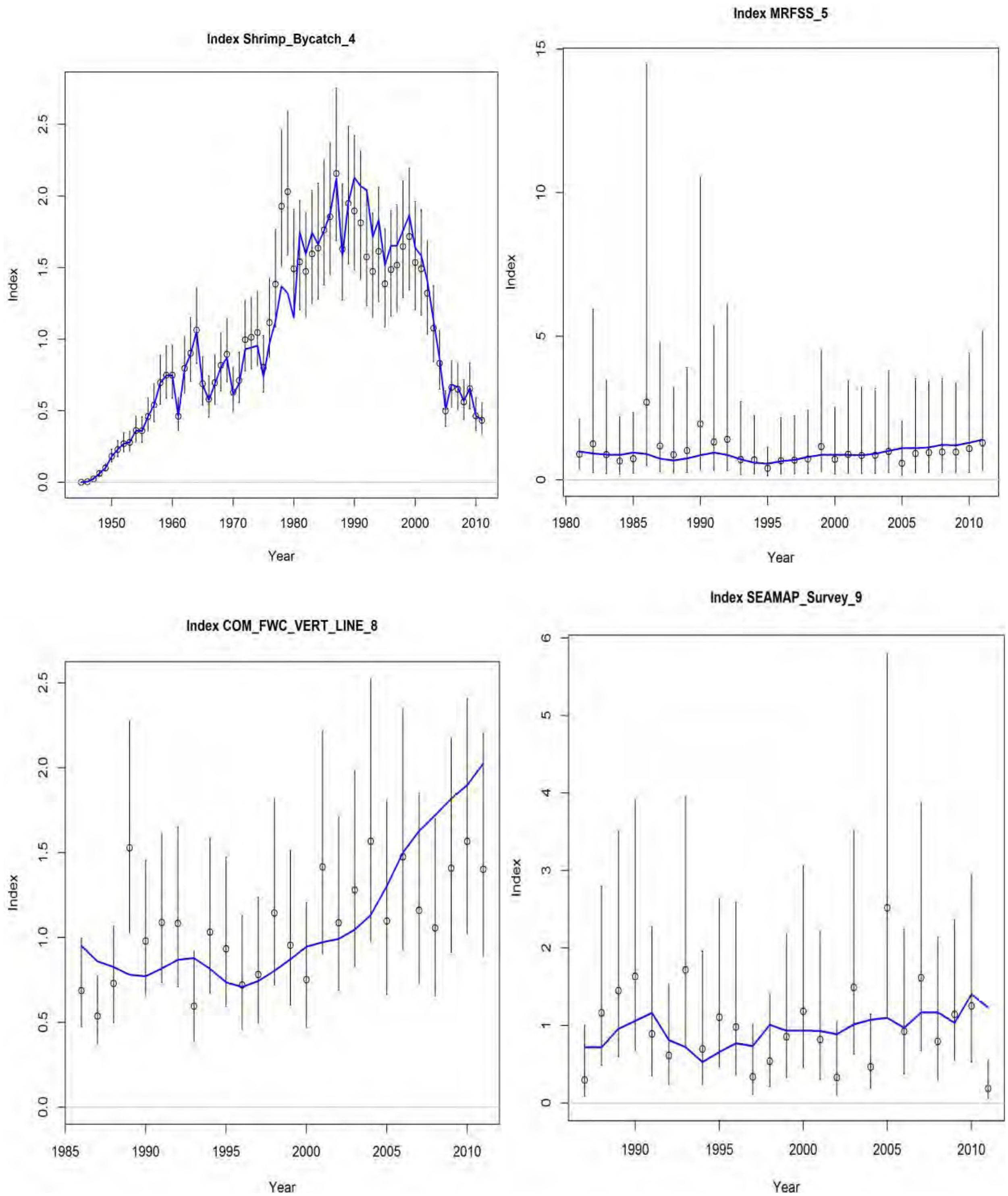


Figure 5.4. Observed and predicted index of CPUE for Gulf of Mexico Spanish mackerel from AW Panel Preferred SS Model Run #3. Indices include the shrimp fishery effort series (Shrimp_Bycatch_4), the recreational (MRFSS), the commercial line gear (COM_FWC_ VERT_Line), and the SEAMAP trawl survey (SEAMAP_Survey). Error bars represent the observed log-scale standard errors.

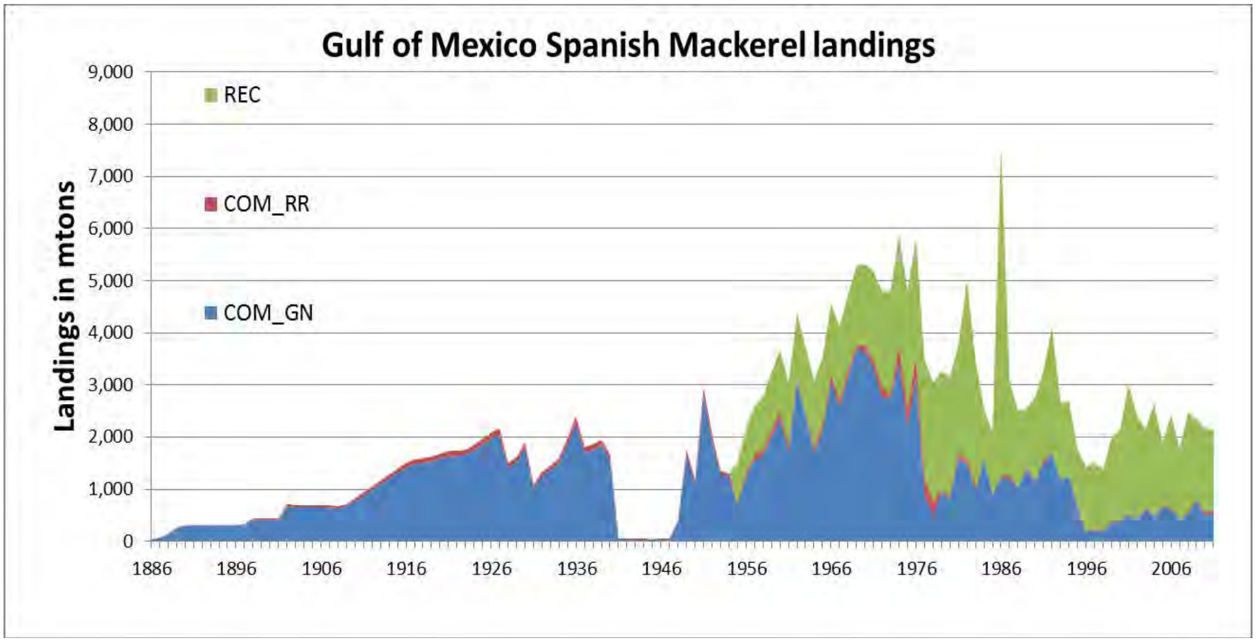


Figure 5.5. Combined landings (mtons, whole weight) for Gulf of Mexico Spanish mackerel. Landings are partitioned into three fisheries: commercial gillnet (COM_GN), commercial line gears (COM_RR), and recreational modes combined (REC=charter, private angler, shore and headboat).

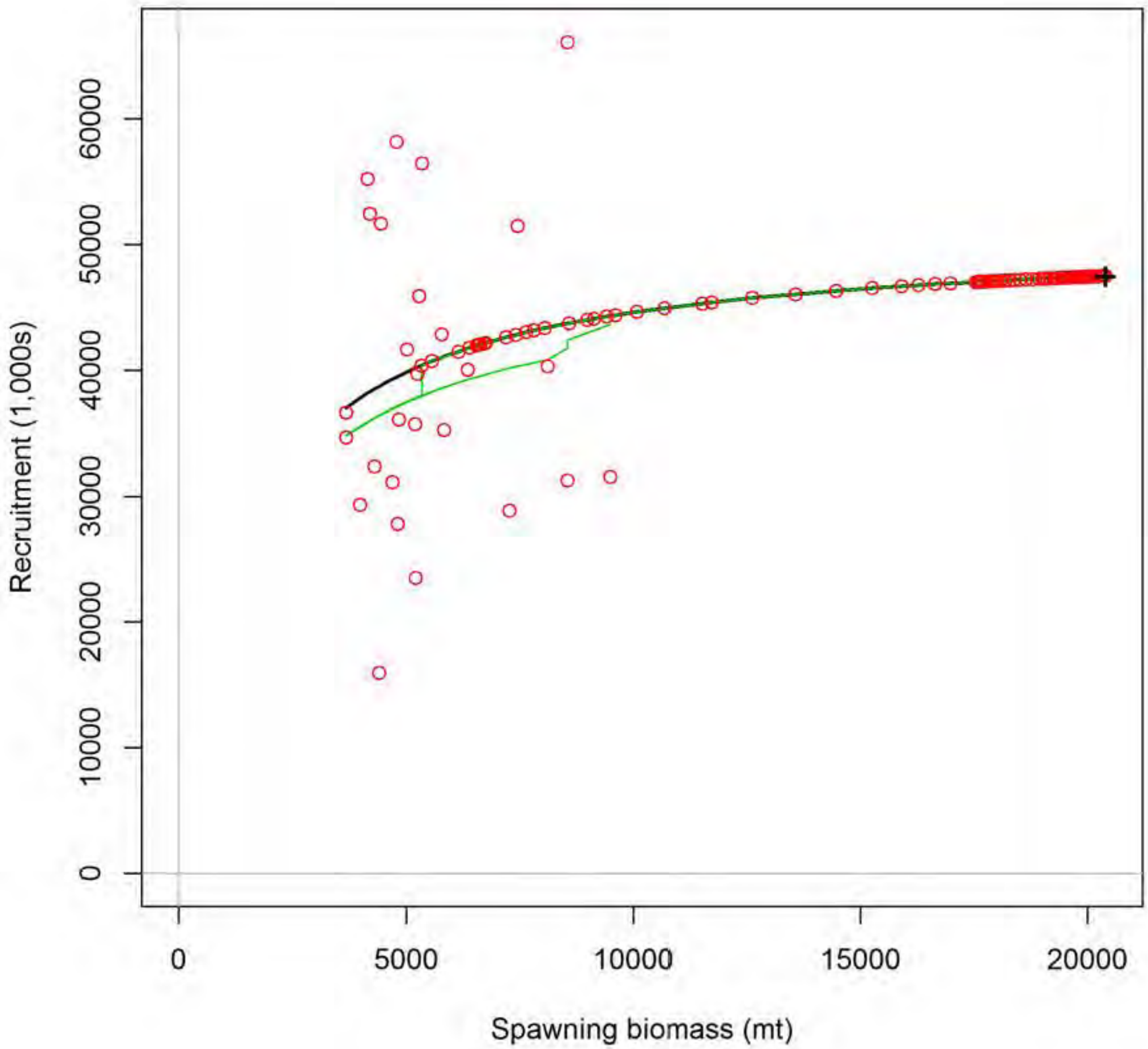


Figure 5.6. Predicted stock-recruitment relationship for Gulf of Mexico Spanish mackerel from AW Panel Preferred SS Model Run #3 (M = 0.38 $y^{-1}$ and steepness = 0.8). Plotted are predicted annual recruitments from SS (circles), expected recruitment from the stock recruit relationship (green line), and bias adjusted recruitment from the stock-recruit relationship (black line). Labels included on first, last, and years with (log) deviations > 0.5.

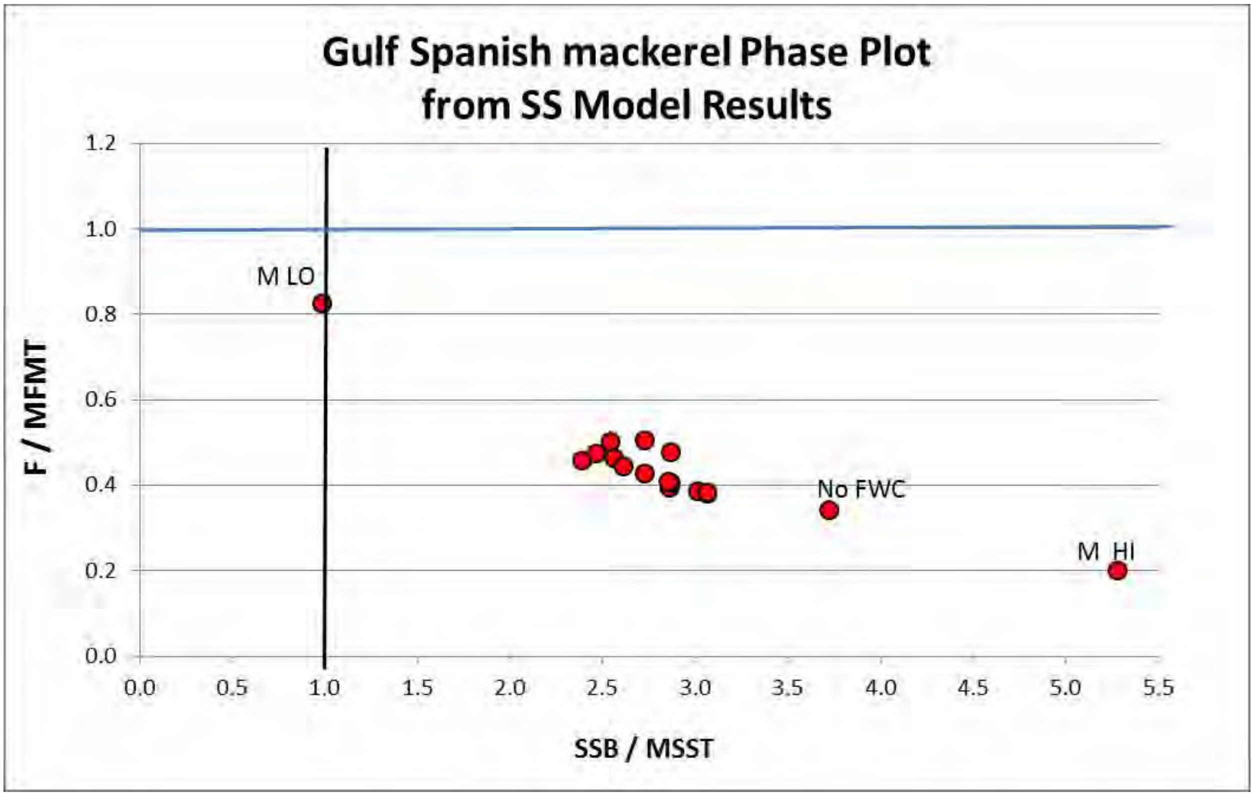


Figure 5.7. Phase plot of AW Panel Preferred SS Model Run #3 estimates of SSB/MSST and F/MFMT benchmarks for Gulf of Mexico Spanish mackerel, including sensitivities. $SSB_{Ratio}$ = $SSB_{2011}$ / MSST. MSST = (1-M) * $SSB_{MSY}$, where $SSB_{MSY}$ = SSB @ $F_{30\%SPR}$. MFMT = $F_{30\%SPR}$.

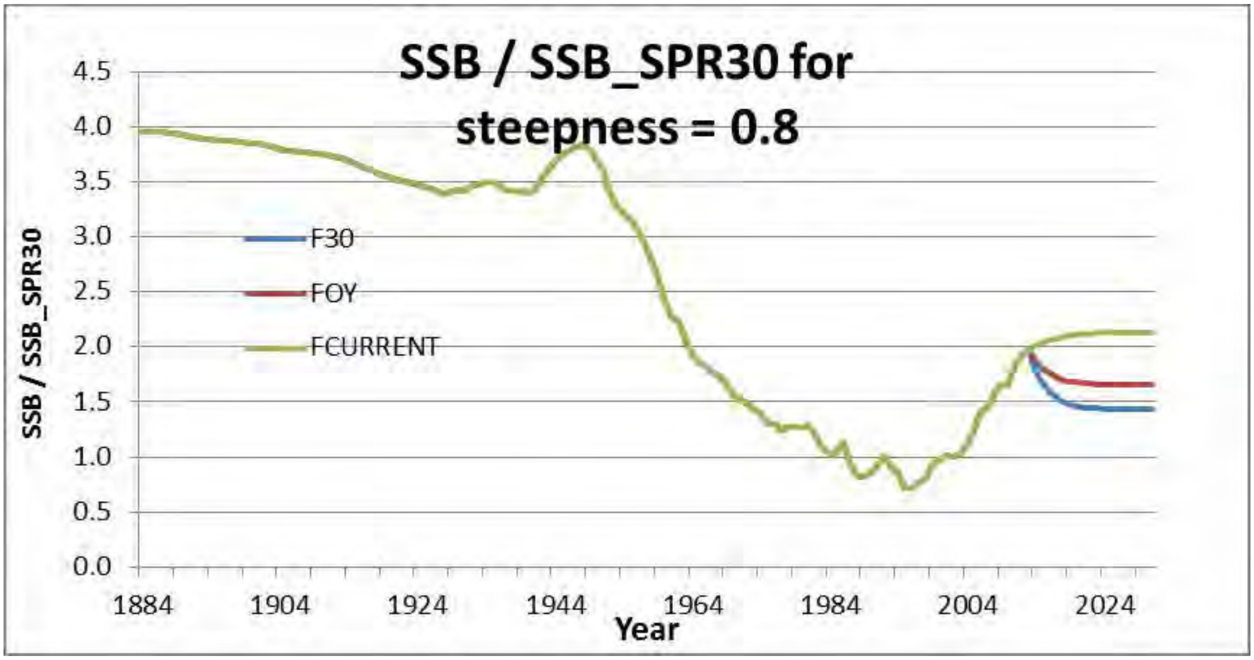


Figure 5.8. Predicted spawning biomass (SSB) relative to $F_{30\%SPR}$ for AW Panel Preferred SS Model Run #3 under three fishing mortality scenarios: $F_{Current}$, $F_{SPR30\%}$, and $F_{OY}$. All scenarios assumed M = 0.38$y^{-1}$ in the input Lorenzen function.

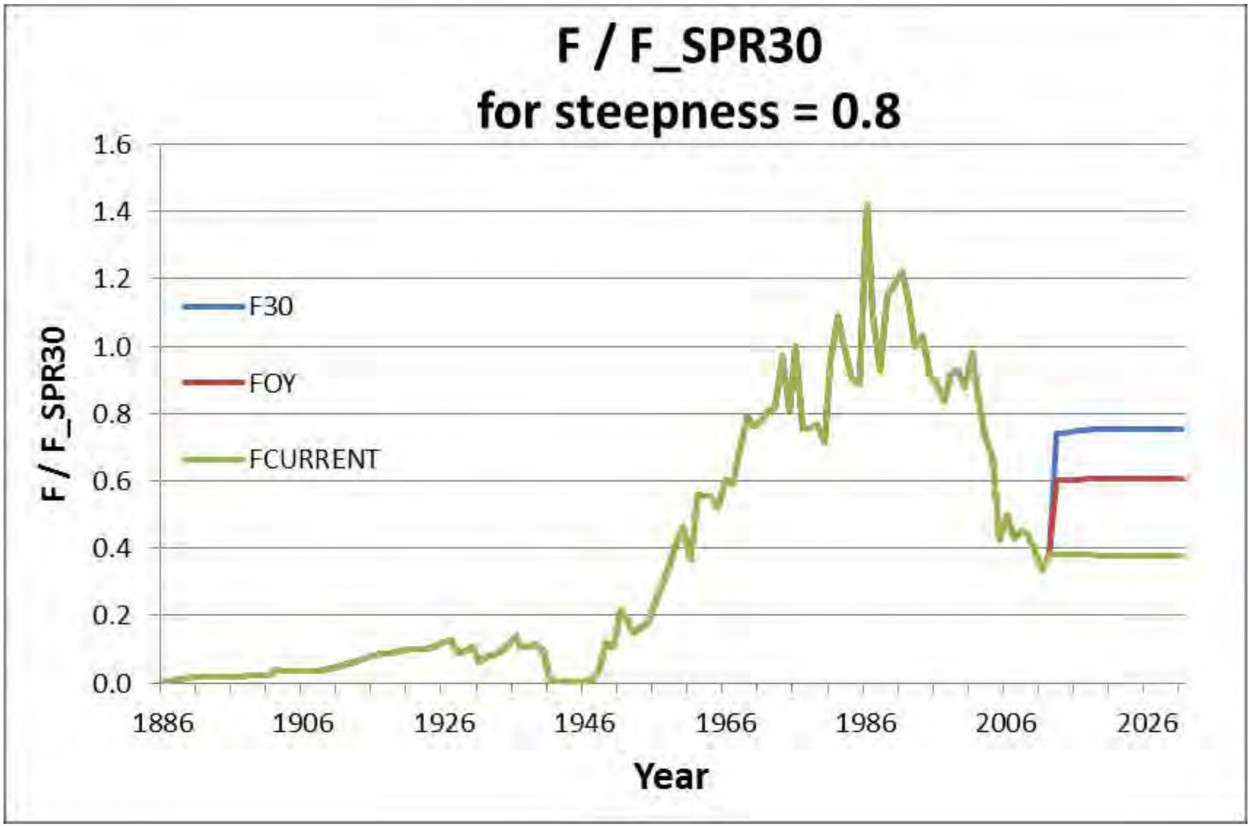


Figure 5.9. Projected fishing mortality rate relative to $F_{SPR30\%}$ for AW Panel Preferred SS Model Run #3 under three fishing mortality scenarios: $F_{Current}$, $F_{SPR30\%}$, and $F_{OY}$. All scenarios assumed $M = 0.38\ y^{-1}$ in the input Lorenzen function.

## 6. SEDAR Abbreviations

| | |
|---|---|
| ABC | Acceptable Biological Catch |
| ACCSP | Atlantic Coastal Cooperative Statistics Program |
| ADMB | AD Model Builder software program |
| ALS | Accumulated Landings System; SEFSC fisheries data collection program |
| ASMFC | Atlantic States Marine Fisheries Commission |
| B | stock biomass level |
| BMSY | value of B capable of producing MSY on a continuing basis |
| CFMC | Caribbean Fishery Management Council |
| CIE | Center for Independent Experts |
| CPUE | catch per unit of effort |
| EEZ | exclusive economic zone |
| F | Fishing mortality (instantaneous) |
| FMSY | Fishing mortality to produce MSY under equilibrium conditions |
| FOY | Fishing mortality rate to produce Optimum Yield under equilibrium |
| FXX% SPR | Fishing mortality rate resulting in retaining XX% of the maximum spawning production under equilibrium conditions |
| FMAX | Fishing mortality that maximizes the average weight yield per fish recruited to the fishery |
| $F_0$ | Fishing mortality close to, but slightly less than, Fmax |
| FL FWCC | Florida Fish and Wildlife Conservation Commission |
| FWRI | (State of) Florida Fisheries and Wildlife Research Institute |
| GA DNR | Georgia Department of Natural Resources |
| GLM | General Linear Model |
| GMFMC | Gulf of Mexico Fishery Management Council |
| GSMFC | Gulf States Marine Fisheries Commission |
| GULF FIN | GSMFC Fisheries Information Network |
| M | natural mortality (instantaneous) |
| MARMAP | Marine Resources Monitoring, Assessment, and Prediction |
| MFMT | Maximum Fishing Mortality Threshold, a value of F above which overfishing is deemed to be occurring |
| MRFSS | Marine Recreational Fisheries Statistics Survey; combines a telephone survey of households to estimate number of trips with creel surveys to estimate catch and effort per trip |
| MRIP | Marine Recreational Information Program |
| MSST | Minimum Stock Size Threshold, a value of B below which the stock is deemed to be overfished |
| MSY | maximum sustainable yield |
| NC DMF | North Carolina Division of Marine Fisheries |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanographic and Atmospheric Administration |
| OY | Optimum Yield |
| SAFMC | South Atlantic Fishery Management Council |
| SAS | Statistical Analysis Software, SAS Corporation |
| SC DNR | South Carolina Department of Natural Resources |
| SEDAR | Southeast Data, Assessment and Review |

| | |
|---|---|
| SEFSC | Southeast Fisheries Science Center, National Marine Fisheries Service |
| SERO | Southeast Regional Office, National Marine Fisheries Service |
| SPR | Spawning Potential Ratio, stock biomass relative to an unfished state of the stock |
| SSB | Spawning Stock Biomass |
| SSC | Science and Statistics Committee |
| TIP | Trip Incident Program; biological data collection program of the SEFSC and Southeast States. |
| Z | total mortality, the sum of M and F |

# SEDAR

## Southeast Data, Assessment, and Review

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# SEDAR 28

## Gulf of Mexico Spanish Mackerel

## SECTION II: Data Workshop Report

May 2012

SEDAR
4055 Faber Place Drive, Suite 201
North Charleston, SC 29405

## Contents

# 1 Introduction

## 1.1 Workshop Time and Place

The SEDAR 28 Data Workshop was held February 6-10, 2012 in Charleston, South Carolina. Webinars were held January 11, 2012 and March 14, 2012.

## 1.2 Terms of Reference

**I. Data Workshop**

1. Characterize stock structure and develop an appropriate stock definition. Provide maps of species and stock distribution.
2. Review, discuss and tabulate available life history information.
   - Provide appropriate models to describe growth, maturation, and fecundity by age, sex, or length as applicable
   - Evaluate the adequacy of available life-history information for conducting stock assessments and recommend life history information for use in population modeling
3. Provide measures of population abundance that are appropriate for stock assessment.
   - Consider and discuss all available and relevant fishery dependent and independent data sources
   - Document all programs evaluated, addressing program objectives, methods, coverage (provide maps), sampling intensity, and other relevant characteristics
   - Develop CPUE and index values by appropriate strata (e.g., age, size, area, and fishery) and provide measures of precision and accuracy
   - Evaluate the degree to which available indices adequately represent fishery and population conditions
   - Recommend which data sources are considered adequate for use in assessment modeling
4. Characterize commercial and recreational catch.
   - Include both landings and discards, in pounds and number of fish
   - Provide estimates of discard mortality rates by fishery and other strata as feasible
   - Evaluate and discuss the adequacy of available data for accurately characterizing harvest and discard by species and fishery sector
   - Provide length and age distributions if feasible, and maps of fishery effort and harvest
5. Determine appropriate stock assessment models and/or other methods of evaluating stock status, determining yields, estimating appropriate population benchmarks, and making future projections that are suitable for making management decisions.
6. Describe any environmental covariates or episodic events that would be reasonably expected to affect population abundance.
7. Provide any information available about demographics and socioeconomics of fishermen, especially as they may relate to fishing effort.
8. Provide recommendations for future research, including guidance on sampling design, intensity, and appropriate strata and coverage.

9. Develop a spreadsheet of assessment model input data that reflects the decisions and recommendations of the Data Workshop. Review and approve the contents of the input spreadsheet.
10. Prepare the Data Workshop report providing complete documentation of workshop actions and decisions (Section II of the SEDAR assessment report).
    - Develop a list of tasks to be completed following the workshop
    - Review and describe any ecosystem consideration(s) that should be included in the stock assessment report

**II. Assessment Process**

1. Review and provide justification for any changes in data following the data workshop and any analyses suggested by the data workshop. Summarize data as used in each assessment model.
2. Recommend a model configuration which is deemed most reliable for providing management advice using available compatible data. Document all input data, assumptions, and equations.
3. Incorporate known applicable environmental covariates into the selected model, and provide justification for why any of those covariates cannot be included at the time of the assessment.
4. Provide estimates of stock population parameters.
    - Include fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship, and other parameters as appropriate given data availability and modeling approaches
    - Include appropriate and representative measures of precision for parameter estimates
5. Characterize uncertainty in the assessment and estimated values.
    - Considering components such as input data, modeling approach, and model configuration
    - Provide appropriate measures of model performance, reliability, and 'goodness of fit'
6. Provide yield-per-recruit, spawner-per-recruit, and stock-recruitment evaluations.
7. Provide estimates of stock status relative to management criteria consistent with applicable FMPs, proposed FMPs and Amendments, other ongoing or proposed management programs, and National Standards for each model run presented for review.
8. Project future stock conditions and develop rebuilding schedules if warranted, including estimated generation time. Develop stock yield projections in both biomass and numbers of fish in accordance with the following:

    A) If stock is overfished:

    $F=0$, $F_{Current}$, $F_{MSY}$, $F_{OY}$

    $F=F_{Rebuild}$ (max that permits rebuild in allowed time)

    B) If stock is undergoing overfishing:

    $F= F_{Current}$, $F_{MSY}$, $F_{OY}$

    C) If stock is neither overfished nor undergoing overfishing:

    $F= F_{Current}$, $F_{MSY}$, $F_{OY}$

    D) If data limitations preclude classic projections (i.e. A, B, C above), explore alternate models to provide management advice
9. Provide a probability distribution function for the base model, or a combination of models that represent alternate states of nature, presented for review.
    - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments for use with the Tier 1 ABC control rule

- Provide justification for the weightings used in producing combinations of models

10. Provide recommendations for future research and data collection. Be as specific as possible in describing sampling design and intensity, and emphasize items which will improve assessment capabilities and reliability. Recommend the interval and type for the next assessment.
11. Prepare a spreadsheet containing all model parameter estimates and all relevant population information resulting from model estimates and projection and simulation exercises. Include all data included in assessment report tables and all data that support assessment workshop figures.
12. Complete the Assessment Workshop Report (Section III: SEDAR Stock Assessment Report).

**III. Review Workshop**

1. Evaluate the quality and applicability of data used in the assessment.
2. Evaluate the quality and applicability of methods used to assess the stock.
3. Recommend appropriate estimates of stock abundance, biomass, and exploitation.
4. Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.
5. Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.
6. Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.
   - Provide measures of uncertainty for estimated parameters
   - Ensure that the implications of uncertainty in technical conclusions are clearly stated
   - If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternate states of nature, presented for review.
   - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments
   - Provide justification for the weightings used in producing the combinations of models
7. If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.
8. Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.
9. Make any additional recommendations or prioritizations warranted.
   - Clearly denote research and monitoring needs that could improve the reliability of future assessments
10. Prepare a Review Summary Report summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Review Summary Report no later than the date set by the Review Panel Chair at the conclusion of the workshop.

The review panel may request additional sensitivity analyses, evaluation of alternative assumptions, and correction of errors identified in the assessments provided by the assessment workshop panel; the review panel may not request a new assessment. Additional details regarding the latitude given the review panel to deviate from assessments provided by the assessment workshop panel are provided in the SEDAR Guidelines and the SEDAR Review Panel Overview and Instructions.

** The panel shall ensure that corrected estimates are provided by addenda to the assessment report in the event corrections are made, alternate model configurations are recommended, or additional analyses are prepared as a result of review panel findings regarding the TORs above.**

## 1.3 List of Participants

Amy Dukes
Amy Schueller
Beverly Sauls
Bill Parker
Bob Zales II
Chip Collier
Chris Kalinowski
Chris Palmer
Dave Donaldson
David Gloeckner
Donna Bellais
Doug Devries
Doug Mumford
Eric Fitzpatrick
Erik Williams
Ernst Peebles
Jeanne Boylan
Jeff Isely
Jennifer Potts
Jim Franks
Joe Cimino
Joe Smith
John Ward
Julia Byrd
Julie Defilippi
Justin Yost
Karl Brenkert
Katie Andrews
Kelly Fitzpatrick
Ken Brennan
Kevin Craig
Kevin McCarthy
Kyle Shertzer
Lew Coggins
Liz Scott-Denton
Marcel Reichert
Matt Perkinson
Meaghan Bryan
Mike Denson
Nancie Cummings
Neil Baertlein
Pearse Webster
Read Hendon
Refik Orhum
Rob Cheshire
Robert Johnson
Rusty Hudson
Shannon Calay
Stephanie McInerny
Steve Brown
Ben Hartig
Kari Fenske
Ryan Rindone
Rachael Silvas
Mike Errigo
Sue Gerhart
Gregg Waugh
Clay Porch
Todd Gedamke
Mike Larkin
Steve Saul
Adam Pollack
Steve Turner
Patrick Gilles
John Carmichael
Michael Schirripa
Julie Neer
Tanya Darden
Tim Sartwell
Tom Ogle
Vivian Matter
Walter Ingram
Danielle Chesky
Katie Drew
Erik Hiltz
Frank Hester
Peter Barile
Carly Altizer
Marin Hawk
Mark E Brown
C. Michelle Willis
Carrie Hendrix
Jon Richardsen
Patrick Biando

## 1.4 List of Data Workshop Working Papers

Gulf and South Atlantic Spanish Mackerel and Cobia
Workshop Document List

| Document # | Title | Authors |
|---|---|---|
| **Documents Prepared for the Data Workshop** | | |
| SEDAR28-DW01 | Cobia preliminary data analyses – US Atlantic and GOM genetic population structure | T. Darden 2012 |
| SEDAR28-DW02 | South Carolina experimental stocking of cobia *Rachycentron canadum* | M. Denson 2012 |
| SEDAR28-DW03 | Spanish Mackerel and Cobia Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of Mexico | Pollack and Ingram, 2012 |
| SEDAR28-DW04 | Calculated discards of Spanish mackerel and cobia from commercial fishing vessels in the Gulf of Mexico and US South Atlantic | K. McCarthy |
| SEDAR28-DW05 | Evaluation of cobia movement and distribution using tagging data from the Gulf of Mexico and South Atlantic coast of the United States | M. Perkinson and M. Denson 2012 |
| SEDAR28-DW06 | Methods for Estimating Shrimp Bycatch of Gulf of Mexico Spanish Mackerel and Cobia | B. Linton 2012 |
| SEDAR28-DW07 | Size Frequency Distribution of Spanish Mackerel from Dockside Sampling of Recreational and Commercial Landings in the Gulf of Mexico 1981-2011 | N.Cummings and J. Isely |
| SEDAR28-DW08 | Size Frequency Distribution of Cobia from Dockside Sampling of Recreational and Commercial Landings in the Gulf of Mexico 1986-2011 | J. Isely and N. Cummings |
| SEDAR28-DW09 | Texas Parks and Wildlife Catch Per unit of Effort Abundance Information for Spanish mackerel | N. Cummings and J. Isely |
| SEDAR28-DW10 | Texas Parks and Wildlife Catch Per unit of Effort Abundance Information for cobia | J. Isely and N. Cummings |
| SEDAR28-DW11 | Size Frequency Distribution of Cobia and Spanish Mackerel from the Galveston, Texas, Reef Fish Observer Program 2006-2011 | J Isely and N Cummings |
| SEDAR28-DW12 | Estimated conversion factors for calibrating MRFSS charterboat landings and effort estimates for the South Atlantic and Gulf of Mexico in 1981-1985 with For Hire Survey estimates with application to Spanish mackerel and cobia landings | V. Matter, N Cummings, J Isely, K Brennen, and K Fitzpatrick |
| SEDAR28-DW13 | Constituent based tagging of cobia in the Atlantic and Gulf of Mexico waters | E. Orbesen |
| SEDAR28-DW14 | Recreational Survey Data for Spanish Mackerel and Cobia in the Atlantic and the Gulf of Mexico | V. Matter |

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|---|---|---|
| | from the MRFSS and TPWD Surveys | |
| SEDAR28-DW15 | Commercial Vertical Line and Gillnet Vessel Standardized Catch Rates of Spanish Mackerel in the US Gulf of Mexico, 1998-2010 | N. Baertlein and K. McCarthy |
| SEDAR28-DW16 | Commercial Vertical Line Vessel Standardized Catch Rates of Cobia in the US Gulf of Mexico, 1993-2010 | K. McCarthy |
| SEDAR28-DW17 | Standardized Catch Rates of Spanish Mackerel from Commercial Handline, Trolling and Gillnet Fishing Vessels in the US South Atlantic, 1998-2010 | K. McCarthy |
| SEDAR28-DW18 | Standardized catch rates of cobia from commercial handline and trolling fishing vessels in the US South Atlantic, 1993-2010 | K. McCarthy |
| SEDAR28-DW19 | MRFSS Index for Atlantic Spanish mackerel and cobia | Drew et al. |
| SEDAR28-DW20 | Preliminary standardized catch rates of Southeast US Atlantic cobia (*Rachycentron canadum*) from headboat data. | NMFS Beaufort |
| SEDAR28-DW21 | Spanish mackerel preliminary data summary: SEAMAP-SA Coastal Survey | Boylan and Webster |
| SEDAR28-DW22 | Recreational indices for cobia and Spanish mackerel in the Gulf of Mexico | Bryan and Saul |
| SEDAR28-DW23 | A review of Gulf of Mexico and Atlantic Spanish mackerel (*Scomberomorus maculatus*) age data, 1987-2011, from the Panama City Laboratory, Southeast Fisheries Science Center, NOAA Fisheries Service | Palmer, DeVries, and Fioramonti |
| SEDAR28-DW24 | SCDNR Charterboat Logbook Program Data, 1993 - 2010 | Errigo, Hiltz, and Byrd |
| SEDAR28-DW25 | South Carolina Department of Natural Resources State Finfish Survey (SFS) | Hiltz and Byrd |
| SEDAR28-DW26 | Cobia bycatch on the VIMS elasmobranch longline survey:1989-2011 | Parsons et al. |
| **Reference Documents** | | |
| SEDAR28-RD01 | List of documents and working papers for SEDAR 17 (South Atlantic Spanish mackerel) – all documents available on the SEDAR website | SEDAR 17 |
| SEDAR28-RD02 | 2003 Report of the mackerel Stock Assessment Panel | GMFMC and SAFMC, 2003 |
| SEDAR28-RD03 | Assessment of cobia, *Rachycentron canadum*, in the waters of the U.S. Gulf of Mexico | Williams, 2001 |

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|---|---|---|
| SEDAR28-RD04 | Biological-statistical census of the species entering fisheries in the Cape Canaveral area | Anderson and Gehringer, 1965 |
| SEDAR28-RD05 | A survey of offshore fishing in Florida | Moe 1963 |
| SEDAR28-RD06 | Age, growth, maturity, and spawning of Spanish mackerel, *Scomberomorus maculates* (Mitchill), from the Atlantic Coast of the southeastern United States | Schmidt et al. 1993 |
| SEDAR28-RD07 | Omnibus amendment to the Interstate Fishery Management Plans for Spanish mackerel, spot, and spotted seatrout | ASMFC 2011 |
| SEDAR28-RD08 | Life history of Cobia, *Rachycentron canadum* (Osteichthyes: Rachycentridae), in North Carolina waters | Smith 1995 |
| SEDAR28-RD09 | Population genetics of cobia *Rachycentron canadum*: Management implications along the Southeastern US coast | Darden et al, 2012 |
| SEDAR28-RD10 | Inshore spawning of cobia (*Rachycentron canadum*) in South Carolina | Lefebvre and Denson, 2012 |
| SEDAR28-RD11 | A review of age, growth, and reproduction of cobia *Rachycentron canadum*, from US water of the Gulf of Mexico and Atlantic ocean | Franks and Brown-Peterson, 2002 |
| SEDAR28-RD12 | An assessment of cobia in Southeast US waters | Thompson 1995 |
| SEDAR28-RD13 | Reproductive biology of cobia, *Rachycentron canadum*, from coastal waters of the southern United States | Brown-Peterson et al. 2001 |
| SEDAR28-RD14 | Larval development, distribution, and ecology of cobia *Rachycentron canadum* (Family: Rachycentridae) in the northern Gulf of Mexico | Ditty and Shaw 1992 |
| SEDAR28-RD15 | Age and growth of cobia, *Rachycentron canadum*, from the northeastern Gulf of Mexico | Franks et al 1999 |
| SEDAR28-RD16 | Age and growth of Spanish mackerel, *Scomberomorus maculates*, in the Chesapeake Bay region | Gaichas, 1997 |
| SEDAR28-RD17 | Status of the South Carolina fisheries for cobia | Hammond, 2001 |
| SEDAR28-RD18 | Age, growth and fecundity of the cobia, *Rachycentron canadum*, from Chesapeake Bay and adjacent Mid-Atlantic waters | Richards 1967 |
| SEDAR28-RD19 | Cobia (*Rachycentron canadum*) tagging within Cheasapeake Bay and updating of growth equations | Richards 1977 |
| SEDAR28-RD20 | Synopsis of biological data on the cobia *Rachycentron canadum* (Pisces: Rachycentridae) | Shaffer and Nakamura 1989 |
| SEDAR28-RD21 | South Carolina marine game fish tagging program 1978-2009 | Wiggers, 2010 |

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| SEDAR28-RD22 | Cobia (*Rachycentron canadum*), amberjack (*Seriola dumerili*), and dolphin (*Coryphaena hipurus*) migration and life history study off the southwest coast of Florida | MARFIN 1992 |
| SEDAR28-RD23 | Sport fish tag and release in Mississippi coastal water and the adjacent Gulf of Mexico | Hendon and Franks 2010 |
| SEDAR28-RD24 | VMRC Cobia otolith preparation protocol | VMRC |
| SEDAR28-RD25 | VMRC Cobia otolith ageing protocol | VMRC |

# 2 Life History

## 2.1 Overview

**Overview**
The life history working group (LHG) discussed information regarding stock structure, natural mortality, discard mortality, age, growth, movements, and reproduction of Atlantic and Gulf of Mexico stocks of Spanish mackerel.

**Group Membership**
Jennifer Potts (Workgroup Leader)……..…NMFS -Beaufort
Doug DeVries (Leader – Cobia)…………...NMFS - Panama City
Chris Palmer (Leader – Spanish mackerel)...NMFS – Panama City
Karl Brenkert…………………………..…..SC DNR
Joe Cimino…………………………………VMRC
Chip Collier………………………………..SA SSC
Tanya Darden…………………….………..SC DNR
Mike Denson………………………………SC DNR
Jim Franks……………………….…….…USM
Randy Gregory…………………………….NC DMF
Read Hendon………………………………USM
Chris Kalinowski………………………….GA DNR
Ernst Peebles………………...…….….….USF
Matt Perkinson…………………………….SC DNR
Marcel Reichert………………………..….SA SSC
Joe Smith………………………...……….NMFS Beaufort
John Ward………………………………....Gulf SSC
Erik Williams……………………….……...NMFS Beaufort
Justin Yost……………………………..…...SC DNR

**Issues**
Some of the main issues discussed by the LHG were discard mortality rates in both the Atlantic and Gulf of Mexico stocks and fitting the von Bertalanffy parameter $t_0$ age 0 samples to more accurately model growth parameters as was the case in SEDAR 17.

## 2.2 Review of Working Papers

(SEDAR28-DW23) A review of Gulf of Mexico and Atlantic Spanish mackerel (Scomberomorus maculatus) age data, 1987-2011, from the Panama City Laboratory, Southeast Fisheries Science Center, NOAA Fisheries Service

C. Palmer, D. DeVries, and C. Fioramonti

**Abstract**

A total of 29,168 (n = 16,667 ATL, n = 12,501 GOM) Spanish mackerel collected during 1987 - 2011 have been aged by the Panama City Laboratory. Of those aged, 49% were from the commercial sector, 33% from the recreational sector (CP, HB, and PR combined), 10% from scientific surveys, 4% from tournaments, and 4% from unknown sectors. Spanish mackerel collected during 1987 – 2011 and aged by the NMFS Panama City Lab ranged in age from 0 to 11 yr, with the majority (Atlantic 90%, Gulf 89%) between 0 and 4 yr (Figure 2). Females from the Atlantic and Gulf ranged in age from 0 to 11 yr. Atlantic males ranged from 0 to 11 yr and Gulf males from 0 to 10 yr. Ninety percent of both Atlantic females and males and 89% of both Gulf females and males were ages 0 to 4 yr. The size ranges of Atlantic commercial (N = 10,699) and recreational (N = 3,972) Spanish mackerel age samples were similar (~250 – 700 mm / 9.8 – 27.6 in), and modal sizes were only slightly different (CM: 350-400 mm vs REC: 400-450 mm). Spanish mackerel age samples were similar (~300 – 650 mm / 011.8 – 25.6 in), but modal sizes of recreational samples were ~100 mm smaller than that of commercial samples (400 vs 500-550 mm). Recreationally-caught females from the Atlantic, ages 4 - 10, averaged 53 mm larger at age than those from commercial catches, probably reflecting differences in selectivity and/or spatial distribution of the samples.

*Critique: The working paper describes Spanish mackerel age data from the Panama City laboratory. The data is collected from commercial and recreational fisheries. The data sources use uniform sampling methdologies. The data are reviewed using rigorous quality assurance, quality control procedures, validation rules for data entry and proofed against original data sheets. Ages were validated for precision using published techniques. Indexes of precision between readers is documented and descriptive statistics provided are appropriate.*

## 2.3 Stock Definition and Description

Spanish mackerel are found throughout the Gulf of Mexico and US Atlantic Coast (Collette and Russo 1979, 1984). The bulk of the stock is found in Florida waters and are sought after by both the commercial and recreational sectors throughout their range (Trent and Anthony 1978). Based on electrophoresis studies, spawning locations, stock distribution patters, and catch history (Skow and Chittenden 1981; GMFMC and SAFMC 1987), amendment 2 to the Coastal Pelagics FMP designated two groups of Spanish mackerel. The Dade – Monroe County, Florida boundary was acknowledged as feasible boundary, because both commercial and recreational catch data for the Gulf and Atlantic have used this boundary. For SEDAR 28 it was agreed that fish landed north of US Highway 1 in Monroe County Florida were Gulf of Mexico stock and fish landed south of US Highway 1 were Atlantic stock.

**Per SEDAR 17:**
This species has been investigated for evidence of stock structure by multiple researchers with conflicting results. Early studies of morphometrics and meristics (Collette and Russo, 1984), a single allozyme study (Skow and Chittenden, 1981), and an electrophoresis study using 44 muscle enzyme loci (Nakamura, 1987) noted differences between Spanish mackerel in the Atlantic and Gulf of Mexico. More recent work using

mitochondrial and nuclear DNA (Buonaccorsi et al., 2001) did not detect a difference between the Atlantic and Gulf of Mexico Spanish mackerel. Given the highly migratory nature of this species, possible mixing of pelagic eggs, and low number of individuals needed to homogenize the genetic signal, it is not surprising that mitochondrial and nuclear DNA differences were not detected; and the authors themselves noted that "From an ecological and fisheries management perspective, even a sensitive genetic analysis is not sufficient to determine that there is no difference among putative stocks. Migration on the order of tens of individuals per generation is sufficient to homogenize allele frequencies among genetic stocks for both markers." In the report of the life history workgroup from the recent data workshop on the closely related king mackerel (SEDAR 16), a discussion on stock structure noted that "a lack of a significant genetic difference in selectively neutral markers, such as mtDNA or nuclear DNA microsatellites, is not definitive evidence that interregional population structure does not exist (Nolan et al. 1991; Pruett et al. 2005)".

Additionally, the differences observed in morphometrics, meristics (Collette and Russo, 1984), and electrophoretic analyses (Nakamura, 1987) indicate separate stocks between the Atlantic and Gulf of Mexico Spanish mackerel. These stocks may have different demographic parameters (eg. length weight relationship, size at age, and fecundity), which will influence inputs and parameters for a stock assessment model. In the co-occurring king mackerel, for which there is ample evidence of movements and mixing between the Atlantic and Gulf of Mexico (Sutter et al. 1991), DeVries et al. (1997) reported significant differences in growth and size at age estimates between fish sampled in Atlantic waters off the SE U.S. and the eastern Gulf of Mexico. More recent studies of otolith shape and elemental composition (Clardy et al. 2008, Patterson and Shepard 2008) strongly supported the existence of separate Atlantic and eastern Gulf of Mexico stocks. The consensus of the LHG was that the management units should remain distinct between the Atlantic and Gulf to remain consistent with Amendment 2 of the Fishery Mangement Plan for the Coastal Migratory Pelagic Resources (Mackerels) (GMFMC and SAFMC, 1987).

Recommendation for the AW:
The Atlantic stock and Gulf of Mexico stock should be split along SAFMC/GMFMC jurisdictions. Atlantic stock consists of all fish caught south of highway US 1 through the Florida Keys, northward along the east coast of Florida to Maine.

## 2.4 Natural Mortality

Natural mortality (M) in many marine fish stocks is a difficult parameter to estimate. Several equations have been derived to attempt to estimate M that use various life history parameters ($L_\infty$, K, maximum age, age at 50% maturity). The LHG selected 14 equations that give point estimates (Table 2.1) and the age-varying M from Lorenzen (1996) (Figure 2.1).

The point estimates of M ranged widely. The Beverton estimate was the highest at 3.44. Other estimates that rely heavily on K from the von Bertalanffy parameters include

Ralston, Jenson and Pauly, which also estimated high M, 0.92 – 2.20. The LHG is cautious of using these estimates because of the issues inherent in modeling growth of the species. The $L_\infty$ and K parameters are inversely correlated and can be highly variable depending on the range of the input data and assumptions made when modeling growth.

The other estimates of M rely more on maximum age in the population. These estimates ranged from 0.16 – 0.40. Hoenig (1983), Hewitt and Hoenig (2005), and Alagaraja (1984), which all use maximum age exclusively, averaged 0.37. The Hoenig estimate from the "fish" equation was 0.38. Estimates of M using maximum age in the population have been generally accepted by previous SEDARs. Caution should be taken when selecting maximum age in the population: how many fish were sampled to find that one, old fish; what could be the longevity of the species in an un-fished stock; and what amount of error is associated with the age readings? These questions were taken into consideration by the LHG, and maximum age in the population was set at 11 years. This data point came from an aging study by Nobel et al. (1992).

The LHG recommends modeling the natural mortality rate of Spanish mackerel as a declining 'Lorenzen' function of size (translated to age by use of a growth curve) (Lorenzen 1996), scaled to the Hoenig (fish) point estimate for the fully recruited ages, 2 - 11 years. For sensitivity analysis, the LHG recommends using a CV of 54% (MacCall in Brodziak et al., 2011) about the Hoenig point estimate, though that value may be too high (Hoenig comment in MacCall in Brodziak et al., 2011). The assessment workshop can explore this option. This parallels the recommendations from SEDAR 16 (king mackerel) and 17 (Spanish mackerel).

## 2.5 Discard Mortality

The discussion concerning discard mortality was not addressed specifically to each region, Gulf or Atlantic, and was considered the same for both stocks.

Discard mortality rate is an important estimation included in stock assessments and rebuilding projections calculated from a stock assessment. Discard mortality rate can be impacted by several factors including: fish size, sea conditions, temperature, air exposure, handling, light conditions, and delayed mortality (Davis 2002). The longer fish are exposed to most of these factors and the more severe they are, the greater the cumulative stress on the fish (Rummer and Bennett 2007). The impacts of many of these factors are difficult to track or quantify and have led to variability in determining discard mortality rates. Spanish mackerel are harvested by several gears, which have varying discard mortality rates. Currently, few data sets are published on discard mortality of Spanish mackerel (Harrington et al. 2005). Data are collected by the NOAA Southeast Fisheries Science Center on discards in the commercial logbook program. This program randomly samples 20% of commercial vessels operating in the South Atlantic and Gulf of Mexico. From the commercial logbooks, discards were classified into five categories of kept, alive, mostly alive, mostly dead, and dead for gillnets, hook and line, and trolling fisheries (McCarthy 2008 SEDAR17-DW10). The gillnet fisheries, including set gillnets, run around gillnets, and cast nets, had a low number of discards due to gear selectivity for legal sized fish, but any discarded fish likely had a high release mortality rate. Three sources of information were available to estimate gillnet discard mortality: commercial logbook reports, a published study, and gillnet observers. The commercial logbooks estimated a gillnet discard mortality for Spanish mackerel at 100% (McCarthy 2008 SEDAR17-DW10). A discard mortality rate for Spanish mackerel in gillnets (one hour soak time) was estimated to be 93.4% based a fishery independent study off Florida (Hueter and Manire 1994). Observers have been onboard gillnet boats in the South Atlantic since 1998 with most observed trips occurring off Cape Hatteras and Cape Canaveral. The targeted species on the observed trips varied and included Spanish mackerel, sharks, sea mullet (*Menticirrhus* spp), Atlantic croaker, and other species. All Spanish mackerel that were discarded were reported discarded dead (discard mortality rate- 100%) but the number of fish discarded was very low (Table 2.2., Simon Gulak, Gillnet Coordinator SEFSC NOAA Fisheries, personal communication).

SEDAR 17 estimated a discard mortality of 80% for hand line, 98% for trolling fisheries, and a combined estimate of 88% for all hook fisheries based on logbook reporting. The numbers included a high percentage of discards reported with a kept disposition. The fish with a kept disposition were requested to be removed from the discard estimate and added to landings. The remaining discarded fish would have the discard mortality rate applied to them. Few data were available to estimate a discard mortality rate for hook and line fisheries. Discard mortality from the gill net fishery as reported by observer data is shown in Table 2.2. Commercial and recreational hook and line fishermen suggested discard mortality ranges from 5 to 15% based on personal observations. Potential sources of mortality included predation after release, broken gill arches, and other hooking injuries. The handling time was said to be short especially for the commercial fishermen and there has been an increase in the use of dehooking devices in the recreational fishery. A telemetry study tagged Spanish mackerel and recorded movements for up to five hours (Edwards 1994). The study observed two fish die immediately and two more died during the telemetry. The author estimated a range of discard mortality rate of 9 to 28%. A follow up study combined data for Spanish and king mackerels and estimated a range of discard mortality rate of 7 to 35%. SEDAR 16 for king mackerel used discard mortality rates of 20% for MRFSS and 33% for charter boats. Another surrogate species considered for estimating discard mortality rate was bluefish. The NEFSC used a 15% discard mortality rate in the bluefish stock assessment. Another bluefish study reported catch and release discard mortality was higher (38%) and included size, age, and handling time as factors in the model (Fabrizio et al. 2008). The bluefish were held in tanks for 21 days after capture to include estimates of delayed mortality. Most bluefish died on the first day (65%) and 35% of the mortality occurred after the first day.

A final component of discard mortality for Spanish mackerel would result from the shrimp trawl fishery. Any discarded would most likely have a high discard mortality rate around 100% (SEDAR 17).

**Discussion**

There was considerable discussion on the discard mortality rate estimates. There was some concern about the rate in hook and line fisheries, and the discussion was tabled for a following plenary. Bluefish were thought not be representative of Spanish mackerel discard mortality and there was some concern about holding fish in tanks. An experienced charter boat captain commented that bluefish are much hardier than Spanish mackerel; thus, their discard mortality rates are not comparable. After discussing several issues and reviewing the limited data on Spanish mackerel, the commercial fishery was suspected to have a lower discard mortality rate than the recreational. It was brought up that commercial fishermen can hook and release a fish within 20 seconds. Not all recreational fishermen would have this level of skill; and therefore, the discard mortality in the recreational fishery should be higher. The commercial fishermen present felt the 10% point estimate was appropriate with a range of 5 to 15% for the commercial fishery. The panel agreed to use a discard mortality rate point estimate of 20% for the base assessment run for the recreational fishery based on the Edwards (1994) telemetry study findings, which roughly ranged from 10 to 30%. The recreational fishermen present were comfortable with that estimate.

Recommendation for the AW:
Discard mortality rates:

Gillnet 100%
Handline 10% (5 to 15%) commercial
Handline 20% (10 to 30%) recreational
Shrimp Trawl 100%

## 2.6 Age

The Panama City NMFS Laboratory provided age and length data (n = 12,501) from 1987-2011 of Spanish mackerel collected in Gulf waters north of U.S. Highway 1 in Monroe County Florida (Figure 2.15.1). Per the SEDAR 17 report, ages from 1987 should be excluded from any analysis for SEDAR 28. A description of the methods, information on quality control, and the distribution of age samples by year, sex, geographical location, gear, fishery, and collection agency or program are detailed in SEDAR 28-DW23. Approximately 423 samples from The North Carolina Division of Marine Fisheries (2011) were not available for ageing at the time of this report and will be made available for the assessment workshop.

Recommendations for the AW:
None.

## 2.7 Growth

The LHG discussed several growth issues, including whether to model growth with a correction for minimum size-limit bias effect, inversely weighting the von Bertalanffy model by samples size at each age, the need to constrain $t_0$, and whether to use sex-specific growth curves.

Growth of Atlantic Spanish mackerel was estimated for all fish combined and by sex. Spanish mackerel exhibit sexually-dimorphic growth, with females attaining larger sizes at age and a much larger maximum size than males. Because the majority of the age data was derived from fishery-dependent samples, which were subject to a minimum size limit, it was assumed that the fastest growers in the population would recruit to the fishery first. The presumed bias in size-at-age of the age affected most by the size-limit could be "corrected" by a model developed by Diaz et al. (2004). This model has been used in several previous SEDARs and specifically in SEDAR 17.

The LHG group agreed to run the growth model using the Diaz et al. (2004) correction that incorporates inverse weighted growth (Figure 2.3). The initial model run for all data combined resulted in the following parameter estimates: $t_0 = -1.03$, K = 0.45, and $L\infty$ = 572.8. This $t_0$, which predicts an unrealistic size at age – 0 (Figure 2.4), results from the lack of very small fish (needed to estimate initial growth of the fish) in the age data set. Also, the value of k was lower than expected for a fast growing pelagic species. One way to handle these issues is to fix $t_0$ to a more biologically reasonable value, such as -0.5 and when this is done, the resulting parameters were $t_0 = -0.5$, K = 0.61, and $L\infty$ = 560.1 (Figure 2.4). Because most of the aged samples are in the middle of the age distribution, the model was driven by those samples and had trouble fitting the tails (youngest and oldest fish) of the curve. Inverse weighting by sample size-at-age, an accepted practice in modeling growth, produces a better fit in the tails of the data distribution.

Due to the dimorphic growth exhibited by Spanish mackerel, sex specific growth models were run. The models incorporated the size-limit bias correction, inverse weighting, and a fixed $t_0$ value to -0.5 years (Figure 2.3). For females, the resulting parameter estimates were $t_0 = -0.5$, K = 0.58, and $L\infty$ = 586.9. For males, the resulting parameter estimates were $t_0 = -0.5$, K = 0.54, and $L\infty$ = 538.1.

Recommendations for the AW:

Because most of the fishery data does not identify the sex of the fish, use the model for the sexes combined, corrected for the minimum size limit bias and inversly weighted by sample size at calendar age for the overall population model. Use sex-specific growth models where appropriate

Fix $t_0$ at -0.5 to more realistically model the growth rate of younger fish.

## 2.8 Reproduction

Recent data concerning Spanish mackerel sexual maturity were queried from databases (Panama City Lab - PCLAB) and taken from at-sea surveys (MARMAP and SEAMAP). Results showed no notable departures from prior estimates (SEDAR 17). For consistency, the PCLAB maturity data included records of macroscopic maturity stage from northwest Florida (Apalachicola Bay west to St. Andrew's Bay) for all years available (1999 – 2011) from the months of April – September and were combined with the macroscopic Finucane and Collins (1986) tabular data from Gulf waters. Macroscopically staged mature fish were defined as having the characteristics of developing, spent, regressed, or ripe gonads (NMFS PCLAB, AGR 2008). Data from SEAMAP and MARMAP (both Atlantic data sets) sampling surveys were based on histological readings (Schmidt et al., 1993) and were filtered for the same monthly period and combined with the macroscopic Finucane and Collins (1986) tabular data from Atlantic waters. Percent maturity per size-class instead of age was used due to the lack of age data for all samples. Data sets from SEAMAP, MARMAP, and the Panama City Lab were combined and filtered by region. Tabular data by size-class as reported by Schmidt et al. (1993) and Finucane and Collins (1986) were combined with the newer data sets using the same size classes. The size classes used by Finucane and Collins (1986) were 1 mm FL smaller versus the size classes used by Schmidt et al. (1993) and it was decided that this would not be an issue when combining the data.

### 2.8.1 Spawning Seasonality

Per SEDAR 17:
The spawning season of Spanish mackerel is progressively longer from north to south, primarily due to water temperature. In lower Chesapeake Bay, Cooksey (1996) found partially spent, gravid, and running ripe females from June through August. Off the Carolinas and Georgia, females spawn from May through August (Finucane and Collins 1986; Schmidt et al. 1993), perhaps as late as September based on the presence of larvae (Collins and Stender 1987). Off the Atlantic coast of Florida, spawning females have been collected during April through September (Beaumariage 1970; Powell 1975; Finucane and Collins 1986), and as late as October in some years (Klima 1959).

The gonadosomatic index of females is at a maximum during June in the lower Chesapeake (Cooksey 1996) and off southeast Florida (Finucane and Collins 1986).

Spawning appears to take place on the inner continental shelf, as females with “maturing” (hydrated) oocytes have been collected with gillnets near inlets and shoals along Florida’s east coast (Powell 1975) and ripe females have been collected at depths of ca. 9 m from Onslow Bay (North Carolina) through Georgia (Schmidt et al. 1993). The spatial distribution of Spanish mackerel larvae also indicates that spawning takes place on the inner shelf (Collins and Stender 1987).

The major spawning period in Atlantic waters off of North Carolina and south into the Gulf of Mexico off of the Mississippi delta extended from May into September and peaked during the spring and early summer (Finucane and Collins 1986). There have been no new recent studies concerning spawning seasonality of Spanish mackerel in the Gulf of Mexico. The PCLAB maturity data shows the peak GSI occurring in the month of June (Figure 2.5). It should be noted that the low sample size (N =261) of Spanish mackerel data available may not confidently represent the spawning season.

### 2.8.2 Sexual Maturity

Combined tabular data of percent maturity by size class and region for females from the Atlantic and Gulf are shown in Table 2.3. In the Gulf, the smallest size-class of females collected was 226-250 mm FL; 1 of the 2 fish in that class was mature and it was 236 mm

FL. The size at 50% maturity for Gulf females fell in the 301-325 mm FL size class (Figure 2.6). Age at 50% maturity for Gulf females was 0.20 yr (std err 0.04-0.44) (Figure 2.8). This relatively young age at maturity may be attributed to the fact that all of the Gulf female gonads were staged macroscopically and the potential to stage immature gonads from younger fish, as mature, is high. Atlantic females were staged using histological methods, a more precise method. The youngest mature female was age 0 from both regions. In the Gulf both males in the smallest size-class (201-225 mm FL) were immature (Table 2.4). The smallest mature Gulf male was 274 mm FL and the size at 50% maturity was approximately 276-300 mm FL (Figure 2.7). The youngest mature male was age 0 from both regions.

### 2.8.3 Sex ratio

Strong sexual dimorphism in Spanish mackerel (females larger than males at aged 1- 5; see Powel 1975; Fable et al. 1987; Schmidt et al. 1993) may result in skewed adult sex ratios when data are analyzed by gear type. In the PCLAB data set females age 0 - 7 made up 69% of all gill net samples from commercial and scientific surveys and recreational hook-and-line samples (Figure 2.9, Table 2.5). Size selectivity due to gill net mesh size may have resulted in the targeting of larger fish which are generally females. Recreational hook and line caught females age 0 - 7 made up 63% of the catch (Table 2.6). However, above 40 cm females make up 72% of gill net sampled fish (Figure 2.10). Females above 40 cm from recreational hook-and-line samples totaled 76% of the catch (Figure 2.11). In recreational hook-and-line catches off southeast Florida Klima (1959) noted a highly skewed sex ratio (80% females, including immature fish). Klima speculated that the higher percentage of females was a product of their more aggressive feeding behavior and not the absence of males in the areas fished.

<u>Recommendations for the AW:</u>
Use the Atlantic age at 50% maturity value (0.70 yr) as a proxy for both regions.

Over all ages and gears, weighted percent females 66%.

Collect Spanish mackerel maturity data from both regions and both sexes from specimens approximately 275 mm FL. and lower to be staged via histological methods.

## 2.9 Movements and Migrations

Per SEDAR 17:
The following is quoted from section 3.1 of the Atlantic States Marine Fisheries Commission's fishery management plan for Spanish mackerel (Mercer et al. 1990): "Spanish mackerel make seasonal migrations along the Atlantic coast and appear to be much more abundant in Florida during the winter. They move northward each spring to occur off the Carolinas by April or May, off Chesapeake Bay by May or June, and some years, as far north as Narragansett Bay by July (Berrien and Finan 1977)." In a tagging study in North Carolina, 1986-1990, by the NC Division of Marine Fisheries, fish were recaptured as far south as Sebastian Inlet, FL and as far north as the York River in

Virginia (Noble 1992). The few fish recaptured in Florida were caught in winter and spring, confirming a southern movement during the fall, while those recaptured in Virginia were caught in summer and fall, supporting a northerly movement during that time of year (Phalen 1989, Noble 1992).

Recommendations for the AW:
None

## 2.10 Meristics and Conversion Factors

Equations to make length-length and weight-length conversions were derived using the simple linear regression model and power functions, respectively (Table 2.7). All weights are shown in kilograms and lengths in millimeters. Coefficients of determination ($r^2$) ranged from 0.916 to 0.989 for these linear (length) and nonlinear (weight) regressions.

Recommendations for the AW:
1) Use the equations based on combined sources.

## 2.11 Comments on adequacy of data for assessment analyses

Included in individual sections above.

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## 2.13 Tables

Table 2.1. Point estimates of natural mortality (M) for the Gulf stock of Spanish mackerel based on maximum age = 11 years and von Bertalanffy parameter estimates: $t_0 = -0.5$, $k = 0.61$, and $L_\infty = 560$.

| Equations for Estimating M: | Parameters: | M |
|---|---|---|
| Alverson & Carney | k, tmax | 0.16 |
| Beverton | k, am | 3.44 |
| $\text{Hoenig}_{fish}$ | tmax | 0.38 |
| $\text{Hoenig}_{alltaxa}$ | tmax | 0.4 |
| Pauly | | 1.03 |
| Ralston | k | 1.28 |
| Ralston (geometric mean) | k | 2.20 |
| Ralston (method II) | k | 2.11 |
| Hewitt & Hoenig | tmax | 0.36 |
| Jensen | k | 0.92 |
| Rule of thumb | tmax | 0.27 |
| Alagaraja | survivorship to tmax: 0.1 | 0.42 |
| Alagaraja | survivorship to tmax: 0.2 | 0.36 |
| Alagaraja | survivorship to tmax: 0.5 | 0.27 |

Table 2.2. Number, percent kept, and percent discarded dead for Spanish mackerel caught in gillnet fisheries based on observed trips from 1998-2011. Data were provided by Simon Gulak (Gillnet Coordinator SEFSC NOAA Fisheries).

| Gear Type | Species | Total Number Caught | % Kept | % Discarded Dead |
|---|---|---|---|---|
| Drift | Spanish mackerel | 14,531 | 99% | 99% |
| Sink | Spanish mackerel | 40,810 | 99% | 99% |
| Strike | Spanish mackerel | 45 | 100% | 0 |

Table 2.3. Percent maturity per size class of females from the Atlantic and Gulf; Finucane and Collins (1986), MARMAP, PCLAB, and SEAMAP combined data sets.

| Atlantic Females | | | | | Gulf Females | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Size Class | No | Yes | Total | % Mature | Size Class | No | Yes | Total | % Mature |
| 151-175 | 3 | 0 | 3 | 0 | 151-175 | | | | |
| 176-200 | 6 | 0 | 6 | 0 | 176-200 | | | | |
| 201-225 | 49 | 0 | 49 | 0 | 201-225 | | | | |
| 226-250 | 72 | 0 | 72 | 0 | 226-250 | 1 | 1 | 2 | 50 |
| 251-275 | 97 | 4 | 101 | 4 | 251-275 | 5 | 1 | 6 | 17 |
| 276-300 | 73 | 14 | 87 | 16 | 276-300 | 16 | 3 | 19 | 16 |
| 301-325 | 54 | 38 | 92 | 41 | 301-325 | 18 | 25 | 43 | 58 |
| 326-350 | 32 | 63 | 95 | 66 | 326-350 | 29 | 115 | 144 | 80 |
| 351-375 | 20 | 81 | 101 | 80 | 351-375 | 22 | 159 | 181 | 88 |
| 376-400 | 4 | 73 | 77 | 95 | 376-400 | 10 | 212 | 222 | 95 |
| 401-425 | 3 | 64 | 67 | 96 | 401-425 | 10 | 190 | 200 | 95 |
| 426-450 | 1 | 41 | 42 | 98 | 426-450 | 11 | 146 | 157 | 93 |
| 451-475 | 0 | 24 | 24 | 100 | 451-475 | 4 | 147 | 151 | 97 |
| 476-500 | 0 | 17 | 17 | 100 | 476-500 | 11 | 85 | 96 | 89 |
| 501-525 | 0 | 17 | 17 | 100 | 501-525 | 0 | 101 | 101 | 100 |
| 526-550 | 0 | 6 | 6 | 100 | 526-550 | 1 | 66 | 67 | 99 |
| 551-575 | 0 | 7 | 7 | 100 | 551-575 | 2 | 60 | 62 | 97 |
| 576-600 | 0 | 4 | 4 | 100 | 576-600 | 1 | 57 | 58 | 98 |
| 601-625 | 0 | 12 | 12 | 100 | 601-625 | 0 | 31 | 31 | 100 |
| 626-650 | 0 | 4 | 4 | 100 | 626-650 | 1 | 20 | 21 | 95 |
| 651-725 | 0 | 7 | 7 | 100 | 651-725 | 0 | 12 | 12 | 100 |

Table 2.4. Percent maturity per size class of males from the Atlantic and Gulf from Finucane and Collins (1986), MARMAP, PCLAB, and SEAMAP combined data sets.

| Atlantic Males | | | | | Gulf Males | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Size Class | No | Yes | Total | % Mature | Size Class | No | Yes | Total | % Mature |
| 151-175 | 4 | 1 | 5 | 20 | 151-175 | | | | |
| 176-200 | 15 | 1 | 16 | 6 | 176-200 | | | | |
| 201-225 | 20 | 13 | 33 | 39 | 201-225 | 2 | 0 | 2 | 0 |
| 226-250 | 9 | 56 | 65 | 86 | 226-250 | 3 | 0 | 3 | 0 |
| 251-275 | 20 | 90 | 110 | 82 | 251-275 | 5 | 3 | 8 | 38 |
| 276-300 | 7 | 64 | 71 | 90 | 276-300 | 58 | 35 | 93 | 38 |
| 301-325 | 15 | 55 | 70 | 79 | 301-325 | 25 | 49 | 74 | 66 |
| 326-350 | 13 | 73 | 86 | 85 | 326-350 | 18 | 142 | 160 | 89 |
| 351-375 | 14 | 93 | 107 | 87 | 351-375 | 7 | 154 | 161 | 96 |
| 376-400 | 11 | 113 | 124 | 91 | 376-400 | 6 | 139 | 145 | 96 |
| 401-425 | 0 | 45 | 45 | 100 | 401-425 | 2 | 76 | 78 | 97 |
| 426-450 | 0 | 22 | 22 | 100 | 426-450 | 0 | 42 | 42 | 100 |
| 451-475 | 0 | 6 | 6 | 100 | 451-475 | 1 | 21 | 22 | 95 |
| 476-500 | 0 | 6 | 6 | 100 | 476-500 | 0 | 12 | 12 | 100 |
| 501-525 | 0 | 3 | 3 | 100 | 501-525 | 0 | 14 | 14 | 100 |
| 526-550 | 0 | 5 | 5 | 100 | 526-550 | 0 | 10 | 10 | 100 |
| 551-575 | 0 | 1 | 1 | 100 | 551-575 | 0 | 7 | 7 | 100 |
| 576-600 | 0 | 1 | 1 | 100 | 576-600 | 0 | 4 | 4 | 100 |
| 601-625 | 0 | 1 | 1 | 100 | 601-625 | | | | |
| 626-650 | 0 | 1 | 1 | 100 | 626-650 | | | | |
| 651-725 | 0 | 1 | 1 | 100 | 651-725 | | | | |

Table 2.5. Sex ratios of Gulf of Mexico Spanish mackerel gill net samples by age from commercial and scientific surveys in the PCLAB data set; 5% and 95% confidence intervals.

| Age | Females | Males | Total | % Female | F : M | low C.I. | high C.I. |
|---|---|---|---|---|---|---|---|
| 0 | 60 | 14 | 74 | 81 | 4.3 : 1.0 | 71 | 88 |
| 1 | 451 | 152 | 603 | 75 | 2.8 : 1.0 | 71 | 78 |
| 2 | 639 | 284 | 923 | 69 | 2.2 : 1.0 | 66 | 72 |
| 3 | 754 | 318 | 1,072 | 70 | 2.4 : 1.0 | 68 | 73 |
| 4 | 485 | 194 | 679 | 71 | 2.5 : 1.0 | 68 | 75 |
| 5 | 215 | 118 | 333 | 65 | 1.8 : 1.0 | 59 | 70 |
| 6 | 70 | 53 | 123 | 57 | 1.3 : 1.0 | 48 | 65 |
| 7 | 36 | 21 | 57 | 63 | 1.7 : 1.0 | 50 | 74 |
| 8 | 6 | 10 | 16 | 38 | 0.6 : 1.0 | 18 | 61 |
| 9 | 2 | 6 | 8 | 25 | 0.3 : 1.0 | 7 | 59 |
| 10 | 0 | 0 | 0 | 0 | | | |
| 11 | 1 | 0 | 1 | 100 | 1.0 : 0.0 | 21 | 100 |
| Total | 2,719 | 1,170 | 3,889 | 69* | 2.3 : 1.0 | | |

* ages 0 - 7

Table 2.6. Sex ratios of Gulf of Mexico Spanish mackerel recreational hook-and-line samples by age in the PCLAB data set; 5% and 95% confidence intervals.

Sex ratio of GOM recreational hook-and-line SMK by age

| Age | Females | Males | Total | % Female | F : M | low C.I. | high C.I. |
|---|---|---|---|---|---|---|---|
| 0 | 215 | 98 | 313 | 69 | 2.2 : 1.0 | 63 | 74 |
| 1 | 1,168 | 692 | 1,860 | 63 | 1.7 : 1.0 | 61 | 65 |
| 2 | 831 | 571 | 1,402 | 59 | 1.5 : 1.0 | 57 | 62 |
| 3 | 636 | 335 | 971 | 65 | 1.9 : 1.0 | 62 | 68 |
| 4 | 357 | 187 | 544 | 66 | 1.9 : 1.0 | 62 | 69 |
| 5 | 154 | 107 | 261 | 59 | 1.4 : 1.0 | 53 | 65 |
| 6 | 66 | 45 | 111 | 59 | 1.5 : 1.0 | 50 | 68 |
| 7 | 17 | 11 | 28 | 61 | 1.5 : 1.0 | 42 | 76 |
| 8 | 5 | 6 | 11 | 45 | 0.8 : 1.0 | 21 | 72 |
| 9 | 1 | 0 | 1 | 100 | 1.0 : 0.0 | 21 | 100 |
| 10 | 0 | 2 | 2 | 0 | 0.0 : 2.0 | 0 | 66 |
| Total | 3,450 | 2,054 | 5,504 | 63* | 1.7 : 1.0 | | |

* ages 0 - 7

Table 2.7. Meristics and conversion factors.

| LENGTH TO WEIGHT CONVERSIONS[1] | | | | (see sex-specific results below) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data | Area | Dep. Var. | Ind. Var. | a | b | r2 | n | LEN SE | WT SE | Length Range | Units | Function |
| Sexes Combined | S. Atl. | Weight | FL | 2.2492e-8 | 2.8452 | 0.9132 | 49,471 | 0.3400 | 0.0019 | 160-900 | kg mm | Power |
| Sexes Combined | Gulf | Weight | FL | 2.0284e-8 | 2.8640 | 0.9152 | 37,785 | 0.4221 | 0.0024 | 110-892 | kg mm | Power |
| Sexes Combined | Combined | Weight | FL | 2.1591e-8 | 2.8530 | 0.9159 | 87,579 | 0.2692 | 0.0015 | 110-900 | kg mm | Power |
| Sexes Combined | S. Atl. | Weight | TL | 2.8627e-9 | 3.1056 | 0.9293 | 23,473 | 0.4653 | 0.0021 | 210-882 | kg mm | Power |
| Sexes Combined | Gulf | Weight | TL | 1.2237e-8 | 2.8790 | 0.9804 | 8,404 | 1.0660 | 0.0060 | 210-978 | kg mm | Power |
| Sexes Combined | Combined | Weight | TL | 5.4935e-9 | 3.0025 | 0.9644 | 31,877 | 0.5082 | 0.0025 | 210-978 | kg mm | Power |
| | | | | | | | | | | | | |
| LENGTH TO LENGTH CONVERSIONS[1] | | | | RECOMMENDED | | | | | | | | |
| Data | Area | Dep. Var. | Ind. Var. | a | b | r2 | n | a SE | b SE | Length Range | Units | Function |
| Sexes Combined | S. Atl. | TL | FL | 16.6508 | 1.1262 | 0.9874 | 19,334 | 0.3551 | 0.0009 | 194-780 | mm | Linear |
| Sexes Combined | S. Atl. | FL | TL | -9.7850 | 0.8768 | 0.9874 | 19,334 | 0.3231 | 0.0007 | 224-882 | mm | Linear |
| Sexes Combined | Gulf | TL | FL | 27.6228 | 1.0995 | 0.9871 | 954 | 2.0529 | 0.0041 | 217-872 | mm | Linear |
| Sexes Combined | Gulf | FL | TL | -18.4462 | 0.8978 | 0.9871 | 954 | 1.9335 | 0.0033 | 245-980 | mm | Linear |
| Sexes Combined | Combined | TL | FL | 18.4306 | 1.1214 | 0.9886 | 20,288 | 0.3339 | 0.0008 | 194-872 | mm | Linear |
| Sexes Combined | Combined | FL | TL | -11.8218 | 0.8816 | 0.9886 | 20,288 | 0.3064 | 0.0007 | 224-980 | mm | Linear |
| Sexes Combined | S. Atl. | SL | FL | -6.3811 | 0.9630 | 0.9923 | 2,640 | 0.6506 | 0.0016 | 194-753 | mm | Linear |
| Sexes Combined | S. Atl. | FL | SL | 9.5589 | 1.0306 | 0.9924 | 2,640 | 0.6594 | 0.0018 | 177-728 | mm | Linear |
| Sexes Combined | S. Atl. | SL | TL | -19.4029 | 0.8450 | 0.9855 | 2,695 | 0.9197 | 0.0020 | 224-860 | mm | Linear |
| Sexes Combined | S. Atl. | TL | SL | 29.3078 | 1.1663 | 0.9855 | 2,695 | 1.0210 | 0.0027 | 177-728 | mm | Linear |
| | | | | | | | | | | | | |
| SEX-SPECIFIC WEIGHT AT LENGTH[1] | | | | RECOMMENDED | | | | | | | | |
| Data Source | Area | Dep. Var. | Ind. Var. | a | b | r2 | n | LEN SE | WT SE | Length Range | Units | Function |
| Female | S. Atl. | Weight | FL | 7.4558e-9 | 3.0244 | 0.9514 | 2,896 | 1.2412 | 0.0068 | 218-753 | kg mm | Power |
| Male | S. Atl. | Weight | FL | 1.6486e-8 | 2.8934 | 0.9091 | 2,141 | 0.9747 | 0.0039 | 252-605 | kg mm | Power |
| Female | Gulf | Weight | FL | 2.5969e-8 | 2.8310 | 0.9123 | 320 | 4.9400 | 0.0300 | 294-687 | kg mm | Power |
| Male | Gulf | Weight | FL | 5.1469e-9 | 3.0884 | 0.9657 | 124 | 7.1702 | 0.0395 | 298-640 | kg mm | Power |
| Female | Combined | Weight | FL | 7.9232e-9 | 3.0155 | 0.9464 | 3,216 | 1.2514 | 0.0070 | 218-753 | kg mm | Power |
| Male | Combined | Weight | FL | 1.0511e-8 | 2.9694 | 0.9280 | 2,265 | 1.0274 | 0.0044 | 252-640 | kg mm | Power |
| Sexes Combined | Combined | Weight | FL | 2.154E-08 | 2.8534 | 0.9161 | 88,067 | 0.2688 | 0.0015 | 110-900 | kg mm | Power |

[1] Data restrictions – TL < 1000, FL < 900, obvious errors omitted. Dep. Var. = Dependent variable, Ind. Var. = Independent variable.

## 2.14 Figures


Figure 2.1. Lorenzen age-varying natural mortality of the Gulf stock of Spanish mackerel.

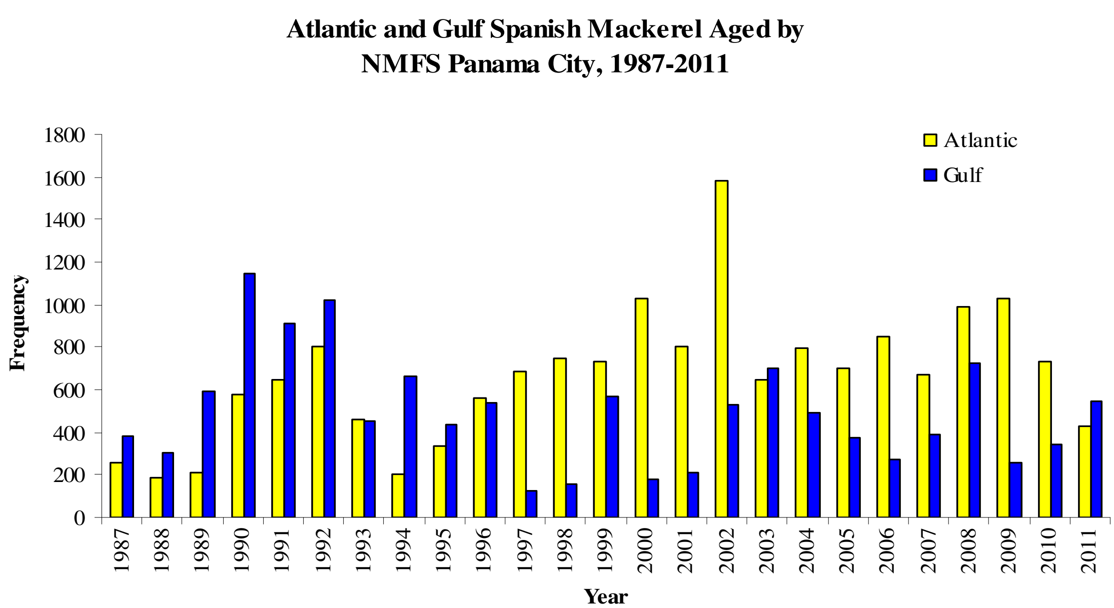


Figure 2.2. Atlantic and Gulf Spanish mackerel aged by NMFS Panama City, 1987-2011.

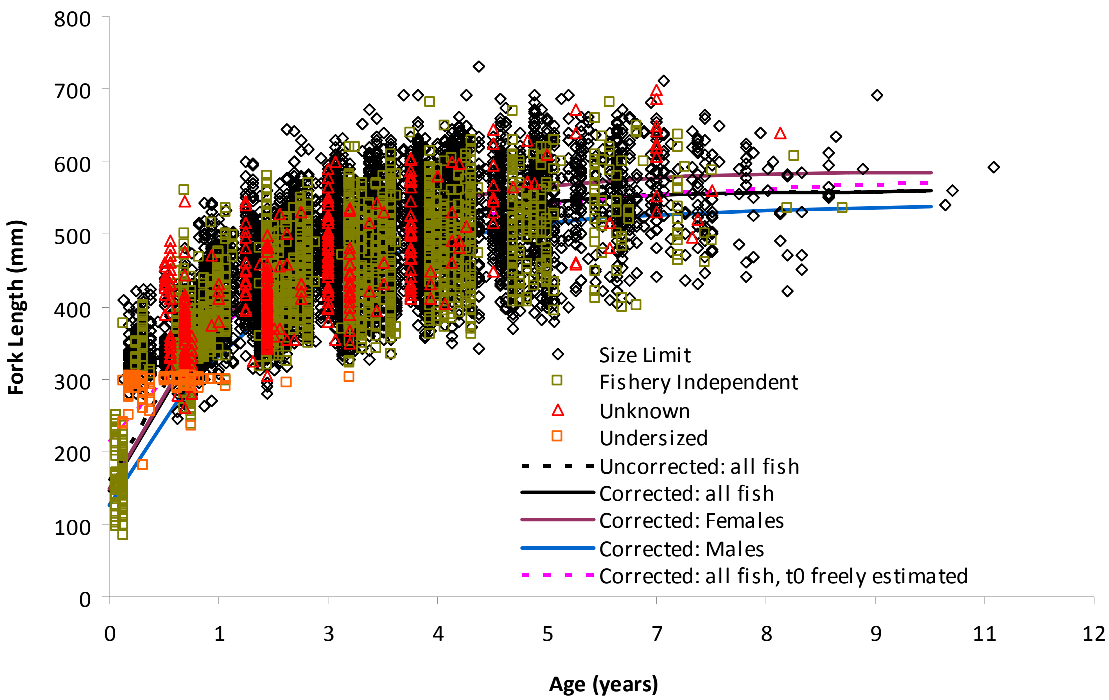


Figure 2.3. Gulf Spanish mackerel inversely weighted von Bertalanffy growth curves and raw data from the PCLAB data set. "Corrected" refers to the Diaz et al. correction in the growth model to handle the bias in the size-at-age data under the influence of the minimum size limit regulation.

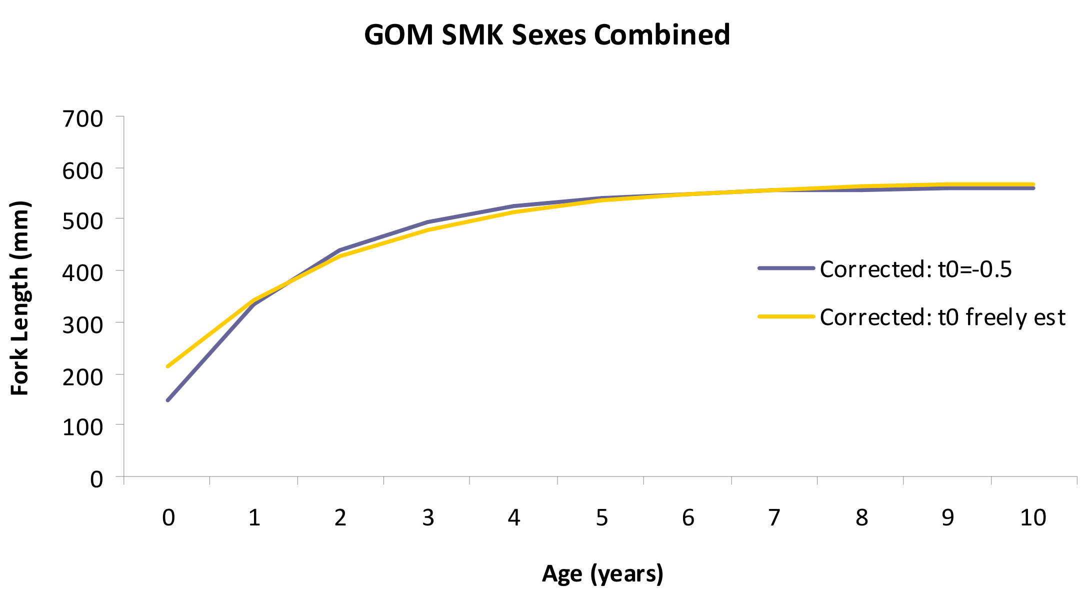


Figure 2.4. Spanish mackerel overall von Bertalanffy growth curves: corrected for size limit bias and inverse weighted with fixed $t_0 = -0.5$ and freely estimated $t_0 = -1.03$.

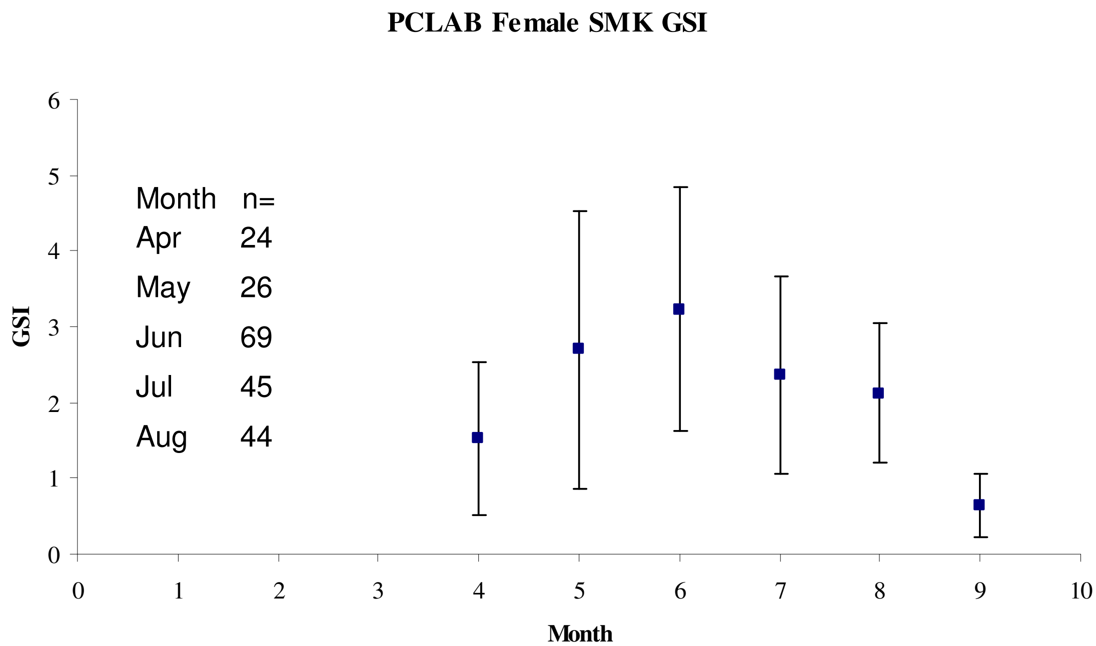


Figure 2.5. Gonadosmotic index of Gulf females from the PCLAB data set. Error bars are +/- 1 standard deviation.

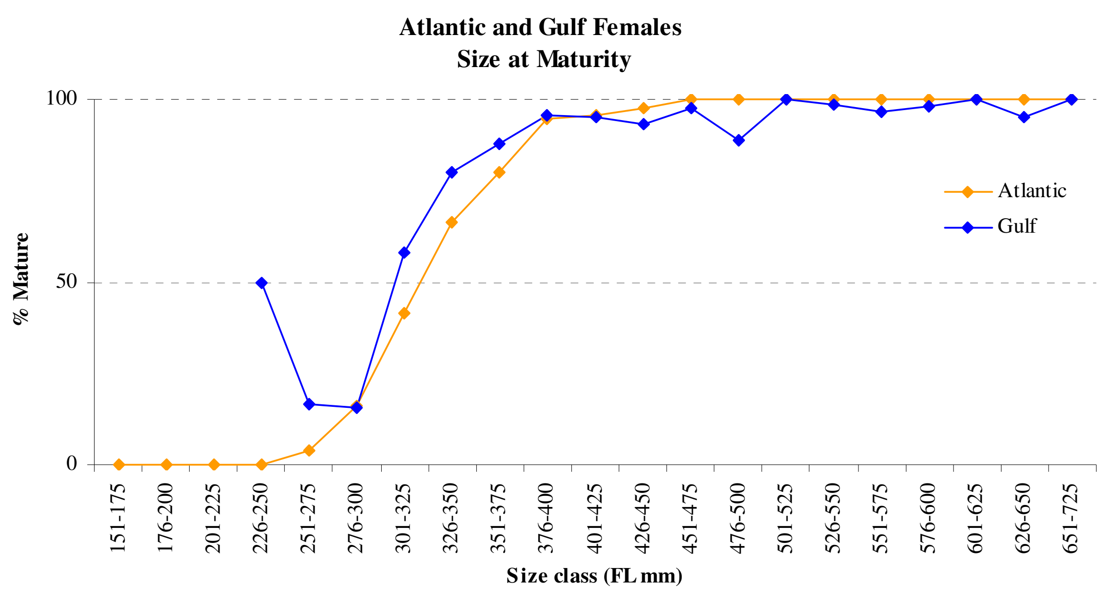


Figure 2.6. Size at maturity of female Spanish mackerel from the Atlantic and Gulf; Finucane and Collins (1986), MARMAP, PCLAB, and SEAMAP combined data sets.

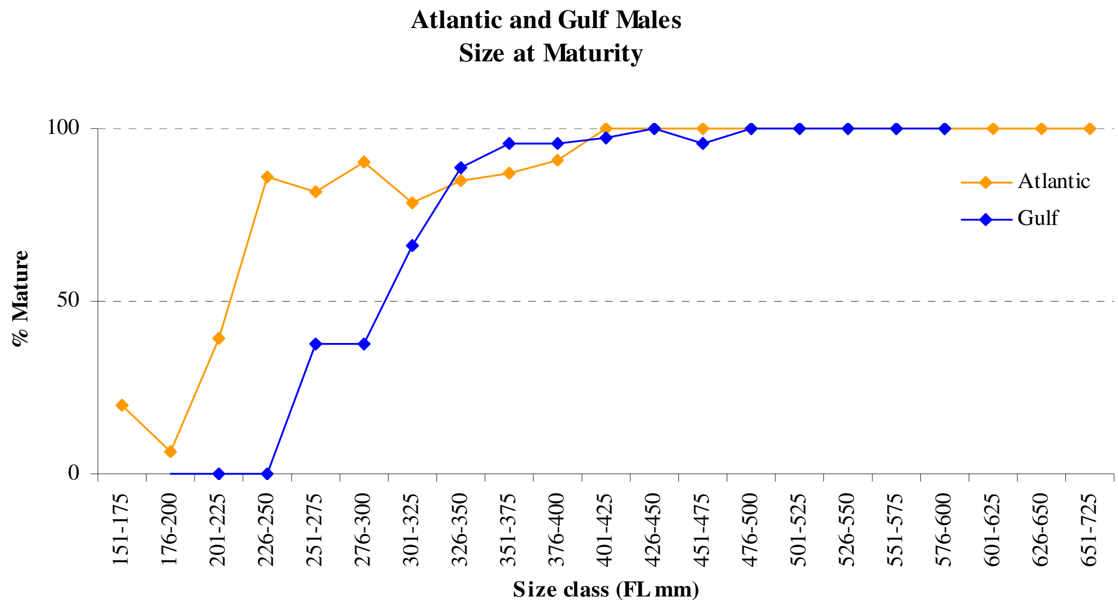


Figure 2.7. Size at maturity of male Spanish mackerel from the Atlantic and Gulf; Finucane and Collins (1986), MARMAP, PCLAB, and SEAMAP combined data sets.

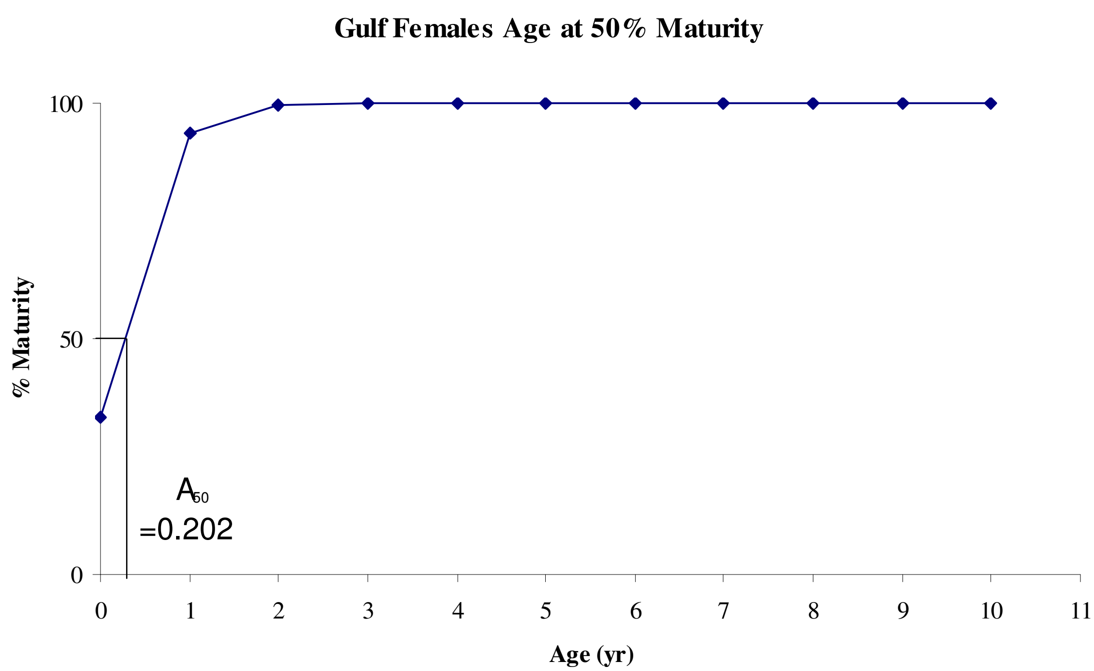


Figure 2.8. Age at 50% maturity of Gulf females from the PCLAB data set.

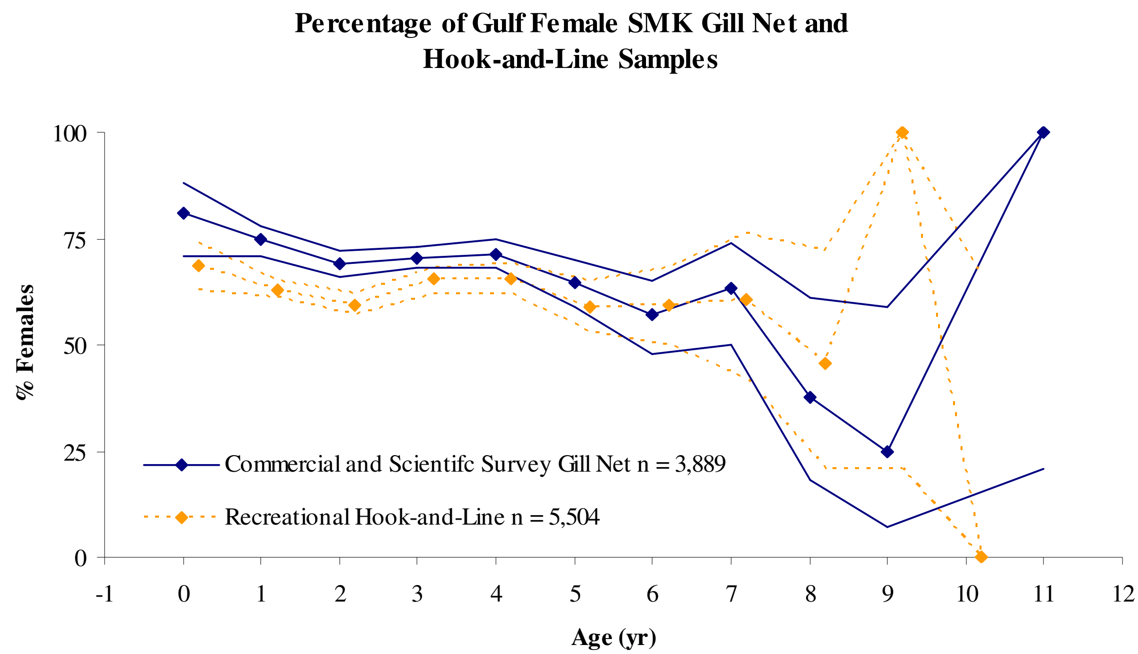


Figure 2.9. Percentage by age of Gulf female Spanish mackerel commercial and scientific survey gill nets, and recreational hook-an-line samples in the PCLAB data set; 5% and 95% confidence intervals.

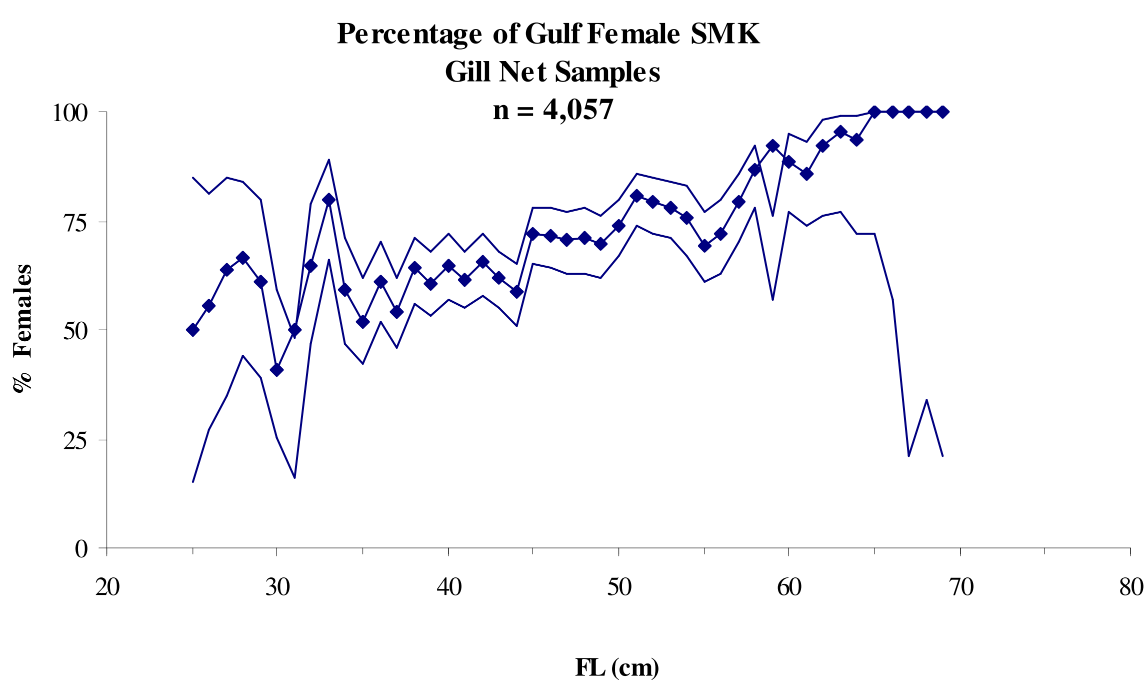

Figure 2.10. Percentage by size of Gulf females by size in the PCLAB data set from commercial and scientific survey gill nets; 5% 95% confidence intervals.

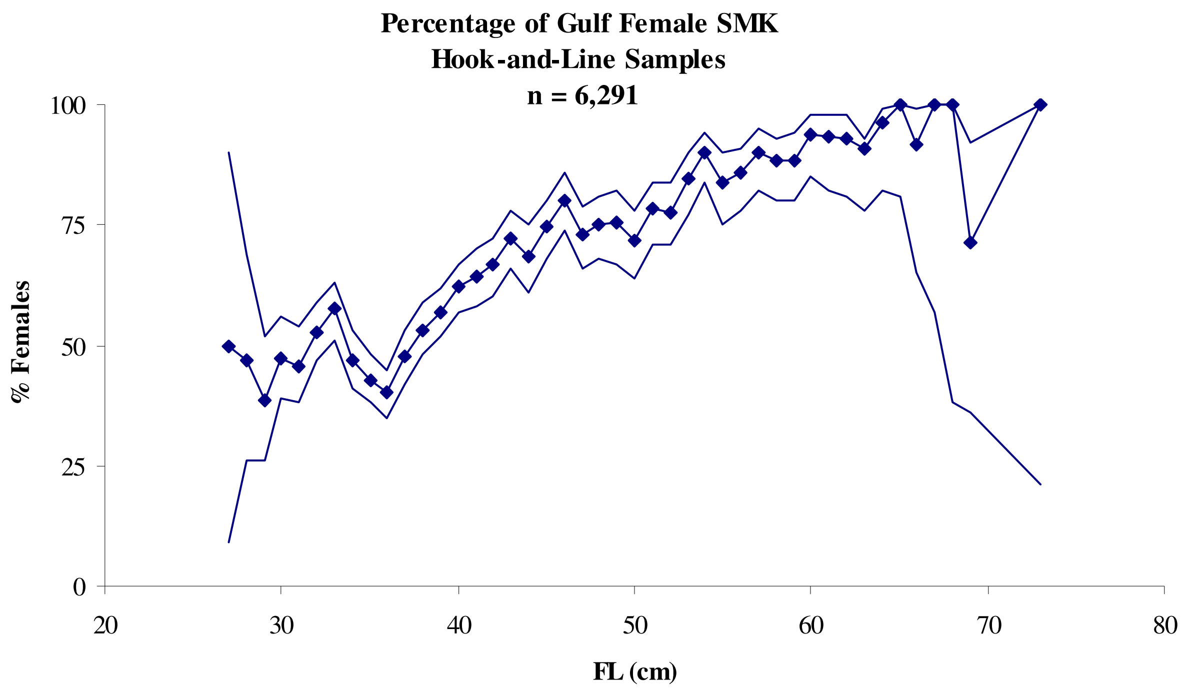


Figure 2.11. Percentage by size of Gulf females by size in the PCLAB data set from recreational hook-and-line samples; 5% and 95% confidence intervals.

# 3 Commercial Fishery Statistics

## 3.1 Overview

Commercial landings for the U.S. Gulf of Mexico (GoM) Spanish mackerel stock were developed by gear (gill net, hand lines, and miscellaneous) in whole weight for the period 1890–2010 based on federal and state databases. Corresponding landings in numbers were based on mean weights estimated from the Trip Interview Program (TIP) by gear, state, and year.

Commercial discards were calculated from vessels fishing in the US Gulf of Mexico and reporting to the NMFS Coastal Logbook Program. Shrimp bycatch of Spanish mackerel was estimated from observer data and SEAMAP trawl data and scaled using shrimping effort.

Sampling intensity for lengths and ages by gear and year were considered, and length and age compositions were developed by gear and year for which samples were available.

### 3.1.1 Participants Commercial Workgroup

David Gloeckner, NMFS, Miami, FL (co-leader)
Kyle Shertzer, NMFS, Beaufort, NC (co-leader)
Donna Bellais, GulfFIN, Ocean Springs, MS
Steve Brown, FL FWC, St. Petersburg, FL
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Julie Defilippi, ACCSP, Arlington, VA
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Other contributors: Katie Andrews, Meaghan Bryan, Rob Cheshire, Ben Hartig, Rusty Hudson, Kevin McCarthy, Julie Califf, Liz Scott-Denton

### 3.1.2 Issues Discussed at the Data Workshop

The Workgroup (WG) discussed several issues that needed to be resolved before data could be compiled. The major issues discussed included: stock boundaries, length of time series, primary gears, discard estimates from the directed fishery and shrimp fishery, as well as length composition adequacy for characterizing size of the catch. All decisions are described in more detail in the following sections.

### 3.1.3 Map of Fishing Area

A map of the council boundaries is presented in Figure 3.1. The GoM Spanish mackerel fishery is considered to include the area north of the Florida Keys around to the Texas/ Mexico border.

## 3.2 Review of Working Papers

The WG reviewed four working papers. All four of these papers were focused on GoM stocks.

**SEDAR28-DW6**: This working paper described a Bayesian approach to estimating shrimp bycatch in the GoM of both cobia and Spanish mackerel. The group found the methods to be sound, but questioned whether sample sizes for cobia were adequate to support the Bayesian model.

**SEDAR28-DW7**: This working paper described length frequency distributions of Spanish mackerel from commercial and recreational fleets in the GoM. Length frequencies of commercial landings were compiled from TIP data, and these data were considered adequate for use in the assessment.

**SEDAR28-DW8**: This working paper described length frequency distributions of cobia from commercial and recreational fleets in the GoM. Length frequencies of commercial landings were compiled from TIP data, and these data were considered adequate for use in the assessment.

**SEDAR28-DW04**: This working paper described the calculation of Spanish mackerel discard from the commercial gillnet, vertical line, and trolling fisheries. Discards were calculated as the product of gear-specific self-reported discard rates and total effort.

## 3.3 Commercial Landings

### 3.3.1 Time Series Duration

The WG made the decision to examine landings as far back in time as possible, because the longer time period might shed light on stock resilience and potential. Landings were compiled starting in 1880, the first year of available data, but the reliability of information improved substantially in 1950 with several additional improvements since (described along with methods).

> **Decision 1:** Landings will be presented from the earliest available year to the agreed upon terminal year. This was accepted by the plenary.

The terminal year considered for this report was 2010. However, the intent is to provide data through 2011 in time for the assessment workshop. Several data streams (e.g., discards) depend on statistics computed across years and could therefore change throughout the time series with the inclusion of 2011.

> **Decision 2:** Terminal year will be 2010 for this report, but the intent is to update with 2011 data for input to the assessment model. This decision was accepted by the plenary.

### 3.3.2 Fishing Year vs. Calendar Year

The WG recommended that commercial landings be aligned to the calendar year running from January 1 through December 31 because fishing years can change over time and calendar year will facilitate easier comparisons over time.

> **Decision 3:** The data will be compiled by calendar year. This was accepted by the plenary.

### 3.3.3 Stock Boundaries

Commercial landings were compiled from FL through TX. The eastern boundary was the FL Keys along the South Atlantic and Gulf of Mexico Council Boundary. Landings north and west of the Keys to the TX/Mexico border were considered to be from the Gulf of Mexico stock, and landings south of the Keys were considered to be from the Atlantic stock (Figures 3.1 and 3.2).

Data reported as north and west of the Keys (ALS fishing areas: 0018, 0020, 0028, 0030-0219, 7441, 7481, 1121-1202, 2121-5189, 8141-9202) were included in the GoM stock. If an area fished was not specified (ALS fishing areas 0000, 9999, 7994) then the landing was assigned to the Gulf of Mexico if it was landed on the FL West Coast, AL, MS, LA or TX (ALS states 11, 01, 21, 27, 46).

> **Decision 4:** Eastern boundary is the South Atlantic/Gulf of Mexico Fisheries Management Council boundary along the Florida Keys and the western boundary is the Texas/Mexico border. This was accepted by the plenary.

### 3.3.4 Identification Issues

The conclusion from the SEDAR 17 Spanish mackerel assessment was not revisited. The SEDAR 17 report states: "There was discussion about whether small king mackerel are mis-identified as Spanish mackerel, and vice versa (SEDAR, 2008). This was not thought to be an issue. The recent king mackerel assessment made a similar judgment in the SEDAR 16 data workshop. Currently, a landings category does not exist for unclassified mackerels. Further, Spanish mackerels have been identified as such historically back to the 1800s."

> **Decision 5:** There is not a misidentification issue with Spanish mackerel. This was accepted by the plenary.

### 3.3.5 Commercial Gears

The WG evaluated the distribution of gears in the landings and in the TIP data, and concluded that the data supported grouping commercial landings into two primary gears and one miscellaneous group. Thus, commercial landings were apportioned into: gill net, hand line (including trolling), and miscellaneous (including longline) (Table 3.1). Gill nets were the dominant gear type. The WG recommended that, for the assessment model, landings from the miscellaneous gear might be distributed among the other two gears according to their annual proportions of total landings.

> **Decision 6:** Landings will be aggregated by gill net, hand line and miscellaneous (other) gears. For the assessment model, the miscellaneous gears should be proportioned into gill net and hand line gears based on the annual proportions of landings by those gears. This was accepted by the plenary.

Data on commercial landings from 1926-1961 are housed in a database in the National Marine Fisheries Service's Office of Science and Technology (S&T). Historical commercial landings (1962 to present) for all species on the GoM coast are maintained in the Accumulated Landings System (ALS) at the Southeast Fisheries Science Center (SEFSC). Data prior to 1968 were collected by the Bureau of Commercial Fisheries or US Fish and Fisheries Commission and are available from the database at the NMFS office of Science and Technology (NMFS personal communication). Original reports from the Bureau are available at:
http://docs.lib.noaa.gov/rescue/cof/data_rescue_fish_commission_annual_reports.html. These historical landings are also reported in NMFS, 1990.

The data collected prior to the advent of the trip ticket programs in each state are generally referred to as the NMFS General Canvass data. General Canvass data were collected by port agents stationed in each county. The port agents would collect total landings from dealers and use local knowledge to proportion the landings into the proper fishing areas and gears. The ALS uses trip level data after the advent of trip ticket programs in each state.

Data from state trip ticket programs begin in various years, depending on the state. In the Gulf of Mexico, trip ticket data were available directly from the state trip ticket program or through the Gulf of Mexico Fisheries Information Network (GulfFIN) housed at the Gulf States Marine Fisheries Commission (GSMFC). Where data were available from state trip ticket programs, those data were used in lieu of data from ALS. Data are presented using the gear categories as determined at the workshop. The specific NMFS gears in each category are listed in Table 3.1. Commercial landings in pounds (whole weight) were developed based on methodologies for gear as defined by the WG for each state as available by gear for 1890-2010.

A precipitous drop in landings occurred in 1977 following a cold weather event in Florida during 1976 and 1977. After these cold weather events, landings remained much lower than previous years. There is evidence that this cold weather event affected other coastal migratory species as well (Fable et al., 1981).

Florida – Prior to 1986, Florida commercial landings data were collected through the NMFS General Canvass via monthly dealer reports. In 1984, the state of Florida instituted a mandatory trip level reporting program to report harvest of commercial marine fisheries products in Florida via a marine fisheries trip ticket. The program requires seafood dealers to report all transactions of marine fisheries products purchased from commercial fishers, and to interview fishers for pertinent effort data. Trip tickets are required to be received monthly, or weekly for federally managed species. Data reported on trip tickets include participant identifiers, dates of activity, effort and location data, gear used, as well as composition and disposition of catch. The program encompasses commercial fishery activity in waters of the Gulf of Mexico and South Atlantic from the Alabama-Florida border to the Florida-Georgia border. The first full year of available data from Florida trip tickets is 1986.

A data set was provided to the commercial WG of summarized Spanish mackerel landings by year and gear with pounds (whole weight) from Florida Gulf of Mexico waters (Monroe county landings were assigned to the Gulf when catch area indicated a Gulf catch area; Monroe county landings were assigned to Gulf if no catch area was reported). Gear categories include gill net, hand line (including trolling), and miscellaneous (including longline). Gear was not accurately reported on trip ticket data from 1986 to 1996, so for those years the landings by gear from the NMFS General Canvass data were used.

NMFS logbook data were evaluated and it was decided to use Florida trip ticket data from 1997 forward for landings, area, and gear distributions, and NMFS General Canvass landings data prior to 1997. All vessels permitted for coastal species were not required to submit logbooks until 1993, and while gear distributions were similar to Florida trip ticket landings data, logbook did not account for inshore landings of Spanish mackerel, and total landings of Spanish mackerel were significantly less than trip ticket landings from 1993 to 2010.

Alabama – Alabama trip ticket data have been collected since 2000. These data are recoded in the FIN format and copied to the GulfFIN database every few months. GulfFIN provided the Spanish mackerel landings data from AL for 2000-2010. ALS data were used for 1962-1999.

Mississippi –Mississippi finfish landings are currently collected by a NMFS port agent and housed in the ALS. Mississippi intends to begin a state trip ticket program for finfish during 2012. All MS landings for Spanish mackerel were compiled from the ALS 1962-2010.

Louisiana – Louisiana trip ticket data has been collected since 1993, however, gear and fishing area were not required. In 1998 LA began to require information on gear and area of capture. Data collected since 2000 are recoded in the FIN format and copied to the GulfFIN database every few months. GulfFIN provided the Spanish mackerel landings data from LA for 2000-2010. ALS data were used for 1962-1999.

Texas – Texas trip ticket data have been collected since 2009, however, TX is still developing quality control procedures to allow the data to be edited for errors before transfer to GulfFIN. Prior to the beginning of the TX trip ticket program, NMFS port agents had collected TX landings data. Because the NMFS data collection method has been in place since the 1970s, ALS was used for TX Spanish mackerel landings from 1962-2010.

Gulf of Mexico Spanish mackerel landings by gear and year are presented in Table 3.2 and Figure 3.3. The distribution of catches reported on coastal logbooks are presented in Figures 3.6 and 3.7.

**Decision 7:** The WG made the following decisions for reporting of commercial landings:

- Landings would be presented by calendar year/gear across all states.
- Final landings data would come from the following sources:
    - FL:
    - 1890-1949 (Bureau of Commercial Fisheries reports)
    - 1950-1961 (S&T)
    - 1962-1996 (ALS)

- 1997-2010 (FLFWC)
- AL:
- 1890-1949 (Bureau of Commercial Fisheries reports)
- 1950-1961 (S&T)
- 1962-1999 (ALS)
- 2000-2010 (GulfFIN)
- MS:
- 1890-1949 (Bureau of Commercial Fisheries reports)
- 1950-1961 (S&T)
- 1962-2010 (ALS)
- LA:
- 1890-1949 (Bureau of Commercial Fisheries reports)
- 1950-1961 (S&T)
- 1962-1999 (ALS)
- 2000-2010 (GulfFIN)
- TX:
- 1890-1949 (Bureau of Commercial Fisheries reports)
- 1950-1961 (S&T)
- 1962-2010 (ALS)

Whole vs Gutted Weight – The Commercial WG discussed the topic of what units to use to report commercial landings. Spanish mackerel are typically landed whole, therefore for this analysis, landings were provided in whole weight.

> **Decision 8:** Landings will be presented in pounds whole weight. This was accepted by the plenary.

Confidentiality Issues – The Commercial WG agreed that it was necessary to hide commercial landings with fewer than three submitters. The WG recommended that landings be hidden if they fail to meet the rule of 3.

> **Decision 9:** Landings with fewer than 3 submitters should be hidden for years when the number of submitters is known. This was accepted by the plenary.

### 3.3.6 Converting Landings in Weight to Landings in Numbers

The weight in pounds for each sample was calculated, as was the mean weight by gear and year (weighted by: weight of fish in the sample in pounds whole weight, trip weight in pounds whole weight, and strata landing weight in pounds whole weight). Where the sample size was less than 20, the mean across all years for that gear was used, if the sample size was less than 20 across all years for the gear, then the mean across all gears and years was used (Table 3.3). It was suggested by the lead analyst that 50 be considered as the cutoff for minimum sample size, as was done in previous assessments by SEFSC. This was examined, but resulted in an average difference of only 0.02 pounds between the 20 fish minimum and the 50 fish minimum size, so 20 fish was used as the minimum sample size. The landings in pounds whole weight were divided by the mean weight for that stratum to derive landings in numbers (Table 3.4 and Figure 3.4).

## 3.4 Commercial Discards

### 3.4.1 Discards from Commercial Finfish Operations

Spanish mackerel discards from the commercial vertical line, trolling, and gillnet fisheries were calculated for the US South Atlantic (statistical areas 2300-3700; Table 3.5) and Gulf of Mexico (statistical areas 1-21; Table 3.5). A map of logbook areas is presented in Figure 3.5. The number of trips that reported discards of Spanish mackerel was very low (Table 3.5), limiting the complexity of any analysis. Methods for calculating discards are detailed in SEDAR28-DW04 and are summarized below.

Spanish mackerel discard rates were calculated as the mean nominal discard rate among all trips (by gear) that reported to the discard logbook program during the period 2002–2010. Rates were separately calculated for vertical line, trolling, and gill net gears. Yearly gear specific discards were calculated as the product of the gear specific discard rate and gear specific yearly total effort (vertical line and trolling effort = total hook-hours fished; gill net effort = square yard hours fished) reported to the coastal logbook program. Discards were calculated for the years 1998–2010. Prior to 1998, federal permits were not required to land Spanish mackerel caught in federal waters. Total Spanish mackerel fishing effort, particularly for trolling vessels, was not reported to the coastal logbook program by all commercial vessels, and thus any estimates of total discards would have been erroneously low for years prior to 1998.

Approximately 1.3 percent of all Spanish mackerel discard reports for the period 2002–2010 were from trips reporting fishing gears other than vertical lines, trolling, and gill nets. Data reported for those other gears were not included in the discard calculations.

Yearly total gear specific discards (calculated in number of fish) from the Gulf of Mexico are provided in Table 3.6. Those totals include all discards reported to the discard logbook program including those reported as “kept, not sold”.

The yearly calculated Spanish mackerel discards from the commercial fishery (of vessels with federal permits reporting to the coastal logbook program) were relatively low. During the 13 years included in the analysis, fewer than 20,000 Spanish mackerel were discarded in the Gulf of Mexico per year. The number of trips upon which the calculations were based, however, was very small. An additional concern was the possible under-reporting of commercial discards. The percentage of fishers returning discard logbooks with reports of “no discards” has been much greater than the percentage of observer reports of “no discards” on commercial fishing trips suggesting that under-reporting of discards may be occurring. These results should, therefore, be used with caution. Discards calculated here may represent the minimum number of discards from the commercial fishery.

A high percentage of Spanish mackerel discards were reported as “dead” or “majority dead” in the South Atlantic gill net fishery (Table 3.7). The vertical line and trolling fisheries in both regions report many fish that may have otherwise been discards as “kept” (Table 3.7). Many of those “kept” fish may have been used as bait.

**Decision 10:** The Commercial WG supports the methodology of calculating discards and recommends the use of these data. However, the discards reported as "kept, not sold" should be added to the landings, not included with the discards. This was accepted by the plenary.

### 3.4.2 Discards from the Shrimp Fishery

The WG considered the estimates of Spanish mackerel bycatch in the Gulf of Mexico shrimp fishery presented in SEDAR28-DW06 as prepared by Brian Linton. This method used a Bayesian approach to estimating bycatch, developed by Scott Nichols for the SEDAR 7 Gulf Red Snapper Assessment. The methods used and preliminary results are repeated below.

The data used in this analysis came from various shrimp observer programs, the SEAMAP groundfish survey, shrimp effort estimates, and the Vessel Operating Units file. The primary data on CPUE in the shrimp fishery came from a series of shrimp observer programs, which began in 1972 and extend to the current shrimp observer program. Additional CPUE data were obtained from the SEAMAP groundfish survey. Only data from 40 ft trawls by the Oregon II were used in this analysis, because these trawls were identified as being most similar to trawls conducted by the shrimp fishery. Point estimates and associated standard errors of shrimp effort were generated by the NMFS Galveston Lab using their SN-pooled method of effort estimation (Nance 2004). Most observer program CPUE data were expressed in numbers per net-hour, while the shrimp effort data were expressed in vessel-hours. Therefore, data from the NMFS Vessel Operating Units file were used to estimate the average number of nets per vessel for the shrimp fishery.

The following Bayesian model was used to estimate shrimp bycatch (i.e., model 02 from Nichols 2004a):

$$Ln(CPUE)_{ijklm} = year_i + season_j + area_k + depth_l + data\_set_m + local_{ijklm}.$$

The factor levels for the main effects are presented in Table 3.8. Catch in numbers for each cell was assumed to follow a negative binomial distribution. The main effects and local term, as expressed above (i.e, on the log-scale), were assigned normal prior distributions. A lognormal hyperprior was assigned to the precision ($1/\sigma 2$) parameter of the local term. Therefore, the data determined the distribution of the local term in cells with data, while the distribution of the local term defaulted to the prior with fitted precision for cells without data. In effect, the local term became a fixed effect for cells with data and a random effect for cells without data.

The shrimp bycatch estimation model was fit using WinBUGS version 1.4.3. Markov Chain Monte Carlo (MCMC) methods were used to estimate the marginal posterior distributions of the parameters and important derived quantities. Two parallel chains of 29,000 iterations each were run. The first 4,000 iterations of each chain were dropped as a burn-in period, to remove the effects of the initial parameter values. A thinning interval of five iterations (i.e., only every fifth iteration was used) was applied to each chain, to reduce autocorrelation in parameter estimates and derived quantities. The marginal posterior distributions were calculated from the remaining 10,000 iterations. Convergence of the chains was determined by visual inspection of trace plots, marginal posterior density plots, and Gelman-Rubin statistic (Brooks and Gelman, 1998) plots.

Annual observed bycatch is reported in Table 3.9. Annual estimates (predicted) of total Spanish mackerel bycatch in the Gulf of Mexico shrimp fishery are presented in Table 3.10. The CVs associated with these estimates ranged from 25% to 911%. Ten of the 39 years had CVs below 100%. The marginal posterior densities of the estimates showed a high degree of skew in every year, with 2008 having the least amount of skew.

Although there were some years with small sample sizes, the WG felt the method was adequate for estimating Spanish mackerel bycatch in the Gulf of Mexico shrimp fishery.

> **Decision 11:** The Commercial WG supports the methodology of calculating Spanish mackerel bycatch in the Gulf of Mexico shrimp fishery and recommends the use of these data. This was accepted by the plenary.

## 3.5 Commercial Effort

The distribution of commercial effort in trips by year was compiled from the Coastal Logbook Program for 1990-2010 and supplied here for informational purposes. These data are presented in Figures 3.8 and 3.9.

## 3.6 Biological Sampling

Biological sample data were obtained from the TIP sample data at NMFS/SEFSC. Data that were not already in the TIP database were also incorporated from NCDMF, as well as sample data from VMRC covering Virginia commercial fisheries. Data were filtered to eliminate those records that included a size or effort bias, were known to be collected non-randomly, were not from commercial trips, were selected by quota sampling, or were not collected shore-side (observer data). These data were further limited to those that could be assigned a year, gear, and state. Data that had an unknown landing year, gear, or state were deleted from the file. Additionally, samples were removed if they were drawn from market categories. This was due to the potential for bias in sampling, although a review of length data during SEDAR 17 indicated only trivial difference in the length distributions if the market categories were excluded. Further, only lengths from fish caught in the Gulf were included in the analysis.

The group reviewed the distribution of sample size to size of the catch to determine if trip weighting was needed. For Spanish mackerel there was not a significant relationship between catch size and sample size, indicating that sampling fraction varied by trip, thus the WG recommended weighting the length data by trip. Where no trip landings data were available, the sample weight was used as a proxy, as the sample weight gives a minimum weight landed for the species. If there was no landing weight or sample weight recorded for the sample, the length sample was dropped. Length data were also weighted spatially by the landings for the particular year, state and gear stratum, and thus were limited to where those strata could be identified in the corresponding landings. Landings and biological data were assigned a state based on landing location or sample location if there was no landing location assigned.

**Decision 12:** The Commercial WG recommends weighting the length samples by trip weight to overcome any sampling bias arising from differences in sampling fractions across trips. This was accepted by the plenary.

### 3.6.1 Sampling Intensity for Lengths

The number of trips with samples used in the length compositions ranged from a high of 21 for hand line gear in 2010 to a low of zero for many strata (Table 3.11). The number of trips with samples used in the length compositions was consistently greater than 10 trips for hand line gear since 2008. The number of trips with samples used averaged 10 for gill net gear since 2005. Trips using other miscellaneous gear were rarely sampled. Table 3.11 displays number of trips with samples with unbiased samples and number of trips with samples used (trip weights and landings available).

The number of fish sampled had a high of 794 for gill net gear in 2006 and lows of zero for many of the strata (Table 3.12). The number of lengths sampled was consistently greater than 100 for gill net gear since 2004. Hand line gear had over 100 lengths available for only years within 2006-2008. For other miscellaneous gears, the numbers of length samples available were above 100 for 1992, 2004 and 2006-2008. Table 3.12 displays the number of valid samples and number of samples used (trip weights and landings available).

### 3.6.2 Length/Age Distribution

All lengths were converted to fork length (FL) in mm using the formula provided in the Spanish mackerel Life History section of the SEDAR 28 Data Workshop Report and binned into one centimeter groups with a floor of 0.6 cm and a ceiling of 0.5 cm. Length was converted to weight (whole weight in pounds) using conversions provided by the life history group. The length data and landings data were divided into gill net, hand line, and other miscellaneous gears. Length compositions were weighted by the trip landings in numbers and the landings in numbers by strata (state, year, gear). Annual length compositions of Spanish mackerel are summarized in Figures 3.10-3.12.

Observer samples were provided from the Reeffish Observer Program by the NMFS Galveston Lab. These data were filtered to remove non-random samples. Of the remaining data, only two Spanish mackerel were reported as discarded (43 cm FL, and 45 cm FL).

Sample size of Spanish mackerel ages are summarized by gear from commercial landings in the U.S. Gulf of Mexico for 1983-2010 (Table 3.13). Age compositions were developed for gill net (1988-2010 with exceptions in Figure 3.13), hand line (1988-2010, Figure 3.14), and other miscellaneous (1988-2010, Figure 3.15) gear types. The commercial group suggests ages are weighted by the length composition with the formula:

$$RW_i = \frac{NLi / TN}{OLi / TO},$$

where *NLi* is the number of fish measured with length *i*, *TN* is the total number of fish measured in that strata, *OLi* is the number of ages sampled at length *i,* and *TO* is the total number of ages sampled within the strata and $RW_i$ is the weight to apply to the age (Chih, 2009). This weighting corrects for a potential sampling bias of age samples relative to length samples (SEDAR, 2006). Weighting by length composition was not done at this time, pending resolution of how to correct the age data when length compositions are not available for the given year and gear strata. The age compositions presented in Figures 3.13-3.15 are unweighted.

## 3.7 Comments on Adequacy of Data for Assessment Analyses

Landings data appear to be adequate to support the assessment, with landings reports beginning in the 1880s. Landings have greatest certainty since the individual state's trip ticket programs were initiated. Landings prior to 1950 are considered highly uncertain.

Discard estimates have greater uncertainty than the landings, as there are very few trips where Spanish mackerel discards were observed by the Reeffish Observer Program. Additionally, the NMFS logbook doesn't capture the entire fishery, so the discards reported to this program should be considered a minimum estimate. Bycatch in the shrimp fishery is difficult to determine given the low encounter rate between shrimp trawls and Spanish mackerel, and because of irregular observer coverage. As a consequence, the annual variability in shrimp bycatch may be poorly estimated, although the estimated mean bycatch may be at the appropriate scale.

Commercial discards and shrimp bycatch are based on estimated encounter rates and effort. In years when multi-year averages are used to compute encounter rates, these estimates do not account for year-specific age structure in the Spanish mackerel stock.

Sample sizes for developing length compositions were inadequate for a considerable number of year and gear strata. This may impact the ability in those years to use length compositions to correct for potential biases in age compositions. In some year and gear strata, sample sizes appeared adequate, although a small proportion of the overall catch was sampled. The annual proportion of commercial trips sampled for lengths was typically less than 1% in all years (Table 3.14).

## 3.8 Literature Cited

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## Addendum to Commercial Landings (Section 3.3):

### NMFS SEFIN Accumulated Landings (ALS)

Information on the quantity and value of seafood products caught by fishermen in the U.S. has been collected starting in the late1800s (first year varies by species). Fairly serious collection activity began in the 1920s. The data set maintained by the Southeast Fisheries Science Center (SEFSC) in the SEFIN database management system is a continuous data set that begins in 1962.

In addition to the quantity and value, information on the gear used to catch the fish, the area where the fishing occurred and the distance from shore are also recorded. Because the quantity and value data are collected from seafood dealers, the information on gear and fishing location are estimated and added to the data by data collection specialists. In some states, this ancillary data are not available.

Commercial landings statistics have been collected and processed by various organizations during the 1962-to-present period that the SEFIN data set covers. During the 16 years from 1962 through 1978, these data were collected by port agents employed by the Federal government and stationed at major fishing ports in the southeast. The program was run from the Headquarters Office of the Bureau of Commercial Fisheries in Washington DC. Data collection procedures were established by Headquarters and the data were submitted to Washington for processing and computer storage. In 1978, the responsibility for collection and processing were transferred to the SEFSC.

In the early 1980s, the NMFS and the state fishery agencies within the Southeast began to develop a cooperative program for the collection and processing of commercial fisheries statistics. With the exception of two counties, one in Mississippi and one in Alabama, all of the general canvass statistics are collected by the fishery agency in the respective state and provided to the SEFSC under a comprehensive Cooperative Statistics Program (CSP).

The purpose of this documentation is to describe the current collection and processing procedures that are employed for the commercial fisheries statistics maintained in the SEFIN database.

1960 - Late 1980s

================
Although the data processing and database management responsibility were transferred from the Headquarters in Washington DC to the SEFSC during this period, the data collection procedures remained essentially the same. Trained data collection personnel, referred to as fishery reporting specialists or port agents, were stationed at major fishing ports throughout the Southeast Region. The data collection procedures for commercial landings included two parts.

The primary task for the port agents was to visit all seafood dealers or fish houses within their assigned areas at least once a month to record the pounds and value for each species or product type that were purchased or handled by the dealer or fish house. The agents summed the landings and value data and submitted these data in monthly reports to their area supervisors. All of the monthly data were submitted in essentially the same form.

The second task was to estimate the quantity of fish that were caught by specific types of gear and the location of the fishing activity. Port agents provided this gear/area information for all of the landings data that they collected. The objective was to have gear and area information assigned to all monthly commercial landings data.

There are two problems with the commercial fishery statistics that were collected from seafood dealers. First, dealers do not always record the specific species that are caught and second, fish or shellfish are not always purchased at the same location where they are unloaded, i.e., landed.

Dealers have always recorded fishery products in ways that meet their needs, which sometimes make it ambiguous for scientific uses. Although the port agents can readily identify individual species, they usually were not at the fish house when fish were being unloaded and thus, could not observe and identify the fish.

The second problem is to identify where the fish were landed from the information recorded by the dealers on their sales receipts. The NMFS standard for fisheries statistics is to associate commercial statistics with the location where the product was first unloaded, i.e., landed, at a shore-based facility. Because some products are unloaded at a dock or fish house and purchased and transported to another dealer, the actual 'landing' location may not be apparent from the dealers' sales receipts. Historically, communications between individual port agents and the area supervisors were the primary source of information that was available to identify the actual unloading location.

Cooperative Statistics Program
============================
In the early 1980s, it became apparent that the collection of commercial fisheries statistics was an activity that was conducted by both the Federal government and individual state fishery agencies. Plans and negotiations were initiated to develop a program that would provide the fisheries statistics that are needed for management by both Federal and state agencies. By the mid- 1980s, formal cooperative agreements had been signed between the NMFS/SEFSC and each of the eight coastal states in the southeast, Puerto Rico and the US Virgin Islands.

Initially, the data collection procedures that were used by the states under the cooperative agreements were essentially the same as the historical NMFS procedures. As the states developed their data collection programs, many of them promulgated legislation that authorized their fishery agencies to collect fishery statistics. Many of the state statutes include mandatory data submission by seafood dealers.

Because the data collection procedures (regulations) are different for each state, the type and detail of data varies throughout the Region. The commercial landings database maintained in SEFIN contains a standard set of data that is consistent for all states in the Region.

A description of the data collection procedures and associated data submission requirements for each state follows.

Florida
=======

Prior to 1986, commercial landings statistics were collected by a combination of monthly mail submissions and port agent visits. These procedures provided quantity and value, but did not provide information on gear, area or distance from shore. Because of the large number of dealers, port agents were not able to provide the gear, area and distance information for monthly data. This information, however, is provided for annual summaries of the quantity and value and known as the Florida Annual Canvas data (see below).

Beginning in 1986, mandatory reporting by all seafood dealers was implemented by the State of Florida. The State requires that a report (ticket) be completed and submitted to the State for every trip. Dealers have to report the type of gear as well as the quantity (pounds) purchased for each species. Information on the area of catch can also be provided on the tickets for individual trips. As of 1986 the ALS system relies solely on the Florida trip ticket data to create the ALS landings data for all species other than shrimp.

Alabama
=======
Data collection in Alabama is voluntary and is conducted by state and federal port agents that visit dealers and docks monthly. Summaries of the total landings (pounds) and value for species or market category are recorded. Port agents provide information on gear and fishing area from their knowledge of the fisheries and interaction with fishermen and dealers. As of mid- 2000, the State of Alabama required fishermen and dealers to report all commercial landings data through a trip ticket system. As of 2001 the ALS system relies solely on the Alabama trip ticket data to create the ALS landings data for Alabama.

Mississippi
===========
Data collection in Mississippi is voluntary and is conducted by state and federal port agents that visit dealers and docks monthly. Summaries of the total landings (pounds) and value for species or market category are recorded. Port agents provide information on gear and fishing area from their knowledge of the fisheries and interaction with fishermen and dealers.

Louisiana
===========
Prior to 1993, commercial landings statistics were collected in Louisiana by Federal port agents following the traditional procedures established by the NMFS. Monthly summaries of the quantity and value were collected from each dealer in the state. The information on gear, area and distance from shore were added by the individual port agents.

Beginning in January 1993, the Department of Wildlife and Fisheries, State of Louisiana began to enforce the states' mandatory reporting requirement. Dealers have to be licensed by the State and are required to submit monthly summaries of the purchases that were made for individual species or market categories. With the implementation of the State statute, Federal port agents did not participate in the collection of commercial fishery statistics.

Since the implementation of the State program, information on the gear used, the area of catch and the distance from shore has not been added to the landings statistics (1992-1999). In 1998 the State of Louisiana required fishermen and dealers to report all commercial landings data through a trip ticket system. These data contain detailed landings information by trip including gear, area of capture and vessel information. As of 2000, the ALS system relies solely on the Louisiana trip ticket data to create the ALS landings data for Louisiana.

Texas
=====
The State has a mandatory reporting requirement for dealers licensed by the State. Dealers are required to submit monthly summaries of the quantities (pounds) and value of the purchases that were made for individual species or market categories.

Information on gear, area and distance from shore are added to the state data by SEFSC personnel. Furthermore, landings of species that are unloaded in Texas, but transported to locations in other states are added to the commercial landings statistics by SEFSC personnel.

**NMFS SEFIN Annual Canvas Data for Florida**

The Florida Annual Data files from 1976 – 1996 represent annual landings by county (from dealer reports) which are broken out on a percentage estimate by species, gear, area of capture, and distance from shore. These estimates are submitted by Port agents, which were assigned responsibility for the particular county, from interviews and discussions from dealers and fishermen collected throughout the year. The estimates are processed against the annual landings totals by county on a percentage basis to create the estimated proportions of catch by the gear, area and distance from shore. (The sum of percentages for a given Year, State, County, Species combination will equal 100.)

Area of capture considerations: ALS is considered to be commercial landings data base which reports where the marine resource was landed. With the advent of some State trip ticket programs as the data source the definition is more loosely applied. As such one cannot assume reports from the ALS by State or county will accurately inform you of Gulf vs South Atlantic vs Foreign catch. To make that determination you must consider the area of capture.

## 3.9 Tables

**Table 3.1.** NMFS gears in each gear category for Spanish mackerel commercial landings.

| NMFS GEAR CODE | GEAR DESCRIPTION | GEAR CATEGORY |
|---|---|---|
| 000 | Not Coded | OTHER |
| 020 | Haul Seines, Beach | OTHER |
| 030 | Haul Seines, Long | OTHER |
| 032 | Haul Seines, Long(Danish) | OTHER |
| 040 | Stop Seines | OTHER |
| 050 | Stop Nets | OTHER |
| 100 | Encircling Nets (Purse) | OTHER |
| 103 | Purse Seines, Anchovy | OTHER |
| 105 | Purse Seines, Barracuda | OTHER |
| 110 | Purse Seines, Herring | OTHER |
| 120 | Purse Seines, Mackerel | OTHER |
| 125 | Purse Seines, Menhaden | OTHER |
| 130 | Purse Seines, Salmon | OTHER |
| 135 | Purse Seines, Sardine | OTHER |
| 140 | Purse Seines, Tuna | OTHER |
| 145 | Purse Seines, Other | OTHER |
| 150 | Nets Unc, Hawaii | OTHER |
| 151 | Nets, excluding trawls | OTHER |
| 155 | Lampara & Ring Nets, Mackerel | OTHER |
| 160 | Lampara & Ring Nets, Sardine | OTHER |
| 165 | Lampara & Ring Nets, Squid | OTHER |
| 170 | Lampara & Ring Nets, Tuna | OTHER |
| 175 | Lampara & Ring Nets, Other | OTHER |
| 180 | Bag Nets | OTHER |
| 185 | Paranella Nets | OTHER |
| 187 | Skimmer Nets | OTHER |
| 189 | Butterfly Nets | OTHER |
| 191 | Beam Trawls, Crab | OTHER |
| 192 | Beam Trawls, Shrimp | OTHER |
| 193 | Beam Trawls, Other | OTHER |
| 194 | BEAM TRAWLS, CHOPSTICKS | OTHER |
| 200 | Trawls, Unspecified | OTHER |
| 205 | Otter Trawl Bottom, Crab | OTHER |
| 210 | Otter Trawl Bottom, Fish | OTHER |
| 212 | Otter Trawl Bottom, Lobster | OTHER |
| 214 | Otter Trawl Bottom, Scallop | OTHER |
| 215 | Otter Trawl Bottom, Shrimp | OTHER |

| | | |
|---|---|---|
| 217 | Otter Trawl Bottom, Twin | OTHER |
| 220 | Otter Trawl Bottom, Other | OTHER |
| 230 | Otter Trawl Midwater | OTHER |
| 233 | Trawl Midwater, Paired | OTHER |
| 235 | Trawl Bottom, Paired | OTHER |
| 240 | Scottish Seine | OTHER |
| 250 | Weirs | OTHER |
| 275 | Pound Nets, Fish | OTHER |
| 280 | Pound Nets, Crab | OTHER |
| 285 | Pound Nets, Horseshoe Crab | OTHER |
| 289 | Pound Nets, Other | OTHER |
| 290 | Trap Nets | OTHER |
| 295 | Floating Traps (Shallow) | OTHER |
| 300 | Pots And Traps, Cmb | OTHER |
| 305 | Fyke And Hoop Nets, Crab | OTHER |
| 310 | Fyke And Hoop Nets, Fish | OTHER |
| 315 | Fyke And Hoop Nets, Turtle | OTHER |
| 320 | Fyke Net, Other | OTHER |
| 325 | Pots And Traps, Conch | OTHER |
| 330 | Pots And Traps, Crab, Blue | OTHER |
| 331 | Pots And Traps, Crab, Dungens | OTHER |
| 332 | Pots And Traps, Crab, King | OTHER |
| 333 | Pots And Traps, Crab, Other | OTHER |
| 334 | Pots and Traps, Crab, Blue Peeler | OTHER |
| 335 | Pots And Traps,Crayfsh(frhwa) | OTHER |
| 340 | Pots And Traps, Eel | OTHER |
| 345 | Pots And Traps, Fish | OTHER |
| 350 | Pots And Traps, Lobster Inshore | OTHER |
| 351 | Pots And Traps, Lobster Ofshore | OTHER |
| 355 | Pots And Traps, Spiny Lobster | OTHER |
| 360 | Pots And Traps, Octopus | OTHER |
| 365 | Pots And Traps, Perwkle Or Ckle | OTHER |
| 370 | Pots And Traps, Shrimp | OTHER |
| 375 | Pots And Traps, Turtle | OTHER |
| 379 | Pots And Traps, Other | OTHER |
| 380 | Pots And Traps, Box Trap | OTHER |
| 385 | Pots And Traps, Wire Baskets | OTHER |
| 387 | Pots, Unclassified | OTHER |
| 390 | Slat Traps (Virginia) | OTHER |
| 400 | Entangling Nets (Gill) Unspc | GILL NET |
| 405 | Gill Nets, California Halibut | GILL NET |
| 410 | Gill Nets, Crab | GILL NET |
| 415 | Gill Nets, Salmon | GILL NET |

| | | |
|---|---|---|
| 420 | Gill Nets, Sea Bass | GILL NET |
| 425 | Gill Nets, Other | GILL NET |
| 430 | Gill Nets, Sink/Anchor, Other | GILL NET |
| 450 | Gill Nets, Drift, Barracuda | GILL NET |
| 455 | Gill Nets, Drift, Salmon | GILL NET |
| 460 | Gill Nets, Drift, Sea Bass | GILL NET |
| 465 | Gill Nets, Drift, Shad | GILL NET |
| 470 | Gill Nets, Drift, Other | GILL NET |
| 475 | Gill Nets, Drift, Runaround | GILL NET |
| 480 | Gill Nets, Stake | GILL NET |
| 490 | Gill Nets, Gl Shoal | GILL NET |
| 500 | Gill Nets, Gl 1 - 2 Inch | GILL NET |
| 505 | Gill Nets, Gl 2 - 4 Inch | GILL NET |
| 510 | Gill Nets, Gl 4 - 7 Inch | GILL NET |
| 515 | Gill Nets, Gl 7 - 14 Inch | GILL NET |
| 520 | Gill Nets, Drift Large Pelagic | GILL NET |
| 530 | Trammel Nets | OTHER |
| 600 | Troll & Hand Lines Cmb | HAND LINE |
| 601 | Lines Hand, Albacore | HAND LINE |
| 605 | Lines Hand, Rockfish | HAND LINE |
| 607 | Lines Hand, Yellowfish | HAND LINE |
| 610 | Lines Hand, Other | HAND LINE |
| 611 | Rod and Reel | HAND LINE |
| 612 | Reel, Manual | HAND LINE |
| 613 | Reel, Electric or Hydraulic | HAND LINE |
| 614 | BUOY GEAR, VERTICAL | OTHER |
| 616 | Rod and Reel, Electric (Hand) | HAND LINE |
| 621 | Lines Jigging Machine | HAND LINE |
| 650 | Lines Troll, Salmon | HAND LINE |
| 651 | Lines Power Troll Salmon | HAND LINE |
| 655 | Lines Troll, Tuna | HAND LINE |
| 656 | Lines Power Troll Tuna | HAND LINE |
| 657 | LINES TROLL, GREEN-STICK | HAND LINE |
| 660 | Lines Troll, Other | HAND LINE |
| 661 | Lines Power Troll Other | HAND LINE |
| 665 | Lines Troll, Mackerel | HAND LINE |
| 675 | Lines Long Set With Hooks | OTHER |
| 676 | Lines Long, Reef Fish | OTHER |
| 677 | Lines Long, Shark | OTHER |
| 678 | Lines Long Drift With Hooks | OTHER |
| 680 | Lines Trot With Baits | OTHER |
| 685 | Lines Snag | OTHER |
| 690 | Lines Electrical Devices | OTHER |

| | | |
|---|---|---|
| 703 | Dip Nets, Common | OTHER |
| 705 | Dip Nets, Drop | OTHER |
| 710 | Brail Or Scoop | OTHER |
| 715 | Lift Net | OTHER |
| 720 | Reef Net | OTHER |
| 725 | Push Net | OTHER |
| 730 | Wheels | OTHER |
| 735 | Cast Nets | OTHER |
| 751 | Harpoons, Swordfish | OTHER |
| 752 | Harpoons, Turtle | OTHER |
| 753 | Harpoons, Whale | OTHER |
| 754 | Harpoons, Other | OTHER |
| 760 | Spears | OTHER |
| 765 | Powerheads (Bangsticks) | OTHER |
| 770 | Scrapes | OTHER |
| 781 | Water Pump,Sand Shrimp | OTHER |
| 785 | Barge Kelp | OTHER |
| 802 | Dredge Clam Hydraulic | OTHER |
| 803 | Dredge Clam | OTHER |
| 804 | Dredge Conch | OTHER |
| 805 | Dredge Crab | OTHER |
| 810 | Dredge Mussel | OTHER |
| 815 | Dredge Oyster, Common | OTHER |
| 820 | Dredge Oyster, Suction | OTHER |
| 823 | Dredge Scallop, Bay | OTHER |
| 825 | Dredge Scallop, Sea | OTHER |
| 827 | Dredge Urchin, Sea | OTHER |
| 830 | Dredge Other | OTHER |
| 840 | Tongs and Grabs, Oyster | OTHER |
| 841 | Tongs Patent, Oyster | OTHER |
| 845 | Tongs and Grabs, Other | OTHER |
| 846 | Tongs Patent, Clam Other | OTHER |
| 853 | Rakes, Oyster | OTHER |
| 855 | Rakes, Other | OTHER |
| 860 | Hoes | OTHER |
| 865 | Forks | OTHER |
| 870 | Shovels | OTHER |
| 875 | Picks | OTHER |
| 880 | Brush Trap | OTHER |
| 890 | Crowfoot Bars | OTHER |
| 895 | Frog Grabs | OTHER |
| 925 | Hooks, Sponge | OTHER |
| 930 | Hooks, Abalone | OTHER |

| | | |
|---|---|---|
| 935 | Hooks, Other | OTHER |
| 941 | Diving Outfits, Abalone | OTHER |
| 942 | Diving Outfits, Sponge | OTHER |
| 943 | Diving Outfits, Other | OTHER |
| 944 | Diving with Nets | OTHER |
| 951 | By Hand, Oyster | OTHER |
| 955 | By Hand, Other | OTHER |
| 966 | Other Gear, Hawaii | OTHER |
| 967 | Various Gear, Fishponds Hawaii | OTHER |
| 989 | Unspecified Gear | OTHER |
| 999 | Combined Gears | OTHER |

**Table 3.2.** Spanish mackerel landings (pounds whole weight) by gear from the U.S. Gulf of Mexico, 1880-2010.

| | GEAR | | |
|---|---|---|---|
| YEAR | GILL NET | HAND LINE | OTHER |
| 1880 | | | |
| 1881 | | | |
| 1882 | | | |
| 1883 | | | |
| 1884 | | | |
| 1885 | | | |
| 1886 | | | |
| 1887 | 124,613 | 7,544 | 27,843 |
| 1888 | 242,995 | 14,711 | 54,294 |
| 1889 | 465,740 | 28,196 | 104,064 |
| 1890 | 539,729 | 32,675 | 120,596 |
| 1891 | | | |
| 1892 | | | |
| 1893 | | | |
| 1894 | | | |
| 1895 | | | |
| 1896 | | | |
| 1897 | 584,901 | 35,410 | 130,689 |
| 1898 | | | |
| 1899 | | | |
| 1900 | | | |
| 1901 | | | |
| 1902 | 1,233,667 | 74,686 | 275,648 |
| 1903 | | | |
| 1904 | | | |
| 1905 | | | |
| 1906 | | | |
| 1907 | | | |
| 1908 | 1,157,341 | 70,065 | 258,594 |
| 1909 | | | |
| 1910 | | | |
| 1911 | | | |
| 1912 | | | |
| 1913 | | | |
| 1914 | | | |
| 1915 | | | |
| 1916 | | | |
| 1917 | | | |

| | | | |
|---|---|---|---|
| 1918 | 2,743,039 | 166,062 | 612,898 |
| 1919 | | | |
| 1920 | | | |
| 1921 | | | |
| 1922 | | | |
| 1923 | 3,010,178 | 182,235 | 672,587 |
| 1924 | | | |
| 1925 | | | |
| 1926 | | | |
| 1927 | 3,716,484 | 224,987 | 830,395 |
| 1928 | 2,573,232 | 155,777 | 574,952 |
| 1929 | 2,784,325 | 168,556 | 622,117 |
| 1930 | 3,267,511 | 197,807 | 730,079 |
| 1931 | 1,853,856 | 112,228 | 414,217 |
| 1932 | 2,285,394 | 138,352 | 510,639 |
| 1934 | 2,753,561 | 166,694 | 615,244 |
| 1936 | 4,100,885 | 248,258 | 916,284 |
| 1937 | 3,103,491 | 187,878 | 693,431 |
| 1938 | 3,204,253 | 193,978 | 715,944 |
| 1939 | 3,341,472 | 202,285 | 746,604 |
| 1940 | 2,877,597 | 174,203 | 642,958 |
| 1945 | 72,198 | 4,371 | 16,132 |
| 1948 | 698,846 | 42,307 | 156,147 |
| 1949 | 3,018,910 | 182,758 | 674,532 |
| 1950 | 2,019,590 | 122,261 | 451,248 |
| 1951 | 5,070,822 | 306,976 | 1,133,002 |
| 1952 | 3,518,064 | 212,975 | 786,061 |
| 1953 | 2,324,192 | 140,701 | 519,307 |
| 1954 | 2,248,178 | 136,099 | 502,323 |
| 1955 | 1,267,472 | 76,730 | 283,198 |
| 1956 | 2,273,412 | 137,627 | 507,961 |
| 1957 | 2,841,726 | 172,031 | 634,943 |
| 1958 | 3,013,692 | 182,442 | 673,366 |
| 1959 | 3,653,581 | 221,179 | 816,340 |
| 1960 | 4,258,500 | 257,800 | 951,501 |
| 1961 | 3,126,701 | 189,283 | 698,616 |
| 1962 | 5,644,600 | 116,000 | 1,150,300 |
| 1963 | 4,538,400 | 68,100 | 840,700 |
| 1964 | 3,479,100 | 160,000 | 316,800 |
| 1965 | 4,159,400 | 257,600 | 488,500 |
| 1966 | 6,070,600 | 301,500 | 694,200 |
| 1967 | 4,745,000 | 235,700 | 995,400 |
| 1968 | 5,849,800 | 215,400 | 1,166,200 |

| | | | |
|---|---|---|---|
| 1969 | 7,079,500 | 190,100 | 1,072,600 |
| 1970 | 6,650,500 | 220,000 | 1,399,200 |
| 1971 | 5,907,900 | 219,500 | 1,530,600 |
| 1972 | 4,524,700 | 335,400 | 1,671,900 |
| 1973 | 5,370,100 | 120,000 | 704,200 |
| 1974 | 6,972,000 | 646,700 | 648,500 |
| 1975 | 4,527,900 | 739,800 | 353,600 |
| 1976 | 6,619,600 | 790,900 | 372,500 |
| 1977 | 1,805,690 | 580,377 | 250,351 |
| 1978 | 964,343 | 511,574 | 229,130 |
| 1979 | 1,712,868 | 57,728 | 351,376 |
| 1980 | 1,415,870 | 75,811 | 440,165 |
| 1981 | 2,772,772 | 157,368 | 778,927 |
| 1982 | 2,823,398 | 155,258 | 476,935 |
| 1983 | 1,752,312 | 123,738 | 389,939 |
| 1984 | 3,281,759 | 49,140 | 174,816 |
| 1985 | 1,744,186 | 55,486 | 257,023 |
| 1986 | 2,534,583 | 29,282 | 168,292 |
| 1987 | 2,570,864 | 219,854 | 58,722 |
| 1988 | 2,155,022 | 24,134 | 136,357 |
| 1989 | 2,845,737 | 53,464 | 218,525 |
| 1990 | 2,312,456 | 16,210 | 249,192 |
| 1991 | 2,972,476 | 145,310 | 323,905 |
| 1992 | 3,357,279 | 34,455 | 354,716 |
| 1993 | 2,371,091 | 26,445 | 206,101 |
| 1994 | 2,511,070 | 20,743 | 245,888 |
| 1995 | 1,323,496 | 19,152 | 166,447 |
| 1996 | 350,340 | 26,362 | 30,261 |
| 1997 | 486,266 | 39,634 | 14,086 |
| 1998 | 345,020 | 44,375 | 72,293 |
| 1999 | 747,682 | 55,126 | 69,308 |
| 2000 | 815,645 | 39,180 | 56,128 |
| 2001 | 984,247 | 71,016 | 127,664 |
| 2002 | 855,151 | 36,098 | 57,047 |
| 2003 | 1,345,072 | 42,359 | 40,667 |
| 2004 | 999,017 | 40,274 | 37,311 |
| 2005 | 1,446,003 | 34,262 | 14,906 |
| 2006 | 1,163,146 | 53,596 | 199,389 |
| 2007 | 898,808 | 28,785 | 13,906 |
| 2008 | 1,129,503 | 83,865 | 21,091 |
| 2009 | 1,717,062 | 75,316 | 23,638 |
| 2010 | 1,065,323 | 139,223 | 45,203 |

** = indicates confidential data withheld.

**Table 3.3.** Mean weights in pounds whole weight used to derive landings in numbers by year and gear. Source indicates the level of aggregation used: GEAR_MEANS = mean weight for the gear across all years, STRATA = mean weight within the gear and year strata.

| | GEAR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | GILL NET | | | HAND LINE | | | OTHER | | |
| YEAR | MEAN WEIGHT | STANDARD DEVIATION | SOURCE | MEAN WEIGHT | STANDARD DEVIATION | SOURCE | MEAN WEIGHT | STANDARD DEVIATION | SOURCE |
| 1880 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1881 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1882 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1883 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1884 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1885 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1886 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1887 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1888 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1889 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1890 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1891 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1892 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1893 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1894 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1895 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1896 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1897 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1898 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1899 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1900 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1901 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1902 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1903 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1904 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1905 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1906 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1907 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1908 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1909 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1910 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1911 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1912 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1913 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1914 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1915 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1916 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1917 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1918 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1919 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1920 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1921 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1922 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1923 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1924 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1925 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1926 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1927 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1928 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1929 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1930 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1931 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1932 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1933 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1934 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1935 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1936 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1937 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1938 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1939 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1940 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1941 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1942 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1943 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1944 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1945 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1946 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1947 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1948 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1949 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1950 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1951 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1952 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1953 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1954 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1955 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1956 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1957 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1958 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1959 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1960 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1961 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1962 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1963 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1964 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1965 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1966 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1967 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1968 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1969 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1970 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1971 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1972 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1973 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1974 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1975 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1976 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1977 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1978 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1979 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1980 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1981 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1982 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1983 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1984 | 2.808 | 1.951 | GEAR_MEANS | 5.869 | 4.472 | STRATA | 3.099 | 2.459 | GEAR_MEANS |
| 1985 | 2.808 | 1.951 | GEAR_MEANS | 15.216 | 35.299 | STRATA | 3.099 | 2.459 | GEAR_MEANS |
| 1986 | 2.808 | 1.951 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 1.161 | 0.809 | STRATA |
| 1987 | 2.483 | 1.296 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1988 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1989 | 1.612 | 1.035 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1990 | 1.882 | 1.139 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1991 | 1.580 | 0.708 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1992 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 1.016 | 0.599 | STRATA |
| 1993 | 1.533 | 0.631 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1994 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1995 | 2.978 | 1.276 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1996 | 3.468 | 1.352 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1997 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1998 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 1999 | 2.808 | 1.951 | GEAR_MEANS | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 2000 | 2.063 | 0.842 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 2001 | 1.820 | 0.547 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 3.099 | 2.459 | GEAR_MEANS |
| 2002 | 2.808 | 1.951 | GEAR_MEANS | 5.120 | 3.098 | STRATA | 2.488 | 1.295 | STRATA |
| 2003 | 1.983 | 0.770 | STRATA | 5.497 | 3.121 | STRATA | 3.099 | 2.459 | GEAR_MEANS |
| 2004 | 3.317 | 2.465 | STRATA | 5.265 | 7.977 | GEAR_MEANS | 3.630 | 5.766 | STRATA |
| 2005 | 2.893 | 2.160 | STRATA | 4.386 | 3.280 | STRATA | 3.099 | 2.459 | GEAR_MEANS |
| 2006 | 2.462 | 1.778 | STRATA | 5.222 | 3.601 | STRATA | 2.799 | 1.834 | STRATA |
| 2007 | 2.962 | 2.115 | STRATA | 3.321 | 3.119 | STRATA | 3.168 | 2.355 | STRATA |
| 2008 | 3.004 | 2.183 | STRATA | 3.967 | 3.316 | STRATA | 2.977 | 1.623 | STRATA |
| 2009 | 2.968 | 2.012 | STRATA | 4.675 | 3.325 | STRATA | 2.869 | 1.297 | STRATA |
| 2010 | 2.369 | 1.705 | STRATA | 5.476 | 4.515 | STRATA | 1.645 | 0.410 | STRATA |

**Table 3.4.** Gulf of Mexico Spanish mackerel commercial landings by gear and year in numbers (thousands)

| | GEAR | | |
|---|---|---|---|
| YEAR | GILL NET | HAND LINE | OTHER |
| 1880 | 0 | 0 | 0 |
| 1881 | 0 | 0 | 0 |
| 1882 | 0 | 0 | 0 |
| 1883 | 0 | 0 | 0 |
| 1884 | 0 | 0 | 0 |
| 1885 | 0 | 0 | 0 |
| 1886 | 0 | 0 | 0 |
| 1887 | 44 | 1 | 9 |
| 1888 | 87 | 3 | 18 |
| 1889 | 166 | 5 | 34 |
| 1890 | 192 | 6 | 39 |
| 1891 | 0 | 0 | 0 |
| 1892 | 0 | 0 | 0 |
| 1893 | 0 | 0 | 0 |
| 1894 | 0 | 0 | 0 |
| 1895 | 0 | 0 | 0 |
| 1896 | 0 | 0 | 0 |
| 1897 | 208 | 7 | 42 |
| 1898 | 0 | 0 | 0 |
| 1899 | 0 | 0 | 0 |
| 1900 | 0 | 0 | 0 |
| 1901 | 0 | 0 | 0 |
| 1902 | 439 | 14 | 89 |
| 1903 | 0 | 0 | 0 |
| 1904 | 0 | 0 | 0 |
| 1905 | 0 | 0 | 0 |
| 1906 | 0 | 0 | 0 |
| 1907 | 0 | 0 | 0 |
| 1908 | 412 | 13 | 83 |
| 1909 | 0 | 0 | 0 |
| 1910 | 0 | 0 | 0 |
| 1911 | 0 | 0 | 0 |
| 1912 | 0 | 0 | 0 |
| 1913 | 0 | 0 | 0 |
| 1914 | 0 | 0 | 0 |
| 1915 | 0 | 0 | 0 |
| 1916 | 0 | 0 | 0 |

| | | | |
|---|---|---|---|
| 1917 | 0 | 0 | 0 |
| 1918 | 977 | 32 | 198 |
| 1919 | 0 | 0 | 0 |
| 1920 | 0 | 0 | 0 |
| 1921 | 0 | 0 | 0 |
| 1922 | 0 | 0 | 0 |
| 1923 | 1,072 | 35 | 217 |
| 1924 | 0 | 0 | 0 |
| 1925 | 0 | 0 | 0 |
| 1926 | 0 | 0 | 0 |
| 1927 | 1,323 | 43 | 268 |
| 1928 | 916 | 30 | 186 |
| 1929 | 991 | 32 | 201 |
| 1930 | 1,163 | 38 | 236 |
| 1931 | 660 | 21 | 134 |
| 1932 | 814 | 26 | 165 |
| 1933 | 0 | 0 | 0 |
| 1934 | 980 | 32 | 199 |
| 1935 | 0 | 0 | 0 |
| 1936 | 1,460 | 47 | 296 |
| 1937 | 1,105 | 36 | 224 |
| 1938 | 1,141 | 37 | 231 |
| 1939 | 1,190 | 38 | 241 |
| 1940 | 1,025 | 33 | 207 |
| 1941 | 0 | 0 | 0 |
| 1942 | 0 | 0 | 0 |
| 1943 | 0 | 0 | 0 |
| 1944 | 0 | 0 | 0 |
| 1945 | 26 | 1 | 5 |
| 1946 | 0 | 0 | 0 |
| 1947 | 0 | 0 | 0 |
| 1948 | 249 | 8 | 50 |
| 1949 | 1,075 | 35 | 218 |
| 1950 | 719 | 23 | 146 |
| 1951 | 1,806 | 58 | 366 |
| 1952 | 1,253 | 40 | 254 |
| 1953 | 828 | 27 | 168 |
| 1954 | 801 | 26 | 162 |
| 1955 | 451 | 15 | 91 |
| 1956 | 810 | 26 | 164 |
| 1957 | 1,012 | 33 | 205 |
| 1958 | 1,073 | 35 | 217 |
| 1959 | 1,301 | 42 | 263 |

| | | | |
|---|---|---|---|
| 1960 | 1,516 | 49 | 307 |
| 1961 | 1,113 | 36 | 225 |
| 1962 | 2,010 | 22 | 371 |
| 1963 | 1,616 | 13 | 271 |
| 1964 | 1,239 | 30 | 102 |
| 1965 | 1,481 | 49 | 158 |
| 1966 | 2,162 | 57 | 224 |
| 1967 | 1,690 | 45 | 321 |
| 1968 | 2,083 | 41 | 376 |
| 1969 | 2,521 | 36 | 346 |
| 1970 | 2,368 | 42 | 451 |
| 1971 | 2,104 | 42 | 494 |
| 1972 | 1,611 | 64 | 539 |
| 1973 | 1,912 | 23 | 227 |
| 1974 | 2,483 | 123 | 209 |
| 1975 | 1,612 | 140 | 114 |
| 1976 | 2,357 | 150 | 120 |
| 1977 | 643 | 110 | 81 |
| 1978 | 343 | 97 | 74 |
| 1979 | 610 | 11 | 113 |
| 1980 | 504 | 14 | 142 |
| 1981 | 987 | 30 | 251 |
| 1982 | 1,005 | 29 | 154 |
| 1983 | 624 | 23 | 126 |
| 1984 | 1,169 | 8 | 56 |
| 1985 | 621 | 4 | 83 |
| 1986 | 903 | 6 | 145 |
| 1987 | 1,035 | 42 | 19 |
| 1988 | 767 | 5 | 44 |
| 1989 | 1,766 | 10 | 71 |
| 1990 | 1,229 | 3 | 80 |
| 1991 | 1,881 | 28 | 105 |
| 1992 | 1,195 | 7 | 349 |
| 1993 | 1,547 | 5 | 66 |
| 1994 | 894 | 4 | 79 |
| 1995 | 444 | 4 | 54 |
| 1996 | 101 | 5 | 10 |
| 1997 | 173 | 8 | 5 |
| 1998 | 123 | 8 | 23 |
| 1999 | 266 | 10 | 22 |
| 2000 | 395 | 7 | 18 |
| 2001 | 541 | 13 | 41 |
| 2002 | 304 | 7 | 23 |

| | | | |
|---|---|---|---|
| 2003 | 678 | 8 | 13 |
| 2004 | 301 | 8 | 10 |
| 2005 | 500 | 8 | 5 |
| 2006 | 472 | 10 | 71 |
| 2007 | 303 | 9 | 4 |
| 2008 | 376 | 21 | 7 |
| 2009 | 579 | 16 | 8 |
| 2010 | 450 | 25 | 27 |

** = indicates confidential data withheld

**Table 3.5.** Number of trips reporting Spanish mackerel discards by region and gear fished; all years combined (2002-2010). "Other species" totals include all other reports to the discard logbook program. Also included in "other species" totals are trips with no reported discards. Trips with multiple gears fished reported or that fished in both regions may be counted more than once. Totals include only those vessels with federal fishing permits.

| Region | Species | Gillnet | Vertical line | Trolling | All other gears |
|---|---|---|---|---|---|
| GOM | Spanish Mackerel | 0 | 39 | 17 | 0 |
| | Other species (sm boundaries) | 73 | 14,423 | 1,342 | 2,532 |
| SA | Spanish Mackerel | 37 | 84 | 46 | confidential |
| | Other species (sm boundaries) | 2,470 | 23,990 | 14,079 | 3,541 |

**Table 3.6.** Spanish mackerel yearly total calculated discards from commercial gill net, vertical line, and trolling vessels with federal fishing permits in the Gulf of Mexico. Discards are reported as number of fish. No Spanish mackerel discards were reported from gill net trips in the Gulf of Mexico, although discards of other species were reported.

| Year | Gill net | Vertical line | Trolling | Calculated discards |
|---|---|---|---|---|
| 1998 | 0 | 16,808 | 623 | 17,431 |
| 1999 | 0 | 18,918 | 611 | 19,528 |
| 2000 | 0 | 17,995 | 363 | 18,358 |
| 2001 | 0 | 16,746 | 385 | 17,131 |
| 2002 | 0 | 17,559 | 337 | 17,897 |
| 2003 | 0 | 18,962 | 345 | 19,307 |
| 2004 | 0 | 17,018 | 251 | 17,269 |
| 2005 | 0 | 16,350 | 168 | 16,518 |
| 2006 | 0 | 15,909 | 279 | 16,187 |
| 2007 | 0 | 15,075 | 295 | 15,370 |
| 2008 | 0 | 13,207 | 217 | 13,425 |
| 2009 | 0 | 16,529 | 218 | 16,747 |
| 2010 | 0 | 15,244 | 153 | 15,397 |

**Table 3.7.** Self-reported discard mortality/disposition of Spanish mackerel caught on commercial fishing vessels with federal fishing permits, 2002-2010. No Spanish mackerel discards were reported from gill net vessels in the Gulf of Mexico.

| Region | Gear | Disposition | | | | | | | Number of fish |
|---|---|---|---|---|---|---|---|---|---|
| | | All Dead | Majority Dead | All Alive | Majority Alive | Kept | Unable to Determine | Unreported | |
| South Atlantic | Gillnet | 71% | 24% | 0% | 0% | 5% | 0% | 0% | 398 |
| | Hand line/Electric | 3% | 3% | 21% | 4% | 47% | 23% | 0% | 577 |
| | Trolling | 1% | 0% | 33% | 8% | 58% | 0% | 0% | 722 |
| Gulf of Mexico | Gill net | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 0 |
| | Hand line/Electric | 12% | 4% | 3% | 31% | 41% | 0% | 9% | 625 |
| | Trolling | 1% | 0% | 19% | 21% | 59% | 0% | 0% | 126 |

**Table 3.8.** List of factor levels for the main effects of the shrimp bycatch estimation model.

| Main Effect | Levels | Description |
|---|---|---|
| Year | 39 | 1972-2010 |
| Season | 3 | Jan-Apr, May-Aug, Sep-Dec |
| Area | 4 | Stat grids 1-9, 10-12, 13-17, 18-21 |
| Depth | 2 | Inside 10 fm, Outside 10 fm |
| Data Set | 2 | Observer program, Research vessel |

**Table 3.9.** Observed shrimp bycatch of Spanish mackerel in the Gulf of Mexico from the observer program and SEAMAP groundfish survey. Bycatch is reported in numbers of fish.

| Year | Spanish Mackerel bycatch |
|---|---|
| 1972 | 57 |
| 1973 | 111 |
| 1974 | 96 |
| 1975 | 338 |
| 1976 | 739 |
| 1977 | 1,228 |
| 1978 | 526 |
| 1979 | 76 |
| 1980 | 2,048 |
| 1981 | 275 |
| 1982 | 165 |
| 1983 | 41 |
| 1984 | 554 |
| 1985 | 13 |
| 1986 | 69 |
| 1987 | 29 |
| 1988 | 92 |
| 1989 | 129 |
| 1990 | 181 |
| 1991 | 140 |
| 1992 | 1,787 |
| 1993 | 6,164 |
| 1994 | 790 |
| 1995 | 242 |
| 1996 | 115 |
| 1997 | 55 |
| 1998 | 83 |
| 1999 | 79 |
| 2000 | 156 |
| 2001 | 1,243 |
| 2002 | 2,968 |
| 2003 | 2,444 |
| 2004 | 17,407 |
| 2005 | 11,432 |
| 2006 | 64 |
| 2007 | 3,545 |
| 2008 | 7,096 |
| 2009 | 5,027 |
| 2010 | 5,351 |

**Table 3.10**. Predicted annual shrimp bycatch (millions of fish) of Spanish mackerel in the Gulf of Mexico.

| year | mean | sd | MC error | 2.50% | 25.00% | median | 75.00% | 97.50% | start | sample |
|---|---|---|---|---|---|---|---|---|---|---|
| 1972 | 22.05 | 53.44 | 0.981 | 1.194 | 4.487 | 9.378 | 20.59 | 122.6 | 4001 | 10000 |
| 1973 | 2.035 | 4.095 | 0.06811 | 0.2053 | 0.6094 | 1.096 | 2.125 | 9.168 | 4001 | 10000 |
| 1974 | 5.957 | 23.65 | 0.3076 | 0.4607 | 1.411 | 2.686 | 5.483 | 29.74 | 4001 | 10000 |
| 1975 | 5.087 | 9.934 | 0.1324 | 0.9573 | 2.052 | 3.216 | 5.501 | 19.29 | 4001 | 10000 |
| 1976 | 7.031 | 5.969 | 0.0854 | 2.433 | 4.135 | 5.682 | 8.142 | 19.2 | 4001 | 10000 |
| 1977 | 20.24 | 18.72 | 0.2544 | 5.826 | 10.36 | 15.02 | 23.01 | 67.97 | 4001 | 10000 |
| 1978 | 22.96 | 37.12 | 0.5091 | 5.326 | 10.02 | 14.85 | 24.01 | 86.13 | 4001 | 10000 |
| 1979 | 68.18 | 620.9 | 7.318 | 2.5 | 9.513 | 20.86 | 50.7 | 340.1 | 4001 | 10000 |
| 1980 | 17.2 | 11.11 | 0.1539 | 6.621 | 10.88 | 14.53 | 20.31 | 42.55 | 4001 | 10000 |
| 1981 | 9.979 | 27.39 | 0.3813 | 1.346 | 2.768 | 4.567 | 8.762 | 52.79 | 4001 | 10000 |
| 1982 | 15.48 | 43.81 | 0.577 | 0.9467 | 3.19 | 6.35 | 13.92 | 84.47 | 4001 | 10000 |
| 1983 | 13.8 | 56.97 | 0.8974 | 0.8958 | 2.932 | 5.925 | 12.87 | 73.64 | 4001 | 10000 |
| 1984 | 32.54 | 82.47 | 1.225 | 2.278 | 7.124 | 14.03 | 30.82 | 173.1 | 4001 | 10000 |
| 1985 | 7.824 | 24.26 | 0.3157 | 0.4689 | 1.663 | 3.354 | 7.241 | 39.12 | 4001 | 10000 |
| 1986 | 20 | 56.73 | 0.6918 | 1.118 | 3.989 | 8.151 | 18 | 104.5 | 4001 | 10000 |
| 1987 | 17.9 | 54.35 | 0.675 | 0.958 | 3.627 | 7.335 | 16.42 | 96.49 | 4001 | 10000 |
| 1988 | 31 | 105.2 | 1.292 | 1.796 | 6.149 | 12.63 | 27.54 | 162.4 | 4001 | 10000 |
| 1989 | 45.25 | 211 | 2.662 | 2.594 | 8.899 | 17.75 | 38.1 | 253.6 | 4001 | 10000 |
| 1990 | 63.69 | 340.5 | 3.603 | 3.792 | 12.67 | 25.75 | 56.09 | 335 | 4001 | 10000 |
| 1991 | 44.37 | 124.5 | 1.61 | 2.809 | 9.5 | 18.97 | 40.88 | 240.9 | 4001 | 10000 |
| 1992 | 23.91 | 15.12 | 0.1936 | 9.944 | 15.71 | 20.53 | 27.57 | 58.61 | 4001 | 10000 |
| 1993 | 69.27 | 61.61 | 0.7912 | 21.34 | 36.96 | 53.08 | 80.59 | 214.9 | 4001 | 10000 |
| 1994 | 12.89 | 42.35 | 0.5414 | 1.423 | 3.123 | 5.479 | 11.02 | 66.6 | 4001 | 10000 |
| 1995 | 12.8 | 32.24 | 0.3707 | 1.09 | 3.095 | 5.826 | 12.11 | 65.56 | 4001 | 10000 |
| 1996 | 11.69 | 38.36 | 0.472 | 0.7456 | 2.502 | 4.969 | 10.62 | 61.63 | 4001 | 10000 |
| 1997 | 12.84 | 34.18 | 0.4091 | 0.871 | 2.82 | 5.561 | 11.75 | 67.04 | 4001 | 10000 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1998 | 17.97 | 62.92 | 0.6922 | 1.043 | 3.58 | 7.443 | 16.39 | 96.55 | 4001 | 10000 |
| 1999 | 12.81 | 35.74 | 0.4432 | 0.7573 | 2.738 | 5.555 | 12.06 | 65.19 | 4001 | 10000 |
| 2000 | 31.68 | 140.5 | 1.66 | 1.807 | 6.258 | 12.94 | 28.21 | 161.4 | 4001 | 10000 |
| 2001 | 14.4 | 36.56 | 0.4504 | 1.925 | 4.005 | 7.007 | 13.54 | 70.56 | 4001 | 10000 |
| 2002 | 8.296 | 13.72 | 0.1602 | 2.393 | 3.953 | 5.718 | 8.95 | 28.61 | 4001 | 10000 |
| 2003 | 15.9 | 15.84 | 0.1806 | 4.245 | 7.811 | 11.49 | 18.17 | 54.36 | 4001 | 10000 |
| 2004 | 23.01 | 18.39 | 0.2313 | 11.44 | 15.83 | 19.32 | 24.64 | 56.29 | 4001 | 10000 |
| 2005 | 26.84 | 20.9 | 0.2839 | 11.36 | 17.32 | 22.66 | 30.67 | 64.84 | 4001 | 10000 |
| 2006 | 12.21 | 34.85 | 0.3982 | 0.7668 | 2.592 | 5.3 | 11.44 | 64.48 | 4001 | 10000 |
| 2007 | 10.34 | 6.653 | 0.1023 | 4.164 | 6.683 | 8.831 | 12.12 | 25.27 | 4001 | 10000 |
| 2008 | 4.105 | 4.462 | 0.05798 | 2.099 | 2.7 | 3.204 | 4.069 | 11.8 | 4001 | 10000 |
| 2009 | 2.873 | 0.7141 | 0.008543 | 1.77 | 2.371 | 2.766 | 3.268 | 4.527 | 4001 | 10000 |
| 2010 | 2.913 | 1.05 | 0.01266 | 1.762 | 2.32 | 2.723 | 3.244 | 5.229 | 4001 | 10000 |

**Table 3.11.** Number of Gulf of Mexico trips from logbooks landing any amount of Spanish mackerel, where Spanish mackerel was targeted (Spanish mackerel was at least 30% of catch) and the number of trips with valid samples (no biases) and number of trips with samples usable for analysis (trip weights available) by year and gear.

| | GEAR | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GILL NET | | | | HAND LINE | | | | OTHER | | | |
| YEAR | ALL LOGBOOK TRIPS | TARGETED LOGBOOK TRIPS | SAMPLES USED | VALID SAMPLES | ALL LOGBOOK TRIPS | TARGETED LOGBOOK TRIPS | SAMPLES USED | VALID SAMPLES | ALL LOGBOOK TRIPS | TARGETED LOGBOOK TRIPS | SAMPLES USED | VALID SAMPLES |
| 1983 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 |
| 1984 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 12 | 0 | 0 | 2 | 2 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 12 | 0 | 0 | 2 | 2 |
| 1986 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 2 |
| 1987 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 1 | 1 | 13 | 0 | 0 | 0 | ** | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 2 | 18 | 0 | 0 | 25 | ** | 0 | 2 | 2 |
| 1992 | 0 | 0 | 0 | 9 | 141 | ** | 0 | 37 | ** | ** | 6 | 6 |
| 1993 | 0 | 0 | 3 | 5 | 267 | ** | 3 | 29 | 33 | ** | 3 | 3 |
| 1994 | ** | 0 | 4 | 13 | 356 | ** | 0 | 28 | 58 | ** | 2 | 2 |
| 1995 | ** | ** | 4 | 11 | 365 | 26 | 0 | 13 | 25 | ** | 0 | 0 |
| 1996 | 24 | 23 | 3 | 6 | 370 | 49 | 2 | 5 | ** | ** | 0 | 0 |
| 1997 | 48 | 32 | 0 | 2 | 398 | 98 | 0 | 1 | ** | ** | 0 | 0 |
| 1998 | 62 | 55 | 0 | 0 | 519 | 124 | 1 | 3 | ** | 0 | 0 | 0 |
| 1999 | 145 | 129 | 2 | 2 | 622 | 139 | 0 | 1 | 14 | ** | 2 | 2 |
| 2000 | 98 | 86 | 3 | 3 | 704 | 145 | 0 | 0 | 13 | 0 | 0 | 0 |
| 2001 | 86 | 82 | 2 | 2 | 663 | 192 | 0 | 1 | 22 | ** | 0 | 0 |
| 2002 | 46 | 34 | 0 | 0 | 578 | 85 | 4 | 4 | 27 | ** | 0 | 1 |
| 2003 | 52 | 48 | 1 | 3 | 526 | 99 | 10 | 11 | 16 | ** | 0 | 0 |
| 2004 | 31 | 29 | 8 | 8 | 384 | 86 | 6 | 6 | 13 | ** | 4 | 4 |
| 2005 | 45 | 45 | 14 | 14 | 314 | 65 | 14 | 14 | ** | 0 | 0 | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2006 | 23 | 20 | 11 | 11 | 337 | 62 | 13 | 13 | ** | ** | 2 | 2 |
| 2007 | 44 | 44 | 9 | 9 | 286 | 57 | 8 | 8 | ** | 0 | 11 | 11 |
| 2008 | 39 | 36 | 10 | 10 | 394 | 60 | 17 | 17 | ** | 0 | 5 | 5 |
| 2009 | 91 | 82 | 6 | 6 | 474 | 84 | 19 | 20 | 20 | ** | 0 | 1 |
| 2010 | 24 | 24 | 11 | 11 | 550 | 91 | 21 | 21 | 21 | ** | 1 | 1 |

**=data deemed confidential have been removed

**Table 3.12.** Number of length samples used for analysis and number of valid (no biases) length samples collected by year and gear.

| | GEAR | | | | | |
|---|---|---|---|---|---|---|
| | GILL NET | | HAND LINE | | OTHER | |
| YEAR | SAMPLES USED | VALID SAMPLES | SAMPLES USED | VALID SAMPLES | SAMPLES USED | VALID SAMPLES |
| 1983 | 0 | 0 | 7 | 7 | 0 | 0 |
| 1984 | 0 | 0 | 23 | 23 | 19 | 19 |
| 1985 | 0 | 0 | 178 | 178 | 41 | 41 |
| 1986 | 0 | 17 | 0 | 1 | 96 | 96 |
| 1987 | 0 | 557 | 0 | 0 | 0 | 0 |
| 1988 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 62 | 62 | 0 | 0 | 0 | 0 |
| 1990 | 66 | 66 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 54 | 0 | 197 | 5 | 5 |
| 1992 | 0 | 447 | 0 | 235 | 152 | 152 |
| 1993 | 72 | 82 | 28 | 119 | 25 | 25 |
| 1994 | 443 | 496 | 0 | 109 | 2 | 2 |
| 1995 | 212 | 279 | 0 | 38 | 0 | 0 |
| 1996 | 256 | 296 | 10 | 22 | 0 | 0 |
| 1997 | 0 | 12 | 0 | 1 | 0 | 0 |
| 1998 | 0 | 0 | 6 | 16 | 0 | 0 |
| 1999 | 17 | 17 | 0 | 1 | 19 | 19 |
| 2000 | 38 | 38 | 0 | 0 | 0 | 0 |
| 2001 | 23 | 23 | 0 | 1 | 0 | 0 |
| 2002 | 0 | 0 | 21 | 21 | 0 | 97 |
| 2003 | 28 | 31 | 35 | 37 | 0 | 0 |
| 2004 | 484 | 484 | 16 | 16 | 413 | 413 |
| 2005 | 636 | 636 | 78 | 78 | 0 | 0 |
| 2006 | 794 | 794 | 100 | 100 | 192 | 192 |
| 2007 | 381 | 381 | 207 | 207 | 342 | 342 |
| 2008 | 462 | 462 | 209 | 209 | 105 | 105 |
| 2009 | 153 | 153 | 70 | 79 | 0 | 32 |
| 2010 | 457 | 457 | 67 | 67 | 20 | 20 |

**Table 3.13.** U.S. Gulf of Mexico commercial Spanish mackerel age samples by gear and year.

| | GEAR | | |
|---|---|---|---|
| YEAR | GILL NET | HAND LINE | OTHER |
| 1988 | 32 | 3 | 0 |
| 1989 | 0 | 117 | 0 |
| 1990 | 245 | 160 | 89 |
| 1991 | 198 | 177 | 1 |
| 1992 | 508 | 117 | 27 |
| 1993 | 178 | 63 | 16 |
| 1994 | 452 | 23 | 0 |
| 1995 | 213 | 18 | 14 |
| 1996 | 243 | 8 | 0 |
| 1997 | 0 | 5 | 0 |
| 1998 | 0 | 10 | 0 |
| 1999 | 0 | 2 | 0 |
| 2000 | 21 | 0 | 0 |
| 2001 | 37 | 12 | 0 |
| 2002 | 0 | 13 | 0 |
| 2003 | 0 | 36 | 0 |
| 2004 | 12 | 5 | 0 |
| 2005 | 0 | 28 | 113 |
| 2006 | 0 | 11 | 0 |
| 2007 | 0 | 19 | 0 |
| 2008 | 0 | 22 | 0 |
| 2009 | 0 | 35 | 0 |
| 2010 | 0 | 38 | 0 |

**Table 3.14.** Gulf of Mexico Spanish mackerel commercial length sampling fractions (length samples used/landings in numbers) by gear and year.

| | GEAR | | |
|---|---|---|---|
| YEAR | GILL NET | HAND LINE | OTHER |
| 1983 | 0.000 | 0.000 | 0.000 |
| 1984 | 0.000 | 0.003 | 0.000 |
| 1985 | 0.000 | 0.049 | 0.000 |
| 1986 | 0.000 | 0.000 | 0.001 |
| 1987 | 0.000 | 0.000 | 0.000 |
| 1988 | 0.000 | 0.000 | 0.000 |
| 1989 | 0.000 | 0.000 | 0.000 |
| 1990 | 0.000 | 0.000 | 0.000 |
| 1991 | 0.000 | 0.000 | 0.000 |
| 1992 | 0.000 | 0.000 | 0.000 |
| 1993 | 0.000 | 0.006 | 0.000 |
| 1994 | 0.000 | 0.000 | 0.000 |
| 1995 | 0.000 | 0.000 | 0.000 |
| 1996 | 0.003 | 0.002 | 0.000 |
| 1997 | 0.000 | 0.000 | 0.000 |
| 1998 | 0.000 | 0.001 | 0.000 |
| 1999 | 0.000 | 0.000 | 0.001 |
| 2000 | 0.000 | 0.000 | 0.000 |
| 2001 | 0.000 | 0.000 | 0.000 |
| 2002 | 0.000 | 0.003 | 0.000 |
| 2003 | 0.000 | 0.005 | 0.000 |
| 2004 | 0.002 | 0.002 | 0.040 |
| 2005 | 0.001 | 0.010 | 0.000 |
| 2006 | 0.002 | 0.010 | 0.003 |
| 2007 | 0.001 | 0.024 | 0.078 |
| 2008 | 0.001 | 0.010 | 0.015 |
| 2009 | 0.000 | 0.004 | 0.000 |
| 2010 | 0.001 | 0.003 | 0.001 |

## 3.10 Figures

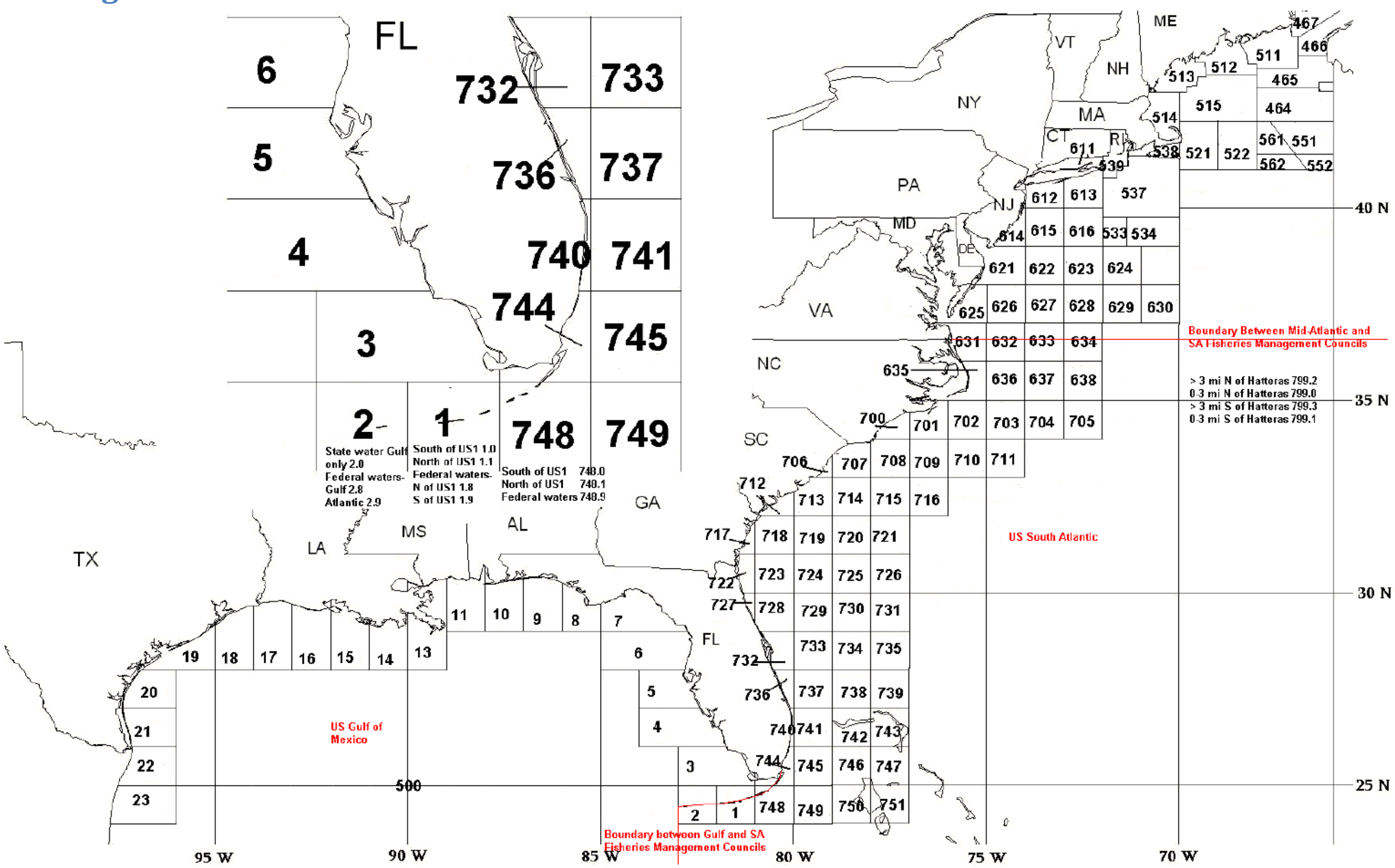



**Figure 3.1.** Map of U.S. Atlantic and Gulf coast with shrimp area designations and council boundaries. Boundary used for Gulf and Atlantic Spanish Mackerel is the SAFMC/GMFMC boundary along the FL Keys.

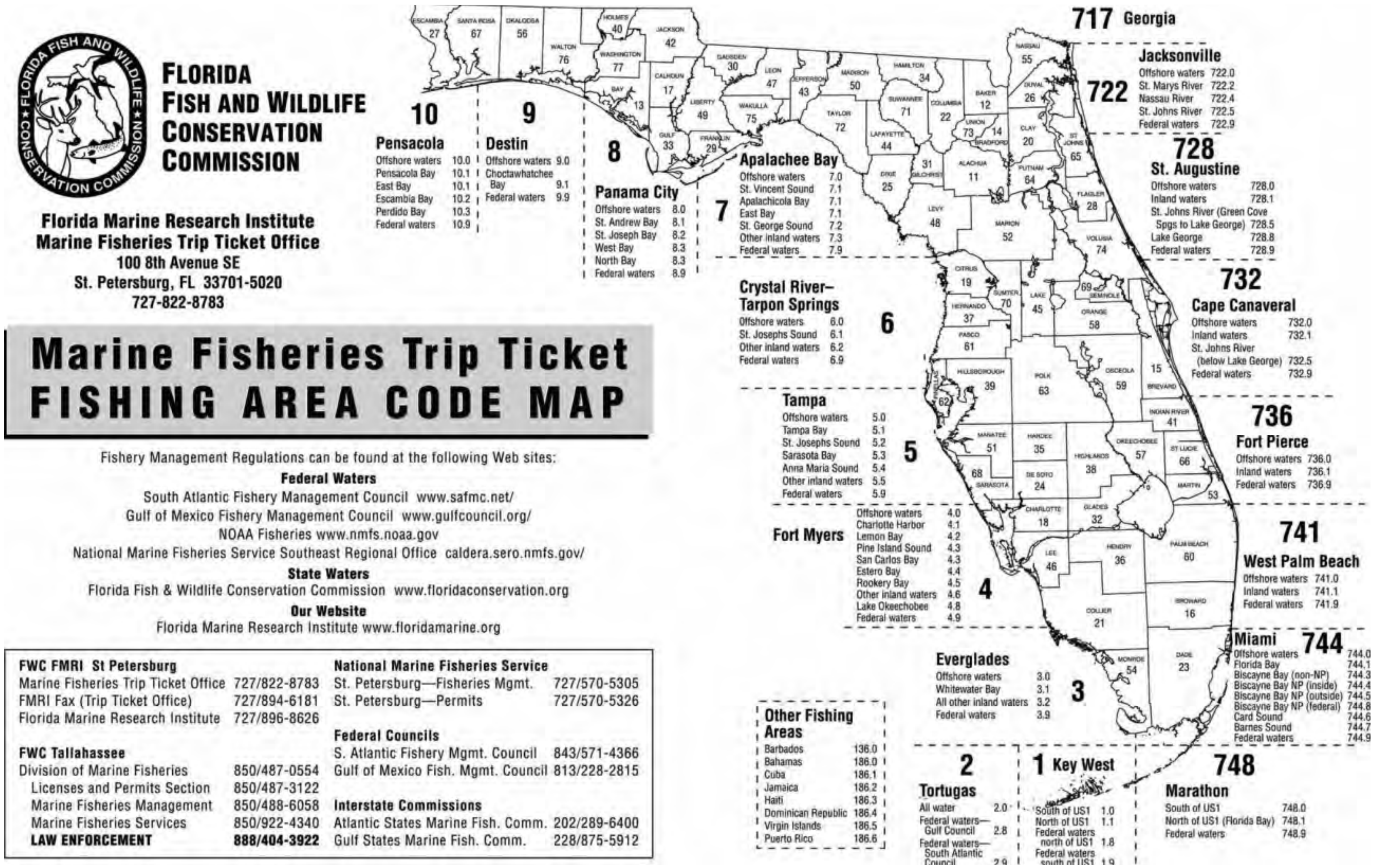



**Figure 3.2.** Map showing marine fisheries trip ticket fishing area code map for Florida.

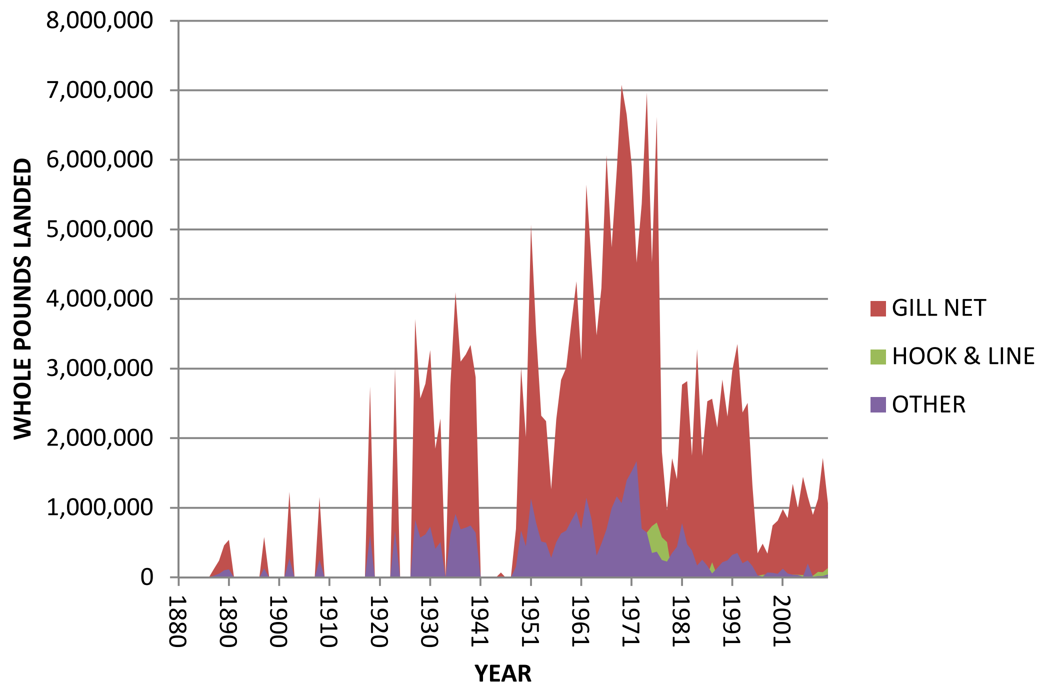



**Figure 3.3.** Spanish mackerel landings in pounds (whole weight) by gear (gill net, hand line, and other) from the Gulf of Mexico, 1880-2010.

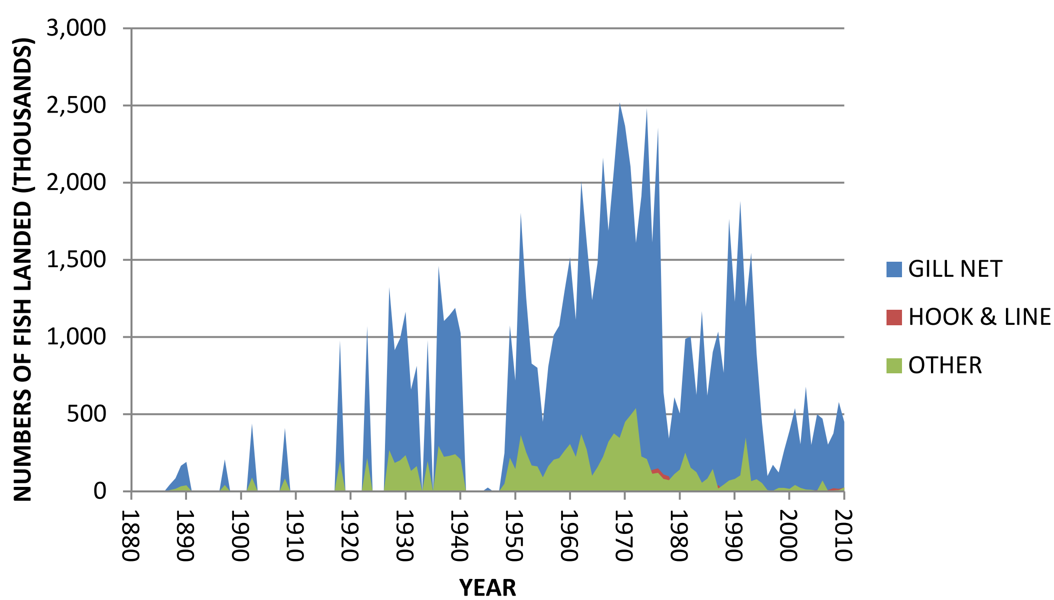



**Figure 3.4.** Spanish mackerel landings in numbers of fish (thousands) by gear (gill net, hand line, and other) from the Gulf of Mexico, 1880-2010.

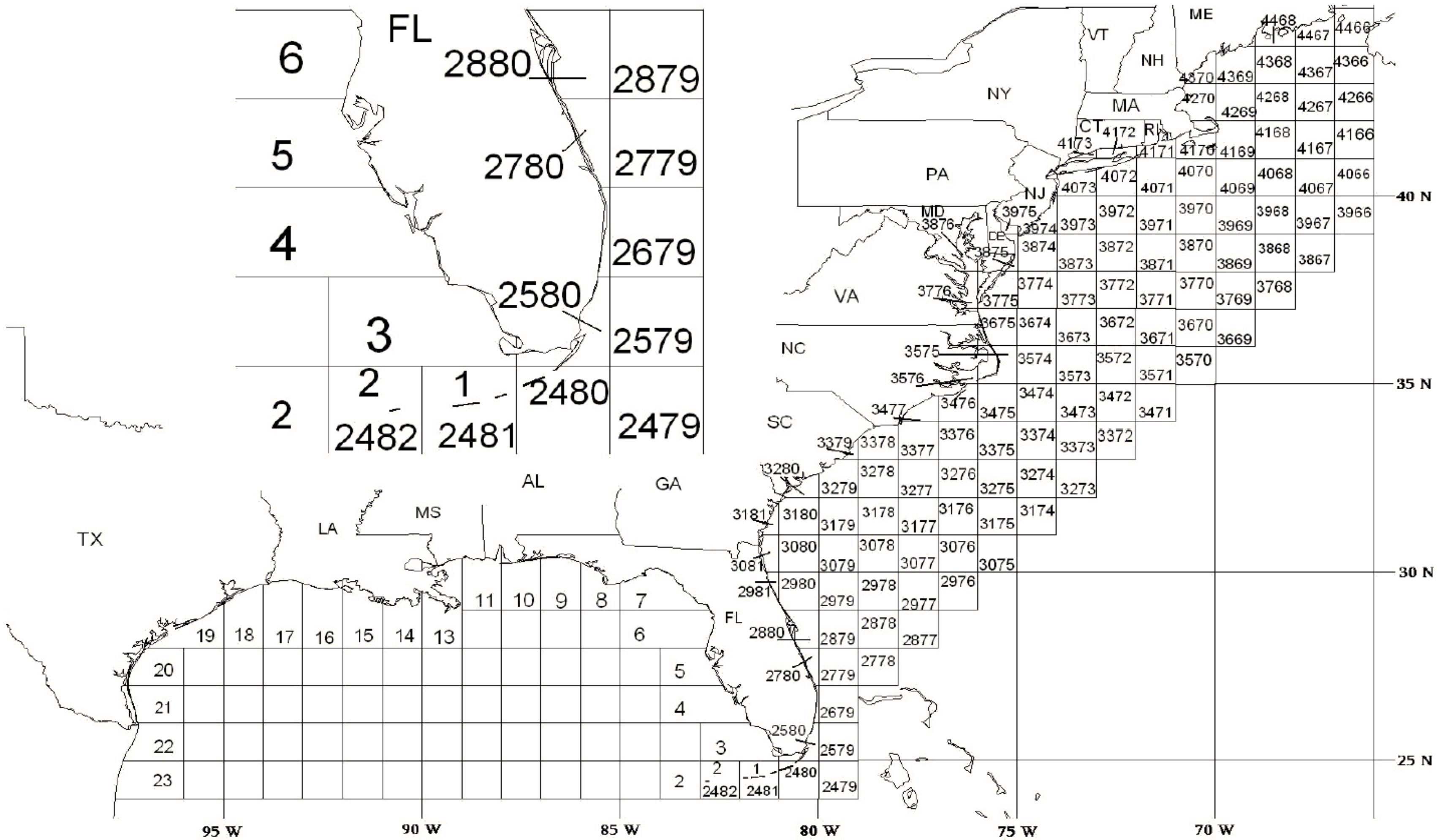



**Figure 3.5.** Map of U.S. Atlantic and Gulf coast logbook areas.

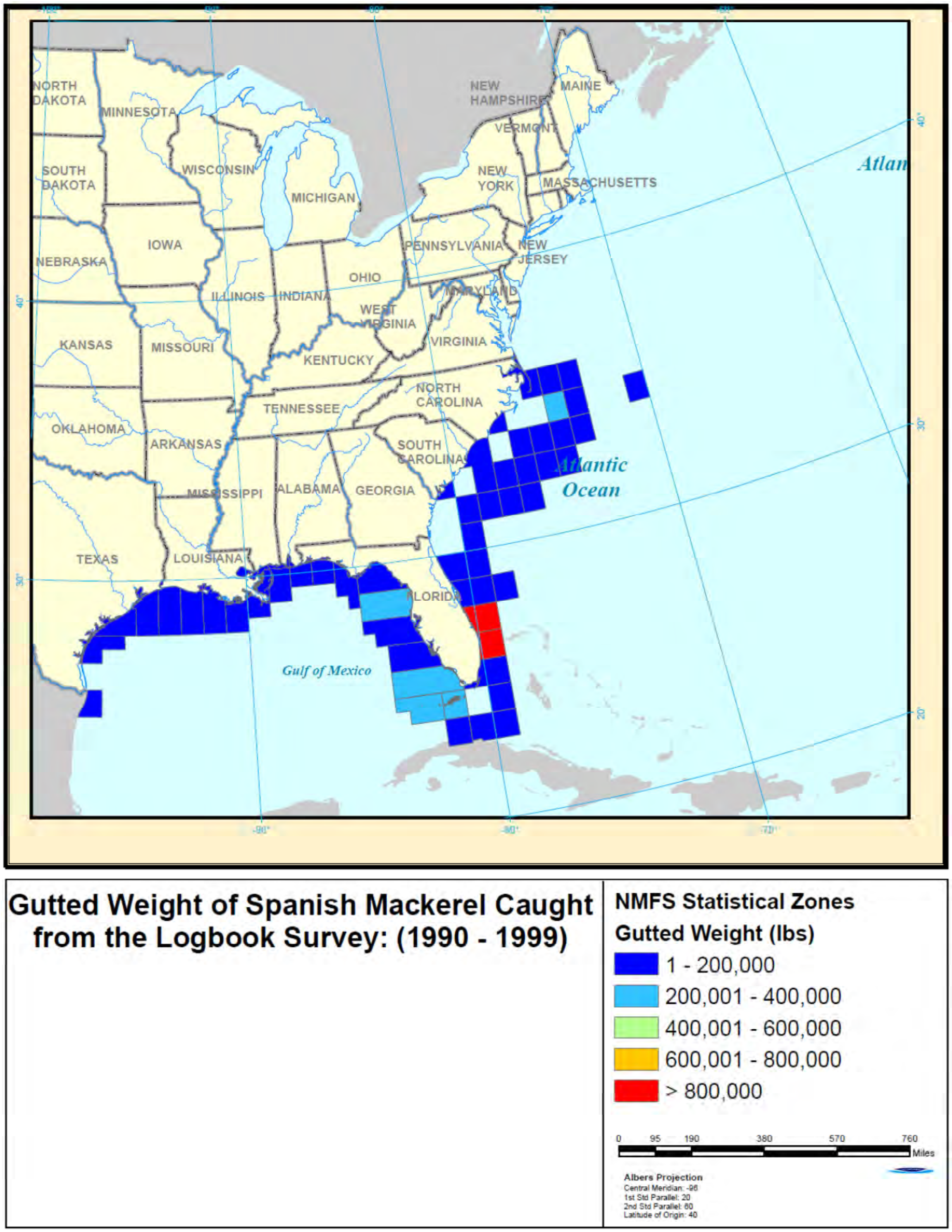



**Figure 3.6.** Map of Spanish mackerel catches reported to the Coastal Logbook Program for the U.S. Atlantic and Gulf coast areas (1990-1999).

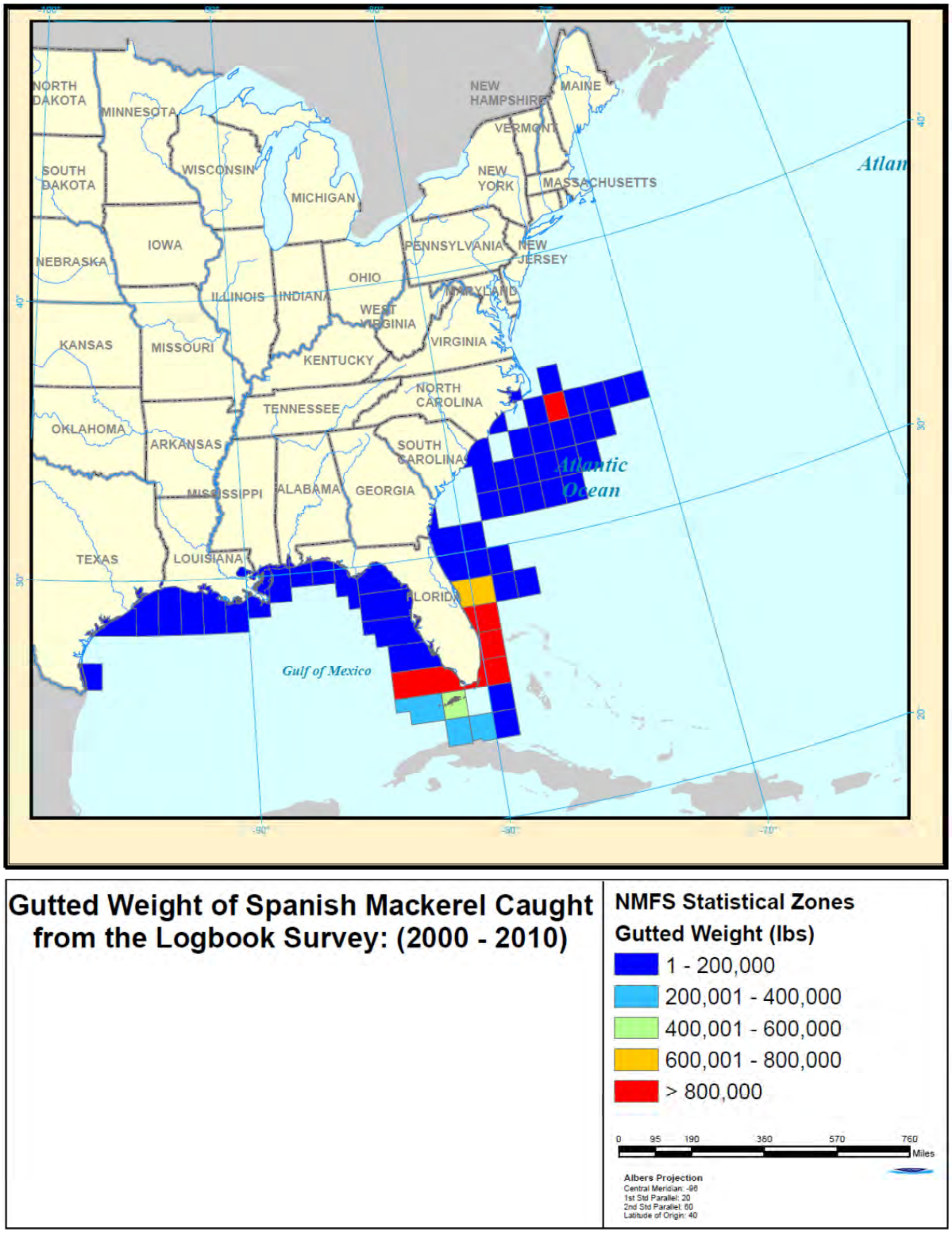



**Figure 3.7.** Map of Spanish mackerel catches reported to the Coastal Logbook Program for the U.S. Atlantic and Gulf coast areas (2000-2010).

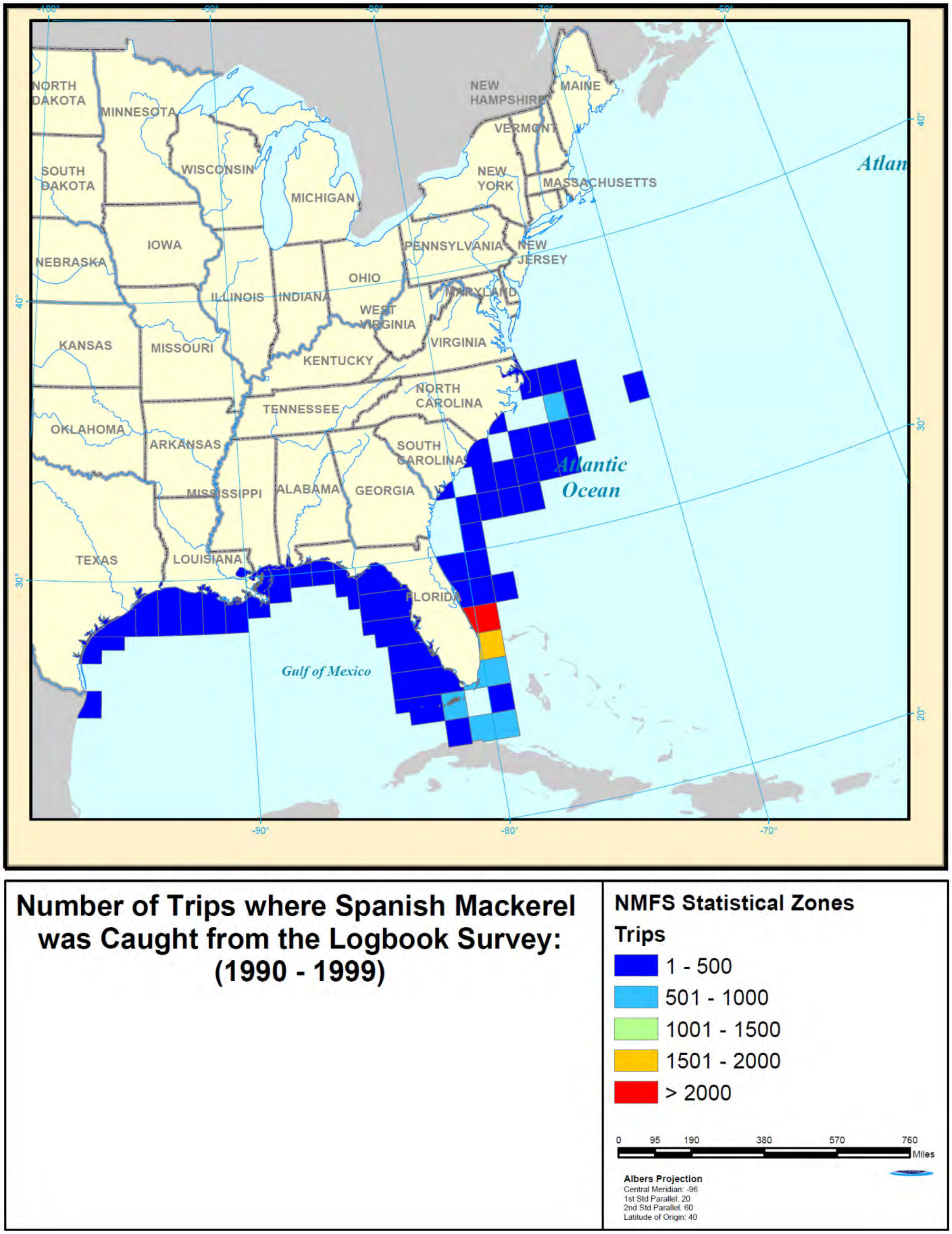



**Figure 3.8.** Map of Spanish mackerel trips reported to the Coastal Logbook Program for the U.S. Atlantic and Gulf coast areas (1990-1999).

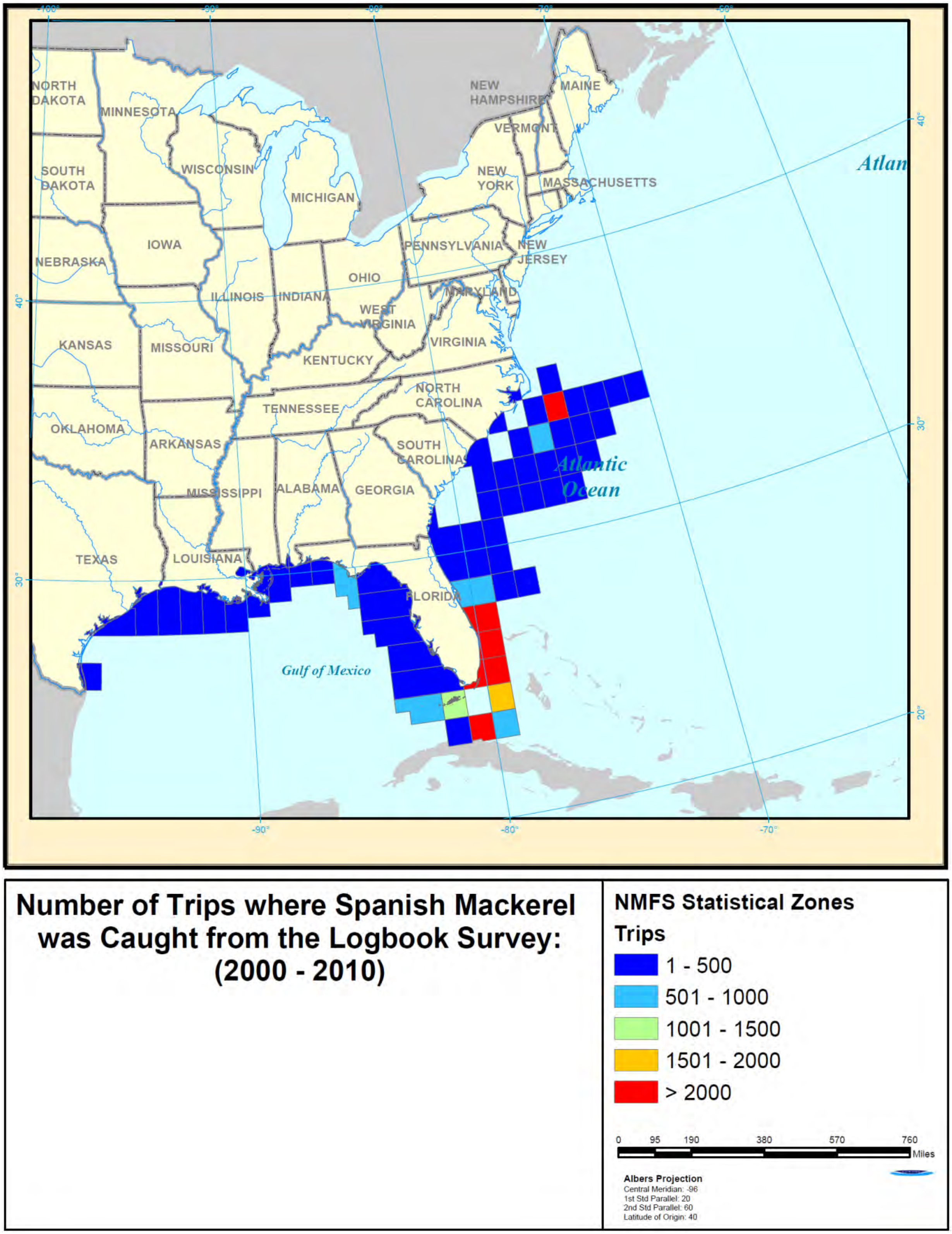



**Figure 3.9.** Map of Spanish mackerel trips reported to the Coastal Logbook Program for the U.S. Atlantic and Gulf coast areas (2000-2010).

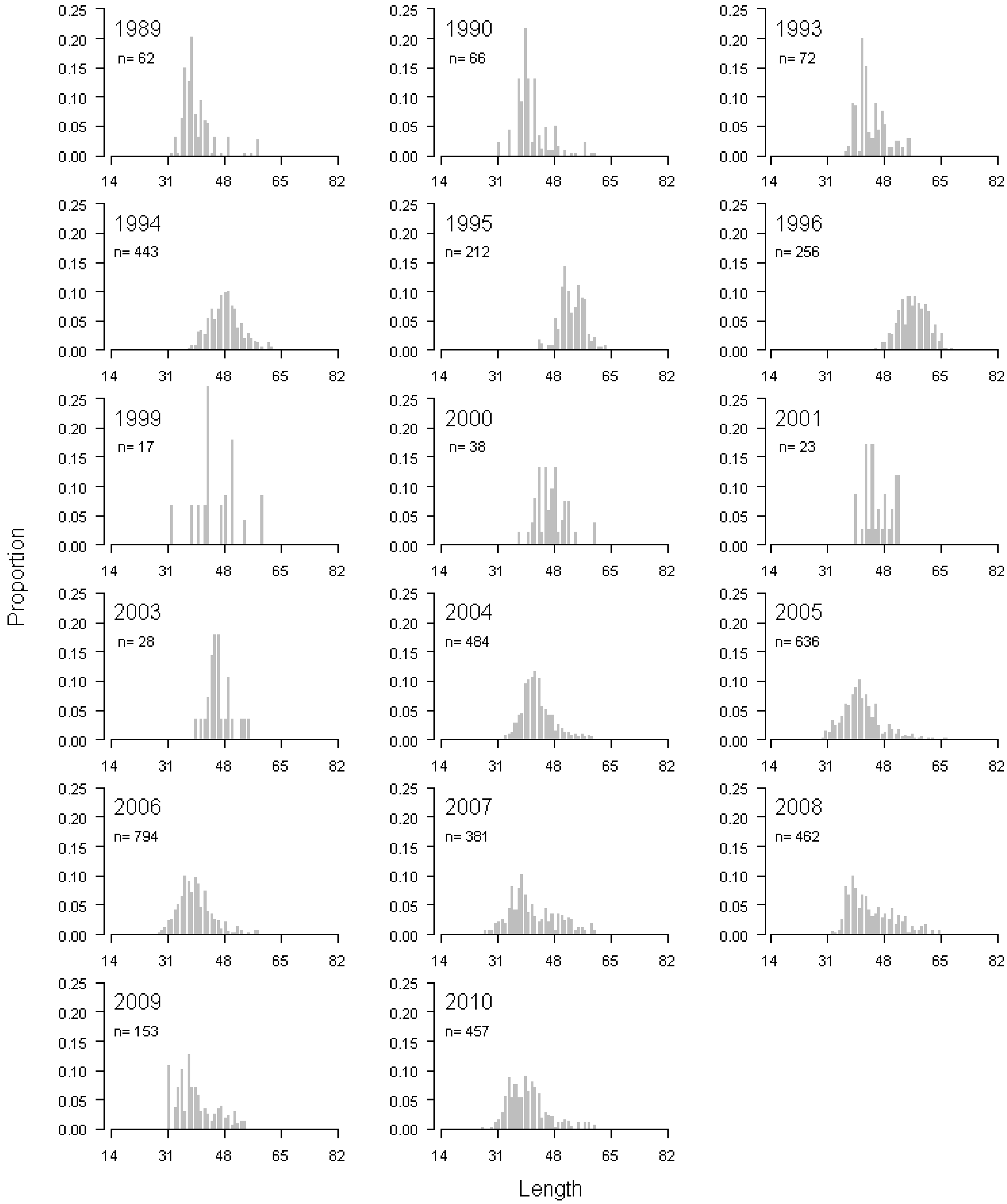



**Figure 3.10.** Relative length composition of commercial length (FL in mm) samples by year for gill net gear (n = number of fish).

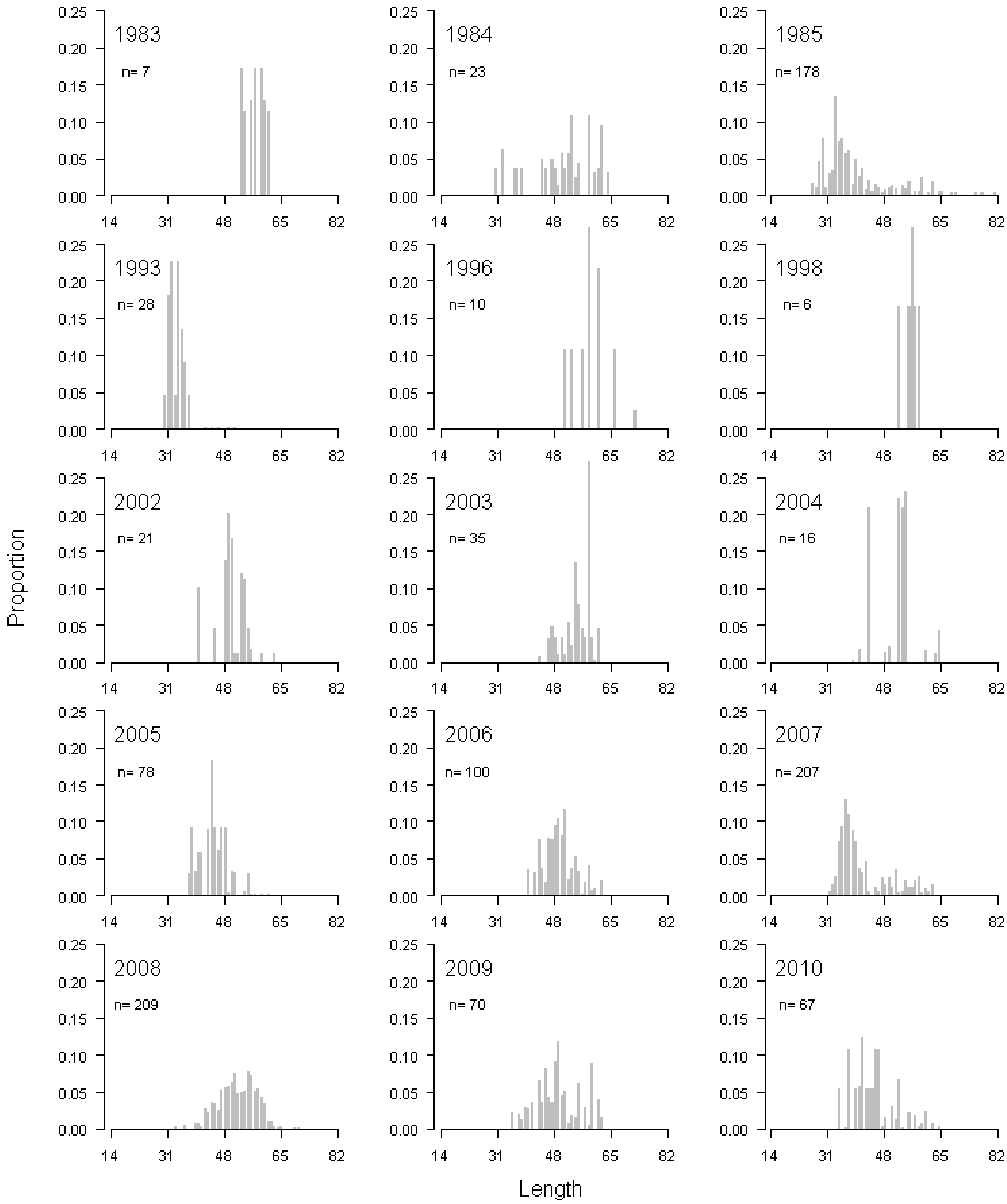



**Figure 3.11.** Relative length composition of commercial length (FL in mm) samples by year for hand line gear (n = number of fish).

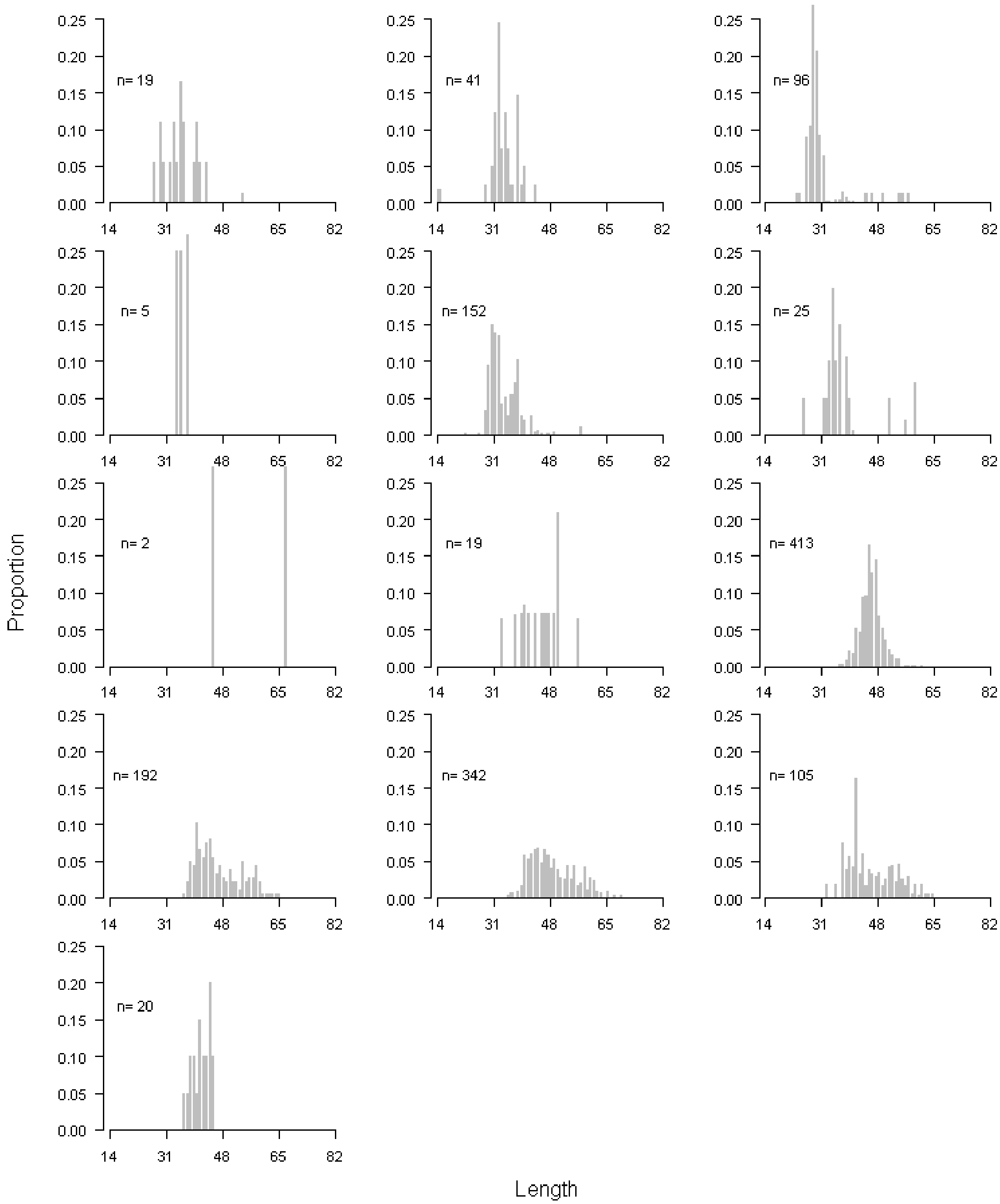



**Figure 3.12.** Relative length composition of commercial length (FL in mm) samples by year for other miscellaneous gear (n = number of fish).

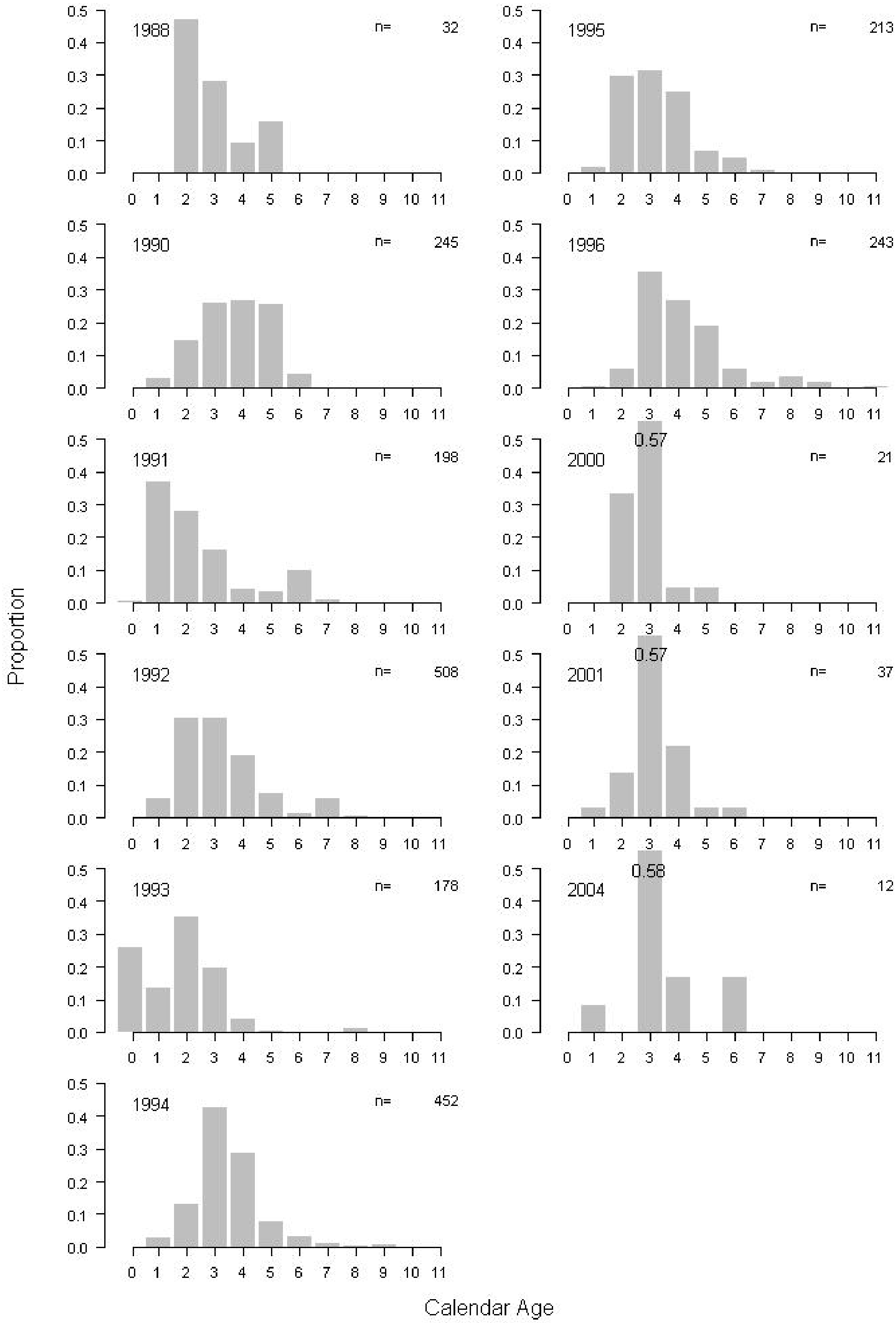



**Figure 3.13.** Unweighted relative age composition of commercial age (calendar years) samples by year for gill net gear (n = number of fish).

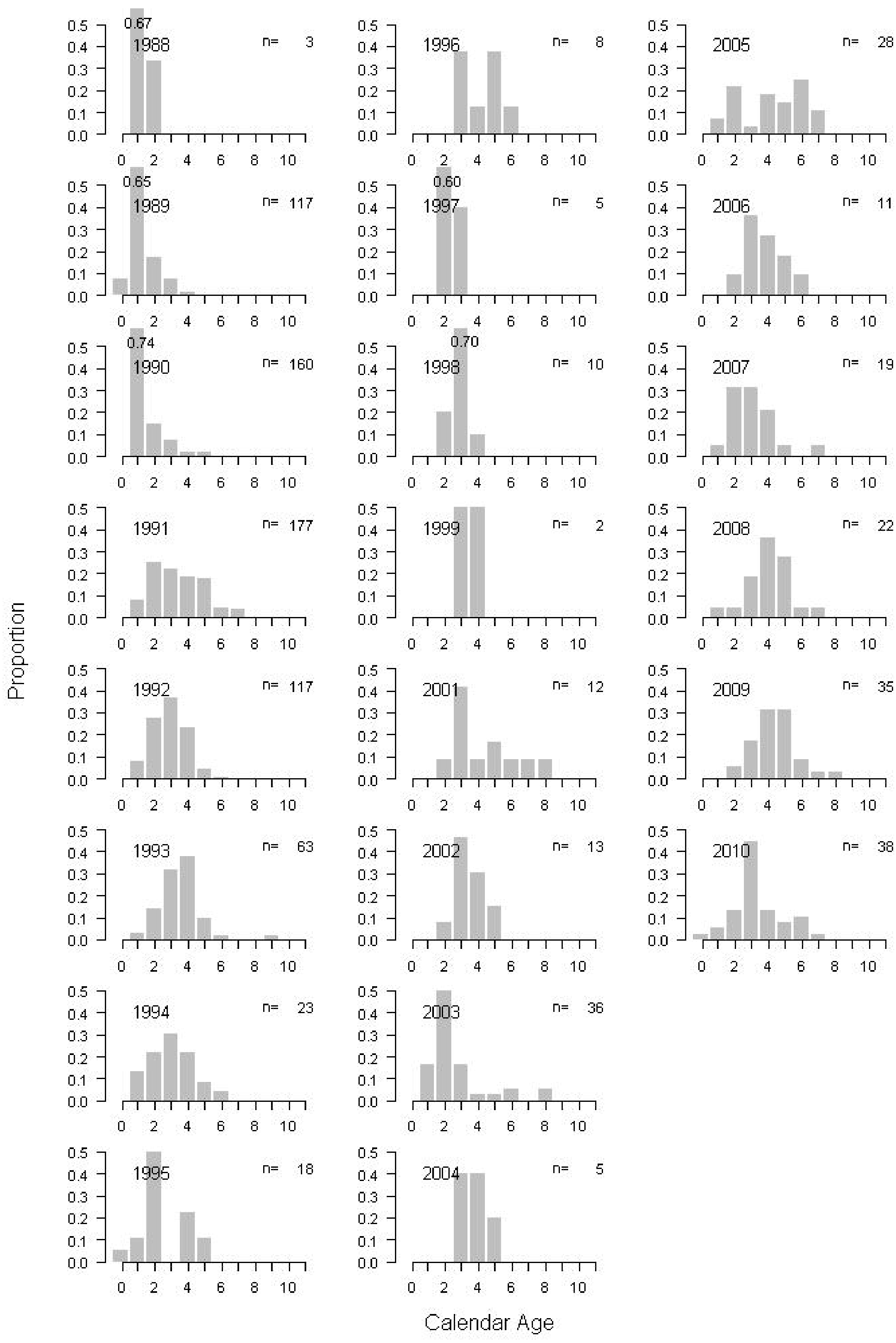



**Figure 3.14.** Unweighted relative age composition of commercial age (calendar years) samples by year for hand line gear (n = number of fish).

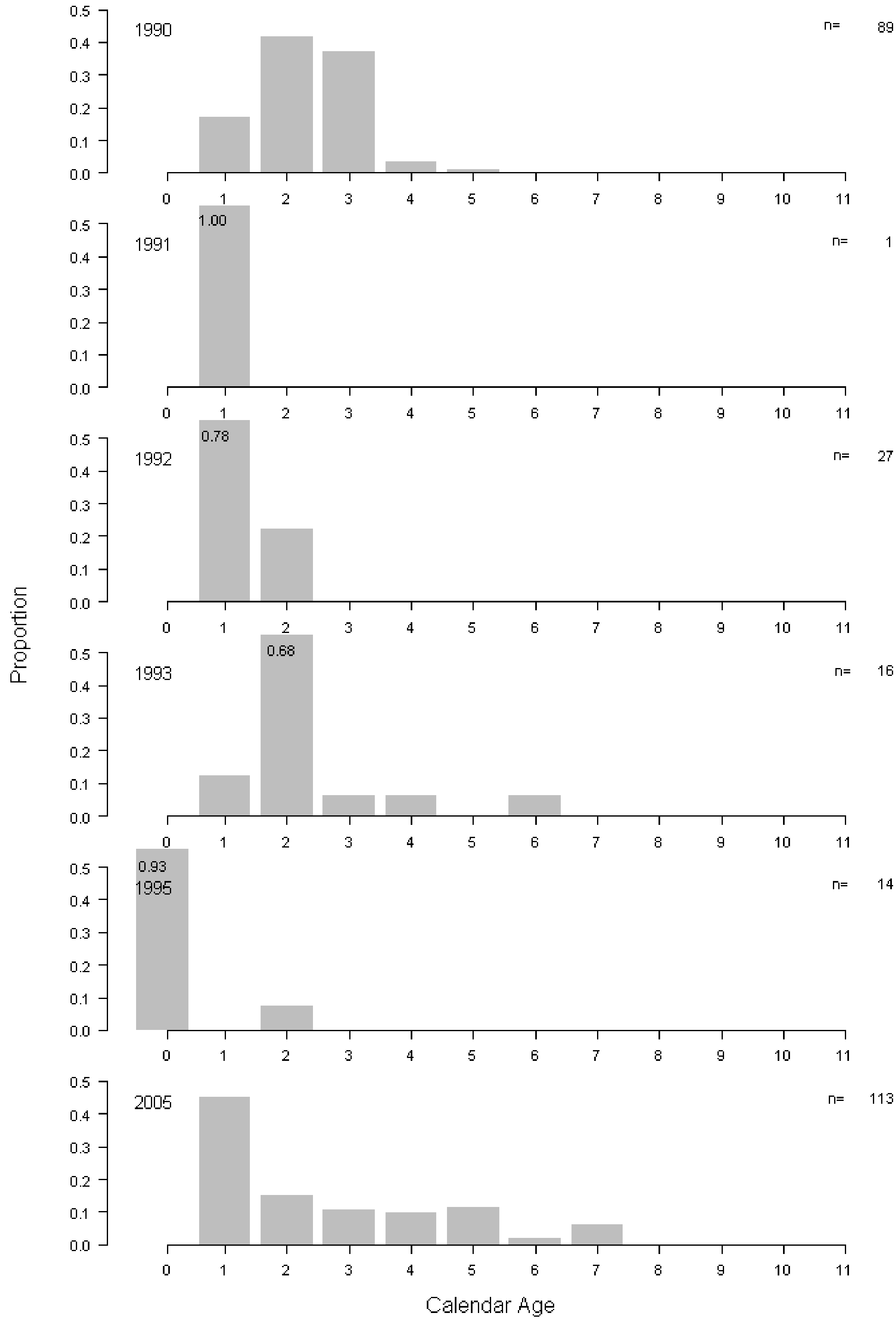



**Figure 3.15.** Unweighted relative age composition of commercial age (calendar years) samples by year for other miscellaneous gear (n = number of fish).

# 4 Recreational Fishery Statistics

## 4.1 Overview

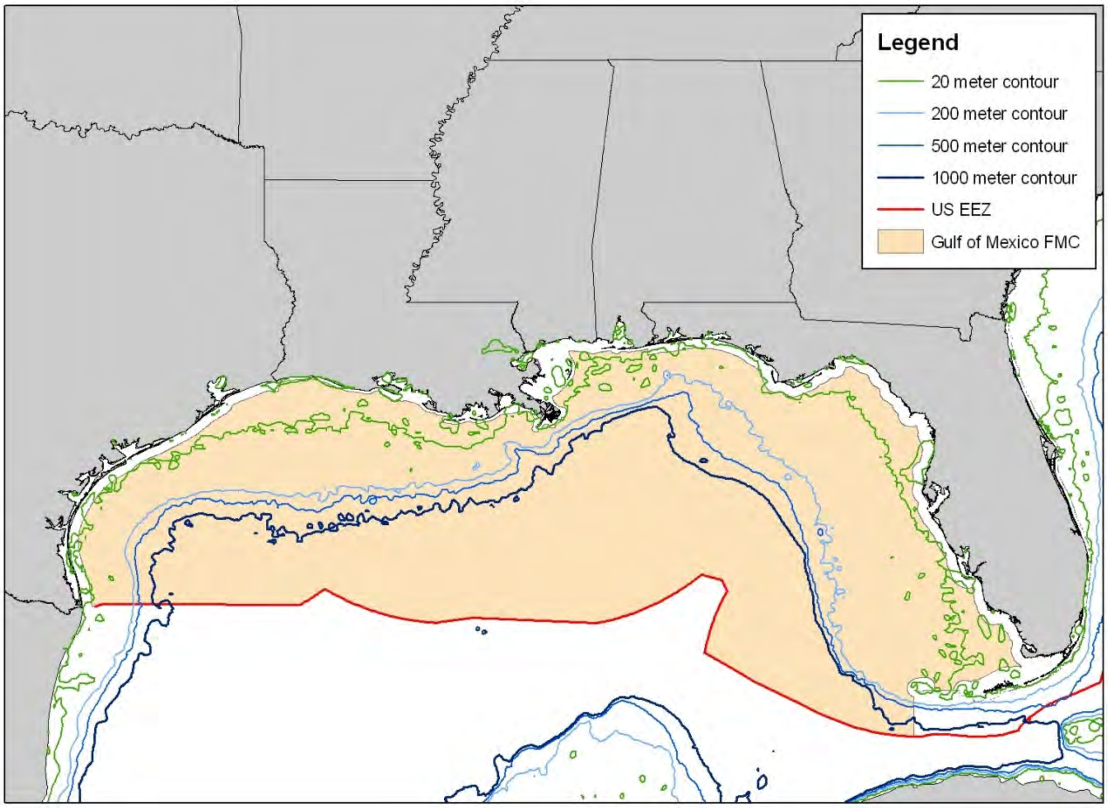
### 4.1.1 Group membership

Members- Ken Brennan (Leader South Atlantic\NMFS Beaufort), Julia Byrd (SCDNR), Kelly Fitzpatrick (NMFS Beaufort), Eric Hiltz (SCDNR), Robert Johnson (SAFMC Appointee\ Industry rep FL), Vivian Matter (Leader Gulf of Mexico\NMFS SEFSC), Bill Parker (SAFMC Appointee/Industry rep SC), Tom Ogle (SAFMC Appointee/Industry rep SC), Bob Zales (GMFMC Appointee/Industry rep FL).

### 4.1.2 Issues

1) Allocation of Monroe county catches to the Atlantic or the Gulf of Mexico: may vary by data source depending on differing spatial resolutions of the datasets.
2) Missing weight estimates for some recreational "cells" (i.e., specific year, state, fishing mode, wave combinations).
3) Headboat discards. Data are available from the SRHS since 2004. Review whether they are reliable for use, and determine if there are other sources of data prior to 2004 that could be used as a proxy to estimate headboat discards.
4) Charter boat landings: MRFSS charter survey methods changed in 1998 in the Gulf of Mexico.
5) New MRIP weighted estimates are available for 2004-2011: Determine appropriate use of datasets to cover the entire period from 1981-2011.
6) Texas estimates in the MRFSS is only available from 1981-1985 and is sporadic, not covering all modes and waves.
7) TPWD survey does not estimate landings in weight or discards.
8) Usefulness of historical data sources such as the 1960, 1965, and 1970 U.S. Fish and Wildlife Service (FWS) surveys to generate estimates of landings prior to 1981. Review whether other data sources also available.

### 4.1.3 Gulf of Mexico Fishery Management Council Jurisdictional Boundaries




## 4.2 Review of Working Papers

***SEDAR28-DW12,*** *Estimated conversion factors for calibrating MRFSS charter boat landings and effort estimates for the South Atlantic and Gulf of Mexico in 1981-1985 with For Hire Survey estimates with application to Spanish mackerel and cobia landings. Vivian M. Matter, Nancie Cummings, John Jeffrey Isely, Kenneth Brennan, and Kelly Fitzpatrick.*

This working paper presents correction factors to calibrate the traditional MRFSS charter boat/headboat combined mode estimates with the For-Hire Survey for 1981-1985. These calibration factors are based on equivalent units of effort and consistent methodologies across both sub regions.

***SEDAR28-DW14,*** *Recreational Survey Data for Spanish Mackerel and Cobia in the Atlantic and the Gulf of Mexico from the MRFSS and TPWD Surveys. Vivian Matter*

This working paper presents recreational survey data for Spanish mackerel and cobia from the Marine Recreational Fishery Statistics Survey (MRFSS) and the Texas Parks and Wildlife Department (TPWD) surveys in the Atlantic and the Gulf of Mexico. Issues addressed include the allocation of the Spanish mackerel landings in the Keys into the Gulf of Mexico or Atlantic

Ocean, the split of cobia landings along the east coast of Florida, the calibration of MRFSS charter boat estimates back in time, 1981-1985 adjustments and substitutions, MRIP vs MRFSS estimates for 2004-2011, and estimating recreational landings in weight from the surveys.

## 4.3 Recreational Landings

### 4.3.1 Marine Recreational Fisheries Statistics Survey (MRFSS)

*Introduction*

The Marine Recreational Fisheries Statistics Survey (MRFSS) provides a long time series of estimated catch per unit effort, total effort, landings, and discards for six two-month periods (waves) each year. The survey provides estimates for three recreational fishing modes: shore-based fishing (SH), private and rental boat fishing (PR), and for-hire charter and guide fishing (CH). When the survey first began in Wave 2 (Mar/Apr), 1981, headboats were included in the for-hire mode, but were excluded after 1985 to avoid overlap with the Southeast Region Headboat Survey (SRHS) conducted by the NMFS Beaufort, NC lab.

The MRFSS survey covers coastal Gulf of Mexico states from Florida to Louisiana. The state of Texas was included in the survey from 1981-1985, although not all modes and waves were covered. The state of Florida is sampled as two sub-regions. The east Florida sub-region includes counties adjacent to the Atlantic coast from Nassau County south through Miami-Dade County, and the west Florida sub-region includes Monroe County (Florida Keys) and counties adjacent to the Gulf of Mexico. Separate estimates are generated for each Florida sub-region, and those estimates may be post-stratified into smaller regions based on proportional sampling.

The MRFSS design incorporates three complementary survey methods for estimating catch and effort. Catch data are collected through angler interviews during dockside intercept surveys of recreational fishing trips after they have been completed. Effort data are collected using two telephone surveys. The Coastal Household Telephone Survey (CHTS) uses random digit dialing of coastal households to obtain detailed information about the previous two months of recreational fishing trips from the anglers. The weekly For-Hire Survey interviews charter boat operators (captains or owners) to obtain the trip information with only one-week recall period. These effort data and estimates are aggregated to produce the wave estimates. Catch rates from dockside intercept surveys are combined with estimates of effort from telephone interviews to estimate total landings and discards by wave, mode, and area fished (inland, state, and federal waters). Catch estimates from early years of the survey are highly variable with high proportional standard errors (PSE's), and sample size in the dockside intercept portion have been increased over time to improve precision of catch estimates. Full survey documentation and ongoing efforts to review and improve survey methods are available on the MRFSS website at: http://www.st.nmfs.gov/st1/recreational.

Survey methods for the for-hire fishing mode have seen the most improvement over time. Catch rate data has improved through increased sample quotas and additional sampling (requested and funded by the states) to the intercept portion of the survey. It was also recognized that the random household telephone survey was intercepting relatively few anglers in the for-hire fishing mode and the For-Hire Telephone Survey (FHS) was developed to estimate effort in the for-hire mode. The new method draws a random sample of known for-hire charter and guide vessels each week and vessel operators are called and asked directly to report their fishing activity. The FHS was pilot tested in the Gulf of Mexico in 1998 and officially adopted in 2000. The two pilot years' estimates are considered unofficial but have been used in many SEDARs (SEDAR 7 red snapper, SEDAR 16 king mackerel, etc). The FHS was pilot tested in east Florida in 2000 and officially adopted in 2003.

A further improvement in the FHS method was the pre-stratification of Florida into smaller sub-regions for estimating effort. Pre-stratification defines the sample unit on a sub-state level to produce separate effort estimates by these finer geographical regions. The FHS sub-regions include five distinct regions: NW Florida panhandle from Escambia to Dixie counties (sub-region 1), SW Florida peninsula from Levy to Collier counties (sub-region 2), Monroe county (sub-region 3), SE Florida from Dade through Indian River counties (sub-region 4), and NE Florida from Martin through Nassau counties (sub-region 5). The coastal household telephone survey method for the for-hire fishing mode continues to run concurrently with the newer FHS method.

*Calibration of traditional MRFSS charter boat estimates*

Conversion factors have been estimated to calibrate the traditional MRFSS charter boat estimates with the FHS for 1986-1997 in the Gulf of Mexico (SEDAR7-AW03, Diaz and Phares, 2004), for 1986-2003 in the South Atlantic (SEDAR16-DW15, Sminkey, 2008), and for 1981-2003 in the mid-Atlantic (SEDAR17-Data Workshop Report, 2008). 1986-2003 South Atlantic calibration factors were updated in 2011 (SEDAR25-Data Workshop Report, 2011). These calibration factors are tabulated in SEDAR 28-DW14. The relationship between the old charter boat method estimates of angler trips and the FHS estimates of angler trips was used to estimate the conversion factors. Since these factors are based on effort, they can be applied to all species' landings. In the Gulf of Mexico and South Atlantic, the period of 1981-1985 could not be calibrated with the same ratios developed for 1986+ because in the earlier 1981-1985 time period, MRFSS considered charter boat and headboat as a single combined mode in both regions. Thus, in order to properly calibrate the estimates from 1981-1985, headboat data from the Southeast Region Head-boat Survey (SRHS) must be included in the analysis. To calibrate the MRFSS combined charter boat and headboat mode effort estimates in 1981-1985, conversion factors were estimated using 1986-1990 effort estimates from both modes, in equivalent effort units, an angler trip (SEDAR 28-DW12).

*New MRIP weighted estimates*

Revised catch and effort estimates, based on an improved estimation method, were released on January 25, 2012. These estimates are available for the Atlantic and Gulf Coasts for January 2004 through October 2011. This new estimation method, developed as part of the Marine Recreational Information Program (MRIP), provides more accurate data by removing potential biases that were included in the previous estimates. Since new MRIP estimates are only available for a portion of the recreational time series that the MRFSS covers, calibration factors between the MRFSS estimates and the MRIP estimates must be developed in order to maintain one consistent time series for the recreational estimates. To that end a calibration workshop is planned for the spring that will address this important data need.

Figure 4.12.1 shows the comparison of the MRIP and MRFSS estimates for 2004-2011. At the SEDAR 28 DW plenary, the MRFSS estimates were identified as the best available data for 1981-2003. The MRIP estimates were identified as the best available data for 2004-2011. If the calibration workshop is able to produce correction factors that can be applied to the data in time for the SEDAR 28 Assessment Workshop in May, then these correction factors will be used to adjust the MRFSS estimates from 1981-2003. If the calibration workshop is not able to produce results in time then MRFSS estimates will be used from 1981-2003 and MRIP estimates will be used from 2004-2011.

*Monroe County*

Monroe County landings can be post-stratified to separate them from the MRFSS West Florida estimates. Post-stratification proportionally distributes the state-wide (FLE and FLW) effort into finer scale sub-regions and then produces effort estimates at this finer geographical scale. This is needed for the private and shore modes (all years) and charter boat mode (prior to FHS). FHS charter boat mode estimates are already pre-stratified, as discussed above. Although Monroe county estimates can be separated using this process, they cannot be partitioned into those from the Atlantic Ocean and those from the Gulf of Mexico. Anecdotal information from recreational fishermen revealed most, if not all, recreational Spanish mackerel fishing in the Florida Keys occurs in the Gulf of Mexico. Therefore, the recreational workgroup decided to leave the Monroe county landings in the Gulf of Mexico as part of the official MRFSS West Florida estimate.

*Missing cells in MRFSS weight estimates*

MRFSS landings estimates in weight must be treated with caution due to the occurrence of missing fish mean weight estimates in some strata. MRFSS weight estimates are calculated by multiplying the estimated number harvested in a cell (year/wave/state/mode/area/species) by the mean weight of the measured fish in that cell. When there are no fish measured in the cell (fish were gutted or too big for the sampler to weigh, harvest was all self-reported, etc.) estimates of landings in number are provided but there are no corresponding estimates of landings in weight.

The MRFSS Spanish mackerel estimates of landings in weight are used when provided by the survey. In cases where there is an estimate of landings in number but not weight, the Southeast Fisheries Science Center has used the MRFSS sample data to obtain an average weight using the following hierarchy: species, region, year, state, mode, and wave (SEDAR 22-DW16). The minimum number of weights used at each level of substitution is 30 fish, except for the final species level, where the minimum is 1 fish. In some cases, the MRFSS sample data records length, but not weight. These lengths were converted to weights using length weight equations developed by the Life History Working Group. These converted weights were used only in cases where having these additional converted weights would increase the number of weights available at each hierarchy level to meet the 30 fish minimum. Average weights are then multiplied by the landings estimates in number to obtain estimates of landings in weight. These estimates are provided in pounds whole weight.

*1981, wave 1*

MRFSS began in 1981, wave 2. In the Gulf of Mexico and east coast of Florida, catch needs to be estimated for 1981, wave 1. This gap was filled by determining the proportion of wave 1 to other waves in years 1982-1984 by fishing mode and area. These proportions were then used to estimate wave 1 in 1981 from the estimated catches in other waves of that year. (SEDARs 10 and 12 gag and red grouper).

*Texas*
Texas data from the MRFSS is only available from 1981-1985 and is sporadic, not covering all modes and waves. Boat mode estimates from Texas were eliminated from the MRFSS. Instead, TPWD data, which covers charter and private modes, was used to fill in theses modes prior to the start of the TPWD survey in May 1983. This method has been used in past SEDARs (king mackerel, red snapper). The only shore mode estimates available from Texas from any data source are from the MRFSS. These estimates seemed reasonable and were kept. Hurricane Alicia in 1983 may have affected the shore mode landings in Texas in 1984 and 1985. The lack of shore mode estimates from Texas 1986+ was discussed but there is no reasonable method available to fill in that gap.

*Catch Estimates*
Final MRFSS/MRIP landings estimates are shown in tables 4.11.1 and 4.11.2 by year and mode and in Figure 4.12.2.

*Maps*
Figures 4.12.3, 4.12.4, and 4.12.5 show the number of Spanish mackerel intercepted by the MRFSS from 1981-1989, 1990-1999, and 2000-2010 respectively. Numbers of fish mapped are intercepted by the survey as an A fish (seen by the interviewer) or a B1 fish (reported dead but not seen by the interviewer). Latitude and longitudes of the intercept site are mapped when available; otherwise, the mid-point of the county of intercept is mapped. Intercepted fish are shown for the Gulf of Mexico and Atlantic Ocean.

### 4.3.2 Southeast Region Headboat Survey (SRHS)

*Introduction*
The Southeast Region Headboat Survey estimates landings and effort for headboats in the South Atlantic and Gulf of Mexico. The Headboat Survey was started in 1972 but only included vessels from North Carolina and South Carolina until 1975. In 1976 the survey was expanded to northeast Florida (Nassau-Indian River counties) and Georgia, followed by southeast Florida (St. Lucie-Monroe counties) in 1978. The SRHS began in the Gulf of Mexico in 1986 and extends from Naples, FL to South Padre Island, TX. Due to headboat area definitions, West Florida and Alabama landings are combined. The South Atlantic and Gulf of Mexico Headboat Surveys generally include 70-80 vessels participating in each region annually.

The Headboat Survey incorporates two components for estimating catch and effort. 1) Information about the size of fishes landed are collected by port samplers during dockside sampling, where fish are measured to the nearest mm and weighed to the nearest 0.01 kg. These data are used to generate mean weights for all species by area and month. Port samplers also collect otoliths for ageing studies during dockside sampling events. 2) Information about total catch and effort are collected via the logbook, a form filled out by vessel personnel and containing total catch and effort data for individual trips. These logbooks are summarized by vessel to generate estimated landings by species, area, and time strata.

*Issue 1:* Gulf of Mexico Spanish mackerel headboat landings prior to 1986: From 1981-1985 headboat landings were combined with MRFSS charter boat landings for FLW to LA.

Option 1: Start headboat time series in 1986 when the SRHS began in the Gulf of Mexico.

Option 2: Use combined MRFSS charter\headboat mode estimates for FLW to LA to take headboat estimates back to 1981 for recreational Spanish mackerel landings in the Gulf of Mexico.

**Decision:** Option 2

*Issue 2:* Texas Spanish mackerel headboat landings 1981 to 1985: From 1981 to 1985 Texas was not included in the MRFSS charter\headboat combined landings 1981 -1985.

Option 1: Use the average Texas headboat landings for Spanish mackerel from 1986 to 1988 for years prior to the start of the SRHS, 1981 to 1985.

Option 2: Start headboat landings time series in 1986 when the SRHS began in the Gulf of Mexico.

**Decision:** Option 1

*Catch Estimates*

Final SRHS landings estimates are shown in Table 4.11.3 by year and state and in Figure 4.12.6 SRHS areas 18-28 are included in the Gulf of Mexico Spanish mackerel stock. Figures 4.12.7, 4.12.8, and 4.12.9 show the Gulf of Mexico Spanish mackerel headboat landings from 1986-1989, 1990-1999, and 2000-2011 respectively. Headboat landings of Spanish mackerel in the Gulf of Mexico, from the 1980's to present, have mostly been concentrated in three areas: southwest Florida, Louisiana, and Texas. Catch of Spanish mackerel was evenly distributed between these areas in the 1980s (Figure 4.12.7), however, since 1990 headboat landings of Spanish mackerel have declined and shifted between these areas in the Gulf of Mexico (Figures 4.12.8 and 4.12.9).

Mississippi headboats were added to the SRHS in 2010. These headboats are smaller vessels that carry 10-15 anglers and combine trolling trips with bottom fishing trips. The MS vessels running these types of trips accounted for the increased landings of Spanish mackerel in the GOM for 2011.

### 4.3.3 Texas Parks and Wildlife Department

*Introduction*

The TPWD Sport-boat Angling Survey was implemented in May 1983 and samples fishing trips made by sport-boat anglers fishing in Texas marine waters. All sampling takes place at recreational boat access sites. The raw data includes information on catch, effort and length composition of the catch for sampled boat-trips. These data are used by TPWD to generate recreational catch and effort estimates. The survey is designed to estimate landings and effort by high-use (May 15-November 20) and low-use seasons (November 21-May 14). SEFSC personnel disaggregates the TPWD seasonal estimates into waves (2 month period) using the TPWD intercept data, in order to be compatible with MRFSS. Only private boat and charter boat fishing are surveyed. Most of the sampled trips are private boats fishing in bay/pass because these represent most of the fishing effort, but all trips (private, charter boat, ocean, bay/pass) are sampled. Charter boat trips in ocean waters are the least encountered in the survey.

*Producing landings estimates in weight*
In the TPWD survey, landings estimates are produced only in number of fish. In addition, the TPWD sample data does not provide weights, only lengths of the intercepted fish. TPWD length-weight equations were applied to the lengths in order to obtain weights. In order to obtain estimated landings in weight, a similar method used to fill in the missing weights in MRFSS (described above) is applied to the TPWD landings. The hierarchy used for TPWD is expanded to include area fished (species, region, year, state, mode, wave, and area). This is equivalent to the MRFSS estimate of weight provided by that survey.

*1981-1983 Texas estimates*
The TPWD survey begins with the high-use season in 1983 (May15, 1983). Charter and private mode estimates need to be filled in for this state and these modes back to 1981. Averages from TPWD 1983-1985 were used by mode and wave to fill in the missing estimates. In addition, headboat landings from TX from 1981-1985 are not covered by any survey. As discussed above, SRHS 1986-1988 average landings were used to fill in this time period.

*Catch Estimates*
Final TPWD landings estimates are shown in table 4.11.4 by year and mode and in Figure 4.12.10.

*Maps*
Figures 4.12.11, 4.12.12, and 4.12.13 show the number of Spanish mackerel intercepted by the TPWD from 1983-1989, 1990-1999, and 2000-2010 respectively. Numbers of fish intercepted by the survey are mapped by Texas major bay areas. They are Sabine Lake, Galveston, Matagorda, San Antonio, Aransas, Corpus Christi, Upper Laguna Madre, and Lower Laguna Madre.

### 4.3.4 Historic Recreational Landings

*Introduction*
The historic recreational landings time period is defined as pre-1981 for the charter boat, headboat, private boat, and shore fishing modes, which represents the start of the Marine Recreational Fisheries Statistics Survey (MRFSS) and availability of landings estimates for Spanish mackerel. The Recreational Working Group was tasked with evaluating other potential historical sources and methods to compile landings of Spanish mackerel prior to the available time series of MRFSS and headboat estimated landings.

The sources of historical landings that were reviewed for potential use are as follows:

- Salt Water Angler Surveys (SWAS),1960, 1965 &1970.

- The U.S Fish and Wildlife Service (USFWS), 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey (FHWAR).

*SWAS*

During the SEDAR 28 data workshop the RWG reviewed the Salt Water Angler Surveys (SWAS) from 1960, 1965 &1970. The workgroup noted that the salt-water angling survey estimates for Spanish mackerel are on the order of 6 times those in recent years. These high estimates have been attributed to recall bias and possible exaggeration of catches by anglers (SWAS 1960). This may have been compounded further by the small sample size of salt water angler interviews conducted in these surveys. The average interview sample size for the three surveys was 0.0002% of total estimated saltwater anglers in the United States. The changes in methodology were also discussed by the RWG as part of the overall discussion of using this method.

*FHWAR census method*

The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey presented summary tables of U.S. population estimates, along with estimates of hunting and fishing participation and effort from surveys conduct by the USFWS every 5 years from 1955 to 1985. (Table 4.11.5). This information was used to develop an alternative method for estimating recreational landings prior to 1981.

The two key components from these FHWAR surveys that were used in the census method were the estimates of U.S. saltwater anglers and the estimates of U.S. saltwater days. The first objective was to determine the total saltwater anglers and saltwater days for the Gulf of Mexico (GOM) by using the summary information of U.S. anglers and U.S. saltwater anglers from the FHWAR surveys. The ratio of U.S saltwater anglers to the total U.S anglers was applied to the total number of anglers for the GOM to yield the total saltwater anglers for the GOM. The same method was used to calculate the total saltwater days for the GOM from the FHWAR surveys from 1955-1985.

The FHWAR surveys included the entire state of Florida, east and west coasts, and the South Atlantic. In order to address the management boundaries for Spanish mackerel the saltwater angler days for Florida's west coast (FLW) were separated from Florida's east coast (FLE) saltwater angler days using the ratio of the MRFSS total angler trips for FLW to the MRFSS total angler trips for the GOM (TX to AL). The average ratio from 1983-1985 was applied to the total saltwater days for the 1955-1985 to include FLW effort.

Similar to the SWAS there was a 12 month recall period for respondents, which resulted in greater reporting bias. Research concluded this bias resulted in overestimates of both the catch and effort estimates in the FHWAR surveys from 1955 to 1985. Consequently, an adjustment for recall bias was necessary. The total saltwater days for the GOM 1955-1985 were adjusted for recall bias in the FHWAR surveys. The MRFSS total angler trips for the GOM 1983 to1985 was averaged and divided by the total saltwater days for 1985 from the FHWAR survey. This multiplier was then applied to the total GOM saltwater days 1955-1985 to adjust for recall bias.

The mean CPUE for Spanish mackerel in the Gulf of Mexico from the MRFSS estimates from 1981 to 1985 was then applied to the adjusted saltwater angler days for the GOM 1955-1985 to estimate the historical Spanish mackerel landings for those years (Table 4.11.5).

A bootstrap analysis was used to capture the range of uncertainty in the historic recreational catch estimates. More specifically, the historic catch estimates are based on the average CPUE and the ratio of MRFSS effort to historic effort estimates. These two quantities were bootstrapped 200 times using the empirical estimates that went into each of them. The 5th and 95th percentiles were then computed from the distribution of bootstrap estimates to characterize the uncertainty (Figure 4.12.14).

*Issue:* Available historical Spanish mackerel landings limited 1950-1980.

*Option 1:* Use the Adjusted SWAS Spanish mackerel estimated landings.

*Option 2:* Use average ratio from entire time series (1981-2010) applied to commercial landings to estimate recreational landings (1950-1980).

*Option 3:* Use available recreational time series for the MRFSS\MRIP and headboat estimates 1981- 2010.

*Option 4:* Total Spanish mackerel landings using the FHWAR census method (GOM 1955-1980) are presented with the total estimated Spanish mackerel landings (MRFSS/MRIP and SRHS landings) (GOM 1981-2011) in Table 4.11.6 and Figure 4.12.15.

**Decision:** *Option 4*

## 4.4 Recreational Discards

### 4.4.1 MRFSS discards

Discarded live fish are reported by the anglers interviewed by the MRFSS so both the identity and quantities reported are unverified. Discarded fish size is unknown for all modes of fishing covered by the MRFSS. At-sea sampling of headboat discards was initiated as part of the improved for-hire surveys to characterize the size distribution of live discarded fishes in the headboat fishery, however, the Beaufort, NC Logbook program (SRHS) produces estimates of total discards in the headboat fishery since that class of caught fish was added to their logbook (2004). All estimates of live released fish (B2 fish) in charter or charter boat/headboat combined mode were adjusted in the same manner as the landings (calibration factors, substitutions, etc. described above in section 4.3.1). Size or weight of discarded fishes is not estimated by the MRFSS. Final MRFSS/MRIP discard estimates are shown in Table 4.11.7 by year and mode and in Figure 4.12.16.

### 4.4.2 Headboat Logbook Discards

The Southeast Region Headboat Survey logbook form was modified in 2004 to include a category to collect self-reported discards for each reported trip. This category is described on the form as the number of fish by species released alive and number released dead. Port agents instructed each captain on criteria for determining the condition of discarded fish. A fish is considered "released alive" if it is able to swim away on its own. If the fish floats off or is obviously dead or unable to swim, it is considered "released dead". These self-reported data are currently not validated within the Headboat Survey. Due to low Spanish mackerel sample sizes in the MRFSS At-Sea Observer Headboat program, it was determined that the logbook discard data would be used from 2004-2011. The RWG further concluded that a proxy should be used to estimate the headboat Spanish mackerel discards for previous years. The RWG considered the following two possible data sources to be used as a proxy for estimated headboat discards for 1981-2003 (Figure 4.12.17).

- MRFSS charter boat discard estimates (corrected for FHS adjustment) applied– Extend back to 1981.
- MRFSS private boat discard ratio estimates– Extend back to 1981 and follows the pattern exhibited in the Southeast Region Headboat Survey in later years.

*Issue: Proxy for estimated headboat discards from 1981-2003.*

Option 1: Apply the MRFSS charter boat discard:landings ratio to estimated headboat landings in order to estimate headboat discards from 1981-2003.
Option 2: Apply the MRFSS private boat discard:landings ratio to estimated headboat landings in order to estimate headboat discards from 1981-2003.
Option 3: Calculate a ratio of the mean ratio of SRHS discard:landings (2004-2011) to the mean ratio of MRFSS CH discard:landings (2004-2011). Apply this ratio to the yearly MRFSS charter boat discard:landings ratio (1981-2003) in order to estimate the yearly SRHS discard:landings ratio (1981-2003). This ratio is then applied to the SRHS landings (1981-2003) in order to estimate headboat discards (1981-2003).

**Decision:** Option 3. Calculate a ratio of the mean ratio of SRHS discard:landings (2004-2010) to the mean MRFSS CH discard:landings ratio (2004-2010). Apply this ratio to the yearly MRFSS charter boat discard:landings ratio (1981-2003) in order to estimate the yearly SRHS discard:landings ratio (1981-2003). This ratio is then applied to the SRHS landings (1981-2003) in order to estimate headboat discards (1981-2003). The MRFSS charter boat discard estimates followed the pattern exhibited in the SRHS in later years. Because the MRFSS charter boat discard ratio was greater than the SRHS discard ratio, using the MRFSS charter boat ratio without the adjustment described in Option 3 could result in overestimating the SRHS discards. Headboat discard estimates for Texas in 1981-1985 were estimated in the same manner as the landings, using the mean of the resulting discard estimates from 1986-1988.

Final discard estimates from the SRHS are shown in Table 4.11.8 by year and state and in Figure 4.12.18.

### 4.4.3 Headboat At-Sea Observer Survey Discards

An observer survey of the recreational headboat fishery was run in some Gulf region states to collect more detailed information on recreational headboat catch, particularly for discarded fish.

The survey was conducted in Alabama from 2004 to 2007, in West Florida from 2005-2007, and in East Florida from 2005 to the present. Headboat vessels are randomly selected throughout the year in each state, and the east coast of Florida is further stratified into northern and southern sample regions. Biologists board selected vessels with permission from the captain and observe anglers as they fish on the recreational trip. Data collected include number and species of fish landed and discarded, size of landed and discarded fish, and the release condition of discarded fish (FL only). Biological samples such as scales, otoliths, spines, stomachs and gonads, are not typically collected as part of this protocol. Data are also collected on the length of the trip, area fished (inland, state, and federal waters) and, in Florida, the minimum and maximum depth fished. In the Florida Keys (sub-region 3) some vessels that run trips that span more than 24 hours are also sampled to collect information on trips that fish farther offshore and for longer durations, primarily in the vicinity of the Dry Tortugas. Due to low Spanish mackerel sample sizes the MRFSS At-Sea Observer data was not used in this assessment.

### 4.4.4 Texas Parks and Wildlife Department Discards

The TPWD recreational survey does not estimate discards. The recreational workgroup looked at the data available and decided to use a Gulf wide ratio from the MRFSS by mode (charter and private) and apply it to the TPWD landings in order to estimate discards from Texas. Similar methods have been used in past SEDARs (red snapper). Discard estimates for Texas charter and private modes are shown in Table 4.11.9 by year and mode and in Figure 4.12.19.

### 4.4.5 Alternatives for characterizing discards

Due to low Spanish mackerel sample sizes in the MRFSS At-Sea Observer data it was concluded that the headboat logbook discard estimates should be used from 2004-2011 for the Gulf of Mexico headboat fishery. Further, the group decided to use the charter mode as a proxy to calculate headboat discards for 1981-2003, since the discard rates from the longer time series of MRFSS reflect historic changes in discard rates. These rates include the impacts from changes in recreational size limits and bag limits for Spanish mackerel over time.

## 4.5 Biological Sampling

### 4.5.1 Sampling Intensity Length/Age/Weight

*MRFSS Charter, Private, and Shore*

The MRFSS' angler intercept survey includes the collection of fish lengths from the harvested (landed, whole condition) catch. Up to 15 of each species landed per angler interviewed are measured to the nearest mm along a center line (defined as tip of snout to center of tail along a straight line, not curved over body). In those fish with a forked tail, this measure would typically be referred to as a fork length, e.g., Spanish mackerel, and in those fish that do not have a forked tail it would typically be referred to as a total length with the exception of some fishes that have a single, or few, caudal fin rays that extend further. Weights are typically collected for the same fish measured although weights are preferred when time is constrained. Ageing structures and other biological samples are not collected during MRFSS assignments because of concerns over the introduction of bias to survey data collection.

The number of Spanish mackerel measured or weighed in the Gulf of Mexico (FLW-TX) in the MRFSS charter fleet, private-rental mode, and shore mode are summarized by year and state in tables 4.11.10, 4.11.11, and 4.11.12, respectively. The number of angler trips with measured or weighed Spanish mackerel in the Gulf of Mexico (FLW-TX) in the MRFSS charter fleet, private-rental mode, and shore mode are summarized by year and state in tables 4.11.13, 4.11.14, and 4.11.15, respectively. The number of MRFSS intercept trips conducted in the Gulf of Mexico (FLW-TX) and the percentage of intercepts that encountered Spanish mackerel are summarized by year and mode in Table 4.11.16. Dockside mean weights of Spanish mackerel weighed from the MRFSS in the Gulf of Mexico (FLW-TX) are tabulated for 1981-2011 in Table 4.11.17.

*Headboat Survey Biological Sampling*
Lengths were collected from 1986 to 2011 by headboat dockside samplers in the Gulf of Mexico. Mississippi was added to the survey in 2010. Weights are typically collected for the same fish measured during dockside sampling. Also, biological samples (scales, otoliths, spines, stomachs and gonads) are collected routinely and processed for aging, diet studies, and maturity studies.

Annual numbers of Spanish mackerel measured for length in the headboat fleet and the number of trips from which Spanish mackerel were measured are summarized in Table 4.11.18. The number of Spanish mackerel aged from the headboat fleet by year and state are summarized in Table 4.11.19. Dockside mean weights for the headboat fishery are tabulated for 1986-2011 in Table 4.11.20.

*Texas Parks and Wildlife Department Biological Sampling*
The TPWD Sport-boat Angling Survey samples fishing trips made by sport-boat anglers fishing in Texas marine waters. All sampling takes place at recreational boat access sites. Length composition of the catch for sampled boat-trips has been collected since the high-season of 1983 (mid-May). Total length is measured by compressing the caudal fin lobes dorsoventrally to obtain the maximum possible total length. Weight of sampled fish is not recorded.

The number of Spanish mackerel measured in the TPWD charter and private-rental modes are summarized by year in table 4.11.21. The number of trips with measured Spanish mackerel in the TPWD charter and private-rental modes are summarized by year in table 4.11.22. The number of TPWD intercept trips conducted in Texas and the percentage of intercepts that encountered Spanish mackerel are summarized by year and mode in Table 4.11.23.

*Aging data*
The number of Spanish mackerel aged from the SRHS by year and state is summarized in Table 4.11.19. Age samples collected from the private/rental boat, charter boat, and shore modes are not typically collected as part of the MRFSS sampling protocol. These samples come from a number of sources including state agencies, special projects, and sometimes as add-ons to the MRFSS survey. The number of Spanish mackerel aged from the charter boat fleet by year and state is summarized in Table 4.11.24. The number of Spanish mackerel aged from the private fleet by year and state is summarized in Table 4.11.25. The number of Spanish mackerel aged from the recreational fishery (mode unknown) by year and state is summarized in Table 4.11.26. In some cases mode of catch was either not recorded or the samples were taken from tournament

weigh stations where trip information was not collected. It was not possible to determine the number of trips from which age samples were taken for approximately half of the age samples. Therefore number of trips with age samples was not reported.

### 4.5.2 Length – Age distributions

*MRFSS and TPWD Length Frequency Analysis Protocol*

The angler intercept survey is stratified by wave (2-month period), state, and fishing mode (shore, charter boat, party boat, private or rental boat) so simple aggregations of fish lengths across strata cannot be used to characterize a regional, annual length distribution of landed fish; a weighting scheme is needed to representatively include the distributions of each stratum value. The MRFSS' angler intercept length frequency analysis produces unbiased estimates of length-class frequencies for more than one stratum by summing respectively weighted relative length-class frequencies across strata. The steps used are:

1) Output a distribution of measured fish among state/mode /wave strata,
2) Output a distribution of estimated catch among state/mode/wave strata,
3) Calculate and output relative length-class frequencies for each state/mode/wave stratum,
4) Calculate appropriate relative weighting factors to be applied to the length-class frequencies for each state/mode/ wave stratum prior to pooling among strata,
5) Sum across strata as defined, e.g., annual, sub-region length frequencies, by year in 1-cm length bins.
6) Convert to annual proportion in each size bin (Figure 4.12.20).

Lengths were taken from the MRFSS (charter boat, private/rental boat, and shore modes) during 1981 to 2011. The number of vessel trips sampled were not available from the MRFSS. Lengths from the TPWD survey were converted to fork length using the equation FL = 0.8816*(TL) – 11.82 as recommended by the SEDAR 28 DW panel.

*Southeast Region Headboat Survey Length Frequency Analysis Protocol*

Headboat landings (1983 to 2011) were pooled across five time intervals (Jan-May, Jun, July, Aug, Sep-Dec) because landings were not estimated by month until 1996. Spatial weighting was developed by region for the headboat survey by pooling landings by region; western FL and AL, MS, LA, and TX. For each measured fish a landings value was assigned based on month of capture and region. The landings associated with each length measurement were summed by year in 1-cm length bins. These landings are typically then converted to annual proportion in each size bin (Figure 4.12.21).

*Recreational Age Frequency*

Age compositions were calculated for the charter, private/rental, and recreational (unknown mode) fisheries (Figure 4.12.22) and for the headboat fishery (Figure 4.12.23). Ages 0-10 were plotted for the charter, private/rental, and recreational (unknown mode) fisheries. Ages 0-7 were plotted for the headboat fishery.

It was not possible to determine the number of trips from which age samples were taken for approximately half of the age samples. Therefore number of trips with age samples was not reported.

## 4.6 Recreational Catch-at-Age/Length; directed and discard

Catch at age is handled within the assessment model and does not require discussion or presentation here.

## 4.7 Recreational Effort

### 4.7.1 MRFSS Recreational & Charter Effort

Effort estimation for the recreational fishery surveys are produced via telephone surveys of both anglers (private/rental boats and shore fishers) and for-hire boat operators (charter boat anglers, and in early years, party or charter anglers). The methods have changed during the full time series (see section 4.3 for descriptions of survey method changes and adjustments to survey estimates for uniform time-series of catch estimates). Angler trip estimates are tabulated in table 4.11.27 by year and mode. An angler-trip is a single day of fishing in the specified mode, not to exceed 24 hours.

Figures 4.12.24, 4.12.25, and 4.12.26 show the number of angler trips that intercepted Spanish mackerel from the MRFSS from 1981-1989, 1990-1999, and 2000-2010 respectively. Latitude and longitudes of the intercept site are mapped when available; otherwise, the mid-point of the county of intercept is mapped. Intercepted trips that caught Spanish mackerel are shown for the Gulf of Mexico and Atlantic Ocean.

### 4.7.2 Headboat Effort

Catch and effort data are reported on logbooks provided to all headboats in the survey. These forms are completed by the captain or designated crew member after each trip and represent the total number and weight of all the species kept, along with the total number of fish discarded for each species. Data on effort are provided as number of anglers on a given trip. Numbers of anglers are standardized, depending on the type of trip (length in hours), by converting number of anglers to "angler days" (e.g., 40 anglers on a half-day trip would yield 40 * 0.5 = 20 angler days). Angler days are summed by month for individual vessels. Each month, port agents collect these logbook trip reports and check for accuracy and completeness. Although reporting via the logbooks is mandatory, compliance is not 100% and is variable by location. To account for non-reporting, a correction factor is developed based on sampler observations, angler numbers from office books and all available information. This information is used to provide estimates of total catch by month and area, along with estimates of effort.

Figures 4.12.27, 4.12.28, and 4.12.29 show the Gulf of Mexico Spanish mackerel positive headboat trips from 1980-1989, 1990-1999, and 2000-2011 respectively. During the 1980s and 1990s, Louisiana and north Texas also showed concentrations of Spanish mackerel positive trips on headboats (Figures 4.12.27 and 4.12.28). In more recent years from 2000-2011, positive

Spanish mackerel trips were concentrated off Louisiana and the west coast of Florida (Figures 4.12.29).

Estimated headboat angler days have decreased in the Gulf of Mexico in recent years (Table 4.11.28). The most obvious factor which impacted the headboat fishery in both the Atlantic and Gulf of Mexico was the high price of fuel. This coupled with the economic down turn starting in 2008 has resulted in a marked decline in angler days in the Gulf of Mexico headboat fishery. Reports from industry staff, captains\owners, and port agents indicated fuel prices, the economy and fishing regulations are the factors that most affected the amount of trips, number of passengers, and overall fishing effort. Also important to note, is the noticeable decrease in effort in Louisiana, Alabama and west Florida due to the Deepwater Horizon oil spill in the Gulf of Mexico in 2010.

### 4.7.3 Texas Parks and Wildlife Effort

The TPWD survey is designed to estimate landings and effort by high-use (May 15-November 20) and low-use seasons (November 21-May 14). Only private boat and charter boat fishing are surveyed. Most of the sampled trips are private boats fishing in bay/pass because these represent most of the fishing effort, but all trips (private, charter boat, ocean, bay/pass) are sampled. Charter boat trips in ocean waters are the least encountered in the survey.

Estimates of TPWD angler trips are shown in table 4.11.29 by year, season, and mode. Figures 4.12.30, 4.12.31, and 4.12.32 show the number of angler hours from trips that intercepted Spanish mackerel from the TPWD from 1983-1989, 1990-1999, and 2000-2010 respectively. Angler hours are mapped by Texas major bay areas. They are Sabine Lake, Galveston, Matagorda, San Antonio, Aransas, Corpus Christi, Upper Laguna Madre, and Lower Laguna Madre.

## 4.8 Comments on adequacy of data for assessment analyses

Regarding the adequacy of the available recreational data for assessment analyses, the RWG discussed the following:

- Landings, as adjusted, appear to be adequate for the time period covered.
- Size data appear to adequately represent the landed catch for the charter and headboat sector.

## 4.9 Literature Cited

Matter, V. and S. Turner 2010. Estimated Recreational Catch in Weight: Method for Filling in Missing Weight Estimates from the Recreational Surveys with Application to Yellowedge Grouper, Tilefish (golden), and Blueline Tilefish (SEDAR 22-DW16), National Marine Fisheries Service, Southeast Fisheries Science Center, Sustainable Fisheries Division (SFD-2010-003).

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Deuel, D.G. 1973. The 1970 Salt-Water Angling Survey. U.S. Department of Commerce, National Marine Fisheries Service, Current Fishery Statistics No. 6200, 54 pp.

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## 4.10 Tables

**Table 4.11.1.** Gulf of Mexico (FLW-LA) Spanish mackerel landings (numbers of fish and whole weight in pounds) for charter boat mode and charter boat/headboat mode (MRFSS, NMFS, 1981-2003; MRIP, NMFS, 2004-2011). CH and CH/HB mode adjusted for FHS conversion prior to 1997. CH/HB mode landings from 1981-1985 only. 2011 data is preliminary and through October.

| | Estimated CH Landings | | | Estimated CH/HB Landings | | |
|---|---|---|---|---|---|---|
| YEAR | Number | CV | Pounds | Number | CV | Pounds |
| 1981 | | | | 942,170 | 0.33 | 999,274 |
| 1982 | | | | 1,569,489 | 0.29 | 1,846,794 |
| 1983 | | | | 582,555 | 0.39 | 826,316 |
| 1984 | | | | 385,137 | 0.25 | 503,035 |
| 1985 | | | | 388,053 | 0.25 | 533,690 |
| 1986 | 354,699 | 0.25 | 482,316 | | | |
| 1987 | 335,781 | 0.22 | 495,719 | | | |
| 1988 | 125,666 | 0.36 | 205,167 | | | |
| 1989 | 196,290 | 0.22 | 305,182 | | | |
| 1990 | 203,674 | 0.25 | 370,623 | | | |
| 1991 | 86,893 | 0.21 | 211,477 | | | |
| 1992 | 99,051 | 0.26 | 158,410 | | | |
| 1993 | 76,330 | 0.24 | 125,521 | | | |
| 1994 | 166,952 | 0.23 | 220,634 | | | |
| 1995 | 337,320 | 0.24 | 532,316 | | | |
| 1996 | 130,534 | 0.27 | 190,518 | | | |
| 1997 | 159,434 | 0.38 | 333,330 | | | |
| 1998 | 127,348 | 0.09 | 234,461 | | | |
| 1999 | 121,573 | 0.10 | 238,184 | | | |
| 2000 | 213,272 | 0.11 | 366,095 | | | |
| 2001 | 170,786 | 0.09 | 278,357 | | | |
| 2002 | 131,692 | 0.10 | 254,485 | | | |
| 2003 | 171,765 | 0.10 | 302,770 | | | |
| 2004 | 146,385 | 0.20 | 194,663 | | | |
| 2005 | 68,578 | 0.20 | 123,791 | | | |
| 2006 | 307,135 | 0.20 | 562,234 | | | |
| 2007 | 179,424 | 0.18 | 327,774 | | | |
| 2008 | 226,053 | 0.23 | 350,013 | | | |
| 2009 | 226,333 | 0.24 | 305,900 | | | |
| 2010 | 131,864 | 0.16 | 250,844 | | | |
| 2011 | 275,494 | 0.12 | 427,721 | | | |

**Table 4.11.2.** Gulf of Mexico (FLW-TX) Spanish mackerel landings (numbers of fish and whole weight in pounds) for private/rental boat mode and shore mode (MRFSS, NMFS, 1981-2003; MRIP, NMFS, 2004-2011). TX landings for shore mode from 1981-1985 only. 2011 data is preliminary and through October.

| | Estimated PR Landings | | | Estimated SH Landings | | |
|---|---|---|---|---|---|---|
| YEAR | Number | CV | Pounds | Number | CV | Pounds |
| 1981 | 793,825 | 0.22 | 935,490 | 353,215 | 0.28 | 349,489 |
| 1982 | 1,576,510 | 0.29 | 1,569,107 | 283,874 | 0.18 | 391,016 |
| 1983 | 1,222,084 | 0.24 | 1,441,054 | 614,142 | 0.23 | 787,227 |
| 1984 | 272,316 | 0.27 | 395,700 | 272,610 | 0.34 | 386,743 |
| 1985 | 532,221 | 0.17 | 626,199 | 246,748 | 0.26 | 321,479 |
| 1986 | 2,536,448 | 0.12 | 2,590,750 | 3,498,704 | 0.25 | 3,703,806 |
| 1987 | 824,869 | 0.09 | 1,509,214 | 608,050 | 0.18 | 829,874 |
| 1988 | 1,070,955 | 0.10 | 1,555,563 | 258,849 | 0.19 | 359,773 |
| 1989 | 694,372 | 0.09 | 1,106,122 | 236,696 | 0.17 | 210,012 |
| 1990 | 703,798 | 0.10 | 1,241,017 | 678,748 | 0.13 | 860,659 |
| 1991 | 1,043,554 | 0.09 | 1,592,566 | 576,463 | 0.16 | 734,535 |
| 1992 | 988,084 | 0.05 | 1,588,078 | 1,296,872 | 0.08 | 1,737,928 |
| 1993 | 356,467 | 0.10 | 696,190 | 1,050,065 | 0.09 | 1,098,361 |
| 1994 | 424,917 | 0.08 | 624,728 | 817,555 | 0.07 | 974,511 |
| 1995 | 313,021 | 0.14 | 688,173 | 396,766 | 0.14 | 489,486 |
| 1996 | 463,174 | 0.11 | 781,511 | 638,295 | 0.12 | 727,071 |
| 1997 | 494,843 | 0.15 | 1,039,336 | 591,042 | 0.12 | 704,404 |
| 1998 | 404,157 | 0.11 | 821,234 | 632,420 | 0.12 | 840,299 |
| 1999 | 630,435 | 0.09 | 1,085,320 | 823,952 | 0.09 | 1,017,865 |
| 2000 | 584,505 | 0.10 | 1,185,553 | 916,551 | 0.09 | 1,383,914 |
| 2001 | 772,196 | 0.09 | 1,313,957 | 1,534,160 | 0.09 | 1,957,295 |
| 2002 | 721,118 | 0.09 | 1,480,183 | 1,109,254 | 0.09 | 1,467,450 |
| 2003 | 572,993 | 0.08 | 1,189,324 | 759,608 | 0.11 | 1,122,474 |
| 2004 | 834,347 | 0.11 | 1,314,717 | 1,144,339 | 0.17 | 1,239,844 |
| 2005 | 665,629 | 0.15 | 1,097,404 | 457,444 | 0.24 | 539,439 |
| 2006 | 677,614 | 0.11 | 1,182,120 | 773,926 | 0.28 | 755,261 |
| 2007 | 557,693 | 0.10 | 977,828 | 593,883 | 0.17 | 715,410 |
| 2008 | 1,027,872 | 0.22 | 1,961,999 | 642,929 | 0.31 | 631,962 |
| 2009 | 681,267 | 0.18 | 1,105,777 | 595,596 | 0.22 | 661,319 |
| 2010 | 606,458 | 0.12 | 1,012,579 | 826,898 | 0.16 | 1,282,606 |
| 2011 | 520,844 | 0.15 | 728,938 | 611,632 | 0.16 | 767,059 |

**Table 4.11.3.** Estimated headboat landings of Spanish mackerel in the Gulf of Mexico 1981-2011. Due to headboat area definitions, West Florida and Alabama landings are combined.

| | FLW/AL | | MS* | | LA** | | TX† | | Gulf of Mexico | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Number | Weight (lb) | Number | Weight (lb) | Number | Weight (lb) | Number | Weight (lb) | Number | Weight (lb) |
| 1981 | | | | | | | 153 | 478 | 153 | 478 |
| 1982 | | | | | | | 153 | 478 | 153 | 478 |
| 1983 | | | | | | | 153 | 478 | 153 | 478 |
| 1984 | | | | | | | 153 | 478 | 153 | 478 |
| 1985 | | | | | | | 153 | 478 | 153 | 478 |
| 1986 | 278 | 546 | | | 29 | 18 | 84 | 305 | 391 | 869 |
| 1987 | 455 | 1,215 | | | 671 | 1,808 | 204 | 551 | 1,330 | 3,574 |
| 1988 | 44 | 133 | | | 113 | 300 | 170 | 484 | 327 | 918 |
| 1989 | 201 | 184 | | | 150 | 292 | 211 | 492 | 562 | 967 |
| 1990 | 639 | 1,543 | | | 137 | 361 | 101 | 261 | 877 | 2,165 |
| 1991 | 489 | 708 | | | 845 | 1,600 | 385 | 3,238 | 1,719 | 5,546 |
| 1992 | 480 | 1,169 | | | 558 | 1,526 | 304 | 823 | 1,342 | 3,517 |
| 1993 | 277 | 628 | | | 80 | 191 | 212 | 486 | 569 | 1,305 |
| 1994 | 815 | 2,246 | | | 382 | 978 | 406 | 993 | 1,603 | 4,217 |
| 1995 | 147 | 476 | | | 550 | 1,859 | 183 | 585 | 880 | 2,921 |
| 1996 | 198 | 471 | | | 231 | 388 | 212 | 598 | 641 | 1,457 |
| 1997 | 187 | 407 | | | 303 | 1,071 | 50 | 139 | 540 | 1,617 |
| 1998 | 277 | 444 | | | 41 | 143 | 18 | 73 | 336 | 659 |
| 1999 | 359 | 1,068 | | | 44 | 116 | 71 | 202 | 474 | 1,386 |
| 2000 | 411 | 1,230 | | | 46 | 167 | 60 | 178 | 517 | 1,576 |
| 2001 | 169 | 434 | | | 14 | 38 | 28 | 86 | 211 | 559 |
| 2002 | 169 | 448 | | | 14 | 27 | 82 | 164 | 265 | 639 |
| 2003 | 194 | 373 | | | - | - | 77 | 145 | 271 | 518 |
| 2004 | 241 | 418 | | | | | 20 | 32 | 261 | 449 |
| 2005 | 230 | 774 | | | | | 52 | 171 | 282 | 945 |
| 2006 | 264 | 639 | | | - | - | 128 | 314 | 392 | 953 |
| 2007 | 425 | 1,446 | | | 3 | 11 | 106 | 361 | 534 | 1,817 |
| 2008 | 542 | 1,367 | | | 22 | 50 | 70 | 179 | 634 | 1,596 |
| 2009 | 560 | 1,097 | | | 29 | 20 | 104 | 181 | 693 | 1,298 |
| 2010 | 279 | 294 | 1,288 | 1,318 | - | - | 30 | 31 | 1,597 | 1,642 |
| 2011 | 528 | 1,302 | 4,513 | 8,200 | - | - | 220 | 543 | 5,261 | 10,046 |

*MS added to survey in 2010.
**LA not sampled during 2004-2005 due to Hurricane Katrina.
†TX 1981-1985 landings estimated using the mean landings 1986-1988.

**Table 4.11.4** Texas Spanish mackerel landings (numbers of fish and whole weight in pounds) for charter boat mode and private mode (TPWD). 2011 data is through mid-May.

| | Estimated CH Landings | | Estimated PR Landings | | Total Landings | |
|---|---|---|---|---|---|---|
| year | Number | Pounds | Number | Pounds | Number | Pounds |
| 1981 | 303 | 611 | 3,922 | 8,226 | 4,225 | 8,837 |
| 1982 | 303 | 611 | 3,922 | 8,226 | 4,225 | 8,837 |
| 1983 | 801 | 1,633 | 2,952 | 6,044 | 3,753 | 7,677 |
| 1984 | 98 | 180 | 5,472 | 11,096 | 5,570 | 11,276 |
| 1985 | 40 | 79 | 3,353 | 7,556 | 3,393 | 7,635 |
| 1986 | 76 | 157 | 2,448 | 5,117 | 2,524 | 5,274 |
| 1987 | 378 | 649 | 7,797 | 12,296 | 8,175 | 12,944 |
| 1988 | 95 | 179 | 1,291 | 2,432 | 1,386 | 2,610 |
| 1989 | 34 | 51 | 2,526 | 4,142 | 2,560 | 4,193 |
| 1990 | 172 | 296 | 3,274 | 5,547 | 3,446 | 5,843 |
| 1991 | 357 | 737 | 9,626 | 23,599 | 9,983 | 24,336 |
| 1992 | | | 2,561 | 6,996 | 2,561 | 6,996 |
| 1993 | 223 | 444 | 1,417 | 2,692 | 1,640 | 3,136 |
| 1994 | 186 | 372 | 5,336 | 11,554 | 5,522 | 11,927 |
| 1995 | 86 | 231 | 8,401 | 24,231 | 8,487 | 24,462 |
| 1996 | 15 | 35 | 9,234 | 24,111 | 9,249 | 24,146 |
| 1997 | 264 | 543 | 5,070 | 11,475 | 5,334 | 12,018 |
| 1998 | 27 | 66 | 5,545 | 13,953 | 5,572 | 14,018 |
| 1999 | 223 | 529 | 4,403 | 11,888 | 4,626 | 12,417 |
| 2000 | 262 | 601 | 5,119 | 13,934 | 5,381 | 14,535 |
| 2001 | 7 | 14 | 1,465 | 2,937 | 1,472 | 2,951 |
| 2002 | 896 | 1,909 | 3,685 | 7,814 | 4,581 | 9,723 |
| 2003 | 214 | 523 | 4,356 | 10,851 | 4,570 | 11,374 |
| 2004 | 43 | 90 | 8,293 | 18,133 | 8,336 | 18,223 |
| 2005 | 232 | 529 | 7,926 | 18,657 | 8,158 | 19,185 |
| 2006 | 823 | 2,286 | 9,336 | 21,381 | 10,159 | 23,667 |
| 2007 | 603 | 2,037 | 6,529 | 14,810 | 7,132 | 16,847 |
| 2008 | 133 | 266 | 2,443 | 5,554 | 2,576 | 5,820 |
| 2009 | 64 | 142 | 4,912 | 11,313 | 4,976 | 11,455 |
| 2010 | 264 | 451 | 11,175 | 22,361 | 11,439 | 22,812 |
| 2011 | 880 | 1,203 | 474 | 648 | 1,354 | 1,850 |

**Table 4.11.5.** FHWAR estimation method for historical recreational Spanish mackerel landings in the Gulf of Mexico (1955-1985).

| Year | US saltwater angler days | Proportion anglers GOM | Saltwater angler days (GOM) | Mean CPUE (MRFSS 1981-1985) | Recall bias adjustment | Adjusted saltwater days (GOM) | Adjusted Spanish mackerel landings (n) |
|---|---|---|---|---|---|---|---|
| 1955 | 58,621,000 | 0.19 | 17,551,372 | 0.11 | 0.40 | 7,034,684 | 774,329 |
| 1960 | 80,602,000 | 0.21 | 27,144,209 | 0.11 | 0.40 | 10,879,544 | 1,197,544 |
| 1965 | 95,837,000 | 0.19 | 29,581,307 | 0.11 | 0.40 | 11,856,346 | 1,305,064 |
| 1970 | 113,694,000 | 0.20 | 35,428,990 | 0.11 | 0.40 | 14,200,129 | 1,563,051 |
| 1975 | 167,499,000 | 0.19 | 51,531,494 | 0.11 | 0.40 | 20,654,099 | 2,273,458 |
| 1980 | 164,040,000 | 0.20 | 51,984,003 | 0.11 | 0.40 | 20,835,467 | 2,293,422 |
| 1985 | 171,055,000 | 0.20 | 54,291,623 | 0.11 | 0.40 | 21,760,373 | 2,395,229 |

**Table 4.11.6.** Gulf of Mexico estimated recreational Spanish mackerel landings (number) using FHWAR census method (1955-1980), MRFSS (1981-2003), MRIP (2004-2011),TPWD (81-11), and SRHS (81-11) estimation methods.

| Year | Estimated landings (n) | Year | Estimated landings (n) |
|---|---|---|---|
| 1955 | 774,329 | 1984 | 935,785 |
| 1956 | 858,972 | 1985 | 1,170,567 |
| 1957 | 943,615 | 1986 | 6,392,766 |
| 1958 | 1,028,258 | 1987 | 1,778,205 |
| 1959 | 1,112,901 | 1988 | 1,457,183 |
| 1960 | 1,197,544 | 1989 | 1,130,480 |
| 1961 | 1,219,048 | 1990 | 1,590,542 |
| 1962 | 1,240,552 | 1991 | 1,718,612 |
| 1963 | 1,262,056 | 1992 | 2,387,911 |
| 1964 | 1,283,560 | 1993 | 1,485,071 |
| 1965 | 1,305,064 | 1994 | 1,416,548 |
| 1966 | 1,356,661 | 1995 | 1,056,474 |
| 1967 | 1,408,258 | 1996 | 1,241,893 |
| 1968 | 1,459,856 | 1997 | 1,251,192 |
| 1969 | 1,511,453 | 1998 | 1,169,834 |
| 1970 | 1,563,051 | 1999 | 1,581,061 |
| 1971 | 1,705,132 | 2000 | 1,720,226 |
| 1972 | 1,847,214 | 2001 | 2,478,825 |
| 1973 | 1,989,295 | 2002 | 1,966,911 |
| 1974 | 2,131,377 | 2003 | 1,509,207 |
| 1975 | 2,273,458 | 2004 | 2,133,669 |
| 1976 | 2,277,451 | 2005 | 1,200,092 |
| 1977 | 2,281,444 | 2006 | 1,769,226 |
| 1978 | 2,285,437 | 2007 | 1,338,667 |
| 1979 | 2,289,429 | 2008 | 1,900,065 |
| 1980 | 2,293,422 | 2009 | 1,508,864 |
| 1981 | 2,093,589 | 2010 | 1,578,256 |
| 1982 | 3,434,252 | 2011 | 1,414,585 |
| 1983 | 2,422,686 | | |

**Table 4.11.7.** Gulf of Mexico (FLW-TX) Spanish mackerel discards for the recreational fishing modes by year (MRFSS, NMFS, 1981-2003; MRIP, NMFS, 2004-2011. CH and CH/HB mode adjusted for FHS conversion prior to 1997. CH/HB mode discards from 1981-1985 only. 2011 data is preliminary and through October. TX estimates for 1981-1985 shore mode only.

| | Estimated CH Discards | | Estimated CH/HB Discards | | Estimated PR Discards | | Estimated SH Discards | |
|---|---|---|---|---|---|---|---|---|
| YEAR | Number | CV | Number | CV | Number | CV | Number | CV |
| 1981 | | | 6,371 | 1.00 | 28,533 | 0.46 | 42,872 | 0.43 |
| 1982 | | | 33,938 | 0.73 | 20,734 | 0.52 | 483,958 | 0.51 |
| 1983 | | | 0 | 0.00 | 33,953 | 0.46 | 1,144,786 | 0.61 |
| 1984 | | | 9,794 | 0.58 | 36,422 | 0.75 | 13,898 | 0.54 |
| 1985 | | | 393 | 1.00 | 76,648 | 0.45 | 63,611 | 0.45 |
| 1986 | 34,884 | 0.35 | | | 1,477,188 | 0.16 | 2,497,470 | 0.33 |
| 1987 | 11,982 | 0.88 | | | 208,933 | 0.16 | 191,520 | 0.36 |
| 1988 | 22,312 | 0.43 | | | 541,171 | 0.16 | 154,673 | 0.35 |
| 1989 | 81,812 | 0.37 | | | 279,559 | 0.22 | 134,107 | 0.34 |
| 1990 | 55,639 | 0.63 | | | 533,147 | 0.21 | 1,579,443 | 0.18 |
| 1991 | 10,840 | 0.37 | | | 409,828 | 0.14 | 813,299 | 0.27 |
| 1992 | 65,660 | 0.59 | | | 489,251 | 0.08 | 1,125,772 | 0.14 |
| 1993 | 51,089 | 0.48 | | | 185,858 | 0.15 | 812,998 | 0.13 |
| 1994 | 17,571 | 0.54 | | | 229,742 | 0.14 | 409,293 | 0.14 |
| 1995 | 49,663 | 0.39 | | | 256,240 | 0.46 | 257,388 | 0.23 |
| 1996 | 11,968 | 0.49 | | | 273,371 | 0.12 | 404,150 | 0.22 |
| 1997 | 48,643 | 0.38 | | | 263,843 | 0.15 | 541,915 | 0.18 |
| 1998 | 71,196 | 0.18 | | | 218,006 | 0.14 | 457,726 | 0.18 |
| 1999 | 23,635 | 0.18 | | | 479,096 | 0.10 | 731,813 | 0.09 |
| 2000 | 41,917 | 0.19 | | | 574,323 | 0.43 | 880,679 | 0.15 |
| 2001 | 41,348 | 0.30 | | | 633,266 | 0.09 | 1,170,206 | 0.11 |
| 2002 | 49,595 | 0.37 | | | 550,088 | 0.08 | 1,320,444 | 0.10 |
| 2003 | 38,521 | 0.13 | | | 789,883 | 0.10 | 1,382,511 | 0.13 |
| 2004 | 55,788 | 0.24 | | | 1,222,939 | 0.20 | 1,037,331 | 0.15 |
| 2005 | 21,159 | 0.20 | | | 809,693 | 0.21 | 542,023 | 0.23 |
| 2006 | 55,502 | 0.37 | | | 1,101,592 | 0.13 | 1,697,021 | 0.32 |
| 2007 | 53,778 | 0.25 | | | 705,093 | 0.14 | 1,345,546 | 0.32 |
| 2008 | 26,193 | 0.27 | | | 584,706 | 0.13 | 1,430,259 | 0.28 |
| 2009 | 99,643 | 0.50 | | | 799,311 | 0.14 | 736,605 | 0.17 |
| 2010 | 111,390 | 0.22 | | | 717,842 | 0.11 | 1,646,305 | 0.22 |
| 2011 | 97,599 | 0.22 | | | 704,535 | 0.14 | 911,046 | 0.27 |

**Table 4.11.8.** Estimated Gulf of Mexico Spanish mackerel discards for SRHS by year and state.† Due to headboat area definitions, West Florida and Alabama discards are combined.

| Year | FLW\AL | MS* | LA** | TX† | Gulf of Mexico |
|---|---|---|---|---|---|
| 1981 | | | | 2 | 2 |
| 1982 | | | | 2 | 2 |
| 1983 | | | | 2 | 2 |
| 1984 | | | | 2 | 2 |
| 1985 | | | | 2 | 2 |
| 1986 | - | | - | - | - |
| 1987 | 10 | | - | 2 | 12 |
| 1988 | 0 | | - | - | 0 |
| 1989 | 6 | | - | 3 | 9 |
| 1990 | 29 | | - | - | 29 |
| 1991 | 13 | | - | - | 13 |
| 1992 | 8 | | - | 1 | 8 |
| 1993 | 27 | | - | 2 | 29 |
| 1994 | 72 | | - | - | 72 |
| 1995 | 1 | | - | - | 1 |
| 1996 | 4 | | - | 1 | 5 |
| 1997 | 3 | | - | - | 3 |
| 1998 | 16 | | - | 0 | 16 |
| 1999 | 31 | | - | - | 31 |
| 2000 | 9 | | - | 0 | 9 |
| 2001 | 4 | | - | - | 4 |
| 2002 | 5 | | - | 1 | 5 |
| 2003 | 9 | | - | 1 | 10 |
| 2004 | - | | | - | - |
| 2005 | 4 | | | - | 4 |
| 2006 | 15 | | - | 4 | 19 |
| 2007 | 48 | | - | 4 | 52 |
| 2008 | 11 | | - | - | 11 |
| 2009 | 20 | | - | - | 20 |
| 2010 | 8 | 10 | - | - | 18 |
| 2011 | 13 | 24 | - | - | 37 |

*MS added to survey in 2010.
**LA not sampled during 2004-2005 due to Hurricane Katrina.
†TX 1981-1985 discards estimated using the mean discards 1986-1988.

**Table 4.11.9** Texas Spanish mackerel discards (numbers of fish) for charter boat mode and private mode (TPWD). 2011 data is through mid-May.

| year | Estimated CH Discards | Estimated PR Discards | Total Discards |
|---|---|---|---|
| 1981 | 1 | 271 | 272 |
| 1982 | 1 | 271 | 272 |
| 1983 | 0 | 87 | 87 |
| 1984 | 5 | 273 | 278 |
| 1985 | 0 | 456 | 457 |
| 1986 | 7 | 1,233 | 1,240 |
| 1987 | 11 | 1,202 | 1,213 |
| 1988 | 71 | 311 | 381 |
| 1989 | 11 | 815 | 825 |
| 1990 | 31 | 1,381 | 1,413 |
| 1991 | 54 | 3,235 | 3,288 |
| 1992 | | 1,039 | 1,039 |
| 1993 | 51 | 524 | 574 |
| 1994 | 150 | 3,055 | 3,205 |
| 1995 | 58 | 5,341 | 5,399 |
| 1996 | 2 | 4,566 | 4,568 |
| 1997 | 58 | 1,966 | 2,024 |
| 1998 | 8 | 2,901 | 2,909 |
| 1999 | 28 | 2,960 | 2,988 |
| 2000 | 45 | 3,984 | 4,028 |
| 2001 | 1 | 921 | 922 |
| 2002 | 255 | 2,506 | 2,760 |
| 2003 | 40 | 4,140 | 4,180 |
| 2004 | 13 | 9,450 | 9,463 |
| 2005 | 44 | 7,033 | 7,077 |
| 2006 | 142 | 11,080 | 11,222 |
| 2007 | 203 | 5,420 | 5,623 |
| 2008 | 29 | 1,460 | 1,489 |
| 2009 | 25 | 3,959 | 3,984 |
| 2010 | 136 | 10,484 | 10,619 |
| 2011 | 464 | 659 | 1,123 |

**Table 4.11.10**. Number of Spanish mackerel measured or weighed in the Gulf of Mexico (FLW-LA) in the MRFSS charter fleet by year and state.

| YEAR | LA | MS | AL | FLW | TOTAL |
|---|---|---|---|---|---|
| 1981 | | 53 | 17 | 34 | 104 |
| 1982 | | 91 | 10 | 4 | 105 |
| 1983 | 1 | 250 | | 35 | 286 |
| 1984 | 2 | 361 | | 3 | 366 |
| 1985 | 2 | 146 | 5 | | 153 |
| 1986 | 4 | 400 | 46 | 163 | 613 |
| 1987 | 6 | 271 | 81 | 211 | 569 |
| 1988 | 5 | 302 | 33 | 46 | 386 |
| 1989 | 2 | 337 | 44 | 62 | 445 |
| 1990 | 8 | 331 | 12 | 39 | 390 |
| 1991 | 24 | 248 | 36 | 26 | 334 |
| 1992 | 13 | 288 | 23 | 42 | 366 |
| 1993 | 5 | 20 | 18 | 57 | 100 |
| 1994 | 3 | 56 | 13 | 59 | 131 |
| 1995 | 11 | 34 | 7 | 200 | 252 |
| 1996 | 2 | 55 | 20 | 40 | 117 |
| 1997 | 6 | 113 | 7 | 321 | 447 |
| 1998 | 5 | 138 | 132 | 350 | 625 |
| 1999 | 4 | 475 | 550 | 475 | 1,504 |
| 2000 | 1 | 397 | 374 | 1,294 | 2,066 |
| 2001 | | 332 | 162 | 1,799 | 2,293 |
| 2002 | 4 | 209 | 48 | 792 | 1,053 |
| 2003 | 5 | 182 | 42 | 807 | 1,036 |
| 2004 | 6 | 190 | 74 | 842 | 1,112 |
| 2005 | 1 | 71 | 31 | 373 | 476 |
| 2006 | 5 | 70 | 19 | 406 | 500 |
| 2007 | 6 | 140 | 108 | 450 | 704 |
| 2008 | 3 | 201 | 129 | 449 | 782 |
| 2009 | 15 | 210 | 89 | 345 | 659 |
| 2010 | | 107 | 108 | 666 | 881 |
| 2011 | 2 | 197 | 227 | 907 | 1,333 |
| Grand Total | 151 | 6,275 | 2,465 | 11,297 | 20,188 |

**Table 4.11.11.** Number of Spanish mackerel measured or weighed in the Gulf of Mexico (FLW-TX) in the MRFSS private fleet by year and state. TX data for 1981-1985 only.

| YEAR | TX | LA | MS | AL | FLW | TOTAL |
|---|---|---|---|---|---|---|
| 1981 | 2 | 5 | 42 | 77 | 46 | 172 |
| 1982 | | 45 | 77 | 73 | 53 | 248 |
| 1983 | | 9 | 18 | 33 | 36 | 96 |
| 1984 | | 11 | 8 | 19 | 5 | 43 |
| 1985 | 1 | 20 | 12 | 27 | 18 | 78 |
| 1986 | | 8 | 16 | 147 | 121 | 292 |
| 1987 | | 22 | 37 | 219 | 260 | 538 |
| 1988 | | 34 | 28 | 56 | 133 | 251 |
| 1989 | | 50 | 6 | 48 | 121 | 225 |
| 1990 | | 32 | 4 | 92 | 138 | 266 |
| 1991 | | 45 | 35 | 119 | 234 | 433 |
| 1992 | | 107 | 54 | 212 | 613 | 986 |
| 1993 | | 23 | 6 | 63 | 117 | 209 |
| 1994 | | 11 | 16 | 61 | 199 | 287 |
| 1995 | | 16 | 6 | 24 | 73 | 119 |
| 1996 | | 16 | 5 | 72 | 258 | 351 |
| 1997 | | 14 | 31 | 41 | 185 | 271 |
| 1998 | | 2 | 18 | 49 | 382 | 451 |
| 1999 | | 17 | 14 | 331 | 477 | 839 |
| 2000 | | 10 | 14 | 134 | 323 | 481 |
| 2001 | | 1 | 4 | 248 | 429 | 682 |
| 2002 | | 5 | 8 | 89 | 498 | 600 |
| 2003 | | 2 | 5 | 68 | 417 | 492 |
| 2004 | | 3 | 4 | 126 | 557 | 690 |
| 2005 | | 7 | 8 | 71 | 275 | 361 |
| 2006 | | 13 | 6 | 87 | 429 | 535 |
| 2007 | | 3 | 1 | 37 | 499 | 540 |
| 2008 | | 6 | 6 | 67 | 407 | 486 |
| 2009 | | 3 | 14 | 43 | 386 | 446 |
| 2010 | | | | 67 | 519 | 586 |
| 2011 | | 2 | 1 | 34 | 564 | 601 |
| Grand Total | 3 | 542 | 504 | 2,834 | 8,772 | 12,655 |

**Table 4.11.12.** Number of Spanish mackerel measured or weighed in the Gulf of Mexico (FLW-TX) in the MRFSS shore mode by year and state. TX data for 1981-1985 only.

| YEAR | TX | LA | MS | AL | FLW | TOTAL |
|---|---|---|---|---|---|---|
| 1981 | 1 | 2 | | 2 | 28 | 33 |
| 1982 | 2 | 17 | 1 | 8 | 60 | 88 |
| 1983 | 1 | 4 | | 103 | 29 | 137 |
| 1984 | 2 | | | 30 | 6 | 38 |
| 1985 | | | | 1 | 35 | 36 |
| 1986 | | | | 3 | 123 | 126 |
| 1987 | | | 1 | 51 | 93 | 145 |
| 1988 | | | | 16 | 38 | 54 |
| 1989 | | | 1 | 43 | 33 | 77 |
| 1990 | | 1 | | 85 | 71 | 157 |
| 1991 | | 1 | | 50 | 46 | 97 |
| 1992 | | 8 | 3 | 70 | 271 | 352 |
| 1993 | | 6 | 7 | 35 | 235 | 283 |
| 1994 | | 4 | | 42 | 256 | 302 |
| 1995 | | 5 | | 13 | 64 | 82 |
| 1996 | | | | 5 | 110 | 115 |
| 1997 | | 3 | | 11 | 201 | 215 |
| 1998 | | 2 | | 3 | 176 | 181 |
| 1999 | | 1 | 1 | 38 | 325 | 365 |
| 2000 | | | | 44 | 196 | 240 |
| 2001 | | 1 | | 34 | 388 | 423 |
| 2002 | | | 1 | 24 | 309 | 334 |
| 2003 | | 1 | | | 184 | 185 |
| 2004 | | 7 | | 28 | 264 | 299 |
| 2005 | | 1 | 1 | 13 | 154 | 169 |
| 2006 | | 1 | | 13 | 172 | 186 |
| 2007 | | | | 15 | 243 | 258 |
| 2008 | | | | | 225 | 225 |
| 2009 | | 3 | 1 | 4 | 275 | 283 |
| 2010 | | | 2 | 38 | 258 | 298 |
| 2011 | | 1 | 1 | 35 | 272 | 309 |
| Grand Total | 6 | 69 | 20 | 857 | 5,140 | 6,092 |

**Table 4.11.13**. Number of angler trips with measured or weighed Spanish mackerel in the Gulf of Mexico (FLW-LA) in the MRFSS charter fleet by year and state.

| YEAR | LA | MS | AL | FLW | TOTAL |
|---|---|---|---|---|---|
| 1981 | | 10 | 3 | 7 | 20 |
| 1982 | | 14 | 1 | 3 | 18 |
| 1983 | 1 | 32 | | 5 | 38 |
| 1984 | 1 | 44 | | 2 | 47 |
| 1985 | 2 | 18 | 4 | | 24 |
| 1986 | 3 | 51 | 10 | 26 | 90 |
| 1987 | 2 | 36 | 21 | 49 | 108 |
| 1988 | 5 | 47 | 13 | 21 | 86 |
| 1989 | 1 | 56 | 9 | 17 | 83 |
| 1990 | 5 | 61 | 6 | 10 | 82 |
| 1991 | 10 | 35 | 9 | 12 | 66 |
| 1992 | 9 | 35 | 13 | 15 | 72 |
| 1993 | 1 | 7 | 4 | 16 | 28 |
| 1994 | 3 | 9 | 7 | 12 | 31 |
| 1995 | 7 | 5 | 3 | 24 | 39 |
| 1996 | 1 | 11 | 4 | 16 | 32 |
| 1997 | 6 | 47 | 6 | 82 | 141 |
| 1998 | 3 | 22 | 24 | 103 | 152 |
| 1999 | 2 | 83 | 81 | 149 | 315 |
| 2000 | 1 | 51 | 64 | 297 | 413 |
| 2001 | | 46 | 27 | 170 | 243 |
| 2002 | 3 | 25 | 10 | 146 | 184 |
| 2003 | 4 | 30 | 7 | 166 | 207 |
| 2004 | 5 | 28 | 13 | 185 | 231 |
| 2005 | 1 | 13 | 10 | 98 | 122 |
| 2006 | 2 | 11 | 8 | 64 | 85 |
| 2007 | 4 | 25 | 23 | 103 | 155 |
| 2008 | 2 | 25 | 20 | 98 | 145 |
| 2009 | 6 | 29 | 31 | 70 | 136 |
| 2010 | | 12 | 15 | 109 | 136 |
| 2011 | 2 | 23 | 29 | 154 | 208 |
| Grand Total | 92 | 941 | 475 | 2,229 | 3,737 |

**Table 4.11.14.** Number of angler trips with measured or weighed Spanish mackerel in the Gulf of Mexico (FLW-TX) in the MRFSS private fleet by year and state. TX data for 1981-1985 only.

| YEAR | TX | LA | MS | AL | FLW | TOTAL |
|---|---|---|---|---|---|---|
| 1981 | 1 | 3 | 10 | 21 | 20 | 55 |
| 1982 | | 16 | 27 | 37 | 17 | 97 |
| 1983 | | 5 | 4 | 11 | 16 | 36 |
| 1984 | | 2 | 3 | 14 | 5 | 24 |
| 1985 | 1 | 6 | 3 | 13 | 14 | 37 |
| 1986 | | 7 | 10 | 41 | 43 | 101 |
| 1987 | | 8 | 9 | 60 | 134 | 211 |
| 1988 | | 14 | 14 | 16 | 70 | 114 |
| 1989 | | 24 | 6 | 11 | 53 | 94 |
| 1990 | | 14 | 2 | 28 | 69 | 113 |
| 1991 | | 24 | 7 | 27 | 98 | 156 |
| 1992 | | 48 | 20 | 43 | 247 | 358 |
| 1993 | | 11 | 2 | 21 | 64 | 98 |
| 1994 | | 9 | 9 | 24 | 100 | 142 |
| 1995 | | 13 | 4 | 10 | 46 | 73 |
| 1996 | | 6 | 2 | 15 | 117 | 140 |
| 1997 | | 7 | 6 | 17 | 93 | 123 |
| 1998 | | 2 | 9 | 20 | 161 | 192 |
| 1999 | | 6 | 8 | 80 | 193 | 287 |
| 2000 | | 5 | 9 | 66 | 152 | 232 |
| 2001 | | 1 | 4 | 52 | 189 | 246 |
| 2002 | | 4 | 5 | 38 | 232 | 279 |
| 2003 | | 2 | 1 | 21 | 202 | 226 |
| 2004 | | 3 | 2 | 33 | 238 | 276 |
| 2005 | | 4 | 4 | 19 | 138 | 165 |
| 2006 | | 4 | 6 | 27 | 168 | 205 |
| 2007 | | 2 | 1 | 15 | 251 | 269 |
| 2008 | | 3 | 6 | 15 | 191 | 215 |
| 2009 | | 3 | 7 | 25 | 169 | 204 |
| 2010 | | | | 22 | 207 | 229 |
| 2011 | | 1 | 1 | 11 | 213 | 226 |
| Grand Total | 2 | 257 | 201 | 853 | 3,910 | 5,223 |

**Table 4.11.15.** Number of angler trips with measured or weighed Spanish mackerel in the Gulf of Mexico (FLW-TX) in the MRFSS shore mode by year and state. TX data for 1981-1985 only.

| YEAR | TX | LA | MS | AL | FLW | TOTAL |
|---|---|---|---|---|---|---|
| 1981 | 1 | 2 | | 2 | 13 | 18 |
| 1982 | 2 | 5 | 1 | 7 | 31 | 46 |
| 1983 | 1 | 1 | | 26 | 18 | 46 |
| 1984 | 2 | | | 12 | 4 | 18 |
| 1985 | | | | 1 | 13 | 14 |
| 1986 | | | | 1 | 30 | 31 |
| 1987 | | | 1 | 23 | 29 | 53 |
| 1988 | | | | 5 | 19 | 24 |
| 1989 | | | 1 | 7 | 16 | 24 |
| 1990 | | 1 | | 19 | 31 | 51 |
| 1991 | | 1 | | 14 | 23 | 38 |
| 1992 | | 1 | 3 | 19 | 93 | 116 |
| 1993 | | 6 | 3 | 7 | 69 | 85 |
| 1994 | | 3 | | 18 | 98 | 119 |
| 1995 | | 1 | | 3 | 28 | 32 |
| 1996 | | | | 3 | 42 | 45 |
| 1997 | | 2 | | 5 | 59 | 66 |
| 1998 | | 1 | | 3 | 63 | 67 |
| 1999 | | 1 | 1 | 9 | 115 | 126 |
| 2000 | | | | 11 | 65 | 76 |
| 2001 | | 1 | | 14 | 122 | 137 |
| 2002 | | | 1 | 10 | 95 | 106 |
| 2003 | | 1 | | | 53 | 54 |
| 2004 | | 2 | | 11 | 78 | 91 |
| 2005 | | 1 | 1 | 7 | 54 | 63 |
| 2006 | | 1 | | 10 | 49 | 60 |
| 2007 | | | | 5 | 72 | 77 |
| 2008 | | | | | 70 | 70 |
| 2009 | | 1 | 1 | 2 | 92 | 96 |
| 2010 | | | 2 | 13 | 86 | 101 |
| 2011 | | 1 | 1 | 7 | 80 | 89 |
| Grand Total | 6 | 33 | 16 | 274 | 1,710 | 2,039 |

**Table 4.11.16.** Number of MRFSS intercept trips conducted in the Gulf of Mexico (FLW-TX) by year and mode with the percentage of intercepts that encountered Spanish mackerel. TX data for 1981-1985 only.

| | Shore | | | Cbt | | | Priv | | |
|---|---|---|---|---|---|---|---|---|---|
| YEAR | TOT int | SM int | %sm | TOT int | SM int | %sm | TOT int | SM int | %sm |
| 1981 | 2,106 | 55 | 2.61% | 360 | 33 | 9.17% | 1,970 | 95 | 4.82% |
| 1982 | 3,971 | 85 | 2.14% | 329 | 37 | 11.25% | 4,146 | 216 | 5.21% |
| 1983 | 2,739 | 72 | 2.63% | 713 | 45 | 6.31% | 1,822 | 73 | 4.01% |
| 1984 | 3,130 | 39 | 1.25% | 847 | 70 | 8.26% | 2,301 | 52 | 2.26% |
| 1985 | 3,679 | 40 | 1.09% | 543 | 63 | 11.60% | 2,792 | 84 | 3.01% |
| 1986 | 2,108 | 92 | 4.36% | 2,601 | 214 | 8.23% | 9,597 | 416 | 4.33% |
| 1987 | 2,323 | 92 | 3.96% | 2,421 | 191 | 7.89% | 8,951 | 433 | 4.84% |
| 1988 | 3,771 | 62 | 1.64% | 1,952 | 143 | 7.33% | 9,343 | 325 | 3.48% |
| 1989 | 3,060 | 89 | 2.91% | 1,510 | 130 | 8.61% | 6,304 | 252 | 4.00% |
| 1990 | 2,641 | 185 | 7.00% | 1,145 | 157 | 13.71% | 5,480 | 259 | 4.73% |
| 1991 | 3,096 | 106 | 3.42% | 1,778 | 140 | 7.87% | 6,203 | 309 | 4.98% |
| 1992 | 6,162 | 385 | 6.25% | 3,243 | 203 | 6.26% | 14,523 | 742 | 5.11% |
| 1993 | 8,408 | 365 | 4.34% | 1,825 | 67 | 3.67% | 10,676 | 227 | 2.13% |
| 1994 | 9,625 | 436 | 4.53% | 1,909 | 77 | 4.03% | 12,644 | 320 | 2.53% |
| 1995 | 8,768 | 179 | 2.04% | 1,731 | 102 | 5.89% | 10,945 | 175 | 1.60% |
| 1996 | 6,324 | 202 | 3.19% | 1,966 | 80 | 4.07% | 14,013 | 363 | 2.59% |
| 1997 | 6,241 | 205 | 3.28% | 3,193 | 198 | 6.20% | 14,027 | 318 | 2.27% |
| 1998 | 7,009 | 296 | 4.22% | 6,272 | 289 | 4.61% | 16,086 | 408 | 2.54% |
| 1999 | 9,162 | 584 | 6.37% | 10,759 | 500 | 4.65% | 20,494 | 722 | 3.52% |
| 2000 | 7,410 | 340 | 4.59% | 13,493 | 582 | 4.31% | 16,887 | 525 | 3.11% |
| 2001 | 7,650 | 473 | 6.18% | 11,546 | 366 | 3.17% | 18,399 | 634 | 3.45% |
| 2002 | 7,648 | 482 | 6.30% | 11,550 | 347 | 3.00% | 19,901 | 740 | 3.72% |
| 2003 | 8,277 | 356 | 4.30% | 12,298 | 447 | 3.63% | 19,054 | 644 | 3.38% |
| 2004 | 7,539 | 429 | 5.69% | 12,746 | 476 | 3.73% | 20,872 | 936 | 4.48% |
| 2005 | 7,532 | 239 | 3.17% | 10,589 | 288 | 2.72% | 18,478 | 570 | 3.08% |
| 2006 | 7,121 | 343 | 4.82% | 8,319 | 211 | 2.54% | 19,601 | 753 | 3.84% |
| 2007 | 7,604 | 420 | 5.52% | 8,543 | 315 | 3.69% | 20,215 | 750 | 3.71% |
| 2008 | 7,715 | 379 | 4.91% | 7,914 | 300 | 3.79% | 21,008 | 707 | 3.37% |
| 2009 | 8,193 | 177 | 2.16% | 6,754 | 147 | 2.18% | 21,518 | 374 | 1.74% |
| 2010 | 8,141 | 544 | 6.68% | 6,898 | 387 | 5.61% | 19,973 | 899 | 4.50% |

**Table 4.11.17.** Mean weight (lb) of Spanish mackerel weighed from the MRFSS in the Gulf of Mexico (FLW-TX) by year and mode, 1981-2011. TX data for 1981-1985 only.

| | Cbt | | | | Priv | | | | Shore | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | N | Mean (lbs) | Min (lbs) | Max (lbs) | N | Mean (lbs) | Min (lbs) | Max (lbs) | N | Mean (lbs) | Min (lbs) | Max (lbs) |
| 1981 | 99 | 1.11 | 0.44 | 2.65 | 171 | 1.34 | 0.22 | 3.31 | 33 | 1.10 | 0.66 | 5.95 |
| 1982 | 97 | 0.90 | 0.22 | 3.31 | 231 | 1.42 | 0.22 | 5.73 | 88 | 1.23 | 0.22 | 4.41 |
| 1983 | 286 | 1.49 | 0.44 | 3.75 | 96 | 1.24 | 0.44 | 3.09 | 134 | 1.33 | 0.22 | 3.97 |
| 1984 | 363 | 1.32 | 0.44 | 4.41 | 42 | 1.63 | 0.44 | 4.19 | 38 | 1.18 | 0.44 | 4.85 |
| 1985 | 153 | 1.45 | 0.88 | 4.41 | 78 | 1.46 | 0.22 | 5.07 | 36 | 1.14 | 0.22 | 2.20 |
| 1986 | 608 | 1.38 | 0.22 | 5.07 | 289 | 1.22 | 0.22 | 5.51 | 126 | 1.05 | 0.44 | 1.98 |
| 1987 | 564 | 1.60 | 0.22 | 7.05 | 529 | 1.72 | 0.44 | 7.50 | 140 | 1.35 | 0.44 | 4.41 |
| 1988 | 331 | 1.53 | 0.44 | 5.29 | 248 | 1.71 | 0.44 | 5.29 | 53 | 1.26 | 0.22 | 4.41 |
| 1989 | 445 | 1.23 | 0.44 | 5.51 | 215 | 1.61 | 0.44 | 6.61 | 77 | 0.76 | 0.22 | 1.98 |
| 1990 | 346 | 1.38 | 0.44 | 5.07 | 244 | 1.78 | 0.22 | 5.73 | 144 | 1.09 | 0.22 | 4.19 |
| 1991 | 309 | 1.80 | 0.44 | 7.72 | 416 | 1.61 | 0.44 | 11.24 | 85 | 1.02 | 0.22 | 3.09 |
| 1992 | 355 | 1.47 | 0.44 | 10.14 | 963 | 1.56 | 0.22 | 27.56 | 342 | 1.34 | 0.44 | 5.51 |
| 1993 | 98 | 1.99 | 0.44 | 5.73 | 199 | 1.87 | 0.22 | 5.73 | 278 | 1.08 | 0.44 | 4.85 |
| 1994 | 109 | 1.66 | 0.55 | 5.29 | 276 | 1.49 | 0.44 | 6.17 | 269 | 1.22 | 0.22 | 6.61 |
| 1995 | 237 | 1.57 | 0.44 | 4.41 | 114 | 1.87 | 0.44 | 5.29 | 76 | 1.25 | 0.33 | 3.53 |
| 1996 | 115 | 1.47 | 0.22 | 4.85 | 316 | 1.79 | 0.44 | 5.95 | 111 | 1.12 | 0.44 | 3.97 |
| 1997 | 407 | 2.63 | 0.22 | 18.52 | 243 | 2.10 | 0.44 | 13.23 | 212 | 1.18 | 0.33 | 4.19 |
| 1998 | 607 | 1.85 | 0.44 | 7.72 | 438 | 2.09 | 0.11 | 6.50 | 177 | 1.28 | 0.22 | 3.53 |
| 1999 | 1,489 | 1.73 | 0.33 | 6.61 | 827 | 1.65 | 0.22 | 6.50 | 356 | 1.21 | 0.11 | 4.72 |
| 2000 | 2,028 | 1.59 | 0.11 | 6.06 | 466 | 2.05 | 0.51 | 7.28 | 230 | 1.54 | 0.44 | 5.75 |
| 2001 | 2,219 | 1.34 | 0.35 | 6.11 | 661 | 1.65 | 0.31 | 6.17 | 402 | 1.29 | 0.33 | 5.69 |
| 2002 | 1,033 | 1.88 | 0.29 | 6.00 | 586 | 1.99 | 0.44 | 6.17 | 331 | 1.36 | 0.40 | 4.59 |
| 2003 | 960 | 1.85 | 0.24 | 7.72 | 472 | 2.03 | 0.24 | 12.13 | 178 | 1.39 | 0.31 | 4.74 |
| 2004 | 1,065 | 1.80 | 0.33 | 9.92 | 669 | 1.56 | 0.33 | 7.05 | 282 | 1.24 | 0.35 | 4.76 |
| 2005 | 468 | 1.79 | 0.42 | 10.71 | 353 | 1.67 | 0.44 | 5.51 | 159 | 1.05 | 0.22 | 4.45 |
| 2006 | 472 | 1.71 | 0.49 | 7.72 | 514 | 1.72 | 0.40 | 5.75 | 185 | 1.12 | 0.40 | 4.08 |
| 2007 | 690 | 1.57 | 0.13 | 6.06 | 516 | 1.69 | 0.40 | 5.91 | 247 | 1.25 | 0.44 | 5.73 |
| 2008 | 725 | 1.61 | 0.31 | 6.22 | 412 | 1.85 | 0.49 | 6.61 | 162 | 1.06 | 0.22 | 5.07 |
| 2009 | 633 | 1.59 | 0.40 | 7.32 | 411 | 1.70 | 0.44 | 5.62 | 259 | 1.14 | 0.26 | 3.73 |
| 2010 | 815 | 1.76 | 0.37 | 6.70 | 574 | 1.66 | 0.33 | 6.17 | 290 | 1.34 | 0.35 | 5.07 |
| 2011 | 1,222 | 1.39 | 0.22 | 5.78 | 526 | 1.46 | 0.44 | 5.86 | 258 | 1.14 | 0.40 | 4.06 |

**Table 4.11.18.** Number of Spanish mackerel measured and positive trips in the SRHS by year and area. Due to headboat area definitions, West Florida and Alabama data are combined.

| | Fish(N) | | | | | Trips(N) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | FLW/AL | MS* | LA** | TX | Total | FLW/AL | MS* | LA** | TX | Total |
| 1986 | 14 | - | - | 4 | 18 | 10 | - | - | 4 | 14 |
| 1987 | 1 | - | 6 | 8 | 15 | 1 | - | 4 | 8 | 13 |
| 1988 | - | - | 5 | 12 | 17 | - | - | 1 | 8 | 9 |
| 1989 | 15 | - | 29 | 32 | 76 | 11 | - | 18 | 13 | 42 |
| 1990 | 7 | - | 58 | 5 | 70 | 7 | - | 3 | 3 | 13 |
| 1991 | 12 | - | 49 | 36 | 97 | 7 | - | 8 | 8 | 23 |
| 1992 | 3 | - | 28 | 33 | 64 | 3 | - | 12 | 7 | 22 |
| 1993 | 4 | - | 21 | 16 | 41 | 4 | - | 13 | 8 | 25 |
| 1994 | 9 | - | 24 | 36 | 69 | 7 | - | 11 | 17 | 35 |
| 1995 | 1 | - | 48 | 14 | 63 | 1 | - | 14 | 13 | 28 |
| 1996 | 2 | - | 32 | 23 | 57 | 2 | - | 14 | 8 | 24 |
| 1997 | 19 | - | 75 | - | 94 | 12 | - | 24 | - | 36 |
| 1998 | 15 | - | 33 | - | 48 | 12 | - | 10 | - | 22 |
| 1999 | 5 | - | 29 | 4 | 38 | 5 | - | 14 | 1 | 20 |
| 2000 | 5 | - | 33 | - | 38 | 5 | - | 15 | - | 20 |
| 2001 | 3 | - | 19 | 6 | 28 | 3 | - | 14 | 3 | 20 |
| 2002 | 12 | - | 73 | - | 85 | 12 | - | 8 | - | 20 |
| 2003 | 7 | - | 27 | - | 34 | 5 | - | 11 | - | 16 |
| 2004 | 5 | - | - | 8 | 13 | 5 | - | - | 2 | 7 |
| 2005 | 1 | - | 2 | 1 | 4 | 1 | - | 2 | 1 | 4 |
| 2006 | 6 | - | - | 1 | 7 | 4 | - | - | 1 | 5 |
| 2007 | 11 | - | - | 1 | 12 | 7 | - | - | 1 | 8 |
| 2008 | 13 | - | - | - | 13 | 10 | - | - | - | 10 |
| 2009 | 23 | - | - | 1 | 24 | 10 | - | - | 1 | 11 |
| 2010 | 4 | - | - | 1 | 5 | 4 | - | - | 1 | 5 |
| 2011 | 1 | 52 | - | 1 | 54 | 1 | 3 | - | 1 | 5 |

*MS added to survey in 2010.
**LA not sampled during 2004-2005 due to Hurricane Katrina.

**Table 4.11.19.** Number of Gulf of Mexico Spanish mackerel aged from the SRHS by year and state. Due to headboat area definitions, West Florida and Alabama data are combined.

| Year | FLW/AL | MS* | LA** | TX | Total |
|---|---|---|---|---|---|
| 1981 | - | - | - | - | - |
| 1982 | - | - | - | - | - |
| 1983 | - | - | - | - | - |
| 1984 | - | - | - | - | - |
| 1985 | - | - | - | - | - |
| 1986 | - | - | - | - | - |
| 1987 | - | - | - | - | - |
| 1988 | - | - | - | 1 | 1 |
| 1989 | - | - | - | 68 | 68 |
| 1990 | - | - | - | 10 | 10 |
| 1991 | 6 | - | - | 75 | 81 |
| 1992 | 16 | 7 | - | 21 | 44 |
| 1993 | 2 | - | - | 2 | 4 |
| 1994 | - | - | - | - | - |
| 1995 | - | - | - | - | - |
| 1996 | - | - | - | - | - |
| 1997 | - | - | - | - | - |
| 1998 | - | - | - | - | - |
| 1999 | 2 | - | - | - | 2 |
| 2000 | - | - | - | - | - |
| 2001 | - | - | - | - | - |
| 2002 | 1 | - | - | - | 1 |
| 2003 | - | - | - | - | - |
| 2004 | - | - | - | - | - |
| 2005 | - | - | - | - | - |
| 2006 | - | - | - | - | - |
| 2007 | 1 | - | - | - | 1 |
| 2008 | 3 | - | - | - | 3 |
| 2009 | 3 | - | - | - | 3 |
| 2010 | - | - | - | - | - |
| 2011 | 2 | - | - | - | 2 |

*MS added to survey in 2010.
**LA not sampled during 2004-2005 due to Hurricane Katrina.

**Table 4.11.20.** Mean weight (kg) of Spanish mackerel measured in the SRHS by year and state, 1986-2011. Due to headboat area definitions, West Florida and Alabama data are combined.

| | FLW/AL | | | | MS* | | | | LA** | | | | TX | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | N | Mean (kg) | Min (kg) | Max (kg) | N | Mean (kg) | Min (kg) | Max (kg) | N | Mean (kg) | Min (kg) | Max (kg) | N | Mean (kg) | Min (kg) | Max (kg) |
| 1986 | 14 | 0.79 | 0.32 | 1.89 | - | - | - | - | - | - | - | - | 4 | 1.65 | 1.30 | 2.00 |
| 1987 | 1 | 1.10 | 1.10 | 1.10 | - | - | - | - | 6 | 0.86 | 0.53 | 1.40 | 8 | 1.40 | 0.34 | 2.60 |
| 1988 | - | - | - | - | - | - | - | - | 5 | 1.05 | 0.60 | 1.60 | 12 | 1.20 | 0.17 | 2.10 |
| 1989 | 15 | 0.44 | 0.00 | 0.99 | - | - | - | - | 29 | 0.76 | 0.01 | 3.06 | 32 | 1.08 | 0.22 | 2.10 |
| 1990 | 7 | 0.69 | 0.33 | 1.02 | - | - | - | - | 58 | 1.19 | 0.30 | 2.25 | 5 | 0.92 | 0.29 | 2.29 |
| 1991 | 12 | 0.58 | 0.30 | 0.99 | - | - | - | - | 49 | 1.04 | 0.40 | 10.19 | 36 | 3.64 | 0.48 | 7.80 |
| 1992 | 3 | 1.20 | 0.87 | 1.52 | - | - | - | - | 28 | 1.18 | 0.33 | 2.32 | 33 | 3.56 | 0.79 | 8.66 |
| 1993 | 4 | 1.00 | 0.65 | 1.40 | - | - | - | - | 21 | 1.01 | 0.28 | 1.89 | 16 | 1.02 | 0.45 | 1.57 |
| 1994 | 9 | 1.24 | 0.50 | 2.90 | - | - | - | - | 24 | 1.19 | 0.32 | 2.12 | 36 | 1.11 | 0.41 | 2.24 |
| 1995 | 1 | 0.95 | 0.95 | 0.95 | - | - | - | - | 48 | 1.28 | 0.45 | 2.69 | 14 | 1.44 | 0.52 | 2.21 |
| 1996 | 2 | 1.22 | 0.63 | 1.80 | - | - | - | - | 32 | 0.88 | 0.32 | 2.22 | 23 | 2.06 | 0.67 | 5.29 |
| 1997 | 19 | 1.07 | 0.28 | 2.97 | - | - | - | - | 75 | 1.21 | 0.32 | 2.73 | - | - | - | - |
| 1998 | 15 | 0.72 | 0.32 | 1.84 | - | - | - | - | 33 | 1.20 | 0.48 | 2.44 | - | - | - | - |
| 1999 | 5 | 0.92 | 0.45 | 1.40 | - | - | - | - | 29 | 1.28 | 0.37 | 3.21 | 4 | 1.09 | 0.81 | 1.43 |
| 2000 | 5 | 1.33 | 0.46 | 2.56 | - | - | - | - | 33 | 1.36 | 0.29 | 4.39 | - | - | - | - |
| 2001 | 3 | 1.26 | 0.72 | 2.06 | - | - | - | - | 19 | 1.54 | 0.53 | 9.01 | 6 | 1.68 | 0.97 | 2.33 |
| 2002 | 12 | 1.30 | 0.55 | 2.57 | - | - | - | - | 73 | 0.85 | 0.42 | 1.82 | - | - | - | - |
| 2003 | 7 | 0.82 | 0.52 | 1.05 | - | - | - | - | 27 | 0.90 | 0.41 | 1.84 | - | - | - | - |
| 2004 | 5 | 1.36 | 0.63 | 1.91 | - | - | - | - | - | - | - | - | 8 | 0.40 | 0.17 | 0.71 |
| 2005 | 1 | 0.92 | 0.92 | 0.92 | - | - | - | - | 2 | 2.30 | 2.19 | 2.40 | 1 | 0.86 | 0.86 | 0.86 |
| 2006 | 6 | 1.14 | 0.41 | 1.90 | - | - | - | - | - | - | - | - | 1 | 2.16 | 2.16 | 2.16 |
| 2007 | 11 | 0.72 | 0.23 | 1.34 | - | - | - | - | - | - | - | - | 1 | 2.30 | 2.30 | 2.30 |
| 2008 | 13 | 0.73 | 0.26 | 1.46 | - | - | - | - | - | - | - | - | - | - | - | - |
| 2009 | 23 | 0.82 | 0.22 | 2.89 | - | - | - | - | - | - | - | - | 1 | 1.19 | 1.19 | 1.19 |
| 2010 | 4 | 0.68 | 0.37 | 1.41 | - | - | - | - | - | - | - | - | 1 | 0.59 | 0.59 | 0.59 |
| 2011 | 1 | 0.37 | 0.37 | 0.37 | 52 | 0.69 | 0.03 | 1.79 | - | - | - | - | 1 | 1.87 | 1.87 | 1.87 |

*MS added to survey in 2010. **LA not sampled during 2004-2005 due to Hurricane Katrina.

**Table 4.11.21.** Number of Spanish mackerel measured in Texas in the TPWD survey by year and mode. 2011 data is through mid-May.

| YEAR | Cbt | Priv | Grand Total |
|---|---|---|---|
| 1983 | 8 | 125 | 133 |
| 1984 | 1 | 94 | 95 |
| 1985 | 2 | 169 | 171 |
| 1986 | 1 | 55 | 56 |
| 1987 | 13 | 239 | 252 |
| 1988 | 4 | 136 | 140 |
| 1989 | 3 | 221 | 224 |
| 1990 | 13 | 230 | 243 |
| 1991 | 22 | 307 | 329 |
| 1992 | 6 | 163 | 169 |
| 1993 | 8 | 178 | 186 |
| 1994 | 13 | 276 | 289 |
| 1995 | 2 | 423 | 425 |
| 1996 | 8 | 479 | 487 |
| 1997 | 13 | 245 | 258 |
| 1998 | 3 | 214 | 217 |
| 1999 | 4 | 171 | 175 |
| 2000 | 8 | 320 | 328 |
| 2001 | 4 | 111 | 115 |
| 2002 | 22 | 163 | 185 |
| 2003 | 7 | 196 | 203 |
| 2004 | 20 | 295 | 315 |
| 2005 | 12 | 441 | 453 |
| 2006 | 47 | 640 | 687 |
| 2007 | 34 | 312 | 346 |
| 2008 | 41 | 348 | 389 |
| 2009 | 14 | 328 | 342 |
| 2010 | 32 | 255 | 287 |
| 2011 | 2 | 5 | 7 |
| Grand Total | 367 | 7,139 | 7,506 |

**Table 4.11.22.** Number of trips with measured Spanish mackerel in Texas from the TPWD survey by year and mode. 2011 data is through mid-May.

| YEAR | Cbt | Priv | Grand Total |
|---|---|---|---|
| 1983 | 6 | 79 | 85 |
| 1984 | 1 | 46 | 47 |
| 1985 | 2 | 97 | 99 |
| 1986 | 1 | 41 | 42 |
| 1987 | 6 | 105 | 111 |
| 1988 | 3 | 60 | 63 |
| 1989 | 2 | 87 | 89 |
| 1990 | 7 | 111 | 118 |
| 1991 | 11 | 146 | 157 |
| 1992 | 3 | 101 | 104 |
| 1993 | 3 | 100 | 103 |
| 1994 | 5 | 136 | 141 |
| 1995 | 2 | 206 | 208 |
| 1996 | 6 | 214 | 220 |
| 1997 | 9 | 127 | 136 |
| 1998 | 3 | 103 | 106 |
| 1999 | 4 | 109 | 113 |
| 2000 | 3 | 157 | 160 |
| 2001 | 4 | 59 | 63 |
| 2002 | 8 | 101 | 109 |
| 2003 | 7 | 102 | 109 |
| 2004 | 10 | 135 | 145 |
| 2005 | 7 | 180 | 187 |
| 2006 | 19 | 299 | 318 |
| 2007 | 17 | 133 | 150 |
| 2008 | 17 | 161 | 178 |
| 2009 | 10 | 166 | 176 |
| 2010 | 10 | 110 | 120 |
| 2011 | 2 | 5 | 7 |
| Grand Total | 188 | 3,476 | 3,664 |

**Table 4.11.23** Number of TPWD intercept trips conducted in Texas by year and mode with the percentage of intercepts that encountered Spanish mackerel.

| | Cbt | | | Priv | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| YEAR | TOT int | SM int | %sm | TOT int | SM int | %sm | TOT int | SM int | %sm |
| 1983 | 367 | 6 | 1.63% | 14,223 | 79 | 0.56% | 14,590 | 85 | 0.58% |
| 1984 | 247 | 1 | 0.40% | 9,149 | 46 | 0.50% | 9,396 | 47 | 0.50% |
| 1985 | 403 | 2 | 0.50% | 12,149 | 97 | 0.80% | 12,552 | 99 | 0.79% |
| 1986 | 474 | 1 | 0.21% | 12,306 | 41 | 0.33% | 12,780 | 42 | 0.33% |
| 1987 | 498 | 6 | 1.20% | 16,333 | 105 | 0.64% | 16,831 | 111 | 0.66% |
| 1988 | 570 | 3 | 0.53% | 14,929 | 60 | 0.40% | 15,499 | 63 | 0.41% |
| 1989 | 665 | 2 | 0.30% | 12,285 | 87 | 0.71% | 12,950 | 89 | 0.69% |
| 1990 | 425 | 7 | 1.65% | 9,740 | 111 | 1.14% | 10,165 | 118 | 1.16% |
| 1991 | 694 | 11 | 1.59% | 12,090 | 146 | 1.21% | 12,784 | 157 | 1.23% |
| 1992 | 991 | 3 | 0.30% | 15,294 | 101 | 0.66% | 16,285 | 104 | 0.64% |
| 1993 | 968 | 3 | 0.31% | 16,538 | 100 | 0.60% | 17,506 | 103 | 0.59% |
| 1994 | 1,045 | 5 | 0.48% | 18,654 | 136 | 0.73% | 19,699 | 141 | 0.72% |
| 1995 | 1,089 | 2 | 0.18% | 17,727 | 206 | 1.16% | 18,816 | 208 | 1.11% |
| 1996 | 1,264 | 6 | 0.47% | 16,780 | 214 | 1.28% | 18,044 | 220 | 1.22% |
| 1997 | 1,194 | 9 | 0.75% | 17,032 | 127 | 0.75% | 18,226 | 136 | 0.75% |
| 1998 | 1,355 | 3 | 0.22% | 17,064 | 103 | 0.60% | 18,419 | 106 | 0.58% |
| 1999 | 1,538 | 4 | 0.26% | 20,017 | 109 | 0.54% | 21,555 | 113 | 0.52% |
| 2000 | 1,731 | 3 | 0.17% | 18,950 | 157 | 0.83% | 20,681 | 160 | 0.77% |
| 2001 | 1,861 | 4 | 0.21% | 16,853 | 59 | 0.35% | 18,714 | 63 | 0.34% |
| 2002 | 1,561 | 8 | 0.51% | 15,623 | 100 | 0.64% | 17,184 | 108 | 0.63% |
| 2003 | 1,799 | 7 | 0.39% | 17,339 | 102 | 0.59% | 19,138 | 109 | 0.57% |
| 2004 | 1,703 | 10 | 0.59% | 17,175 | 135 | 0.79% | 18,878 | 145 | 0.77% |
| 2005 | 1,705 | 7 | 0.41% | 16,632 | 179 | 1.08% | 18,337 | 186 | 1.01% |
| 2006 | 2,072 | 19 | 0.92% | 18,468 | 298 | 1.61% | 20,540 | 317 | 1.54% |
| 2007 | 2,067 | 17 | 0.82% | 16,864 | 133 | 0.79% | 18,931 | 150 | 0.79% |
| 2008 | 1,797 | 17 | 0.95% | 17,045 | 161 | 0.94% | 18,842 | 178 | 0.94% |
| 2009 | 1,891 | 10 | 0.53% | 18,204 | 166 | 0.91% | 20,095 | 176 | 0.88% |
| 2010 | 1,963 | 10 | 0.51% | 16,796 | 110 | 0.65% | 18,759 | 120 | 0.64% |

**Table 4.11.24.** Number of Spanish mackerel aged in the Gulf of Mexico (FLW-TX) from the charter boat fleet by year and state.

| Year | FLW/AL | MS | LA | TX | Total |
|---|---|---|---|---|---|
| 1981 | - | - | - | - | - |
| 1982 | - | - | - | - | - |
| 1983 | - | - | - | - | - |
| 1984 | - | - | - | - | - |
| 1985 | - | - | - | - | - |
| 1986 | - | - | - | - | - |
| 1987 | - | - | - | - | - |
| 1988 | - | - | - | - | - |
| 1989 | 27 | 47 | - | 42 | 116 |
| 1990 | 216 | 125 | - | 43 | 384 |
| 1991 | 78 | - | 2 | 22 | 102 |
| 1992 | 168 | - | - | 13 | 181 |
| 1993 | 42 | - | - | 2 | 44 |
| 1994 | 98 | - | - | - | 98 |
| 1995 | 46 | - | - | - | 46 |
| 1996 | 245 | - | - | - | 245 |
| 1997 | 109 | - | - | - | 109 |
| 1998 | 108 | - | - | - | 108 |
| 1999 | 156 | 196 | - | - | 352 |
| 2000 | 153 | - | - | - | 153 |
| 2001 | 105 | - | - | - | 105 |
| 2002 | 342 | - | - | - | 342 |
| 2003 | 458 | - | - | - | 458 |
| 2004 | 270 | - | - | - | 270 |
| 2005 | 52 | - | - | - | 52 |
| 2006 | 132 | - | - | - | 132 |
| 2007 | 186 | - | - | - | 186 |
| 2008 | 329 | - | - | - | 329 |
| 2009 | 101 | - | - | - | 101 |
| 2010 | 209 | - | - | - | 209 |
| 2011 | 266 | - | - | - | 266 |

**Table 4.11.25.** Number of Spanish mackerel aged in the Gulf of Mexico (FLW-TX) from the private/rental fleet by year and state.

| Year | FLW/AL | MS | LA | TX | Total |
|---|---|---|---|---|---|
| 1981 | - | - | - | - | - |
| 1982 | - | - | - | - | - |
| 1983 | - | - | - | - | - |
| 1984 | - | - | - | - | - |
| 1985 | - | - | - | - | - |
| 1986 | - | - | - | - | - |
| 1987 | - | - | - | - | - |
| 1988 | - | - | - | - | - |
| 1989 | - | - | - | - | - |
| 1990 | - | 1 | - | 1 | 2 |
| 1991 | 12 | - | - | - | 12 |
| 1992 | 16 | - | - | - | 16 |
| 1993 | 31 | - | - | - | 31 |
| 1994 | 3 | - | - | - | 3 |
| 1995 | 62 | - | - | - | 62 |
| 1996 | 3 | - | - | - | 3 |
| 1997 | 1 | - | - | - | 1 |
| 1998 | 21 | - | - | - | 21 |
| 1999 | 6 | 129 | - | - | 135 |
| 2000 | - | - | - | - | - |
| 2001 | - | - | - | - | - |
| 2002 | 86 | - | - | - | 86 |
| 2003 | 128 | - | - | - | 128 |
| 2004 | 71 | - | - | - | 71 |
| 2005 | 6 | - | - | - | 6 |
| 2006 | 1 | - | - | - | 1 |
| 2007 | 20 | - | - | - | 20 |
| 2008 | 70 | - | - | - | 70 |
| 2009 | 8 | - | - | - | 8 |
| 2010 | 21 | - | - | - | 21 |
| 2011 | 11 | - | - | - | 11 |

**Table 4.11.26.** Number of Spanish mackerel aged in the Gulf of Mexico (FLW-TX) from the recreational fishery (mode unknown) by year and state.

| Year | FLW/AL | MS | LA | TX | Total |
|---|---|---|---|---|---|
| 1981 | - | - | - | - | - |
| 1982 | - | - | - | - | - |
| 1983 | - | - | - | - | - |
| 1984 | - | - | - | - | - |
| 1985 | - | - | - | - | - |
| 1986 | - | - | - | - | - |
| 1987 | - | - | - | - | - |
| 1988 | 1 | 107 | 21 | 6 | 135 |
| 1989 | 32 | - | 2 | - | 34 |
| 1990 | 2 | - | 44 | - | 46 |
| 1991 | - | - | - | - | - |
| 1992 | - | - | - | - | - |
| 1993 | - | - | - | - | - |
| 1994 | - | - | - | - | - |
| 1995 | - | - | - | - | - |
| 1996 | - | - | - | - | - |
| 1997 | - | - | - | - | - |
| 1998 | - | - | - | - | - |
| 1999 | - | - | - | - | - |
| 2000 | - | - | - | - | - |
| 2001 | - | - | - | - | - |
| 2002 | - | - | - | - | - |
| 2003 | - | - | - | - | - |
| 2004 | - | - | - | - | - |
| 2005 | - | - | - | - | - |
| 2006 | - | - | - | - | - |
| 2007 | - | - | - | - | - |
| 2008 | - | - | - | - | - |
| 2009 | - | - | - | - | - |
| 2010 | - | - | - | - | - |
| 2011 | - | - | - | - | - |

**Table 4.11.27.** Gulf of Mexico (FLW-TX) estimated number of angler trips for charter boat mode, charter boat/headboat mode, private/rental mode, and shore mode (MRFSS, NMFS, 1981-2003; MRIP, NMFS, 2004-2011). CH and CH/HB mode adjusted for FHS conversion prior to 1997. CH/HB mode estimates from 1981-1985 only. TX estimates for 1981-1985 only. 2011 data is preliminary and through October.

| | Estimated CH Angler Trips | | Estimated CH/HB Angler Trips | | Estimated PR Angler Trips | | Estimated SH Angler Trips | |
|---|---|---|---|---|---|---|---|---|
| YEAR | Trips | CV | Trips | CV | Trips | CV | Trips | CV |
| 1981 | | | 341,346 | 0.10 | 7,764,455 | 0.20 | 7,119,118 | 0.09 |
| 1982 | | | 843,916 | 0.08 | 5,438,965 | 0.07 | 10,051,388 | 0.07 |
| 1983 | | | 672,312 | 0.10 | 6,841,641 | 0.06 | 16,623,065 | 0.11 |
| 1984 | | | 547,252 | 0.10 | 7,506,796 | 0.07 | 13,709,706 | 0.10 |
| 1985 | | | 796,565 | 0.09 | 8,314,889 | 0.08 | 10,268,895 | 0.10 |
| 1986 | 513,342 | 0.13 | | | 8,136,242 | 0.05 | 10,405,962 | 0.07 |
| 1987 | 546,764 | 0.16 | | | 8,517,788 | 0.04 | 6,923,388 | 0.12 |
| 1988 | 559,513 | 0.12 | | | 10,698,532 | 0.03 | 8,524,356 | 0.05 |
| 1989 | 524,157 | 0.13 | | | 8,712,307 | 0.03 | 6,419,667 | 0.06 |
| 1990 | 426,134 | 0.15 | | | 7,216,506 | 0.03 | 5,706,778 | 0.05 |
| 1991 | 449,908 | 0.12 | | | 9,086,738 | 0.03 | 8,642,251 | 0.04 |
| 1992 | 469,662 | 0.10 | | | 9,373,254 | 0.02 | 8,265,502 | 0.03 |
| 1993 | 788,055 | 0.08 | | | 9,041,306 | 0.02 | 7,642,451 | 0.02 |
| 1994 | 860,370 | 0.07 | | | 9,384,801 | 0.02 | 7,293,305 | 0.02 |
| 1995 | 1,020,387 | 0.07 | | | 9,570,896 | 0.02 | 6,925,453 | 0.02 |
| 1996 | 990,457 | 0.07 | | | 9,351,017 | 0.02 | 6,800,513 | 0.03 |
| 1997 | 1,091,871 | 0.08 | | | 10,195,083 | 0.02 | 7,423,022 | 0.03 |
| 1998 | 760,667 | 0.03 | | | 8,938,905 | 0.02 | 6,861,289 | 0.03 |
| 1999 | 683,768 | 0.03 | | | 9,097,803 | 0.02 | 5,918,885 | 0.03 |
| 2000 | 811,634 | 0.03 | | | 11,728,464 | 0.02 | 8,477,685 | 0.03 |
| 2001 | 742,386 | 0.03 | | | 12,371,138 | 0.02 | 9,776,174 | 0.03 |
| 2002 | 764,222 | 0.03 | | | 11,635,095 | 0.02 | 7,266,262 | 0.03 |
| 2003 | 691,362 | 0.03 | | | 14,110,007 | 0.02 | 8,155,304 | 0.03 |
| 2004 | 831,069 | 0.03 | | | 15,644,093 | 0.03 | 9,954,045 | 0.05 |
| 2005 | 690,735 | 0.03 | | | 13,585,144 | 0.03 | 9,013,928 | 0.05 |
| 2006 | 836,049 | 0.03 | | | 13,620,320 | 0.03 | 8,836,552 | 0.05 |
| 2007 | 851,757 | 0.03 | | | 14,980,146 | 0.03 | 8,457,361 | 0.05 |
| 2008 | 819,045 | 0.03 | | | 15,194,949 | 0.03 | 8,775,859 | 0.05 |
| 2009 | 822,266 | 0.03 | | | 13,442,881 | 0.03 | 8,332,102 | 0.05 |
| 2010 | 580,190 | 0.03 | | | 12,684,738 | 0.03 | 7,782,505 | 0.05 |
| 2011 | 698,725 | 0.03 | | | 11,024,029 | 0.03 | 7,800,767 | 0.05 |

**Table 4.11.28.** Gulf of Mexico headboat estimated angler days by year and state, 1986-2011.

| Year | FLW/AL | MS* | LA** | TX |
|---|---|---|---|---|
| 1986 | 480,154 | | 11,782 | 113,136 |
| 1987 | 434,098 | | 12,724 | 126,726 |
| 1988 | 391,896 | | 15,382 | 140,792 |
| 1989 | 416,650 | | 5,734 | 126,778 |
| 1990 | 427,812 | | 13,796 | 116,288 |
| 1991 | 348,624 | | 12,746 | 119,938 |
| 1992 | 369,604 | | 19,822 | 152,436 |
| 1993 | 415,793 | | 22,512 | 161,809 |
| 1994 | 409,123 | | 25,302 | 201,555 |
| 1995 | 364,821 | | 20,996 | 180,929 |
| 1996 | 309,826 | | 21,976 | 183,706 |
| 1997 | 298,884 | | 18,016 | 164,415 |
| 1998 | 370,666 | | 15,709 | 155,303 |
| 1999 | 352,234 | | 16,052 | 116,470 |
| 2000 | 318,662 | | 9,904 | 116,790 |
| 2001 | 314,486 | | 12,444 | 110,722 |
| 2002 | 283,662 | | 12,444 | 133,902 |
| 2003 | 288,422 | | 13,272 | 127,164 |
| 2004 | 316,860 | | | 129,980 |
| 2005 | 260,466 | | | 119,714 |
| 2006 | 248,125 | | 10,010 | 141,577 |
| 2007 | 273,755 | | 5,044 | 127,524 |
| 2008 | 260,349 | | 5,889 | 82,373 |
| 2009 | 284,873 | | 6,536 | 101,470 |
| 2010 | 222,035 | 995 | 434 | 94,304 |
| 2011 | 314,046 | 3,541 | 3,772 | 94,566 |

*MS added to survey in 2010.
**LA not sampled during 2004-2005 due to Hurricane Katrina.

**Table 4.11.29.** Texas estimated angler trips by year, season, and mode, 1983-2011.

| | Estimated CH trips | | Estimated PR trips | | Total |
|---|---|---|---|---|---|
| year | High | Low | High | Low | |
| 1983 | 31,710 | | 637,416 | | 669,126 |
| 1984 | 19,292 | 3,287 | 540,420 | 172,321 | 735,321 |
| 1985 | 23,578 | 6,852 | 587,673 | 254,969 | 873,072 |
| 1986 | 23,137 | 6,772 | 553,830 | 346,804 | 930,542 |
| 1987 | 24,636 | 11,866 | 751,020 | 350,008 | 1,137,530 |
| 1988 | 23,674 | 4,778 | 705,650 | 335,498 | 1,069,600 |
| 1989 | 35,518 | 9,580 | 678,535 | 234,013 | 957,645 |
| 1990 | 30,298 | 4,319 | 620,597 | 215,878 | 871,092 |
| 1991 | 38,340 | 10,997 | 637,275 | 214,490 | 901,102 |
| 1992 | 35,486 | 11,501 | 730,467 | 252,919 | 1,030,374 |
| 1993 | 40,419 | 15,111 | 681,545 | 313,340 | 1,050,415 |
| 1994 | 73,902 | 17,829 | 719,053 | 375,014 | 1,185,798 |
| 1995 | 51,984 | 21,696 | 675,113 | 404,477 | 1,153,270 |
| 1996 | 58,813 | 19,753 | 741,427 | 357,446 | 1,177,440 |
| 1997 | 80,733 | 19,298 | 694,991 | 305,589 | 1,100,611 |
| 1998 | 90,497 | 22,903 | 668,794 | 303,733 | 1,085,927 |
| 1999 | 91,571 | 25,287 | 796,383 | 407,326 | 1,320,566 |
| 2000 | 109,834 | 53,419 | 718,916 | 441,329 | 1,323,498 |
| 2001 | 109,895 | 53,006 | 681,733 | 306,038 | 1,150,672 |
| 2002 | 116,305 | 25,583 | 632,336 | 332,565 | 1,106,789 |
| 2003 | 96,782 | 26,336 | 665,238 | 343,297 | 1,131,654 |
| 2004 | 85,355 | 35,320 | 665,287 | 340,596 | 1,126,558 |
| 2005 | 86,159 | 22,429 | 616,715 | 336,175 | 1,061,479 |
| 2006 | 121,298 | 41,601 | 602,954 | 390,877 | 1,156,730 |
| 2007 | 120,344 | 33,387 | 599,832 | 304,208 | 1,057,770 |
| 2008 | 122,555 | 28,351 | 557,073 | 349,425 | 1,057,404 |
| 2009 | 88,148 | 33,703 | 619,872 | 293,770 | 1,035,493 |
| 2010 | 97,303 | 25,859 | 604,487 | 259,673 | 987,323 |
| 2011 | | 35,471 | | 346,716 | 382,188 |

## 4.11 Figures

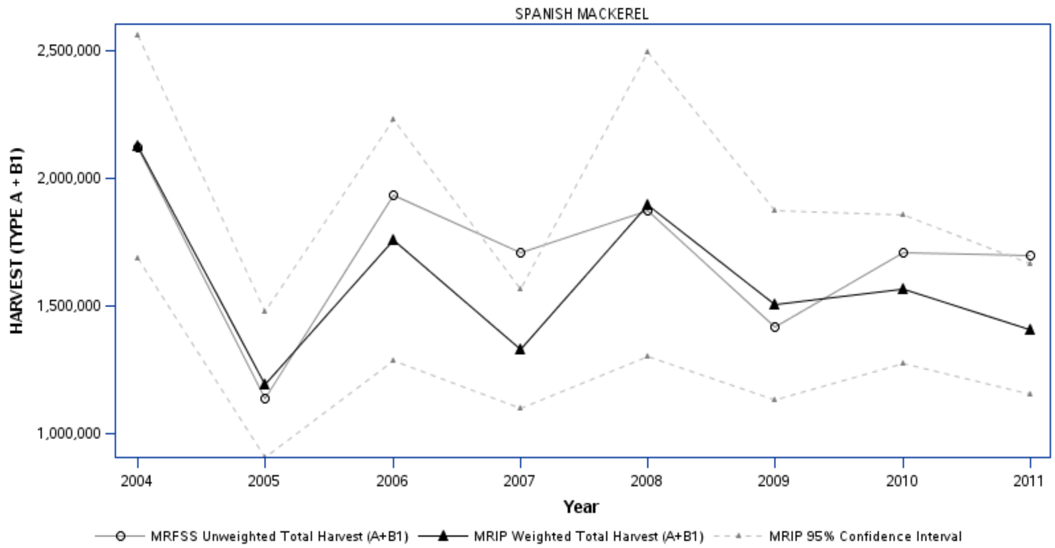


**Figure 4.12.1.** Comparison of MRIP and MRFSS landings (A+B1) for Gulf of Mexico Spanish mackerel (FLW-LA).

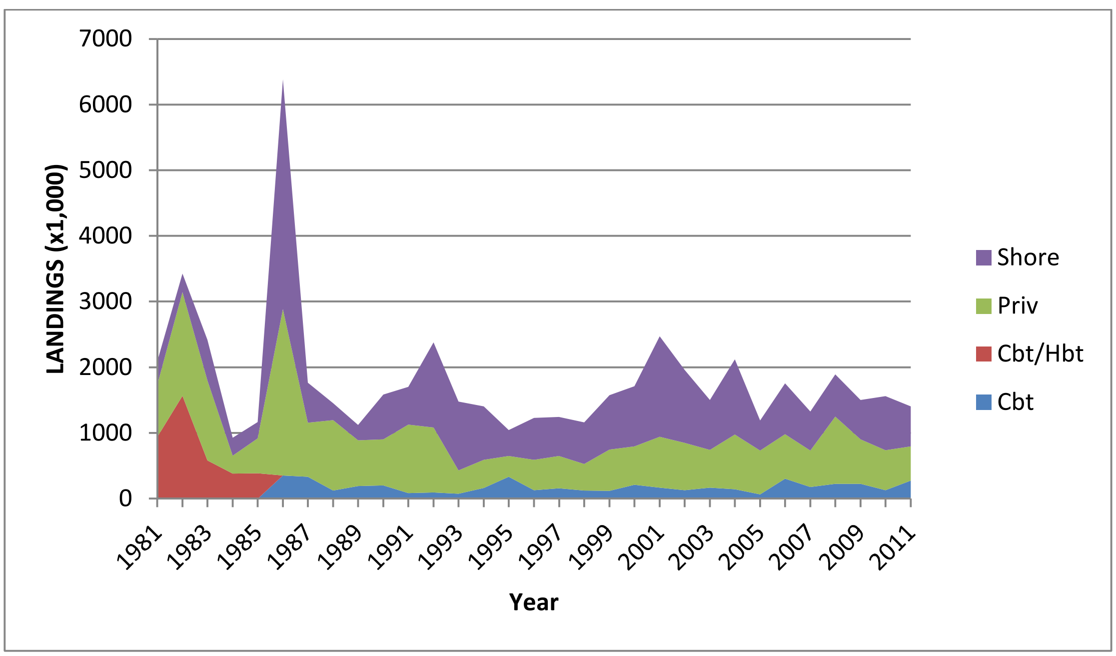


**Figure 4.12.2.** Gulf of Mexico (FLW-TX) Spanish mackerel landings (numbers of fish) by year and mode (MRFSS, NMFS, 1981-2003; MRIP, NMFS, 2004-2011). 2011 data is preliminary and through October. TX estimates for 1981-1985 shore mode only.


**Figure 4.12.3.** The number of Spanish mackerel intercepted by the MRFSS from 1981-1989.

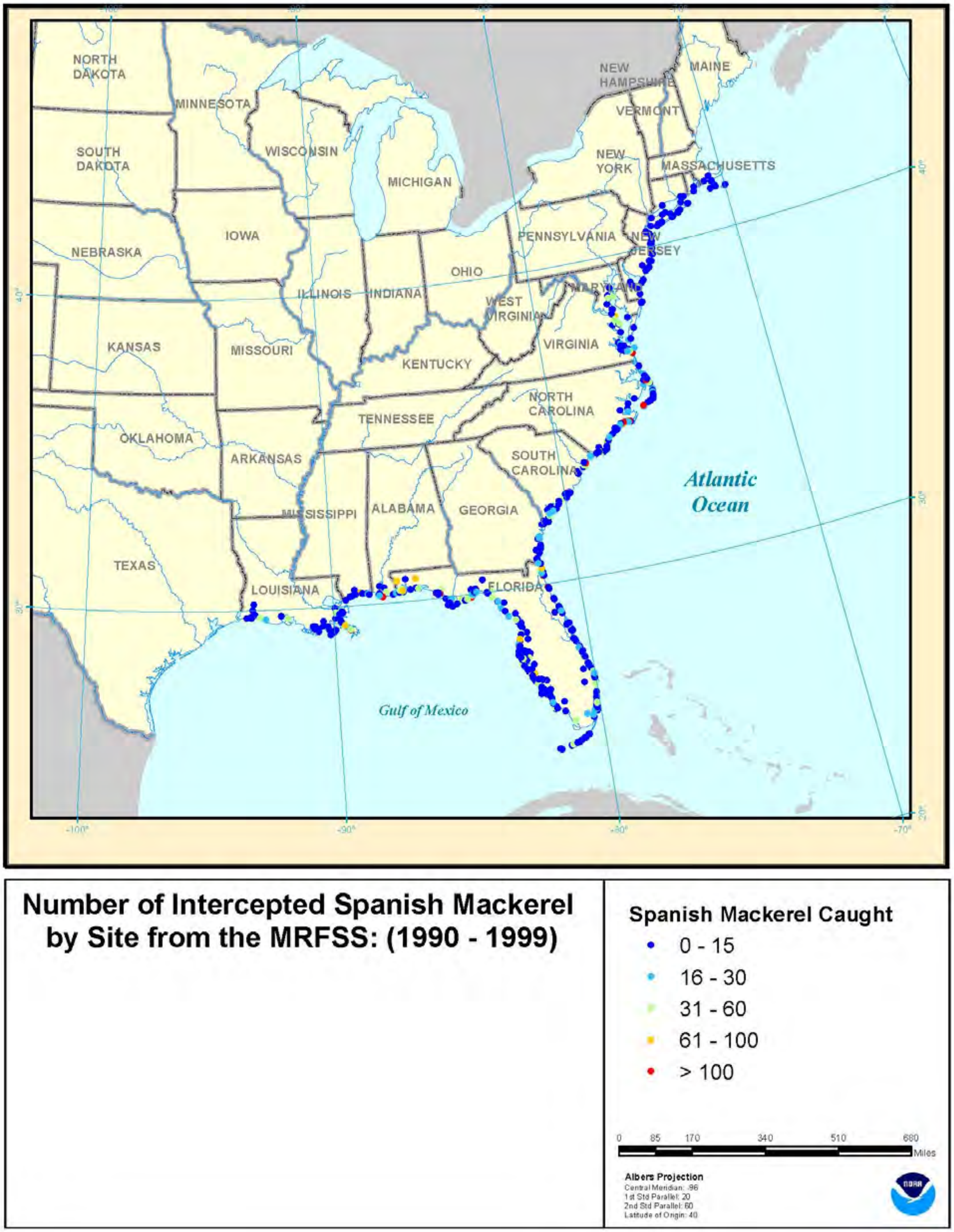


**Figure 4.12.4.** The number of Spanish mackerel intercepted by the MRFSS from 1990-1999.


**Figure 4.12.5.** The number of Spanish mackerel intercepted by the MRFSS from 2000-2010.

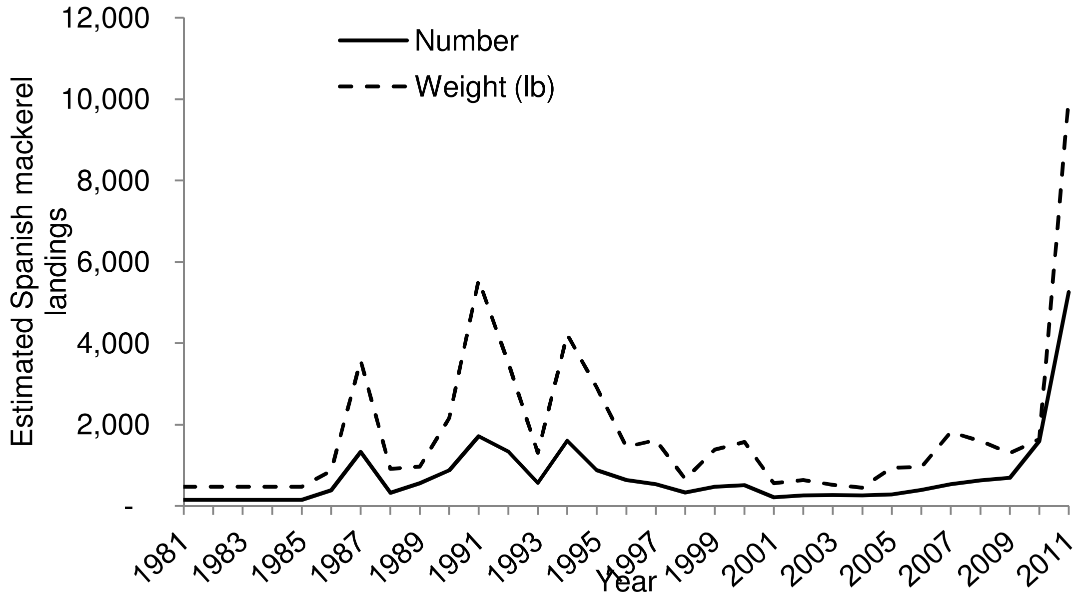


**Figure 4.12.6.** Gulf of Mexico estimated Spanish mackerel landings (number and pounds) for the headboat fishery, 1981-2011.

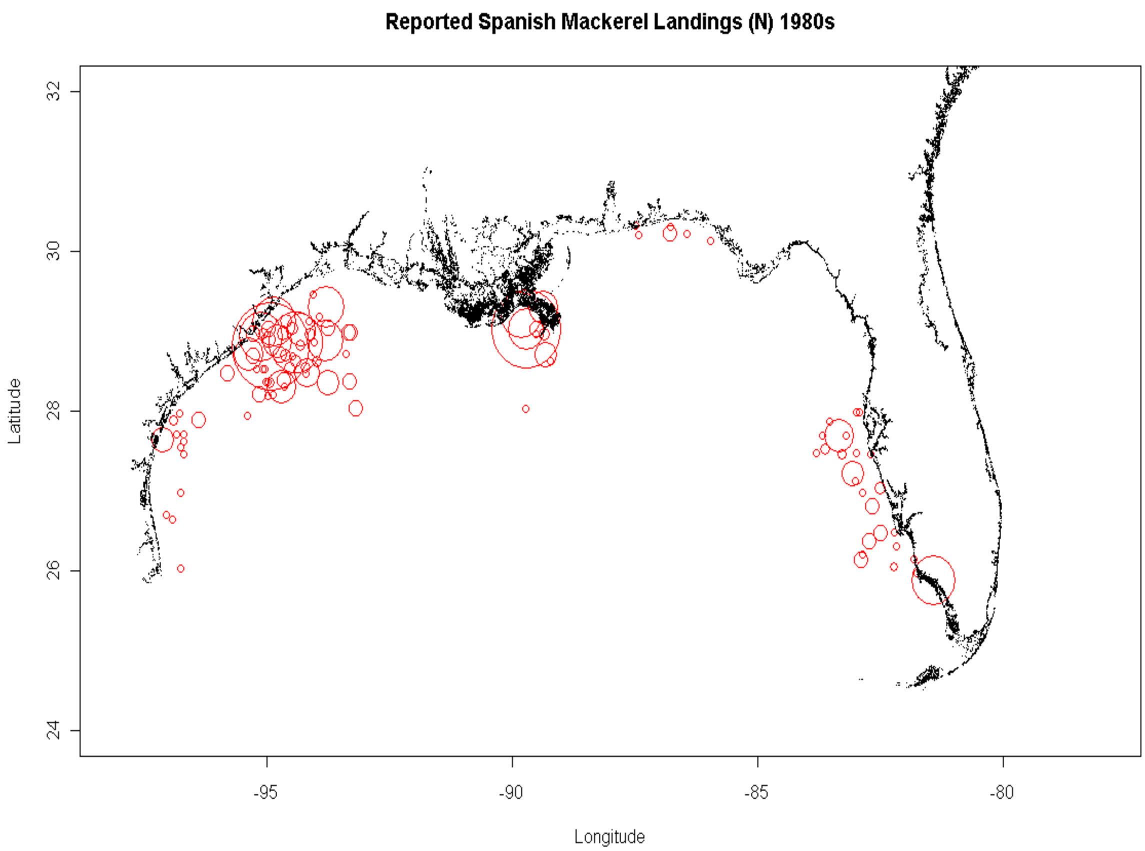


**Figure 4.12.7.** Reported Spanish mackerel landings (numbers of fish) from SRHS, 1986-1989. The size of each point is proportional to the reported landings (N) at the given location.

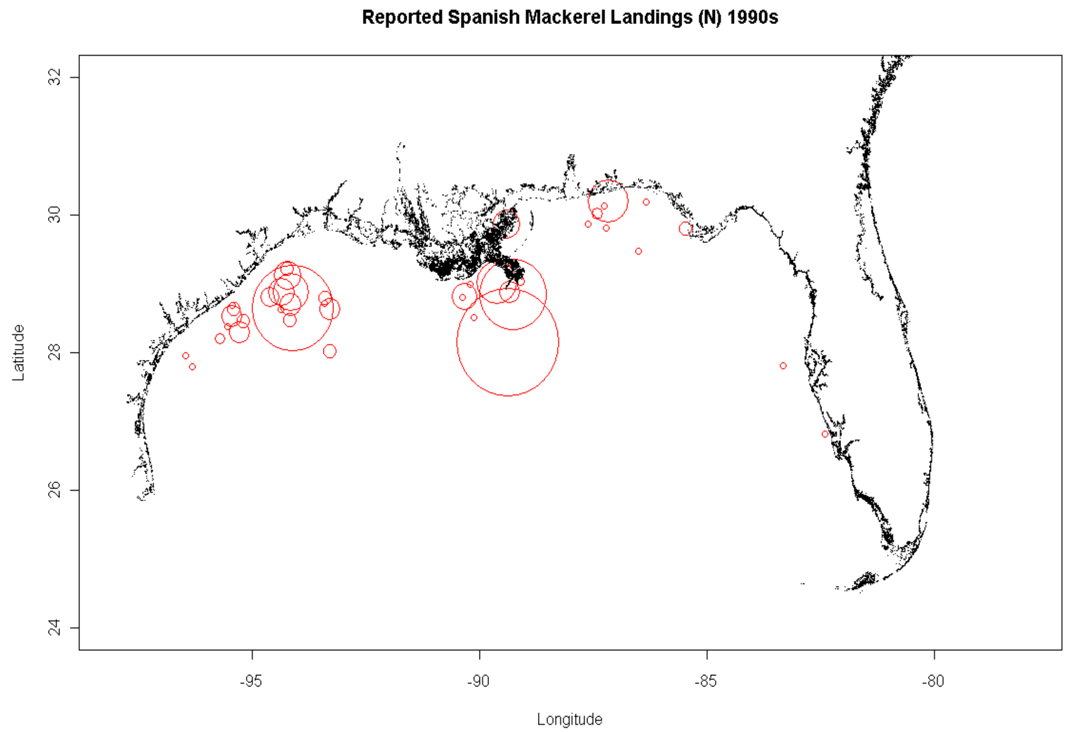


**Figure 4.12.8.** Reported Spanish mackerel landings (numbers of fish) from SRHS, 1990-1999. The size of each point is proportional to the reported landings (N) at the given location.

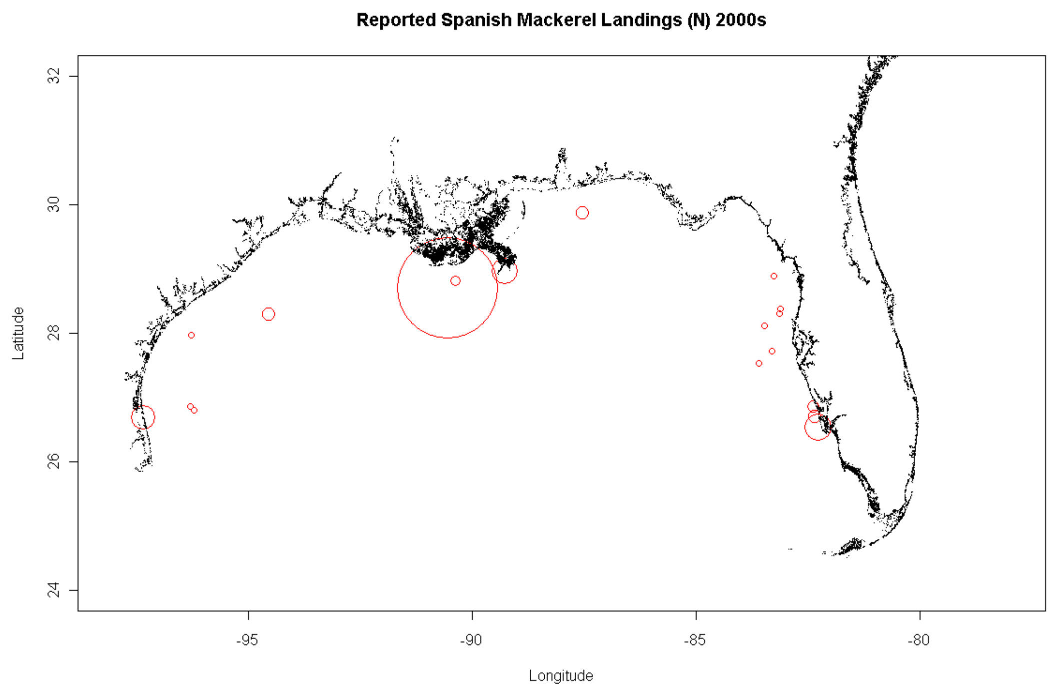


**Figure 4.12.9.** Reported Spanish mackerel landings (numbers of fish) from SRHS, 2000-2011. The size of each point is proportional to the reported landings (N) at the given location.

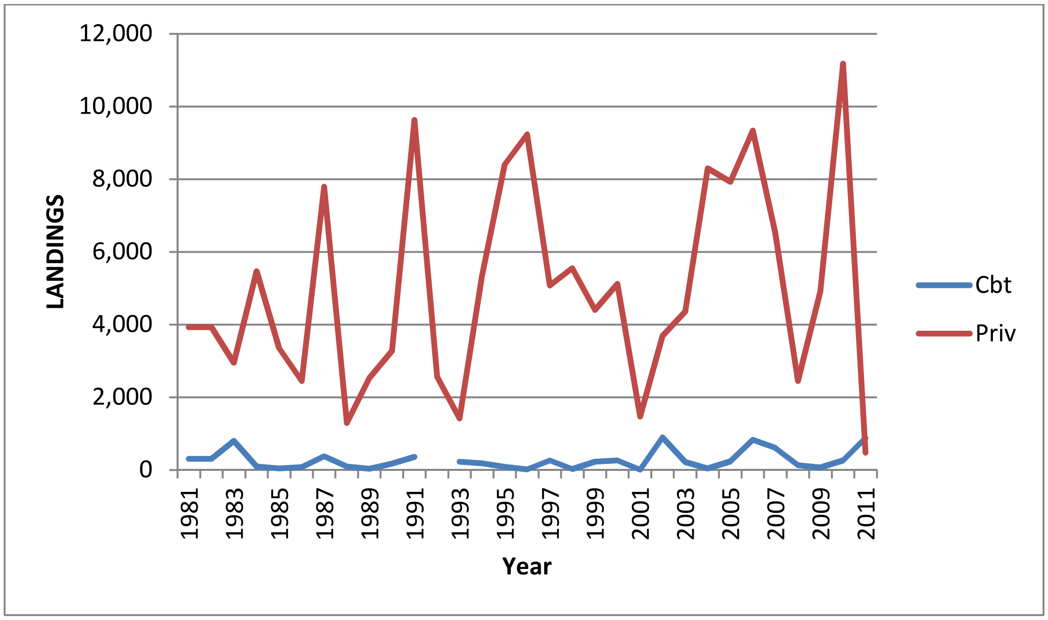


**Figure 4.12.10** Texas Spanish mackerel landings (numbers of fish) for charter boat mode and private mode (TPWD). 2011 data is through mid-May.

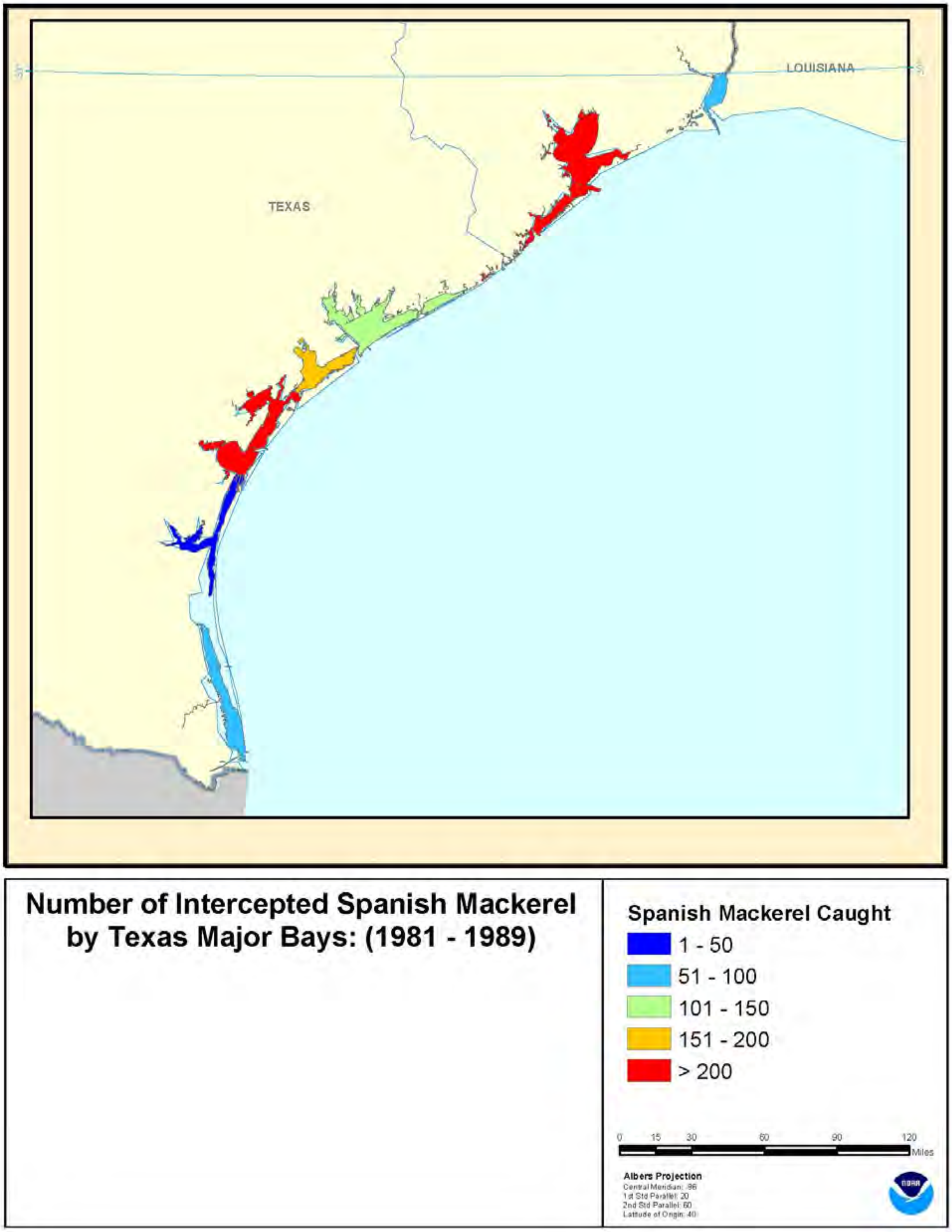


**Figure 4.12.11.** The number of Spanish mackerel intercepted by the TPWD from 1983-1989.

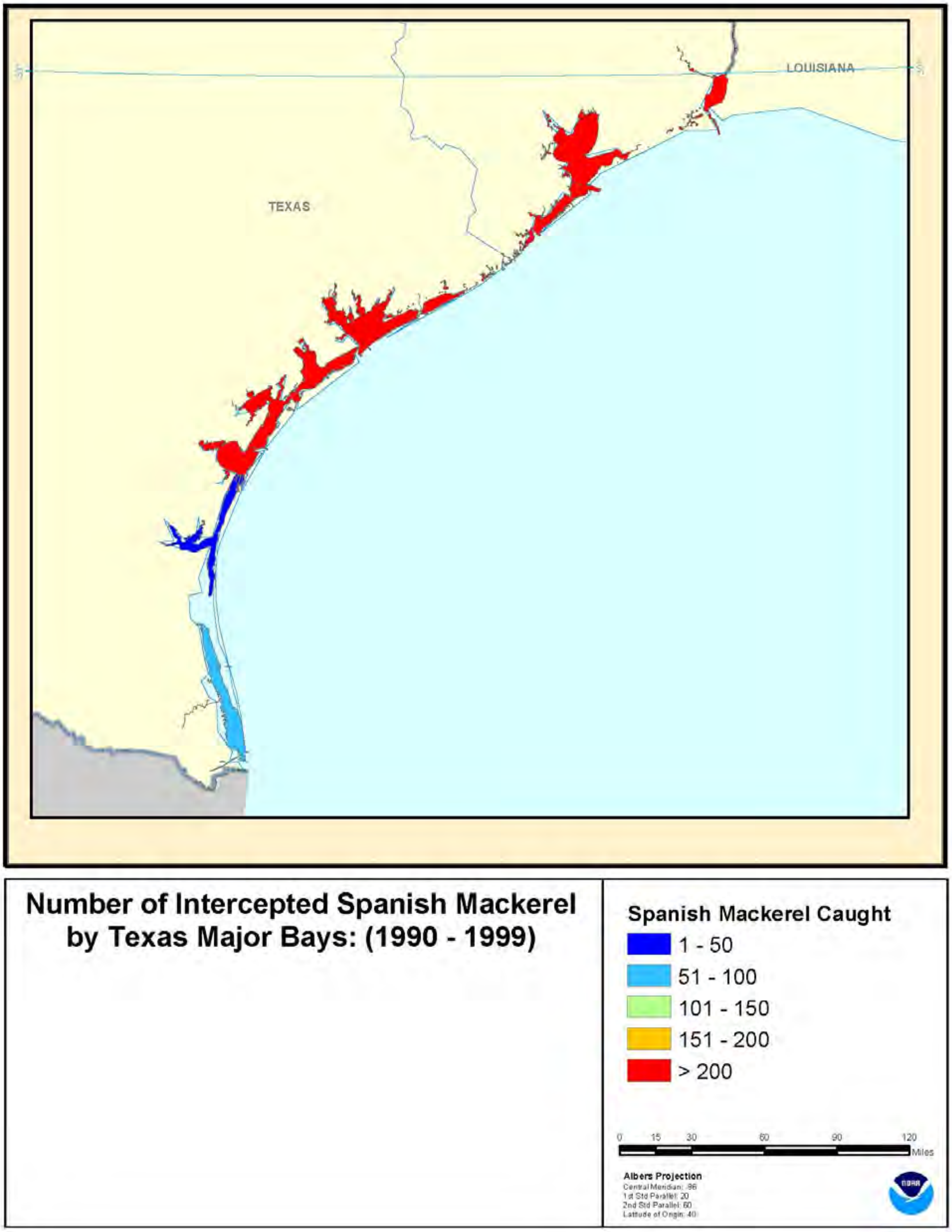


**Figure 4.12.12.** The number of Spanish mackerel intercepted by the TPWD from 1990-1999.

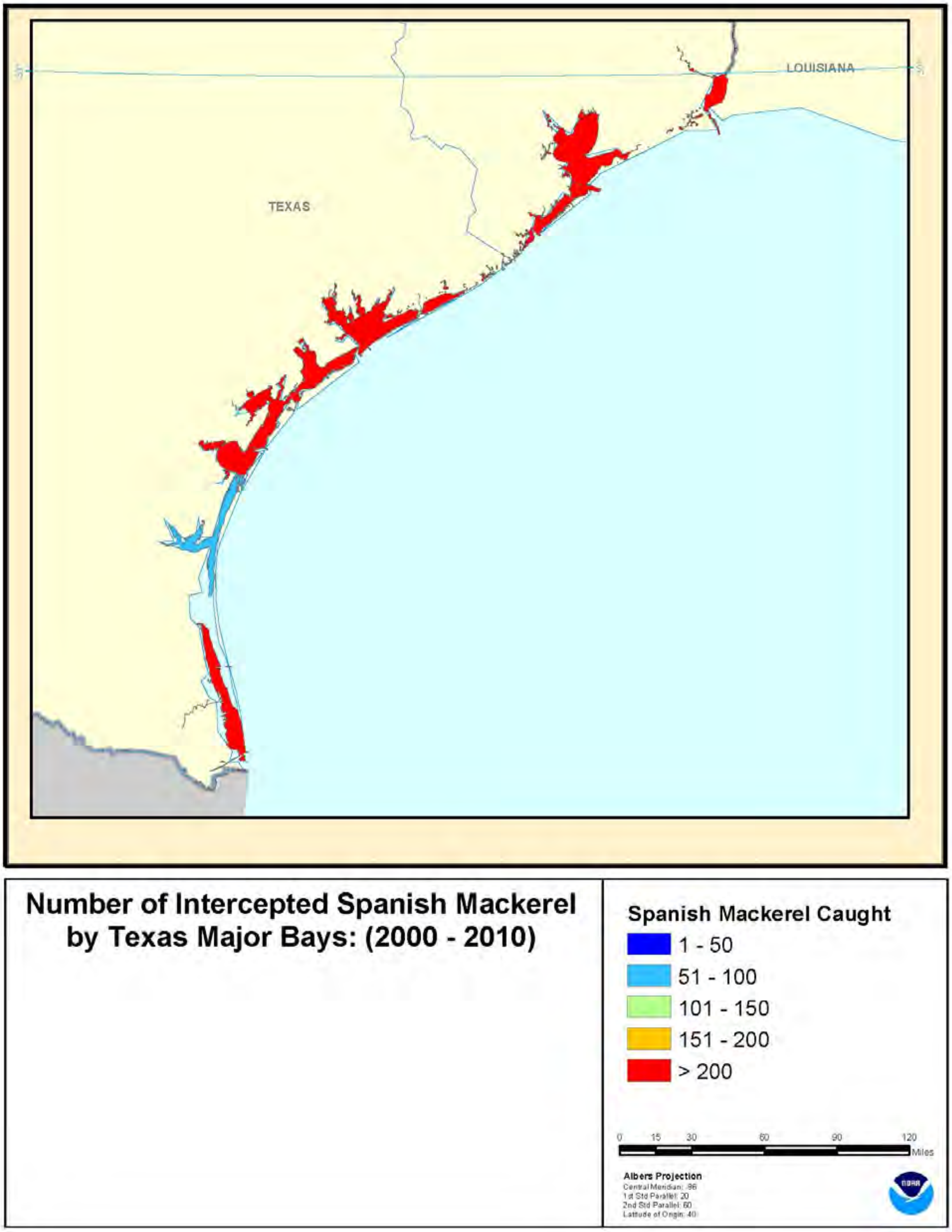


**Figure 4.12.13.** The number of Spanish mackerel intercepted by the TPWD from 2000-2010.

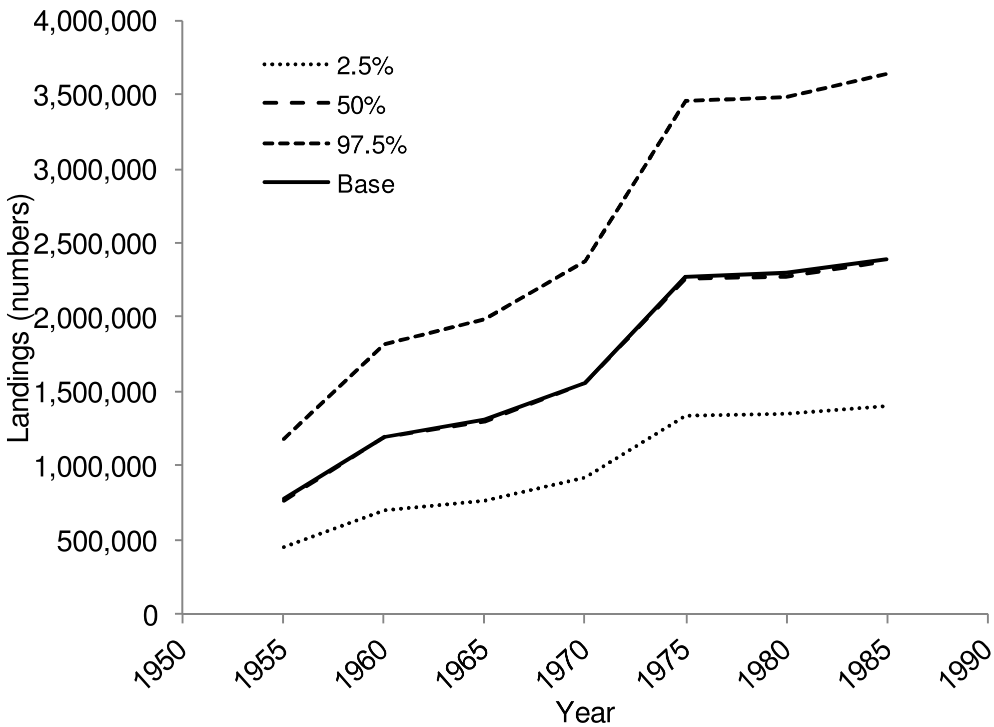


**Figure 4.12.14.** Bootstrap analysis of FHWAR census method (1955-1984) Gulf of Mexico Spanish mackerel landings estimates.

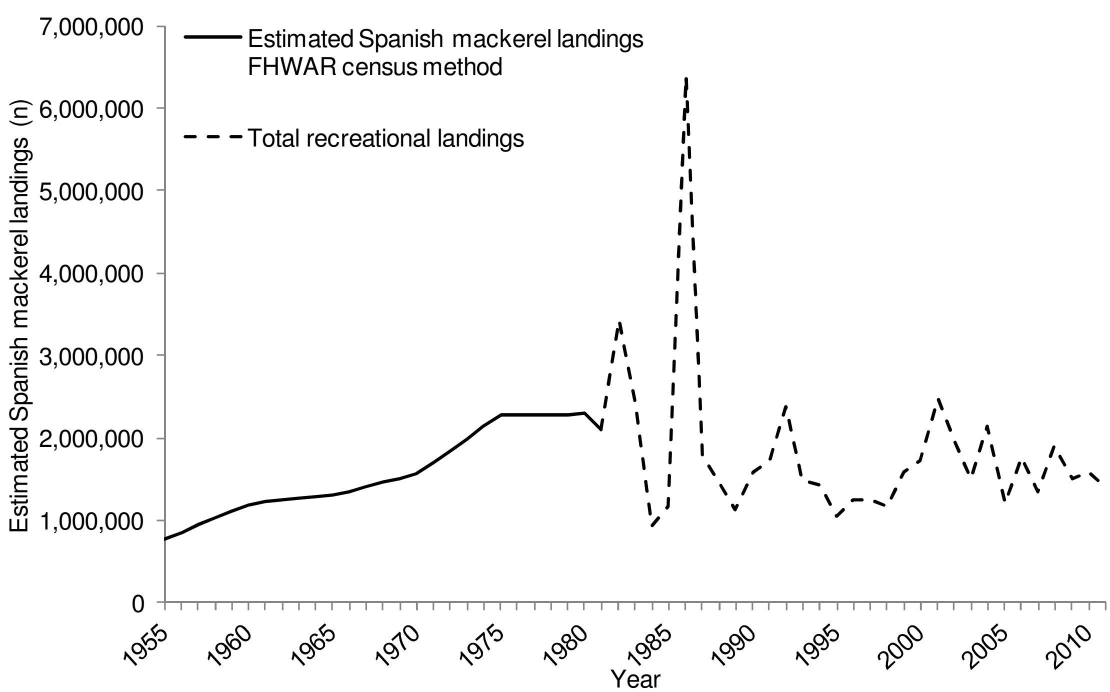


**Figure 4.12.15.** Estimated Spanish mackerel landings (number) using FHWAR census method (1955-1980), MRFSS (1981-2003), MRIP (2004-2011), TPWD (81-11), and SRHS (81-11) estimation methods.

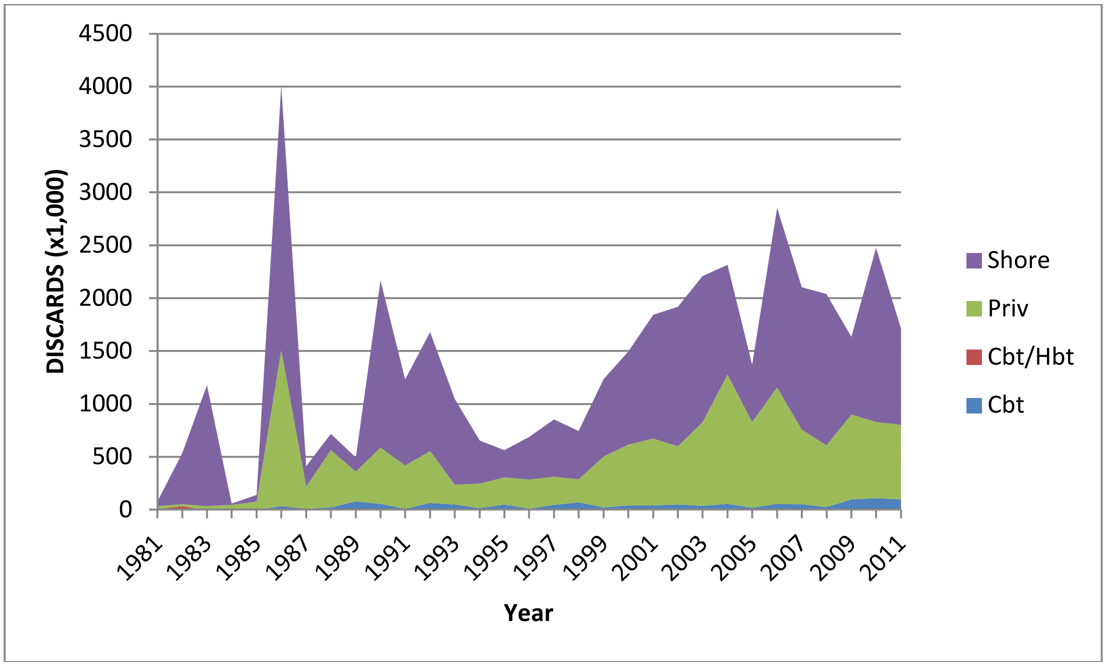


**Figure 4.12.16.** Gulf of Mexico (FLW-TX) Spanish mackerel discards (numbers of fish) by year and mode (MRFSS, NMFS, 1981-2003; MRIP, NMFS, 2004-2011). 2011 data is preliminary and through October. TX estimates for 1981-1985 shore mode only.

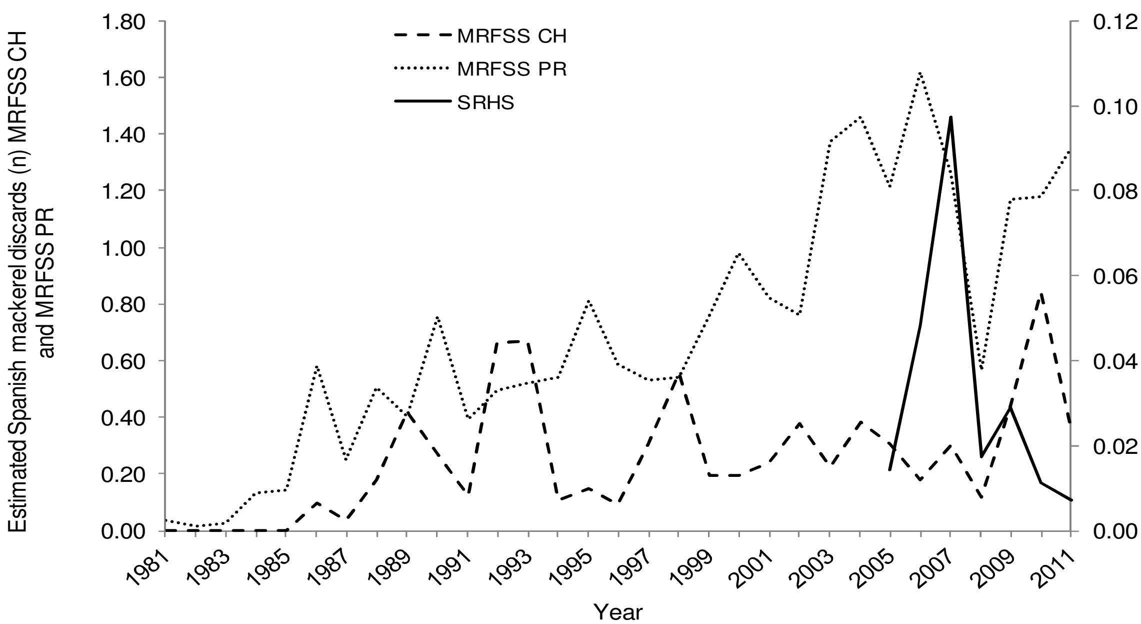


**Figure 4.12.17.** Percentage of Spanish mackerel discards in the recreational fishery, 1981-2011.

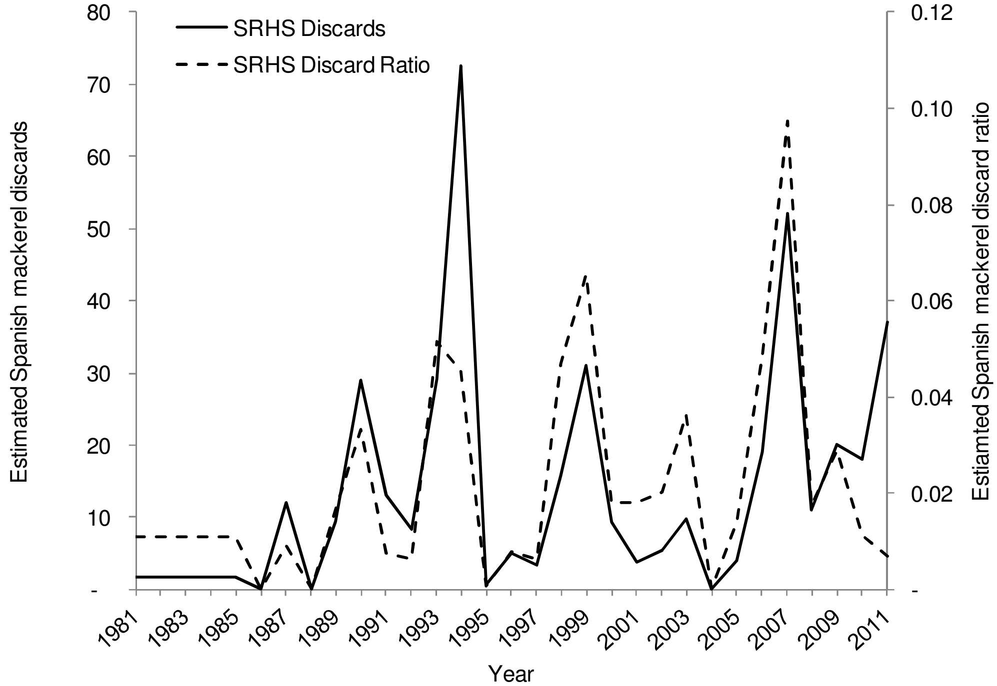


**Figure 4.12.18.** Gulf of Mexico estimated Spanish mackerel discards and discard ratio for the headboat fishery (MRFSS proxy 1981-2003; SRHS 2004-2011).

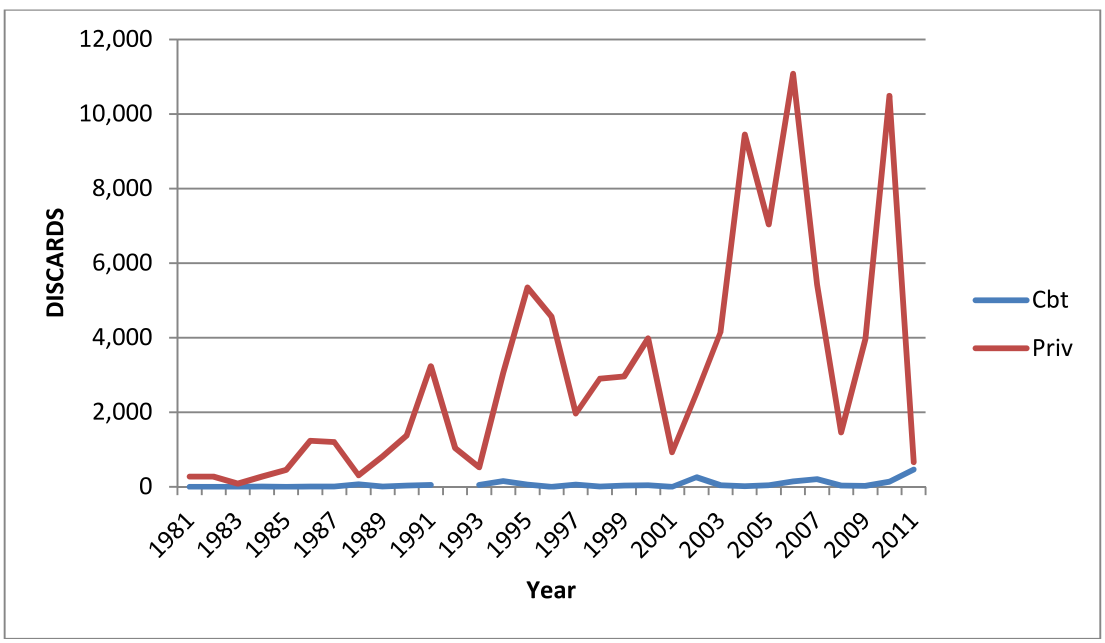


**Figure 4.12.19** Texas Spanish mackerel discards (numbers of fish) for charter boat mode and private mode (TPWD). 2011 data is through mid-May.

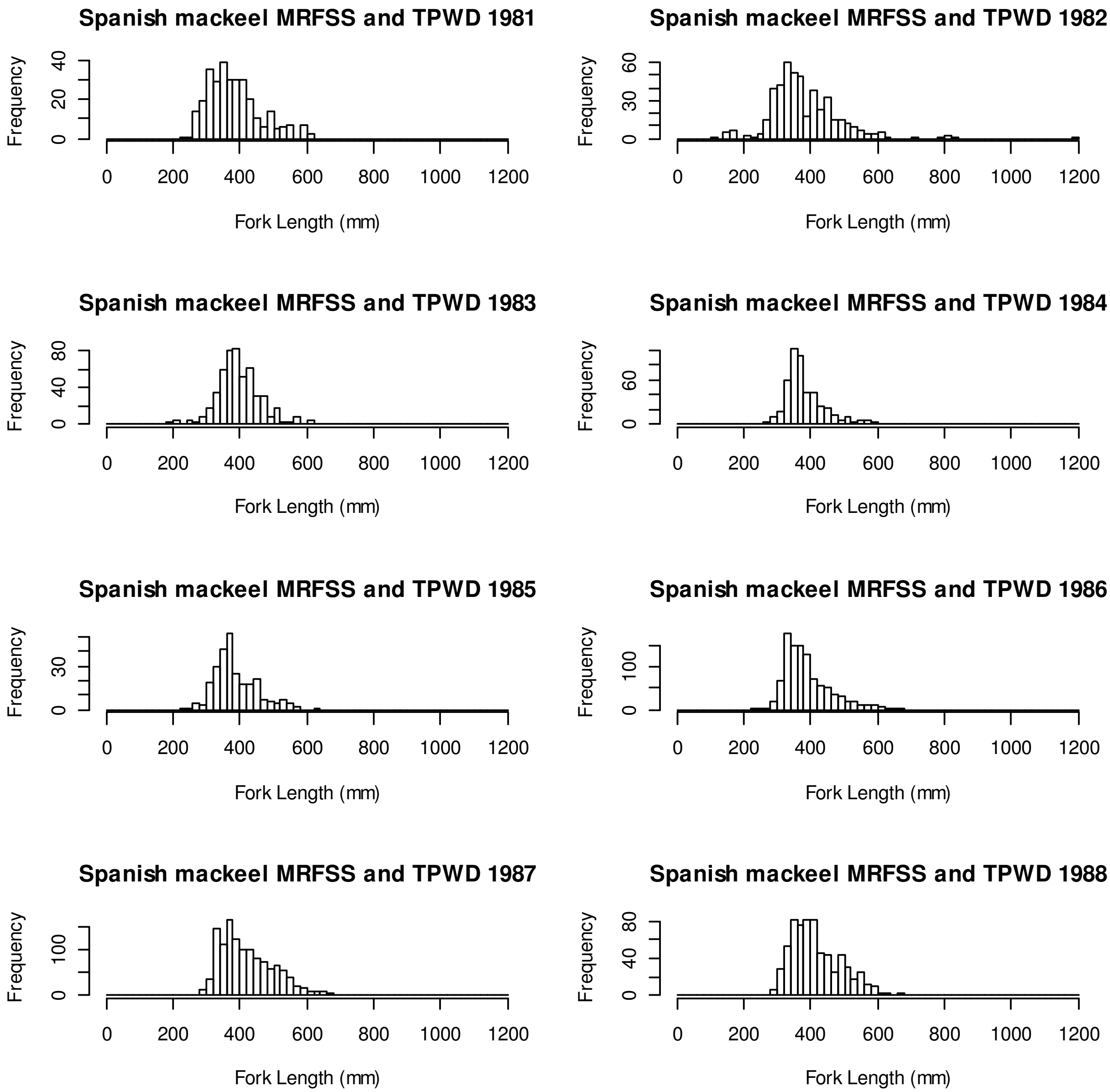


**Figure 4.12.20.** Length composition from the MRFSS (1981-2011) and TPWD (1983-2011).

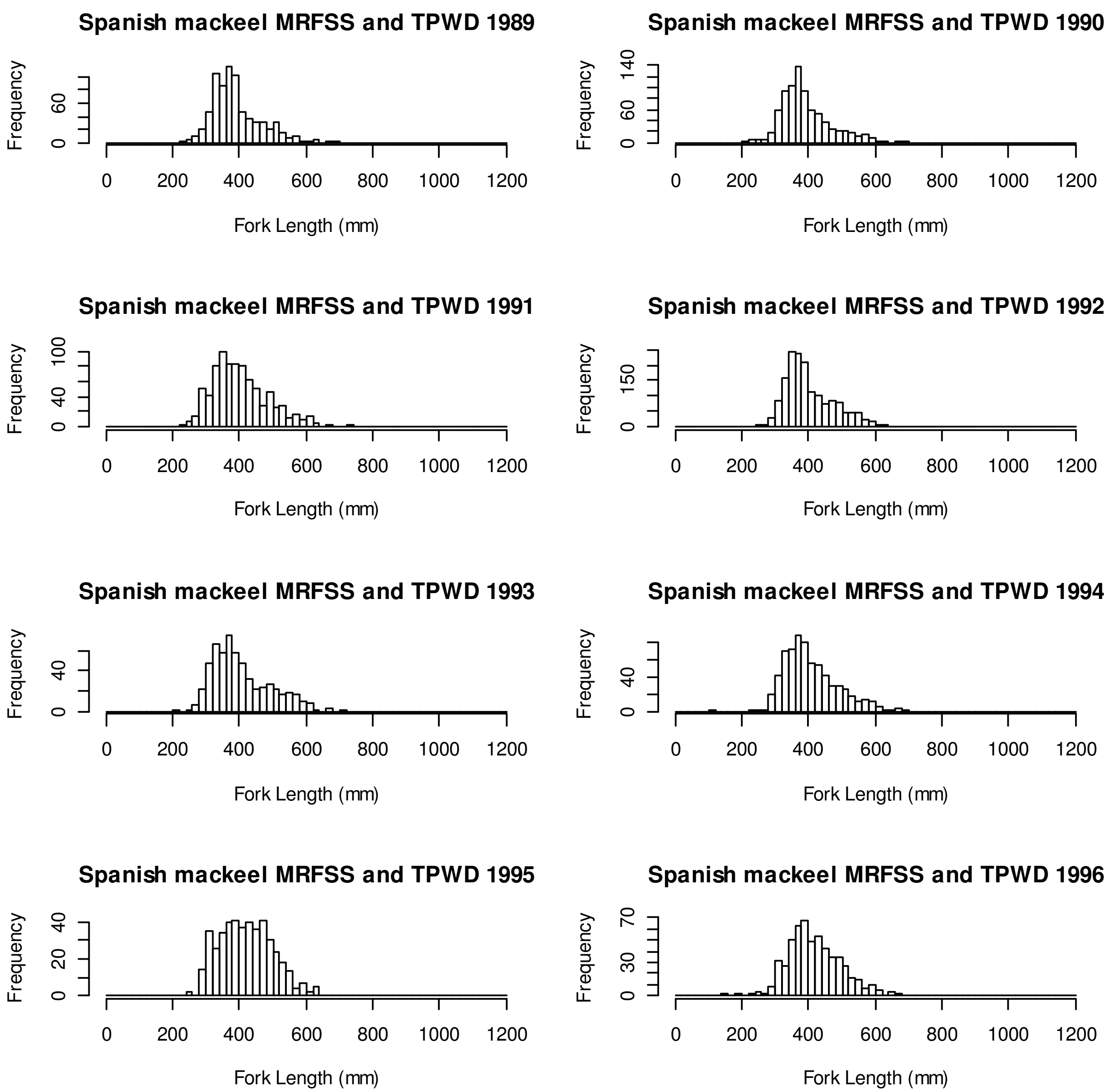


**Figure 4.12.20.** Length composition from the MRFSS (1981-2011) and TPWD (1983-2011) (continued).

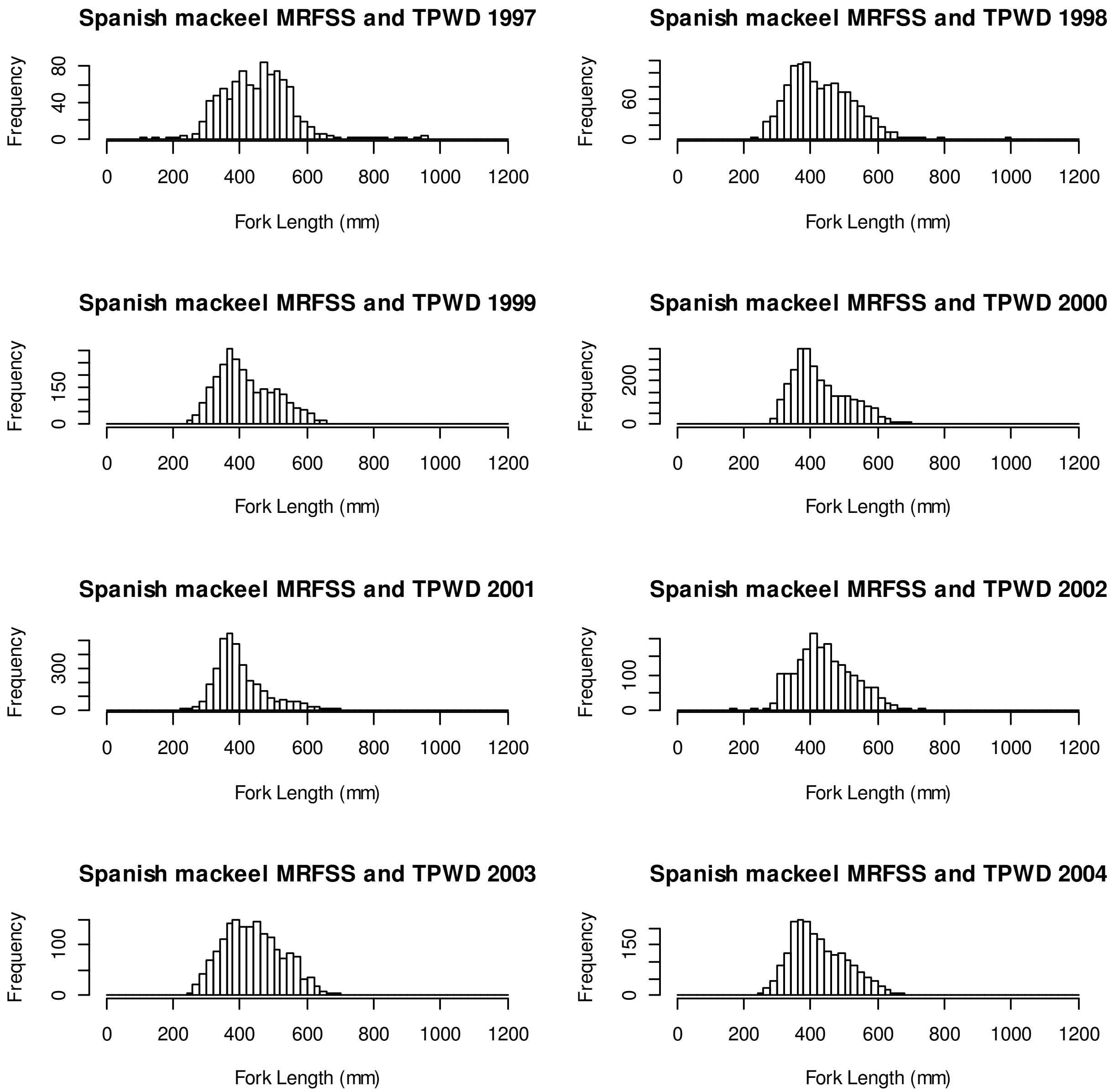


**Figure 4.12.20.** Length composition from the MRFSS (1981-2011) and TPWD (1983-2011) (continued).

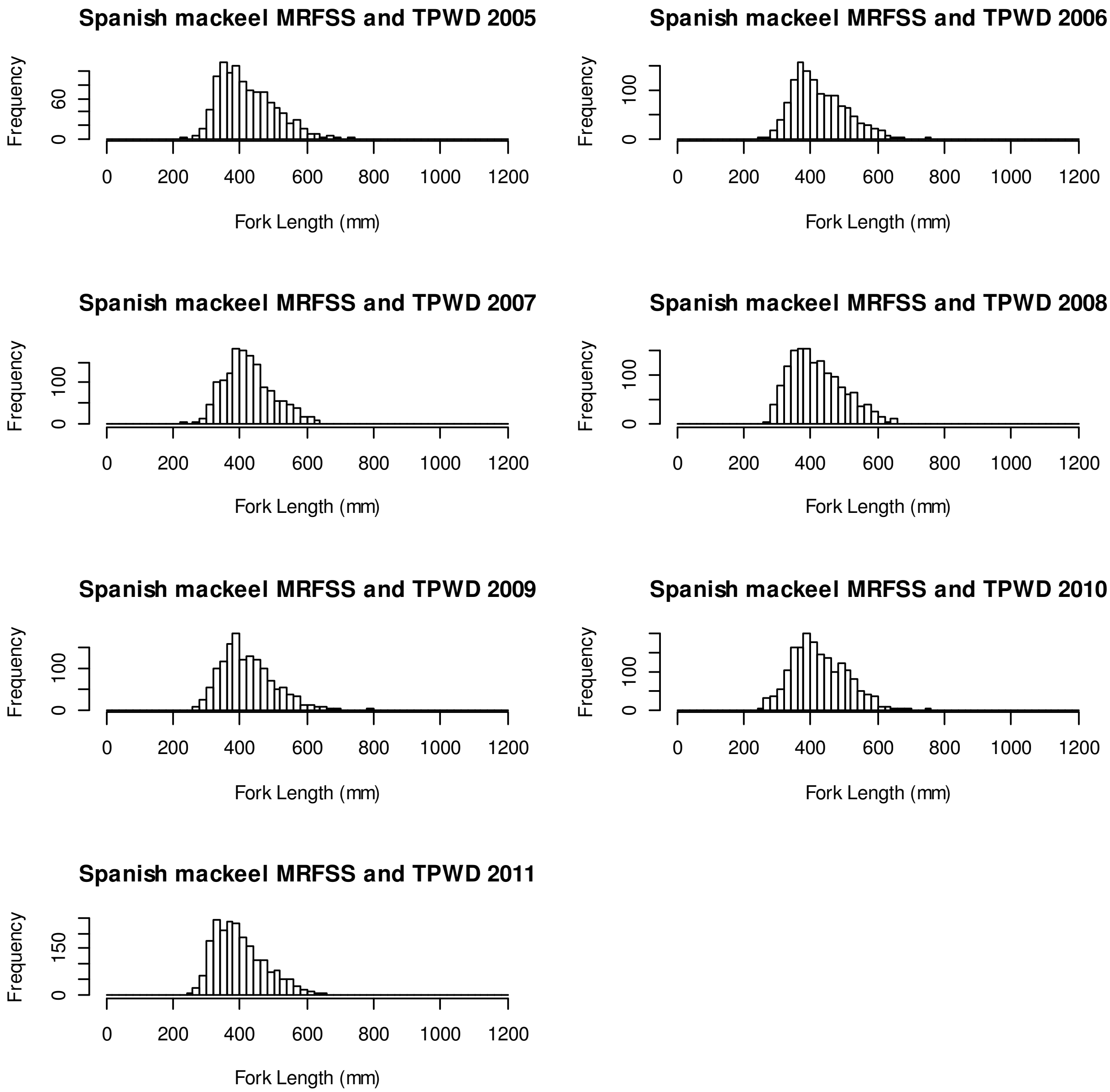


**Figure 4.12.20.** Length composition from the MRFSS (1981-2011) and TPWD (1983-2011) (continued).

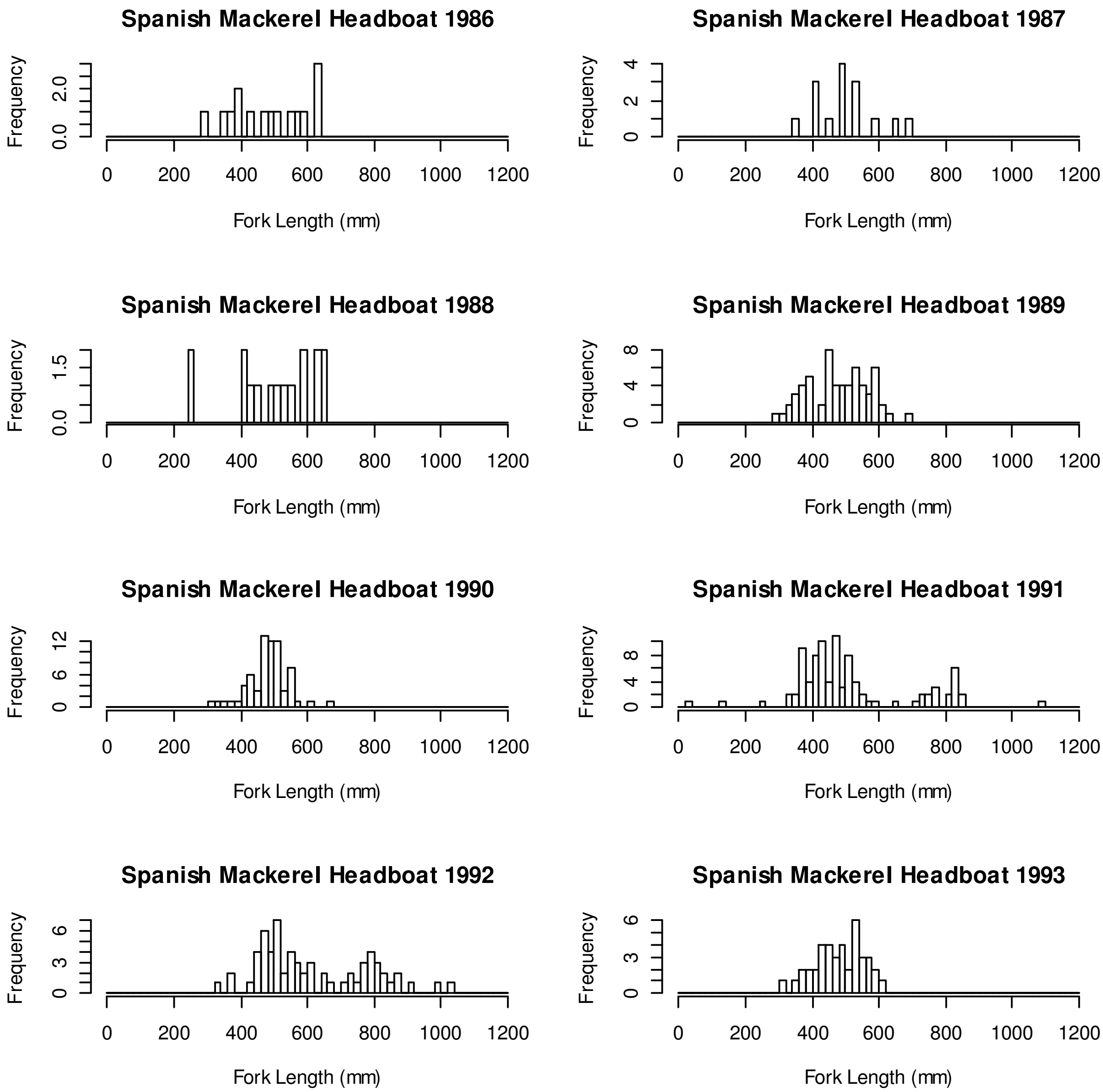


**Figure 4.12.21.** Headboat length composition 1986-2011.

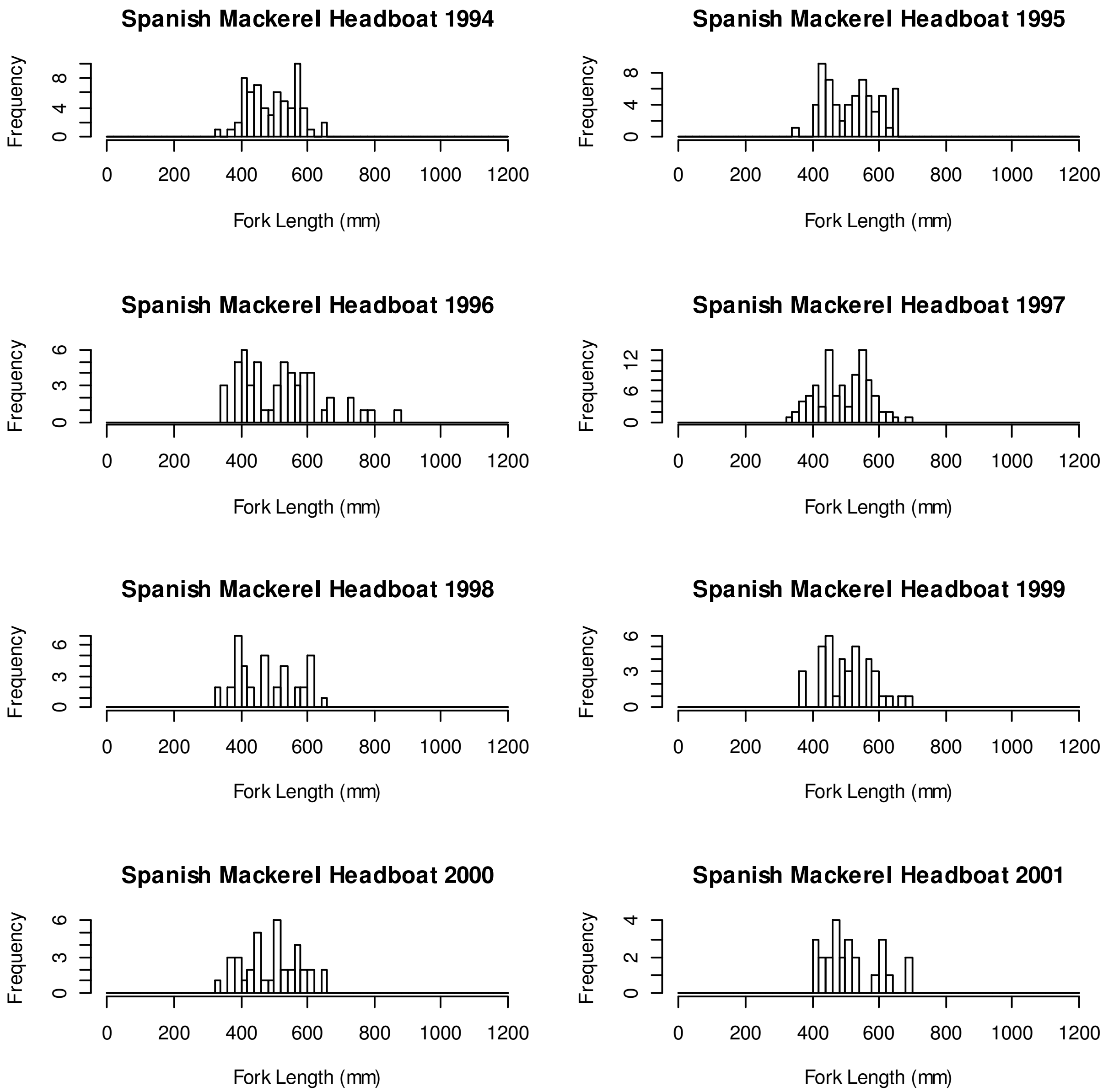


**Figure 4.12.21.** Headboat length composition 1981-2011 (Continued).

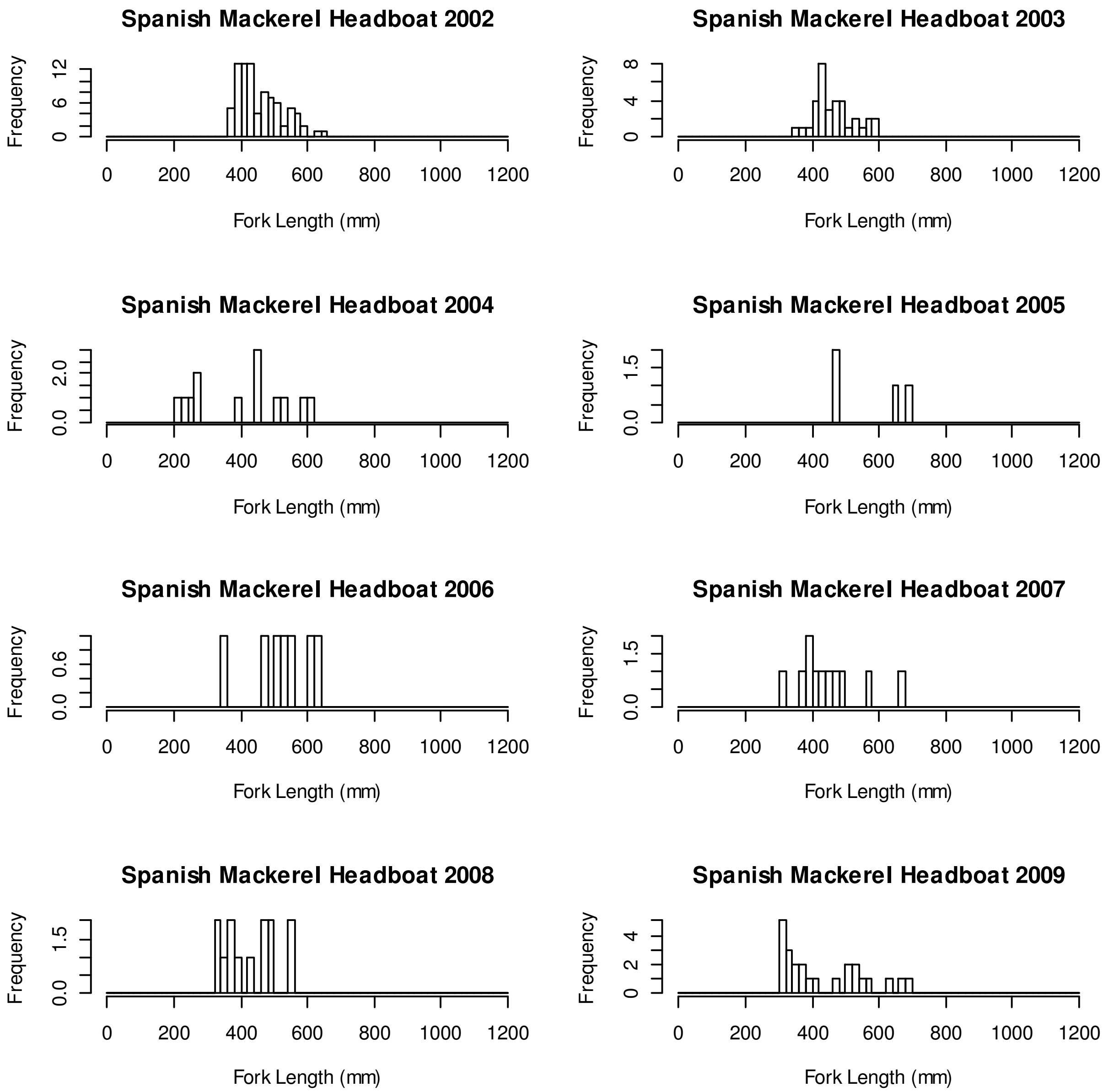


**Figure 4.12.21.** Headboat length composition 1981-2011 (Continued).

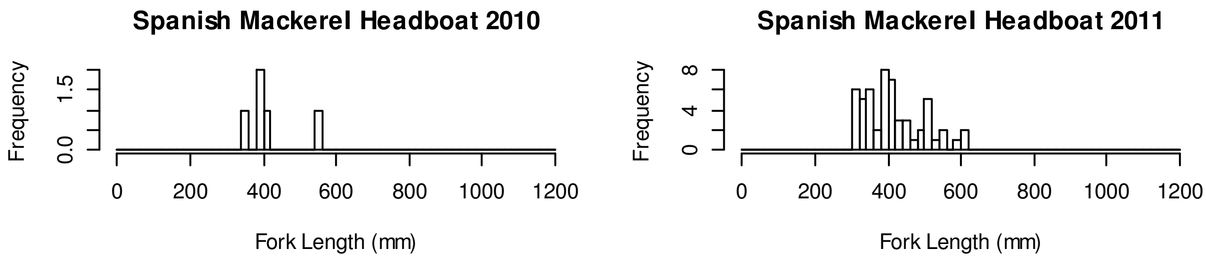


**Figure 4.12.21.** Headboat length composition 1981-2011 (Continued).

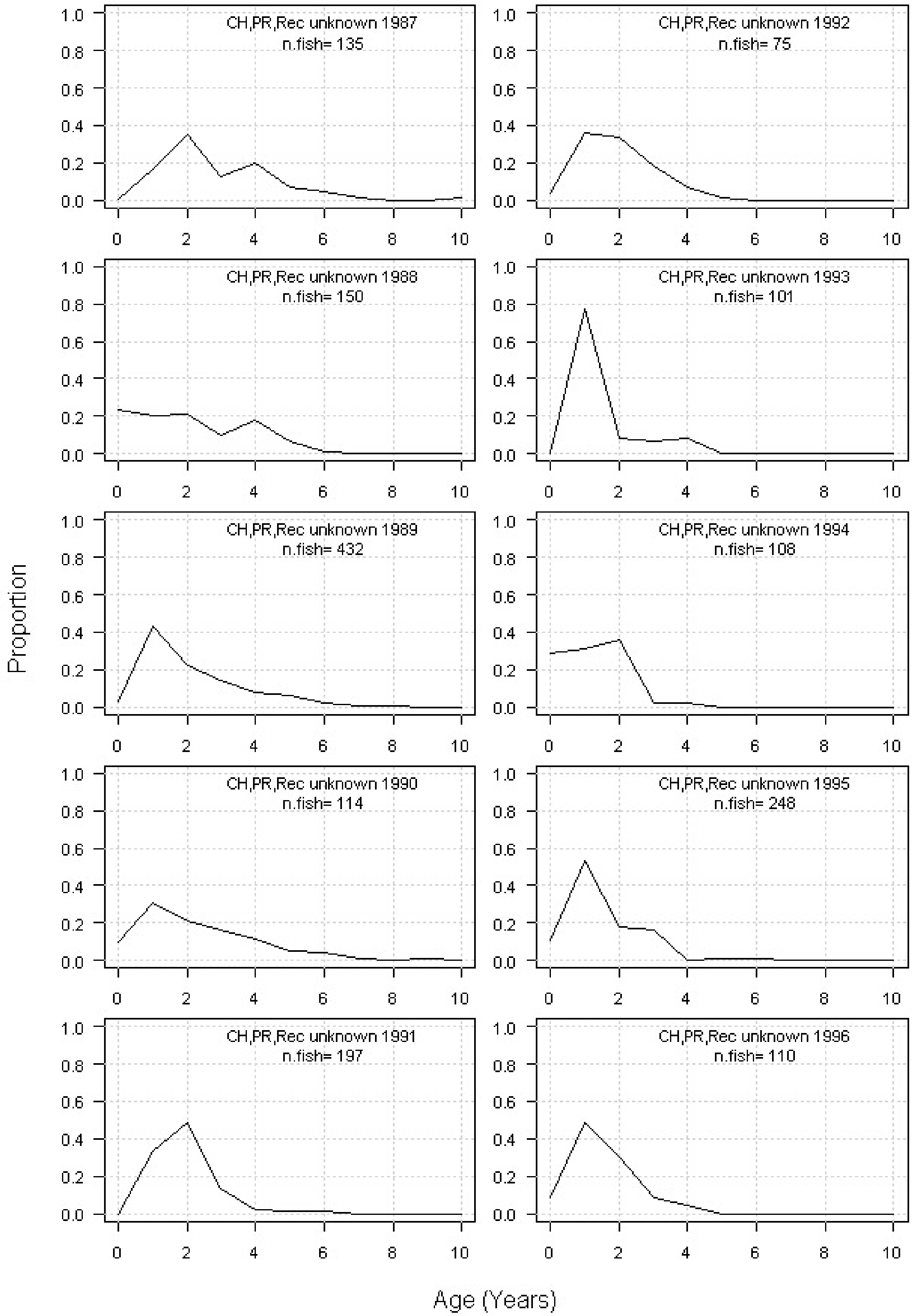


**Figure 4.12.22.** Age composition of Spanish mackerel from the charter boat, private/rental boat, and recreational (mode unknown) modes (1987-2002, 2004-2011).

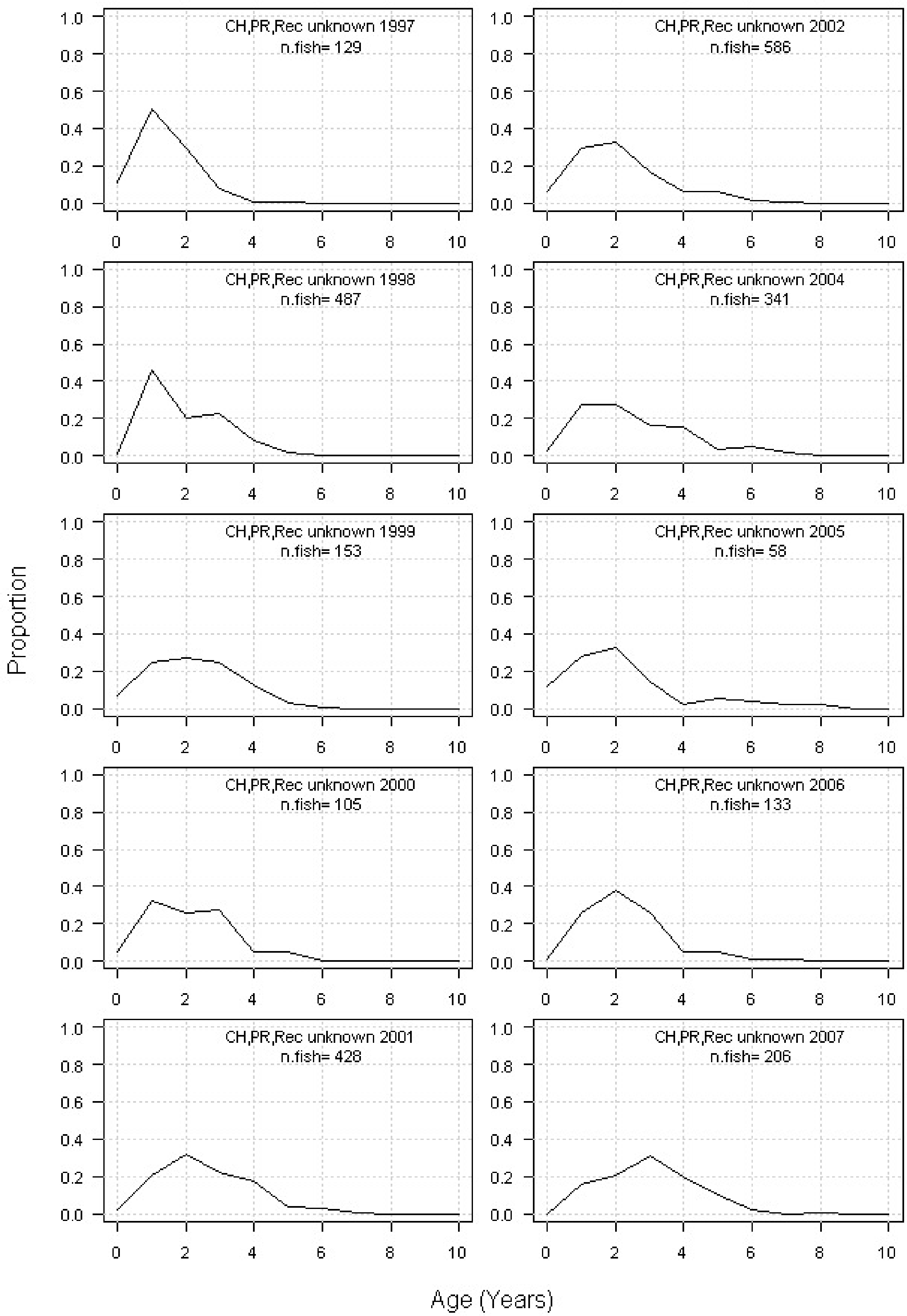


**Figure 4.12.22.** Age composition of Spanish mackerel from the charter boat, private/rental boat, and recreational (mode unknown) modes (1987-2002, 2004-2011).

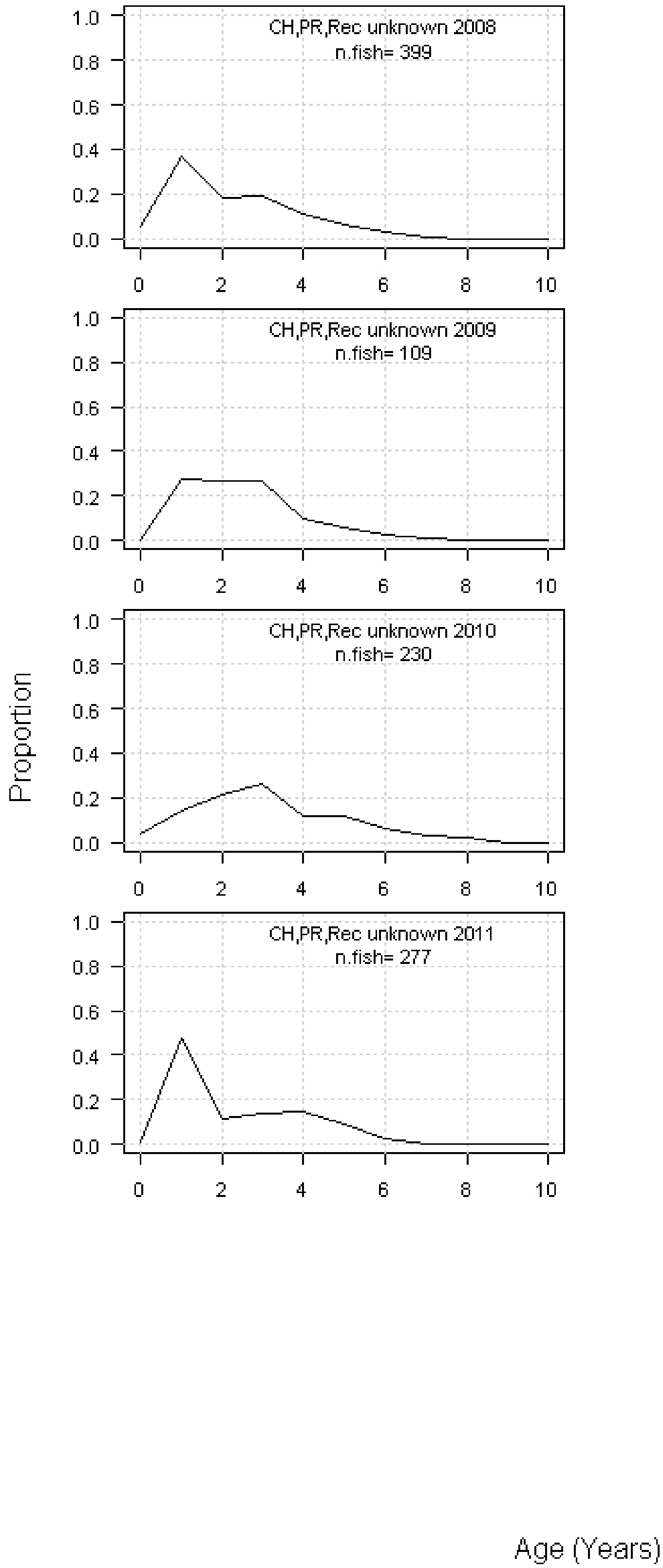


**Figure 4.12.22.** Age composition of Spanish mackerel from the charter boat, private/rental boat, and recreational (mode unknown) modes (1987-2002, 2004-2011) (continued).

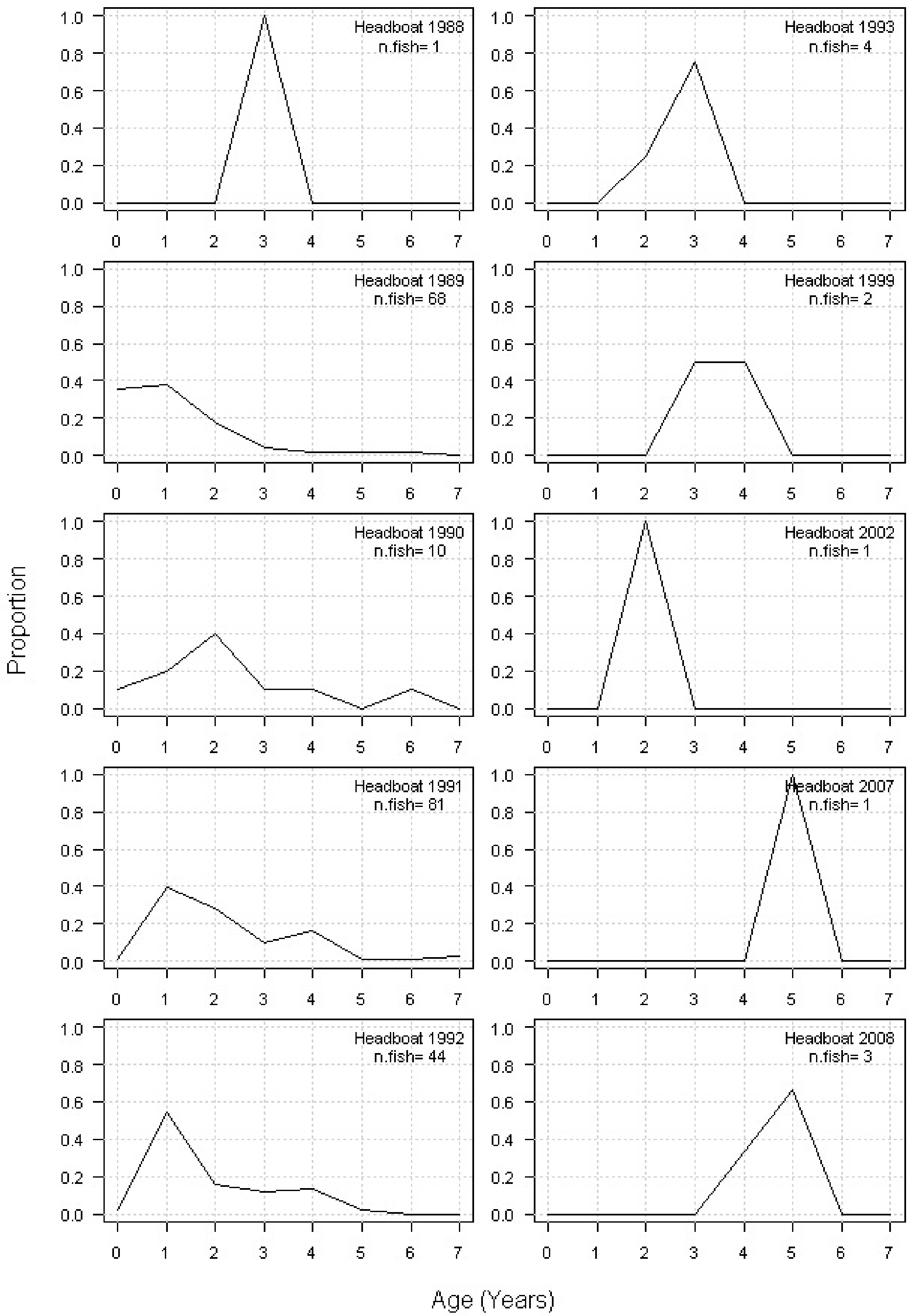


**Figure 4.12.23.** Age composition of Spanish mackerel from the headboat fleet during 1988-1993, 1999, 2002, 2007-2009, and 2011.

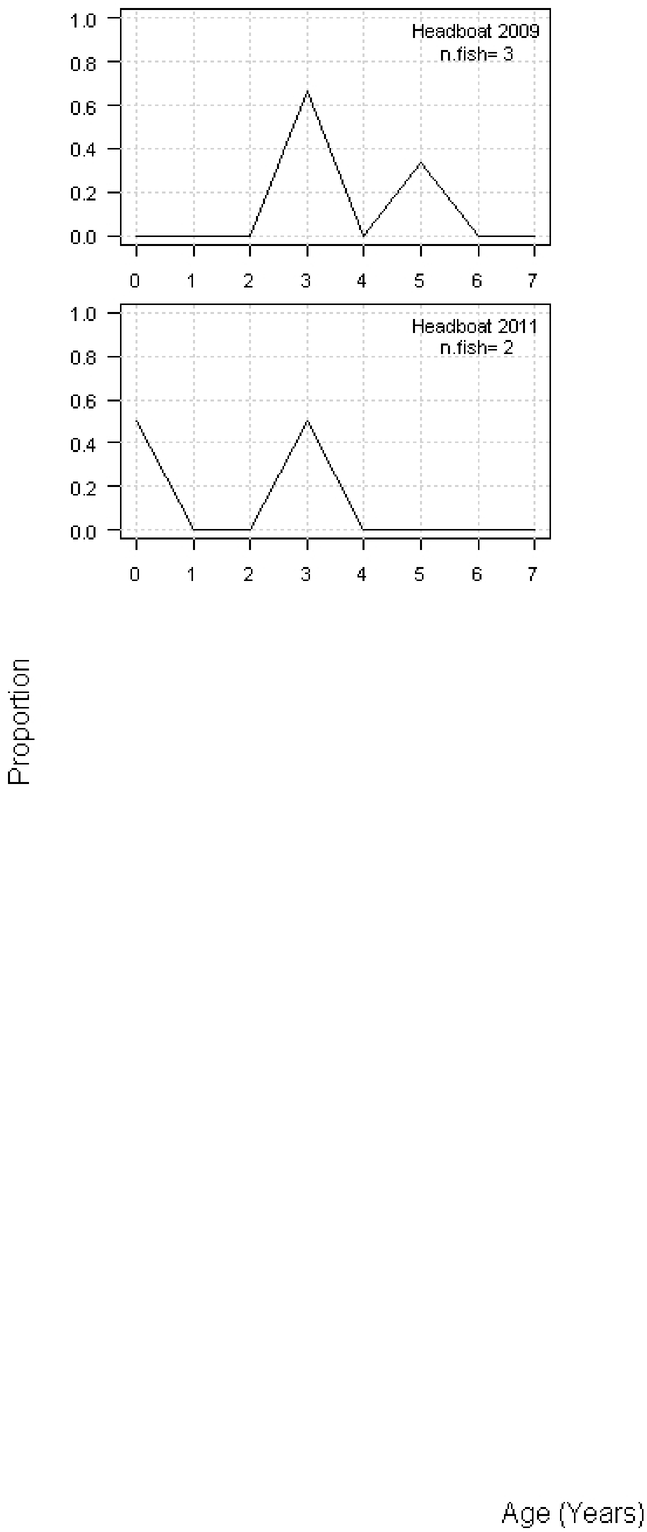


**Figure 4.12.23.** Age composition of Spanish mackerel from the headboat fleet during 1988-1993, 1999, 2002, 2007-2009, and 2011 (continued).

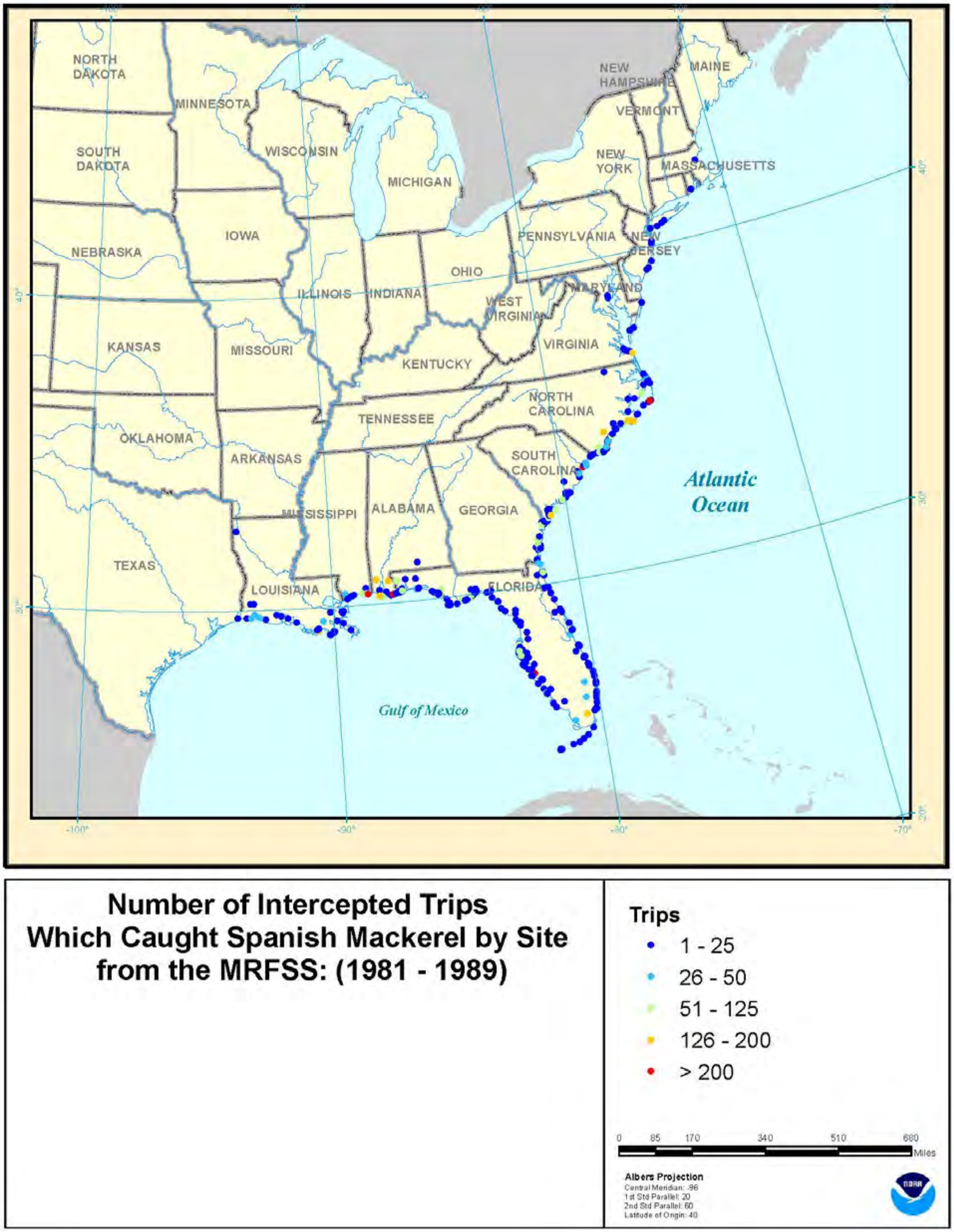


**Figure 4.12.24.** The number MRFSS intercepted trips which caught Spanish mackerel from 1981-1989.

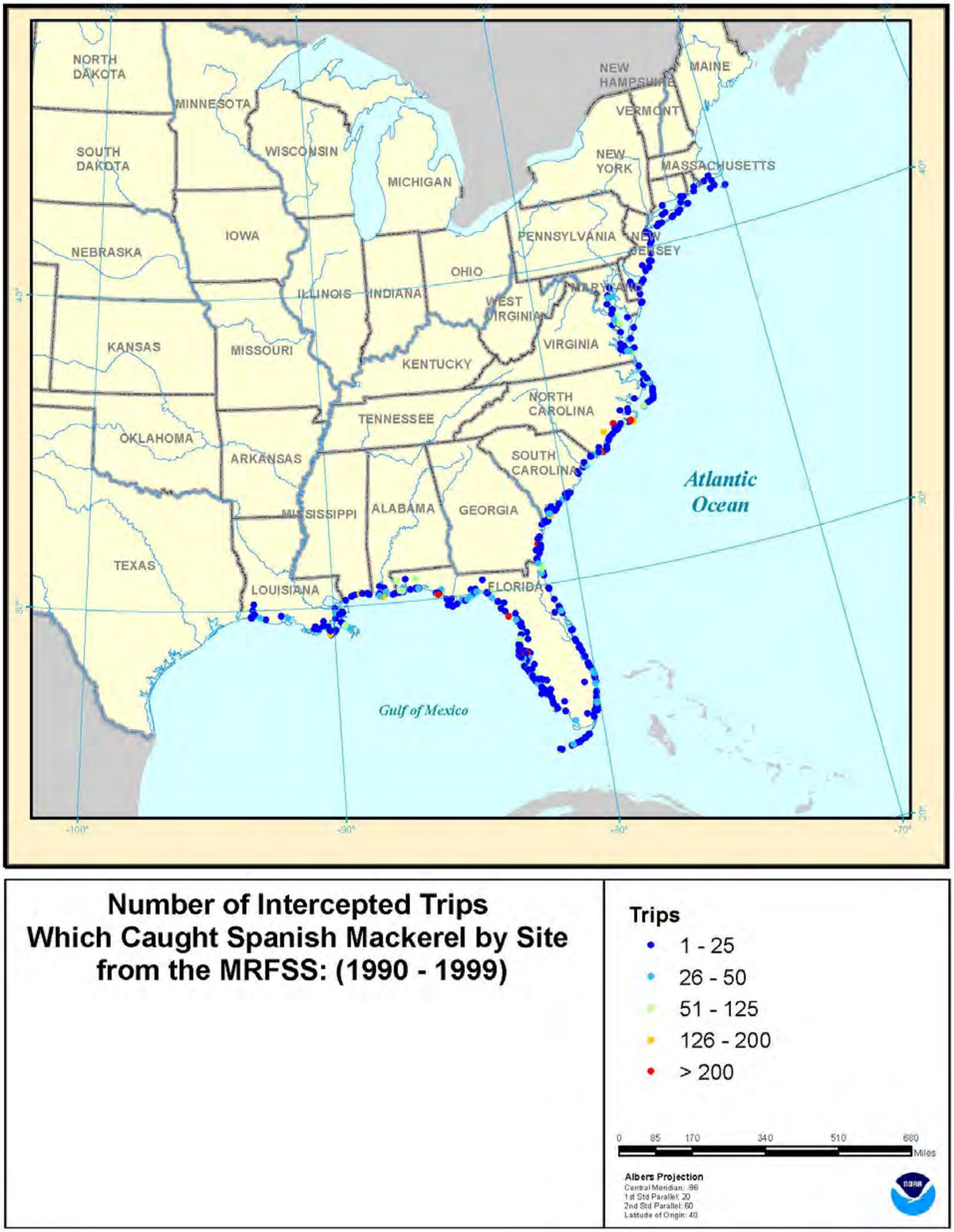


**Figure 4.12.25.** The number MRFSS intercepted trips which caught Spanish mackerel from 1990-1999.

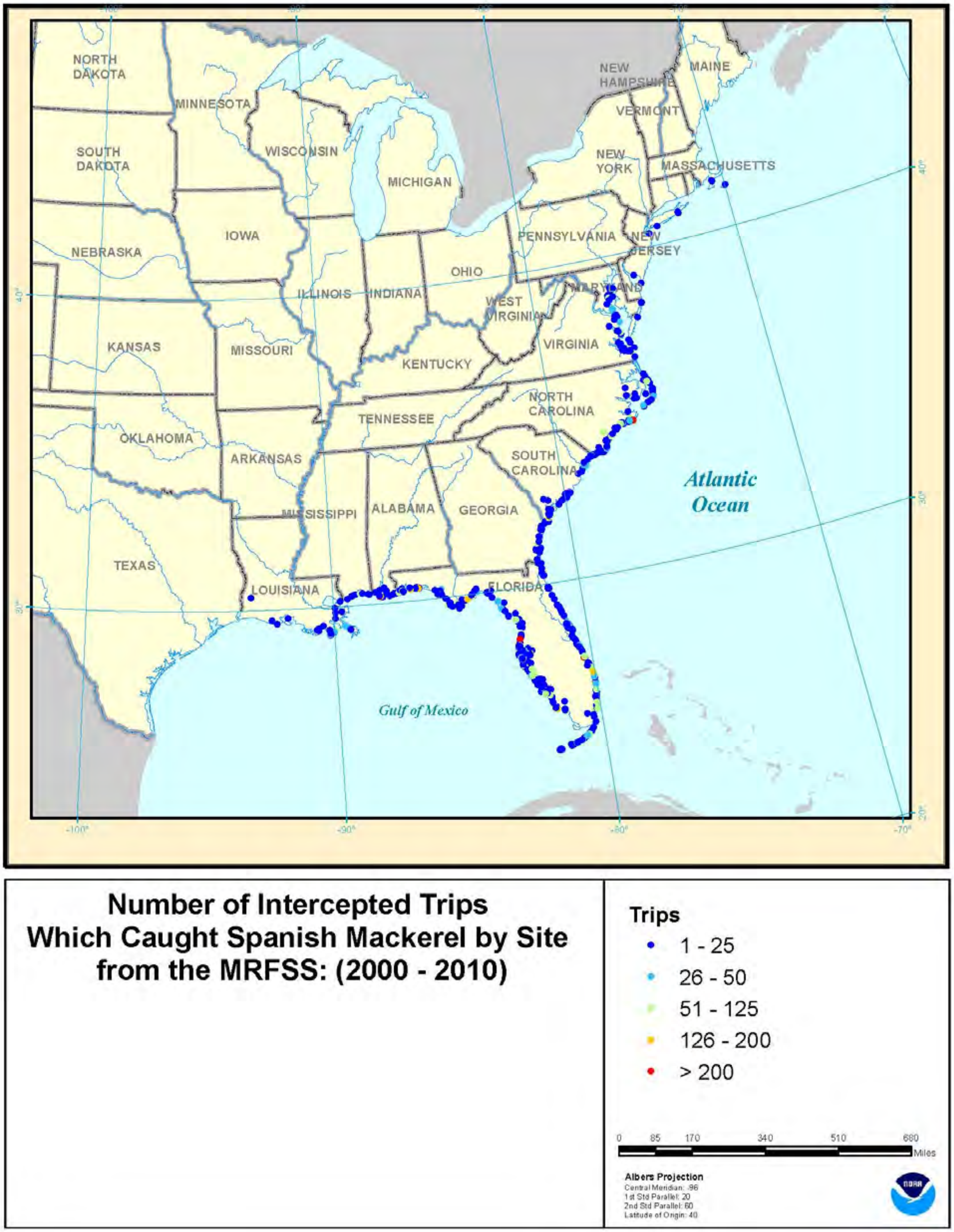


**Figure 4.12.26.** The number MRFSS intercepted trips which caught Spanish mackerel from 2000-2010.

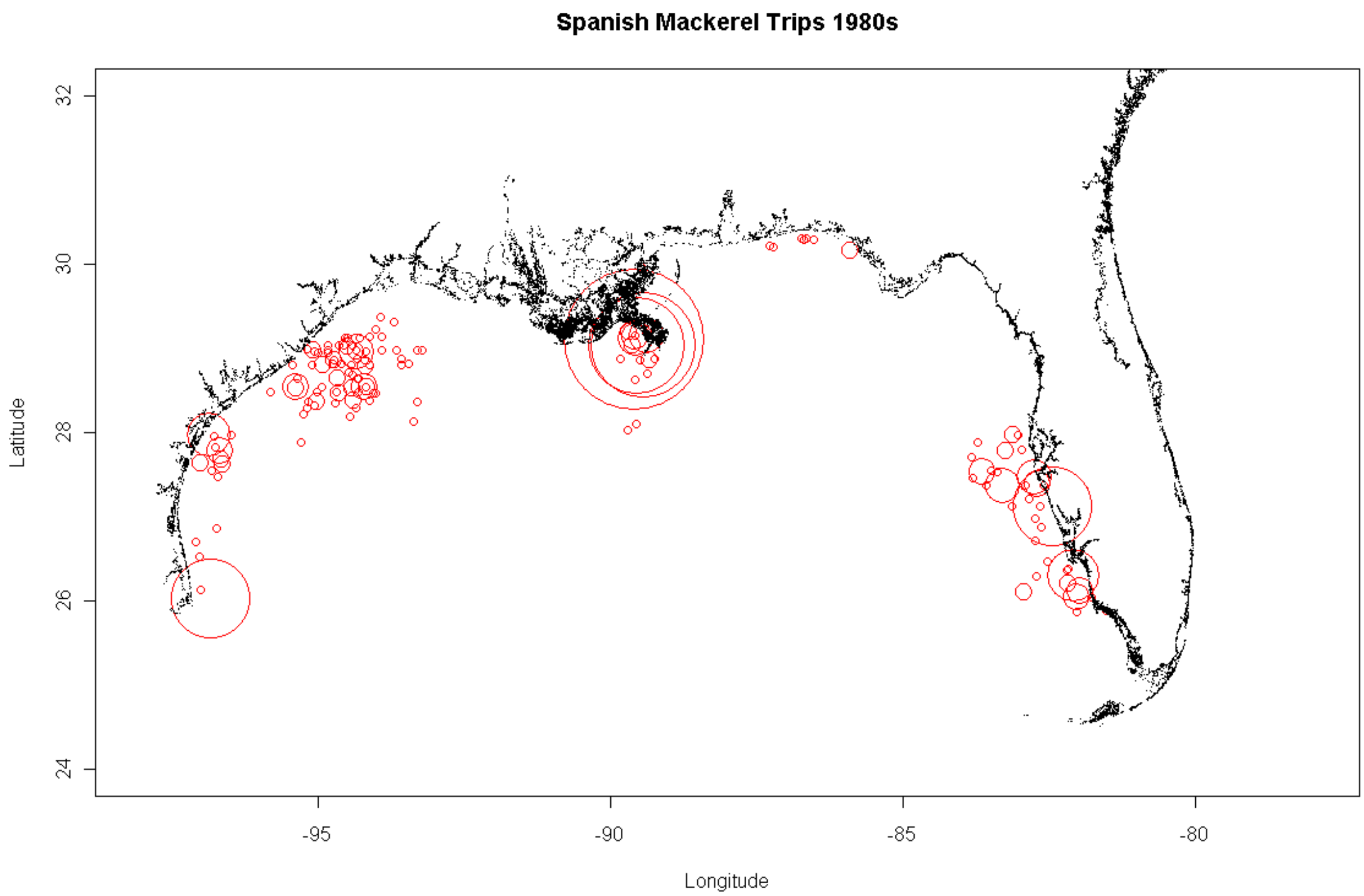


**Figure 4.12.27.** Reported Spanish mackerel trips from SRHS, 1986-1989. The size of each point is proportional to the frequency of reported trips at the given location.

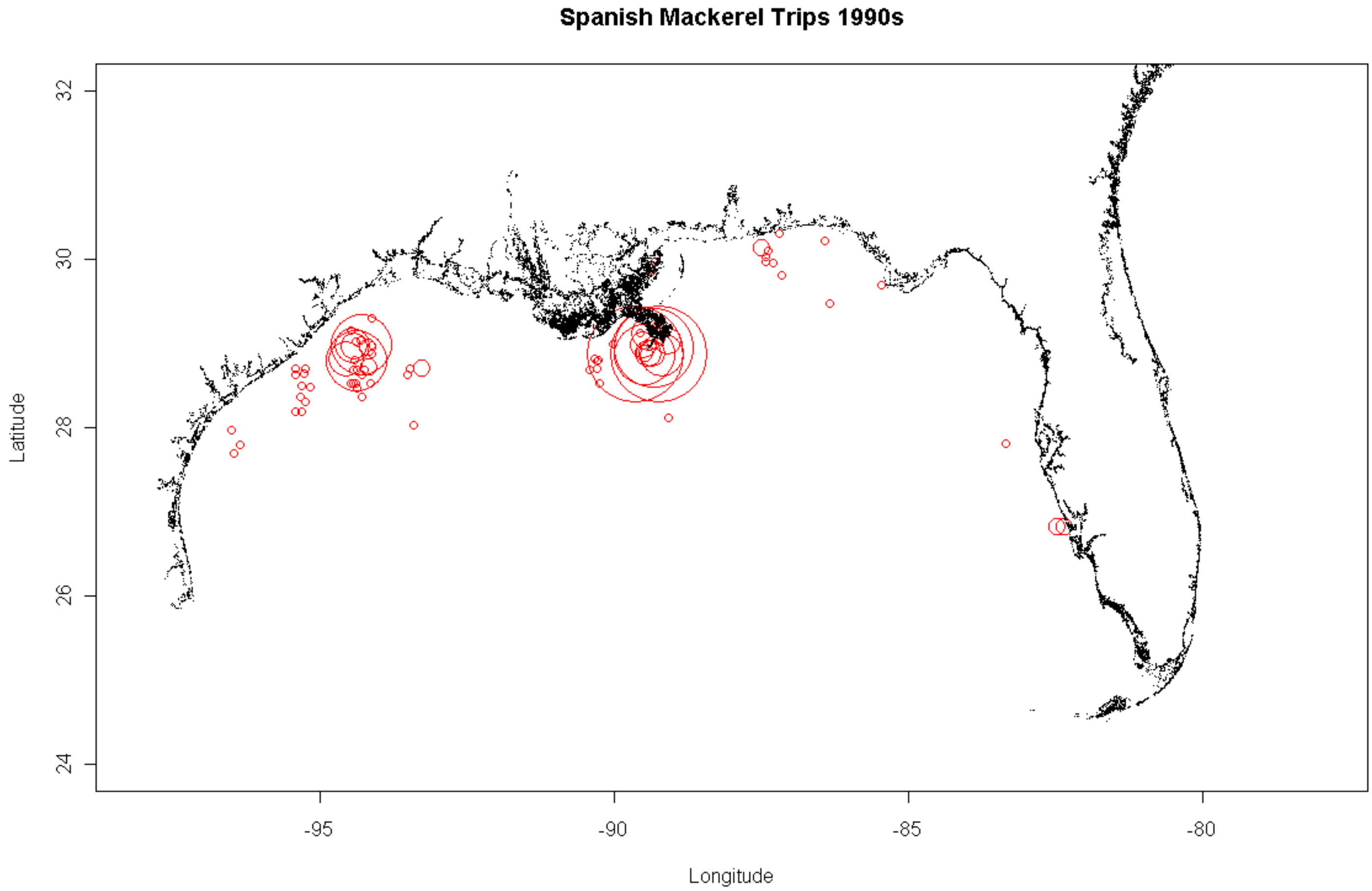


**Figure 4.12.28.** Reported Spanish mackerel trips from SRHS, 1990-1999. The size of each point is proportional to the frequency of reported trips at the given location.

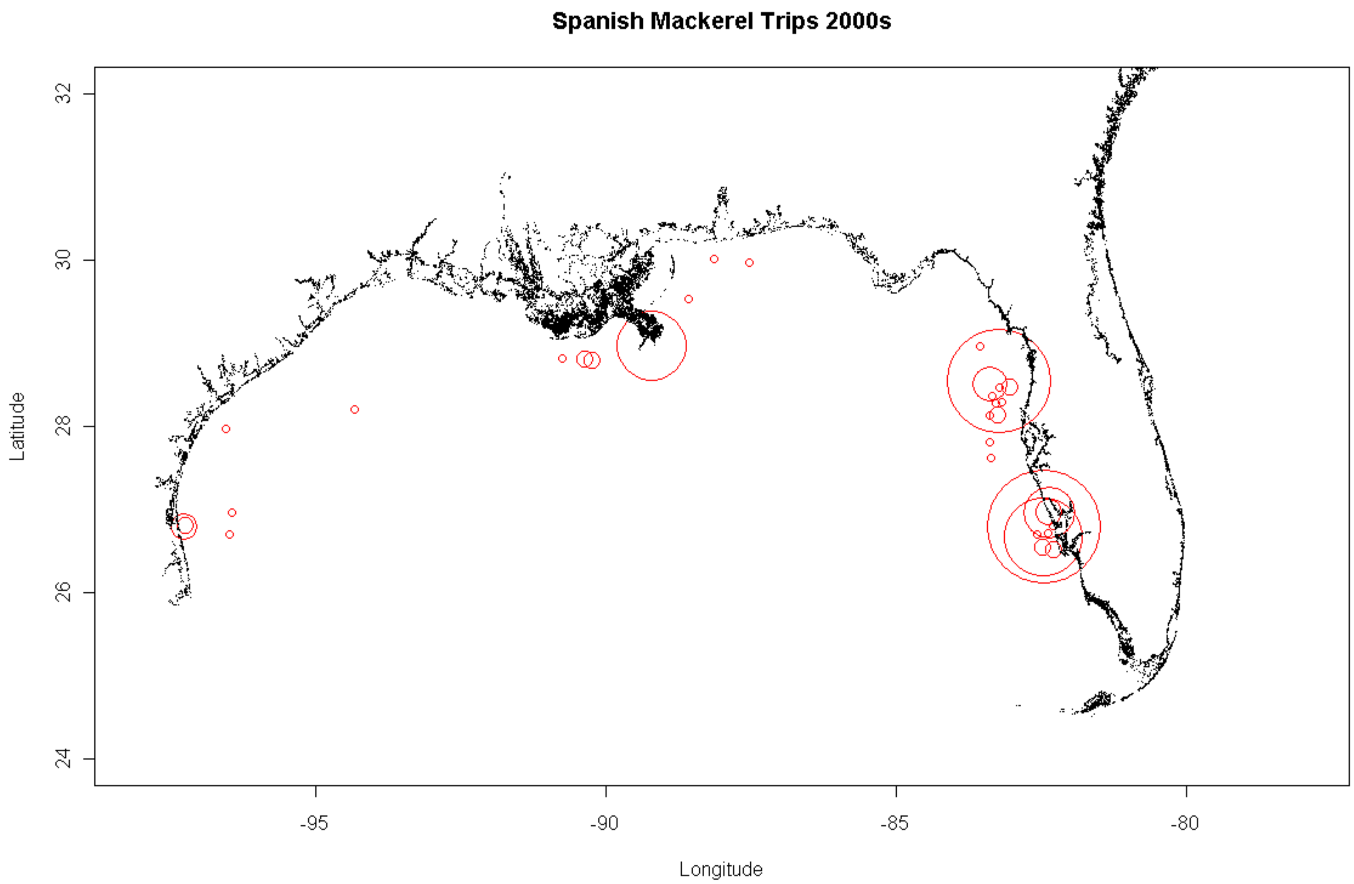


**Figure 4.12.29.** Reported Spanish mackerel trips from SRHS, 2000-2011. The size of each point is proportional to the frequency of reported trips at the given location.

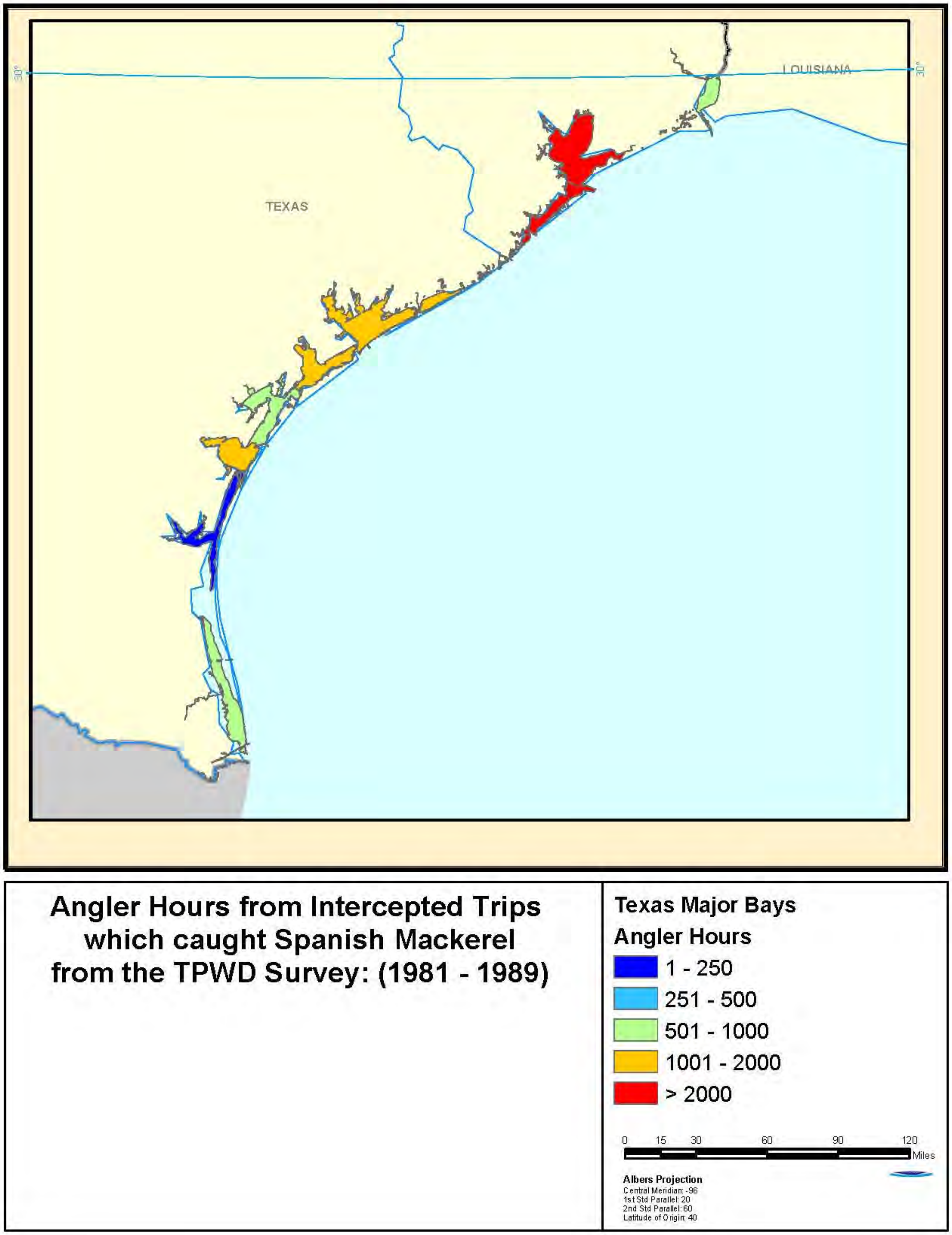


**Figure 4.12.30** Angler hours from trips which intercepted Spanish mackerel in the TPWD, 1983-1989.

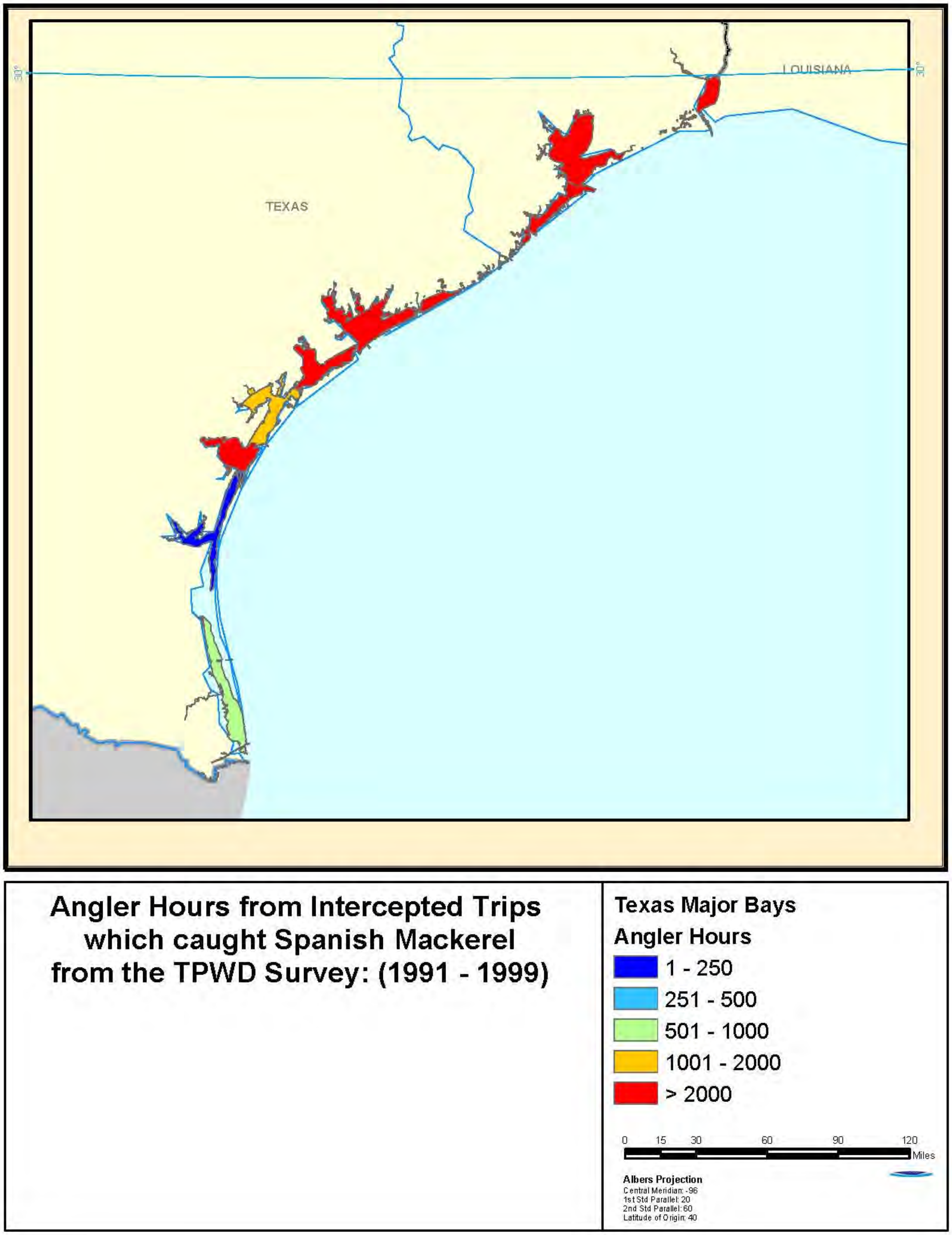


**Figure 4.12.31** Angler hours from trips which intercepted Spanish mackerel in the TPWD, 1991-1999.

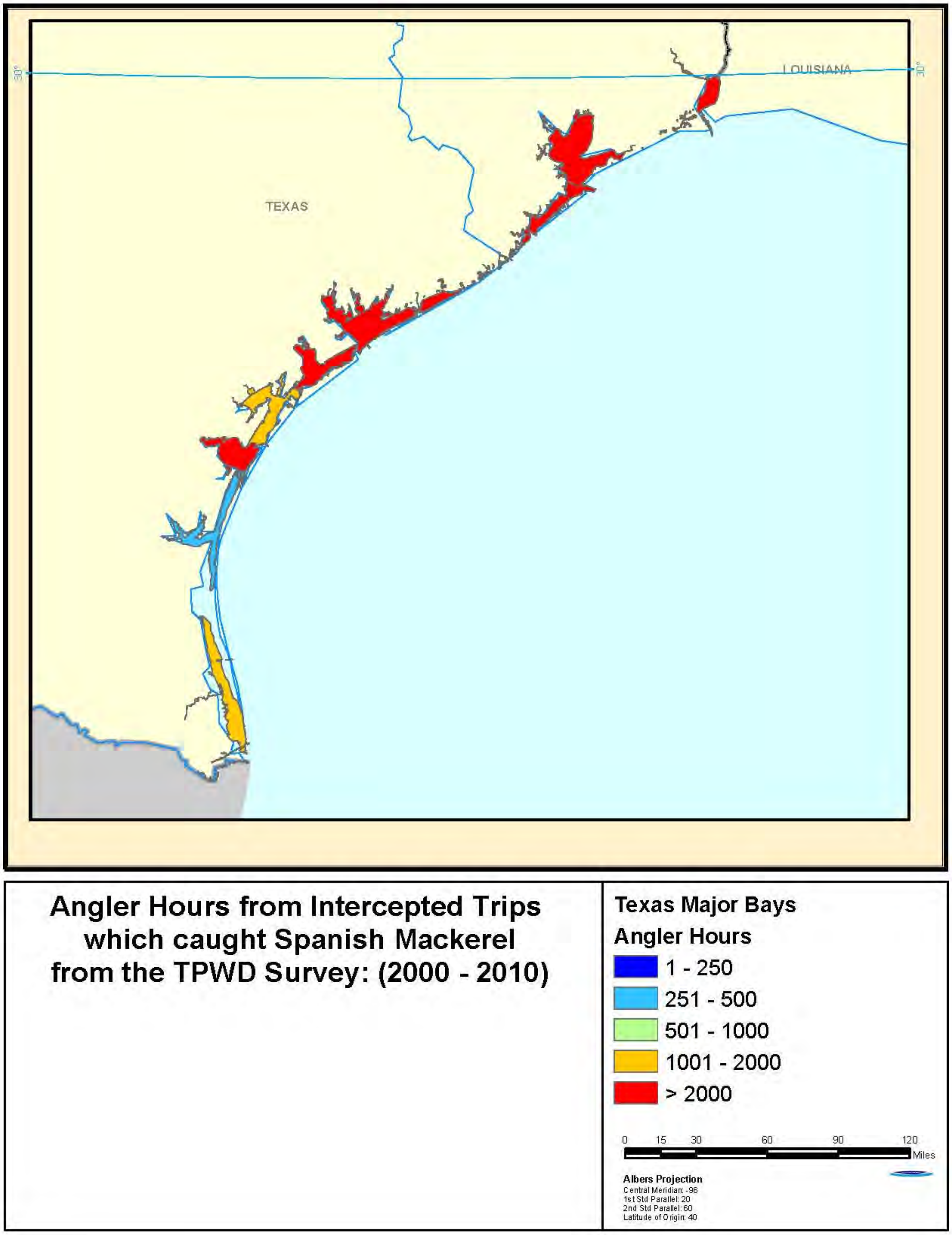


**Figure 4.12.32** Angler hours from trips which intercepted Spanish mackerel in the TPWD, 2000-2010.

# 5 Measures of Population Abundance

## 5.1 Overview

Analytical results of nine data sets were presented to the Index Working Group (IWG). Eight of the data sets were of fishery-dependent origin and one was of fishery-independent origin. These data sets are listed here along with recommendations by the IWG of whether or not to use the resulting indices in the stock assessment model:

- SEAMAP groundfish survey (*Recommended for use*)
- Texas sport boat angler survey (*Not recommended for use*)
- Commercial logbooks – vertical lines (*Not recommended for use*)
- Commercial logbooks – gillnet (*Not recommended for use*)
- Headboat (*Not recommended for use*)
- MRFSS (*Recommended for use*)
- FL trip ticket – castnet (*Not recommended for use*)
- FL trip ticket – handline/trolling (*Recommended for use*)
- FL trip ticket – gillnet (*Not recommended for use*)

The ranking of indices for Gulf Spanish mackerel by the IWG was 1) SEAMAP 2) trip ticket 3) MRFSS. Also, index adequacies and inadequacies are in report card comments.

**Group Membership**
IWG members included, Walter Ingram, Jeanne Boylan, Pearse Webster, Clay Porch, Neil Baertlein, Kevin McCarthy, Steve Saul, Meaghan Bryan, Katie Andrews, Kevin Craig, Michael Schirripa, Nancie Cummings, Julia Byrd, Amy Schueller, Eric Fitzpatrick and Mike Errigo, and included other DW participants as needed for discussions throughout the week.

## 5.2 Review of Working Papers

Not identified.

## 5.3 Fishery Independent Indices

### 5.3.1 SEAMAP Groundfish Survey

The Southeast Fisheries Science Center (SEFSC) Mississippi Laboratories have conducted standardized groundfish surveys under the Southeast Area Monitoring and Assessment Program (SEAMAP) in the Gulf of Mexico (GOM) since 1987. SEAMAP is a collaborative effort between federal, state and university programs, designed to collect, manage and distribute fishery independent data throughout the region. The primary objective of this trawl survey is to collect data about the abundance and distribution of demersal organisms in the northern GOM. This survey, which is conducted semi-annually (summer and fall), provides an important source of fisheries independent information on many commercially and recreationally important species throughout the GOM.

A full review of the survey design and methodologies are described in SEDAR28-DW03. The appendix of the document provides an additional index for Spanish mackerel, which was requested by the data working group that only includes data from the federal vessels, since complete state data for 2011 was not available at the time for analysis. We caution using this index (1987-2011, federal only), especially under the new survey design since the states make up a larger portion of the survey (2009: 645 vs. 506 total stations; 2010: 389 vs. 286 total stations). A significant about of data is lost east of the Mississippi River, since MS and AL sample about 60 stations a year. It is also important to note that the majority of the state stations are the shallower stations that get included in the analysis due to the depth distribution of Spanish mackerel.

#### *5.3.1.1 Methods of Estimation*

**Data Filtering Techniques**

Based upon the limited recent sampling that has taken place in shrimp statistical zones 3-9 (Table 5.3.1.1), it was decided to limit the data for this analysis to only zones 10-21 (note that zone 12 is completely outside of the depth range of this survey (5 to 60 fathoms), therefore it is not sampled). Of the 495 stations sampled, only 3 occurrences of Spanish mackerel were reported from these statistical zones. Upon examining the depth zone distribution of occurrences of Spanish mackerel (Table 5.3.1.2), the data were also limited by depth zone, in addition to the aforementioned shrimp statistical zones. For the full model run, all depth zones greater than 35 fathoms were excluded from the analysis. These depth zones accounted for less than 1% of all Spanish mackerel occurrence overall, in addition to not having occurrences greater than 1 % individually.

Based upon the recommendations of the Data Working Group, in addition to the indices from the combined summer and fall surveys, individual indices were prepared from summer and fall surveys. For the fall survey, the same depth zones and statistical zones as the full model run were excluded. However, during the summer months, Spanish mackerel were found in shallower depths overall, with only 6 stations outside of 20 fathoms having a positive occurrence, therefore it was necessary to exclude all depth zones greater than 20 fathoms from the analysis.

**Standardization**

Delta-lognormal modeling methods were used to estimate relative abundance indices for Spanish mackerel (Lo *et al*. 1992). The main advantage of using this method is allowance for the probability of zero catch (Ortiz *et al.* 2000). The index computed by this method is a mathematical combination of yearly abundance estimates from two distinct generalized linear models: a binomial (logistic) model which describes proportion of positive abundance values (i.e. presence/absence) and a lognormal model which describes variability in only the nonzero abundance data (Lo *et al*. 1992).

The submodels of the delta-lognormal model were built using a backward selection procedure based on type 3 analyses with an inclusion level of significance of $\alpha = 0.05$. Binomial submodel performance was evaluated using AIC, while the performance of the lognormal submodel was evaluated based on analyses of residual scatter and QQ plots in addition to AIC.

**Submodel Variables**

Year: 1987-2010

Area: Texas (statistical zones 18-21), West Delta (statistical zones 13-17), East Delta (statistical zones 10-11)

Depth Zone: 5-6, 6-7, 7-8, 8-9, 9-10, 10-11, 11-12, 12-13, 13-14, 14-15, 15-16, 16-17, 17-18, 18-19, 19-20, 20-22, 22-25, 25-30, 30-35
Time of Day: Day, Night
Season: Summer, Fall
Survey: Old, New

**Annual Abundance Indices**
For a full review of the backward selection procedure for each submodel and diagnostic plots, refer to SEDAR28-DW03.

In the full model (summer and fall surveys), year, area, depth zone, time of day and season were retained in the binomial submodel. The variables retained in the lognormal submodel were year, area, depth zone and time of day. The AIC for the binomial and lognormal submodels were 56,581.5 and 1999.9, respectively. The AIC for the binomial submodel increased slightly when the survey variable was removed from the submodel, however, based upon the p-value (0.2844), it was determined that the slight increase was acceptable. However, the AIC for the lognormal submodel was the lowest of all the model runs.

For the summer model, year, area, depth zone and time of day were retained in the binomial submodel. The variable retained in the lognormal submodel was year. The AIC for the binomial and lognormal submodels were 23,424.2 and 627.0, respectively. Since all the variables were significant in the binomial submodel the AIC remained unchanged. However, the AIC value increased slightly when variables were removed from the lognormal submodel. Based upon the p-values for area, depth zone and time of day (0.9707, 0.2587 and 0.0691, respectively), it was determined that the slight increase was acceptable.

For the fall model, year, area, depth zone and time of day were retained in both the binomial and lognormal submodels. The AIC for the binomial and lognormal submodels were 27,218.7 and 1300.5, respectively. Since all variables were significant in the both submodels the AIC remained unchanged.

#### *5.3.1.2 Sampling Intensity*
A total of 11,433 stations were sampled from 1987- 2010 (Figure 5.3.1.1).

#### *5.3.1.3 Size/Age Data*
The sizes of Spanish mackerel represented in this index are presented in Table 5.3.1.3 and Figures 5.3.1.2.

#### *5.3.1.4 Catch Rates*
Standardized catch rates are presented in Tables 5.3.1.4 - 5.3.1.6.

#### *5.3.1.5 Uncertainty and Measures of Precision*
Annual CVs of catch rates are presented in Tables 5.3.1.4 - 5.3.1.6.

#### *5.3.1.6 Comments on Adequacy for Assessment*

The IWG recommended this index for Spanish mackerel for use in the assessment model, due to the fact that it is a fisheries independent survey across a long time series (1987-2010), with very good spatial converge (TX/Mexico border to Mobile Bay).

## 5.4 Fishery Dependent Indices

### 5.4.1 Texas Parks and Wildlife Departments Sport-boat Angling Survey

Information on catch per unit of effort for recreational coastal sport-boat fisheries in Texas was summarized. These data were evaluated for the use of calculating catch per unit of effort (CPUE) abundance trends for Spanish mackerel in the Gulf of Mexico for use in SEDAR 28 stock evaluations. The Texas Parks and Wildlife Departments Sport-boat Angling Survey (TPWD) index included interviews from May through September, private and charterboat modes, Gulf areas off major bay systems in nearshore and offshore waters only. Observations of recreational catch and effort were available for sport-boat fisheries in Texas from 1983 - 2010. The TPWD Sport-boat Angling Survey samples fishing trips made by sport-boat anglers fishing in Texas marine waters; these include private and charterboat fisheries. All sampling takes place at recreational boat access sites. The primary focus of the TPWD survey is on private boats fishing in bays and passes because this accounts for most of the coastwide fishing pressure and landings in TX (78% of fishing effort and 67% of landings during May15, 2002 to May 14, 2003). Private boats in gulf waters (7% of effort), charterboats in bays and passes (14% of effort), and charterboats in gulf waters (<2% of effort) are also included in the TPWD survey, but special surveys are added to increase the precision of trips fishing in gulf areas since they are not encountered frequently in the normal survey. In addition, the survey is designed to estimate landings and effort by high-use seasons (May15-November 20) and low-use seasons (November 21-May 14). More details regarding the TPWD sport-boat fishing surveys are provided in Appendices I and II. For all analyses CPUE was calculated as catch (number fish caught) divided by effort (number anglers x triplength).

The development of the CPUE index is described in more detail in SEDAR28-DW09. The appendix to the working paper describes decisions made by the SEDAR 28 DW panel with updated tables and figures. The SEDAR 28 DW index working group decisions summarized in SEDAR28-DW09 (Appendix 1).

#### *5.4.1.1 Methods of Estimation*

**Data Filtering Techniques**

While exploring TPWD data to develop a standardized index for Spanish mackerel in the Gulf of Mexico, the following methods were investigated.

*Stephens & McCall*

First the Stephens and MacCall (2004) method was explored in an attempt to identify directed Spanish mackerel trips in the complete TPWD recreational data CPUE data set. This method uses the species composition information on a trip to subset the complete data or to help identify trips or set to only those trips on which the species of interest (the target species, Spanish mackerel in this case) would occur. The analysis involves fitting a logistic regression to the presence-absence of each trip's species catch. Routinely, the species composition included in the regression includes only those species occurring in at least 1% of all the trips combined. The analysis results include a critical probability value that predicts the target species presence and/or absence in the study data set which is used to select trips on an objective basis. In the Stephens and MacCall analysis of the TPWD data 329,616 unique trips were evaluated for Spanish mackerel targeting preference. The species that occurred in at least 1% of all the trips were TPWD species codes: 614, 629, 616, 625, 613, 602, 621, 772, 758, 818, 611, and 681 (Spanish mackerel). These species were then included in the logistic regression with Spanish mackerel included as the target species. The results of the Stephens MacCall analyses of the TPWD recreational CPUE data were not successful in identifying a suite of trips targeting Spanish mackerel. We found that on the majority of the 329, 616 fishing trips only one or two species were caught making it difficult to identify a group of species that might associate with the target species (Spanish mackerel). In total, across all the time series, 1983-2010, Spanish mackerel occurred on only 1.1% (n=3,653) of all trips. Thus, we considered two datasets for the CPUE standardization analyses. The first set of observations included all the data. The second data set that was evaluated for CPUE was formed by excluding inshore fishing trips from the CPUE SEDAR28-DW09 2 standardizations. We found that the majority of the recreational fishing effort for Spanish mackerel did not occur inshore but rather in waters <10 miles (TTS, NEWAREA 3) or in waters >10 miles (EEZ, NEWAREA area 4) thus inshore effort in the bays and passes (NEWAREA 5) was excluded from subsequent analyses. The total number of trips in these two areas waters <10 miles and waters >10 miles) was 25, 337 of which Spanish mackerel occurred in 308 or 1.2% across all years. The exclusion of bays and passes is consistent with the previous MSAP 2003 analysis. For each analysis data set (Set 1: all observations (n=329, 616 trips) and Set 2: NEWAREAS 3 and 4 (n=25,337 trips) we then attempted to construct standardized CPUE indices were explored using the delta-lognormal modeling approach (Lo et al. 1992). This method applies two separate models, fitting a lognormal model to the positive CPUE observations and a separate binomial (logistic) model to the proportion of successful (positive) observations and combines results from the two models to obtain a single index. Parameter estimates were obtained using a general linear modeling (GLM) procedure (SAS GLIMMIX and MIXED procedures; SAS v.9.2 2004 of the SAS System, SAS Institute Inc.; Cary, NC, USA) to develop the binomial and lognormal sub models. Factor (covariate) significance was evaluated using Type 3 residual analysis and overall performance was assessed from residual analysis graphics. Residuals by year were plotted and reviewed and QQ plots of the residuals against a normal distribution were plotted. In applying the GLM procedure we assumed the proportion of successful trips per stratum approximated a binomial distribution, where the estimated probability was a linearized function of the fixed factors. We used a second generalized linear model to examine the influence the fixed factors on log(CPUE) of successful trips assuming a normal error distribution for the positive catch rates. As defined earlier, catch rate was calculated as number fish caught divided by (number anglers x triplength). Model Construction A forward stepwise procedure was used to quantify the relative importance of the factors that influenced catch rates. Factors evaluated were: YEAR, MONTH, NEWAREA (3 = <10 miles (TTS), 4 = >10 miles (EEZ), 5 = inshore (bays and passes), major bay (1 = Sabine Lake, 2 = Galveston, 3 = Matagorda, 4 = San Antonio, 5 = Aransas, 6 = Corpus Christi, 7 = Upper Laguna Madre, 8 = lower Laguna Madre), mode (3 = charterboat, 4 = private boat). First the null model was run. These results reflect the distribution of the nominal data. Next we added each potential factor to the null model one at a time, and examined the resulting reduction in deviance per degree of freedom. The factor that caused the greatest reduction in deviance per degree of freedom was added to the base model if the factor was significant ($p<0.05$) based upon a Chi-Square test, and the reduction in deviance per degree of freedom was >1%. This model then became the base model, and the process was repeated, adding factors and interactions individually until no factor or interaction met the criteria for incorporation into the final model. Year was always included in the model, regardless of its importance because it is required to calculate the standardized catch index for each year. After the models were identified, they were fit to the proper response variables using the SAS macro GLIMMIX (c/o Russ Wolfinger, SAS Institute Inc.). All factors and interactions were treated as fixed effects except year*factor interactions, which were treated as random effects. Interaction effects at the first level were considered for all the fixed factors.

**Positive Trips**
Applying methods described by Stephens & MacCall (2004) to Spanish mackerel resulted in a 67% reduction in positive Spanish mackerel trips while identifying approximately 11,000 trips that were unsuccessful at catching Spanish mackerel. A large reduction in positive Spanish mackerel trips and an inflation of zero Spanish mackerel trips was anticipated due to the infrequency of Spanish mackerel in the Texas nearshore fishery, therefore a more appropriate method was pursued.

**Analytic Approach**
For each analysis data set (Set 1: all observations (n=329, 616 trips) and Set 2: areas 3 and 4 only (n=25,337 trips) we then attempted to construct standardized CPUE indices were explored using the delta-lognormal modeling approach (Lo et al. 1992). This method applies two separate models, fitting a lognormal model to the positive CPUE observations and a separate binomial (logistic) model to the proportion of successful (positive) observations and combines results from the two models to obtain a single index. Parameter estimates were obtained using a general linear modeling (GLM) procedure (SAS GLIMMIX and MIXED procedures; SAS v.9.2 2004 of the SAS System, SAS Institute Inc.; Cary, NC, USA) to develop the binomial and lognormal sub models. Factor (covariate) significance was evaluated using Type 3 residual analysis and overall performance was assessed from residual analysis graphics. Residuals by year were plotted and reviewed and QQ plots of the residuals against a normal distribution were plotted. In applying the GLM procedure we assumed the proportion of successful trips per stratum approximated a binomial distribution, where the estimated probability was a linearized function of the fixed factors. We used a second generalized linear model to examine the influence the fixed factors on log(CPUE) of successful trips assuming a normal error distribution for the positive catch rates. As defined earlier, catch rate was calculated as number fish caught divided by (number anglers x triplength).

#### *5.4.1.2 Sampling Intensity*
The resulting data set contained n=329, 616 trips for all areas, and n=25,337 trips for areas 3 and 4 only.

#### *5.4.1.3 Size/Age data*
The sizes/ages represented in this index should be the same as those of landings from the corresponding fleet.

#### 5.4.1.4 Catch Rates
Standardized catch rates and associated error bars are shown in SEDAR28-DW09.

#### 5.4.1.6 Comments on Adequacy for Assessment
The index of abundance created from the TPWD data was considered by the indices working group to be inadequate for potential use in the Spanish mackerel assessment. Although the data set has an adequately large sample size and has a long enough time series to provide potentially meaningful information for the assessment, the survey covers only a small portion of the stock as described for the Gulf of Mexico and mostly surveys an area where Spanish mackerel are not abundant or targeted. In addition, catch rates were extremely low and the index was derived from fishery dependent data.

### 5.4.2 Commercial Vertical line Index
Using the Coastal Fisheries Logbook Program's (CFLP) available catch per unit effort (CPUE) data, indices of abundance of Spanish mackerel were constructed for the U.S. Gulf of Mexico from 1998 through 2010. The indices were constructed using data submitted by Federally permitted commercial vertical line vessels. Commercial fishing activity reported by fishers to the CFLP is at the trip level. For each fishing trip, the CFLP database includes a unique trip identifier, the landing date, fishing gear deployed, areas, number of days at sea, number of crew, gear specific fishing effort, species caught and weight of the landings.

Using only positive trips, a lognormal model was used for the construction of the vertical line index of abundance. The catch per unit effort for vertical line was defined as gutted pounds per hook hour fished. Complete details concerning the methods and results of the analyses are described in SEDAR28-DW15.

#### 5.4.2.1 Methods
**Data Filtering Techniques**

Multiple areas fished and multiple gears fished may be recorded for a single fishing trip. In such cases, assigning catch and effort to specific locations or gears was not always possible; therefore, only trips which reported one area category and one gear fished were included in these analyses. Data were further restricted to include only those trips with landings and effort data received by the CFLP within 45 days of the completion of the trip. Reporting delays beyond 45 days likely results in less accurate effort data. Trips in which errant or missing data were present were removed from the analyses. These included missing number lines, number of hooks, and hours fished for vertical gear. Vertical gear trips reporting 24 or more hours per day fishing were also excluded.

Following the exclusion of trips listed above, outliers were removed in which number of lines, and hooks fell outside the upper 99.5 percentile.

**Subsetting trips**

For the vertical gear analysis, only positive Spanish mackerel trips were used from 1998 through 2010.

**Model Input**
Significant effects on the CPUE of positive trips were tested using general linear model (GLM) analysis. For the analysis of catch rates on successful trips, a type-3 model assuming lognormal error distribution was examined. The linking function selected was "normal", and the response variable was log(CPUE). The response variable of data was calculated as: log(CPUE) = ln(pounds of Spanish mackerel/hook hour). All 2-way interactions among significant main effects were examined. Higher order interaction terms were not examined.
The final model for the lognormal on CPUE of successful trips was:
**Vertical Line:**
**LOG(CPUE) = Year + Days_at_sea + Subregion + Quarter + Days_at_sea*Subregion + Subregion*Quarter**

**Standardization**
For vertical trips, only positive trips were included and a lognormal model was used for index construction. The lognormal model was fit using a PROC MIXED SAS procedure (Version 9.2 SAS Institute). All factors were modeled as fixed effects except two-way interaction terms containing YEAR which were examined as random effects to be included in the final model. Selection of the final mixed model was based on the Akaike's Information Criterion (AIC), Schwarz's Bayesian Criterion (BIC), and a chi-square test of the difference between the –2 log likelihood statistics between successive model formulations (Littell et al. 1996). For comparison, a relative index and relative nominal CPUE series were calculated by dividing each value in the series by the mean value of the series.
The standardized indices of abundance, number of trips, and relative nominal CPUE for vertical are shown in Table 5.4.2.1. The relative nominal CPUE and standardized index, with 95% confidence intervals, are shown in Figure 5.4.2.1.

### *5.4.2.2 Sampling Intensity*
The final dataset for the vertical line index contained 4,628 trips, all of which were positive trips.

### *5.4.2.3 Size/Age data*
The sizes/ages represented in these indices would likely be reflective of those in the GOM commercial landings.

### *5.4.2.4 Catch Rates*
The relative nominal CPUE and standardized indices, with 95% confidence intervals, are shown in Figure 5.4.2.1.

### *5.4.2.5 Comments on Adequacy for Assessment*
Despite covering the entire Gulf of Mexico, the working group recommended to not use the vertical line index. It was recommended that the Florida Trip Ticket index be used instead as it showed the same general trend during the common years (1998-2010), but had a much longer time series dating back to 1986. Confidence in the Florida Trip Ticket index was reinforced by the fact that Florida possesses the majority of the Gulf of Mexico Spanish Mackerel fishery. For exploratory purposes, an additional vertical line index was constructed with CFLP data for all areas west of the Florida panhandle as the Florida Trip Ticket program would not capture this data.

### 5.4.3 Commercial Gillnet Index

Using the Coastal Fisheries Logbook Program's (CFLP) available catch per unit effort (CPUE) data, indices of abundance of Spanish mackerel were constructed for the U.S. Gulf of Mexico from 1998 through 2010. The index was constructed using data submitted by Federally permitted commercial gillnet vessels. Commercial fishing activity reported by fishers to the CFLP is at the trip level. For each fishing trip, the CFLP database includes a unique trip identifier, the landing date, fishing gear deployed, areas, number of days at sea, number of crew, gear specific fishing effort, species caught and weight of the landings.

A delta-lognormal was model was used for the construction of the gillnet index. The proportion of positive trips for gillnet ranged from 37-79%. Gillnet CPUE was defined as gutted pounds per square yard hour fished. Complete details concerning the methods and results of the analyses are described in SEDAR28-DW15.

#### *5.4.3.1 Methods*

**Data Filtering Techniques**

Multiple areas fished and multiple gears fished may be recorded for a single fishing trip. In such cases, assigning catch and effort to specific locations or gears was not always possible; therefore, only trips which reported one area category and one gear fished were included in these analyses. Data were further restricted to include only those trips with landings and effort data received by the CFLP within 45 days of the completion of the trip. Reporting delays beyond 45 days likely results in less accurate effort data. Trips in which errant or missing data were present were removed from the analyses. Gillnet trips with missing net length, depth (i.e. width), or hours fished were excluded.

Following the exclusion of trips listed above, records were dropped when gillnet length or gillnet depth (width) were below the 0.5 percentile or above the 99.5 percentile. Additional gillnet trips were removed from consideration when stake gillnet was reported or when shark landings were reported as this fishing effort were unlikely to land any Spanish mackerel.

**Subsetting trips**

All gillnet trips from 1998 through 2010 were considered for the gillnet index. Gillnet trips were also categorized as having, or not having, a king mackerel gillnet endorsement. Catchability of those vessels likely differs from other gillnet vessels.

**Model Input**

Significant effects on the proportion of positive trips and on the CPUE of positive trips were tested using general linear model (GLM) analyses. For the GLM analysis of proportion positive trips, a type-3 model was fit, a binomial error distribution was assumed, and the logit link was selected. The response variable was proportion successful trips. For the analysis of catch rates on successful trips, a type-3 model assuming lognormal error distribution was examined. The linking function selected was "normal", and the response variable was log(CPUE). The response variable of data was calculated as: log(CPUE) = ln(pounds of Spanish mackerel/square yard hours). All 2-way interactions among significant main effects were examined. Higher order interaction terms were not examined.

The final models for the binomial on proportion positive trips (PPT) and the lognormal on CPUE of successful trips were:

**Gillnet:**
**PPT = Year + Total_effort + GN_Endorsement + Subregion + Total_effort*GN_Endorsement**
**LOG(CPUE) = Year + Subregion + Year*Subregion**

**Standardization**

For gillnet, the final delta-lognormal model was fit using a SAS macro, GLMMIX (Russ Wolfinger, SAS Institute). All factors were modeled as fixed effects except two-way interaction terms containing YEAR which were examined as random effects to be included in the final model. Selection of the final mixed model was based on the Akaike's Information Criterion (AIC), Schwarz's Bayesian Criterion (BIC), and a chi-square test of the difference between the –2 log likelihood statistics between successive model formulations (Littell et al. 1996). For comparison, a relative index and relative nominal CPUE series were calculated by dividing each value in the series by the mean value of the series.

The standardized index of abundance, number of trips, and relative nominal CPUE for gillnet are shown in Table 5.4.3.1. The relative nominal CPUE and standardized index, with 95% confidence intervals, are shown in Figure 5.4.3.1.

#### *5.4.3.2 Sampling Intensity*

There were 855 gillnet trips used in the construction of the gillnet index. Proportion positive gillnet trips ranged from 37-79%.

#### *5.4.3.3 Size/Age data*

The sizes/ages represented in these indices would likely be reflective of those in the GOM commercial landings.

#### *5.4.3.4 Catch Rates*

The relative nominal CPUE and standardized indices, with 95% confidence intervals, are shown in Figure 5.4.3.1.

#### *5.4.3.5 Comments on Adequacy for Assessment*

The working group decided against recommending the gillnet index as the method of targeting Spanish mackerel schools and using a runaround gillnet to capture them would like cause 'hyper-stability' in the index and would not be a true reflection of abundance.

### 5.4.4 Recreational Headboat Index – Spanish mackerel

The Headboat Survey covers the Gulf of Mexico headboats starting in 1986 and was used develop standardized catch per unit effort (CPUE) indices of abundance. This work uses the catch and effort observations from the Headboat Survey to develop standardized catch per unit effort (CPUE) indices of abundance for the recreational fishery for Spanish mackerel (*Scomberomorus maculatus*) in the Gulf of Mexico (GOM). A delta lognormal modeling approach was used to develop these indices. The Species Association Approach (Stephens and

MacCall 2004) was explored to identify directed Spanish mackerel trips, while balancing these subsets of the data with sample size.

#### *5.4.4.1 Methods for Estimation*

The Headboat Survey data were looked at across different strata to assess the sample size of total trips and positive trips within each of the strata. The datasets were spatially partitioned according to the decisions that were made during the SEDAR 28 data workshop plenary sessions. For Spanish mackerel, the stock boundary dividing the Gulf of Mexico from the South Atlantic stock during the data workshop was determined to be the Florida Keys. For Spanish mackerel, the headboat dataset was partitioned where fish surveyed in areas 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, and 17 (all the areas shown on the map in Figure 5.4.4.1).

**Data filtering techniques**

*Stephens and MacCall*

The Stephens and MacCall (2004) approach was explored to identify Spanish mackerel directed trips. This approach resulted in a large reduction in the Spanish mackerel trips and was therefore not used.

*All trips versus positive trips*

The SEDAR 28 data workshop Indices Working Group and panel evaluated and discussed the various alternatives to identifying targeted trips, and agreed that they served little utility for the GOM subset of the data. The working group also noted that there was little difference in the indices that were estimated for the entire dataset and the indices estimated for the subset of only positive trips. Therefore, it was decided at the data workshop, that fishing effort for Spanish mackerel would be based on all trips. This decision was made because Spanish mackerel represent an opportunistically captured fish while targeting other species. Therefore, most trips in the Headboat database represents potential fishing effort for Spanish mackerel.

**Model Input**

*Response and explanatory variables*

*CPUE*- catch per unit effort (CPUE) has units of the number of caught to the number of fish caught on a given trip divided by the effort, where effort was calculated as the product of the number of people on the headboat and the hours fished.

*Year* – A summary of the total number of trips, the number of positive trips, and the percent of positive trips per year is presented in Table 5.4.4.1.

*Month* –The total number of trips, the number of positive trips, and the percent of positive trips per month and year were summarized due to the significant interaction between month and year however tables cannot be displayed for confidentiality reasons.

*Area* – The total number of trips, the number of positive trips, and the percent of positive trips per area and year were summarized due to the significant interaction between these factors however tables cannot be displayed for confidentiality reasons.

**Standardization**

For the indices constructed on the complete datasets, the delta lognormal model approach (Lo et al. 1992) was used. This method combines separate generalized linear model (GLM) analyses of the proportion of successful trips (trips that landed Spanish mackerel) and the catch rates on successful trips to construct a single standardized CPUE index. Parameterization of each model was accomplished using a GLM procedure (GENMOD; Version 8.02 of the SAS System for Windows © 2000. SAS Institute Inc., Cary, NC, USA). To estimate the response variable, the proportion of positive trips, a binomial model was used. The GLM procedure was fitted to the observed proportion positive trips using a type-3 model with a binomial error distribution and a logit link function. The second component of the delta lognormal approach is to estimate the natural log of the CPUE using a type-3 model with a lognormal error distribution and a normal link function.

A stepwise approach was used to quantify the relative importance of the explanatory factors. First a GLM model was fit on year. These results reflect the distribution of the nominal data. Next, each potential explanatory factor was added to the null model sequentially and the resulting reduction in deviance per degree of freedom was examined. The factor that caused the greatest reduction in deviance per degree of freedom was added to the base model if the factor was significant based upon a Chi-Square test ($p<0.05$), and the reduction in deviance per degree of freedom was ≥1%. This model then became the base model, and the process was repeated, adding factors and interactions individually until no factor or interaction met the criteria for incorporation into the final model. All 2-way interactions among significant main effects were examined, however higher order interaction terms were not examined. The final delta-lognormal model was fit using a SAS macro, GLIMMIX (Russ Wolfinger, SAS Institute). All factors were modeled as fixed effects except two-way interaction terms containing year which were modeled as random effects. To facilitate visual comparison, a relative standardized index and relative nominal CPUE series were calculated by dividing each value in the series by the mean value of the entire time-series.

#### *5.4.4.2 Sampling Intensity*

The resulting data set contained 186,184 trips with 38.89% positive Spanish mackerel trips (Table 5.4.4.1).

#### *5.4.4.3 Size/Age data*

The sizes/ages represented in this index should be the same as those of landings from the corresponding fleet.

#### *5.4.4.4 Catch Rates*

Standardized catch rates and confidence intervals are shown in Figure 5.4.4.2 and tabulated in Table 5.4.4.3. Figure 5.4.4.3 shows the Q-Q plot of the CPUE observations and Figure 5.4.4.4 shows the binomial fit to the observed proportion positive Spanish mackerel trips.

#### *5.4.4.5 Uncertainty and Measures of Precision*

95% confidence intervals were calculated from the mean square error output from the GLM procedures.

#### *5.4.4.6 Comments on Adequacy for Assessment*

The WG group decided that this index was suitable for assessment.

### 5.4.5 Recreational MRFSS Index – Spanish mackerel

MRFSS provides information on participation, effort, and species-specific catch. Data are collected to provide catch and effort estimates in two-month periods ("waves") for each recreational fishing mode (shore fishing, private/rental boat, charterboat, or headboat/charterboat combined) and area of fishing (inshore, state Territorial Seas, U.S. Exclusive Economic Zone) in each state, except TX. MRFSS was conducted in TX through 1985 and did not include all modes in all years. Starting in 1986, MRFSS no longer covered headboats in the Gulf of Mexico and South Atlantic. Catch estimates are made for strata used in the intercepts: fish landed whole and observed by the samplers ("Type A"), fish reported as killed by the fishers ("Type B1") and fish reported as released alive by the fishers ("Type B2").

This work uses the catch and effort observations from the MRFSS database to develop standardized catch per unit effort (CPUE) indices of abundance for the recreational fishery for Spanish mackerel (*Scomberomorus maculatus*) in the Gulf of Mexico (GOM). A delta lognormal modeling approach was used to develop these indices.

The MRFSS data set was evaluated across different strata to assess the sample size of total trips and positive trips within each of the strata. Data from Texas, present in the years 1981 through 1985, were removed from the MRFSS data because the State of Texas has its own survey. In addition, data from the headboat mode in MRFSS, also present in the years 1981 through 1985, was removed because this information is covered by the Headboat Survey program.

The dataset was partitioned according to the decisions that were made during the SEDAR 28 data workshop during the plenary sessions. The stock boundary for GOM Spanish mackerel was determined to be the Florida Keys at the Monroe County line.

For the MRFSS data, if there were anglers on a trip that actively fished but were not interviewed, the data were adjusted to account for the catch and effort of these non-interviewed anglers. This adjustment was made by dividing the total catch made by those individuals who were interviewed by the number of people interviewed. This average catch per person was then multiplied by the number of anglers that were not interviewed and the resulting catch was then added to the total catch for that trip.

#### *5.4.5.1 Methods for Estimation*

**Data filtering techniques**

*Stephens and MacCall*

The Stephens and MacCall (2004) approach was explored to identify Spanish mackerel directed trips. This approach resulted in a large reduction in the Spanish mackerel trips and was therefore not used.

*All trips versus positive trips*

The SEDAR 28 data workshop Indices Working Group and panel evaluated and discussed the various alternatives to identifying targeted trips, and agreed that they served little utility for the GOM subset of the data. The working group also noted that there was little difference in the indices that were estimated for the entire dataset and the indices estimated for the subset of only positive trips. Therefore, it was decided at the data workshop, that fishing effort for Spanish mackerel would be based on all trips. This decision was made because Spanish mackerel represent an opportunistically captured fish while targeting other species. Therefore, most trips in the MRFSS database represent potential fishing effort for Spanish mackerel.

**Model Input**

*Response and explanatory variables*

*CPUE*- catch per unit effort (CPUE) has units of the number of caught to the number of fish caught on a given trip divided by the effort, where effort was calculated as the product of the number of people on the headboat and the hours fished.

*Year* – A summary of the total number of trips, the number of positive trips, and the percent of positive trips per year is presented in Table 5.4.5.1.

*Month* – Tables 5.4.5.2-5.4.5.4 summarize the total number of trips, the number of positive trips, and the percent of positive trips per month and year due to the significant interaction between month and year.

*Mode* – Table 5.4.5.5 summarizes the total number of trips, the number of positive trips, and the percent of positive trips per mode and year.

*State* – Table 5.4.5.6 summarizes the total number of trips, the number of positive trips, and the percent of positive trips per state and year due to their significant interaction.

**Standardization**

For the indices constructed on the complete datasets, the delta lognormal model approach (Lo et al. 1992) was used. This method combines separate generalized linear model (GLM) analyses of the proportion of successful trips (trips that landed Spanish mackerel) and the catch rates on successful trips to construct a single standardized CPUE index. Parameterization of each model was accomplished using a GLM procedure (GENMOD; Version 8.02 of the SAS System for Windows © 2000. SAS Institute Inc., Cary, NC, USA). To estimate the response variable, the proportion of positive trips, a binomial model was used. The GLM procedure was fitted to the observed proportion positive trips using a type-3 model with a binomial error distribution and a logit link function. The second component of the delta lognormal approach is to estimate the natural log of the CPUE using a type-3 model with a lognormal error distribution and a normal link function.

A stepwise approach was used to quantify the relative importance of the explanatory factors. First a GLM model was fit on year. These results reflect the distribution of the nominal data. Next, each potential explanatory factor was added to the null model sequentially and the resulting reduction in deviance per degree of freedom was examined. The factor that caused the greatest reduction in deviance per degree of freedom was added to the base model if the factor was significant based upon a Chi-Square test ($p<0.05$), and the reduction in deviance per degree of freedom was ≥1%. This model then became the base model, and the process was repeated, adding factors and interactions individually until no factor or interaction met the criteria for incorporation into the final model. All 2-way interactions among significant main effects were examined, however higher order interaction terms were not examined. The final delta-lognormal model was fit using a SAS macro, GLIMMIX (Russ Wolfinger, SAS Institute). All factors were modeled as fixed effects except two-way interaction terms containing year which were modeled as random effects. To facilitate visual comparison, a relative standardized index and relative nominal CPUE series were calculated by dividing each value in the series by the mean value of the entire time-series.

The model used for standardization was:

$$Success = \mu + (Year)\alpha_1 + (Month)\alpha_2 + \varepsilon$$

$$\ln(CPUE) = \mu + (Year)\alpha_1 + (Mode)\alpha_2 + (State)\alpha_3 + (Month)\alpha_4 + (Year * Month)\alpha_5 + (Year * State)\alpha_6 + \varepsilon$$

#### 5.4.5.2 Sampling Intensity

The resulting data set contained 559,659 trips with 4.77% positive Spanish mackerel trips (Table 5.4.5.1).

#### 5.4.5.3 Size/Age data

The sizes/ages represented in this index should be the same as those of landings from the corresponding fleet.

#### 5.4.5.4 Catch Rates

Standardized catch rates and confidence intervals are shown in Figure 5.4.5.1 and tabulated in Table 5.4.4.3. Figure 5.4.5.2 shows the Q-Q plot of the CPUE observations and Figure 5.4.5.3 shows the binomial fit to the observed proportion positive Spanish mackerel trips.

#### 5.4.5.5 Uncertainty and Measures of Precision

95% confidence intervals were calculated from the mean square error output from the GLM procedures.

#### 5.4.5.6 Comments on Adequacy for Assessment

The WG group decided that this index was suitable for assessment.

### 5.4.6 Florida Trip Ticket

There were eight indices for Spanish mackerel developed from Florida trip tickets: Atlantic Coast (ATL) gill nets for 1986-June 30, 1995 (ATL_GN_early), ATL gill nets for July 1, 1995 to 2010 (ATL_GN_after), ATL cast nets for 1996-2010 (ATL_CN), ATL hook and line gears for 1985-2010 (ATL_HL), Gulf of Mexico (GULF) gill nets for 1986-June 30, 1995 (GULF_GN_early), GULF gill nets for July 1, 1995 to 2010 (GULF_GN_after), GULF cast nets for 1996-2010 (GULF_CN), GULF hook and line gears for 1985-2010 (GULF_HL). Each of the GN and CN indices were analyzed during time periods when trip limits allowed more than 1,500 pounds of Spanish mackerel to be landed, and each of the HL indices used data for time periods when trip limits allowed greater than 500 pounds of Spanish mackerel to be landed. The logic behind these choices for trip limits was that it was less likely for the landings from these trips using these gears to exceed the prevailing trip limit and therefore the landing may be more likely to reflect the availability of fish on that trip.

**Introduction**

Established by the Florida Legislature in Florida Statute (F.S.) 370.026 during 1983, the Florida Marine Fisheries Commission in conjunction with the Department of Natural Resources (DNR) [1]

[1] The Department of Natural Resources was established by the Florida Legislature in 1968, and incorporated the Florida Board of Conservation into it's structure. Later, in 1993, Governor Lawton Chiles combined the Department of Natural Resources and the Department of Environmental Regulation into a single agency called the Department

was charged with conserving and managing Florida's marine fisheries. In late-1984, the DNR implemented the mandatory reporting of detailed trip-level commercial fishery landings data by wholesale and retail seafood dealers using marine fisheries trip tickets. Prior to this time, commercial fisheries data was collected from seafood dealers on a monthly basis by the National Marine Fisheries Service (NMFS). Data were collected by both the NMFS and the DNR trip ticket system during 1985 to enable a comparison of the new data collection system. After determinations that the monthly dealer summaries and the detailed trip ticket information were comparable, the trip ticket system became the official commercial fisheries landings data collection system in Florida.

Wholesale and retail dealers operating in Florida are required to purchase dealer licenses, and wholesale dealers that purchase saltwater products (marine fish, invertebrates, live marine specimens, etc.) from commercial fishermen or wholesale and retail dealers that catch saltwater products themselves for sale in Florida are required to report these amounts on marine fisheries trip tickets to the Florida Fish and Wildlife Conservation Commission. Exceptions to the reporting requirements are: 1) restaurants who harvest their own catch for consumption on their premises; 2) transshipments of saltwater products after landing in Florida for destinations outside of the state for which no purchase occurred (e.g., a corporate vessel landing saltwater products at a Florida port without receiving payment and shipping product to another state). Fishermen who harvest saltwater products commercially are required to purchase Saltwater Products Licenses and sell only to licensed wholesale seafood dealers or sell their catches directly to the public if they have a retail dealer license. Fishermen may also be required to have additional license endorsements and federal permits for the legal harvest and sale of some species (e.g., Spanish mackerel).

Trip tickets have been used by wholesale and retail seafood dealers for the reporting of fish and invertebrates purchased in Florida from fishermen since the system's inception in 1984. There have been revisions to the trip ticket fields and the mandatory nature of some fields over time, as well as additions of new species codes, gear codes, and reporting units. Seafood dealers are required to report the preceding month's purchases from fishermen by the tenth day of the month following transaction. In the case of quota-managed species like Spanish mackerel, weekly reporting is required. Time lags for data entry of submitted paper forms is approximately four weeks after forms are received. Editing of computerized data typically takes two to three weeks. Computerized reporting of trip tickets, which eliminates the time lag for data entry, has occurred as early as 1987, and there has been considerable growth in level of computerized reporting by seafood dealers over the years.

#### *5.4.6.1. Methods of Estimation*

Geographic range

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of Environmental Protection. During the 1998 general election, a majority Florida voters approved an amendment to the Florida Constitution which combined the Florida Game and Freshwater Fish Commission, the Florida Marine Fisheries Commission, and portions (chiefly, most of the Division of Marine Resources and most of the Florida Marine Patrol) of the Department of Environmental Protection into a single commission. The Florida Legislature, on July 1, 1999, formed the new Florida Fish and Wildlife Conservation Commission in fulfillment of that amendment.

All commercial harvests landed and sold in Florida are required to be reported on Florida marine fisheries trip tickets. Reports are required to have all mandatory information submitted with the landings data. The area fished information required on trip tickets is based on the NMFS' shrimp grid zones (see SEDAR28 –AW01). Additional areas fished for locations outside of Florida are available, and supplied to dealers upon request.

*Assignment of fishing gears to trips:*

At the time of applying for or renewing Saltwater Products License (SPL), fishermen were asked to indicate their use of fishing gears for the upcoming license year. Many license holders indicated more than one gear on their annual license application or renewal, and some did not indicate any gear at all. From the inception of the Florida trip ticket program until February of 1990, a "gear fished" field was not on the trip ticket so analysts inferred the gear used by a combination of the reported catch (species, amounts) and the gear fields on a fisherman's SPL license application. Beginning in 1990, the trip ticket was revised to include the gear fished field which consisted of rather generic "check boxes" for gears and a 4-digit gear code if the reporting of a more specific gear was desired. Old trip tickets were still in use for a couple of years, so not all records from 1990 to 1992 contained gear information. As the old stocks of trip tickets were used up by dealers, the reporting of gear used by trip increased.

Gear related to trip tickets was retrieved from the Saltwater Products (SPL) license record for the 1986 to 1992 license years during the editing of trip tickets, and this "gear" record was retained in the trip ticket data base. The SPL number was prohibited from being retained on the trip ticket by the Florida legislature when then trip ticket program was initially approved, but later was allowed to be retained in the trip ticket data base in late 1986.

For trip tickets from 1986-1992, gear was assigned from the commercial fishing license application database (which was retained on the edited trip ticket record) based on a species/gear hierarchy from later years where gear was reported by trip. Target species and species groups were identified on trips where gear was reported from 1991-1994. The species-gear associations from these data were ranked from most common to least common and applied to the trip ticket data from 1986-1992. The target species (defined as the species with the highest poundage) and species groups were identified on trips where gears was not reported by trip from 1986-1992. Gear was assigned to each trip based on matching the species-license gear association with the species-ticket gear association from the 1991-1994 data. Gears by trip for these analyses were grouped into gill net, cast net, trawls, hook and line gears, and other. If gears were not determined for a trip (no license-gear information in the 1986-1992 period, or missing from the trip ticket from 1993-2011), the trip ticket was dropped from the analyses. The majority of Spanish mackerel landings were categorized as one of these gear types, and analyses for gill nets, cast nets, and hook and line gears are provided in this report.

At the Data Workshop, the Indices workgroup examined the preliminary results and suggested that the hook-and-line gear assignments for the 1986-1992 period may have included some landings exceeding reasonable limits for trips using this gear. Trips for this period were re-analyzed and landings in excess of the $99^{th}$ percentile were excluded from the analyses. For the Florida Atlantic coast Spanish mackerel trips, those with landings greater than 840 pounds were excluded. For Florida Gulf coast Spanish mackerel trips, those with landings greater than 1,223 pounds were excluded. Trips from 1991-1994 where gear was reported on the trip ticket were also analyzed for maximum landings of Spanish mackerel on hook-and-line trips. The results from those years verified the $99^{th}$ percentiles calculated from 1986-1992. The analyses in this report incorporate the recommendations of the Indices workgroup.

*Species and species groups*

As in SEDAR 17, trip tickets with Spanish mackerel ("positive" trips) were selected for analyses. A suitable method for selecting a universe of trips to evaluate (i.e., all trips which could have caught Spanish mackerel – zeros as well as positives) has not been developed yet, but possibly could be done using clustering techniques (e.g., Shertzer and Williams 2008) or other selection procedure (e.g., Stephens and MacCall 2004).

Species were assigned to fishery groups based upon fishery characteristics. The pounds landed by fishery group were summed for a trip ticket. Spanish mackerel was assigned to its own "group" since this was the species of interest for developing indices. For the purposes of developing the indices, a fishery group was classed as present or absent for the analyses.

*Trip limits*

Limits on harvest (pounds) of Spanish mackerel per trip during specific periods of the year would potentially affect the observed catch per trip, so the trip limits that were in effect during these periods were added to the trip ticket records. The dates for these trip limits for Atlantic Group Spanish mackerel were taken from SEDAR 17 (index code from Paul Conn, NMFS Beaufort Laboratory, personal communication) and from Sue Gerhart (NMFS SERO, personal communication). Some of the trip limits were based on day of the week. Gill net and cast net trips with trip limits greater than 1,500 pounds and hook and line trips with trip limits greater than 500 pounds were selected for analyses as in SEDAR 17. There were no periods on the Florida Gulf of Mexico Coast when trips were limited as to the number of pounds harvested or landed.

*Unit measure of abundance:*

Pounds of Spanish mackerel landed on a trip was the response variable for most models (gamma models), and in a few cases the pounds of Spanish mackerel were log transformed (lognormal models).

Trips with Spanish mackerel (pounds whole weight landed) were selected by coast, gear, time period, and trip limit in effect. The pounds of other species landed on the same trip ticket were grouped by fishery code, and converted to '1' or '0' to indicate presence or absence from the landings for a trip. Year, month, Florida sub-region, and fishery codes were the twelve classification variables used to examine for trends in the amount (pounds) of Spanish mackerel landed.

A general linear model [GENMOD procedure (SAS Institute Inc. 2008)] using a forward stepwise selection technique was used to estimate trends in catch per trip by gear and coast. Two types of model probability distributions were explored: gamma (with a log link function) and lognormal. When the lognormal distribution was used, the pounds of Spanish mackerel landed were log-transformed and the model used a normal probability distribution with an identity link function. The forward selection process analyzes the null model (no class variables chosen), and then each class variable added singly in the model. If the GLM successfully converged, the reduction in deviance from the null model is assessed for each of these runs, and the class variable with the largest percentage reduction in deviance, a significant $\chi^2$ (Chi-square) value, and a lower AICc than other class variables is selected for the model. The next series of model runs includes the variable selected in the previous series along with each of the remaining variables (one at a time), and each of the resulting two variable models are assessed for model convergence, the largest percentage reduction in deviance from the null model and significance criteria ($\chi^2$, AICc) as before. This process continues until the percentage reduction in deviance becomes less than some desired level. For these model runs, a 0.25% reduction in deviance from the null model was the selected level of acceptance for a suite of class variables. If there were cases when the variable of interest (in this case, year was important) failed to be selected, it would have been included in the model statement so that a year effect could be estimated. However, all of the models included year using the criteria described. Annual values (and associated coefficients of variation) were estimated using the least squares mean method (SAS Institute Inc. 2008) for the year effect.

The model results from the forward stepwise selection of variables for the linear models are in SEDAR28-AW01, and the diagnostic plots (standardized residuals by year, q-q plot, and standardized residuals versus the fitted distribution) and scaled index values (index values scaled to their means) over time are also in SEDAR28-AW01. The adjusted average catch rates (pounds per trip), coefficient of variation (as a percentage of the mean), and the scaled index values are in Tables 5.4.6.1-5.4.6.2. Nominal average catch rates (simple averages) and adjusted averages by gear, and a comparison of the annual scaled index values by gear are detailed in SEDAR28-AW01.

### *5.4.6.2. Sampling Intensity*

*Temporal and spatial resolution:*

Quotas for Spanish mackerel are managed by the NMFS for the South Atlantic Fishery Management Council (SAFMC) and the Gulf of Mexico Fishery Management Council (GMFMC). The boundary separating the SAFMC and GMFMC in Florida for Spanish mackerel is the line dividing Monroe County (Florida Keys) and Miami-Dade County. For SEDAR 28, discussions during a conference call expressed the desire, if possible, to divide the landings by US 1 in the Florida Keys which corresponds to the councils' jurisdictional boundaries rather than the boundaries used for managing Spanish mackerel quotas.

The separation of landings of Spanish mackerel to coincide with the council jurisdictions rather than how they are currently managed was approximate. Landings were first assigned to a migratory group based upon the area fished (if present on the trip ticket) or county landed corresponding to the quota management regime (separated at the Monroe County and Miami-Dade County boundary) so that any trip limits in effect could be assigned to the records. Once the migratory group was determined, landings were categorized based on the quota management boundaries as either Atlantic Coast or Gulf Coast, and separately by area fished (if present on the trip ticket) and county landed for SEDAR 28. Gulf group Spanish mackerel, if reported from areas 748 or 1 (Florida Keys) were classed as Atlantic Coast landings for SEDAR 28, while those in area 2 were considered Gulf Coast landings. If area fished was not reported on trip tickets from Monroe County (especially prior to 1992 when the reporting of this field was optional), the landings were considered to belong to the Gulf Coast. [There is a portion of area 2 that is in the SAFMC jurisdiction, but dividing catches into each council jurisdiction for area 2 is difficult to accomplish unless there are gear restrictions (e.g., SAFMC long line regulations)]. Additionally, the county of landing for Spanish mackerel was grouped into Florida subregions for these analyses. The subregion groupings were Nassau to Brevard (subregion 5), Indian River to Miami-Dade (subregion 4), Monroe County (subregion 3), Collier-Levy (subregion 2), and Dixie-Escambia (subregion 1). Landings may occur in a county in some years but not in others, and this situation can lead to missing cells in the general models that could result in model instability or inappropriate estimates for class variables. Two subregion groupings were devised. The first was based solely on county landed (corresponding to the usual subdivision of Florida landings in the NMFS commercial landings (Nassau County to Miami-Dade County landings are assigned to the Florida Atlantic Coast, and Monroe County to Escambia County are assigned to the Florida Gulf of Mexico Coast). A second subregion grouping modified the subregion based upon area fished (if reported on the trip ticket) as outlined in the preceding paragraph.

*Series period:*
Florida trip tickets reported for the time period of 1986 to 2010 were used for developing the indices. The hook and line indices were developed over the entire period by coast. Because of the entangling net limitations implemented in Florida on July 1, 1995, trip tickets with the reported or assigned gear of gill nets were split into groups before and after this date by coast. Trip tickets where cast nets were the reported gear were only used after this date because of the rare use of this gear type prior to the net limitation date.

### 5.4.6.3. Size/Age Data

Not included as part of this index analysis.

### 5.4.6.4. Catch Rates – Number and Biomass

See Tables 5.4.6.1-5.4.6.2.

### 5.4.6.5. Uncertainty and Measures of Precision

Gill net and cast net trips were problematic. There are different methods to deploy gill nets (which may have different mesh sizes, lengths, and panels) and each method targets and catches fish differently which can affect the amounts of catch. The highest catches on trips were from run-around gill nets, where a school or portion of a school of fish is surrounded by an actively fished gill net and the fish are "startled" into the net by noise (e.g., by jumping on the bottom of the boat or some other method). If the target species was Spanish mackerel, landings could be in the thousands to tens of thousands of pounds. If the target species was not Spanish mackerel, there may only be a few pounds (i.e., Spanish mackerel may have been part of the retained bycatch). Gill nets may also be fished anchored to the bottom (stab nets, anchored gill nets) as a more passively fished gear, or may drift on the current (drift gill nets). There have also been restrictions on the amount of soak time in some years (e.g., to reduce the potential encounter with marine turtles), and on transfers of catch at sea. The specific type of gill net deployment is not often provided on trip tickets. Prior to July 1, 1995, gill nets could be used in state as well as in federal waters. After Florida's net limitations (Article X of the Florida Constitution) went into effect on July 1, 1995, usage of entangling nets was limited to federal waters only, and other nets (seines, trawls, cast nets) usable in state waters were limited to 500 square feet or smaller in mesh area. Changes in the way gears are designed (mesh sizes, panels, depth, etc.), used (deployment method, soak time, etc.), and non-specific gear identification (e.g., "gill nets") make interpretation of patterns observed in the data more complex especially when trying to develop indices of abundance.

In retrospect, there were issues with the choice of the time period analyzed for the gill net indices. Because the four GN indices (2 ATL and 2 GULF) included only a partial year for 1995, the model may not give an appropriate "annual" value for 1995 since it would be based on only 6 months of the year. It may be more appropriate, if these indices are accepted for use, to drop all of the 1995 data from the GN indices.

Catches of Spanish mackerel were infrequent from cast nets until after Florida's net limitations. Several years after the passage of Article X, some fishermen on the southeastern coast of Florida developed a thrown net effective at catching Spanish mackerel especially in an area of shallow offshore hard bottom [offshore of "Peck's Lake", about 3-5 miles southeast of St. Lucie Inlet, Martin County (Hartig, 2007)]. While called a cast net, it is not the typical cast net used for bait fish or mullet. It is of larger mesh, more heavily weighted to sink more quickly, and when retrieved the net does not "purse" in the usual way. In southwest Florida, this type of modified cast net is not being used, and cast net-caught Spanish mackerel are a bycatch species from other nearshore fisheries.

The more important limitation to all of the indices produced is that they are based upon only "positive" trips (i.e., trips when Spanish mackerel were landed). Ideally, an index of abundance includes a component estimating the probability of encountering the target species on a trip ("zero" trips on which the target species might have been caught but was not, and "positive" trips on which the species was caught) as well as a component estimating the rate of capture on a trip (the number or weight of the target species caught on "positive" trips). Including "zero trips" (trips which could have but did not land Spanish mackerel) would be a refinement that would enhance an index's potential value as an indicator of abundance.

#### *5.4.6.6. Comments on Adequacy for Assessment*

The indices produced had reasonable fits to the distributions used and most had relatively modest coefficients of variation. The period of time covered by the indices were relatively long (ten years for gill nets over the 1986-1995 period, sixteen years for gill nets for the 1995-2010 period, fifteen years for cast nets over 1996-2010, and 25 years for hook and line gears over 1986-2010). The hook-and-line gears index may be more reliable indicator of abundance because of selectivity issues that complicate the interpretation of data from trips using gill nets (e.g., deployment methods, mesh sizes, configuration of panels, and changes in state/federal waters restrictions) and cast nets (e.g., configuration, depth, bottom types).

*Cast Net Index*

This index was not recommended for use. It's potentially useful as a year class indicator, but has gear saturation effects, limited spatial extent, and hyperstability issues since it's targeting large schools. Only trips that did not hit up against the trip limits were included in the analysis.

*Gillnet Index*

This index was not recommended for use. This index is from a longer time series than the commercial logbook data, and similar trends to the logbook data. But it has hyperstability issues and concerns regarding spatial overlap between gear and population. Changes in the way gill nets are designed and used, and non-specific gear identification on trip tickets (e.g. "gill nets") make interpretation of patterns observed in the data more complex. Only trips that did not hit up against the trip limits were included in the analysis.

*Handline/Trolling Index*
This index was recommended for use. The data used for this index occurs over a long time series and has similar trends to the commercial logbook data. It also samples the entire fishery, both inshore and offshore.

## 5.5 Literature Cited

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Ortiz, M. 2006. Standardized catch rates for gag grouper (*Mycteroperca microlepis*) from the marine recreational fisheries statistical survey (MRFSS). Southeast Data Assessment and Review (SEDAR) Working Document S10 DW-09.

## 5.6 Tables

Table 5.3.1.1. Number of stations sampled by shrimp statistical zone during the Summer (top) and Fall (bottom) SEAMAP groundfish survey from 1987-2010.

| | Shrimp Statistical Zone | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Total |
| 1987 | | | | | | | | 30 | 66 | 6 | 20 | 19 | 25 | 20 | 16 | 25 | 28 | 19 | *274* |
| 1988 | | | | | | | | 19 | 49 | 5 | 4 | 3 | 19 | 24 | 14 | 25 | 28 | 23 | *213* |
| 1989 | | | | | | | | 23 | 30 | | 3 | 18 | 25 | 7 | 15 | 20 | 29 | 24 | *194* |
| 1990 | | | | | | | | | 68 | 11 | 20 | 15 | 23 | 16 | 20 | 23 | 24 | 20 | *240* |
| 1991 | | | | | | | | | 46 | 12 | 24 | 13 | 23 | 22 | 24 | 18 | 23 | 26 | *231* |
| 1992 | | | | | | | | 1 | 45 | 2 | 20 | 24 | 20 | 25 | 12 | 31 | 26 | 20 | *226* |
| 1993 | | | | | | | | | 45 | 10 | 19 | 17 | 24 | 19 | 14 | 29 | 24 | 22 | *223* |
| 1994 | | | | | | | | | 61 | 6 | 17 | 22 | 25 | 17 | 20 | 22 | 26 | 22 | *238* |
| 1995 | | | | | | | | | 44 | 10 | 16 | 18 | 22 | 23 | 13 | 27 | 26 | 21 | *220* |
| 1996 | | | | | | | | | 46 | 14 | 12 | 19 | 22 | 18 | 17 | 21 | 26 | 25 | *220* |
| 1997 | | | | | | | | | 44 | | 12 | 16 | 22 | 23 | 10 | 28 | 26 | 26 | *207* |
| 1998 | | | | | | | | | 35 | 2 | 14 | 21 | 25 | 18 | 14 | 22 | 36 | 17 | *204* |
| 1999 | | | | | | | | | 44 | 7 | 20 | 19 | 20 | 23 | 13 | 25 | 32 | 20 | *223* |
| 2000 | | | | | | | | | 45 | 2 | 19 | 15 | 19 | 27 | 8 | 29 | 31 | 21 | *216* |
| 2001 | | | | | | | | | 36 | 7 | 18 | 18 | 13 | 3 | 10 | 9 | 17 | 21 | *152* |
| 2002 | | | | | | | | | 44 | 11 | 14 | 21 | 27 | 19 | 15 | 25 | 29 | 22 | *227* |
| 2003 | | | | | | | | | 44 | 9 | 10 | 8 | 2 | 17 | 20 | 22 | 26 | 23 | *181* |
| 2004 | | | | | | | | | 39 | 11 | 18 | 17 | 20 | 25 | 21 | 19 | 25 | 21 | *216* |
| 2005 | | | | | | | | | 32 | 10 | 9 | 11 | 16 | 21 | 5 | 28 | 22 | 27 | *181* |
| 2006 | | | | | | | | | 45 | 11 | 21 | 12 | 20 | 23 | 17 | 23 | 31 | 18 | *221* |
| 2007 | | | | | | | | | 41 | | 6 | 15 | 22 | 23 | 7 | 29 | 32 | 21 | *196* |
| 2008 | | 1 | 8 | 11 | 6 | 11 | 8 | 11 | 43 | 24 | 19 | 27 | 23 | 22 | 17 | 24 | 21 | 29 | *305* |
| 2009 | | 25 | 17 | 29 | 15 | 16 | 18 | 25 | 68 | 25 | 21 | 38 | 39 | 47 | 55 | 34 | 30 | 24 | *526* |
| 2010 | 31 | 24 | 17 | 24 | 10 | 12 | 14 | 15 | 22 | 5 | 20 | 16 | 21 | 33 | 34 | 27 | 27 | 19 | *371* |
| Total | *31* | *50* | *42* | *64* | *31* | *39* | *40* | *124* | *1082* | *200* | *376* | *422* | *517* | *515* | *411* | *585* | *645* | *531* | *5705* |

| | Shrimp Statistical Zone | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Total |
| 1987 | | | | | | | | 16 | 28 | 15 | 14 | 16 | 17 | 15 | 15 | 15 | 18 | 3 | *172* |
| 1988 | | | | | | | | 8 | 28 | 7 | 22 | 17 | 18 | 26 | 19 | 21 | 31 | 20 | *217* |
| 1989 | | | | | | | | | 43 | 12 | 19 | 17 | 22 | 20 | 17 | 22 | 25 | 26 | *223* |
| 1990 | | | | | | | | | 52 | 14 | 12 | 23 | 22 | 19 | 18 | 22 | 19 | 27 | *228* |
| 1991 | | | | | | | | | 47 | 6 | 24 | 14 | 20 | 25 | 24 | 19 | 25 | 22 | *226* |
| 1992 | | | | | | | | | 33 | 7 | 23 | 14 | 25 | 18 | 17 | 27 | 30 | 18 | *212* |
| 1993 | | | | | | | | | 72 | 10 | 19 | 17 | 26 | 18 | 16 | 25 | 28 | 18 | *249* |
| 1994 | | | | | | | | | 50 | 9 | 16 | 21 | 25 | 20 | 21 | 23 | 24 | 20 | *229* |
| 1995 | | | | | | | | | 40 | 10 | 17 | 18 | 24 | 19 | 14 | 26 | 30 | 19 | *217* |
| 1996 | | | | | | | | | 45 | 9 | 18 | 19 | 17 | 28 | 13 | 25 | 29 | 24 | *227* |
| 1997 | | | | | | | | | 44 | 10 | 17 | 20 | 26 | 19 | 18 | 23 | 22 | 24 | *223* |
| 1998 | | | | | | | | | 44 | 10 | 22 | 14 | 34 | 11 | 15 | 24 | 29 | 22 | *225* |
| 1999 | | | | | | | | | 42 | 10 | 17 | 18 | 29 | 18 | 12 | 28 | 29 | 22 | *225* |
| 2000 | | | | | | | | | 43 | 10 | 14 | 22 | 20 | 26 | 12 | 30 | 25 | 21 | *223* |
| 2001 | | | | | | | | | 21 | 10 | 17 | 19 | 26 | 20 | 14 | 27 | 28 | 23 | *205* |
| 2002 | | | | | | | | 1 | 51 | 10 | 13 | 22 | 22 | 23 | 14 | 26 | 30 | 21 | *233* |
| 2003 | | | | | | | | 1 | 76 | 9 | 16 | 21 | 24 | 22 | 20 | 23 | 25 | 23 | *260* |
| 2004 | | | | | | | | | 43 | | 11 | 18 | 17 | 27 | 14 | 24 | 30 | 21 | *205* |
| 2005 | | | | | | | | | 44 | 11 | 20 | 16 | 33 | 18 | 14 | 23 | 24 | 27 | *230* |
| 2006 | | | | | | | | 1 | 47 | 7 | 22 | 14 | 18 | 28 | 13 | 23 | 32 | 19 | *224* |
| 2007 | | | | | | | | | 32 | 9 | 20 | 17 | 18 | 28 | 17 | 20 | 18 | 26 | *205* |
| 2008 | | | 15 | 14 | 4 | 4 | 3 | 4 | 36 | 18 | 28 | 34 | 42 | 46 | 44 | 19 | 36 | 20 | *367* |
| 2009 | | 20 | 21 | 25 | 10 | 21 | 13 | 12 | 49 | 12 | 23 | 23 | 31 | 49 | 48 | 31 | 36 | 24 | *448* |
| 2010 | | 9 | 10 | 11 | 18 | | | 14 | 16 | 7 | 15 | 18 | 26 | 31 | 29 | 18 | 19 | 14 | *255* |
| Total | | *29* | *46* | *50* | *32* | *25* | *16* | *57* | *1026* | *232* | *439* | *452* | *582* | *574* | *458* | *564* | *642* | *504* | *5728* |

Table 5.3.1.2. Number of stations with a positive occurrence of Spanish mackerel by depth zone during the Summer (top) and Fall (bottom) SEAMAP groundfish survey from 1987-2010.

| Year | Depth Zone | | | | | | | | | | | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0506 | 0607 | 0708 | 0809 | 0910 | 1011 | 1112 | 1213 | 1314 | 1415 | 1516 | 1617 | 1718 | 1819 | 1920 | 2022 | 2225 | 2530 | 3035 | 3540 | 4045 | 4550 | 5060 | |
| 1987 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *7* |
| 1988 | 2 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | *8* |
| 1989 | 3 | 1 | 1 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *11* |
| 1990 | 2 | 3 | 1 | 2 | 1 | 2 | 1 | 3 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *18* |
| 1991 | 3 | 1 | 2 | 0 | 1 | 0 | 1 | 2 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *15* |
| 1992 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *3* |
| 1993 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | *5* |
| 1994 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *8* |
| 1995 | 3 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *9* |
| 1996 | 1 | 1 | 2 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *8* |
| 1997 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *5* |
| 1998 | 2 | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *9* |
| 1999 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *3* |
| 2000 | 1 | 1 | 1 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | *11* |
| 2001 | 0 | 1 | 0 | 1 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *6* |
| 2002 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *4* |
| 2003 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *5* |
| 2004 | 2 | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *9* |
| 2005 | 4 | 2 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *11* |
| 2006 | 1 | 3 | 3 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | *13* |
| 2007 | 2 | 3 | 0 | 1 | 1 | 0 | 0 | 2 | 1 | 1 | 1 | 1 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *17* |
| 2008 | 2 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *10* |
| 2009 | 0 | 0 | 1 | 0 | 1 | 1 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *10* |
| 2010 | 0 | 0 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *8* |
| Total | *36* | *28* | *24* | *17* | *17* | *12* | *17* | *10* | *13* | *9* | *5* | *6* | *5* | *4* | *4* | *2* | *2* | *0* | *1* | *1* | *0* | *0* | *0* | *213* |

| Year | Depth Zone | | | | | | | | | | | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0506 | 0607 | 0708 | 0809 | 0910 | 1011 | 1112 | 1213 | 1314 | 1415 | 1516 | 1617 | 1718 | 1819 | 1920 | 2022 | 2225 | 2530 | 3035 | 3540 | 4045 | 4550 | 5060 | |
| 1987 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | *5* |
| 1988 | 2 | 2 | 2 | 1 | 3 | 1 | 2 | 2 | 1 | 0 | 1 | 1 | 2 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | *23* |
| 1989 | 1 | 2 | 3 | 2 | 2 | 1 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | *17* |
| 1990 | 3 | 0 | 4 | 1 | 0 | 1 | 1 | 3 | 2 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *19* |
| 1991 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | *14* |
| 1992 | 2 | 1 | 2 | 2 | 0 | 1 | 4 | 1 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | *22* |
| 1993 | 4 | 2 | 3 | 5 | 1 | 3 | 1 | 1 | 0 | 1 | 1 | 3 | 1 | 1 | 1 | 2 | 0 | 1 | 1 | 2 | 1 | 0 | 1 | *36* |
| 1994 | 2 | 3 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | *13* |
| 1995 | 3 | 2 | 0 | 1 | 1 | 1 | 0 | 2 | 1 | 2 | 0 | 0 | 2 | 2 | 0 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | *23* |
| 1996 | 0 | 3 | 3 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | *15* |
| 1997 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | *14* |
| 1998 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 1 | 1 | 4 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | *16* |
| 1999 | 3 | 4 | 3 | 1 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | *20* |
| 2000 | 3 | 1 | 2 | 4 | 2 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *19* |
| 2001 | 0 | 2 | 2 | 0 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | *12* |
| 2002 | 0 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | *7* |
| 2003 | 0 | 0 | 6 | 6 | 5 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *25* |
| 2004 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 1 | 1 | 1 | 0 | 1 | 2 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | *15* |
| 2005 | 2 | 1 | 4 | 2 | 3 | 1 | 5 | 2 | 2 | 2 | 1 | 0 | 2 | 1 | 2 | 1 | 1 | 3 | 1 | 0 | 0 | 0 | 1 | *37* |
| 2006 | 2 | 2 | 1 | 2 | 1 | 3 | 1 | 2 | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | *20* |
| 2007 | 0 | 2 | 2 | 1 | 2 | 4 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *22* |
| 2008 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | *14* |
| 2009 | 0 | 2 | 4 | 1 | 7 | 9 | 5 | 5 | 3 | 3 | 4 | 1 | 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | *51* |
| 2010 | | 1 | 2 | 5 | 3 | 4 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | *22* |
| Total | *30* | *34* | *48* | *40* | *45* | *49* | *35* | *32* | *16* | *17* | *18* | *20* | *15* | *15* | *10* | *10* | *11* | *15* | *12* | *4* | *1* | *1* | *3* | *481* |

Table 5.3.1.3. Summary of the Spanish mackerel data used in these analyses collected by NOAA Fisheries during Summer and Fall SEAMAP groundfish surveys conducted between 1987 and 2010.

| Survey Year | Number of Stations | Number Collected | Number Measured | Minimum Total Length (mm) | Maximum Total Length (mm) | Mean Total Length (mm) | Standard Deviation |
|---|---|---|---|---|---|---|---|
| 1987 | 385 | 32 | 14 | 120 | 380 | 237 | 94 |
| 1988 | 360 | 104 | 82 | 108 | 406 | 255 | 80 |
| 1989 | 358 | 129 | 93 | 116 | 370 | 199 | 53 |
| 1990 | 405 | 231 | 137 | 100 | 415 | 196 | 76 |
| 1991 | 382 | 147 | 107 | 90 | 422 | 311 | 67 |
| 1992 | 363 | 123 | 98 | 130 | 530 | 252 | 84 |
| 1993 | 403 | 199 | 138 | 92 | 409 | 234 | 72 |
| 1994 | 387 | 78 | 61 | 94 | 389 | 197 | 88 |
| 1995 | 371 | 99 | 89 | 51 | 518 | 268 | 95 |
| 1996 | 372 | 140 | 78 | 154 | 498 | 267 | 74 |
| 1997 | 359 | 34 | 34 | 56 | 378 | 246 | 81 |
| 1998 | 357 | 67 | 61 | 55 | 432 | 227 | 74 |
| 1999 | 374 | 85 | 68 | 80 | 430 | 234 | 85 |
| 2000 | 369 | 156 | 97 | 102 | 371 | 204 | 64 |
| 2001 | 302 | 90 | 68 | 73 | 435 | 165 | 60 |
| 2002 | 384 | 35 | 28 | 149 | 454 | 264 | 96 |
| 2003 | 379 | 193 | 129 | 137 | 369 | 213 | 48 |
| 2004 | 356 | 61 | 54 | 98 | 362 | 238 | 75 |
| 2005 | 363 | 487 | 166 | 105 | 380 | 205 | 58 |
| 2006 | 382 | 82 | 75 | 137 | 407 | 271 | 65 |
| 2007 | 347 | 203 | 124 | 51 | 441 | 218 | 68 |
| 2008 | 489 | 132 | 100 | 75 | 436 | 225 | 83 |
| 2009 | 645 | 204 | 161 | 137 | 405 | 216 | 59 |
| 2010 | 389 | 112 | 64 | 70 | 382 | 253 | 80 |
| Total Number of Years | Total Number of Stations | Total Number Collected | Total Number Measured | | | Overall Mean Total Length (mm) | |
| 24 | 9281 | 3223 | 2127 | | | 230 | |

Table 5.3.1.4. Indices of Spanish mackerel (full model) developed using the delta-lognormal model for 1987-2010. The nominal frequency of occurrence, the number of samples (*N*), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

| Survey Year | Frequency | *N* | DL Index | Scaled Index | CV | LCL | UCL |
|---|---|---|---|---|---|---|---|
| 1987 | 0.03117 | 385 | 0.10039 | 0.31226 | 0.67432 | 0.09178 | 1.06238 |
| 1988 | 0.08333 | 360 | 0.33883 | 1.05392 | 0.28133 | 0.60686 | 1.83033 |
| 1989 | 0.07821 | 358 | 0.45726 | 1.42231 | 0.29306 | 0.80108 | 2.52530 |
| 1990 | 0.09136 | 405 | 0.53600 | 1.66725 | 0.28593 | 0.95171 | 2.92076 |
| 1991 | 0.07592 | 382 | 0.28553 | 0.88814 | 0.33637 | 0.46143 | 1.70944 |
| 1992 | 0.06612 | 363 | 0.18879 | 0.58722 | 0.31427 | 0.31786 | 1.08487 |
| 1993 | 0.09181 | 403 | 0.51389 | 1.59848 | 0.25684 | 0.96421 | 2.64997 |
| 1994 | 0.05426 | 387 | 0.23166 | 0.72057 | 0.43390 | 0.31400 | 1.65358 |
| 1995 | 0.08625 | 371 | 0.35457 | 1.10289 | 0.28118 | 0.63524 | 1.91482 |
| 1996 | 0.06183 | 372 | 0.31361 | 0.97551 | 0.37302 | 0.47394 | 2.00786 |
| 1997 | 0.04735 | 359 | 0.09861 | 0.30674 | 0.49132 | 0.12102 | 0.77745 |
| 1998 | 0.06723 | 357 | 0.17563 | 0.54631 | 0.34927 | 0.27717 | 1.07678 |
| 1999 | 0.06150 | 374 | 0.24460 | 0.76083 | 0.33175 | 0.39868 | 1.45194 |
| 2000 | 0.08130 | 369 | 0.36328 | 1.12998 | 0.34691 | 0.57580 | 2.21755 |
| 2001 | 0.05960 | 302 | 0.25269 | 0.78600 | 0.38920 | 0.37086 | 1.66583 |
| 2002 | 0.02865 | 384 | 0.10442 | 0.32480 | 0.60282 | 0.10667 | 0.98902 |
| 2003 | 0.07916 | 379 | 0.45133 | 1.40387 | 0.26920 | 0.82715 | 2.38271 |
| 2004 | 0.06742 | 356 | 0.14970 | 0.46564 | 0.29732 | 0.26016 | 0.83339 |
| 2005 | 0.12948 | 363 | 0.74764 | 2.32555 | 0.25517 | 1.40725 | 3.84308 |
| 2006 | 0.08639 | 382 | 0.28682 | 0.89216 | 0.29229 | 0.50321 | 1.58175 |
| 2007 | 0.11239 | 347 | 0.56336 | 1.75234 | 0.28765 | 0.99706 | 3.07977 |
| 2008 | 0.04499 | 489 | 0.24844 | 0.77279 | 0.38643 | 0.36645 | 1.62970 |
| 2009 | 0.09457 | 645 | 0.33117 | 1.03011 | 0.18099 | 0.71935 | 1.47512 |
| 2010 | 0.07455 | 389 | 0.37753 | 1.17432 | 0.26837 | 0.69299 | 1.98997 |

Table 5.3.1.5. Indices of Spanish mackerel (summer model) developed using the delta-lognormal model for 1987-2010. The nominal frequency of occurrence, the number of samples (*N*), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

| Survey Year | Frequency | *N* | DL Index | Scaled Index | CV | LCL | UCL |
|---|---|---|---|---|---|---|---|
| 1987 | 0.03784 | 185 | 0.18625 | 0.46182 | 0.89668 | 0.09938 | 2.14620 |
| 1988 | 0.04930 | 142 | 0.23456 | 0.58162 | 0.73493 | 0.15626 | 2.16494 |
| 1989 | 0.07857 | 140 | 1.34106 | 3.32531 | 0.46395 | 1.37506 | 8.04159 |
| 1990 | 0.10465 | 172 | 1.40658 | 3.48777 | 0.41285 | 1.57749 | 7.71131 |
| 1991 | 0.09150 | 153 | 0.60189 | 1.49245 | 0.52590 | 0.55551 | 4.00965 |
| 1992 | 0.02013 | 149 | 0.09337 | 0.23153 | 1.20364 | 0.03488 | 1.53671 |
| 1993 | 0.02685 | 149 | 0.19434 | 0.48189 | 0.86371 | 0.10827 | 2.14481 |
| 1994 | 0.05229 | 153 | 0.36121 | 0.89565 | 0.86398 | 0.20116 | 3.98779 |
| 1995 | 0.06122 | 147 | 0.38049 | 0.94347 | 0.59443 | 0.31401 | 2.83476 |
| 1996 | 0.05479 | 146 | 0.39826 | 0.98753 | 0.60307 | 0.32418 | 3.00825 |
| 1997 | 0.03650 | 137 | 0.03294 | 0.08167 | 1.29947 | 0.01117 | 0.59685 |
| 1998 | 0.06618 | 136 | 0.28571 | 0.70846 | 0.58943 | 0.23768 | 2.11170 |
| 1999 | 0.02041 | 147 | 0.04729 | 0.11726 | 1.70488 | 0.01136 | 1.21085 |
| 2000 | 0.06338 | 142 | 0.27592 | 0.68418 | 0.57334 | 0.23557 | 1.98716 |
| 2001 | 0.05660 | 106 | 0.65155 | 1.61558 | 0.60729 | 0.52682 | 4.95446 |
| 2002 | 0.02703 | 148 | 0.10513 | 0.26067 | 1.63964 | 0.02653 | 2.56104 |
| 2003 | 0.04000 | 125 | 0.19127 | 0.47428 | 0.79479 | 0.11702 | 1.92227 |
| 2004 | 0.06164 | 146 | 0.26634 | 0.66042 | 0.57553 | 0.22658 | 1.92497 |
| 2005 | 0.07746 | 142 | 0.48427 | 1.20081 | 0.49449 | 0.47123 | 3.05996 |
| 2006 | 0.08000 | 150 | 0.29427 | 0.72967 | 0.52206 | 0.27334 | 1.94782 |
| 2007 | 0.12687 | 134 | 1.24088 | 3.07690 | 0.47541 | 1.24746 | 7.58927 |
| 2008 | 0.04372 | 183 | 0.29391 | 0.72879 | 0.63276 | 0.22833 | 2.32618 |
| 2009 | 0.03831 | 261 | 0.12175 | 0.30190 | 0.69478 | 0.08605 | 1.05923 |
| 2010 | 0.04930 | 142 | 0.18968 | 0.47034 | 0.97410 | 0.09181 | 2.40950 |

Table 5.3.1.6. Indices of Spanish mackerel (fall model) developed using the delta-lognormal model for 1987-2010. The nominal frequency of occurrence, the number of samples (*N*), the DL Index (number per trawl-hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

| Survey Year | Frequency | *N* | DL Index | Scaled Index | CV | LCL | UCL |
|---|---|---|---|---|---|---|---|
| 1987 | 0.03268 | 153 | 0.04749 | 0.12163 | 0.97095 | 0.02383 | 0.62068 |
| 1988 | 0.12778 | 180 | 0.56827 | 1.45531 | 0.34682 | 0.74169 | 2.85555 |
| 1989 | 0.09140 | 186 | 0.26759 | 0.68529 | 0.37082 | 0.33427 | 1.40490 |
| 1990 | 0.09794 | 194 | 0.21522 | 0.55116 | 0.39663 | 0.25661 | 1.18381 |
| 1991 | 0.07407 | 189 | 0.19748 | 0.50574 | 0.41327 | 0.22857 | 1.11901 |
| 1992 | 0.12000 | 175 | 0.33683 | 0.86261 | 0.34460 | 0.44142 | 1.68569 |
| 1993 | 0.14884 | 215 | 0.86505 | 2.21538 | 0.27656 | 1.28719 | 3.81290 |
| 1994 | 0.06806 | 191 | 0.14301 | 0.36624 | 0.50194 | 0.14191 | 0.94514 |
| 1995 | 0.12500 | 184 | 0.53668 | 1.37442 | 0.34304 | 0.70536 | 2.67811 |
| 1996 | 0.07979 | 188 | 0.26482 | 0.67819 | 0.43130 | 0.29689 | 1.54921 |
| 1997 | 0.06417 | 187 | 0.17352 | 0.44438 | 0.54814 | 0.15942 | 1.23867 |
| 1998 | 0.07979 | 188 | 0.22838 | 0.58487 | 0.49573 | 0.22903 | 1.49355 |
| 1999 | 0.10638 | 188 | 0.49804 | 1.27546 | 0.37277 | 0.61995 | 2.62408 |
| 2000 | 0.10053 | 189 | 0.32053 | 0.82088 | 0.36157 | 0.40721 | 1.65478 |
| 2001 | 0.07186 | 167 | 0.21556 | 0.55205 | 0.51677 | 0.20864 | 1.46068 |
| 2002 | 0.03571 | 196 | 0.13674 | 0.35020 | 0.78728 | 0.08731 | 1.40453 |
| 2003 | 0.11312 | 221 | 0.74927 | 1.91886 | 0.28751 | 1.09209 | 3.37152 |
| 2004 | 0.08721 | 172 | 0.21528 | 0.55133 | 0.42316 | 0.24485 | 1.24147 |
| 2005 | 0.18462 | 195 | 1.09266 | 2.79826 | 0.29318 | 1.57568 | 4.96947 |
| 2006 | 0.10309 | 194 | 0.36455 | 0.93360 | 0.39451 | 0.43632 | 1.99764 |
| 2007 | 0.12155 | 181 | 0.32770 | 0.83924 | 0.32478 | 0.44548 | 1.58106 |
| 2008 | 0.05224 | 268 | 0.25678 | 0.65760 | 0.46635 | 0.27081 | 1.59688 |
| 2009 | 0.17057 | 299 | 0.65631 | 1.68079 | 0.19864 | 1.13408 | 2.49107 |
| 2010 | 0.12291 | 179 | 0.69368 | 1.77651 | 0.30726 | 0.97427 | 3.23934 |

**Table 5.4.2.1.** Gulf of Mexico vertical line relative nominal CPUE, number of trips, and relative abundance index

| YEAR | Relative Nominal CPUE | Trips | Proportion Successful Trips | Standardized Index | Lower 95% CI (Index) | Upper 95% CI (Index) | CV (Index) |
|---|---|---|---|---|---|---|---|
| 1998 | 0.896733 | 407 | 1.0 | 1.110020 | 0.916881 | 1.343842 | 0.095796 |
| 1999 | 0.676905 | 484 | 1.0 | 0.818040 | 0.685334 | 0.976443 | 0.088676 |
| 2000 | 0.959316 | 602 | 1.0 | 0.821822 | 0.698381 | 0.967081 | 0.081515 |
| 2001 | 1.277024 | 475 | 1.0 | 0.928847 | 0.776205 | 1.111506 | 0.089945 |
| 2002 | 0.627930 | 442 | 1.0 | 0.839362 | 0.697565 | 1.009984 | 0.092722 |
| 2003 | 0.624959 | 409 | 1.0 | 0.912561 | 0.753036 | 1.105879 | 0.096293 |
| 2004 | 1.008903 | 296 | 1.0 | 1.067666 | 0.856744 | 1.330516 | 0.110380 |
| 2005 | 1.390524 | 246 | 1.0 | 1.085462 | 0.853211 | 1.380934 | 0.120814 |
| 2006 | 1.328267 | 219 | 1.0 | 1.229151 | 0.955510 | 1.581158 | 0.126418 |
| 2007 | 1.224061 | 182 | 1.0 | 1.006811 | 0.764985 | 1.325084 | 0.137994 |
| 2008 | 0.841146 | 242 | 1.0 | 0.915937 | 0.718186 | 1.16814 | 0.122061 |
| 2009 | 0.969648 | 323 | 1.0 | 0.961957 | 0.777388 | 1.190346 | 0.106818 |
| 2010 | 1.174585 | 301 | 1.0 | 1.302363 | 1.043055 | 1.626136 | 0.111356 |

**Table 5.4.3.1.** Gulf of Mexico gillnet relative nominal CPUE, number of trips, proportion positive trips, and relative abundance indices

| YEAR | Relative Nominal CPUE | Trips | Proportion Successful Trips | Standardized Index | Lower 95% CI (Index) | Upper 95% CI (Index) | CV (Index) |
|---|---|---|---|---|---|---|---|
| 1998 | 1.31587 | 66 | 0.77273 | 0.56137 | 0.09827 | 3.2068 | 1.06611 |
| 1999 | 0.85971 | 153 | 0.75163 | 0.36191 | 0.07981 | 1.6411 | 0.87785 |
| 2000 | 0.66704 | 105 | 0.66667 | 0.25462 | 0.05378 | 1.2054 | 0.91108 |
| 2001 | 0.59857 | 89 | 0.77528 | 0.80905 | 0.19655 | 3.3302 | 0.80595 |
| 2002 | 0.45216 | 62 | 0.66129 | 0.07050 | 0.00871 | 0.5705 | 1.40818 |
| 2003 | 1.26842 | 43 | 0.62791 | 2.19239 | 0.51953 | 9.2518 | 0.82409 |
| 2004 | 1.56015 | 41 | 0.58537 | 2.06259 | 0.48658 | 8.7433 | 0.82740 |
| 2005 | 1.17250 | 47 | 0.65957 | 2.37125 | 0.56209 | 10.0034 | 0.82386 |
| 2006 | 0.82636 | 25 | 0.60000 | 0.19907 | 0.04456 | 0.8892 | 0.86644 |
| 2007 | 0.79055 | 49 | 0.69388 | 0.70306 | 0.16638 | 2.9709 | 0.82508 |
| 2008 | 0.95515 | 46 | 0.52174 | 0.56617 | 0.12659 | 2.5321 | 0.86735 |
| 2009 | 1.59290 | 102 | 0.79412 | 0.57952 | 0.13959 | 2.4059 | 0.81215 |
| 2010 | 0.94061 | 27 | 0.37037 | 2.26850 | 0.47157 | 10.9126 | 0.92363 |

Table 5.4.4.1. Total number of trips, positive trips, and the percent positive trips by year in the Gulf of Mexico from the Headboat Survey data for Spanish mackerel.

| Year | Total Trips | Positive Trips | Percent Positive Trips |
|---|---|---|---|
| 1986 | 4459 | 134 | 3.01 |
| 1987 | 4597 | 186 | 4.05 |
| 1988 | 6288 | 95 | 1.51 |
| 1989 | 6920 | 123 | 1.78 |
| 1990 | 10336 | 270 | 2.61 |
| 1991 | 9111 | 381 | 4.18 |
| 1992 | 10273 | 322 | 3.13 |
| 1993 | 10755 | 232 | 2.16 |
| 1994 | 10691 | 334 | 3.12 |
| 1995 | 9001 | 166 | 1.84 |
| 1996 | 8417 | 166 | 1.97 |
| 1997 | 8288 | 143 | 1.73 |
| 1998 | 7675 | 90 | 1.17 |
| 1999 | 6665 | 125 | 1.88 |
| 2000 | 6421 | 181 | 2.82 |
| 2001 | 6229 | 73 | 1.17 |
| 2002 | 6420 | 132 | 2.06 |
| 2003 | 6339 | 101 | 1.59 |
| 2004 | 6823 | 131 | 1.92 |
| 2005 | 6527 | 133 | 2.04 |
| 2006 | 5896 | 143 | 2.43 |
| 2007 | 6404 | 262 | 4.09 |
| 2008 | 6622 | 325 | 4.91 |
| 2009 | 8401 | 325 | 3.87 |
| 2010 | 6626 | 215 | 3.24 |
| Total | 186184 | 4788 | 38.89 |

Table 5.4.4.2. Total number of trips by month and year in the Gulf of Mexico from the Headboat Survey for Spanish mackerel.

| Year | Jan. | Feb. | March | April | May | June | July | August | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1986 | 218 | 211 | 327 | 320 | 315 | 594 | 762 | 567 | 342 | 300 | 271 | 232 |
| 1987 | 205 | 246 | 341 | 418 | 532 | 575 | 653 | 562 | 323 | 272 | 235 | 235 |
| 1988 | 223 | 283 | 438 | 582 | 757 | 892 | 1002 | 779 | 309 | 445 | 265 | 313 |
| 1989 | 381 | 437 | 542 | 644 | 710 | 728 | 891 | 860 | 559 | 544 | 363 | 261 |
| 1990 | 543 | 601 | 907 | 948 | 895 | 1161 | 1250 | 1204 | 835 | 775 | 656 | 561 |
| 1991 | 583 | 638 | 712 | 789 | 797 | 1062 | 1189 | 1015 | 710 | 653 | 473 | 490 |
| 1992 | 496 | 573 | 835 | 864 | 1025 | 1148 | 1425 | 1213 | 802 | 788 | 540 | 564 |
| 1993 | 650 | 677 | 858 | 887 | 1007 | 1199 | 1563 | 1231 | 866 | 799 | 532 | 486 |
| 1994 | 462 | 683 | 969 | 1026 | 1126 | 1181 | 1374 | 1260 | 823 | 734 | 569 | 484 |
| 1995 | 410 | 539 | 789 | 903 | 931 | 1221 | 1397 | 1054 | 753 | 352 | 378 | 274 |
| 1996 | 298 | 417 | 497 | 666 | 845 | 1116 | 1327 | 1152 | 789 | 544 | 364 | 402 |
| 1997 | 449 | 563 | 735 | 544 | 753 | 1071 | 1125 | 1126 | 747 | 550 | 432 | 193 |
| 1998 | 466 | 392 | 642 | 703 | 923 | 970 | 1317 | 937 | 383 | 433 | 293 | 216 |
| 1999 | 325 | 554 | 615 | 633 | 772 | 868 | 945 | 744 | 371 | 347 | 260 | 231 |
| 2000 | 239 | 381 | 504 | 643 | 747 | 906 | 1002 | 731 | 423 | 475 | 210 | 160 |
| 2001 | 172 | 365 | 430 | 663 | 742 | 787 | 1010 | 768 | 492 | 436 | 202 | 162 |
| 2002 | 249 | 295 | 478 | 605 | 633 | 895 | 1078 | 832 | 408 | 505 | 245 | 197 |
| 2003 | 223 | 318 | 470 | 546 | 763 | 891 | 958 | 764 | 449 | 508 | 243 | 206 |
| 2004 | 323 | 393 | 691 | 721 | 837 | 999 | 1069 | 690 | 328 | 426 | 181 | 165 |
| 2005 | 333 | 342 | 484 | 601 | 923 | 984 | 906 | 698 | 351 | 416 | 264 | 225 |
| 2006 | 281 | 333 | 565 | 509 | 711 | 811 | 826 | 612 | 438 | 361 | 279 | 170 |
| 2007 | 263 | 334 | 613 | 552 | 688 | 1016 | 1011 | 683 | 403 | 377 | 222 | 242 |
| 2008 | 178 | 328 | 504 | 678 | 712 | 1051 | 1125 | 662 | 278 | 455 | 313 | 338 |
| 2009 | 381 | 406 | 648 | 679 | 797 | 1359 | 1516 | 1057 | 471 | 461 | 334 | 292 |
| 2010 | 271 | 289 | 588 | 726 | 644 | 917 | 846 | 620 | 427 | 652 | 408 | 238 |
| Total | 8622 | 10598 | 15182 | 16850 | 19585 | 24402 | 27567 | 21821 | 13080 | 12608 | 8532 | 7337 |

Table 5.4.4.3. Standardized indices and corresponding 95% confidence intervals.

| | HEADBOAT SURVEY | | | | | | | | MRFSS SURVEY | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cobia | | | | Spanish Mackerel | | | | Cobia | | | | Spanish Mackerel | | | |
| Year | Index | Lower CI | Uppder CI | CV | Index | Lower CI | Uppder CI | CV | Index | Lower CI | Uppder CI | CV | Index | Lower CI | Uppder CI | CV |
| 1981 | | | | | | | | | 0.705 | 0.349 | 1.424 | 0.363 | 0.974 | 0.523 | 1.814 | 0.318 |
| 1982 | | | | | | | | | 0.898 | 0.546 | 1.476 | 0.252 | 1.292 | 0.784 | 2.131 | 0.254 |
| 1983 | | | | | | | | | 0.627 | 0.324 | 1.211 | 0.339 | 0.826 | 0.451 | 1.515 | 0.310 |
| 1984 | | | | | | | | | 0.605 | 0.335 | 1.092 | 0.302 | 0.631 | 0.325 | 1.223 | 0.340 |
| 1985 | | | | | | | | | 0.532 | 0.278 | 1.018 | 0.333 | 0.701 | 0.380 | 1.293 | 0.313 |
| 1986 | 0.576 | 0.411 | 0.808 | 0.170 | 0.816 | 0.432 | 1.544 | 0.327 | 0.495 | 0.316 | 0.775 | 0.227 | 1.906 | 1.256 | 2.892 | 0.211 |
| 1987 | 0.560 | 0.402 | 0.780 | 0.166 | 1.624 | 0.894 | 2.949 | 0.305 | 0.604 | 0.394 | 0.926 | 0.216 | 1.395 | 0.920 | 2.115 | 0.210 |
| 1988 | 0.563 | 0.403 | 0.785 | 0.168 | 0.505 | 0.263 | 0.970 | 0.335 | 0.860 | 0.554 | 1.336 | 0.223 | 0.802 | 0.514 | 1.252 | 0.225 |
| 1989 | 0.541 | 0.384 | 0.764 | 0.173 | 0.789 | 0.419 | 1.486 | 0.324 | 0.889 | 0.558 | 1.417 | 0.236 | 1.138 | 0.717 | 1.807 | 0.234 |
| 1990 | 0.709 | 0.513 | 0.979 | 0.162 | 0.998 | 0.556 | 1.793 | 0.299 | 1.350 | 0.885 | 2.059 | 0.213 | 1.851 | 1.199 | 2.856 | 0.219 |
| 1991 | 0.799 | 0.587 | 1.089 | 0.155 | 2.023 | 1.145 | 3.572 | 0.290 | 1.505 | 1.034 | 2.191 | 0.190 | 1.350 | 0.871 | 2.092 | 0.222 |
| 1992 | 0.910 | 0.700 | 1.183 | 0.132 | 1.288 | 0.722 | 2.301 | 0.296 | 1.032 | 0.747 | 1.425 | 0.163 | 1.408 | 0.976 | 2.031 | 0.185 |
| 1993 | 1.259 | 0.982 | 1.612 | 0.124 | 0.960 | 0.533 | 1.732 | 0.301 | 1.007 | 0.695 | 1.459 | 0.187 | 0.657 | 0.427 | 1.011 | 0.218 |
| 1994 | 1.136 | 0.879 | 1.467 | 0.129 | 1.292 | 0.726 | 2.298 | 0.294 | 1.440 | 1.021 | 2.030 | 0.173 | 0.613 | 0.406 | 0.926 | 0.208 |
| 1995 | 1.194 | 0.914 | 1.561 | 0.135 | 0.777 | 0.423 | 1.427 | 0.311 | 0.673 | 0.446 | 1.014 | 0.207 | 0.420 | 0.262 | 0.673 | 0.239 |
| 1996 | 1.147 | 0.860 | 1.530 | 0.145 | 0.777 | 0.422 | 1.431 | 0.313 | 1.406 | 1.004 | 1.970 | 0.170 | 0.736 | 0.477 | 1.134 | 0.219 |
| 1997 | 1.309 | 0.995 | 1.723 | 0.138 | 0.685 | 0.367 | 1.279 | 0.320 | 1.734 | 1.274 | 2.360 | 0.155 | 0.627 | 0.414 | 0.950 | 0.210 |
| 1998 | 1.069 | 0.801 | 1.427 | 0.145 | 0.353 | 0.181 | 0.686 | 0.342 | 1.241 | 0.914 | 1.686 | 0.154 | 0.772 | 0.521 | 1.146 | 0.199 |
| 1999 | 0.955 | 0.687 | 1.327 | 0.165 | 0.705 | 0.374 | 1.329 | 0.325 | 1.129 | 0.852 | 1.495 | 0.141 | 1.315 | 0.922 | 1.875 | 0.179 |
| 2000 | 0.777 | 0.554 | 1.089 | 0.170 | 1.044 | 0.568 | 1.916 | 0.311 | 0.915 | 0.679 | 1.233 | 0.150 | 0.960 | 0.667 | 1.383 | 0.184 |
| 2001 | 1.043 | 0.750 | 1.450 | 0.166 | 0.401 | 0.201 | 0.801 | 0.357 | 1.019 | 0.765 | 1.356 | 0.144 | 0.998 | 0.688 | 1.449 | 0.188 |
| 2002 | 0.980 | 0.702 | 1.367 | 0.168 | 0.789 | 0.421 | 1.481 | 0.323 | 1.030 | 0.777 | 1.365 | 0.142 | 0.912 | 0.630 | 1.320 | 0.186 |
| 2003 | 0.931 | 0.657 | 1.319 | 0.176 | 0.569 | 0.292 | 1.108 | 0.343 | 1.158 | 0.870 | 1.542 | 0.144 | 0.987 | 0.676 | 1.440 | 0.191 |
| 2004 | 1.005 | 0.718 | 1.408 | 0.169 | 0.523 | 0.273 | 1.003 | 0.334 | 0.978 | 0.729 | 1.312 | 0.148 | 1.063 | 0.738 | 1.532 | 0.184 |
| 2005 | 1.271 | 0.939 | 1.719 | 0.152 | 0.542 | 0.285 | 1.031 | 0.330 | 0.967 | 0.705 | 1.325 | 0.159 | 0.712 | 0.478 | 1.059 | 0.201 |
| 2006 | 1.105 | 0.802 | 1.522 | 0.161 | 1.011 | 0.544 | 1.880 | 0.318 | 0.889 | 0.650 | 1.216 | 0.158 | 0.871 | 0.594 | 1.277 | 0.193 |
| 2007 | 1.205 | 0.884 | 1.641 | 0.155 | 1.552 | 0.861 | 2.798 | 0.301 | 0.984 | 0.721 | 1.343 | 0.156 | 0.902 | 0.620 | 1.310 | 0.189 |
| 2008 | 1.153 | 0.845 | 1.575 | 0.157 | 1.961 | 1.099 | 3.498 | 0.296 | 1.164 | 0.864 | 1.569 | 0.150 | 1.003 | 0.687 | 1.464 | 0.191 |
| 2009 | 1.304 | 0.992 | 1.714 | 0.137 | 1.916 | 1.088 | 3.374 | 0.289 | 0.960 | 0.693 | 1.330 | 0.164 | 0.822 | 0.570 | 1.187 | 0.185 |
| 2010 | 1.498 | 1.133 | 1.981 | 0.140 | 1.098 | 0.603 | 2.001 | 0.307 | 1.205 | 0.871 | 1.666 | 0.163 | 1.354 | 0.923 | 1.987 | 0.193 |

Table 5.4.5.1. Total trips, positive trips, and percentage of positive trips that encountered Spanish mackerel from the MRFSS database as subset for Spanish mackerel.

| Year | Total Trips | Positive Trips | Percentage Positive Trips |
|---|---|---|---|
| 1981 | 3760 | 177 | 4.71 |
| 1982 | 6633 | 331 | 4.99 |
| 1983 | 4286 | 185 | 4.32 |
| 1984 | 5200 | 149 | 2.87 |
| 1985 | 5930 | 181 | 3.05 |
| 1986 | 10551 | 693 | 6.57 |
| 1987 | 10506 | 689 | 6.56 |
| 1988 | 12467 | 506 | 4.06 |
| 1989 | 8968 | 436 | 4.86 |
| 1990 | 7723 | 540 | 6.99 |
| 1991 | 8568 | 511 | 5.96 |
| 1992 | 18782 | 1243 | 6.62 |
| 1993 | 17628 | 636 | 3.61 |
| 1994 | 20027 | 758 | 3.78 |
| 1995 | 18023 | 413 | 2.29 |
| 1996 | 18652 | 622 | 3.33 |
| 1997 | 19110 | 682 | 3.57 |
| 1998 | 22447 | 930 | 4.14 |
| 1999 | 30760 | 1701 | 5.53 |
| 2000 | 27005 | 1380 | 5.11 |
| 2001 | 27225 | 1391 | 5.11 |
| 2002 | 28550 | 1470 | 5.15 |
| 2003 | 29287 | 1317 | 4.50 |
| 2004 | 29978 | 1704 | 5.68 |
| 2005 | 27006 | 1000 | 3.70 |
| 2006 | 26818 | 1217 | 4.54 |
| 2007 | 28081 | 1415 | 5.04 |
| 2008 | 28436 | 1276 | 4.49 |
| 2009 | 29071 | 1482 | 5.10 |
| 2010 | 28181 | 1637 | 5.81 |
| | 559659 | 26672 | 4.77 |

Table 5.4.5.2. Total number of trips by month and year in the Gulf of Mexico from MRFSS for Spanish mackerel.

| Year | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | | | | 208 | 275 | 330 | 323 | 825 | 327 | 719 | 538 | 215 |
| 1982 | | | 354 | 642 | 1024 | 800 | 1061 | 1003 | 213 | 778 | 443 | 315 |
| 1983 | 107 | 103 | 462 | 647 | 498 | 592 | 401 | 376 | 261 | 440 | 156 | 243 |
| 1984 | 167 | 482 | 434 | 381 | 675 | 552 | 568 | 239 | 616 | 444 | 458 | 184 |
| 1985 | 150 | 275 | 372 | 549 | 552 | 585 | 645 | 503 | 545 | 642 | 552 | 560 |
| 1986 | 255 | 647 | 710 | 871 | 918 | 1120 | 1189 | 1031 | 1038 | 1017 | 917 | 838 |
| 1987 | 463 | 701 | 842 | 1091 | 1128 | 1047 | 1461 | 834 | 1060 | 952 | 685 | 242 |
| 1988 | 541 | 601 | 707 | 584 | 1035 | 744 | 1324 | 1501 | 1340 | 1804 | 1262 | 1024 |
| 1989 | 889 | 424 | 913 | 513 | 1249 | 549 | 905 | 978 | 937 | 634 | 688 | 289 |
| 1990 | 136 | 735 | 669 | 822 | 740 | 787 | 701 | 682 | 701 | 467 | 780 | 503 |
| 1991 | 357 | 707 | 629 | 717 | 786 | 1091 | 789 | 600 | 763 | 848 | 785 | 496 |
| 1992 | 933 | 1593 | 1358 | 2345 | 2274 | 1103 | 1915 | 973 | 1343 | 2083 | 1851 | 1011 |
| 1993 | | 1776 | 1903 | 1137 | 1807 | 1712 | 1840 | 1978 | 1414 | 1367 | 1636 | 1058 |
| 1994 | 1330 | 1768 | 1681 | 1574 | 1813 | 2239 | 2204 | 1811 | 1599 | 1319 | 1456 | 1233 |
| 1995 | 1494 | 1258 | 1655 | 1484 | 1695 | 1829 | 1799 | 1743 | 1671 | 1114 | 1250 | 1031 |
| 1996 | 954 | 1041 | 1342 | 1728 | 1671 | 1809 | 1586 | 1998 | 1429 | 2205 | 1562 | 1327 |
| 1997 | 1143 | 1175 | 1505 | 1435 | 1917 | 1882 | 1796 | 1670 | 1949 | 1876 | 1774 | 988 |
| 1998 | 1513 | 1282 | 1540 | 1535 | 1924 | 1699 | 2409 | 2478 | 882 | 2196 | 2483 | 2506 |
| 1999 | 3076 | 2892 | 3587 | 3978 | 2192 | 2337 | 3012 | 2552 | 1683 | 1978 | 1911 | 1562 |
| 2000 | 1608 | 2185 | 2322 | 2774 | 2736 | 2936 | 2663 | 2257 | 2033 | 2193 | 1714 | 1584 |
| 2001 | 1750 | 1998 | 2306 | 2631 | 2655 | 2743 | 2571 | 2503 | 2529 | 1931 | 2003 | 1605 |
| 2002 | 1753 | 1794 | 2640 | 2690 | 2990 | 3113 | 2550 | 2724 | 2122 | 2350 | 2044 | 1780 |
| 2003 | 1742 | 2573 | 2725 | 2715 | 3089 | 3021 | 3001 | 2441 | 2208 | 2021 | 2238 | 1513 |
| 2004 | 1788 | 1810 | 2865 | 2828 | 3038 | 3177 | 3086 | 2662 | 1921 | 2980 | 1935 | 1888 |
| 2005 | 2094 | 1933 | 2541 | 2898 | 3073 | 2806 | 2562 | 2286 | 1458 | 1762 | 1889 | 1704 |
| 2006 | 1753 | 1582 | 2176 | 2458 | 2462 | 2689 | 2688 | 2492 | 2437 | 2202 | 1864 | 2015 |
| 2007 | 1497 | 1653 | 2316 | 2471 | 2861 | 3075 | 2736 | 2550 | 2418 | 2160 | 2306 | 2038 |
| 2008 | 1704 | 2209 | 2671 | 2223 | 2703 | 2887 | 2883 | 2163 | 1995 | 2581 | 2548 | 1869 |
| 2009 | 2067 | 1758 | 2245 | 2845 | 3338 | 2811 | 2887 | 2480 | 2586 | 2393 | 2222 | 1439 |
| 2010 | 1497 | 1437 | 2142 | 2859 | 3182 | 2734 | 2578 | 2441 | 2653 | 2803 | 2396 | 1459 |
| Total | 32761 | 38392 | 47612 | 51633 | 56300 | 54799 | 56133 | 50774 | 44131 | 48259 | 44346 | 34519 |

Table 5.4.5.3. Number of positive trips that caught Spanish mackerel by month and year in the Gulf of Mexico from MRFSS for Spanish mackerel.

| Year | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | | | | 10 | 31 | 11 | 16 | 50 | 20 | 27 | 9 | 3 |
| 1982 | | | 7 | 42 | 72 | 49 | 33 | 83 | 4 | 35 | 4 | 2 |
| 1983 | 1 | 0 | 0 | 31 | 29 | 24 | 36 | 17 | 16 | 31 | 0 | 0 |
| 1984 | 0 | 2 | 4 | 3 | 10 | 52 | 40 | 1 | 13 | 20 | 3 | 1 |
| 1985 | 1 | 0 | 1 | 32 | 19 | 33 | 41 | 12 | 4 | 20 | 13 | 5 |
| 1986 | 1 | 5 | 12 | 98 | 86 | 111 | 82 | 82 | 77 | 62 | 72 | 5 |
| 1987 | 7 | 2 | 16 | 60 | 145 | 80 | 97 | 80 | 125 | 60 | 17 | 0 |
| 1988 | 1 | 4 | 15 | 63 | 96 | 49 | 56 | 84 | 44 | 62 | 25 | 7 |
| 1989 | 1 | 7 | 8 | 34 | 49 | 9 | 70 | 132 | 77 | 34 | 15 | 0 |
| 1990 | 0 | 16 | 43 | 63 | 34 | 37 | 48 | 96 | 98 | 66 | 35 | 4 |
| 1991 | 9 | 8 | 27 | 83 | 61 | 65 | 55 | 43 | 78 | 60 | 12 | 10 |
| 1992 | 15 | 52 | 162 | 309 | 224 | 65 | 85 | 56 | 59 | 157 | 53 | 6 |
| 1993 | | 11 | 17 | 62 | 46 | 70 | 31 | 72 | 148 | 81 | 83 | 15 |
| 1994 | 3 | 66 | 55 | 115 | 79 | 82 | 59 | 114 | 83 | 45 | 50 | 7 |
| 1995 | 3 | 15 | 25 | 36 | 31 | 24 | 30 | 52 | 110 | 52 | 27 | 8 |
| 1996 | 1 | 2 | 17 | 96 | 87 | 56 | 75 | 85 | 82 | 80 | 27 | 14 |
| 1997 | 11 | 36 | 72 | 51 | 47 | 48 | 72 | 40 | 131 | 96 | 60 | 18 |
| 1998 | 14 | 8 | 13 | 62 | 76 | 66 | 108 | 165 | 59 | 125 | 140 | 94 |
| 1999 | 69 | 60 | 143 | 284 | 190 | 154 | 149 | 168 | 144 | 182 | 103 | 55 |
| 2000 | 24 | 66 | 171 | 182 | 158 | 153 | 142 | 161 | 136 | 113 | 64 | 10 |
| 2001 | 8 | 44 | 58 | 208 | 137 | 137 | 94 | 184 | 226 | 105 | 111 | 79 |
| 2002 | 16 | 15 | 99 | 229 | 174 | 159 | 120 | 206 | 150 | 192 | 76 | 34 |
| 2003 | 13 | 31 | 197 | 162 | 102 | 69 | 76 | 160 | 173 | 170 | 149 | 15 |
| 2004 | 20 | 64 | 287 | 246 | 195 | 147 | 118 | 180 | 83 | 201 | 134 | 29 |
| 2005 | 22 | 18 | 57 | 176 | 291 | 125 | 84 | 99 | 39 | 42 | 37 | 10 |
| 2006 | 4 | 2 | 19 | 131 | 148 | 222 | 175 | 176 | 129 | 109 | 61 | 41 |
| 2007 | 41 | 12 | 130 | 264 | 170 | 135 | 112 | 84 | 119 | 127 | 122 | 99 |
| 2008 | 21 | 73 | 122 | 165 | 106 | 126 | 104 | 130 | 138 | 158 | 98 | 35 |
| 2009 | 18 | 29 | 117 | 111 | 269 | 131 | 107 | 149 | 184 | 181 | 130 | 56 |
| 2010 | 8 | 14 | 50 | 265 | 196 | 124 | 176 | 150 | 214 | 289 | 141 | 10 |
| Total | 332 | 662 | 1944 | 3673 | 3358 | 2613 | 2491 | 3111 | 2963 | 2982 | 1871 | 672 |

Table 5.4.5.4. Percentage of positive trips that caught Spanish mackerel by month and year in the Gulf of Mexico from MRFSS for Spanish mackerel.

| Year | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 0.00 | 0.00 | 0.00 | 4.81 | 11.27 | 3.33 | 4.95 | 6.06 | 6.12 | 3.76 | 1.67 | 1.40 |
| 1982 | 0.00 | 0.00 | 1.98 | 6.54 | 7.03 | 6.13 | 3.11 | 8.28 | 1.88 | 4.50 | 0.90 | 0.63 |
| 1983 | 0.93 | 0.00 | 0.00 | 4.79 | 5.82 | 4.05 | 8.98 | 4.52 | 6.13 | 7.05 | 0.00 | 0.00 |
| 1984 | 0.00 | 0.41 | 0.92 | 0.79 | 1.48 | 9.42 | 7.04 | 0.42 | 2.11 | 4.50 | 0.66 | 0.54 |
| 1985 | 0.67 | 0.00 | 0.27 | 5.83 | 3.44 | 5.64 | 6.36 | 2.39 | 0.73 | 3.12 | 2.36 | 0.89 |
| 1986 | 0.39 | 0.77 | 1.69 | 11.25 | 9.37 | 9.91 | 6.90 | 7.95 | 7.42 | 6.10 | 7.85 | 0.60 |
| 1987 | 1.51 | 0.29 | 1.90 | 5.50 | 12.85 | 7.64 | 6.64 | 9.59 | 11.79 | 6.30 | 2.48 | 0.00 |
| 1988 | 0.18 | 0.67 | 2.12 | 10.79 | 9.28 | 6.59 | 4.23 | 5.60 | 3.28 | 3.44 | 1.98 | 0.68 |
| 1989 | 0.11 | 1.65 | 0.88 | 6.63 | 3.92 | 1.64 | 7.73 | 13.50 | 8.22 | 5.36 | 2.18 | 0.00 |
| 1990 | 0.00 | 2.18 | 6.43 | 7.66 | 4.59 | 4.70 | 6.85 | 14.08 | 13.98 | 14.13 | 4.49 | 0.80 |
| 1991 | 2.52 | 1.13 | 4.29 | 11.58 | 7.76 | 5.96 | 6.97 | 7.17 | 10.22 | 7.08 | 1.53 | 2.02 |
| 1992 | 1.61 | 3.26 | 11.93 | 13.18 | 9.85 | 5.89 | 4.44 | 5.76 | 4.39 | 7.54 | 2.86 | 0.59 |
| 1993 | 0.00 | 0.62 | 0.89 | 5.45 | 2.55 | 4.09 | 1.68 | 3.64 | 10.47 | 5.93 | 5.07 | 1.42 |
| 1994 | 0.23 | 3.73 | 3.27 | 7.31 | 4.36 | 3.66 | 2.68 | 6.29 | 5.19 | 3.41 | 3.43 | 0.57 |
| 1995 | 0.20 | 1.19 | 1.51 | 2.43 | 1.83 | 1.31 | 1.67 | 2.98 | 6.58 | 4.67 | 2.16 | 0.78 |
| 1996 | 0.10 | 0.19 | 1.27 | 5.56 | 5.21 | 3.10 | 4.73 | 4.25 | 5.74 | 3.63 | 1.73 | 1.06 |
| 1997 | 0.96 | 3.06 | 4.78 | 3.55 | 2.45 | 2.55 | 4.01 | 2.40 | 6.72 | 5.12 | 3.38 | 1.82 |
| 1998 | 0.93 | 0.62 | 0.84 | 4.04 | 3.95 | 3.88 | 4.48 | 6.66 | 6.69 | 5.69 | 5.64 | 3.75 |
| 1999 | 2.24 | 2.07 | 3.99 | 7.14 | 8.67 | 6.59 | 4.95 | 6.58 | 8.56 | 9.20 | 5.39 | 3.52 |
| 2000 | 1.49 | 3.02 | 7.36 | 6.56 | 5.77 | 5.21 | 5.33 | 7.13 | 6.69 | 5.15 | 3.73 | 0.63 |
| 2001 | 0.46 | 2.20 | 2.52 | 7.91 | 5.16 | 4.99 | 3.66 | 7.35 | 8.94 | 5.44 | 5.54 | 4.92 |
| 2002 | 0.91 | 0.84 | 3.75 | 8.51 | 5.82 | 5.11 | 4.71 | 7.56 | 7.07 | 8.17 | 3.72 | 1.91 |
| 2003 | 0.75 | 1.20 | 7.23 | 5.97 | 3.30 | 2.28 | 2.53 | 6.55 | 7.84 | 8.41 | 6.66 | 0.99 |
| 2004 | 1.12 | 3.54 | 10.02 | 8.70 | 6.42 | 4.63 | 3.82 | 6.76 | 4.32 | 6.74 | 6.93 | 1.54 |
| 2005 | 1.05 | 0.93 | 2.24 | 6.07 | 9.47 | 4.45 | 3.28 | 4.33 | 2.67 | 2.38 | 1.96 | 0.59 |
| 2006 | 0.23 | 0.13 | 0.87 | 5.33 | 6.01 | 8.26 | 6.51 | 7.06 | 5.29 | 4.95 | 3.27 | 2.03 |
| 2007 | 2.74 | 0.73 | 5.61 | 10.68 | 5.94 | 4.39 | 4.09 | 3.29 | 4.92 | 5.88 | 5.29 | 4.86 |
| 2008 | 1.23 | 3.30 | 4.57 | 7.42 | 3.92 | 4.36 | 3.61 | 6.01 | 6.92 | 6.12 | 3.85 | 1.87 |
| 2009 | 0.87 | 1.65 | 5.21 | 3.90 | 8.06 | 4.66 | 3.71 | 6.01 | 7.12 | 7.56 | 5.85 | 3.89 |
| 2010 | 0.53 | 0.97 | 2.33 | 9.27 | 6.16 | 4.54 | 6.83 | 6.15 | 8.07 | 10.31 | 5.88 | 0.69 |
| Total | 1.01 | 1.72 | 4.08 | 7.11 | 5.96 | 4.77 | 4.44 | 6.13 | 6.71 | 6.18 | 4.22 | 1.95 |

Table 5.4.5.5. Total trips, positive trips, and the percentage of positive trips that caught Spanish mackerel by mode and year in the Gulf of Mexico from MRFSS for Spanish mackerel.

| Year | Total Number of Trips | | | Positive Trips | | | Percentage Positive Trips | | |
|---|---|---|---|---|---|---|---|---|---|
| | Shore | Charter | Private/ Rental | Shore | Charter | Private/ Rental | Shore | Charter | Private/ Rental |
| 1981 | 1937 | 232 | 1591 | 54 | 32 | 91 | 2.79 | 13.79 | 5.72 |
| 1982 | 3488 | 177 | 2968 | 83 | 37 | 211 | 2.38 | 20.90 | 7.11 |
| 1983 | 2530 | 362 | 1394 | 72 | 43 | 70 | 2.85 | 11.88 | 5.02 |
| 1984 | 2955 | 442 | 1803 | 39 | 59 | 51 | 1.32 | 13.35 | 2.83 |
| 1985 | 3415 | 326 | 2189 | 39 | 63 | 79 | 1.14 | 19.33 | 3.61 |
| 1986 | 1930 | 1303 | 7318 | 89 | 201 | 403 | 4.61 | 15.43 | 5.51 |
| 1987 | 2166 | 1014 | 7326 | 90 | 184 | 415 | 4.16 | 18.15 | 5.66 |
| 1988 | 3536 | 1017 | 7914 | 62 | 132 | 312 | 1.75 | 12.98 | 3.94 |
| 1989 | 2900 | 770 | 5298 | 87 | 107 | 242 | 3.00 | 13.90 | 4.57 |
| 1990 | 2449 | 592 | 4682 | 177 | 118 | 245 | 7.23 | 19.93 | 5.23 |
| 1991 | 2880 | 696 | 4992 | 105 | 118 | 288 | 3.65 | 16.95 | 5.77 |
| 1992 | 5704 | 1322 | 11756 | 375 | 174 | 694 | 6.57 | 13.16 | 5.90 |
| 1993 | 7799 | 901 | 8928 | 356 | 60 | 220 | 4.56 | 6.66 | 2.46 |
| 1994 | 8935 | 885 | 10207 | 394 | 68 | 296 | 4.41 | 7.68 | 2.90 |
| 1995 | 8325 | 709 | 8989 | 173 | 72 | 168 | 2.08 | 10.16 | 1.87 |
| 1996 | 6009 | 883 | 11760 | 200 | 72 | 350 | 3.33 | 8.15 | 2.98 |
| 1997 | 5881 | 1484 | 11745 | 199 | 184 | 299 | 3.38 | 12.40 | 2.55 |
| 1998 | 6691 | 2539 | 13217 | 292 | 249 | 389 | 4.36 | 9.81 | 2.94 |
| 1999 | 8693 | 4859 | 17208 | 561 | 462 | 678 | 6.45 | 9.51 | 3.94 |
| 2000 | 7093 | 5480 | 14432 | 334 | 544 | 502 | 4.71 | 9.93 | 3.48 |
| 2001 | 7284 | 4259 | 15682 | 458 | 332 | 601 | 6.29 | 7.80 | 3.83 |
| 2002 | 7322 | 4376 | 16852 | 468 | 305 | 697 | 6.39 | 6.97 | 4.14 |
| 2003 | 8008 | 4997 | 16282 | 342 | 373 | 602 | 4.27 | 7.46 | 3.70 |
| 2004 | 7281 | 4966 | 17731 | 418 | 418 | 868 | 5.74 | 8.42 | 4.90 |
| 2005 | 7271 | 4043 | 15692 | 223 | 243 | 534 | 3.07 | 6.01 | 3.40 |
| 2006 | 6872 | 3218 | 16728 | 333 | 178 | 706 | 4.85 | 5.53 | 4.22 |
| 2007 | 7355 | 3394 | 17332 | 411 | 295 | 709 | 5.59 | 8.69 | 4.09 |
| 2008 | 7423 | 3345 | 17668 | 365 | 259 | 652 | 4.92 | 7.74 | 3.69 |
| 2009 | 7863 | 2873 | 18335 | 427 | 272 | 783 | 5.43 | 9.47 | 4.27 |
| 2010 | 7858 | 3077 | 17246 | 520 | 290 | 827 | 6.62 | 9.42 | 4.80 |
| Total | 169853 | 64541 | 325265 | 7746 | 5944 | 12982 | 4.56 | 9.21 | 3.99 |

Table 5.4.5.6. Total number of trips, positive trips, and the percentage of positive trips that caught Spanish mackerel by state and year in the Gulf of Mexico from MRFSS for Spanish mackerel.

| Year | Total Number of Trips | | | | Positive Trips | | | | Percentage Positive Trips | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LA | MS | LA | FL West | LA | MS | LA | FL West | LA | MS | LA | FL West |
| 1981 | 568 | 367 | 422 | 2403 | 5 | 33 | 48 | 91 | 0.88 | 8.99 | 11.37 | 3.79 |
| 1982 | 952 | 1084 | 1101 | 3496 | 26 | 71 | 139 | 95 | 2.73 | 6.55 | 12.62 | 2.72 |
| 1983 | 873 | 544 | 768 | 2101 | 11 | 40 | 73 | 61 | 1.26 | 7.35 | 9.51 | 2.90 |
| 1984 | 1090 | 855 | 723 | 2532 | 4 | 56 | 58 | 31 | 0.37 | 6.55 | 8.02 | 1.22 |
| 1985 | 1603 | 449 | 803 | 3075 | 9 | 48 | 51 | 73 | 0.56 | 10.69 | 6.35 | 2.37 |
| 1986 | 3811 | 1056 | 884 | 4800 | 15 | 81 | 105 | 492 | 0.39 | 7.67 | 11.88 | 10.25 |
| 1987 | 1563 | 1035 | 1276 | 6632 | 20 | 93 | 153 | 423 | 1.28 | 8.99 | 11.99 | 6.38 |
| 1988 | 2254 | 1243 | 1060 | 7910 | 33 | 81 | 55 | 337 | 1.46 | 6.52 | 5.19 | 4.26 |
| 1989 | 1659 | 1040 | 906 | 5363 | 33 | 73 | 99 | 231 | 1.99 | 7.02 | 10.93 | 4.31 |
| 1990 | 1501 | 882 | 771 | 4569 | 30 | 97 | 118 | 295 | 2.00 | 11.00 | 15.30 | 6.46 |
| 1991 | 1746 | 1020 | 1172 | 4630 | 50 | 78 | 91 | 292 | 2.86 | 7.65 | 7.76 | 6.31 |
| 1992 | 3869 | 1977 | 1630 | 11306 | 84 | 163 | 106 | 890 | 2.17 | 8.24 | 6.50 | 7.87 |
| 1993 | 2645 | 1173 | 1129 | 12681 | 24 | 28 | 64 | 520 | 0.91 | 2.39 | 5.67 | 4.10 |
| 1994 | 3013 | 1547 | 1388 | 14079 | 24 | 32 | 83 | 619 | 0.80 | 2.07 | 5.98 | 4.40 |
| 1995 | 2649 | 1204 | 1112 | 13058 | 29 | 32 | 69 | 283 | 1.09 | 2.66 | 6.21 | 2.17 |
| 1996 | 2732 | 1414 | 1392 | 13114 | 14 | 37 | 90 | 481 | 0.51 | 2.62 | 6.47 | 3.67 |
| 1997 | 3059 | 1411 | 1319 | 13321 | 43 | 65 | 60 | 514 | 1.41 | 4.61 | 4.55 | 3.86 |
| 1998 | 3178 | 1526 | 1711 | 16032 | 15 | 94 | 93 | 728 | 0.47 | 6.16 | 5.44 | 4.54 |
| 1999 | 4325 | 2106 | 2065 | 22264 | 28 | 124 | 226 | 1323 | 0.65 | 5.89 | 10.94 | 5.94 |
| 2000 | 4390 | 1743 | 1873 | 18999 | 42 | 81 | 187 | 1070 | 0.96 | 4.65 | 9.98 | 5.63 |
| 2001 | 4048 | 1470 | 1964 | 19743 | 15 | 61 | 140 | 1175 | 0.37 | 4.15 | 7.13 | 5.95 |
| 2002 | 4314 | 1362 | 1781 | 21093 | 33 | 43 | 81 | 1313 | 0.76 | 3.16 | 4.55 | 6.22 |
| 2003 | 4076 | 1571 | 1786 | 21854 | 20 | 47 | 72 | 1178 | 0.49 | 2.99 | 4.03 | 5.39 |
| 2004 | 4551 | 1511 | 1543 | 22373 | 23 | 38 | 99 | 1544 | 0.51 | 2.51 | 6.42 | 6.90 |
| 2005 | 4018 | 1074 | 1960 | 19954 | 31 | 22 | 62 | 885 | 0.77 | 2.05 | 3.16 | 4.44 |
| 2006 | 4718 | 1602 | 1679 | 18819 | 41 | 23 | 80 | 1073 | 0.87 | 1.44 | 4.76 | 5.70 |
| 2007 | 4753 | 1650 | 2028 | 19650 | 24 | 36 | 79 | 1276 | 0.50 | 2.18 | 3.90 | 6.49 |
| 2008 | 5135 | 1689 | 2026 | 19586 | 21 | 46 | 69 | 1140 | 0.41 | 2.72 | 3.41 | 5.82 |
| 2009 | 4698 | 1703 | 2218 | 20452 | 35 | 60 | 82 | 1305 | 0.74 | 3.52 | 3.70 | 6.38 |
| 2010 | 4056 | 1462 | 1901 | 20762 | 6 | 22 | 106 | 1503 | 0.15 | 1.50 | 5.58 | 7.24 |
| Total | 91847 | 38770 | 42391 | 386651 | 788 | 1805 | 2838 | 21241 | 0.86 | 4.66 | 6.69 | 5.49 |

Table 5.4.6.1. Atlantic Coast Spanish mackerel adjusted average pounds per trip for various gears, the coefficient of variation (cv), and index values scaled to mean. Commercial fishery data reported on Florida trip tickets.

Atlantic Coast, Florida Trip Ticket indices

| Year | Gill nets, 1986-1995 | | | Gill nets, 1995-2010 | | | Cast Nets, 1996-2010 | | | Hook-and-Line Gears | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | index (adjusted mean pounds/trip) | cv (%) | index scaled to mean | index (adjusted mean pounds/trip) | cv (%) | index scaled to mean | index (adjusted mean pounds/trip) | cv (%) | index scaled to mean | index (adjusted mean pounds/trip) | cv (%) | index scaled to mean |
| 1986 | 293.08 | 3.66 | 1.164 | | | | | | | 20.6 | 3.89 | 0.554 |
| 1987 | 261.54 | 3.77 | 1.039 | | | | | | | 24.8 | 4.19 | 0.667 |
| 1988 | 260.30 | 3.78 | 1.034 | | | | | | | 30.5 | 4.85 | 0.819 |
| 1989 | 318.60 | 3.81 | 1.265 | | | | | | | 27.4 | 4.81 | 0.735 |
| 1990 | 222.98 | 3.36 | 0.885 | | | | | | | 29.8 | 3.97 | 0.800 |
| 1991 | 220.92 | 3.38 | 0.877 | | | | | | | 22.2 | 3.14 | 0.596 |
| 1992 | 196.23 | 3.23 | 0.779 | | | | | | | 27.3 | 4.01 | 0.733 |
| 1993 | 317.52 | 8.14 | 1.261 | | | | | | | 31.7 | 4.27 | 0.851 |
| 1994 | 268.34 | 7.30 | 1.066 | | | | | | | 22.6 | 4.58 | 0.606 |
| 1995 | 413.17 | 6.97 | 1.641 | 140.04 | 17.47 | 1.089 | | | | 32.2 | 4.03 | 0.865 |
| 1996 | | | | 176.33 | 10.30 | 1.371 | 3.84 | 12.55 | 0.266 | 28.1 | 3.31 | 0.753 |
| 1997 | | | | 87.60 | 10.55 | 0.681 | 9.31 | 10.70 | 0.643 | 27.5 | 2.93 | 0.737 |
| 1998 | | | | 124.92 | 14.34 | 0.971 | 0.80 | 30.09 | 0.055 | 26.7 | 3.02 | 0.716 |
| 1999 | | | | 115.57 | 9.83 | 0.898 | 1.77 | 17.21 | 0.123 | 32.6 | 3.10 | 0.874 |
| 2000 | | | | 121.39 | 8.93 | 0.944 | 9.45 | 8.05 | 0.653 | 33.9 | 2.83 | 0.911 |
| 2001 | | | | 116.63 | 8.24 | 0.907 | 11.12 | 6.99 | 0.768 | 33.8 | 2.81 | 0.908 |
| 2002 | | | | 103.10 | 9.20 | 0.802 | 10.25 | 6.78 | 0.709 | 32.3 | 2.69 | 0.867 |
| 2003 | | | | 132.28 | 10.62 | 1.028 | 16.84 | 6.18 | 1.163 | 34.9 | 3.03 | 0.937 |
| 2004 | | | | 77.32 | 10.17 | 0.601 | 19.11 | 6.24 | 1.321 | 45.3 | 3.01 | 1.216 |
| 2005 | | | | 149.37 | 9.09 | 1.161 | 15.53 | 6.94 | 1.073 | 44.0 | 2.73 | 1.181 |
| 2006 | | | | 155.75 | 8.71 | 1.211 | 15.89 | 6.50 | 1.098 | 47.1 | 2.80 | 1.264 |
| 2007 | | | | 144.42 | 8.98 | 1.123 | 10.01 | 6.49 | 0.692 | 40.8 | 2.58 | 1.096 |
| 2008 | | | | 143.07 | 9.13 | 1.112 | 12.01 | 6.39 | 0.830 | 42.1 | 2.42 | 1.129 |
| 2009 | | | | 128.61 | 9.09 | 1.000 | 12.59 | 6.19 | 0.870 | 55.7 | 2.24 | 1.496 |
| 2010 | | | | 103.42 | 9.50 | 0.804 | 20.29 | 6.24 | 1.402 | 47.9 | 2.25 | 1.286 |

Table 5.4.6.2. Gulf Coast Spanish mackerel adjusted average pounds per trip for various gears, the coefficient of variation (cv), and index values scaled to mean. Commercial fishery data reported on Florida trip tickets.

Gulf Coast, Florida Trip Ticket indices

| Year | Gill nets, 1986-1995 | | | Gill nets, 1995-2010 | | | Cast Nets, 1996-2010 | | | Hook-and-Line Gears | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | index (adjusted mean pounds/trip) | cv (%) | index scaled to mean | index (adjusted mean pounds/trip) | cv (%) | index scaled to mean | index (adjusted mean pounds/trip) | cv (%) | index scaled to mean | index (adjusted mean pounds/trip) | cv (%) | index scaled to mean |
| 1986 | 153.66 | 2.96 | 0.602 | | | | | | | 29.1 | 4.41 | 0.694 |
| 1987 | 167.59 | 2.63 | 0.656 | | | | | | | 22.8 | 4.12 | 0.545 |
| 1988 | 208.84 | 3.07 | 0.818 | | | | | | | 30.8 | 4.54 | 0.735 |
| 1989 | 202.50 | 2.90 | 0.793 | | | | | | | 64.4 | 5.37 | 1.539 |
| 1990 | 202.82 | 2.45 | 0.794 | | | | | | | 41.7 | 4.97 | 0.996 |
| 1991 | 276.62 | 2.33 | 1.083 | | | | | | | 45.8 | 4.85 | 1.095 |
| 1992 | 312.84 | 2.29 | 1.225 | | | | | | | 45.9 | 5.71 | 1.097 |
| 1993 | 316.03 | 2.64 | 1.238 | | | | | | | 25.3 | 6.41 | 0.604 |
| 1994 | 340.55 | 2.50 | 1.334 | | | | | | | 43.6 | 5.93 | 1.042 |
| 1995 | 253.04 | 3.47 | 0.991 | 91.92 | 32.56 | 0.449 | | | | 39.7 | 7.41 | 0.949 |
| 1996 | | | | 176.80 | 15.64 | 0.864 | 70.22 | 32.49 | 0.937 | 30.4 | 6.10 | 0.727 |
| 1997 | | | | 84.12 | 18.36 | 0.411 | 28.41 | 33.48 | 0.379 | 33.2 | 7.31 | 0.794 |
| 1998 | | | | 84.41 | 15.62 | 0.412 | 63.69 | 33.40 | 0.850 | 48.3 | 7.34 | 1.155 |
| 1999 | | | | 141.49 | 17.34 | 0.691 | 72.52 | 34.57 | 0.967 | 40.1 | 7.05 | 0.958 |
| 2000 | | | | 104.05 | 15.60 | 0.508 | 69.03 | 32.37 | 0.921 | 31.8 | 6.73 | 0.760 |
| 2001 | | | | 265.83 | 17.14 | 1.299 | 137.15 | 32.24 | 1.830 | 59.7 | 6.48 | 1.427 |
| 2002 | | | | 355.52 | 23.53 | 1.737 | 93.54 | 32.50 | 1.248 | 46.0 | 6.46 | 1.100 |
| 2003 | | | | 324.07 | 22.02 | 1.583 | 55.96 | 32.86 | 0.747 | 54.0 | 6.56 | 1.289 |
| 2004 | | | | 630.82 | 27.22 | 3.082 | 43.78 | 36.05 | 0.584 | 66.7 | 7.46 | 1.594 |
| 2005 | | | | 459.92 | 22.91 | 2.247 | 49.32 | 33.68 | 0.658 | 46.9 | 7.56 | 1.119 |
| 2006 | | | | 221.10 | 22.75 | 1.080 | 103.91 | 33.52 | 1.386 | 62.4 | 6.98 | 1.490 |
| 2007 | | | | 233.38 | 21.61 | 1.140 | 37.92 | 36.85 | 0.506 | 49.1 | 6.75 | 1.173 |
| 2008 | | | | 173.62 | 18.50 | 0.848 | 51.93 | 34.80 | 0.693 | 45.4 | 7.83 | 1.086 |
| 2009 | | | | 527.11 | 20.22 | 2.575 | 59.25 | 34.57 | 0.790 | 59.9 | 5.85 | 1.431 |
| 2010 | | | | 307.85 | 22.80 | 1.504 | 148.04 | 35.58 | 1.975 | 66.7 | 5.89 | 1.594 |

## 5.7 Figures

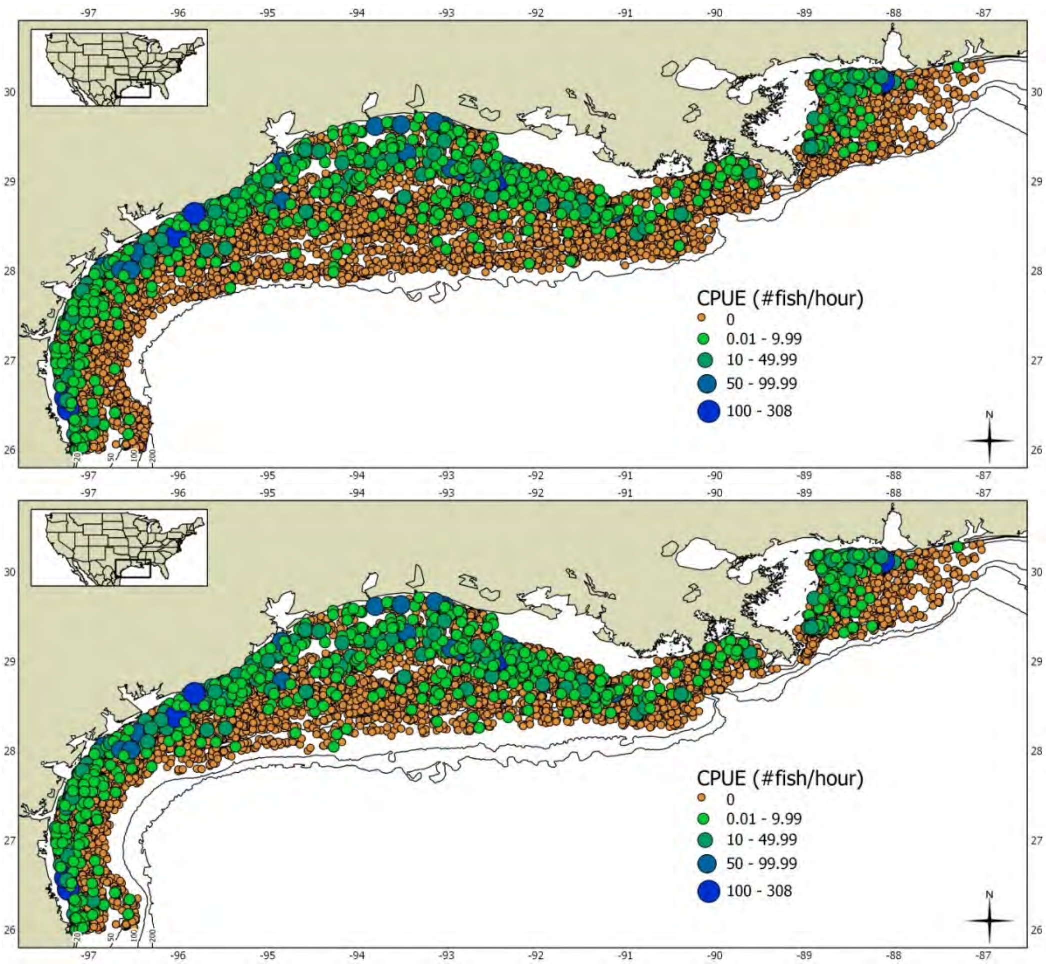


Figure 5.3.1.1. Stations sampled from 1987 to 2010 during the Summer and Fall SEAMAP Groundfish Survey with the CPUE for Spanish mackerel. Top figure has stations from all depth zones, bottom figure has only stations used for the analysis.

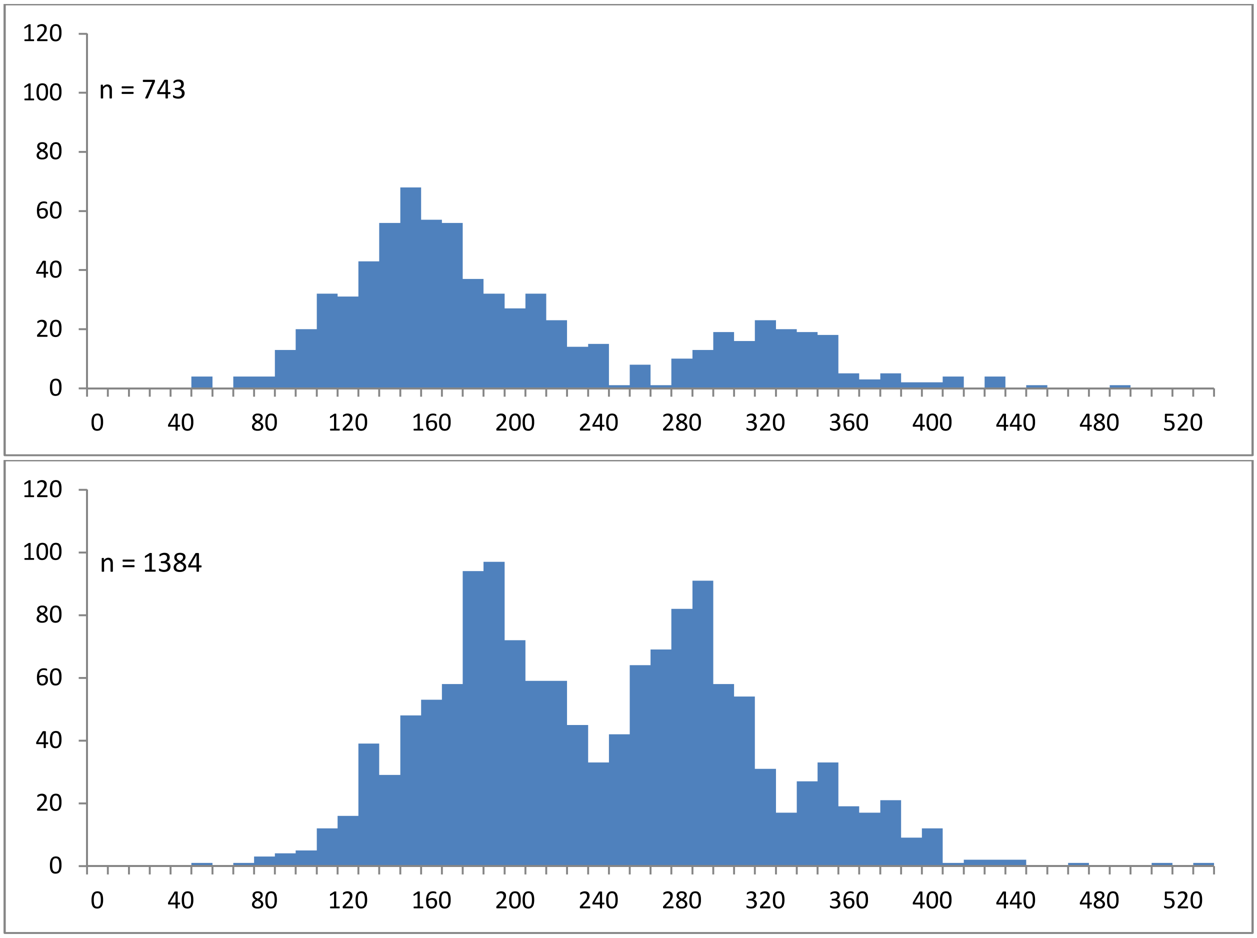


Figure 5.3.1.2. Length frequency distribution for Spanish mackerel caught during the Summer (top) and Fall (bottom) SEAMAP Groundfish Survey from 1987 to 2010.

**Figure 5.4.2.1.** Spanish mackerel nominal CPUE (solid circles), standardized CPUE (open diamonds) and upper and lower 95% confidence limits of the standardized CPUE estimates (dashed lines) for vessels fishing **(a)** Vertical line gear in the Gulf of Mexico.

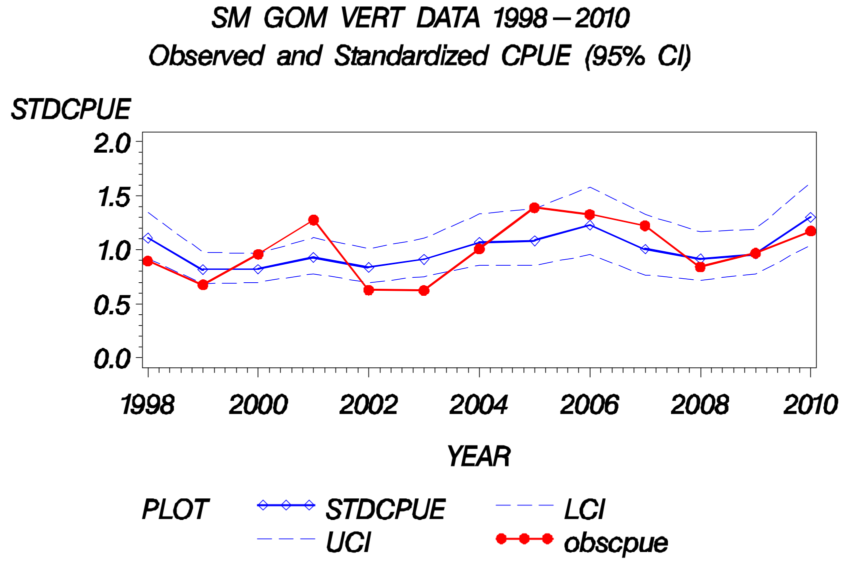


**Figure 5.4.3.1.** Spanish mackerel nominal CPUE (solid circles), standardized CPUE (open diamonds) and upper and lower 95% confidence limits of the standardized CPUE estimates (dashed lines) for vessels fishing Gillnet gear in the Gulf of Mexico.

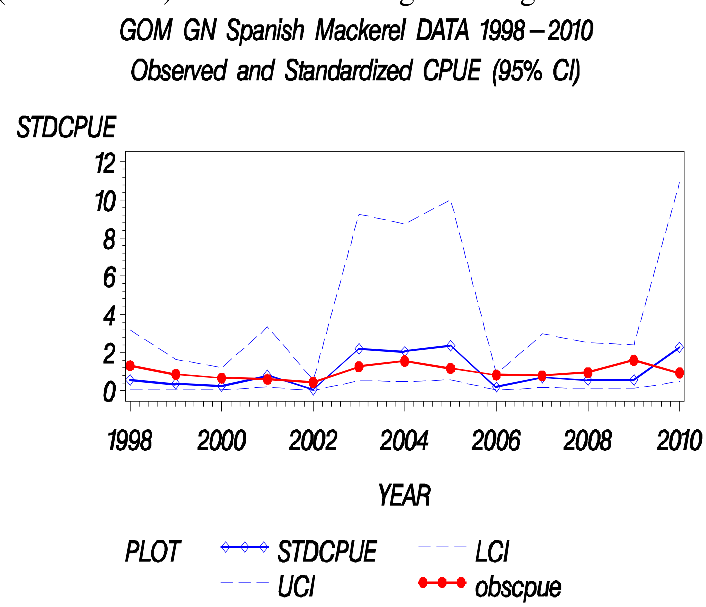


Figure 5.4.4.1. Map of headboat statistical areas.

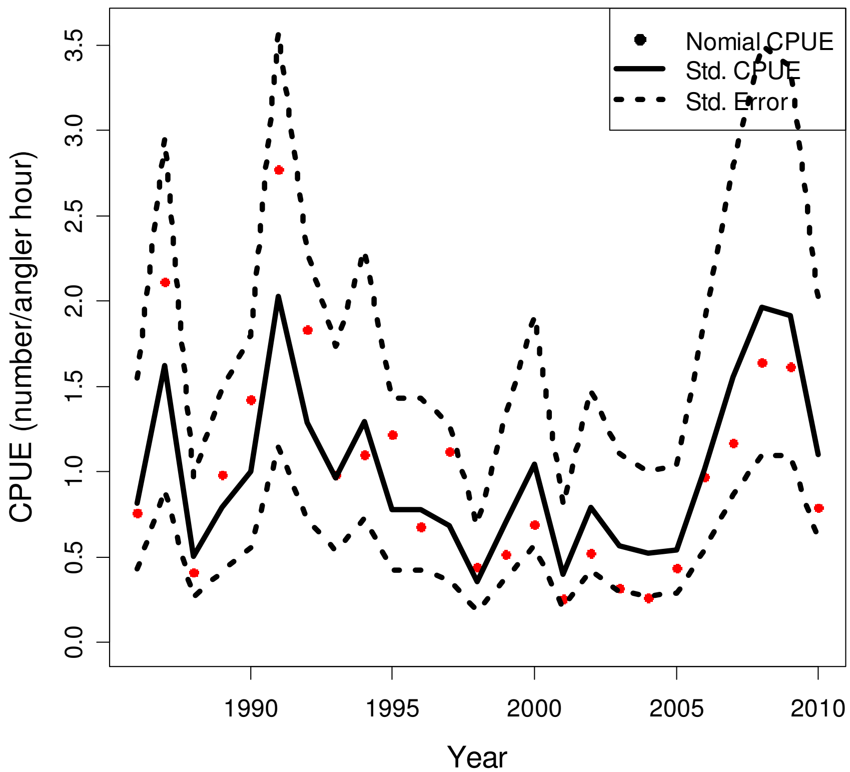


Figure 5.4.4.2. Nominal (observed) and standardized CPUE and the 95% confidence intervals for Spanish mackerel from the Headboat Survey in the GOM. CPUE values were normalized by the mean.

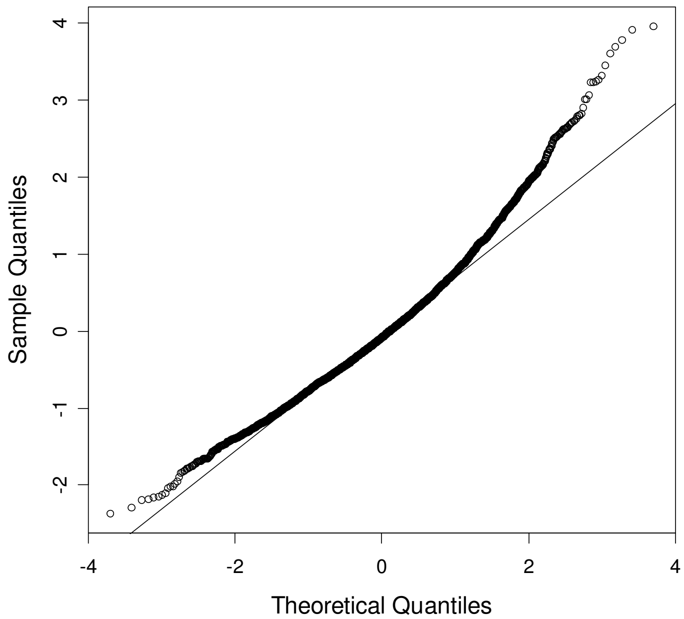


Figure 5.4.4.3. Q-Q plot of CPUE for Spanish mackerel in the GOM for the Headboat Survey.

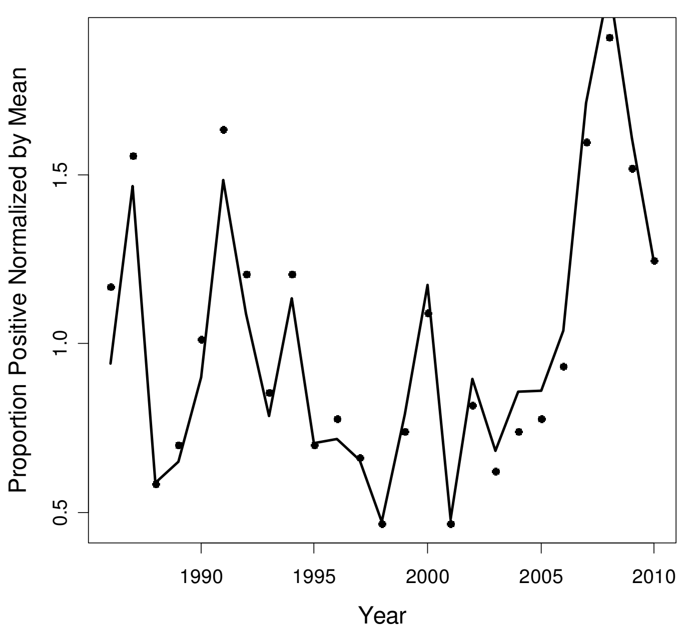


Figure 5.4.4.4. Observed proportion of trips catching Spanish mackerel (black points) and the binomial model fit (blue line) to the data normalized by the mean for the Headboat Survey.

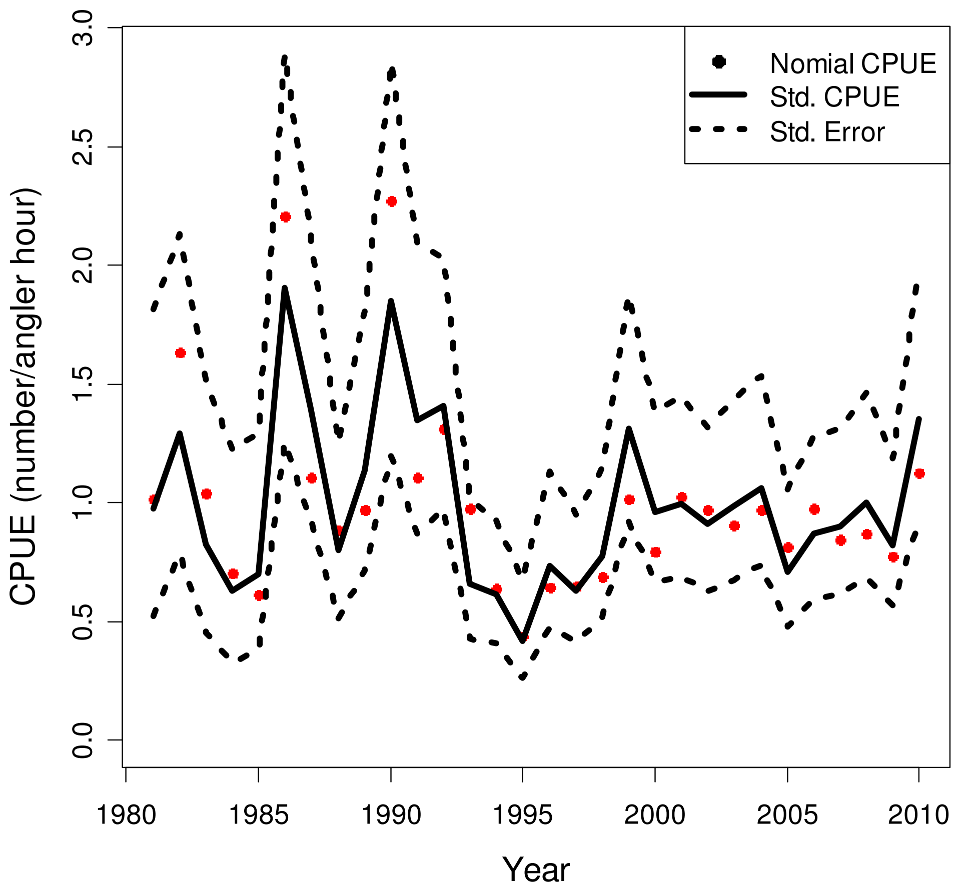


Figure 5.4.5.1. Nominal (observed) and standardized CPUE and the 95% confidence intervals for Spanish mackerel from MRFSS in the GOM. CPUE values were normalized by the mean.

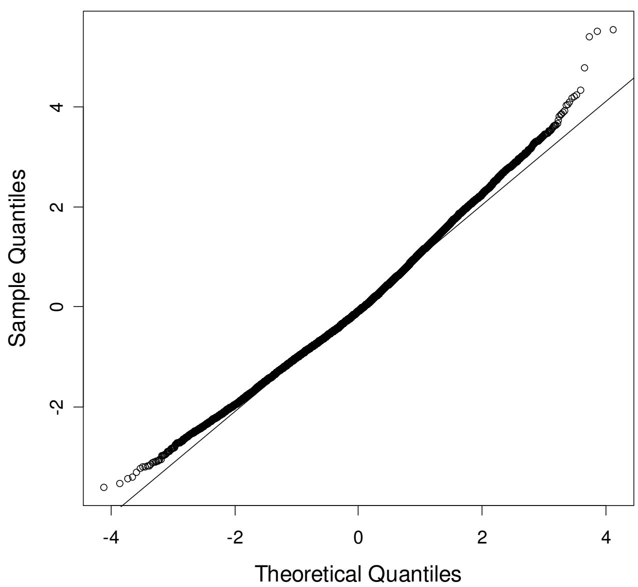


Figure 5.4.5.2. Q-Q plot of CPUE for Spanish mackerel in the GOM MRFSS Survey.

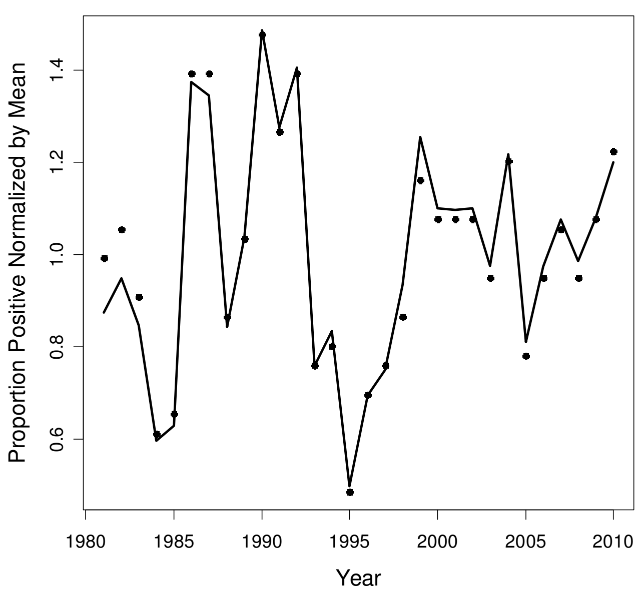


Figure 5.4.5.3. Observed proportion of trips catching Spanish mackerel (black points) and the binomial model fit (line) to the data normalized by the mean for MRFSS.

# 6 Analytic Approach

Recommended Analytic Approach – Gulf of Mexico Spanish mackerel

During the SEDAR28 Data Workshop available data, data quality and data sufficiency were discussed. Commercial and recreational landings data were complete from 1981 through 2010, and that preliminary landings for 2011 should be available for the assessment workshop. The panel concluded that size composition and age composition data were sufficient to consider an age and size structured model. The panel also concluded that a substantial commercial and recreational fishery existed prior to the period when abundance indices are available. Consequently, the analysts recommended that updated population analyses should be conducted using Stock Synthesis III (SS3, Methot 2000) as a first modeling approach Spanish mackerel in the Gulf of Mexico. SS3 is an integrated statistical catch-at-age model widely used for stock assessments in the United States. SS3 incorporates landings, size and age data inputs and can incorporate many important processes (mortality, selectivity, growth, etc.) that operate in conjunction to produce estimated catch, size and age composition and abundance. Because many inputs can be \correlated, they are jointly considered in the model process accounting for uncertainties in the input data. SS3 also has the ability to incorporate an early, data poor time period for which only catch data are available and a more recent, data-rich time period for which indices and length and age observations are available. Because SS3 assumes no uncertainty in landings, model conclusions should be verified using an alternative simple production model such as ASPIC (ASPIC 5.0 Suite of software).

*A note on the assessment models*
Forward-projecting age-structured assessment models will be attempted for both Gulf of Mexico and Atlantic Spanish mackerel. The Gulf of Mexico Spanish mackerel will be modeled using the Stock Synthesis 3 model, and the Atlantic Spanish mackerel will be conducted using the Beaufort Assessment Model. While the specific model platforms have some differences, fundamentally they can produce the same output if given the same input. The two analytical teams have experience working with their respective model platform and time and resource limitations dictate that they use the modeling platform with which they have the most familiarity and efficiency.

# 7 Research Recommendations

## 7.1 Life History

None provided.

## 7.2 Commercial Statistics

**Decision 10.** The WG determined the following recommendations be added to any pending recommendations issued in SEDAR 17 that have not been addressed.

- Need expanded observer coverage for the fisheries for Spanish mackerel.

  - 5-10% allocated by strata within states
  - get maximum information from fish
- Need research methods that capture Spanish mackerel in large enough numbers to create a reasonable index for young (age 0) Spanish mackerel.
- Expand TIP sampling to better cover all statistical strata.
  - Predominantly from Florida and by gillnet
  - Greater emphasis on collecting unbiased samples
- Establish a mechanism for identifying age samples that were collected by length or market categories, so as to better address any potential bias in age compositions.
- Need better information on migration patterns.
- Need to address issue of fish retained for bait (undersized) or used for food by crew (how to capture in landings).
- Compiling commercial data is surprisingly complex. As this is the 28th SEDAR, one might expect that many of the complications would have been resolved by now through better coordination among NMFS, ACCSP, and the states. Increased attention should be given toward the goal of "one-stop shopping" for commercial data.

## 7.3 Recreational Statistics

1) Increase proportion of fish with biological data within MRFSS sampling.

2) Continue to develop methods to collect a higher degree of information on released fish (length, condition, etc.) in the recreational fishery.

3) Require mandatory reporting for all charter boats state and federal.

4) Continue development of electronic mandatory reporting for for-hire sector.

5) Continued research efforts to incorporate/require logbook reporting from recreational anglers.

6) Establish a review panel to evaluate methods for reconstructing historical landings (SWAS, FWS, etc.).

7) Quantify historical fishing photos for use in reconstructing recreational historical landings.

8) Narrow down the sampling universe. Identify angler preference and effort. Require a reef fish stamp for anglers targeting reef fish, pelagic stamp for migratory species, and deep-water complex stamp for deep-water species. The program would be similar to the federal duck stamp required of hunters. This would allow the managers to identify what anglers were fishing for.

9) Continue and expand fishery dependent at-sea-observer surveys to collect discard information, which would provide for a more accurate index of abundance.

## 7.4 Indices

None provided.

## Section 5 Appendix – Index Report Cards

Appendix 5.1 SEAMAP Groundfish Trawl
Appendix 5.2 Texas Parks and Wildlife
Appendix 5.3 Commercial Vertical Line
Appendix 5.4 Commercial Gillnet
Appendix 5.5 Headboat
Appendix 5.6 MRFSS
Appendix 5.7 Florida Trip Ticket – Castnet
Appendix 5.8 Florida Trip Ticket – Handline
Appendix 5.9 Florida Trip Ticket – Gillnet

Appendix 5.1
Gulf of Mexico Spanish Mackerel
SEAMAP Index

## DESCRIPTION OF THE DATA SOURCE

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Fishery Independent Indices** | | | | |
| A. Describe the survey design (e.g. fixed sampling sites, random stratified sampling), location, seasons/months and years of sampling. | | | | ✓ |
| B. Describe sampling methodology (e.g. gear, vessel, soak time etc.) | | | | ✓ |
| C. Describe any changes in sampling methodology (e.g. gear, vessel, sample design etc.) | | | | ✓ |
| D. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | | | | ✓ |
| E. What species or species assemblages are targeted by this survey (e.g. red snapper, reef fish, pelagic). | | | | ✓ |
| F. Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | | | | ✓ |
| **2. Fishery Dependent Indices** | | | | |
| A. Describe the data source and type of fishery (e.g. commercial handline, commercial longline, recreational hook and line etc.). | ✓ | | | |
| B. Describe any changes to reporting requirements, variables reported, etc. | ✓ | | | |
| C. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | ✓ | | | |
| D Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |

## METHODS

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Data Reduction and Exclusions** | | | | |
| A. Describe any data exclusions (e.g. gears, fishing modes, sampling areas etc.). Report the number of records removed and justify removal. | | | | ✓ |
| B. Describe data reduction techniques (if any) used to address targeting (e.g. Stephens and MacCall, 2004; gear configuration, species assemblage etc). | ✓ | | | |
| C. Discuss procedures used to identify outliers. How many were identified? Were they excluded? | ✓ | | | |

**Working Group Comments:**

SEDAR28-DW03

SEAMAP Groundfish Survey

2. Management Regulations (for FD Indices)

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide (or cite) history of management regulations (e.g. bag limits, size limits, trip limits, closures etc.). | ✓ | | | |
| B. Describe the effects (if any) of management regulations on CPUE | ✓ | | | |
| C. Discuss methods used (if any) to minimize the effects of management measures on the CPUE series. | ✓ | | | |

3. Describe Analysis Dataset (after exclusions and other treatments)

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide tables and/or figures of number of observations by factors (including year, area, etc.) and interaction terms. | | ✓ | | |
| B. Include tables and/or figures of number of positive observations by factors and interaction terms. | | ✓ | | |
| C. Include tables and/or figures of the proportion positive observations by factors and interaction terms. | | ✓ | | |
| D. Include tables and/or figures of average (unstandardized) CPUE by factors and interaction terms. | | ✓ | | |
| E. Include annual maps of locations of survey sites (or fishing trips) and associated catch rates ***OR*** supply the raw data needed to construct these maps (Observation, Year, Latitude, Longitude (or statistical grid, area), Catch, Effort). | | | | ✓ |
| F. Describe the effort variable and the units. If more than one effort variable is present in the dataset, justify selection. | | | | ✓ |
| G. What are the units of catch (e.g. numbers or biomass, whole weight, gutted weight, kilograms, pounds). | | | | ✓ |

4. Model Standardization

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe model structure (e.g. delta-lognormal) | | | | ✓ |
| B. Describe construction of GLM components (e.g. forward selection from null etc.) | | | | ✓ |
| C. Describe inclusion criteria for factors and interactions terms. | | | | ✓ |
| D. Were YEAR*FACTOR interactions included in the model? If so, how (e.g. fixed effect, random effect)? Were random effects tested for significance using a likelihood ratio test? | | | | ✓ |
| E. Provide a table summarizing the construction of the GLM components. | | | | ✓ |
| F. Summarize model statistics of the mixed model formulation(s) (e.g. log likelihood, AIC, BIC etc.) | | | | ✓ |
| G. Report convergence statistics. | | | | ✓ |

**Working Group Comments:**

3A-D. Available On Demand

4A. Lo et al. method

4G. Available On Demand.

## MODEL DIAGNOSTICS

***Comment: Other model structures are possible and acceptable. Please provide appropriate diagnostics to the CPUE indices working group.***

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Binomial Component** | | | | |
| A. Include plots of the chi-square residuals by factor. | | | | ✓ |
| B. Include plots of predicted and observed proportion of positive trips by year and factor (e.g. year*area) | | ✓ | | |
| C. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | | | | ✓ |
| **2. Lognormal/Gamma Component** | | | | |
| A. Include histogram of log(CPUE) or a histogram of the residuals of the model on CPUE. Overlay the expected distribution. | | | | ✓ |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | | | | ✓ |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | | | | ✓ |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | | | | ✓ |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | | | | ✓ |
| F. Include plots of the residuals by factor | | | | ✓ |
| **3. Poisson Component** | | | | |
| A. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | ✓ | | | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |
| **4. Zero-inflated model** | | | | |
| A. Include ROC curve to quantify goodness of fit. | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor). | ✓ | | | |
| C. Include QQ-plot (e.g. Student dev. residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | |

**Working Group Comments:**

***The feasibility of this diagnostic is still under review.***

## MODEL DIAGNOSTICS (CONT.)

| Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|

**Working Group Comments:**

| | | | | |
|---|---|---|---|---|
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

## MODEL RESULTS

| | | | | |
|---|---|---|---|---|
| A. Tables of Nominal CPUE, Standardized CPUE, Observations, Positive Observations, Proportion Positive Observations and Coefficients of Variation (CVs). Other statistics may also be appropriate to report | | | | ✓ |
| B. Figure of Nominal and Standardized Indices with measure of variance (i.e. CVs). | | | | ✓ |

## IF MULTIPLE MODEL STRUCTURES WERE CONSIDERED:

(***Note: this is always recommended but required when model diagnostics are poor***.)

| | | | | |
|---|---|---|---|---|
| 1. Plot of resulting indices and estimates of variance | ✓ | | | |
| 2. Table of model statistics (e.g. AIC criteria) | ✓ | | | |

| | *Date Received* | *Workshop Recommendation* | *Revision Deadline **** | *Author and Rapporteur Signatures* |
|---|---|---|---|---|
| **First Submission** | 02/06/2012 | accept as prepared | N/A | |
| **Revision** | | | | |

*The revision deadline is negotiated by the author, the SEDAR coordinator and the CPUE rapporteur. The author* ***DOES NOT*** *commit to any* ***LEGAL OBLIGATION*** *by agreeing to submit a manuscript before this deadline. The maximum penalty for failure to submit a revised document prior to the submission deadline is rejection of the CPUE series.*

***Justification of Working Group Recommendation***

This index for Spanish mackerel was recommended for use. It is a fisheries independent survey across a long time series (1987-2010), with very good spatial converge (TX/Mexico border to Mobile Bay).

Reset Fields

Appendix 5.2
Gulf of Mexico Spanish Mackerel
Texas Parks and Wildlife Index

## DESCRIPTION OF THE DATA SOURCE

### 1. Fishery Independent Indices

| Item | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|
| A. Describe the survey design (e.g. fixed sampling sites, random stratified sampling), location, seasons/months and years of sampling. | ✓ | | | | |
| B. Describe sampling methodology (e.g. gear, vessel, soak time etc.) | ✓ | | | | |
| C. Describe any changes in sampling methodology (e.g. gear, vessel, sample design etc.) | ✓ | | | | |
| D. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | ✓ | | | | |
| E. What species or species assemblages are targeted by this survey (e.g. red snapper, reef fish, pelagic). | ✓ | | | | |
| F. Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | | |

### 2. Fishery Dependent Indices

| Item | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|
| A. Describe the data source and type of fishery (e.g. commercial handline, commercial longline, recreational hook and line etc.). | | | | ✓ | Rec, bay, creel, TX |
| B. Describe any changes to reporting requirements, variables reported, etc. | | | | ✓ | consistent |
| C. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | | | | ✓ | date, catch, effort |
| D Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | | | | ✓ | see size comp report |

## METHODS

### 1. Data Reduction and Exclusions

| Item | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|
| A. Describe any data exclusions (e.g. gears, fishing modes, sampling areas etc.). Report the number of records removed and justify removal. | | | | ✓ | eliminated bays |
| B. Describe data reduction techniques (if any) used to address targeting (e.g. Stephens and MacCall, 2004; gear configuration, species assemblage etc). | | | | ✓ | Ran w/ and w/o Stephens and McCall |
| C. Discuss procedures used to identify outliers. How many were identified? Were they excluded? | | | | ✓ | Plotted, 2 SE. |

| 2. Management Regulations (for FD Indices) | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|
| A. Provide (or cite) history of management regulations (e.g. bag limits, size limits, trip limits, closures etc.). | | | | ✓ | Management was constant over index period |
| B. Describe the effects (if any) of management regulations on CPUE | | | | ✓ | |
| C. Discuss methods used (if any) to minimize the effects of management measures on the CPUE series. | | | | ✓ | |

| 3. Describe Analysis Dataset (after exclusions and other treatments) | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|
| A. Provide tables and/or figures of number of observations by factors (including year, area, etc.) and interaction terms. | | | | ✓ | Data set description provided. |
| B. Include tables and/or figures of number of positive observations by factors and interaction terms. | | | | ✓ | |
| C. Include tables and/or figures of the proportion positive observations by factors and interaction terms. | | | | ✓ | |
| D. Include tables and/or figures of average (unstandardized) CPUE by factors and interaction terms. | | | | ✓ | |
| E. Include annual maps of locations of survey sites (or fishing trips) and associated catch rates ***OR*** supply the raw data needed to construct these maps (Observation, Year, Latitude, Longitude (or statistical grid, area), Catch, Effort). | | | | ✓ | |
| F. Describe the effort variable and the units. If more than one effort variable is present in the dataset, justify selection. | | | | ✓ | |
| G. What are the units of catch (e.g. numbers or biomass, whole weight, gutted weight, kilograms, pounds). | | | | ✓ | |

| 4. Model Standardization | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|
| A. Describe model structure (e.g. delta-lognormal) | | | | ✓ | |
| B. Describe construction of GLM components (e.g. forward selection from null etc.) | | | ✓ | | Details provided upon questioning. |
| C. Describe inclusion criteria for factors and interactions terms. | | | | ✓ | |
| D. Were YEAR*FACTOR interactions included in the model? If so, how (e.g. fixed effect, random effect)? Were random effects tested for significance using a likelihood ratio test? | | | | ✓ | |
| E. Provide a table summarizing the construction of the GLM components. | | ✓ | | | |
| F. Summarize model statistics of the mixed model formulation(s) (e.g. log likelihood, AIC, BIC etc.) | | | | ✓ | |
| G. Report convergence statistics. | | | | ✓ | |

**MODEL DIAGNOSTICS**

***Comment: Other model structures are possible and acceptable. Please provide appropriate diagnostics to the CPUE indices working group.***

| Item | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|
| **1. Binomial Component** | | | | | |
| A. Include plots of the chi-square residuals by factor. | | | | ✓ | |
| B. Include plots of predicted and observed proportion of positive trips by year and factor (e.g. year*area) | | | | ✓ | |
| C. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | | | | ✓ | |
| **2. Lognormal/Gamma Component** | | | | | |
| A. Include histogram of log(CPUE) or a histogram of the residuals of the model on CPUE. Overlay the expected distribution. | | | | ✓ | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | | | | ✓ | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | | | | ✓ | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | | | | ✓ | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | | | | ✓ | |
| F. Include plots of the residuals by factor | | | | ✓ | |
| **3. Poisson Component** | | | | | Poisson component not explored. |
| A. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | ✓ | | | | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | | ***The feasibility of this diagnostic is still under review.*** |
| **4. Zero-inflated model** | | | | | |
| A. Include ROC curve to quantify goodness of fit. | ✓ | | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor). | ✓ | | | | |
| C. Include QQ-plot (e.g. Student dev. residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | | |

**MODEL DIAGNOSTICS (CONT.)**

| | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

## MODEL RESULTS

| | | | | |
|---|---|---|---|---|
| A. Tables of Nominal CPUE, Standardized CPUE, Observations, Positive Observations, Proportion Positive Observations and Coefficients of Variation (CVs). Other statistics may also be appropriate to report | | | | ✓ |
| B. Figure of Nominal and Standardized Indices with measure of variance (i.e. CVs). | | | | ✓ |

## IF MULTIPLE MODEL STRUCTURES WERE CONSIDERED:

(***Note: this is always recommended but required when model diagnostics are poor***.)

| | | | | |
|---|---|---|---|---|
| 1. Plot of resulting indices and estimates of variance | ✓ | | | |
| 2. Table of model statistics (e.g. AIC criteria) | ✓ | | | |

| | *Date Received* | *Workshop Recommendation* | *Revision Deadline **** | *Author and Rapporteur Signatures* |
|---|---|---|---|---|
| **First Submission** | 2/15/2012 | Do not include | | |
| **Revision** | | | | |

*The revision deadline is negotiated by the author, the SEDAR coordinator and the CPUE rapporteur. The author* ***DOES NOT*** *commit to any* ***LEGAL OBLIGATION*** *by agreeing to submit a manuscript before this deadline. The maximum penalty for failure to submit a revised document prior to the submission deadline is rejection of the CPUE series.*

***Justification of Working Group Recommendation***

The TPWD Survey is dominated by bay samples. However, few Spanish mackerel were identified in the survey. The Species Association Approach (Stephens and McCall 2004) was explored to try and identify directed Spanish mackerel trips; however, this approach did not converge. A number of “ad hoc” approaches to subset directed trips for Spanish mackerel from TPWD Survey data were explored; however, these approaches were abandoned because either appropriate subsets could not be identified, they eliminated too many trips leading to the same conclusion as the Species Association Approach, or were not thought to be empirically defensible. An index was constructed using the Delta lognormal approach for the database of all trips, and an index was constructed using a subset of only positive trips using a lognormal model.

The number of Spanish mackerel observed in the survey was extremely small. Consequently, the addition or deletion of a single fish had a drastic impact on the index. Due to the low cpue and high sensitivity of the index, the working group voted to not include the index in the assessment.

Appendix 5.3
Gulf of Mexico Spanish Mackerel
Commercial Vertical line Index

## DESCRIPTION OF THE DATA SOURCE

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Fishery Independent Indices** | | | | |
| A. Describe the survey design (e.g. fixed sampling sites, random stratified sampling), location, seasons/months and years of sampling. | ✓ | | | |
| B. Describe sampling methodology (e.g. gear, vessel, soak time etc.) | ✓ | | | |
| C. Describe any changes in sampling methodology (e.g. gear, vessel, sample design etc.) | ✓ | | | |
| D. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | ✓ | | | |
| E. What species or species assemblages are targeted by this survey (e.g. red snapper, reef fish, pelagic). | ✓ | | | |
| F. Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |
| **2. Fishery Dependent Indices** | | | | |
| A. Describe the data source and type of fishery (e.g. commercial handline, commercial longline, recreational hook and line etc.). | | | | ✓ |
| B. Describe any changes to reporting requirements, variables reported, etc. | | | | ✓ |
| C. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | | | | ✓ |
| D Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |

## METHODS

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Data Reduction and Exclusions** | | | | |
| A. Describe any data exclusions (e.g. gears, fishing modes, sampling areas etc.). Report the number of records removed and justify removal. | | | | ✓ |
| B. Describe data reduction techniques (if any) used to address targeting (e.g. Stephens and MacCall, 2004; gear configuration, species assemblage etc). | | | | ✓ |
| C. Discuss procedures used to identify outliers. How many were identified? Were they excluded? | | | | ✓ |

**Working Group Comments:**

2D unknown, data are pounds landed no size data reported - presume legal size with few sublegal

## Working Group Comments:

3A-E. confidential data.
3C. Only positive trips were used.

4G. Available on demand

### 2. Management Regulations (for FD Indices)

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide (or cite) history of management regulations (e.g. bag limits, size limits, trip limits, closures etc.). | | | | ✓ |
| B. Describe the effects (if any) of management regulations on CPUE | | | | ✓ |
| C. Discuss methods used (if any) to minimize the effects of management measures on the CPUE series. | | ✓ | | |

### 3. Describe Analysis Dataset (after exclusions and other treatments)

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide tables and/or figures of number of observations by factors (including year, area, etc.) and interaction terms. | | | ✓ | |
| B. Include tables and/or figures of number of positive observations by factors and interaction terms. | | | ✓ | |
| C. Include tables and/or figures of the proportion positive observations by factors and interaction terms. | ✓ | | | |
| D. Include tables and/or figures of average (unstandardized) CPUE by factors and interaction terms. | | | ✓ | |
| E. Include annual maps of locations of survey sites (or fishing trips) and associated catch rates ***OR*** supply the raw data needed to construct these maps (Observation, Year, Latitude, Longitude (or statistical grid, area), Catch, Effort). | | | ✓ | |
| F. Describe the effort variable and the units. If more than one effort variable is present in the dataset, justify selection. | | | | ✓ |
| G. What are the units of catch (e.g. numbers or biomass, whole weight, gutted weight, kilograms, pounds). | | | | ✓ |

### 4. Model Standardization

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe model structure (e.g. delta-lognormal) | | | | ✓ |
| B. Describe construction of GLM components (e.g. forward selection from null etc.) | | | | ✓ |
| C. Describe inclusion criteria for factors and interactions terms. | | | | ✓ |
| D. Were YEAR*FACTOR interactions included in the model? If so, how (e.g. fixed effect, random effect)? Were random effects tested for significance using a likelihood ratio test? | | ✓ | | |
| E. Provide a table summarizing the construction of the GLM components. | | | | ✓ |
| F. Summarize model statistics of the mixed model formulation(s) (e.g. log likelihood, AIC, BIC etc.) | | | | ✓ |
| G. Report convergence statistics. | | | ✓ | |

## MODEL DIAGNOSTICS

***Comment: Other model structures are possible and acceptable. Please provide appropriate diagnostics to the CPUE indices working group.***

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Binomial Component** | | | | |
| A. Include plots of the chi-square residuals by factor. | ✓ | | | |
| B. Include plots of predicted and observed proportion of positive trips by year and factor (e.g. year*area) | ✓ | | | |
| C. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | |
| **2. Lognormal/Gamma Component** | | | | |
| A. Include histogram of log(CPUE) or a histogram of the residuals of the model on CPUE. Overlay the expected distribution. | | | | ✓ |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | | | ✓ | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | | | | ✓ |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | | | ✓ | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | | | ✓ | |
| F. Include plots of the residuals by factor | | | | ✓ |
| **3. Poisson Component** | | | | |
| A. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | ✓ | | | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |
| **4. Zero-inflated model** | | | | |
| A. Include ROC curve to quantify goodness of fit. | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor). | ✓ | | | |
| C. Include QQ-plot (e.g. Student dev. residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | |

**Working Group Comments:**

1. positive trips only

2B,D,E. Available on demand

***The feasibility of this diagnostic is still under review.***

## MODEL DIAGNOSTICS (CONT.)

| Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|

**Working Group Comments:**

| | | | | |
|---|---|---|---|---|
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

## MODEL RESULTS

| | | | | |
|---|---|---|---|---|
| A. Tables of Nominal CPUE, Standardized CPUE, Observations, Positive Observations, Proportion Positive Observations and Coefficients of Variation (CVs). Other statistics may also be appropriate to report | | | | ✓ |
| B. Figure of Nominal and Standardized Indices with measure of variance (i.e. CVs). | | | | ✓ |

## IF MULTIPLE MODEL STRUCTURES WERE CONSIDERED:

(***Note: this is always recommended but required when model diagnostics are poor***.)

| | | | | |
|---|---|---|---|---|
| 1. Plot of resulting indices and estimates of variance | ✓ | | | |
| 2. Table of model statistics (e.g. AIC criteria) | ✓ | | | |

| | *Date Received* | *Workshop Recommendation* | *Revision Deadline **** | *Author and Rapporteur Signatures* |
|---|---|---|---|---|
| **First Submission** | 2/6/12 | not recommended | | |
| **Revision** | | | | |

*The revision deadline is negotiated by the author, the SEDAR coordinator and the CPUE rapporteur. The author **DOES NOT** commit to any **LEGAL OBLIGATION** by agreeing to submit a manuscript before this deadline. The maximum penalty for failure to submit a revised document prior to the submission deadline is rejection of the CPUE series.*

***Justification of Working Group Recommendation***

This index was not recommended for use. Most of the Gulf of Mexico Spanish mackerel positive trips were reported from Florida. The Florida trip ticket index, which included all the Florida trips in the coastal logbook data set and was a longer time series, was recommended.
To support the decision to go with the Florida trip ticket index, a Western GOM only index was recommended for comparison.

Reset Fields

Appendix 5.4
Gulf of Mexico Spanish Mackerel
Commercial Gillnet Index

## DESCRIPTION OF THE DATA SOURCE

### 1. Fishery Independent Indices

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe the survey design (e.g. fixed sampling sites, random stratified sampling), location, seasons/months and years of sampling. | ✓ | | | |
| B. Describe sampling methodology (e.g. gear, vessel, soak time etc.) | ✓ | | | |
| C. Describe any changes in sampling methodology (e.g. gear, vessel, sample design etc.) | ✓ | | | |
| D. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | ✓ | | | |
| E. What species or species assemblages are targeted by this survey (e.g. red snapper, reef fish, pelagic). | ✓ | | | |
| F. Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |

### 2. Fishery Dependent Indices

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe the data source and type of fishery (e.g. commercial handline, commercial longline, recreational hook and line etc.). | | | | ✓ |
| B. Describe any changes to reporting requirements, variables reported, etc. | | | | ✓ |
| C. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | | | | ✓ |
| D Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |

## METHODS

### 1. Data Reduction and Exclusions

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe any data exclusions (e.g. gears, fishing modes, sampling areas etc.). Report the number of records removed and justify removal. | | | | ✓ |
| B. Describe data reduction techniques (if any) used to address targeting (e.g. Stephens and MacCall, 2004; gear configuration, species assemblage etc). | | | | ✓ |
| C. Discuss procedures used to identify outliers. How many were identified? Were they excluded? | | | | ✓ |

**Working Group Comments:**

2D unknown, data are pounds landed no size data reported - presume legal size with few sublegal

## 2. Management Regulations (for FD Indices)

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide (or cite) history of management regulations (e.g. bag limits, size limits, trip limits, closures etc.). | | | | ✓ |
| B. Describe the effects (if any) of management regulations on CPUE | | | | ✓ |
| C. Discuss methods used (if any) to minimize the effects of management measures on the CPUE series. | | ✓ | | |

## 3. Describe Analysis Dataset (after exclusions and other treatments)

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide tables and/or figures of number of observations by factors (including year, area, etc.) and interaction terms. | | | ✓ | |
| B. Include tables and/or figures of number of positive observations by factors and interaction terms. | | | ✓ | |
| C. Include tables and/or figures of the proportion positive observations by factors and interaction terms. | | | ✓ | |
| D. Include tables and/or figures of average (unstandardized) CPUE by factors and interaction terms. | | | ✓ | |
| E. Include annual maps of locations of survey sites (or fishing trips) and associated catch rates ***OR*** supply the raw data needed to construct these maps (Observation, Year, Latitude, Longitude (or statistical grid, area), Catch, Effort). | | | ✓ | |
| F. Describe the effort variable and the units. If more than one effort variable is present in the dataset, justify selection. | | | | ✓ |
| G. What are the units of catch (e.g. numbers or biomass, whole weight, gutted weight, kilograms, pounds). | | | | ✓ |

## 4. Model Standardization

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe model structure (e.g. delta-lognormal) | | | | ✓ |
| B. Describe construction of GLM components (e.g. forward selection from null etc.) | | | | ✓ |
| C. Describe inclusion criteria for factors and interactions terms. | | | | ✓ |
| D. Were YEAR*FACTOR interactions included in the model? If so, how (e.g. fixed effect, random effect)? Were random effects tested for significance using a likelihood ratio test? | | | | ✓ |
| E. Provide a table summarizing the construction of the GLM components. | | | | ✓ |
| F. Summarize model statistics of the mixed model formulation(s) (e.g. log likelihood, AIC, BIC etc.) | | | | ✓ |
| G. Report convergence statistics. | | | ✓ | |

**Working Group Comments:**

3A-E. confidential data.

4G. Available on demand

## MODEL DIAGNOSTICS

***Comment: Other model structures are possible and acceptable. Please provide appropriate diagnostics to the CPUE indices working group.***

| Item | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|
| **1. Binomial Component** | | | | | |
| A. Include plots of the chi-square residuals by factor. | | | | ✓ | 1.B,C. Available on demand |
| B. Include plots of predicted and observed proportion of positive trips by year and factor (e.g. year*area) | | | ✓ | | |
| C. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | | | ✓ | | 2B,D,E. Available on demand |
| **2. Lognormal/Gamma Component** | | | | | |
| A. Include histogram of log(CPUE) or a histogram of the residuals of the model on CPUE. Overlay the expected distribution. | | | | ✓ | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | | | ✓ | | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | | | | ✓ | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | | | ✓ | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | | | ✓ | | |
| F. Include plots of the residuals by factor | | | | ✓ | |
| **3. Poisson Component** | | | | | |
| A. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | ✓ | | | | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | | ***The feasibility of this diagnostic is still under review.*** |
| **4. Zero-inflated model** | | | | | |
| A. Include ROC curve to quantify goodness of fit. | ✓ | | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor). | ✓ | | | | |
| C. Include QQ-plot (e.g. Student dev. residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | | |

## MODEL DIAGNOSTICS (CONT.)

| | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

## MODEL RESULTS

| | | | | |
|---|---|---|---|---|
| A. Tables of Nominal CPUE, Standardized CPUE, Observations, Positive Observations, Proportion Positive Observations and Coefficients of Variation (CVs). Other statistics may also be appropriate to report | | | | ✓ |
| B. Figure of Nominal and Standardized Indices with measure of variance (i.e. CVs). | | | | ✓ |

## IF MULTIPLE MODEL STRUCTURES WERE CONSIDERED:

(***Note: this is always recommended but required when model diagnostics are poor***.)

| | | | | |
|---|---|---|---|---|
| 1. Plot of resulting indices and estimates of variance | ✓ | | | |
| 2. Table of model statistics (e.g. AIC criteria) | ✓ | | | |

| | *Date Received* | *Workshop Recommendation* | *Revision Deadline **** | *Author and Rapporteur Signatures* |
|---|---|---|---|---|
| **First Submission** | 2/6/12 | not recommended | | |
| **Revision** | | | | |

*The revision deadline is negotiated by the author, the SEDAR coordinator and the CPUE rapporteur. The author* ***DOES NOT*** *commit to any* ***LEGAL OBLIGATION*** *by agreeing to submit a manuscript before this deadline. The maximum penalty for failure to submit a revised document prior to the submission deadline is rejection of the CPUE series.*

***Justification of Working Group Recommendation***

This index was not recommended for use. Most gillnet trips were thought to be run-around drift nets, which would like cause hyperstability in the index.

Reset Fields

Appendix 5.5
Gulf of Mexico Spanish Mackerel
Headboat Index

**DESCRIPTION OF THE DATA SOURCE**

1. Fishery Independent Indices

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe the survey design (e.g. fixed sampling sites, random stratified sampling), location, seasons/months and years of sampling. | ✓ | | | |
| B. Describe sampling methodology (e.g. gear, vessel, soak time etc.) | ✓ | | | |
| C. Describe any changes in sampling methodology (e.g. gear, vessel, sample design etc.) | ✓ | | | |
| D. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | ✓ | | | |
| E. What species or species assemblages are targeted by this survey (e.g. red snapper, reef fish, pelagic). | ✓ | | | |
| F. Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |

2. Fishery Dependent Indices

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe the data source and type of fishery (e.g. commercial handline, commercial longline, recreational hook and line etc.). | | | | ✓ |
| B. Describe any changes to reporting requirements, variables reported, etc. | | | | ✓ |
| C. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | | | | ✓ |
| D Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | | ✓ | | |

**METHODS**

1. Data Reduction and Exclusions

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe any data exclusions (e.g. gears, fishing modes, sampling areas etc.). Report the number of records removed and justify removal. | | | | ✓ |
| B. Describe data reduction techniques (if any) used to address targeting (e.g. Stephens and MacCall, 2004; gear configuration, species assemblage etc). | | | | ✓ |
| C. Discuss procedures used to identify outliers. How many were identified? Were they excluded? | | | | ✓ |

**Working Group Comments:**

4D Available on Demand

## 2. Management Regulations (for FD Indices)

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide (or cite) history of management regulations (e.g. bag limits, size limits, trip limits, closures etc.). | | ✓ | | |
| B. Describe the effects (if any) of management regulations on CPUE | | | | ✓ |
| C. Discuss methods used (if any) to minimize the effects of management measures on the CPUE series. | | | | ✓ |

## 3. Describe Analysis Dataset (after exclusions and other treatments)

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide tables and/or figures of number of observations by factors (including year, area, etc.) and interaction terms. | | ✓ | | |
| B. Include tables and/or figures of number of positive observations by factors and interaction terms. | | ✓ | | |
| C. Include tables and/or figures of the proportion positive observations by factors and interaction terms. | | ✓ | | |
| D. Include tables and/or figures of average (unstandardized) CPUE by factors and interaction terms. | | ✓ | | |
| E. Include annual maps of locations of survey sites (or fishing trips) and associated catch rates ***OR*** supply the raw data needed to construct these maps (Observation, Year, Latitude, Longitude (or statistical grid, area), Catch, Effort). | | | | ✓ |
| F. Describe the effort variable and the units. If more than one effort variable is present in the dataset, justify selection. | | | | ✓ |
| G. What are the units of catch (e.g. numbers or biomass, whole weight, gutted weight, kilograms, pounds). | | | | ✓ |

## 4. Model Standardization

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe model structure (e.g. delta-lognormal) | | | | ✓ |
| B. Describe construction of GLM components (e.g. forward selection from null etc.) | | | | ✓ |
| C. Describe inclusion criteria for factors and interactions terms. | | | | ✓ |
| D. Were YEAR*FACTOR interactions included in the model? If so, how (e.g. fixed effect, random effect)? Were random effects tested for significance using a likelihood ratio test? | | | | ✓ |
| E. Provide a table summarizing the construction of the GLM components. | | | | ✓ |
| F. Summarize model statistics of the mixed model formulation(s) (e.g. log likelihood, AIC, BIC etc.) | | ✓ | | |
| G. Report convergence statistics. | | | | ✓ |

**Working Group Comments:**

3A-D Confidential Data

**MODEL DIAGNOSTICS**

***Comment: Other model structures are possible and acceptable. Please provide appropriate diagnostics to the CPUE indices working group.***

| | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|
| **1. Binomial Component** | | | | | |
| A. Include plots of the chi-square residuals by factor. | | | | ✓ | |
| B. Include plots of predicted and observed proportion of positive trips by year and factor (e.g. year*area) | | | | ✓ | |
| C. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | | | | ✓ | |
| **2. Lognormal/Gamma Component** | | | | | |
| A. Include histogram of log(CPUE) or a histogram of the residuals of the model on CPUE. Overlay the expected distribution. | | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | | | | ✓ | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | | | | ✓ | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | | | | ✓ | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | | | | ✓ | |
| F. Include plots of the residuals by factor | | | | ✓ | |
| **3. Poisson Component** | | | | | |
| A. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | ✓ | | | | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | | ***The feasibility of this diagnostic is still under review.*** |
| **4. Zero-inflated model** | | | | | |
| A. Include ROC curve to quantify goodness of fit. | ✓ | | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor). | ✓ | | | | |
| C. Include QQ-plot (e.g. Student dev. residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | | |

**MODEL DIAGNOSTICS (CONT.)**

| | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

**MODEL RESULTS**

| | | | | |
|---|---|---|---|---|
| A. Tables of Nominal CPUE, Standardized CPUE, Observations, Positive Observations, Proportion Positive Observations and Coefficients of Variation (CVs). Other statistics may also be appropriate to report | | | | ✓ |
| B. Figure of Nominal and Standardized Indices with measure of variance (i.e. CVs). | | | | ✓ |

**IF MULTIPLE MODEL STRUCTURES WERE CONSIDERED**:

(***Note: this is always recommended but required when model diagnostics are poor***.)

| | | | | |
|---|---|---|---|---|
| 1. Plot of resulting indices and estimates of variance | ✓ | | | |
| 2. Table of model statistics (e.g. AIC criteria) | ✓ | | | |

| | *Date Received* | *Workshop Recommendation* | *Revision Deadline **** | *Author and Rapporteur Signatures* |
|---|---|---|---|---|
| **First Submission** | 02/06/2012 | accept as prepared | | |
| **Revision** | | | | |

*The revision deadline is negotiated by the author, the SEDAR coordinator and the CPUE rapporteur. The author* ***DOES NOT*** *commit to any* ***LEGAL OBLIGATION*** *by agreeing to submit a manuscript before this deadline. The maximum penalty for failure to submit a revised document prior to the submission deadline is rejection of the CPUE series.*

***Justification of Working Group Recommendation***

The Species Association Approach (Stephens and McCall 2004) was explored to try and identify directed Spanish mackerel trips however this approach did not properly converge for either of these species and eliminated too many trips indiscriminately. Some possible reasons for this could be because Spanish mackerel are often not targeted by the headboat fleet   A number of “ad hoc” approaches to subset directed trips for Spanish mackerel  from the  Headboat Survey data were explored by the Indices Group at the data workshop, however, these approaches were abandoned because either appropriate subsets could not be identified, they eliminated too many trips leading to the same conclusion as the Species Association Approach, or were not thought to be empirically defensible.  Due to the inability to use this approach, an index was constructed using the Delta lognormal approach for the entire database of all trips, and an index was constructed using a subset of only positive trips using a lognormal model.  The proportion of positive observations that caught Spanish mackerel was determined to be too small, therefore the Indices Group decided NOT to recommend the use of this data set to develop an index for Spanish Mackerel.

Appendix 5.6
Gulf of Mexico Spanish Mackerel
MRFSS Index

**DESCRIPTION OF THE DATA SOURCE**

**Working Group Comments:**

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Fishery Independent Indices** | | | | |
| A. Describe the survey design (e.g. fixed sampling sites, random stratified sampling), location, seasons/months and years of sampling. | ✓ | | | |
| B. Describe sampling methodology (e.g. gear, vessel, soak time etc.) | ✓ | | | |
| C. Describe any changes in sampling methodology (e.g. gear, vessel, sample design etc.) | ✓ | | | |
| D. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | ✓ | | | |
| E. What species or species assemblages are targeted by this survey (e.g. red snapper, reef fish, pelagic). | ✓ | | | |
| F. Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |
| **2. Fishery Dependent Indices** | | | | |
| A. Describe the data source and type of fishery (e.g. commercial handline, commercial longline, recreational hook and line etc.). | | | | ✓ |
| B. Describe any changes to reporting requirements, variables reported, etc. | | | | ✓ |
| C. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | | | | ✓ |
| D Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | | | | ✓ |

**METHODS**

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Data Reduction and Exclusions** | | | | |
| A. Describe any data exclusions (e.g. gears, fishing modes, sampling areas etc.). Report the number of records removed and justify removal. | | | | ✓ |
| B. Describe data reduction techniques (if any) used to address targeting (e.g. Stephens and MacCall, 2004; gear configuration, species assemblage etc). | | | | ✓ |
| C. Discuss procedures used to identify outliers. How many were identified? Were they excluded? | | | | ✓ |

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|

**Working Group Comments:**

2. Management Regulations (for FD Indices)

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide (or cite) history of management regulations (e.g. bag limits, size limits, trip limits, closures etc.). | | | | ✓ |
| B. Describe the effects (if any) of management regulations on CPUE | | | | ✓ |
| C. Discuss methods used (if any) to minimize the effects of management measures on the CPUE series. | | | | ✓ |

3. Describe Analysis Dataset (after exclusions and other treatments)

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide tables and/or figures of number of observations by factors (including year, area, etc.) and interaction terms. | | | | ✓ |
| B. Include tables and/or figures of number of positive observations by factors and interaction terms. | | | | ✓ |
| C. Include tables and/or figures of the proportion positive observations by factors and interaction terms. | | | | ✓ |
| D. Include tables and/or figures of average (unstandardized) CPUE by factors and interaction terms. | | | | ✓ |
| E. Include annual maps of locations of survey sites (or fishing trips) and associated catch rates ***OR*** supply the raw data needed to construct these maps (Observation, Year, Latitude, Longitude (or statistical grid, area), Catch, Effort). | | | | ✓ |
| F. Describe the effort variable and the units. If more than one effort variable is present in the dataset, justify selection. | | | | ✓ |
| G. What are the units of catch (e.g. numbers or biomass, whole weight, gutted weight, kilograms, pounds). | | | | ✓ |

4. Model Standardization

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe model structure (e.g. delta-lognormal) | | | | ✓ |
| B. Describe construction of GLM components (e.g. forward selection from null etc.) | | | | ✓ |
| C. Describe inclusion criteria for factors and interactions terms. | | | | ✓ |
| D. Were YEAR*FACTOR interactions included in the model? If so, how (e.g. fixed effect, random effect)? Were random effects tested for significance using a likelihood ratio test? | | | | ✓ |
| E. Provide a table summarizing the construction of the GLM components. | | | | ✓ |
| F. Summarize model statistics of the mixed model formulation(s) (e.g. log likelihood, AIC, BIC etc.) | | | | ✓ |
| G. Report convergence statistics. | | | | ✓ |

**MODEL DIAGNOSTICS**

***Comment: Other model structures are possible and acceptable. Please provide appropriate diagnostics to the CPUE indices working group.***

| Item | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|
| **1. Binomial Component** | | | | | |
| A. Include plots of the chi-square residuals by factor. | | | | ✓ | |
| B. Include plots of predicted and observed proportion of positive trips by year and factor (e.g. year*area) | | | | ✓ | |
| C. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | | | | ✓ | |
| **2. Lognormal/Gamma Component** | | | | | |
| A. Include histogram of log(CPUE) or a histogram of the residuals of the model on CPUE. Overlay the expected distribution. | | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | | | | ✓ | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | | | | ✓ | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | | | | ✓ | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | | | | ✓ | |
| F. Include plots of the residuals by factor | | | | ✓ | |
| **3. Poisson Component** | | | | | |
| A. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | ✓ | | | | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | | ***The feasibility of this diagnostic is still under review.*** |
| **4. Zero-inflated model** | | | | | |
| A. Include ROC curve to quantify goodness of fit. | ✓ | | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor). | ✓ | | | | |
| C. Include QQ-plot (e.g. Student dev. residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | | |

**MODEL DIAGNOSTICS (CONT.)**

| | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

## MODEL RESULTS

| | | | | |
|---|---|---|---|---|
| A. Tables of Nominal CPUE, Standardized CPUE, Observations, Positive Observations, Proportion Positive Observations and Coefficients of Variation (CVs). Other statistics may also be appropriate to report | | | | ✓ |
| B. Figure of Nominal and Standardized Indices with measure of variance (i.e. CVs). | | | | ✓ |

## IF MULTIPLE MODEL STRUCTURES WERE CONSIDERED:

(***Note: this is always recommended but required when model diagnostics are poor***.)

| | | | | |
|---|---|---|---|---|
| 1. Plot of resulting indices and estimates of variance | ✓ | | | |
| 2. Table of model statistics (e.g. AIC criteria) | ✓ | | | |

| | *Date Received* | *Workshop Recommendation* | *Revision Deadline* *** | *Author and Rapporteur Signatures* |
|---|---|---|---|---|
| **First Submission** | 02/06/2012 | accept as prepared | | |
| **Revision** | | | | |

*The revision deadline is negotiated by the author, the SEDAR coordinator and the CPUE rapporteur. The author* ***DOES NOT*** *commit to any* ***LEGAL OBLIGATION*** *by agreeing to submit a manuscript before this deadline. The maximum penalty for failure to submit a revised document prior to the submission deadline is rejection of the CPUE series.*

***Justification of Working Group Recommendation***

The Species Association Approach (Stephens and McCall 2004) was explored to try and identify directed Spanish mackerel trips however this approach did not properly converge for either of these species and eliminated too many trips indiscriminately. A number of "ad hoc" approaches to subset directed trips for Spanish mackerel from the MRFSS Survey data were explored by the Indices Group at the data workshop, however, these approaches were abandoned because either appropriate subsets could not be identified, they eliminated too many trips leading to the same conclusion as the Species Association Approach, or were not thought to be empirically defensible. Due to the inability to use this approach, an index was constructed using the Delta lognormal approach for the entire database of all trips, and an index was constructed using a subset of only positive trips using a lognormal model. The Indices Group decided to use the indices of all trips and accepted the Spanish mackerel MRFSS index for recommendation. This index was particularly favored because it presents a long time series.

Appendix 5.7
Gulf of Mexico Spanish Mackerel
Florida Trip Ticket - Castnet

**DESCRIPTION OF THE DATA SOURCE**

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Fishery Independent Indices** | | | | |
| A. Describe the survey design (e.g. fixed sampling sites, random stratified sampling), location, seasons/months and years of sampling. | ✓ | | | |
| B. Describe sampling methodology (e.g. gear, vessel, soak time etc.) | ✓ | | | |
| C. Describe any changes in sampling methodology (e.g. gear, vessel, sample design etc.) | ✓ | | | |
| D. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | ✓ | | | |
| E. What species or species assemblages are targeted by this survey (e.g. red snapper, reef fish, pelagic). | ✓ | | | |
| F. Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |
| **2. Fishery Dependent Indices** | | | | |
| A. Describe the data source and type of fishery (e.g. commercial handline, commercial longline, recreational hook and line etc.). | | | | ✓ |
| B. Describe any changes to reporting requirements, variables reported, etc. | | | | ✓ |
| C. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | | | | ✓ |
| D Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |

**METHODS**

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Data Reduction and Exclusions** | | | | |
| A. Describe any data exclusions (e.g. gears, fishing modes, sampling areas etc.). Report the number of records removed and justify removal. | | | | ✓ |
| B. Describe data reduction techniques (if any) used to address targeting (e.g. Stephens and MacCall, 2004; gear configuration, species assemblage etc). | | | | ✓ |
| C. Discuss procedures used to identify outliers. How many were identified? Were they excluded? | | | | ✓ |

**Working Group Comments:**

1.F. No size information in the data set. Commercial size and age data are collected at the fish houses, independent of trip tickets.

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **2. Management Regulations (for FD Indices)** | | | | |
| A. Provide (or cite) history of management regulations (e.g. bag limits, size limits, trip limits, closures etc.). | | | | ✓ |
| B. Describe the effects (if any) of management regulations on CPUE | | | | ✓ |
| C. Discuss methods used (if any) to minimize the effects of management measures on the CPUE series. | | | | ✓ |
| **3. Describe Analysis Dataset (after exclusions and other treatments)** | | | | |
| A. Provide tables and/or figures of number of observations by factors (including year, area, etc.) and interaction terms. | | | | ✓ |
| B. Include tables and/or figures of number of positive observations by factors and interaction terms. | | | | ✓ |
| C. Include tables and/or figures of the proportion positive observations by factors and interaction terms. | | | | ✓ |
| D. Include tables and/or figures of average (unstandardized) CPUE by factors and interaction terms. | | | | ✓ |
| E. Include annual maps of locations of survey sites (or fishing trips) and associated catch rates ***OR*** supply the raw data needed to construct these maps (Observation, Year, Latitude, Longitude (or statistical grid, area), Catch, Effort). | | | | ✓ |
| F. Describe the effort variable and the units. If more than one effort variable is present in the dataset, justify selection. | | | | ✓ |
| G. What are the units of catch (e.g. numbers or biomass, whole weight, gutted weight, kilograms, pounds). | | | | ✓ |
| **4. Model Standardization** | | | | |
| A. Describe model structure (e.g. delta-lognormal) | | | | ✓ |
| B. Describe construction of GLM components (e.g. forward selection from null etc.) | | | | ✓ |
| C. Describe inclusion criteria for factors and interactions terms. | | | | ✓ |
| D. Were YEAR*FACTOR interactions included in the model? If so, how (e.g. fixed effect, random effect)? Were random effects tested for significance using a likelihood ratio test? | | | | ✓ |
| E. Provide a table summarizing the construction of the GLM components. | | | | ✓ |
| F. Summarize model statistics of the mixed model formulation(s) (e.g. log likelihood, AIC, BIC etc.) | | | | ✓ |
| G. Report convergence statistics. | | | | ✓ |

**Working Group Comments:**

## MODEL DIAGNOSTICS

***Comment: Other model structures are possible and acceptable. Please provide appropriate diagnostics to the CPUE indices working group.***

### 1. Binomial Component

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Include plots of the chi-square residuals by factor. | ✓ | | | |
| B. Include plots of predicted and observed proportion of positive trips by year and factor (e.g. year*area) | ✓ | | | |
| C. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | |

### 2. Lognormal/Gamma Component

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Include histogram of log(CPUE) or a histogram of the residuals of the model on CPUE. Overlay the expected distribution. | | | | ✓ |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | | | ✓ | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | | | | ✓ |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | | | ✓ | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | | | ✓ | |
| F. Include plots of the residuals by factor | | | | ✓ |

### 3. Poisson Component

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | ✓ | | | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

### 4. Zero-inflated model

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Include ROC curve to quantify goodness of fit. | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor). | ✓ | | | |
| C. Include QQ-plot (e.g. Student dev. residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | |

**Working Group Comments:**

2.B,D,E-available on demand if needed.

***The feasibility of this diagnostic is still under review.***

## MODEL DIAGNOSTICS (CONT.)

| Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|

**Working Group Comments:**

| | | | | |
|---|---|---|---|---|
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

## MODEL RESULTS

| | | | | |
|---|---|---|---|---|
| A. Tables of Nominal CPUE, Standardized CPUE, Observations, Positive Observations, Proportion Positive Observations and Coefficients of Variation (CVs). Other statistics may also be appropriate to report | | | | ✓ |
| B. Figure of Nominal and Standardized Indices with measure of variance (i.e. CVs). | | | | ✓ |

## IF MULTIPLE MODEL STRUCTURES WERE CONSIDERED:

(***Note: this is always recommended but required when model diagnostics are poor***.)

| | | | | |
|---|---|---|---|---|
| 1. Plot of resulting indices and estimates of variance | | | | ✓ |
| 2. Table of model statistics (e.g. AIC criteria) | | | | ✓ |

| | *Date Received* | *Workshop Recommendation* | *Revision Deadline **** | *Author and Rapporteur Signatures* |
|---|---|---|---|---|
| **First Submission** | 02/17/2012 | | | |
| **Revision** | | | | |

*The revision deadline is negotiated by the author, the SEDAR coordinator and the CPUE rapporteur. The author* ***DOES NOT*** *commit to any* ***LEGAL OBLIGATION*** *by agreeing to submit a manuscript before this deadline. The maximum penalty for failure to submit a revised document prior to the submission deadline is rejection of the CPUE series.*

***Justification of Working Group Recommendation***

This index was not recommended for use. It's potentially useful as a year class indicator, but has gear saturation effects, limited spatial extent, and hyperstability issues since it's targeting large schools. Only trips that did not hit up against the trip limits were included in the analysis.

Appendix 5.8
Gulf of Mexico Spanish Mackerel
Florida Trip Ticket - Handline

**DESCRIPTION OF THE DATA SOURCE**

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Fishery Independent Indices** | | | | |
| A. Describe the survey design (e.g. fixed sampling sites, random stratified sampling), location, seasons/months and years of sampling. | ✓ | | | |
| B. Describe sampling methodology (e.g. gear, vessel, soak time etc.) | ✓ | | | |
| C. Describe any changes in sampling methodology (e.g. gear, vessel, sample design etc.) | ✓ | | | |
| D. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | ✓ | | | |
| E. What species or species assemblages are targeted by this survey (e.g. red snapper, reef fish, pelagic). | ✓ | | | |
| F. Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |
| **2. Fishery Dependent Indices** | | | | |
| A. Describe the data source and type of fishery (e.g. commercial handline, commercial longline, recreational hook and line etc.). | | | | ✓ |
| B. Describe any changes to reporting requirements, variables reported, etc. | | | | ✓ |
| C. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | | | | ✓ |
| D Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |

**METHODS**

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Data Reduction and Exclusions** | | | | |
| A. Describe any data exclusions (e.g. gears, fishing modes, sampling areas etc.). Report the number of records removed and justify removal. | | | | ✓ |
| B. Describe data reduction techniques (if any) used to address targeting (e.g. Stephens and MacCall, 2004; gear configuration, species assemblage etc). | | | | ✓ |
| C. Discuss procedures used to identify outliers. How many were identified? Were they excluded? | | | | ✓ |

**Working Group Comments:**

1.F. No size information in the data set. Commercial size and age data are collected at the fish houses, independent of trip tickets.

1.C. Outliers ID'd and removed during workshop; result of gear assignments from license data, 1986-1992

| 2. Management Regulations (for FD Indices) | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide (or cite) history of management regulations (e.g. bag limits, size limits, trip limits, closures etc.). | | | | ✓ |
| B. Describe the effects (if any) of management regulations on CPUE | | | | ✓ |
| C. Discuss methods used (if any) to minimize the effects of management measures on the CPUE series. | | | | ✓ |
| **3. Describe Analysis Dataset (after exclusions and other treatments)** | | | | |
| A. Provide tables and/or figures of number of observations by factors (including year, area, etc.) and interaction terms. | | | | ✓ |
| B. Include tables and/or figures of number of positive observations by factors and interaction terms. | | | | ✓ |
| C. Include tables and/or figures of the proportion positive observations by factors and interaction terms. | | | | ✓ |
| D. Include tables and/or figures of average (unstandardized) CPUE by factors and interaction terms. | | | | ✓ |
| E. Include annual maps of locations of survey sites (or fishing trips) and associated catch rates ***OR*** supply the raw data needed to construct these maps (Observation, Year, Latitude, Longitude (or statistical grid, area), Catch, Effort). | | | | ✓ |
| F. Describe the effort variable and the units. If more than one effort variable is present in the dataset, justify selection. | | | | ✓ |
| G. What are the units of catch (e.g. numbers or biomass, whole weight, gutted weight, kilograms, pounds). | | | | ✓ |
| **4. Model Standardization** | | | | |
| A. Describe model structure (e.g. delta-lognormal) | | | | ✓ |
| B. Describe construction of GLM components (e.g. forward selection from null etc.) | | | | ✓ |
| C. Describe inclusion criteria for factors and interactions terms. | | | | ✓ |
| D. Were YEAR*FACTOR interactions included in the model? If so, how (e.g. fixed effect, random effect)? Were random effects tested for significance using a likelihood ratio test? | | | | ✓ |
| E. Provide a table summarizing the construction of the GLM components. | | | | ✓ |
| F. Summarize model statistics of the mixed model formulation(s) (e.g. log likelihood, AIC, BIC etc.) | | | | ✓ |
| G. Report convergence statistics. | | | | ✓ |

**Working Group Comments:**

## MODEL DIAGNOSTICS

***Comment: Other model structures are possible and acceptable. Please provide appropriate diagnostics to the CPUE indices working group.***

### 1. Binomial Component

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Include plots of the chi-square residuals by factor. | ✓ | | | |
| B. Include plots of predicted and observed proportion of positive trips by year and factor (e.g. year*area) | ✓ | | | |
| C. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | |

### 2. Lognormal/Gamma Component

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Include histogram of log(CPUE) or a histogram of the residuals of the model on CPUE. Overlay the expected distribution. | | | | ✓ |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | | | ✓ | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | | | | ✓ |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | | | ✓ | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | | | ✓ | |
| F. Include plots of the residuals by factor | | | | ✓ |

### 3. Poisson Component

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | ✓ | | | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

### 4. Zero-inflated model

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Include ROC curve to quantify goodness of fit. | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor). | ✓ | | | |
| C. Include QQ-plot (e.g. Student dev. residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | |

**Working Group Comments:**

2.B,D,E-available on demand if needed.

***The feasibility of this diagnostic is still under review.***

## MODEL DIAGNOSTICS (CONT.)

| | Not Applicable | Absent | Incomplete | Complete | Working Group Comments: |
|---|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

## MODEL RESULTS

| | | | | |
|---|---|---|---|---|
| A. Tables of Nominal CPUE, Standardized CPUE, Observations, Positive Observations, Proportion Positive Observations and Coefficients of Variation (CVs). Other statistics may also be appropriate to report | | | | ✓ |
| B. Figure of Nominal and Standardized Indices with measure of variance (i.e. CVs). | | | | ✓ |

## IF MULTIPLE MODEL STRUCTURES WERE CONSIDERED:

(***Note: this is always recommended but required when model diagnostics are poor***.)

| | | | | |
|---|---|---|---|---|
| 1. Plot of resulting indices and estimates of variance | | | | ✓ |
| 2. Table of model statistics (e.g. AIC criteria) | | | | ✓ |

| | *Date Received* | *Workshop Recommendation* | *Revision Deadline* *** | *Author and Rapporteur Signatures* |
|---|---|---|---|---|
| **First Submission** | 02/17/2012 | | | |
| **Revision** | | | | |

*The revision deadline is negotiated by the author, the SEDAR coordinator and the CPUE rapporteur. The author* ***DOES NOT*** *commit to any* ***LEGAL OBLIGATION*** *by agreeing to submit a manuscript before this deadline. The maximum penalty for failure to submit a revised document prior to the submission deadline is rejection of the CPUE series.*

***Justification of Working Group Recommendation***

This index was recommended for use. The data used for this index occurs over a long time series and has similar trends to the commercial logbook data. It also samples the entire fishery, both inshore and offshore.

Appendix 5.9
Gulf of Mexico Spanish Mackerel
Florida Trip Ticket - Gillnet

## DESCRIPTION OF THE DATA SOURCE

### 1. Fishery Independent Indices

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe the survey design (e.g. fixed sampling sites, random stratified sampling), location, seasons/months and years of sampling. | ✓ | | | |
| B. Describe sampling methodology (e.g. gear, vessel, soak time etc.) | ✓ | | | |
| C. Describe any changes in sampling methodology (e.g. gear, vessel, sample design etc.) | ✓ | | | |
| D. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | ✓ | | | |
| E. What species or species assemblages are targeted by this survey (e.g. red snapper, reef fish, pelagic). | ✓ | | | |
| F. Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |

### 2. Fishery Dependent Indices

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe the data source and type of fishery (e.g. commercial handline, commercial longline, recreational hook and line etc.). | | | | ✓ |
| B. Describe any changes to reporting requirements, variables reported, etc. | | | | ✓ |
| C. Describe the variables reported in the data set (e.g. location, time, temperature, catch, effort etc.). | | | | ✓ |
| D Describe the size/age range that the index applies to. Include supporting figures (e.g. size comp) if available. | ✓ | | | |

## METHODS

### 1. Data Reduction and Exclusions

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe any data exclusions (e.g. gears, fishing modes, sampling areas etc.). Report the number of records removed and justify removal. | | | | ✓ |
| B. Describe data reduction techniques (if any) used to address targeting (e.g. Stephens and MacCall, 2004; gear configuration, species assemblage etc). | | | | ✓ |
| C. Discuss procedures used to identify outliers. How many were identified? Were they excluded? | | | | ✓ |

## Working Group Comments:

1,F. No size information in the data set. Commercial size and age data are collected at the fish houses, independent of trip tickets.

## 2. Management Regulations (for FD Indices)

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide (or cite) history of management regulations (e.g. bag limits, size limits, trip limits, closures etc.). | | | | ✓ |
| B. Describe the effects (if any) of management regulations on CPUE | | | | ✓ |
| C. Discuss methods used (if any) to minimize the effects of management measures on the CPUE series. | | | | ✓ |

## 3. Describe Analysis Dataset (after exclusions and other treatments)

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Provide tables and/or figures of number of observations by factors (including year, area, etc.) and interaction terms. | | | | ✓ |
| B. Include tables and/or figures of number of positive observations by factors and interaction terms. | | | | ✓ |
| C. Include tables and/or figures of the proportion positive observations by factors and interaction terms. | | | | ✓ |
| D. Include tables and/or figures of average (unstandardized) CPUE by factors and interaction terms. | | | | ✓ |
| E. Include annual maps of locations of survey sites (or fishing trips) and associated catch rates ***OR*** supply the raw data needed to construct these maps (Observation, Year, Latitude, Longitude (or statistical grid, area), Catch, Effort). | | | | ✓ |
| F. Describe the effort variable and the units. If more than one effort variable is present in the dataset, justify selection. | | | | ✓ |
| G. What are the units of catch (e.g. numbers or biomass, whole weight, gutted weight, kilograms, pounds). | | | | ✓ |

## 4. Model Standardization

| Item | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| A. Describe model structure (e.g. delta-lognormal) | | | | ✓ |
| B. Describe construction of GLM components (e.g. forward selection from null etc.) | | | | ✓ |
| C. Describe inclusion criteria for factors and interactions terms. | | | | ✓ |
| D. Were YEAR*FACTOR interactions included in the model? If so, how (e.g. fixed effect, random effect)? Were random effects tested for significance using a likelihood ratio test? | | | | ✓ |
| E. Provide a table summarizing the construction of the GLM components. | | | | ✓ |
| F. Summarize model statistics of the mixed model formulation(s) (e.g. log likelihood, AIC, BIC etc.) | | | | ✓ |
| G. Report convergence statistics. | | | | ✓ |

**Working Group Comments:**

## MODEL DIAGNOSTICS

***Comment: Other model structures are possible and acceptable. Please provide appropriate diagnostics to the CPUE indices working group.***

| | Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|---|
| **1. Binomial Component** | | | | |
| A. Include plots of the chi-square residuals by factor. | ✓ | | | |
| B. Include plots of predicted and observed proportion of positive trips by year and factor (e.g. year*area) | ✓ | | | |
| C. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | |
| **2. Lognormal/Gamma Component** | | | | |
| A. Include histogram of log(CPUE) or a histogram of the residuals of the model on CPUE. Overlay the expected distribution. | | | | ✓ |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | | | ✓ | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | | | | ✓ |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | | | ✓ | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | | | ✓ | |
| F. Include plots of the residuals by factor | | | | ✓ |
| **3. Poisson Component** | | | | |
| A. Report overdispersion parameter and other fit statistics (e.g. chi-square / degrees of freedom). | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor. | ✓ | | | |
| C. Include QQ-plot – (e.g. Student deviance residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | |
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |
| **4. Zero-inflated model** | | | | |
| A. Include ROC curve to quantify goodness of fit. | ✓ | | | |
| B. Include plots describing error distribution (e.g. Studentized residuals vs. linear predictor). | ✓ | | | |
| C. Include QQ-plot (e.g. Student dev. residuals vs. theoretical quantiles), Overlay expected distribution. | ✓ | | | |

### Working Group Comments:

2.B,D,E-available on demand if needed.

***The feasibility of this diagnostic is still under review.***

## MODEL DIAGNOSTICS (CONT.)

| Not Applicable | Absent | Incomplete | Complete |
|---|---|---|---|

### Working Group Comments:

| | | | | |
|---|---|---|---|---|
| D. Include diagnostic plot for variance function (e.g. square root of std residuals vs. fitted values). Overlay expected distribution. | ✓ | | | |
| E. Include diagnostic plot for link function (e.g. linear response variable vs. linear predictor). Overlay expected distribution. | ✓ | | | |

## MODEL RESULTS

| | | | | |
|---|---|---|---|---|
| A. Tables of Nominal CPUE, Standardized CPUE, Observations, Positive Observations, Proportion Positive Observations and Coefficients of Variation (CVs). Other statistics may also be appropriate to report | | | | ✓ |
| B. Figure of Nominal and Standardized Indices with measure of variance (i.e. CVs). | | | | ✓ |

## IF MULTIPLE MODEL STRUCTURES WERE CONSIDERED:

(***Note: this is always recommended but required when model diagnostics are poor***.)

| | | | | |
|---|---|---|---|---|
| 1. Plot of resulting indices and estimates of variance | | | | ✓ |
| 2. Table of model statistics (e.g. AIC criteria) | | | | ✓ |

| | *Date Received* | *Workshop Recommendation* | *Revision Deadline **** | *Author and Rapporteur Signatures* |
|---|---|---|---|---|
| **First Submission** | 02/17/2012 | | | |
| **Revision** | | | | |

*The revision deadline is negotiated by the author, the SEDAR coordinator and the CPUE rapporteur. The author* ***DOES NOT*** *commit to any* ***LEGAL OBLIGATION*** *by agreeing to submit a manuscript before this deadline. The maximum penalty for failure to submit a revised document prior to the submission deadline is rejection of the CPUE series.*

***Justification of Working Group Recommendation***

This index was not recommended for use. This index is from a longer time series than the commercial logbook data, and similar trends to the logbook data. But it has hyperstability issues and concerns regarding spatial overlap between gear and population. Changes in the way gill nets are designed and used, and non-specific gear identification on trip tickets (e.g. "gill nets") make interpretation of patterns observed in the data more complex. Only trips that did not hit up against the trip limits were included in the analysis.

# SEDAR

Southeast Data, Assessment, and Review

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# SEDAR 28

## Gulf of Mexico Spanish mackerel

## SECTION III: Assessment Workshop Report

**December 2012**

SEDAR
4055 Faber Place Drive, Suite 201
North Charleston, SC 29405

**Table of Contents**

# 1. Workshop Proceedings

## 1.1. Introduction

### *1.1.1 Workshop Time and Place*

The SEDAR 28 Assessment Workshop for Gulf of Mexico and South Atlantic Spanish Mackerel (*Scomberomorus maculatus*) and Cobia (*Rachycentron canadum*) was conducted as a workshop held May 7-11 2012 at the Courtyard by Marriott in Miami, FL and eleven webinars. Webinars were held on May 22, June 19, July 10, July 24, August 9, August 17, August 30, September 12th, October 23rd, November 8th, and December 10th, 2012.

### *1.1.2 Terms of Reference*

1. Review and provide justifications for any changes in data following the data workshop and any analyses suggested by the data workshop. Summarize data as used in each assessment model.
2. Recommend a model configuration which is deemed most reliable for providing management advice using available compatible data. Document all input data, assumptions, and equations.
3. Incorporate known applicable environmental covariates into the selected model, and provide justification for why any of those covariates cannot be included at the time of the assessment.
4. Provide estimates of stock population parameters
   - Include fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship, and other parameters as appropriate given data availability and modeling approaches
   - Include appropriate and representative measures of precision for parameter estimates.
5. Characterize uncertainty in the assessment and estimated values
   - Consider components such as input data, modeling approach, and model configuration.
   - Provide appropriate measures of model performance, reliability, and ‘goodness of fit’.
6. Provide yield-per-recruit, spawner - recruit, and stock-recruitment evaluations.
7. Provide estimates of stock status relative to management criteria consistent with applicable FMPs, proposed FMPs and Amendments, other ongoing or proposed management programs, and National Standards for each model run presented for review.
8. Project future stock conditions and develop rebuilding schedules if warranted; include estimated generation time. Develop stock projections in accordance with the following:

   A) If stock is overfished:
   F=0, F=current, F=Fmsy, Ftarget (OY),
   F=Frebuild (max that rebuild in allowed time)
   B) If stock is undergoing overfishing
   F=Fcurrent, F=Fmsy, F= Ftarget (OY)

C) If stock is neither overfished nor overfishing
F=Fcurrent, F=Fmsy, F=Ftarget (OY)
D) If data limitations preclude classic projections (i.e. A, B, C above), explore alternate models to provide management advice

9. Provide a probability distribution function for the base model, or a combination of models that represent alternate states of nature, presented for review.
   - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments for use with the Tier 1 ABC control rule
   - Provide justification for the weightings used in producing combinations of models
10. Provide recommendations for future research and data collection. Be as specific as possible in describing sampling design and intensity, and emphasize items which will improve assessment capabilities and reliability. Recommend the interval and type for the next assessment.
11. Prepare a spreadsheet containing all model parameter estimates and all relevant population information resulting from model estimates and projection and simulation exercises. Include all data included in assessment report tables and all data that support assessment workshop figures.
12. Complete the Assessment Workshop Report (Section III: SEDAR Stock Assessment Report).

### *1.1.3 List of Participants*

**Panelists**

| | | | |
|---|---|---|---|
| Katie Andrews | Kevin Craig | Nancie Cummings | Jeff Isely |
| Rob Cheshire | Meaghan Bryan | Eric Fitzpatrick | Mike Denson |
| Read Hendon | Marcel Reichert | Scott Crosson | Bob Muller |
| Clay Porch | Sean Powers | Joe Powers | Greg Stunz |
| John Walter | John Ward | Erik Williams | |

**Appointed Observers**

| | | |
|---|---|---|
| Rusty Hudson | Tom Ogle | Bill Parker |

**Council Members**

Ben Hartig

**Observers**

| | | | |
|---|---|---|---|
| Erik Hiltz | Peter Barile | Tanya Darden | Joe Cimino |
| Chris Kalinowsky | Jim Franks | Julia Byrd | Karl Brenkert |
| Donna Bellais | Stephanie McInerny | Tim Sartwell | Jeanne Boylan |
| Jason Adriance | Danielle Chesky | Pearce Webster | Julie Defilippi |
| Justin Yost | Matt Perkinson | Liz Scott-Denton | Matt Cieri |
| Roberto Koenecke | Jake Tetzlaff | | |

**Staff and Agency**

| | | | |
|---|---|---|---|
| Kari Fenske | Ryan Rindone | Mike Errigo | Sue Gerhart |
| John Carmichael | Rick Leard | Jack McGovern | Andy Strelcheck |
| Gregg Waugh | Mike Larkin | Lew Coggins | Ken Brennan |
| Kelley Fitzpatrick | Kyle Shertzer | Amy Schueller | Jennifer Potts |
| Vivian Matter | David Gloeckner | Doug DeVries | Chris Palmer |
| Steve Saul | Adam Pollack | Kevin McCarthy | Neil Baertlein |
| Michael Schirripa | Todd Gedamke | Walt Ingram | Shannon Calay |
| Andrea Grabman | | | |

### *1.1.4 List of Assessment Workshop Working Papers*

| Documents Prepared for the Assessment Workshop | | |
|---|---|---|
| SEDAR28-AW01 | Florida Trip Tickets | S. Brown |
| SEDAR28-AW02 | SEDAR 28 Spanish mackerel bycatch estimates from US Atlantic coast shrimp trawls | NMFS Beaufort |

## 1.2. Panel Recommendations and Comment on Terms of Reference

### *1.2.1 Term of Reference 1*

*Review and provide justifications for any changes in data following the data workshop and any analyses suggested by the data workshop. Summarize data as used in each assessment model.*

All revisions to the data following the SEDAR 28 Data Workshop (DW) are reviewed in Section 2. The primary changes include 1) aggregating landings, discard, and length composition data into four fishing fleets; commercial gillnet, commercial line gears, recreational, and shrimping bycatch and 2) making the age – length observation data conditional on length.

### *1.2.2 Term of Reference 2*

*Recommend a model configuration which is deemed most reliable for providing management advice using available compatible data. Document all input data, assumptions, and equations.*

A fully integrated length based statistical-catch-at-age model configured using Stock Synthesis (Methot 2011) was used for the assessment. The model description and configuration are described in Sections 3.1.1 and 3.1.3. Section 2 and Section 3.1.2 provides a complete description of all data inputs. Appendices C-F includes all input files necessary that were used to run the Stock Synthesis (SS) model.

A secondary model was explored, ASPIC a stock production model however results were deemed not useful for providing management advice for the Gulf of Mexico Spanish Mackerel resource therefore the ASPIC model was not pursued further.

### *1.2.3 Term of Reference 3*

*Incorporate known applicable environmental covariates into the selected model, and provide justification for why any of those covariates cannot be included at the time of the assessment.*

At the time of the SEDAR 29 stock assessment, no applicable environmental covariates were recommended by the data or assessment workshop panels.

### *1.2.4 Term of Reference 4*

*Provide estimates of stock population parameters*

- *Include fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship, and other parameters as appropriate given data availability and modeling approaches*
- *Include appropriate and representative measures of precision for parameter estimates.*

Estimates of assessment model parameters and their associated standard errors are reported in Section 3.2.2 and Tables 3.1 and 3.2 for SS. Estimates of stock biomass, spawning stock biomass, recruitment, fishing mortality, and stock- recruitment relationship are presented in Tables 3.4 and Table 3.5 and Figures 3.36 – 3.42.

### *1.2.5 Term of Reference 5*

*Characterize uncertainty in the assessment and estimated values*

- *Consider components such as input data, modeling approach, and model configuration.*
- *Provide appropriate measures of model performance, reliability, and 'goodness of fit'.*

Model performance and reliability are characterized in Section 3.2.7 and Section 3.2. Uncertainty in the assessment and estimated values was characterized using a sensitivity analysis and a parametric bootstrap approach. Results of the sensitivity analysis and retrospective analysis are characterized in Section 3.2.7 and Table 3.6 and Figures 3.43 - 3.46. Uncertainty in the assessment parameters and estimated values is characterized in Section 3.2 and Table 3.7.

### *1.2.6 Term of Reference 6*

*Provide yield-per-recruit, spawner-per-recruit, and stock-recruitment evaluations.*

Yield-per-recruit, spawner-per-recruit, and stock-recruitment evaluations are provided in Section 3.2.8 and Figure 3.40

### *1.2.7 Term of Reference 7*

*Provide estimates of stock status relative to management criteria consistent with applicable FMPs, proposed FMPs and Amendments, other ongoing or proposed management programs, and National Standards for each model run presented for review.*

Stock status relative to a management criteria of $F_{SPR30\%}$, $F_{OY}$ and $F_{current}$ are presented in Table 3.9 and Figures 3.47 – 3.53.

### *1.2.8 Term of Reference 8*

*Project future stock conditions and develop rebuilding schedules if warranted, including estimated generation time. Develop stock yield projections in both biomass and numbers of fish in accordance with the following:*

A) If stock is overfished:
F=0, FCurrent, FMSY, FOY
F=FRebuild (max that permits rebuild in allowed time)
B) If stock is undergoing overfishing:
F= FCurrent, FMSY, FOY
C) If stock is neither overfished nor undergoing overfishing:
F= FCurrent, FMSY, FOY
D) If data limitations preclude classic projections (i.e. A, B, C above), explore alternate models to provide management advice

Stock biomass and yield projections for 2013-2022 are presented in Section 3.2.9 and Table 3.9. Projections were carried out for three levels of fishing mortality: 1) $F_{SPR30\%}$ ($F_{MSY}$ proxy), 2) $F_{OY}$, and $F_{CURRENT}$ (geometric mean of F 2009-2011.

### *1.2.9 Term of Reference 9*

*Provide a probability distribution function for the base model, or a combination of models that represent alternate states of nature, presented for review.*

Ten sensitivity runs were presented to characterize uncertainty in model specification. Of the ten runs presented, one primary run (Run 3) was used for stochastic projections. Probability distribution functions will be developed for the subset of model recommended by the SEDAR AP for projections (Run 3, steepness = 0.8, $M=0.38y^{-1}$) and made available to the Scientific and Statistical Committee (SSC) for the development of management advice, including OFL and ABC.

### *1.2.10 Term of Reference 10*

*Provide recommendations for future research and data collection. Be as specific as possible in describing sampling design and intensity, and emphasize items which will improve assessment capabilities and reliability. Recommend the interval and type for the next assessment.*

Recommendations for future research and data collection were made in the SEDAR 82 Data Workshop (DW) report. Additional recommendations are made in Section 3.3.

### *1.2.11 Term of Reference 11*

*Prepare a spreadsheet containing all model parameter estimates and all relevant population information resulting from model estimates and projection and simulation exercises. Include all data included in assessment report tables and all data that support assessment workshop figures.*

All assessment model inputs are presented in Appendix C-F. All model parameter estimates and their associated standard errors are reported in Table 3.1 and Table 3.2. Model uncertainty is presented in Figures 3.34 and 3.35 and Figures 3.43 – 3.46.

# 2 Data Review and Update

The primary data components utilized in this stock assessment are described in the SEDAR 28 Gulf of Mexico Spanish mackerel Data Workshop (DW) Report (SEDAR 2012). A number of the data inputs used in the SEDAR 28 Gulf of Mexico Spanish Mackerel stock evaluations were updated and finalized after the DW. Final data for 2011 were not available at the time of the DW for these components: recreational and commercial landings, recreational size frequencies, and bycatch from the Gulf of Mexico shrimp fishery. In addition, all of the indices of abundance were updated to include 2011 data after the DW (i.e., MRFSS recreational index, commercial FWC Vertical Line fishery abundance index, and the SEAMAP abundance index). These updates and any other necessary modifications to the data provided at the DW are detailed in the following sections.

## 2.1 Life history

The weight length relation estimated as: Weight (Kg) =1.50E-05 * Fork-Length(cm)$^{2.8617}$ was provided by the DW (Table 2.1a, Figure 3.1a). Per the DW, age specific natural mortality was modeled according to the Lorenzen model and for the stock assessment model runs, scaled to the Hoenig point estimate (M = 0.38 y$^{-1}$) for fully recruited ages, 2-11 (Table 2.1.b). Age was modeled according to a single sex von Bertalanffy function internally in the stock assessment model (Stock Synthesis) using the age length observations from the SEDAR DW. Sex ratio at the start time of the population analysis (1886) was assumed to be 1:1 as recommended by the SEDAR 28 DW. Fish were assumed to be fully mature at age 1 (SEDAR 28 DW). The fecundity schedule was assumed directly proportional to the weight of females in the assessment model. The discard mortality rate was assumed to be 20% for the recreational and 10% for the commercial fisheries as recommended by the DW. Natural mortality was input into the model as an age specific vector developed from inputs provided by the SEDAR 29 DW. The M at-age vector was developed according to a declining Lorenzen function and scaled to fully recruited fish ages 4-11 by the point estimate of the Hoenig maximum age natural mortality estimator recommended by the SEDAR 28 DW of 0.38 y$^{-1}$. Table 2.1 provides life history input metrics.

The primary model used in the Gulf of Mexico Spanish mackerel evaluation was the Stock Synthesis (SS, Methot 2011) model. In the stock assessment, several of the life history parameters were estimated by the model and not fixed. Therefore, further discussions of pertinent life history metrics (i.e., growth, natural mortality) are also addressed in both the Model Configuration and in the Parameters Estimated section (3.1.3 and 3.1.4) of the SEDAR 28 Assessment Report."

## 2.2 Landings

### *2.2.1 Commercial landings*

Commercial landings data were provided through the SEDAR 28 DW; these data were assimilated into three main categories: commercial gillnet (COM_GN), commercial line fisheries (i.e., hook and line, vertical line, rod and reel = COM_RR). There were some minor landings reported for "miscellaneous" commercial gears (traps, trawls, seines); these "miscellaneous" commercial landings were apportioned into commercial gillnet and commercial line gears according to the annual representation of each. Commercial landings data were input into SS as metric tons, whole weight. Table 2.2 and Figure 2.1 present commercial landings data.

### *2.2.2 Recreational landings*
Recreational landings data (REC) were provided through the SEDAR 28 DW and were aggregated across all fishery categories: a) MRFSS/MRIP estimates of landings from charter, private angler, b) Texas Parks and Wildlife (charter, private and headboat), and the c) for hire headboat fishery. Table 2.2 and Figure 2.1 present recreational landings data.

## 2.3 Discards

### *2.3.1 Commercial discards*
Estimates of discards were available from commercial gears (handline and trolling) in numbers of fish. Commercial discards in numbers were converted to pounds using the average weight of fish at the minimum size limit (12 inches). Commercial line gear (COM_RR) discards were input into the SS model as the fraction of the total catch (native units-commercial as pounds of discards of total pounds. It was thought that the estimated commercial discards are highly uncertain owing to low reporting rates for commercial line gear fleet. For use in the stock assessment model (Stock Synthesis), the commercial line gear discard fractions were averaged across all years and input into the SS model as a single super period. Tables 2.3 and 2.4 and provide the time series of commercial discard fractions available for the Gulf Spanish mackerel stock evaluation.

### *2.3.2 Recreational discards*
Discards from the recreational fishery (REC) were available as numbers of fish and for use in SS were input in the same units. Recreational discards were input into the SS model as the fraction of the total catch (native units-commercial as pounds of discards of total pounds, recreational as numbers of total catch). It was thought that the estimated discards are highly uncertain owing to low intercept rates (recreational), and also changes in quality control and assurance that occurred in the recreational catch survey (MRFSS/MRIP) time series (1981-2011). For use in SS, the recreational discard fractions were partitioned into three periods and input into SS as three super periods. It was believed that the recreational discards showed a general increasing trend over the time series and that three separate periods were evident thus three super periods were used to characterize the recreational discards. Partitioning the recreational discards as three super periods also corresponded to points in time associated with improvements in field procedures in the recreational data collection survey, and particularly so for the first period (1981-1990). Tables 2.3 and 2.4 provide the time series of discards available for the Gulf Spanish mackerel stock evaluation.

### *2.3.3 Shrimp discards*
Estimates of Spanish mackerel caught by Gulf of Mexico shrimp trawlers were available for 1972-2010 at the time of the DW. After the completion of the DW, the time series was updated to include 2011. Because of the large uncertainty in the estimates of annual shrimp bycatch (SEDAR 28 DW-06, Table 6 and DW-06 Figure 6 and SEDAR 28 RD-05 Table 2 and Figure 2), it was thought that an average discard value across the time series best reflected the magnitude of removals of Spanish mackerel in the Gulf of Mexico shrimp fishery, so the bycatch discards were also input as a single super period with the mean value from 1972-2011 in 1,000s of fish used to describe the annual discards. Table 2.5 provides shrimp discards.

## 2.4 Length composition

Length composition data were provided by the SEDAR 28 DW. Length composition data used in the assessment are presented in Figures 2a-2d and Appendix A. Lengths are in units of fork length in centimeters. Following the DW, length compositions were computed as numbers at length using the length data from the combined commercial, recreational and fishery independent databases. Length data were aggregated into 2-cm length bins. Length bins ranged from 4 cm to 99 cm, where the bin size represents the minimum size of the bin (e.g., the 4-cm length bin contains fish greater than or equal to 4 cm and less than 5 cm). Length data were stratified by calendar year, fishery/survey (commercial gillnet fleet (COM_GN), commercial line gears (COM_RR), and recreational all fisheries combined (headboat, private angler, charter, shore = REC). Length composition sample sizes were capped at a maximum effective sample size of 100 fish to prevent the length composition data from driving the model fitting process due to large sample sizes (reference). For strata with fewer than 100 length observations the sample size was set equal to the number of observations measured. Figures 2.2a – 2.2d provide length composition data used in the SS evaluation.

### *2.4.1 Commercial length composition*

As summarized above, commercial length composition data were stratified by calendar year, fishery/survey (i.e., commercial gillnet fleet (COM_GN) and commercial vertical line gears (COM_RR) corresponding to the primary fisheries considered for the stock assessment. Each separate length composition sample was then aggregated into 2-cm length bins for use in SS. Length bins ranged from 4 cm to 99 cm, where the bin size represents the minimum size of the bin (e.g., the 4-cm length bin contains fish greater than or equal to 4 cm and less than 5 cm). Figures 2.2a – 2.2d provide length composition data used in the SS evaluation.

### *2.4.2 Recreational length composition*

As summarized above, recreational length composition data of Gulf of Mexico Spanish mackerel were stratified by calendar year, fishery/survey (i.e., commercial gillnet fleet (COM_GN) and commercial vertical line gears (COM_RR) corresponding to the primary fisheries considered for the stock assessment. Each separate length composition sample was then aggregated into 2-cm length bins for use in SS. Length bins ranged from 4 cm to 99 cm, where the bin size represents the minimum size of the bin (e.g., the 4-cm length bin contains fish greater than or equal to 4 cm and less than 5 cm). Figures 2.2a – 2.2d provide length composition data used in the SS evaluation.

### *2.4.3 Survey length composition*

Length composition data sample of Gulf of Spanish mackerel from the SEAMAP trawl survey were provided by the SEDAR 28 DW. Length composition samples were handled identically to the recreational and commercial length composition samples. Observations of length were partitioned by year and aggregated by 2-cm length bins similarly as described above. Figures 2.2a – 2.2d provide length composition data used in the SS evaluation.

## *2.5 Conditional age-length composition*

Observations of Spanish mackerel annular age at length were provided by the SEDAR 28 DW for the stock assessment and presented in Figures 2.3a – 2.3i and Appendix B. Age data were available for the commercial and recreational fisheries. Following the SEDAR 29 DW, age-length compositions were computed as the numbers at age within length intervals using age data from the DW. Thus, the age observations used in the stock assessment were assumed to be conditional on length. A separate age-length composition was specified for each 2-cm length bin containing fish whose ages had been estimated thus providing a link between the length composition data and the age-length data. This linkage provides allows more detailed information on the size-age relationship to be incorporated into the growth model fitting process. This approach provides more detailed information to inform the variance of size-at-age; (Methot 2011). The age-length data were stratified by calendar year, fishery/survey (commercial gillnet, commercial line gear, and recreational all modes combined). Figures 2.3a – 2.3i provides the conditional age-length composition data used in the SS evaluation for Gulf of Mexico Spanish mackerel. Methot notes that "where age data are collected in a length-stratified program, the conditional age'-at-length approach can directly match the protocols of the sampling program". Historically, age samples for Spanish mackerel have followed a two stage sampling protocol (Nancie Cummings, personal communication).

An age estimation error matrix was developed following the DW to account for errors in the estimation of ages for Gulf Spanish mackerel (Table 2.6). The matrix includes mean coded ages and their associated standard deviations. The standard deviations were obtained from an analysis of Spanish mackerel ages estimated by two independent readers for a limited sample of n=73 fish.

In the stock assessment model used in this assessment (SS) fish are age 1 when they first reach the month of January regardless of time of birth. Internally, SS assumes that all the recorded age observation data accurately reflects the adjustment to age 1 so that all the age of fish increments to the next age on January 1. SEDAR 28 DW-23 described the procedures used for age determinations of Spanish mackerel data used in this assessment. Spawning in Gulf of Mexico Spanish mackerel occurs during spring coinciding with the time of annulus deposition. The procedures for Spanish mackerel age determinations incorporated: the advancing of increment count (i.e., annulus age) based on annuli number, otolith edge-type and capture-date, typically advancing increment counts for spring collected samples.

## 2.6 Indices

Three indices **o**f abundance and one index of fishing effort were recommended by the SEDAR 28 DW for use in the stock assessment (Table 2.7 and Figure 2.4). These were: 1) the shrimp effort index (1946-2011), 2) the MRFSS/MRIP catch per angler hour abundance index, 3) the FWC Trip Ticket Vertical line pounds per trip abundance index, and 4) the SEAMAP trawl survey abundance index. The standardized indices (point estimates) and the coefficient of variation (CV) of each, updated through 2011 for each series was incorporated into the population modeling using SS. The CVs were converted to log-scale standard errors for input into SS, adjusted as:

$$\log(SE) = \sqrt{\log_e\left(1 + CV^2\right)}$$

The shrimp effort index was used to derive an estimate of annual fishing mortality for the shrimp fishery bycatch of Spanish mackerel discards. Figures 2.4a -2.4d provides the indices of abundance and associated CV's and the shrimp effort index as used in the SS model evaluation.

Estimates of shrimp effort used in the SS model are provided in Table 2.7. The shrimp effort series was used in SS to develop estimates of annual fishing mortality for the shrimp bycatch fleet.

## 2.7 Tables

Table 2.1a. Weight at length meristic for Gulf Spanish mackerel used in the SEDAR 28 stock evaluations. Source = SEDAR 28 DW Report Table 2.7

| SEX-SPECIFIC WEIGHT AT LENGTH1 | Region | RECOMMENDED | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data Source | Area | Dep. Var. | Ind. Var. | a | b | r2 | n | LEN SE | WT SE | Length Range | Units | Function |
| Female | S. Atl. | Weight | FL | 7.4558e-9 | 3.0244 | 0.9514 | 2,896 | 1.2412 | 0.0068 | 218-753 | kg mm | Power |
| Male | S. Atl. | Weight | FL | 1.6486e-8 | 2.8934 | 0.9091 | 2,141 | 0.9747 | 0.0039 | 252-605 | kg mm | Power |
| Female | Gulf | Weight | FL | 2.5969e-8 | 2.8310 | 0.9123 | 320 | 4.9400 | 0.0300 | 294-687 | kg mm | Power |
| Male | Gulf | Weight | FL | 5.1469e-9 | 3.0884 | 0.9657 | 124 | 7.1702 | 0.0395 | 298-640 | kg mm | Power |
| Female | Combined | Weight | FL | 7.9232e-9 | 3.0155 | 0.9464 | 3,216 | 1.2514 | 0.0070 | 218-753 | kg mm | Power |
| Male | Combined | Weight | FL | 1.0511e-8 | 2.9694 | 0.9280 | 2,265 | 1.0274 | 0.0044 | 252-640 | kg mm | Power |
| Sexes Combined | Combined | Weight | FL | 2.154E-08 | 2.8534 | 0.9161 | 88,067 | 0.2688 | 0.0015 | 110-900 | kg mm | Power |

Table 2.1b. Point estimates of natural mortality (M) for the Gulf stock of Spanish mackerel based on maximum age = 11 years and von Bertalanffy parameter estimates:

| t0 = -0.5, k = 0.61, and L∞ = 560. Source = SEDAR 28 DW Table 2.1. | | |
|---|---|---|
| | | |
| Alverson & Carney | tmax | 0.16 |
| Beverton | k, am | 3.44 |
| $\text{Hoenig}_{\text{fish}}$ | tmax | 0.38 |
| $\text{Hoenig}_{\text{alltaxa}}$ | tmax | 0.4 |
| Pauly | | 1.03 |
| Ralston | k | 1.28 |
| Ralston (geometric mean) | k | 2.20 |
| Ralston (method II) | k | 2.11 |
| Hewitt & Hoenig | tmax | 0.36 |
| Jensen | k | 0.92 |
| Rule of thumb | tmax | 0.27 |
| Alagaraja | survivorship to tmax: 0.1 | 0.42 |
| Alagaraja | survivorship to tmax: 0.2 | 0.36 |
| Alagaraja | survivorship to tmax: 0.5 | 0.27 |

Table 2.2. Commercial and recreational landings data used in the SEDAR 28 Gulf of Mexico Spanish mackerel stock assessment. COM_GN = commercial gillnet, COM_RR = commercial line gears, and REC = recreational all modes (charter, private, shore, headboat). Units are whole weight (mtons) commercial, numbers of fish (recreational, 1,000's of fish).

| YEAR | COM_GN | COM_RR | REC |
|---|---|---|---|
| 1886 | 34 | 2 | |
| 1887 | 68 | 4 | |
| 1888 | 133 | 8 | |
| 1889 | 256 | 15 | |
| 1890 | 296 | 18 | |
| 1891 | 310 | 2 | |
| 1892 | 310 | 2 | |
| 1893 | 310 | 2 | |
| 1894 | 310 | 2 | |
| 1895 | 310 | 2 | |
| 1896 | 310 | 2 | |
| 1897 | 321 | 19 | |
| 1898 | 417 | 25 | |
| 1899 | 417 | 25 | |
| 1900 | 417 | 25 | |
| 1901 | 417 | 25 | |
| 1902 | 677 | 41 | |
| 1903 | 656 | 39 | |
| 1904 | 656 | 39 | |
| 1905 | 656 | 39 | |
| 1906 | 656 | 39 | |
| 1907 | 656 | 39 | |
| 1908 | 636 | 38 | |
| 1909 | 668 | 45 | |
| 1910 | 776 | 50 | |
| 1911 | 884 | 55 | |
| 1912 | 992 | 61 | |
| 1913 | 1,100 | 66 | |
| 1914 | 1,208 | 71 | |
| 1915 | 1,316 | 77 | |
| 1916 | 1,424 | 82 | |
| 1917 | 1,486 | 88 | |
| 1918 | 1,506 | 91 | |
| 1919 | 1,535 | 93 | |
| 1920 | 1,585 | 93 | |
| 1921 | 1,639 | 98 | |

| | | | |
|---|---|---|---|
| 1922 | 1,643 | 99 | |
| 1923 | 1,653 | 100 | |
| 1924 | 1,751 | 104 | |
| 1925 | 1,863 | 110 | |
| 1926 | 1,976 | 115 | |
| 1927 | 2,041 | 124 | |
| 1928 | 1,413 | 86 | |
| 1929 | 1,529 | 93 | |
| 1930 | 1,794 | 109 | |
| 1931 | 1,018 | 62 | |
| 1932 | 1,255 | 76 | |
| 1933 | 1,374 | 82 | |
| 1934 | 1,512 | 92 | |
| 1935 | 1,868 | 110 | |
| 1936 | 2,252 | 136 | |
| 1937 | 1,704 | 103 | |
| 1938 | 1,760 | 107 | |
| 1939 | 1,835 | 111 | |
| 1940 | 1,580 | 96 | |
| 1941 | 36 | 22 | |
| 1942 | 36 | 22 | |
| 1943 | 36 | 22 | |
| 1944 | 36 | 22 | |
| 1945 | 40 | 2 | |
| 1946 | 36 | 22 | |
| 1947 | 36 | 22 | |
| 1948 | 384 | 23 | |
| 1949 | 1,658 | 100 | |
| 1950 | 1,109 | 67 | |
| 1951 | 2,785 | 169 | |
| 1952 | 1,932 | 117 | |
| 1953 | 1,276 | 77 | |
| 1954 | 1,235 | 75 | |
| 1955 | 696 | 42 | 774 |
| 1956 | 1,248 | 76 | 859 |
| 1957 | 1,561 | 94 | 944 |
| 1958 | 1,655 | 100 | 1,028 |
| 1959 | 2,006 | 121 | 1,113 |
| 1960 | 2,339 | 142 | 1,198 |
| 1961 | 1,717 | 104 | 1,219 |
| 1962 | 3,072 | 63 | 1,241 |

| | | | |
|---|---|---|---|
| 1963 | 2,434 | 37 | 1,262 |
| 1964 | 1,715 | 79 | 1,284 |
| 1965 | 2,095 | 130 | 1,305 |
| 1966 | 3,053 | 152 | 1,357 |
| 1967 | 2,582 | 128 | 1,408 |
| 1968 | 3,164 | 116 | 1,460 |
| 1969 | 3,685 | 99 | 1,511 |
| 1970 | 3,631 | 120 | 1,563 |
| 1971 | 3,349 | 124 | 1,705 |
| 1972 | 2,758 | 204 | 1,847 |
| 1973 | 2,748 | 61 | 1,989 |
| 1974 | 3,432 | 318 | 2,131 |
| 1975 | 2,192 | 358 | 2,273 |
| 1976 | 3,153 | 377 | 2,277 |
| 1977 | 905 | 291 | 2,281 |
| 1978 | 505 | 268 | 2,285 |
| 1979 | 931 | 31 | 2,289 |
| 1980 | 832 | 45 | 2,293 |
| 1981 | 1,592 | 90 | 2,102 |
| 1982 | 1,486 | 82 | 3,443 |
| 1983 | 960 | 68 | 2,430 |
| 1984 | 1,567 | 23 | 947 |
| 1985 | 904 | 29 | 1,177 |
| 1986 | 1,225 | 14 | 6,398 |
| 1987 | 1,191 | 102 | 1,795 |
| 1988 | 1,039 | 12 | 1,460 |
| 1989 | 1,388 | 26 | 1,136 |
| 1990 | 1,161 | 8 | 1,597 |
| 1991 | 1,488 | 73 | 1,739 |
| 1992 | 1,682 | 17 | 2,393 |
| 1993 | 1,168 | 13 | 1,488 |
| 1994 | 1,250 | 10 | 1,428 |
| 1995 | 675 | 10 | 1,073 |
| 1996 | 172 | 13 | 1,260 |
| 1997 | 226 | 18 | 1,262 |
| 1998 | 186 | 24 | 1,181 |
| 1999 | 368 | 27 | 1,590 |
| 2000 | 394 | 19 | 1,731 |
| 2001 | 500 | 36 | 2,482 |
| 2002 | 413 | 17 | 1,976 |
| 2003 | 628 | 20 | 1,518 |

| | | | |
|---|---|---|---|
| 2004 | 469 | 19 | 2,150 |
| 2005 | 662 | 16 | 1,216 |
| 2006 | 614 | 28 | 1,790 |
| 2007 | 414 | 13 | 1,353 |
| 2008 | 521 | 39 | 1,905 |
| 2009 | 789 | 35 | 1,519 |
| 2010 | 501 | 66 | 1,601 |
| 2011 | 546 | 54 | 1,547 |

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Table 2.3. Time series of discards for commercial (COM_RR) and recreational (REC) fisheries available for the SEDAR 28 Gulf of Mexico Spanish mackerel stock evaluations. COM_RR average for 1998-2011 super period = 0.1767 Recreational super period averages are: 1) 1981-1990=0.24473, 2) 1991-2002=0.4062, 3) 2003-2011=0.5635. COM_RR discards calculated in weight units, REC discards calculated in numbers of fish units.

| Year | COM_RR | REC |
|---|---|---|
| 1981 | | 0.04 |
| 1982 | | 0.14 |
| 1983 | | 0.33 |
| 1984 | | 0.06 |
| 1985 | | 0.11 |
| 1986 | | 0.39 |
| 1987 | | 0.19 |
| 1988 | | 0.33 |
| 1989 | | 0.30 |
| 1990 | | 0.58 |
| 1991 | | 0.42 |
| 1992 | | 0.41 |
| 1993 | | 0.41 |
| 1994 | | 0.32 |
| 1995 | | 0.35 |
| 1996 | | 0.36 |
| 1997 | | 0.40 |
| 1998 | 0.20 | 0.39 |
| 1999 | 0.18 | 0.44 |
| 2000 | 0.24 | 0.46 |
| 2001 | 0.12 | 0.43 |
| 2002 | 0.26 | 0.49 |
| 2003 | 0.24 | 0.59 |
| 2004 | 0.22 | 0.52 |
| 2005 | 0.25 | 0.53 |
| 2006 | 0.16 | 0.62 |
| 2007 | 0.28 | 0.61 |
| 2008 | 0.08 | 0.52 |
| 2009 | 0.12 | 0.52 |
| 2010 | 0.06 | 0.61 |
| 2011 | 0.07 | 0.56 |

Table 2.4. Calculated discard fraction according to super period designations for the directed fisheries as input into the SS model for Gulf of Mexico Spanish mackerel. Commercial discard fraction calculated as discard weight divided by total reported landings weight. Recreational discard fraction calculated as discard numbers divided by total estimated recreational catch number.

| Fleet | Super period | Fraction |
|---|---|---|
| COM_RR | 1998-2011 | 0.17665 |
| REC | 1981-1990 | 0.24473 |
| REC | 1991-2002 | 0.4062 |
| REC | 2003-2011 | 0.5635 |

Table 2.5. Time series of discards shrimp bycatch for Gulf of Mexico Spanish mackerel for the SEDAR 28 stock assessment. The calculated value for the 1972-2011 super period value used in the SS model was 9,096 million fish.

| Year | Discard Numbers (1,000s) |
|---|---|
| 1972 | 7,700 |
| 1973 | 916 |
| 1974 | 2,230 |
| 1975 | 2,774 |
| 1976 | 5,264 |
| 1977 | 13,750 |
| 1978 | 13,400 |
| 1979 | 16,510 |
| 1980 | 13,870 |
| 1981 | 4,028 |
| 1982 | 5,582 |
| 1983 | 4,506 |
| 1984 | 8,033 |
| 1985 | 2,654 |
| 1986 | 6,586 |
| 1987 | 5,911 |
| 1988 | 9,566 |
| 1989 | 14,530 |
| 1990 | 20,020 |
| 1991 | 14,960 |
| 1992 | 19,070 |
| 1993 | 48,680 |
| 1994 | 4,856 |
| 1995 | 4,555 |
| 1996 | 4,026 |
| 1997 | 4,586 |
| 1998 | 5,672 |
| 1999 | 4,289 |
| 2000 | 9,968 |
| 2001 | 5,797 |
| 2002 | 5,258 |
| 2003 | 10,850 |
| 2004 | 18,680 |
| 2005 | 21,590 |
| 2006 | 3,903 |
| 2007 | 8,264 |
| 2008 | 2,797 |
| 2009 | 2,621 |
| 2010 | 2,945 |
| 2011 | 2,632 |

Table 2.6. Age error matrix for Gulf of Mexico Spanish mackerel used in the SEDAR 28 stock assessment. Data Source: Chris Palmer (NOAA, NMFS, SEFSC Panama City Laboratory, personal communication).

| | | | | AGE (Years) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean age | 0.5 | 1.5 | 2.5 | 3.5 | 4.5 | 5.5 | 6.5 | 7.5 | 8.5 | 9.5 | 10.5 | 11.5 |
| SD (Age) | 0.01 | 0.01 | 0.06 | 0.08 | 0.11 | 0.11 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 |

Table 2.7. Time series of indices of abundance data for Gulf Spanish mackerel used in the SEDAR 28 stock evaluations. Series included are: shrimp effort, MRFSS/MRIP, commercial FWC vertical line index, and SEAMAP survey. Source: SEDAR 28 DW. Units are: MRFSS- number fish caught per hour fished, FWC Vertical line- pounds per trip, and SEAMAP- number per trawl hour.

| | MRFSS | MRFSS | COM_FWC_VERT_LINE | | SEAMAP Trawl Survey | |
|---|---|---|---|---|---|---|
| *Year* | *Std CPUE* | *log SE* | *Std CPUE* | *log SE* | *Std CPUE* | *log SE* |
| 1981 | 0.8981 | 0.4377 | | | | |
| 1982 | 1.2552 | 0.7935 | | | | |
| 1983 | 0.8820 | 0.6986 | | | | |
| 1984 | 0.6564 | 0.6170 | | | | |
| 1985 | 0.7353 | 0.5893 | | | | |
| 1986 | 2.6980 | 0.8561 | 0.6870 | 0.1901 | | |
| 1987 | 1.1851 | 0.7114 | 0.5370 | 0.1854 | 0.2963 | 0.6224 |
| 1988 | 0.8780 | 0.6646 | 0.7290 | 0.1943 | 1.1645 | 0.4463 |
| 1989 | 1.0244 | 0.6841 | 1.5290 | 0.2029 | 1.4515 | 0.4503 |
| 1990 | 1.9452 | 0.8619 | 0.9790 | 0.2027 | 1.6314 | 0.4452 |
| 1991 | 1.3235 | 0.7116 | 1.0890 | 0.2005 | 0.8900 | 0.4792 |
| 1992 | 1.4129 | 0.7470 | 1.0830 | 0.2158 | 0.6126 | 0.4670 |
| 1993 | 0.7096 | 0.6855 | 0.5950 | 0.2220 | 1.7174 | 0.4257 |
| 1994 | 0.6942 | 0.5974 | 1.0320 | 0.2187 | 0.6990 | 0.5265 |
| 1995 | 0.4094 | 0.5214 | 0.9330 | 0.2325 | 1.1066 | 0.4422 |
| 1996 | 0.6716 | 0.5985 | 0.7210 | 0.2284 | 0.9789 | 0.4968 |
| 1997 | 0.6881 | 0.6000 | 0.7820 | 0.2340 | 0.3372 | 0.5634 |
| 1998 | 0.7264 | 0.6124 | 1.1450 | 0.2360 | 0.5403 | 0.4832 |
| 1999 | 1.1596 | 0.6931 | 0.9550 | 0.2350 | 0.8557 | 0.4801 |
| 2000 | 0.7170 | 0.6426 | 0.7520 | 0.2411 | 1.1816 | 0.4850 |
| 2001 | 0.8873 | 0.6959 | 1.4160 | 0.2290 | 0.8205 | 0.5069 |
| 2002 | 0.8451 | 0.6840 | 1.0870 | 0.2317 | 0.3274 | 0.5947 |
| 2003 | 0.8580 | 0.6690 | 1.2810 | 0.2227 | 1.4923 | 0.4371 |
| 2004 | 0.9920 | 0.6841 | 1.5680 | 0.2428 | 0.4669 | 0.4575 |
| 2005 | 0.5725 | 0.6475 | 1.0970 | 0.2556 | 2.5180 | 0.4260 |
| 2006 | 0.9179 | 0.6852 | 1.4750 | 0.2365 | 0.9222 | 0.4536 |
| 2007 | 0.9469 | 0.6546 | 1.1610 | 0.2384 | 1.6153 | 0.4463 |
| 2008 | 0.9681 | 0.6606 | 1.0560 | 0.2425 | 0.7950 | 0.5053 |
| 2009 | 0.9646 | 0.6375 | 1.4080 | 0.2213 | 1.1412 | 0.3707 |
| 2010 | 1.0875 | 0.7155 | 1.5670 | 0.2192 | 1.2501 | 0.4371 |
| 2011 | 1.2902 | 0.7083 | 1.4010 | 0.2311 | 0.1880 | 0.5505 |

Table 2.8. Shrimp bycatch fishery effort time series used in the SEDAR 28 Gulf of Mexico Spanish mackerel stock assessment. Source of data: Brian Linton, NMFS, SEFSC Miami Laboratory, personal communication and SEDAR 28 RD 05). Effort series scaled to the average Days Fished across the series.

| **Year** | **Days Fished** | **Scaled Effort** |
|---|---|---|
| 1945 | 0 | 0.0000 |
| 1946 | 284 | 0.0047 |
| 1947 | 1,448 | 0.0238 |
| 1948 | 3,804 | 0.0626 |
| 1949 | 6,147 | 0.1011 |
| 1950 | 10,959 | 0.1802 |
| 1951 | 13,897 | 0.2285 |
| 1952 | 16,410 | 0.2699 |
| 1953 | 16,935 | 0.2785 |
| 1954 | 22,046 | 0.3625 |
| 1955 | 21,819 | 0.3588 |
| 1956 | 28,008 | 0.4606 |
| 1957 | 32,692 | 0.5376 |
| 1958 | 42,331 | 0.6962 |
| 1959 | 45,525 | 0.7487 |
| 1960 | 45,499 | 0.7482 |
| 1961 | 28,091 | 0.4620 |
| 1962 | 48,445 | 0.7967 |
| 1963 | 54,816 | 0.9015 |
| 1964 | 64,601 | 1.0624 |
| 1965 | 41,836 | 0.6880 |
| 1966 | 35,305 | 0.5806 |
| 1967 | 42,367 | 0.6967 |
| 1968 | 49,673 | 0.8169 |
| 1969 | 54,379 | 0.8943 |
| 1970 | 38,200 | 0.6282 |
| 1971 | 43,275 | 0.7117 |
| 1972 | 60,507 | 0.9951 |
| 1973 | 61,572 | 1.0126 |
| 1974 | 63,546 | 1.0450 |
| 1975 | 48,783 | 0.8022 |
| 1976 | 67,809 | 1.1151 |
| 1977 | 84,191 | 1.3846 |
| 1978 | 117,210 | 1.9276 |
| 1979 | 123,387 | 2.0291 |
| 1980 | 90,717 | 1.4919 |

| | | |
|---|---|---|
| 1981 | 93,669 | 1.5404 |
| 1982 | 89,604 | 1.4736 |
| 1983 | 97,007 | 1.5953 |
| 1984 | 99,486 | 1.6361 |
| 1985 | 107,160 | 1.7623 |
| 1986 | 112,829 | 1.8555 |
| 1987 | 131,122 | 2.1563 |
| 1988 | 99,077 | 1.6294 |
| 1989 | 118,390 | 1.9470 |
| 1990 | 115,261 | 1.8955 |
| 1991 | 110,218 | 1.8126 |
| 1992 | 95,737 | 1.5744 |
| 1993 | 89,589 | 1.4733 |
| 1994 | 98,076 | 1.6129 |
| 1995 | 84,232 | 1.3852 |
| 1996 | 90,320 | 1.4853 |
| 1997 | 92,288 | 1.5177 |
| 1998 | 100,228 | 1.6483 |
| 1999 | 104,433 | 1.7174 |
| 2000 | 93,384 | 1.5357 |
| 2001 | 90,675 | 1.4912 |
| 2002 | 80,352 | 1.3214 |
| 2003 | 65,451 | 1.0764 |
| 2004 | 50,458 | 0.8298 |
| 2005 | 30,345 | 0.4990 |
| 2006 | 40,321 | 0.6631 |
| 2007 | 39,499 | 0.6496 |
| 2008 | 34,113 | 0.5610 |
| 2009 | 39,735 | 0.6535 |
| 2010 | 28,164 | 0.4632 |
| 2011 | 26,366 | 0.4336 |

## 2.8 Figures

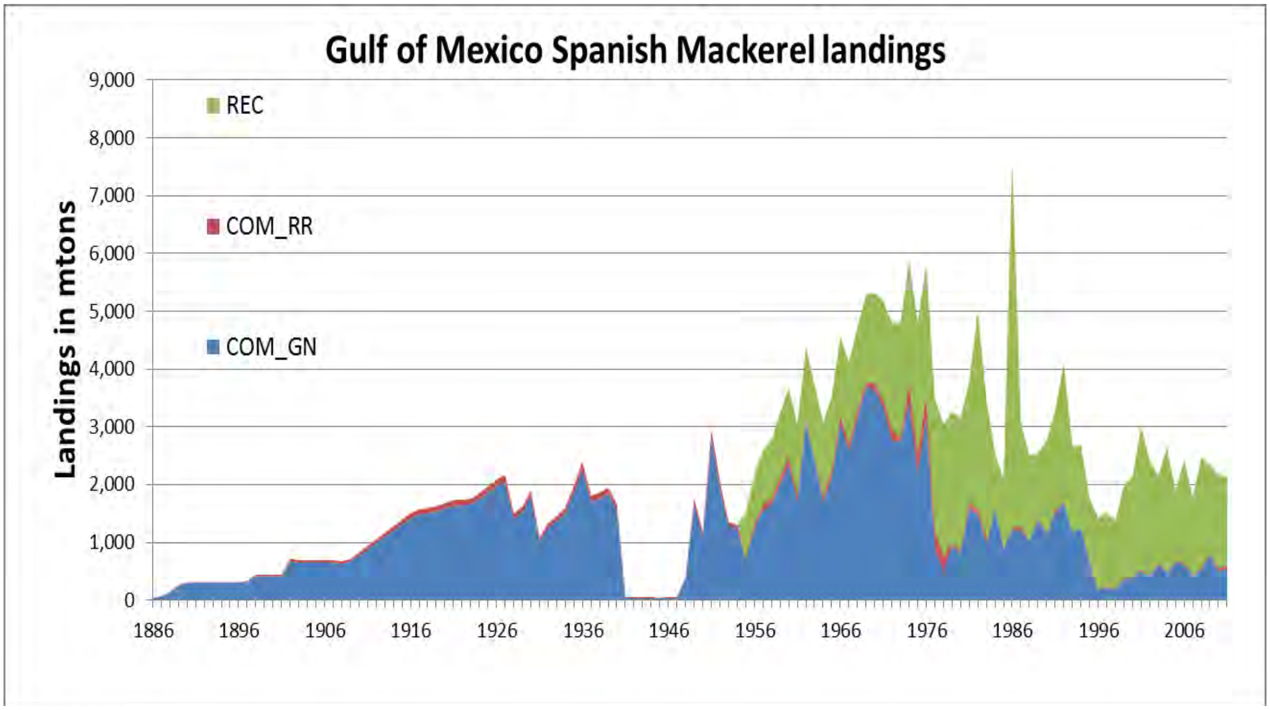
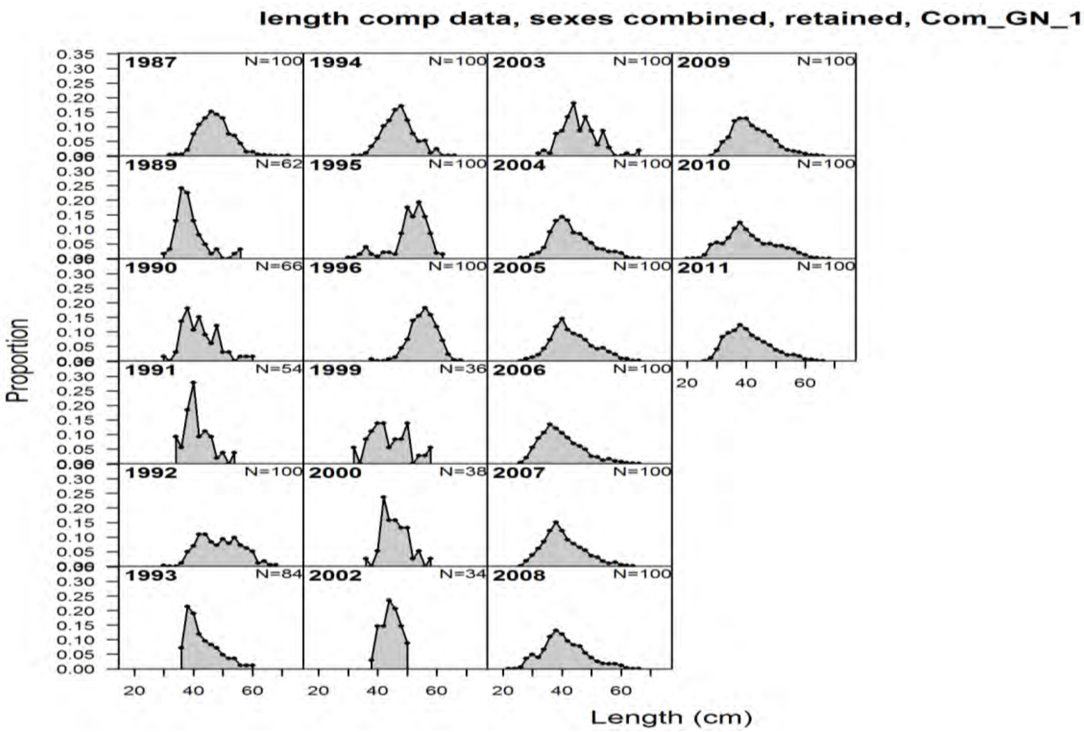



Figure 2.1. Commercial landings (mtons, whole weight) for Gulf of Mexico Spanish mackerel. Landings are partitioned into three fisheries: commercial gillnet (COM_GN), commercial line gears (COM_RR), and recreational modes combined (REC=charter, private angler, shore and headboat).

A.




B.

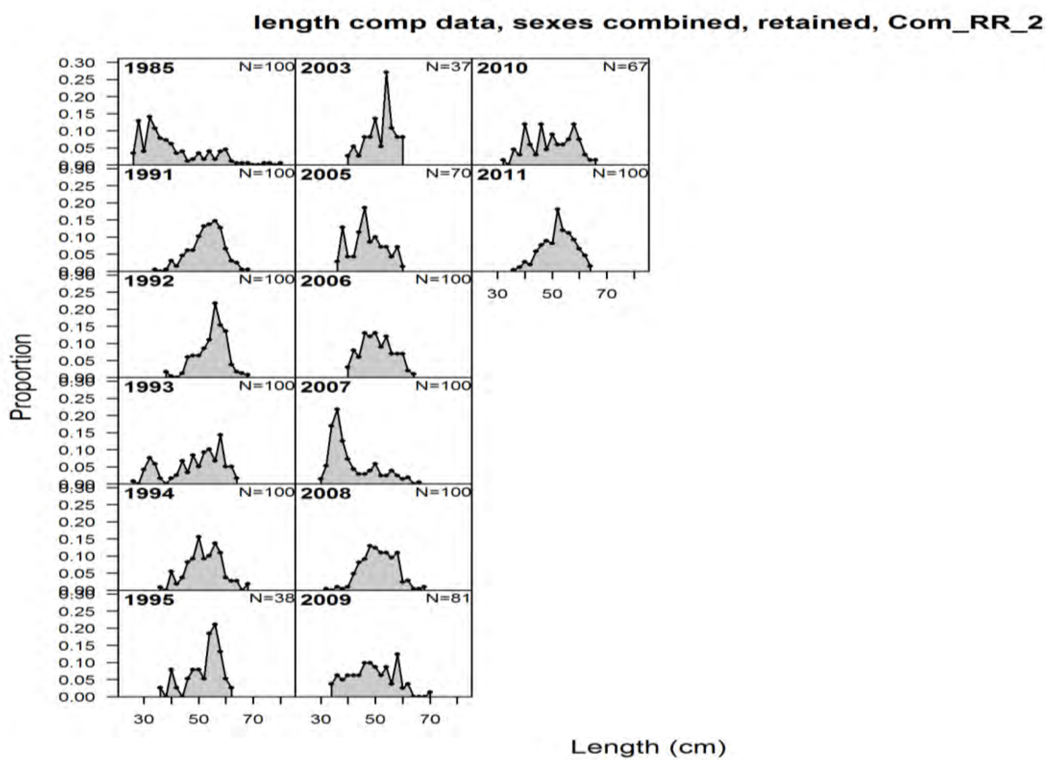
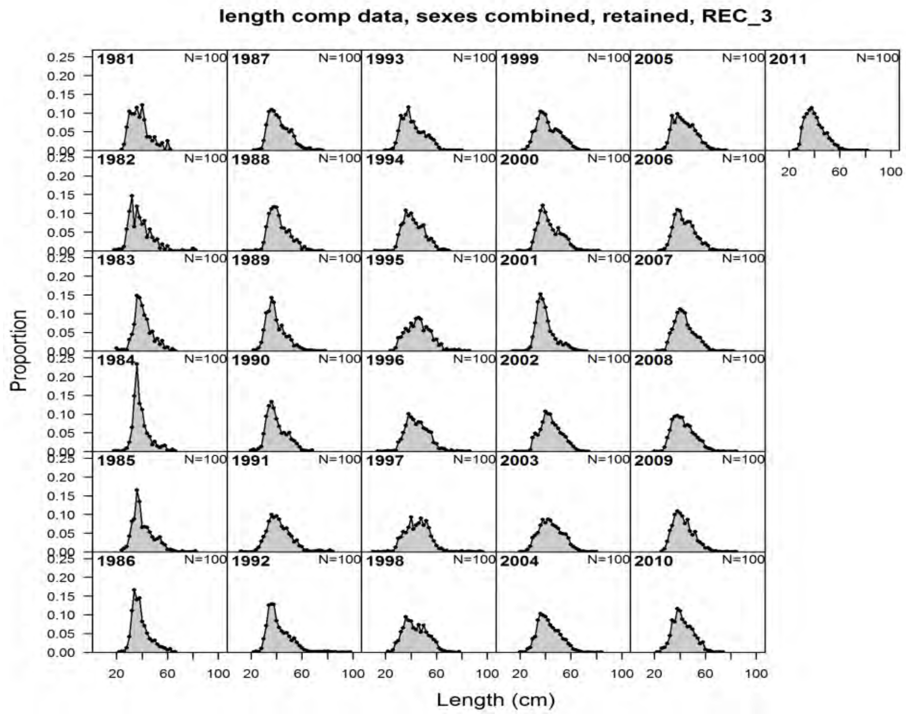



Figure 2.2a,b. Proportion of numbers at length for Gulf of Mexico Spanish mackerel in the a) commercial gillnet (COM_GN) and b) Commercial line gear fishery (COM_RR) of the Gulf of Mexico.

C.




D.

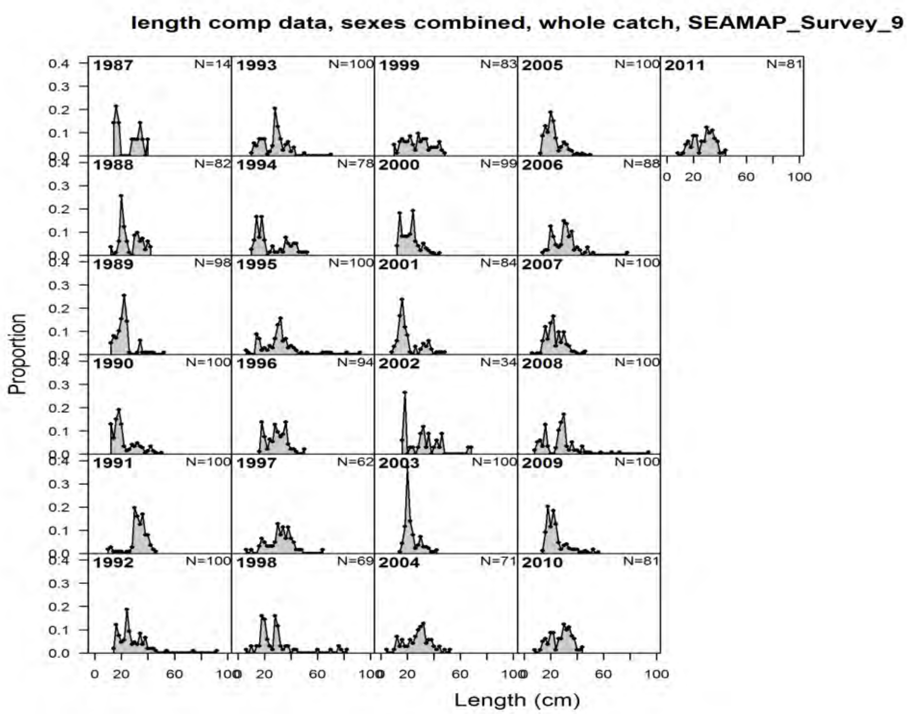



Figure 2.2c, d. Proportion of numbers at length for Gulf of Mexico Spanish mackerel in the recreational combined modes (REC=charter, private angler, shore, and headboat) fisher and c) the SEAMAP trawl survey.

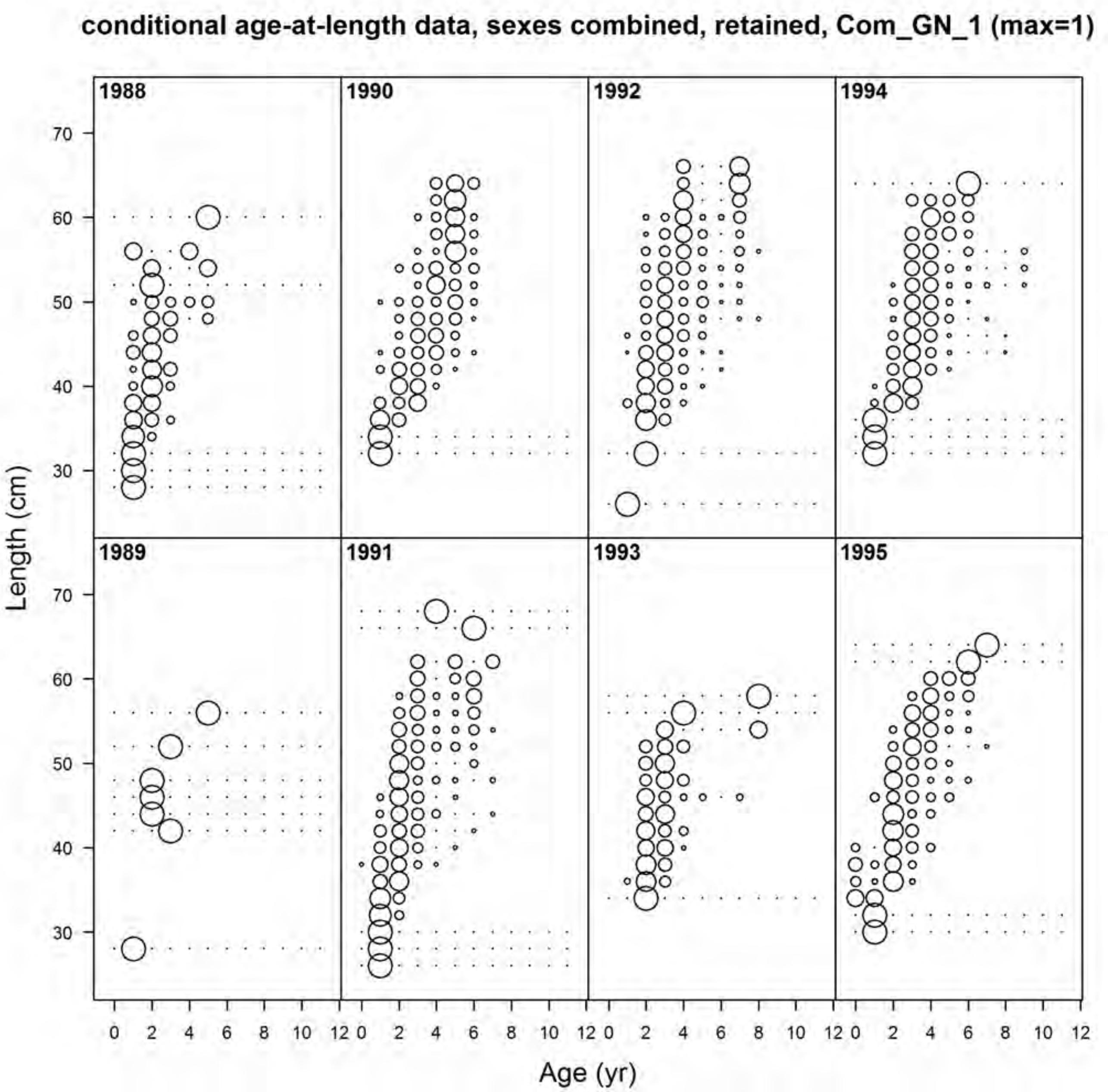



Figure 2.3a. Conditional age at length data, sexes combined, commercial gillnet fishery (COM_GN) for Gulf of Mexico Spanish mackerel.

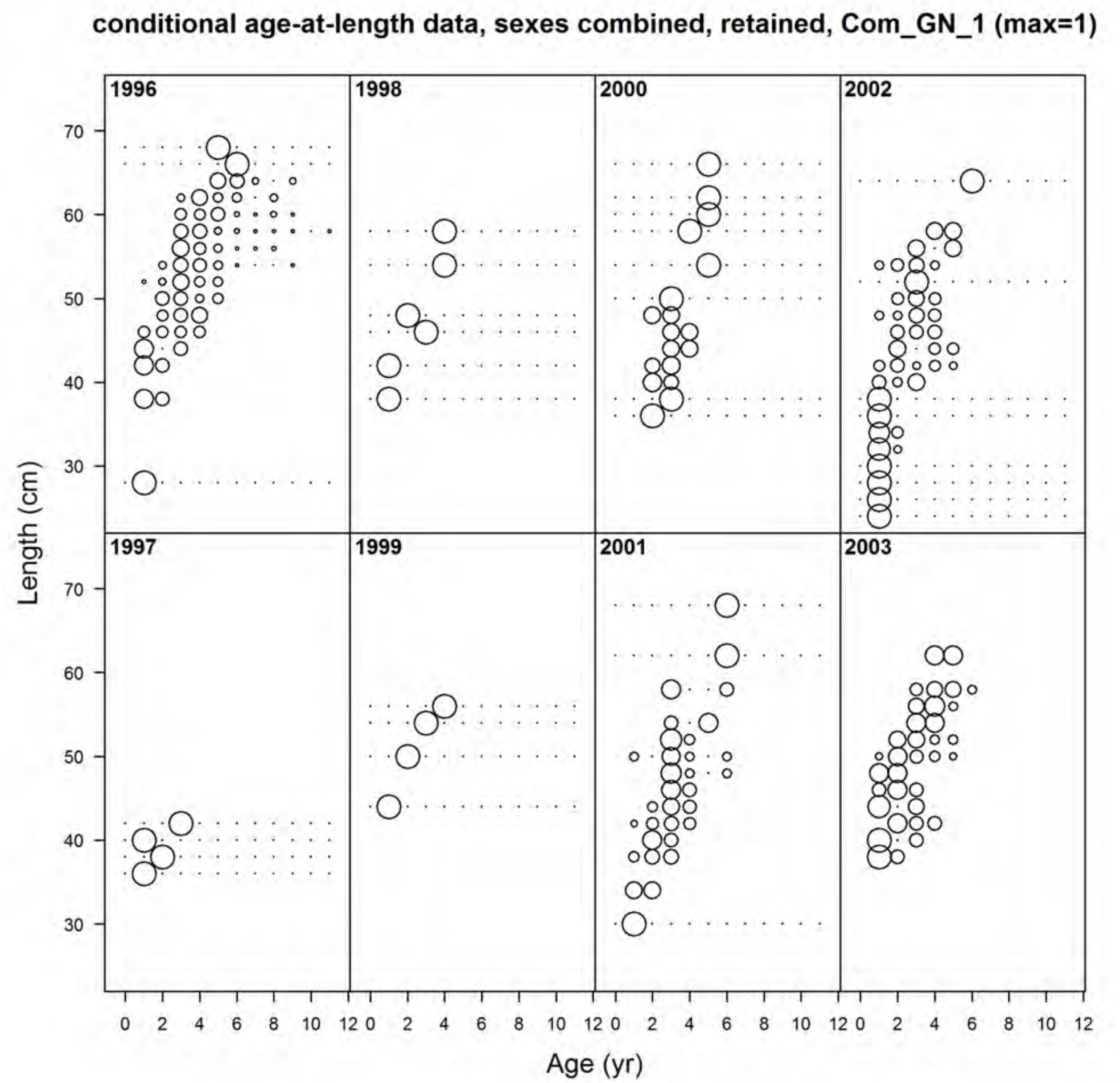



Figure 2.3b. Conditional age at length data, sexes combined, commercial gillnet fishery (COM_GN) ) for Gulf of Mexico Spanish mackerel.

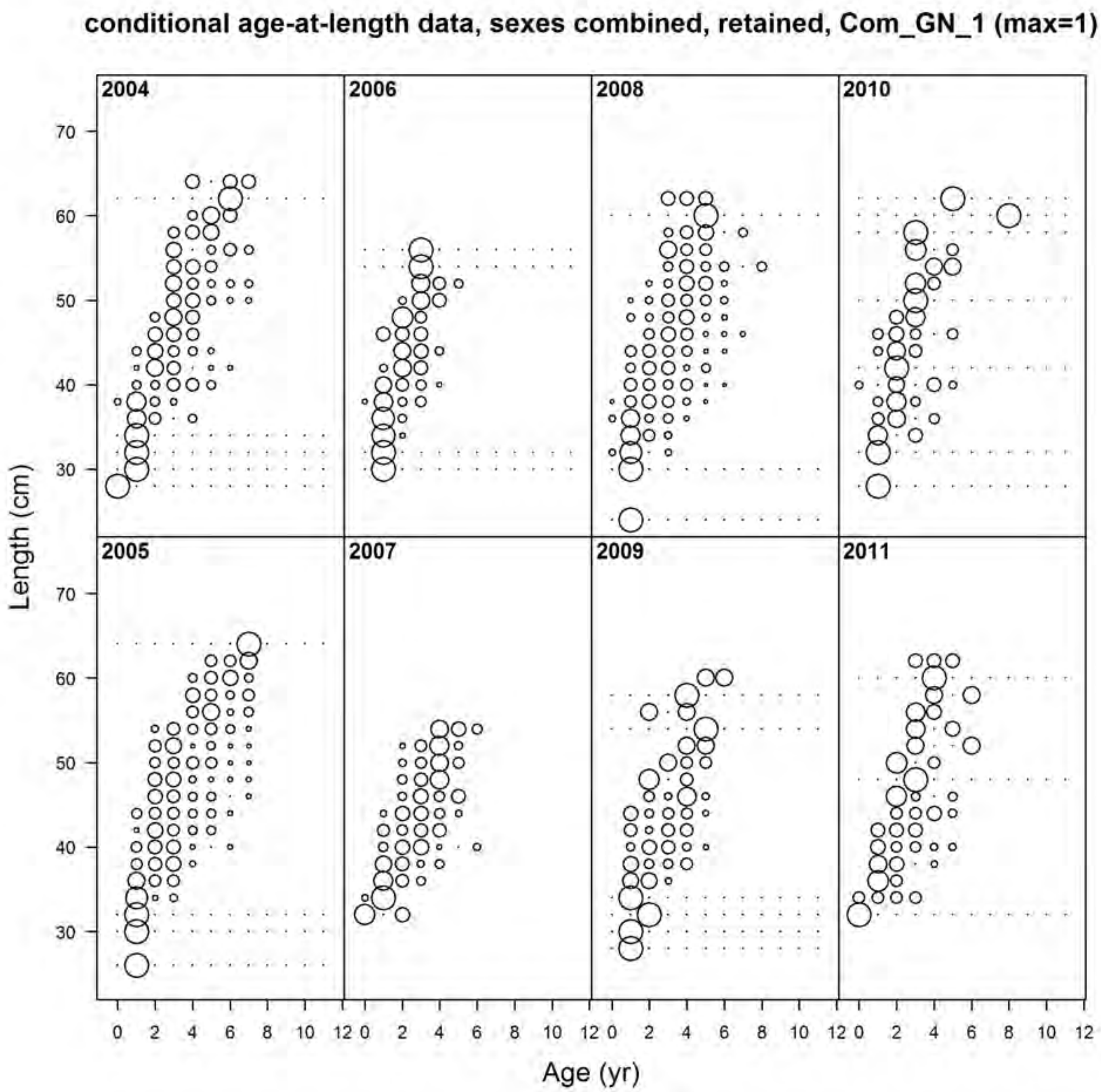



Figure 2.3c. Conditional age at length data, sexes combined, commercial gillnet fishery (COM_GN) ) for Gulf of Mexico Spanish mackerel.

.

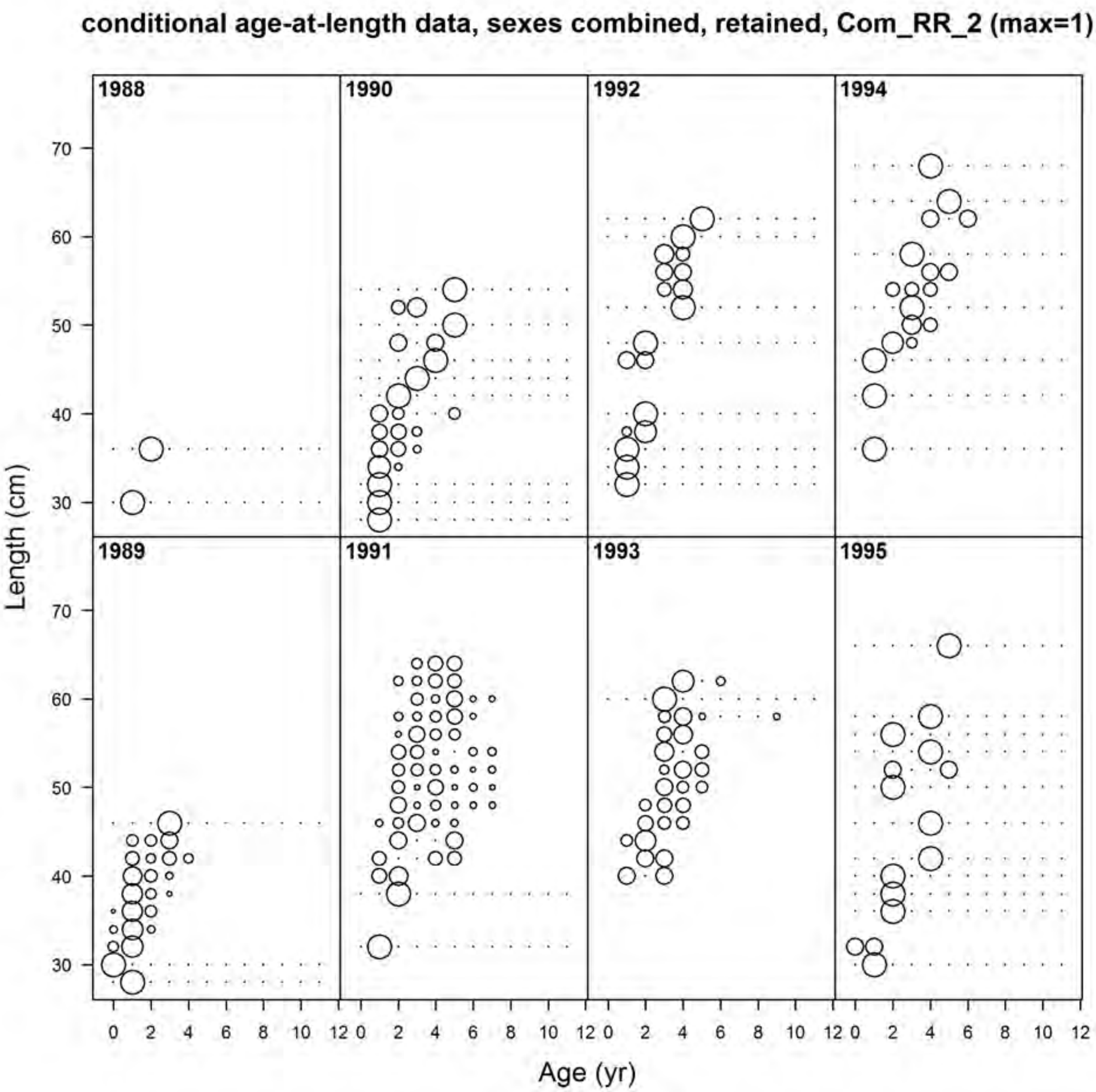



Figure 2.3d. Conditional age at length data, sexes combined, commercial line gear fishery (COM_RR) ) for Gulf of Mexico Spanish mackerel.

.

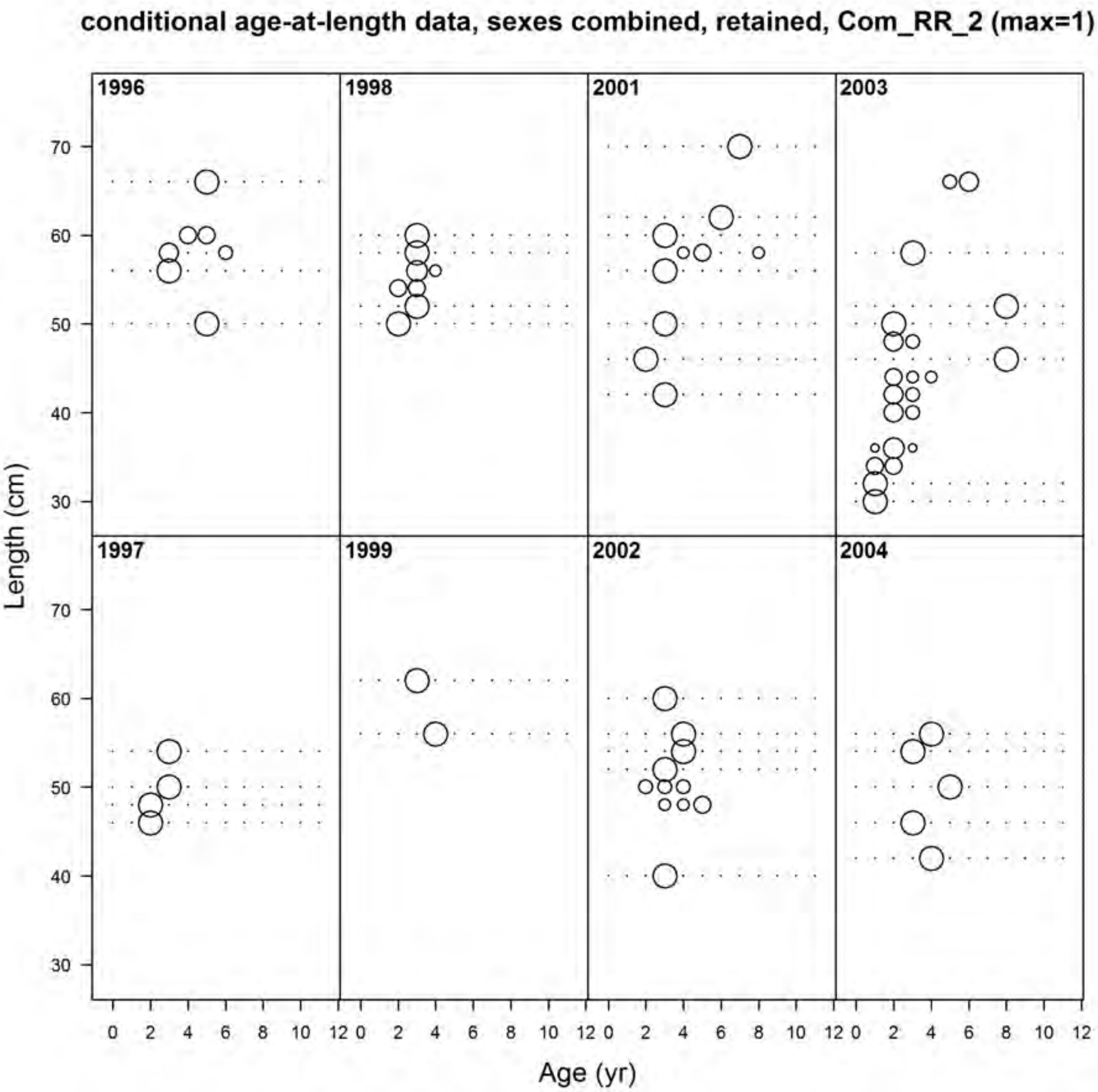



Figure 2.3e. Conditional age at length data, sexes combined, commercial line gear fishery (COM_RR) ) for Gulf of Mexico Spanish mackerel.

.

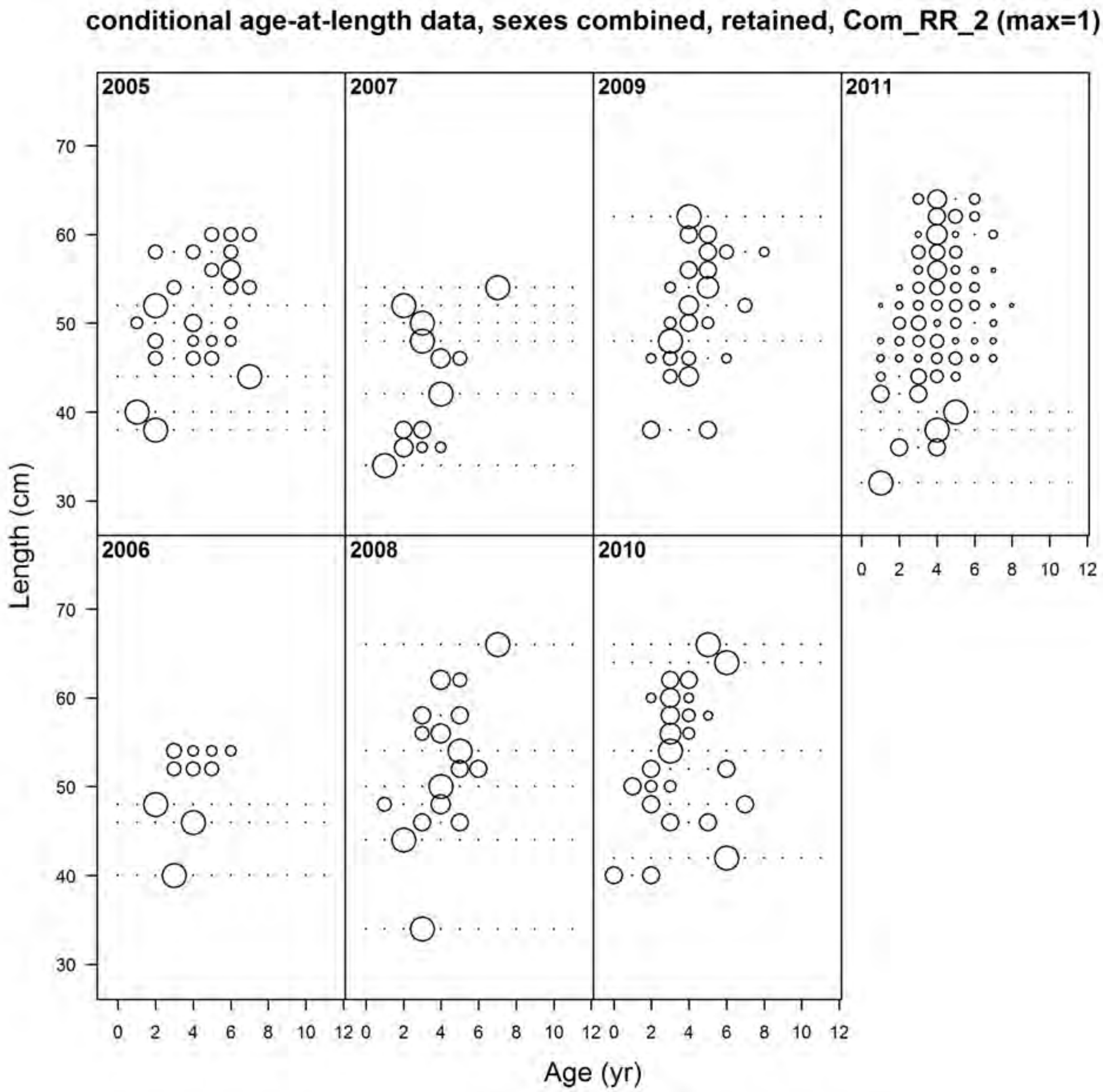



Figure 2.3f. Conditional age at length data, sexes combined, commercial line gear fishery (COM_RR) ) for Gulf of Mexico Spanish mackerel.

.

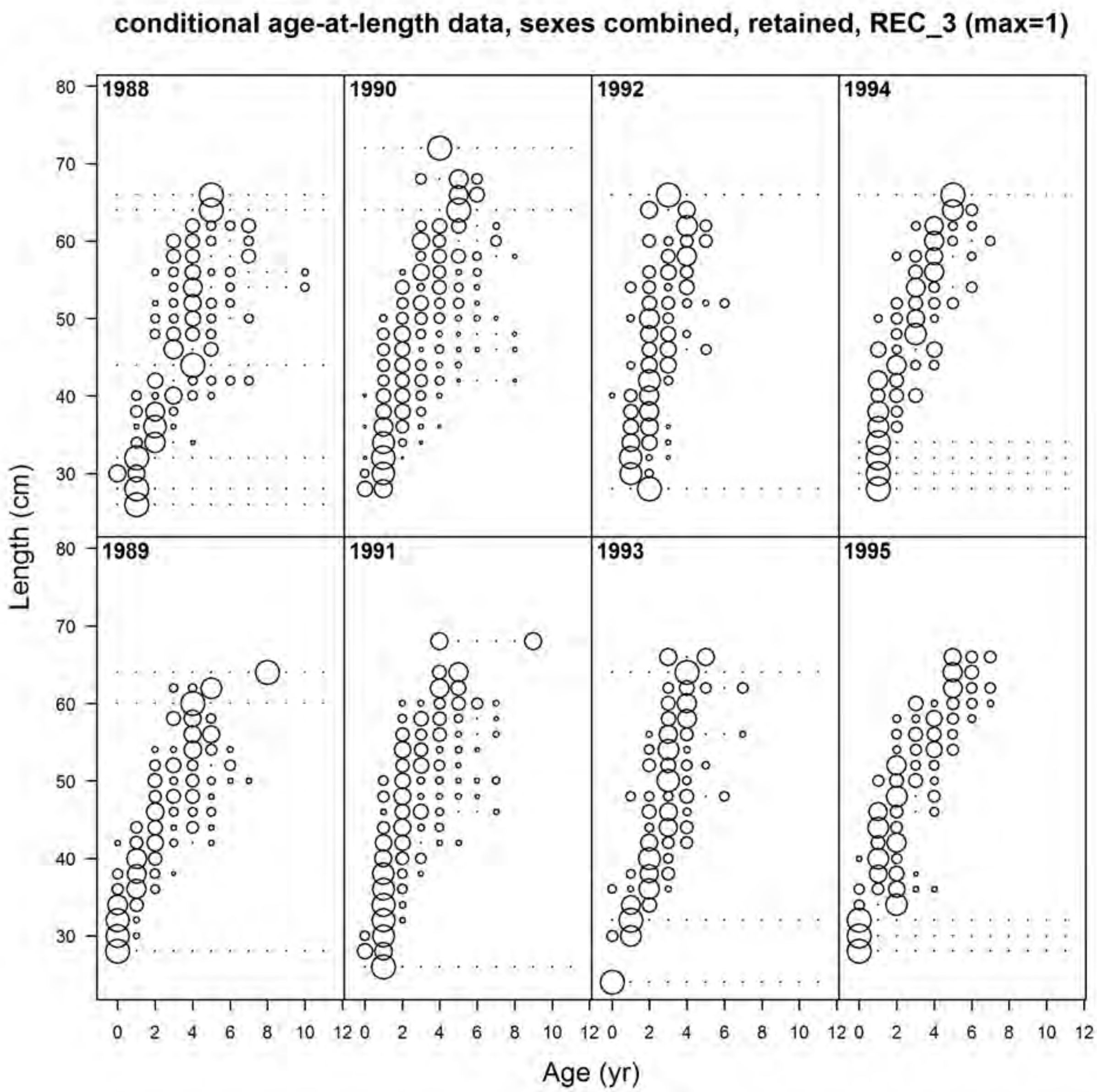



Figure 2.3g. Conditional age at length data, sexes combined, recreational fisheries all modes (REC=shore, charter, private angler, headboat) ) for Gulf of Mexico Spanish mackerel.

.

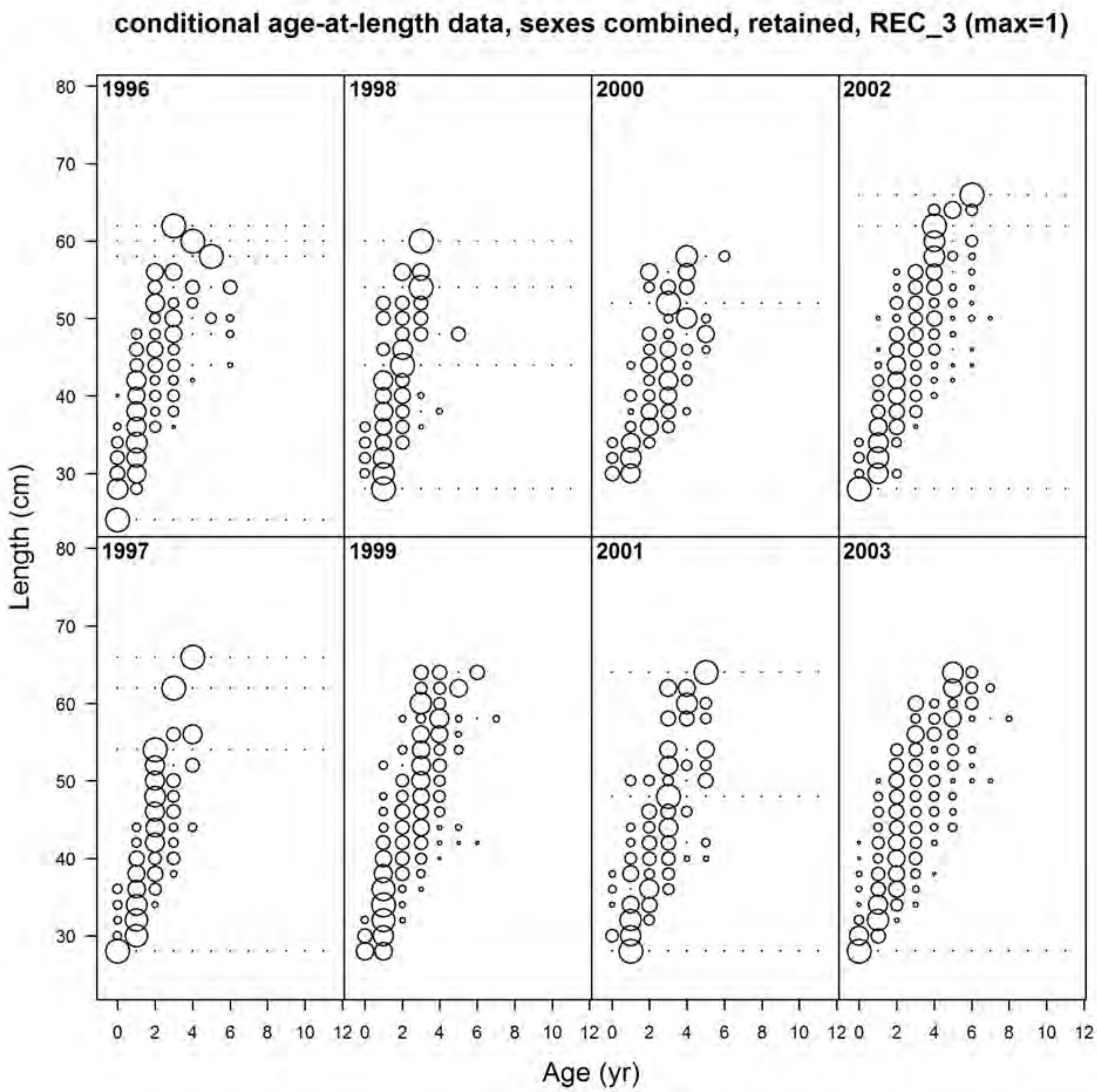



Figure 2.h. Conditional age at length data, sexes combined, recreational fisheries all modes (REC=shore, charter, private angler, headboat) ) for Gulf of Mexico Spanish mackerel.

.

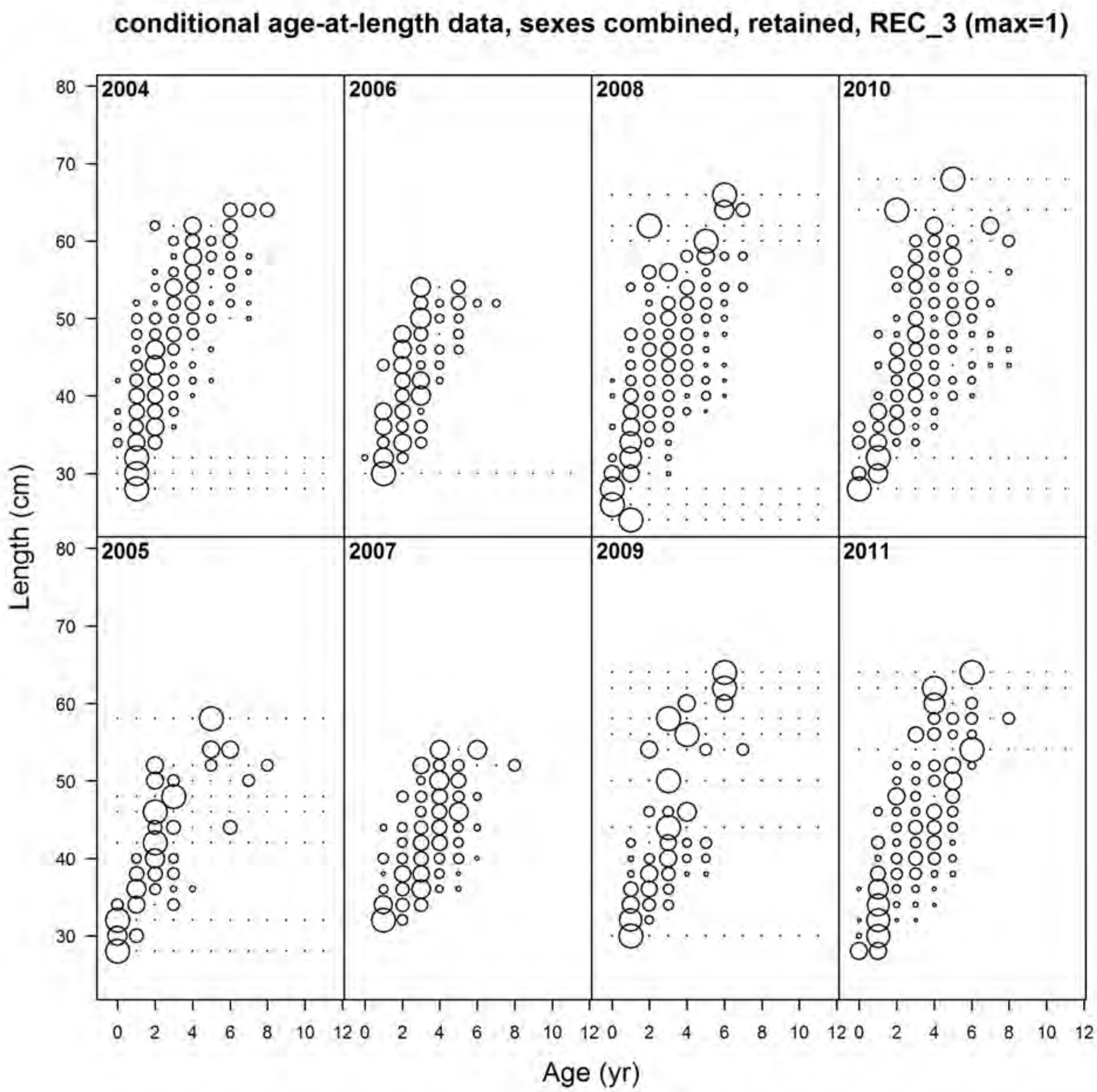



Figure 2.3i. Conditional age at length data, sexes combined, recreational fisheries all modes (REC=shore, charter, private angler, headboat) ) for Gulf of Mexico Spanish mackerel.

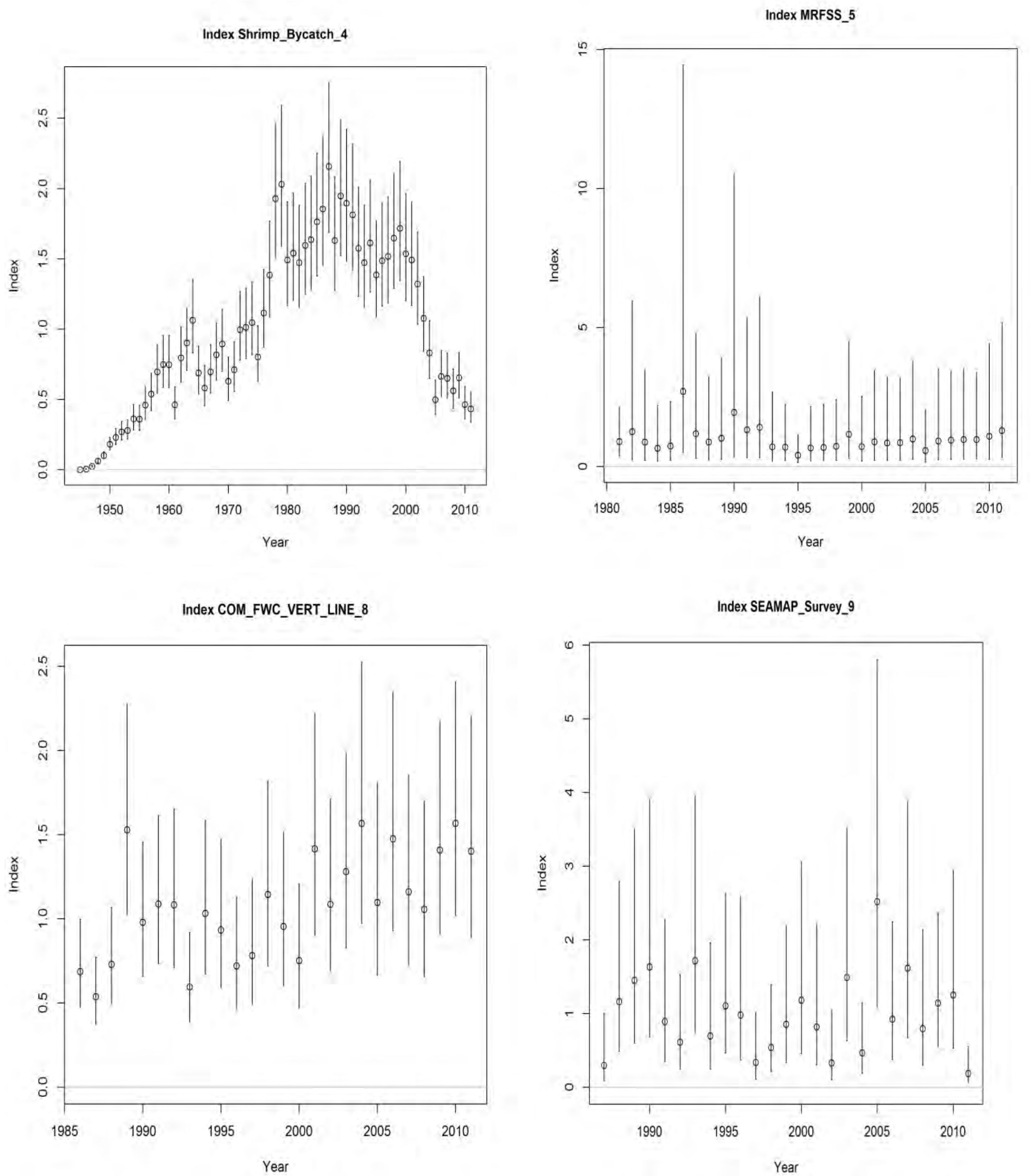



Figure 2.4. Standardized indices of relative abundance and associated coefficients of variation and the index of shrimp effort for Gulf of Mexico. The indices are from the shrimp effort series, b) MRFSS recreational survey (MRFSS), c) commercial line gear fishery (FWC Vertical line index), and d) the SEAMAP trawl survey (SEAMAP). Source: SEDAR 28 DW. Units are: MRFSS- number fish caught per hour fished, FWC Vertical line- pounds per trip, SEAMAP- number per trawl hour.

# 3 Stock Assessment Models and Results

## 3.1 Stock Synthesis

### *3.1.1 Overview*

Stock Synthesis (SS) is an integrated statistical catch-at-age model which is widely used for stock assessments in the United States and throughout the world. SS takes relatively unprocessed input data and incorporates many of the important processes (mortality, selectivity, growth, etc.) that operate in conjunction to produce observed catch, size and age composition and CPUE indices. In addition, SS can incorporate time series of environmental data. Because many of these inputs are correlated, the concept behind SS is that they should be modeled together, which helps to ensure that uncertainties in the input data are properly accounted for in the assessment. SS has the ability to incorporate an early, data poor time period for which only catch data are available and a more recent, data-rich time-period for which indices of abundance and length and age-length or age composition observations are available.

The primary assessment model selected for the Gulf of Mexico Spanish mackerel stock evaluation assessment was stock Synthesis (Methot 2010) version 3.24h (beta). Stock Synthesis has been widely used and tested for assessment evaluations, particularly in the US west coast NMFS centers (Methot 2010). Descriptions of SS algorithms and options are available in the SS user's manual (Methot 2010) and at the NOAA Fisheries Toolbox website (http://nft.nefsc.noaa.gov/). During the course of the SEDAR 28 assessment the lead analysts collaborated frequently with the model developer (Rick Methot, personal communication) on a variety of model issues but particularly as relates the handling of discards into the model. Traditionally, discards have been input into SS applications by adding the discard magnitude to the total landings of each fishery component. In this assessment, discards were input as discards corresponding to super periods (one super period (1) for the commercial line gear fleet, three (3) super periods for the recreational fleets) along with a small CV, thus allowing the model to incorporate variance about the discard level. Section 2.3 presented estimates of discards.

The r4ss software (www.cran.r-project.org/web/packages/**r4ss**/index.html) was utilized extensively to develop various graphics for the SS outputs and also was used to summarize various SS output files and to initially conduct the parametric bootstrap.

The "Fishery Simulation" Graphics User Interface (GUI) tool developed by Lee et al. (2012), see https://fisherysimulation.codeplex.com/) was the approach used to characterize the uncertainty in final model estimates and projections of future caches for a variety of alternative scenarios recommended by the Assessment Panel (AP). This tool is based on parametric bootstrap analyses used with the integrated fishery stock assessment model, Stock Synthesis (SS, Methot R.D. 2011). Applications of the method to fisheries evaluations using SS are described in Lee *et al.* 2011, Piner et al. 2011, and Lee *et al.* 2012).

### *3.1.2 Data Sources*

The SS model was fitted to landings, discards, length composition, conditional age-length observations, and indices of abundance. These categories of data included: annual landings (mtons), directed fishery discards (recreational and commercial fractions entered as super periods), shrimp fishery bycatch (dead discards as numbers in 1,000s ), and standardized indices of relative abundance (recreational (MRFSS), commercial line gear fishery (FWC Vertical line fishery), SEAMAP Independent fishery trawl survey, and a time series of estimated shrimping effort (shrimp fishery). Although annual estimates of release mortality were not available, some information was available to characterize relative amounts of dead discards from the directed commercial line gear and recreational all modes fisheries as described in the SEDAR 29 DW report. The detailed data used in the SS model fitting are as described in Section 2.

### *3.1.3 Model Configuration and Equations*

The stock was assumed to be in equilibrium at the beginning of the data series, 1886. The terminal year of data was 2011. SEDAR 28 DW provides details and a characterization of the fisheries for Spanish mackerel in the Gulf of Mexico since the late 1800s. The history of commercial landings exists since 1886. Recreational fishery removals were available since 1981 and were hindcast from 1955 to 1980 by the SEDAR 28 DW. It was generally thought that recreational removals of Spanish mackerel prior to 1955 were not large. Shrimp discards were available since 1972 and an index of shrimping effort in the Gulf of Mexico inside 15 fathoms was available since 1945. The stock assessment model, SS, was configured to include removals from three directed fisheries representing removals from the commercial gillnet (COM_GN), commercial vertical line gears (Com_RR) and recreational charter, private, headboat and shore anglers (REC). As described above in the Data Section (2), there were some minor landings reported for “miscellaneous” commercial gears (traps, trawls, seines); these “miscellaneous” commercial landings were apportioned into commercial gillnet and commercial line gears according to the annual representation of each. Three abundance surveys were incorporated representing the commercial line gears (Com_RR) and recreational charter, private, headboat and shore anglers (REC), and the SEAMAP trawl survey (SEAMAP). Initial exploitation rate was assumed to be zero for each fleet. Data inputs also included a time series of fishing effort for the shrimp fishery.

Parameter values for the weight-length relationship, maturity schedule, and fecundity were fixed at the values given in the DW Workshop report (SEDAR 28 DW Report- Section 2.10, Table 2.7) and are presented in Figure 3.1a (this report, weight-length relation). Maturity was input as a fixed logistic function of age with full maturity set for ages 1 plus.

For the initial model configuration natural mortality was modeled as a declining ‘Lorenzen’ function of size constant over time, as recommended by the DW (DW Report-Section 2.4, Table 2.1). Operationally, the age specific Lorenzen M vector was obtained via a two-step process, by first running SS specifying the input M value and the reference age for scaling the Lorenzen M to the Hoenig maximum age estimator point estimate. For the Lorenzen M curve in SS, a parameter describing the natural mortality at a specified reference age (i.e., “REF age”) is defined. Natural mortality values for the remaining ages are scaled according to the estimated growth curve. The REF age for the initial Model run was set equal to age 4 (DW Report- Section 2.4). This was done in SS (internally) by specifying the M type switch in the SS control file to ‘2’ Lorenzen and then specifying in the SS control file the age at which the M intersected the Hoenig point estimate, this occurred at ‘REF-age = 4. The resulting vector of M at-age was then input into the SS model (via specifying this vector of M at-age in the SS control file) for the Base (or Sensitivity) model run. This two-step procedure was reported for the sensitivity runs vs.

different values of M or a different REF age. One additional adjustment of the input M at-age vector was necessary to account for the approach that SS advances ages to age 1 when they first reach January 1, irrespective of time of birth. Spanish mackerel undergo spring spawning thus in SS are advanced to age 1 at ~ 0.5 years of life. Thus, the input value of M for 'age 0' fish from the Lorenzen function was reduced by 0.5. The remaining values of M at-age did not require adjusting. Throughout the stock assessment the impact on model results from assumptions on M (at age) were explored by varying the input M value corresponding to a range of point estimates, re-running the SS model to estimate M at-age and subsequently inputting the new sensitivity M at-age vector into SS. Figure 3.1c (this report) presents the SS Model M at-age and the alternative M at-age characterizations used in the stock assessment. Three sensitivity runs around M were considered, two assuming the DW recommended CV around M of 0.54 corresponding to an M value estimate of M of 0.27 $y^{-1}$ and 0.49 $y^{-1}$ (DW Report- Section 2.4) and another using the DW point estimate of M (0.38 $y^{-1}$) and set the input REF age = 3. Figure 3.1c provides the characterizations of natural mortality explored in the stock assessment.

Growth was modeled internally in SS as both sexes combined with a three parameter von Bertalanffy equation ($L_{min}$, $L_{max}$, and $K$) (Figure 3.1a). In SS, when fish recruit at the real age of 0.0 the body size at length is set equal to the lower edge of the first population bin ($L_{bin}$; fixed at 2-cm FL for the Spanish mackerel stock assessment). Then, individuals grow linearly until they reach a real age equal to the input value of $A_{min}$ (growth age for $L_{min}$) and have a size equal to the $L_{min}$. Then, as fish advance in age, the size at age is then characterized according to a von Bertalanffy growth equation. The value of $A_{min}$ was fixed at 0.5 which is representative of a fractional age of ~ 0.5 representing the midpoint of the spawning period (May-August). The Lmin value was selected for $A_{min}$ based on empirical size at age observations by month, from the age 0 fish provided in the age-length data. $L_{max}$ was specified as equivalent to $L_{\infty}$. Variation in the size-at-age was estimated by SS for the growth model for ages 0.5 and 11. For intermediate ages a linear interpolation of the CV on mean size-at-age is used.

The SS model can also incorporate information on age at length (i.e., similar to age length key) in the model estimation process thus estimating the distribution of age within a length interval (Methot 2011). Methot points out that "this approach avoids redundancy of using fish for both age and size information in the model estimation since the age observation is conditional on length". As described in Section 2.5 the age at length data from the SEDAR 29 DW was stratified into age (from age 0 to age 11) by 2-cm length bins ranging from 4 to 99 cm, with age 11 representing a plus group.

Size based selectivity patterns were specified for each fishery and survey in SS. Double normal functions were used to model selectivity, because of the flexibility this functional form provides. The double normal can model dome-shaped selectivity, but it also can model asymptotic selectivity by holding several of the function's parameters at fixed values. Four selectivity patterns were defined in SS corresponding to each fishery and survey: 1) commercial gillnet (COM_GN), 1) commercial line gear (COM_RR), 3) recreational combined modes (private, charter, headboat-REC), and the 4) SEAMAP trawl survey (SEAMAP). The SEDAR 28 AP decided to constrain the commercial line gear fishery and the recreational fishery selectivity patterns to be asymptotic, because there was no strong evidence of dome-shaped selectivity and the fit of the model was not substantially improved when specifying a dome selectivity function.

The MRFSS abundance survey mirrored the recreational combined fisheries (REC) selectivity. The commercial line gear abundance index (from the FWC Vertical line gear fishery) mirrored the commercial line gear fleet (COM_RR).

Retention curves were used to account for discards in the size composition and to adjust for impacts of fishery minimum size regulations implanted in 1993 (12 inch fork length). The retention function was specified as a two parameter logistic function. SS can incorporate time varying parameter estimation thus two time blocks were assumed in modeling the retention function for the COM_RR and Rec fleets corresponding to the size limit, 1992 and earlier and 1993 – 2011.

For the assessment, the SS model configuration assumed a single Beverton-Holt stock-recruitment function and two of the three stock recruitment ("S/R") parameters were estimated: log of unfished equilibrium recruitment (R0) and steepness (h). A third parameter representing the standard deviation in recruitment (*sigmaR*) was input as a fixed value of 0.7.

Stock synthesis is hard-coded to model recruits as age 0 fish. Annual deviations from the stock-recruit function were estimated in SS as a vector of deviations forced to sum to zero. Stock synthesis assumes a lognormal error structure for recruitment. Therefore, expected recruitments were bias adjusted. Methot (2010) recommends that the full bias adjustment only be applied to data-rich years in the assessment therefore the estimates are very precise ($\sigma^2$=0). Therefore, no bias adjustment was applied prior to 1985, when only catch data are available. Prior to 1984, recruitment is estimated as a function of spawning stock biomass based on the stock-recruit parameters. This is done so SS will apply the full bias-correction only to those recruitment deviations that have enough data to inform the model about the full range of recruitment variability (Method 2011). Full bias adjustment was used from 1985 to 2010 when length and age composition data are available. Bias adjustment was phased in from no bias adjustment prior to 1972 to full bias adjustment in 1984 linearly. Bias adjustment was phased out over the last two years (2010-2011), decreasing from full bias adjustment to no bias adjustment, because the age composition data contains little information on recruitments for those years. The years selected for full bias adjustment were estimated following the methods of Methot and Taylor (2011.

During the stock assessment, an update to the SS model was provided that allowed the shrimp fishery discards to be modeled as a bycatch fishery. As mentioned above in the Section 2.3.2 and 2.6, previously, discards were incorporated into the Spanish mackerel stock assessments as a component of the landings and assumed to be precisely estimated. For this stock assessment as recommended by the SEDAR 28 AP, the magnitude of discards was assumed proportional to shrimp fishing effort within 10 fathoms. SS assumes the level of annual fishing mortality and thus Spanish mackerel bycatch is directly proportional to the annual shrimp effort index. The annual median estimates of Spanish mackerel shrimp bycatch for 1972 -2011 were input as a super year and the scaled effort for 1945-2011 time series was input into SS to obtain estimates of total annual fishing mortality by the shrimp fleet and predicted total Spanish mackerel bycatch. In the estimation, a catchability parameter (Q) is used to scale the effort series to the estimate of bycatch. In SS, since the shrimp bycatch was input as the median estimate across the entire time series (i.e., as a super year), the median estimate of bycatch is assumed as the observed value over the time period, 1945-2011. Estimated Spanish mackerel bycatch is then derived from the annual levels of shrimp effort.

For the initial model runs all data inputs (abundance indices, length compositions, and age compositions) were equally weighted and no prior density was assumed for estimated parameters

The SS input files are presented in Appendices C-F.

### *3.1.4 Parameters Estimated*

Table 3.1 provides a listing of all parameters estimated in SS. Results included are predicted parameter values and their associated standard errors from SS, initial parameter values, minimum and maximum values a parameter could take, and prior densities assigned to parameters. Table 3.1 presents the model estimates for Final Model recommended by the SEDAR 28 AP for Gulf Spanish mackerel.

As mentioned in Section 3.1.1.3, growth was estimated internally in SS (using conditional age length data provided by the SEDAR 28 DW). Initial parameter estimates for the growth relationship (i.e., for the Lmin, Lmax, Amin parameters) were guided by external growth model fits using the empirical age length data developed by the DW. Figure 3.1b presents the estimated growth curve from the SS model used in the stock assessment.

Initial starting guesses for the size selectivity patterns were first specified by fitting the observed length compositions and visually inspecting the resulting fits characterizations of either the asymptotic (COM_RR or REC) or dome shaped (COM_GN, SEAMAP). For the asymptotic function, two of the retention parameters were fixed at the input values to force an asymptotic function. SS allows use of time varying selectivity to incorporate effects of size limits (implemented in1993) on selectivity. Time blocks were specified for the two fisheries for which discards were reported from: commercial line gears (COM_RR) and the recreational all modes (REC) as: 1) a pre- 1993 period and 2) a 1993-2011 period corresponding to the time of implementation of a 12 inch fork length size limit. This provided for the possibility of estimation of both retention and selectivity functions for the two different time blocks for these fisheries. Attempts to estimate both retention and selectivity functions for these two fisheries (COM_RR and REC) were not satisfactory and produced unreasonable functions. Length composition data were only available for the retained catch therefore efforts were focused on estimating the retention function as recommended by the SS model developer (R. Methot, personal communication). For the REC fishery it was possible to estimate both the inflection and shape (slope) retention- function parameters for both time blocks. For the COM_RR fishery it was necessary to fix the slope parameter (P2) for period 1, prior to 1993. Selectivity for the remaining fleets, COM_GN and the SEAMAP survey were characterized estimated using the double normal. Efforts were initially made to model the COM_GN selectivity as a single time period however, lack of fit was particularly high in later years, after 2006. Follow up research by the lead analyst to federal and state port samplers confirmed that around 2006, sampling intensity increased significantly in Alabama and in particular observations of fish less than 30 cm fork length, occurred in the time series after that time. Fish less than 30 cm fork length were not previously recorded observed in the gillnet samples. Addition of a selectivity time block for the COM_GN fleet resulted in much improved fits to the COM_GN length composition data.

As mentioned in the model configuration section (Virgin recruitment (R0) and steepness parameters were estimated in SS. Results from attempting to estimate steepness produced a low value (0.52) which suggested very low productivity for the stock. The AP panel had considerable questions on the ability of the model to estimate steepness so the analyst conducted profiling of the steepness and virgin recruitment parameters. The standard deviation parameter (sigmaR) for recruitment was fixed at the initial input value (0.7) and set based on review from other SS examinations. A profile of sigmaR was also carried out and did not indicate disparity in the initial input value choice of 0.7 so this parameter remained fixed throughout the stock assessment at 0.7.

Additional fishing mortality rates used for recommending future harvest levels are estimated conditionally on other outputs from the model. For example, the values corresponding to the *F30%SPR*, and *FMSY* harvest rates are found by satisfying the constraint that given age specific population parameters (e.g., selectivity, maturity, mortality, weight-at-age), unique values exist that correspond to these fishing mortality rates.

In all, 376 parameters were included in the SS model: five (5) to model growth, 26 to characterize the selectivity and/or retention functions, one (1) parameter to estimate the shrimp bycatch fishery catchability coefficient, 28 annual recruitment deviations, and 376 annual fleet specific fishing mortality parameters.

### *3.1.5 Model Convergence*

Uncertainty in the Gulf of Mexico Spanish mackerel stock assessment was examined using multiple approaches.

Uncertainty in model parameter estimation performance was also addressed through an internal SS parameter "jitter" option which randomly changes the input parameter by a specified value. A jitter value of 10% was input for this assessment and 100 runs were made. SS carries out the jitter exercise by randomly changing the initial starting values of the parameters by 10% thus altering the starting estimates across many runs. The purpose in changing the parameter starting estimates across numerous models is to explore the model's ability to reach a global solution (i.e., minima) from starting at different places along the likelihood space.

### *3.1.6 Uncertainty and Measures of Precision*

Uncertainty in parameter estimates was quantified by computing asymptotic standard errors for each parameter (Table 3.1). Asymptotic standard errors are calculated by inverting the Hessian matrix (i.e., the matrix of second derivatives) after the model fitting process. Asymptotic standard errors provide a minimum estimate of uncertainty in parameter values.

The "Fishery Simulation" Graphics User Interface (GUI) tool developed by Lee et al. (2012, https://fisherysimulation.codeplex.com/ ) was the approach used to characterize the uncertainty in final model estimates and projections of future caches for a variety of alternative scenarios recommended by the Assessment Panel (AP). This tool is based on the bootstrap analyses used the integrated fishery stock assessment model, Stock Synthesis (SS, Methot R.D. 2011). General application to other assessment model or other field has not been explored. Applications to the fishery using SS can be referred (Lee *et al.* 2011; Piner et al. 2011; Lee *et al.* 2012). Lee et al. (2012) present detailed steps in the GUI tool. Briefly, within the GUI tool, SS is fit to the model of choice and N new data sets (bootstrap sets) are created based on the original model (all parameters either fixed or estimated the same as the original model) and parametric sampling of the errors (Lee et al. 2012). Using the GUI tool then, the resulting N bootstrap files can be summarized to provide information on uncertainty in the model estimates and other additional output (derived estimates). Lee et al. (2012) discuss the utility of using the Fishery Simulation tool to provide another way to construct a distribution of likely parameter values for a complex fisheries population model.

In the Spanish mackerel assessment, the GUI tool was used to evaluate the uncertainty in model parameters (e.g., growth parameters, selectivity parameters, recruitment deviations) and other key quantities of interest (e.g., total virgin biomass, spawning biomass (SSB), current SSB, etc..).

### *3.1.7 Sensitivity Analysis*

Uncertainty in data inputs and model configuration assumptions was examined through various sensitivity analyses. In all, results of 12 separate SS3 model runs are included in this report describing the initial SS model configuration, sensitivity analyses, data exclusions, and reweighting runs conducted to evaluate a) assumptions on steepness, b) assumptions of input M at-age, c) impact of the elimination of abundance indices on model estimates, and d) consideration of the assumption on release mortality of discards from the directed fisheries (COM_RR and REC). Over the course of the stock assessment, many additional sensitivity analyses were explored. It is the main intent to present here those runs that best explored the sensitivity of key model parameters and/or demonstrated discord (or agreement) in model estimates between runs. Table 3.2 describes the SS Model runs made in the stock assessment and all the alternative (sensitivity, reweighting, retrospective) analyses made for the stock assessment.

Two sensitivity analyses on M were made by varying the level of M from that of the initial model trial (Run 1) configuration. As described earlier, the initial model run M at-age vector was calculated assuming the Hoenig point estimate of M = 0.38$y^{-1}$ for the Lorenzen function. Two additional M sensitivities ((M = 0.27 $y^{-1}$ and 0.49 $y^{-1}$) were considered corresponding to a CV of 54% on the input base M value (0.38$y^{-1}$). In addition, an additional sensitivity analysis on M was specified by varying the reference age (REF age) for the Lorenzen function from 'REF age = 4" to "REF age = 3".

The assumption of the stock recruitment relationship used in the SS model was considered. First the Beverton – Holt steepness parameter was profiled by varying the input value from 0.4 to 1.0 and incrementing by 0.01. Second, three sensitivity runs were made by fixing the steepness parameter: varying the value fixed from 0.7 to 0.9 (by 0.1).

In addition to evaluating impacts on the SS Model from assumptions on steepness and M, the assumptions of data inputs were considered through 1) varying the discard level release mortality and 2) through removing complete suites of data (e.g., abundance indices). The impacts on model estimates from the inclusion of individual data components were addressed through sequentially dropping individual indices (i.e., MRFSS, FWC Fish Ticket, and SEAMAP Survey) from the initial base model run.

A sensitivity analysis was also carried out to determine the influence of 1) the length-frequency and age sample size and b) the impact of variance reweighting of the abundance indices on model results. McAllister and Ianelli (1997) used an analytical method to determine the effective sample size for catch at- age data based on the observed and predicted proportional catch at age. They used a method of iteratively modifying the sample size based on this calculation until the change in sample size was small. In this assessment, the internal procedure within SS was used to determine new sample sizes for each set (fishery and time period) of length-frequency data. The original sample size for the surface gears used in the base case was based on number of observations (lengths or ages) and was capped at 100. SS estimates the effective sample size (N), the model is rerun with variance adjustment factor equal to effective sample size /input N. This is repeated until the effective sample size and input N are equal. Index reweighting was also examined using the internal reweighting option in SS. Survey (index) reweighting is performed by adding the variance adjustment to the survey standard deviation and the model re-run until the model variance and the input standard deviation + the variance adjustment factor are equal. For this sensitivity run, the model assumed the configuration of the initial model run (Run 1) and also estimated steepness.

A complete characterization of all the sensitivity and alternative models explored for the stock assessment were as below and further detailed in Table 3.2:

Run 1: Initial Model
Estimated growth, M=0.38$y^{-1}$ input into Lorenzen and scaled to Reference Age 4, estimate steepness, estimate virgin stock (R0), estimate recruitment deviations (1985-2010), input discards as discards (thousands of fish 1 super period (shrimp bycatch fishery), fractions directed fishery (1 super period commercial line gears (COM_RR), 3 super periods (recreational (REC)), 2 time varying selectivity/retention blocks commercial line gear (COM_RR) and recreational all modes (REC): pre-1993, 1993-2011, 2 time varying selectivity blocks commercial gillnet fleet (COM_GN) pre-2006, 2006-2011.

Run 2: Run 1 Configuration, M = 0.38 $y^{-1}$, except the Beverton and Holt steepness parameter fixed at 0. 9.

Run 3: Run 1 Configuration, M = 0.38 $y^{-1}$, except the Beverton and Holt steepness parameter fixed at 0.8.

Run 4: Run 1 Configuration, M = 0.38 $y^{-1}$, except the Beverton and Holt steepness parameter fixed at 0.7.

Run 5: Run 3 Model Configuration (Beverton and Holt steepness parameter steepness = 0.8) and M SENS HI (M = 0.49 $y^{-1}$) sensitivity with M value input into Lorenzen function.

Run 6: Run 3 Model Configuration (Beverton and Holt steepness parameter = 0.8) and M SENS LO (M = 0.27 $y^{-1}$) sensitivity with M value input into Lorenzen function.

Run 7: Run 3 Model Configuration (Beverton and Holt steepness parameter = 0.8) and M = 0.38 $y^{-1}$), Lorenzen scaling "REF Age = 3".

Run 8: Run 3 Model Configuration (Beverton and Holt steepness parameter = 0.8) and M = 0.38$y^{-1}$, discard release mortality varied from 10% to 20% for COM_RR fleet discards and from 20% to 40% for REC fleet discards)

Run 9: Run 3 Model Configuration (Beverton and Holt steepness parameter = 0.8), and M = 0.38$y^{-1}$, exclusion of MRFSS index.

Run 10: Run 3 Model Configuration (Beverton and Holt steepness parameter steepness = 0.8) and M = 0.38 $y^{-1}$, exclusion of FWC Trip Ticket index.

Run 11: Run 3 Model Configuration (Beverton and Holt steepness parameter = 0.8) and M = 0.38$y^{-1}$, exclusion of SEAMAP Survey Index.

Run 12: Run 1 configuration (Initial Model run), and M (0.38 $y^{-1}$), with SS reweighting of abundance indices, age composition, and length composition components. The Beverton and Holt steepness parameter estimated in this run as in Run 1.

Other alternative models were also explored in this stock assessment. These considered the impacts on model estimates from removing complete data years on estimates of terminal year metrics:

Run 13: Run 3 Model Configuration (Steepness = 0.8, M =0.38$y^{-1}$), "RETROSPECTIVE 2010", assumes 2011 data excluded.

Run 14: Run 3 Model Configuration (Steepness = 0.8, M =0.38$y^{-1}$), "RETROSPECIVE 2009", assumes 2010-2011 data excluded.

Run 15: Run 3 Model Configuration (Steepness = 0.8, M =0.38$y^{-1}$), "RETROSPECTIVE 2008", assumes 2009-2011 data excluded.

Run 16: Run 3 Model Configuration (Steepness = 0.8, M =0.38$y^{-1}$), "RETROSPECTIVE 2008", assumes 2009-2011 data excluded.

Run 17: Run 3 Model Configuration (Steepness = 0.8, M =0.38$y^{-1}$), "RETROSPECTIVE 2006", 2007-2011 data excluded.

### *3.1.8 Retrospective Analysis*

Model performance was also addressed using retrospective analysis of the model configuration recommended by the SEDAR 8 AP for the Run 3 configuration. As described above, Run 3 was the same as the Run 1 model except that the Beverton and Holt steepness parameter was fixed at 0.8. The AP felt that this value of steepness was more reasonable for this species that that estimated by model (0.52). In all five retrospective analyses of the base model were made. For these runs, the model was refit while sequentially dropping the last five years of data (i.e., 2011, 2010-2011, 2009-2011, 2008-2011, 2007-2011, and 2006-2010). Retrospective analysis is used to look for systematic bias in estimates of key model output quantities over time.

### *3.1.9 Benchmark/Reference points methods*

Various stock status benchmarks and reference points are calculated in SS. The user can select reference points based on maximum sustainable yield (MSY), spawning potential ratio (SPR), and spawning stock biomass (SSB). Stock Synthesis calculates SPR as the equilibrium spawning biomass per recruit that would result from a given year's pattern and the levels of F's and selectivity's. For SPR-based reference points, SS searches for an F that will produce the specified level of spawning biomass per recruit relative to the un-fished value. For spawning biomass-based reference points, SS searches for an F that produces the specified level of spawning biomass relative to the un-fished value. Both MSY and spawning biomass-based reference points are dependent on the stock-recruit relationship.

For the Gulf of Mexico Spanish mackerel benchmarks and reference point calculations, SPR30% was the reference. MSST is defined as (1-M) * SSB_MSY (F30% SPR) where the M values used was the point estimate of M for fully recruited ages, resulting from the Hoenig maximum age natural mortality estimator recommended by the SEDAR 28 Data Workshop (i.e., $M = 0.38y^{-1}$). MFMT is defined as F30%SPR. Overfished is defined as $SSB_{Current}$ / SSB@MSST and Overfishing is defined as $F_{Current}$ > MFMT (or FMSY, where the proxy for FMSY for this assessment is F30%SPR. For purposes of calculating $FC_{urrent}$, "current time period" is defined as the geometric mean of Fs for 2009-2011. $SSB_{Current}$ is the model estimated SSB for calendar year 2011. Recruitment deviations are not calculated for the forecast years; recruitment is derived from the model estimated stock-recruitment relationship.

Because of the problems associated with estimating the steepness parameter for the Gulf of Mexico Spanish mackerel stock assessment (see 3.1.1.5), benchmarks based on two levels of steepness (0.8 and 0.9) were developed assuming the M at-age from the Lorenzen function for the Hoenig point estimate ($M = 0.38y^{-1}$). In addition, benchmarks were also computed for the alternative level of M_Hi at-age ($M = 0.49y^{-1}$). One alternative set of projections was made for the M HI scenario, $M = 0.49\ y^{-1}$.

### *3.1.10 Projection Methods*

A standard set of projections is required for each stock managed under Tiers 1, 2, or 3, of Gulf of Mexico Fishery Management Council Coastal Migratory Fishery Management Plan Amendment 18 (http://www.gulfcouncil.org/docs/amendments/Mackerel%20Amendment%2018%20Amendment%20Guide%20Booklet%2011-2-11.pdf). This set of projections encompasses four harvest scenarios designed to satisfy the requirements of Amendment 18, the National Environmental

Policy Act, and the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). These guidelines were used to set ABC for Spanish mackerel for Amendment 18. The standard projection model requires knowledge of future uncertainty in FMSY or the proxy for FMSY.

For this stock assessment, deterministic projections were carried out to evaluate stock status for a period of 20 years beginning in 2013 using the "forecast" option in SS. The terminal year of data for the stock assessment was 2011 therefore in order to initialize the projection at 2013; the 2012 landings were characterized as the landings from the most recent three years (2009-2011). SS estimates the fishing mortality rate to achieve the input 2012 catch value and estimates age 0 recruits from the estimated-spawner recruit model and the 2012 estimate of SSB.

Since the SEDAR 28 AP had concerns regarding what was the logical value to assume for the stock-recruit relationship parameter and also the level of M, this stock assessment conducted projections at two levels of these parameters. Deterministic projections were made for two levels of steepness (0.8 and 0.9) assuming the point estimate of M recommended by the DW for to natural mortality assumption (Base Lorenzen Input ($M = 0.38y^{-1)}$. A second set of projections were made for each level of steepness (0.8, 0.9) for each level of M ($0.38y^{-1}$, $0.49y^{-1}$). The evaluations were made according to these MSRA criteria:

A) If stock is overfished:
F=0, FCurrent, FMSY, FOY
F=FRebuild (max that permits rebuild in allowed time)

B) If stock is undergoing overfishing:
F= FCurrent, FMSY, FOY

C) If stock is neither overfished nor undergoing overfishing:
F= FCurrent, FMSY, FOY

Uncertainty in the projections was also evaluated using the "Fishery Simulation" Graphics User Interface (GUI)" tool discussed in Section 3.1.1.5 (Uncertainty and Model Precision). Through the GUI tool, multiple sets of the data bootstrapped from the Base Model (Run 1) were developed and the SS model fitted to each simulated data set independently. The procedure was to identical to that used to characterize the base model uncertainty with the only difference being that the run was extended to include the period of projections. The stochastic projections were made for each of two steepness levels (0.8, 0.9) assuming the input point estimate of natural mortality ($M=0.^{38y-1).}$

## 3.2 Model Results

### *3.2.1 Measures of overall model fit*

#### *3.2.1.1 Landings*
Stock Synthesis effectively treats the landings data as being known without error. Therefore, the landings are fit precisely.

#### *3.2.1.2 Indices*

In general SS fit the three indices of abundance only fairly well (Figure 3.2). Observed CPUE from the standardized abundance indices varied without trend over the time series for each abundance survey. The only exception was a slight increase in observed abundance in recent years (2003 - 2011) for the FWC Vertical Line Index. There was some apparent trending in the predicted index fits for all three surveys (MRFSS, COM_FWC_VERT_LINE, and SEAMAP_Survey). All of the abundance indices exhibited large variability and in general the predicted fits indicated relatively flat unchanging trends over each of their respective abundance time series. The large variances associated with the directed fishery indices could have contributed to the overall poor fits. The COM_FWC_ VERT_Line was the only abundance index that showed any departure from the average trend, tending to predict a slight increase in abundance after 2003. The observed shrimp effort index showed a linear increase in effort from the beginning of the time series (1946) through around the mid 1980's, a moderate decline through 2000, followed by a sharp decline in shrimp effort between 2000 and the current period. SS fit the shrimp effort index reasonably well (Figure 3.2).

#### *3.2.1.3 Discards*

SS fit the super period discards (fractions for the directed fishery and numbers for the bycatch fishery) reasonably well (Figure 3.3 a - c). As noted above (Section 2.3) for this assessment discards were incorporated into the assessment as super periods discards. This is a departure from previous stock evaluations (VPA, SS, or stock production models (e.g., ASPIC)) for this stock as to the approach in which discards have been analytically incorporated into the population model, for the shrimp bycatch fishery and also the directed fishery. In this evaluation, discards were treated as discards and input with a small CV, thus allowing some variability around the estimate to be incorporated into the model estimation. In addition, it was thought that the actual trend of the discards was more representative of the level of discards than the actual annual estimates thus "super periods" were used to quantify (characterize) the discard removal levels over the time series, or as with the REC discards across each of the three super periods. Section 2.3 reviewed discard data inputs and the specific time periods for each fishery (bycatch, commercial line gear (COM_RR) and recreational all modes combined (REC). Figure 3.3 a, b presents SS predicted discard fraction for the directed fisheries. Figure 3.3c provides the SS predicted discards (thousands of fish) for the shrimp bycatch fishery.

The observed annual discards showed large variability for both the directed fisheries (fractions) and the shrimp bycatch fishery (numbers of fish). Estimates of recreational discards and their associated CV values are presented in the SEDAR 28 DW (Table 4.11.7). The SEDAR 28 DW noted that "Commercial discards and shrimp bycatch are based on estimated encounter rates and effort. In years when multi-year averages are used to compute encounter rates, these estimates do not account for year-specific age structure in the Spanish mackerel stock". In addition, the SEDAR 28 DW noted that other factors contributing to uncertainty in commercial discards were from low coverage of the logbook survey (SEDAR 28 DW Table 3.11). Shrimp fishery discards in particular had low encounter rates of Spanish mackerel thus estimation is hampered by dealing with large number of zero observations. The SEDAR 28 DW noted that although the annual catch of Spanish mackerel by the shrimp fishery was very variable the mean bycatch could reflect the overall scale of bycatch across the time series. These concerns add additional support to the use of super periods in the SS model to characterize the magnitude of removals.

#### *3.2.1.4 Length composition*

SS fit the individual yearly fishery length compositions reasonably well (Figures 3.4 - 3.11). In general length composition sample sizes were lowest for the commercial line gears (COM_RR) and largest for recreational all modes fleet (REC) (Appendix A and Figures 3.4-3.12). There were no striking issues with patterns in residuals.

Initially, for the COM_GN fleet, when only a single time block was specified, a discernible lack of fit was present in the later years (2006+) length compositions. Adding a time block for 2006-2011 cleared up this issue. As noted earlier, 2006 corresponded to a change in the intensity of sampling of the gillnet fishery off Alabama and when a noticeable quantity of smaller size Spanish mackerel were observed in the samples. The poorest fits for the COM_GM length composition correspond to years when the sampling intensity was very low (< n= 75 fish per year sampled). Overall, the fits to the fleet year/fishery strata represented by larger sample sizes, such as characterized by the recreational all modes (REC) compositions in most years, were noticeably superior to other fleet-year strata.

Fits for the commercial line gear (COM_RR) were in general represented by very low sample sizes and poorer length composition fits than for the other fleets and the survey length composition fits. This was not surprising given the low sample sizes in general with some years not represented at all in the length composition. Length composition samples from the COM_RR fleet do not appear before 1985. SS underestimated fish greater than 50cm in several years, since 2008. SS underestimated fish between 30-40 cm in 2008. Spanish mackerel in general are not actively targeted by the Gulf of Mexico commercial line gear fishery so the absence of samples over several sequential years (1986-1990 and 1996-2002) and very low sample sizes for many years is not particularly surprising.

SS fits to the REC length composition was overall quite good with little to no indication of fitting problems. There was a slight pattern in residuals for small fish, about the time of the implementation of the size limit (1993) and for a few subsequent years, indicating that some fish below the minimum size were still being retained through about 1997. The 1993 – 1998 length composition contained a number of fish above 80cm; these samples are in question as they appear much larger than previously reported for Spanish mackerel harvested by the recreational sector. Overall though, SS fit the recreational fleet length composition reasonably well.

SS fit the SEAMAP length composition reasonably well; however there was some tendency of the model to always underestimate the proportion of fish larger than 40 cm.

#### *3.2.1.5 Conditional age-length composition*

The model fits to the conditional age-length age composition samples are presented in Figures 3.12 - 3.23. The conditional age composition fits represent the estimates of age composition within length interval (bin) and in many cases the number of age observations within a bin interval was very low adding difficulty to the fitting process. Low sample sizes and high variability in observed size at age added to the fitting complexity.
Figure 3.1b and c presents the SS estimated von Bertalanffy growth equation, the growth curve estimated by the DW and mean size at age for the observed otolith age observations used in developing the conditional age-length compositions.

### *3.2.2 Parameter estimates & associated measures of uncertainty*

Table 3.1 provides a listing of all parameters estimated in SS for the model recommended by the panel for final projections and status determinations; this was the model Run 3 configuration which was identical to Run 1 except steepness parameter was set at 0.8. This recommendation was based on extensive discussion and review of all of the sensitivity runs, the retrospective analyses, the results of profiling the steepness parameter, and inspection of the uncertainty results from the bootstrap analyses. These results will be detailed in the text below. Table 3.1 includes predicted parameter values and their associated standard errors from SS, initial parameter values, minimum and maximum values a parameter could take, and prior densities assigned to parameters. Parameters designated as fixed were held at their initial values.

Asymptotic standard errors are obtained in SS by inverting the Hessian matrix that is the matrix of second derivatives, after the final model fitting process. The standard errors of most of the parameters are low. The main exception is for the standard errors for some of the selectivity parameters (COM_GN, Shrimp Bycatch P2) (Table 3.1).

Table 3.3 presents summary means and asymptotic standard errors for the parameters estimated for N = 1,000 bootstrap runs on the Run 3 model which assumed steepness = 0.8 and the base M value ($0.38y^{-1}$). As mentioned in Section 3.1.6, the Fishery Simulation" Graphics User Interface (GUI) tool developed by Lee et al. (2012,) was used to carry out bootstrapping to examine model uncertainty. This procedure applies the SS bootstrap option to generate N=1,000 replicate data sets from the 'original input model (Run 3). The bootstrap files are produced by using the parameter error inputs and sample sizes from the original run (Run 3); after generating the 1,000 bootstrap files, the GUI tool then runs the SS model separately on each bootstrap file. In general the results were very similar to that of the

Model convergence was examined by the SS jitter option. Summary results are presented in Table 3.4 and Figures 3.24 - 3.26 for the 100 jitter runs that were run against the SS model configuration for Run 3. Of the 100 runs, ninety-six model runs resulted in likelihood values that were almost identical to that of the Run 3 model value (4,226.76) (Figure 3.24). Results of the model runs that converged on nearly identical solutions predict very similar levels of SSB_REF and SPR in 2011 and Fcurrent and F_REF (Figure 3.27).

### *3.2.3 Fishery Selectivity*

Predicted size selectivity and retention patterns are presented in Figures 3.27 – Figures 3.30 for the Run 3 model configuration (steepness = 0.8 and M = $0.38y^{-1}$).. The FWC Fish Ticket abundance index was assumed to have the same pattern as the COM_RR fleet and the SEAMAP survey pattern was mirrored to the shrimp bycatch fishery.

Two retention functions (logistic in form) were modeled for the COM_RR and the REC fisheries to account for the minimum size limit that was implemented in 1993. The selectivity function was very steep for both COM_RR and the REC fishery. There were no length composition samples to characterize the discards length composition selectivity so more focus was placed on modeling the retention function. It was difficult to model the COM_RR fleet selectivity and retention function at the same time. Other contributing factors included very low sample sizes, truncated distributions, and the appearance of many large fish in some years. When the selectivity function was modeled, SS attempted to push the peak of the curve to very large sizes, and hitting the upper bound of this parameter (99 cm FL). When only the retention function was modeled and the peak for the selectivity function was fixed (at 55cm), improved fits resulted. Insufficient samples lead to overall lack of fit for this fleet selectivity/retention pattern. Several attempts were made using a range of peak (50, 55, 60, and 65 cm FL) values for the COM_RR peak selectivity parameter before the AP decided on 55cm.

The standard errors for some of the COM_GN selectivity parameters were very high and indicate that this selectivity pattern was not well estimated. Initial work to model the gillnet fishery selectivity show lack of fit particularly with estimating selectivity of some small fish that appeared after 2006. An addition of a separate time block (for 2006 -2011) resulted in much improved fits.

The selectivity/retention patterns for the REC fleet were reasonably well behaved and overall produced superior length composition fits.. The REC fleet in general caught smaller fish than the COM_RR fleet but small fish also appeared in the COM_GN fleet during many years. The selectivity pattern was steeper for the REC fleet than the COM_RR. SS predicted that some fish above the size limit would be released however the proportion was fairly low. This is reasonable given the bag limit regulation for the Spanish mackerel. The fishery abundance indices for the MRFSS were assumed to have the same selectivity pattern as the REC fleet pattern

Size selectivity for the shrimp fishery was modeled using a 6 parameter double-normal function and two of the parameters were fixed (Table 3.1). The length composition from the SEAMAP survey shows that fish from about 4 cm to 54 cm were captured by the survey.

### *3.2.4 Recruitment*

The SS model had difficulty estimating the steepness parameter for the Beverton – Holt stock recruitment (S/R) relationship that was assumed for the Spanish mackerel stock assessment. Profiling of the steepness parameter is presented in Figure 3.31 for the Run 1 model configuration ($M = 0.38y^{-1}$). Steepness was estimated to be 0.52 for the initial model (Run 1) and this value was considered quite low for this species. SS was able to estimate the S/R parameter, R0 (log of virgin recruitment level) without difficulty for the Run 1 model which assumed $M = 0.38y^{-1}$ and also estimated steepness (Figure 3.32). SS estimated ln(R0) to be 11.33 from the Run 1 model. Also SS estimated sigmaR, the standard error of log recruitment without difficult (Figure 3.33). After many different runs examining the model's ability to estimate steepness over varying assumptions of natural mortality and also examining the bootstrap results, the AP recommended to use steepness = 0.8 (Run 3) for subsequent summaries of key parameters and in projections and status determinations.

Figure 3.34 presents summary results for 496 bootstrap runs for the Spanish mackerel SS Run 1 model in which steepness parameter was estimated (assuming $M = 0.38y^{-1}$). These results show the difficulty the model had with estimation of this parameter. The bootstrap summary plot shows that there are some runs which produced very low estimates of steepness as low as 0.36 and also the estimate of steepness approached the top bound (1.0) in 37% of the bootstrap runs. Steepness was estimated across the 500 bootstraps at 0.70 and the model estimate was 0.52. The distribution of virgin recruitment level (R_VIRGIN in the Figure 3.34 plot) was quite broad indicating large uncertainty in the estimate of virgin recruitment for the Run 1 model that estimated steepness. Also, the distribution of virgin Biomass across the 500 bootstraps was broad and showed a bimodal distribution. The SEDAR 29 AP felt that the low values of steepness were not logical for this species and recommended using a steepness value of 0.8 for status determinations and projections.

Figure 3.35 presents summary results for 1,000 bootstrap runs for steepness =0.8 (assuming M = 0.38y $^{-1}$). Fourteen runs reached solutions which resulted in large convergence values and illogical estimates of virgin biomass (Figure 3.35). The summarized bootstrap runs for steepness = 0.8 produce much more reasonable distributions of virgin biomass and virgin recruitment and the bimodality in virgin biomass is not present for the steepness = 0.8 run (Run 3 model).

The spawner-recruit relationship as estimated from SS for the Run 3 model configuration (assuming steepness = 0.8 and M =0.38y$^{-1}$) is shown in Figure 3.36. Estimated recruit deviations varied without trend over the time series except during recent years, since 2008 (Figure 3.37). The recent years, since 2008 contain less information from which to estimate the level of recruitment as not all cohorts have fully contributed to the fishery

Predicted abundance at age is presented in Figure 3.38 for the Run 3 model configuration (M = 0.38y$^{-1}$, steepness=0.8). Predicted age-0 recruits are also presented in Table 3.5 and Figure 3.39 for the Run 3 model configuration. Recent years (2005-2010) annual recruitments have been lower than the mean recruitment over the period 1985-2010 and estimated deviations of annual recruitment are much larger in the most recent years (2009-2010) which is not surprising since the more recent years are not as data rich as not all cohorts have contributed fully at this point in time. In general however, the predicted trend for recruitment of Spanish mackerel is fairly flat over the time series. Figure 3.37 presented annual recruitment deviations.

Figure 3.40 presents SS estimated YPR and SPR for Gulf of Mexico Spanish mackerel as estimated for the Run 1 model configuration (with steepness =0.8 and M = 0.38y$^{-1}$).

### *3.2.5 Stock Biomass*

Predicted total biomass and spawning biomass are presented in Table 3.5 and Figure 3. 41 for the Run 3 model (M = 0.38y$^{-1}$, steepness=0.8). Total biomass and spawning biomass show steady trends from the late 1880's through the early 1940's. Significant declines in biomass are evident beginning in the late 1940's and continuing through the late 1980's. Increases in total and spawning stock biomass are predicted by SS beginning in the late 1990s.

Predicted abundance at age was presented in Figure 3.38 for the Run 3 model (M = 0.38y$^{-1}$, steepness=0.8). SS predicted the mean age of Gulf of Mexico Spanish mackerel to be ~ 1.9 in the unfished state in 1886. The population mean age remained fairly stable until the early 1950's varying from ~ 1.7-1.9. After the early 1950's, predicted mean age shows a significant decline through about 1998 with several periods of oscillation beginning around mid-1970. The decline in mean age beginning in the 1950's corresponds to periods of increasing landings by the commercial gill net fleet. Also, from the mid 1970's through about 1998, predicted mean age shows large up and down swings; this period corresponds to increasing shrimp effort and increasing landings from the gillnet and recreational fisheries. SS predicted an increase in mean age between the late 1980's through 1994 followed by a sharp decline through 1998. The increase in mean age in the late 1980's corresponds to implementation of fishery regulations for Gulf Spanish mackerel (e.g., implementation of Fishery Management Plan in 1987 and quotas, and implementation of size limits. The increase in mean age in the late 1990's corresponds to the enactment of a gill net gear ban in Florida territorial waters (1995). SS predicted mean age from 1886 to 2011 to be 1.6 and mean age in 2011 to be 1.34.

### *3.2.6 Fishing Mortality*

Exploitation rate (catch in weight including discards / total biomass) was used as the proxy for annual fishing mortality rate in this assessment. Predicted annual fishing mortality rates are presented in Table 3.6 and Figure 3.42 (top panel) for the SS Run 3 model configuration (steepness = 0.8 and M =$0.38y^{-1}$). Predicted annual fishing mortality estimates (all fleets combined) shows flat and low levels of F through the late 1940s. Between the early 1950's and continuing through the mid 1980's, steady increasing trend in F are predicted. Since the mid 1980's estimated total annual F's have continued to decline.

The trend in annual instantaneous fishing mortality (F) by fleet is variable particularly since the years of implementation of fishery regulations (1987) (Table 3.6, Figure 3.42, lower panel). In particular, annual F's for the COM_GN fleet declined significantly since the early 1990s and have been stable since about 1997. Estimated annual Fs from the shrimp fleet increased steadily through 1990 however show significant declines since around 1999; the trend in estimated F for shrimp bycatch has been stable since 2005. Annual estimated Fs for the recreational all modes fleet (combined private, charter, headboat, shore= REC) show continued increases until 1986 and predicted trends in REC F since have been variable. Estimated REC F decline sharply in 1986 through 1989, increased through 2001, and declined again between 2001 and 2004, and REC Fs have been stable since 2004. In general annual Fs for the commercial line gear fishery (COM_RR fleet) have remained stable and low throughout the time series, with one exception of an increasing trend from 1971-1978.

The more recent years of declines in estimated F since the mid to late 1980's correspond to various management actions associated with the Gulf of Mexico Spanish mackerel fisheries including: a) implementation of the Fishery Management Plan for coastal Migratory Pelagic Resources of the Gulf of Mexico (1983) under which Spanish mackerel were managed, b) implementation of quotas in 1987, c) implementation of size limits (1983) and bag limits (year 1987) for the recreational fisheries and d) enactment of a gill net gear ban in Florida territorial waters (1995). Since the implementation of TACs in 1987 there have been a number of varying annual TACS (2.5 million pounds (MP) in 1987, 5.0 MP in 1988, 5.25 MP in 1989, 8.6 MP 1991, 7.0 1996). In addition to these management actions, varying bag limits have been in place since the initial time of implementation in 1987.

### *3.2.7 Evaluation of Uncertainty*

Tables 3.1 presents' estimates of asymptotic standard errors for all SS estimated parameters for the Gulf of Mexico Spanish mackerel stock assessment for the Run 3 model configuration (steepness = 0.8, M = 0.38 $y^{-1}$). Table 3.2 provides a listing of all the sensitivity runs carried out for the stock assessment. Table 3.3 and Figures 3.43 - 3.45 provides results of all the sensitivity analyses considered for the stock assessment. Table 3.3 provides a complete listing of the mean and standard deviation from the summaries of the 1,000 bootstrap runs that were made for the Run 3 model (input M= 0.38y $^{-1}$, steepness = 0.8). Detailed results are summarized in the following sections for the various sensitivity and retrospective and alternative run configurations that were conducted to further examine impacts on model results from varying assumptions on steepness, natural mortality, data exclusion, data weighting and discard release mortality.

The estimated standard errors estimated from the bootstrap analysis are generally low for most parameters estimated in the stock assessment indicating that for most of the estimated parameters model precision of parameters estimated is reasonable (Table 3.3). Figure 3.37 presents estimates of the asymptotic standard errors for annual recruitment deviations. Annual Estimated asymptotic errors for the annual recruitment deviations ranged from 0.05 to 0.11 over the time series estimated. In general, many of the standard errors associated with the selectivity parameters had standard errors larger than 0.25 (Tables 3.1, 3.3 ).

Because of the concerns around estimating the steepness parameter profiling of steepness and the virgin stock level (R0), and the recruitment standard deviation (sigmaR SS parameter), profiling of these parameters was carried out. Figures 3.31 – 3.32 present profiles for R0 and steepness for the initial model configuration (Run 1, steepness estimated and M = 0.37y $^{-1}$). Figure 3.33 presents profiling of the recruitment standard deviation parameter (sigmaR). The results did not indicate any major deviance from the input value specified for this parameter (0.7) thus this model parameter value was not further adjusted.

Figures 3.34 and 3.35 present the results of the bootstrap runs that were made for two models (Run 1 model estimated steepness and assumed M = 0.38y$^{-1}$, Run 3 model assumed a fixed value of steepness =0.8 and M =0.38y $^{-1}$). The two models were identical in all other aspects of their configuration. The results show that SS had difficulties in estimating steepness for the Gulf of Mexico Spanish mackerel stock. The model estimated steepness was 0.5; the bootstrap summary estimated a range of steepness from about 0.4 to 1.0 hitting the upper bound on about 37% of the bootstrap runs. The SEDAR 28 AP felt that a steepness of around 0.5 was not reasonable for this species. The bootstrap summary results also show bimodality in the estimation of virgin biomass. The bootstrap summary results for the Run 3 model, assuming steepness = 0.8 and the same level of M as for Run 1 (0.38y $^{-1}$) are shown in Figure 3.35.

Figure 3.43 and Table 3.7 presents results of sensitivity analyses for the value of natural mortality input into the Lorenzen function. All comparisons were against the SS Run 3 model configuration which assumed steepness = 0.8. Key model output quantities were examined including: 1) total biomass (virgin, current biomass) 2) spawning biomass (virgin, current), and recruitment (virgin, current). The trend results suggested that the model was insensitive to input assumptions regarding the level of natural mortality at age. The exception however, is for the M_LO scenario (M = 0.27) which results in higher levels of virgin biomass. Estimated virgin total and virgin recruitment for the scenarios assuming the low value of the range suggested a very different level of virgin biomass than either for the Run 3 model input value (0.38 into the Lorenzen function) or for the model assuming the high end of the range (0.49) input into the Lorenzen function. Neither varying the input level of M from the initial base level (0.38) nor changing the scaling reference age (REF Age) from age 4 to age 3 altered the SS estimated current stock status from that of the Run 3 model relative to SPR30% (Table 3).

Figure 3.44 presents results of impacts on key quantities output from SS from varying steepness in response to concern over the model's ability to estimate this parameter. As shown earlier, SS had difficulties estimating steepness for this stock assessment. For the sensitivity examination, steepness was fixed at 3 levels (0.7, 0.8, and 0.9 assuming M from the Run 3 model = 0.38$y^{-1}$). Results of the sensitivity analyses to the steepness parameter are summarized in Table 3.7 and Figure 3.43. For sensitivity runs that considered the alternative steepness scenarios (0.7, 0.8, 0.9) the level of M assumed was that of the initial model run (Run 1, Table 3.2, M = 0.38 $^{y-1}$ as input into the Lorenzen M at-age function. Changes in steepness from 0.8 to 0.7 or 0.9 did not impact the SS estimated current stock status from that of the Run 3 model relative to SPR30% (Table 3.7).

Table 3.7 and Figure 3.45 present results from evaluating the impact of data component through excluding indices of abundance and from alternative assumptions on the level of discard mortality assumed for the recreational line gear fishery and the recreational all modes (REC) fleet. In general when either reweighting of indices or the length or age composition data was incorporated into the model little change in resulting estimates of biomass or recruitment of SPR was predicted. Exclusion of individual indices of abundance (MRFS, FWC Trip Ticket, SEAMAP Survey) from the model also did not have alter the perception of the current stock status from the Run 3 model relative to SPR30%, as neither did increasing the level of discard mortality from 10% to 20% for the commercial line gear and from 20% to 40% for the REC fleet (Table 3.7).

Figure 3.46 presents results of retrospective analyses for 2006-2011. Three model output quantities shown in the plots are: 1) spawning biomass, 2) recruitment, and 3) spawning potential ratio (SPR). There was some variability in model estimate of the terminal year of data for these key parameters as years of data were dropped from the assessment but no strong systematic bias was either discernible nor did SS predict any large divergence in the estimates for any of the three parameters observed. Eliminating sequential years of data did not alter the SS estimated current stock status from the Run 3 model relative to SPR30%.

As described earlier, the Fishery Simulator GUI Tool previously described in Section 3.1.6 (Methods) and 3.2.7 (Results, Uncertainty) was used to further explore uncertainty in the SS model assumptions. For the initial model run (Run 1, M = 0.38 $^{y-1}$) and for the Run 3 model (steepness = 0.8) the parametric bootstrap procedure was carried out. Due to time constraints 500 bootstraps were made for Run 1 while 1,000 bootstraps were made for Run 3. Figures 3.34 and 3.35 present the results for various key quantities estimated by SS.

### *3.2.8 Benchmarks/Reference points*

Benchmarks for the SPR30% reference point are presented in Table 3.8. The SPR30% reference point was used as a proxy for FMSY as recommended in the SEDAR 28 Gulf Spanish Mackerel TORs. The maximum fishing mortality threshold (MFMT) was the fishing mortality rate that produced a SPR of 30%, $F_{SPR30\%}$. The minimum stock size threshold (MSST) was calculated as (1-*M*) * $SSB_{SPR30\%}$. Figure 3.47 presents a phase plot of the SPR30% reference point for the stock assessment for the Run 3 model and each alternative model examined corresponding to varying assumptions of natural mortality at age and steepness. Table 3.2 presented details of each of the varying model configurations examined in the Spanish mackerel stock assessment. Figures 3.48 and 3.49 present estimates of reference points for status determinations of the overfished and overfishing states (SSB_REF, _REF) from the bootstrap runs for the Run 3 model (steepness = 0.8, M = $0.^{38y-}1$). These results in total suggest that the Gulf of Mexico Spanish mackerel stock is not overfished under any of the model scenarios examined and the stock is not undergoing overfishing under any of the scenarios examined.

### *3.2.9 Projections*

According to the SEDAR 28 Terms of Reference evaluations were made according to these MSRA criteria:

A) If stock is overfished:
F=0, FCurrent, FMSY, FOY
F=FRebuild (max that permits rebuild in allowed time)

B) If stock is undergoing overfishing:
F= FCurrent, FMSY, FOY

C) If stock is neither overfished nor undergoing overfishing:
F= FCurrent, FMSY, FOY

#### 3.2.9.1 Deterministic

Projection results for forecasted retained catches (mtons) for 2013-2022 are presented in Table 3.9 corresponding to varying to the recommended level of steepness (0.8) and one alternative level (0.8) is provided. Deterministic projections are also presented in Figures 3.50 - 3.52 for the Run 3 model configuration requested by the SEDAR 28 AP. Metrics included are spawning stock biomass (SSB), SSB and F relative to $SSB_{SPR30\%}$ and FSPR30%. Projections are presented for the requested model (Run 3, steepness =0.8) and also one alternative scenario of steepness (0.8). Both runs assumed M = $0.38y^{-1}$ ) input into the Lorenzen function.

#### 3.2.9.2 Stochastic

Stochastic projections were made using the “Fishery Simulator GUI tool” previously described in Section 3.1.5.

### 3.3 Discussion and Recommendations

Gulf of Mexico Spanish mackerel has a lengthy history of exploitation dating to the early late 1800s. Directed commercial gillnet fisheries have operated on this resource for well over a hundred years and recreational fisheries more than 65 years. However detailed catch statistics on size and individual weight of removals only exists for the recent time period, since the mid to late 1980’s. In addition, management measures including size limits (30.5 cm FL beginning 1983) and quotas (beginning in 1987) have resulted in discards for both fisheries.

Gulf of Mexico Spanish mackerel are not a directed target of the commercial line gear fisheries (COM_RR fleet) therefore extensive samples for length and/or age-length key characterizations are not available. Efforts should be made to obtain samples from this fleet in order to better inform future stock assessment evaluations as relates length composition and discard levels. In particular, a review of the sampling protocols for length and age – length collections is needed to better characterize the catch length and age at length compositions. In addition, attention is needed to evaluate optimal spatial sampling factors in relation to overall removals throughout the year and region.

The magnitude of discards from the recreational fleet is high and very variable over the time series for which estimates exist from the MRFSS/MRIP survey (1981 forward). Hind casting was used to develop estimates of recreational removals and discards prior to 1981 however information on uncertainty in the hind casting was not incorporated into the stock assessment. Future assessments should consider uncertainty around hind casted data.

The indices of abundance are generally flat but variable yielding little information with which to characterize abundance. In addition the additional observations of length and conditional age at length are more recent thus providing only limited history of data with which to estimate the spawner- recruit relationship during the early part of the time period. The quantity and quality of length and age composition information directly impacts the ability to estimate recruitment.

There was difficulties with estimating steepness thus the AW felt that providing benchmarks at several levels and making projections using several levels of steepness was needed.

## 3.4 Acknowledgements

Contributions by numerous researchers lead to the completion of this stock assessment. Significant assistance to learning the SS model was provided by Richard Methot, Ian Taylor Michael Schirripa, Brian Linton. Jeff Isely and Jakob Tetzlaff were part of the SEDAR 28 analyst team and provided significant input along the way. Additional assistance with carrying out the bootstrap analyses was provided by Hua-hui Lee and Ian Taylor. The contents of the Assessment report were improved by input from Clay Porch, Shannon Cass-Calay, and Robert Muller

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## 3.6 Tables

Table 3.1. Listing of parameters from the SS model used for the Gulf of Mexico Spanish mackerel stock assessment. The list includes predicted parameter values and their associated standard errors from SS Base Model Run, initial parameter values, minimum and maximum values a parameter could take, and prior densities assigned to parameters. Parameters designated as fixed were held at their initial values. Table represents model selected by the SEDAR 28 Assessment Panel as the final base model (Base natural Mortality level = of 0.38 $y^{-1}$ input into Lorenzen function and Beverton and Holt steepness parameter value = 0.8.

| | Parameter | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Predicted** | | | | | **Prior** | | | | | |
| **Label** | **Value** | **Parm_StDev** | **Initial** | **Min** | **Max** | **PR_type** | **Prior** | **Pr_SD** | **Status** | **Active / Not Active Parameter** | **Description** |
| L_at_Amin_Fem_GP_1 | 18.7935 | 0.4711 | 10 | 2 | 30 | No_prior | _ | _ | Estimated | A | Size at age 0.5 |
| L_at_Amax_Fem_GP_1 | 60.8046 | 0.8493 | 56 | 40 | 90 | No_prior | _ | _ | Estimated | A | von Bertalanffy Linfintiy |
| VonBert_K_Fem_GP_1 | 0.3008 | 0.0136 | 0.61 | 0.1 | 1.2 | No_prior | _ | _ | Estimated | A | von Bertalanffy K |
| CV_young_Fem_GP_1 | 7.1038 | 0.2140 | 10 | 0.001 | 20 | No_prior | _ | _ | Estimated | A | Young growth CV |
| CV_old_Fem_GP_1 | 9.1385 | 0.2794 | 10 | 0.001 | 45 | No_prior | _ | _ | Estimated | A | Old growth CV |
| Wtlen_1_Fem | 0.0000 | _ | 1.50E-05 | 0.1 | 1 | No_prior | _ | _ | Fixed | NA | Weight length a parameter |
| Wtlen_2_Fem | 2.8617 | _ | 2.8617 | 2 | 4 | No_prior | _ | _ | Fixed | NA | weight length b parameter |
| Mat50%_Fem | 31.0000 | _ | 31 | 25 | 100 | No_prior | _ | _ | Fixed | NA | Maturity inflection point |
| Mat_slope_Fem | -0.0650 | _ | -0.065 | -1 | 0 | No_prior | _ | _ | Fixed | NA | Maturity slope |
| Eggs/kg_inter_Fem | 1.0000 | _ | 1 | -3 | 3 | No_prior | _ | _ | Fixed | NA | Fecundity scalar |
| Eggs/kg_slope_wt_Fem | 0.0000 | _ | 0 | -3 | 3 | No_prior | _ | _ | Fixed | NA | Fecundity slope |
| SR_LN(R0) | 10.7684 | 0.0200 | 10 | 1 | 20 | No_prior | _ | _ | Estimated | A | Virgin recruit |
| SR_BH_steep | 0.8000 | _ | 0.8 | 0.2 | 1 | No_prior | _ | _ | Estimated | A | Steepness |
| SR_sigmaR | 0.7000 | _ | 0.7 | 0 | 2 | No_prior | _ | _ | Fixed | NA | Stock recruit standard deviation |
| SR_envlink | 0.1000 | _ | 0.1 | -5 | 5 | No_prior | _ | _ | Fixed | NA | Stock recruit environmental link |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| SR_R1_offset | 0.0000 | _ | 0 | -5 | 5 | No_prior | _ | _ | Fixed | NA | Stock recruit offset |
| SR_autocorr | 0.0000 | _ | 0 | 0 | 0 | No_prior | _ | _ | Fixed | NA | Stock recruit autocorrelation |
| Main_RecrDev_1985 | 0.3958 | 0.0866 | _ | _ | _ | dev | _ | _ | Estimated | A | 1985 recruit deviation |
| Main_RecrDev_1986 | -0.0918 | 0.0774 | _ | _ | _ | dev | _ | _ | Estimated | A | 1986 recruit deviation |
| Main_RecrDev_1987 | -0.2902 | 0.0705 | _ | _ | _ | dev | _ | _ | Estimated | A | 1987 recruit deviation |
| Main_RecrDev_1988 | -0.1137 | 0.0622 | _ | _ | _ | dev | _ | _ | Estimated | A | 1988 recruit deviation |
| Main_RecrDev_1989 | 0.3761 | 0.0573 | _ | _ | _ | dev | _ | _ | Estimated | A | 1989 recruit deviation |
| Main_RecrDev_1990 | 0.3481 | 0.0629 | _ | _ | _ | dev | _ | _ | Estimated | A | 1990 recruit deviation |
| Main_RecrDev_1991 | 0.4491 | 0.0576 | _ | _ | _ | dev | _ | _ | Estimated | A | 1991 recruit deviation |
| Main_RecrDev_1992 | -0.4735 | 0.0808 | _ | _ | _ | dev | _ | _ | Estimated | A | 1992 recruit deviation |
| Main_RecrDev_1993 | -0.1720 | 0.0738 | _ | _ | _ | dev | _ | _ | Estimated | A | 1993 recruit deviation |
| Main_RecrDev_1994 | -0.8238 | 0.0953 | _ | _ | _ | dev | _ | _ | Estimated | A | 1994 recruit deviation |
| Main_RecrDev_1995 | -0.0042 | 0.0764 | _ | _ | _ | dev | _ | _ | Estimated | A | 1995 recruit deviation |
| Main_RecrDev_1996 | 0.0506 | 0.0783 | _ | _ | _ | dev | _ | _ | Estimated | A | 1996 recruit deviation |
| Main_RecrDev_1997 | -0.1920 | 0.0792 | _ | _ | _ | dev | _ | _ | Estimated | A | 1997 recruit deviation |
| Main_RecrDev_1998 | 0.4302 | 0.0640 | _ | _ | _ | dev | _ | _ | Estimated | A | 1998 recruit deviation |
| Main_RecrDev_1999 | -0.0312 | 0.0734 | _ | _ | _ | dev | _ | _ | Estimated | A | 1999 recruit deviation |
| Main_RecrDev_2000 | 0.1050 | 0.0637 | _ | _ | _ | dev | _ | _ | Estimated | A | 2000 recruit deviation |
| Main_RecrDev_2001 | 0.0482 | 0.0614 | _ | _ | _ | dev | _ | _ | Estimated | A | 2001 recruit deviation |
| Main_RecrDev_2002 | -0.0556 | 0.0625 | _ | _ | _ | dev | _ | _ | Estimated | A | 2002 recruit deviation |
| Main_RecrDev_2003 | 0.1911 | 0.0594 | _ | _ | _ | dev | _ | _ | Estimated | A | 2003 recruit deviation |
| Main_RecrDev_2004 | 0.1043 | 0.0623 | _ | _ | _ | dev | _ | _ | Estimated | A | 2004 recruit deviation |
| Main_RecrDev_2005 | 0.0194 | 0.0623 | _ | _ | _ | dev | _ | _ | Estimated | A | 2005 recruit deviation |
| Main_RecrDev_2006 | -0.3295 | 0.0708 | _ | _ | _ | dev | _ | _ | Estimated | A | 2006 recruit deviation |
| Main_RecrDev_2007 | 0.2449 | 0.0652 | _ | _ | _ | dev | _ | _ | Estimated | A | 2007 recruit deviation |
| Main_RecrDev_2008 | -0.0129 | 0.0813 | _ | _ | _ | dev | _ | _ | Estimated | A | 2008 recruit deviation |
| Main_RecrDev_2009 | -0.2906 | 0.1062 | _ | _ | _ | dev | _ | _ | Estimated | A | 2009 recruit deviation |
| Main_RecrDev_2010 | 0.4441 | 0.1121 | _ | _ | _ | dev | _ | _ | Estimated | A | 2010 recruit deviation |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Main_RecrDev_2011 | -0.3260 | 0.2249 | _ | _ | _ | dev | _ | _ | Estimated | A | 2011 recruit deviation |
| InitF_1Com_GN_1 | 0.0000 | _ | 0 | 0 | 1 | No_prior | _ | _ | Fixed | NA | COM_GN initial F |
| InitF_2Com_RR_2 | 0.0000 | _ | 0 | 0 | 1 | No_prior | _ | _ | Fixed | NA | COM_RR initial F |
| InitF_3REC_3 | 0.0000 | _ | 0 | 0 | 1 | No_prior | _ | _ | Fixed | NA | REC initial F |
| InitF_4Shrimp_Bycatch_4 | 0.0000 | _ | 0 | 0 | 1 | No_prior | _ | _ | Fixed | NA | Shrimp Bycatch initial F |
| F_fleet_1_YR_1886_s_1 | 0.0008 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1886 |
| F_fleet_1_YR_1887_s_1 | 0.0016 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1887 |
| F_fleet_1_YR_1888_s_1 | 0.0032 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1888 |
| F_fleet_1_YR_1889_s_1 | 0.0062 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1889 |
| F_fleet_1_YR_1890_s_1 | 0.0072 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1890 |
| F_fleet_1_YR_1891_s_1 | 0.0076 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1891 |
| F_fleet_1_YR_1892_s_1 | 0.0076 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1892 |
| F_fleet_1_YR_1893_s_1 | 0.0076 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1893 |
| F_fleet_1_YR_1894_s_1 | 0.0076 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1894 |
| F_fleet_1_YR_1895_s_1 | 0.0076 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1895 |
| F_fleet_1_YR_1896_s_1 | 0.0076 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1896 |
| F_fleet_1_YR_1897_s_1 | 0.0079 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1897 |
| F_fleet_1_YR_1898_s_1 | 0.0103 | 0.0004 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1898 |
| F_fleet_1_YR_1899_s_1 | 0.0103 | 0.0004 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1899 |
| F_fleet_1_YR_1900_s_1 | 0.0103 | 0.0004 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1900 |
| F_fleet_1_YR_1901_s_1 | 0.0104 | 0.0004 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1901 |
| F_fleet_1_YR_1902_s_1 | 0.0169 | 0.0006 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1902 |
| F_fleet_1_YR_1903_s_1 | 0.0164 | 0.0006 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1903 |
| F_fleet_1_YR_1904_s_1 | 0.0165 | 0.0006 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1904 |
| F_fleet_1_YR_1905_s_1 | 0.0166 | 0.0006 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1905 |
| F_fleet_1_YR_1906_s_1 | 0.0166 | 0.0006 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1906 |
| F_fleet_1_YR_1907_s_1 | 0.0166 | 0.0006 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1907 |
| F_fleet_1_YR_1908_s_1 | 0.0161 | 0.0006 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1908 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_1_YR_1909_s_1 | 0.0170 | 0.0006 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1909 |
| F_fleet_1_YR_1910_s_1 | 0.0198 | 0.0007 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1910 |
| F_fleet_1_YR_1911_s_1 | 0.0226 | 0.0008 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1911 |
| F_fleet_1_YR_1912_s_1 | 0.0255 | 0.0009 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1912 |
| F_fleet_1_YR_1913_s_1 | 0.0285 | 0.0010 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1913 |
| F_fleet_1_YR_1914_s_1 | 0.0315 | 0.0011 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1914 |
| F_fleet_1_YR_1915_s_1 | 0.0346 | 0.0012 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1915 |
| F_fleet_1_YR_1916_s_1 | 0.0377 | 0.0014 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1916 |
| F_fleet_1_YR_1917_s_1 | 0.0397 | 0.0014 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1917 |
| F_fleet_1_YR_1918_s_1 | 0.0406 | 0.0015 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1918 |
| F_fleet_1_YR_1919_s_1 | 0.0416 | 0.0015 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1919 |
| F_fleet_1_YR_1920_s_1 | 0.0433 | 0.0016 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1920 |
| F_fleet_1_YR_1921_s_1 | 0.0450 | 0.0016 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1921 |
| F_fleet_1_YR_1922_s_1 | 0.0453 | 0.0017 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1922 |
| F_fleet_1_YR_1923_s_1 | 0.0458 | 0.0017 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1923 |
| F_fleet_1_YR_1924_s_1 | 0.0488 | 0.0018 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1924 |
| F_fleet_1_YR_1925_s_1 | 0.0522 | 0.0019 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1925 |
| F_fleet_1_YR_1926_s_1 | 0.0557 | 0.0021 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1926 |
| F_fleet_1_YR_1927_s_1 | 0.0580 | 0.0022 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1927 |
| F_fleet_1_YR_1928_s_1 | 0.0402 | 0.0015 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1928 |
| F_fleet_1_YR_1929_s_1 | 0.0432 | 0.0016 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1929 |
| F_fleet_1_YR_1930_s_1 | 0.0507 | 0.0019 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1930 |
| F_fleet_1_YR_1931_s_1 | 0.0286 | 0.0011 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1931 |
| F_fleet_1_YR_1932_s_1 | 0.0349 | 0.0013 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1932 |
| F_fleet_1_YR_1933_s_1 | 0.0380 | 0.0014 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1933 |
| F_fleet_1_YR_1934_s_1 | 0.0418 | 0.0015 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1934 |
| F_fleet_1_YR_1935_s_1 | 0.0518 | 0.0019 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1935 |
| F_fleet_1_YR_1936_s_1 | 0.0632 | 0.0023 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1936 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_1_YR_1937_s_1 | 0.0482 | 0.0018 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1937 |
| F_fleet_1_YR_1938_s_1 | 0.0498 | 0.0019 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1938 |
| F_fleet_1_YR_1939_s_1 | 0.0521 | 0.0019 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1939 |
| F_fleet_1_YR_1940_s_1 | 0.0448 | 0.0017 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1940 |
| F_fleet_1_YR_1941_s_1 | 0.0010 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1941 |
| F_fleet_1_YR_1942_s_1 | 0.0010 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1942 |
| F_fleet_1_YR_1943_s_1 | 0.0010 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1943 |
| F_fleet_1_YR_1944_s_1 | 0.0009 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1944 |
| F_fleet_1_YR_1945_s_1 | 0.0010 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1945 |
| F_fleet_1_YR_1946_s_1 | 0.0009 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1946 |
| F_fleet_1_YR_1947_s_1 | 0.0009 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1947 |
| F_fleet_1_YR_1948_s_1 | 0.0096 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1948 |
| F_fleet_1_YR_1949_s_1 | 0.0421 | 0.0015 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1949 |
| F_fleet_1_YR_1950_s_1 | 0.0290 | 0.0010 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1950 |
| F_fleet_1_YR_1951_s_1 | 0.0762 | 0.0027 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1951 |
| F_fleet_1_YR_1952_s_1 | 0.0556 | 0.0021 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1952 |
| F_fleet_1_YR_1953_s_1 | 0.0379 | 0.0014 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1953 |
| F_fleet_1_YR_1954_s_1 | 0.0375 | 0.0014 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1954 |
| F_fleet_1_YR_1955_s_1 | 0.0217 | 0.0008 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1955 |
| F_fleet_1_YR_1956_s_1 | 0.0402 | 0.0016 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1956 |
| F_fleet_1_YR_1957_s_1 | 0.0530 | 0.0021 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1957 |
| F_fleet_1_YR_1958_s_1 | 0.0598 | 0.0025 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1958 |
| F_fleet_1_YR_1959_s_1 | 0.0783 | 0.0035 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1959 |
| F_fleet_1_YR_1960_s_1 | 0.0991 | 0.0047 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1960 |
| F_fleet_1_YR_1961_s_1 | 0.0771 | 0.0038 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1961 |
| F_fleet_1_YR_1962_s_1 | 0.1454 | 0.0074 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1962 |
| F_fleet_1_YR_1963_s_1 | 0.1239 | 0.0066 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1963 |
| F_fleet_1_YR_1964_s_1 | 0.0925 | 0.0051 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1964 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_1_YR_1965_s_1 | 0.1180 | 0.0068 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1965 |
| F_fleet_1_YR_1966_s_1 | 0.1787 | 0.0105 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1966 |
| F_fleet_1_YR_1967_s_1 | 0.1556 | 0.0093 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1967 |
| F_fleet_1_YR_1968_s_1 | 0.1970 | 0.0119 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1968 |
| F_fleet_1_YR_1969_s_1 | 0.2441 | 0.0153 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1969 |
| F_fleet_1_YR_1970_s_1 | 0.2558 | 0.0167 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1970 |
| F_fleet_1_YR_1971_s_1 | 0.2442 | 0.0163 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1971 |
| F_fleet_1_YR_1972_s_1 | 0.2063 | 0.0139 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1972 |
| F_fleet_1_YR_1973_s_1 | 0.2120 | 0.0145 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1973 |
| F_fleet_1_YR_1974_s_1 | 0.2812 | 0.0201 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1974 |
| F_fleet_1_YR_1975_s_1 | 0.1875 | 0.0138 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1975 |
| F_fleet_1_YR_1976_s_1 | 0.2777 | 0.0207 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1976 |
| F_fleet_1_YR_1977_s_1 | 0.0803 | 0.0059 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1977 |
| F_fleet_1_YR_1978_s_1 | 0.0435 | 0.0031 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1978 |
| F_fleet_1_YR_1979_s_1 | 0.0798 | 0.0055 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1979 |
| F_fleet_1_YR_1980_s_1 | 0.0713 | 0.0049 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1980 |
| F_fleet_1_YR_1981_s_1 | 0.1406 | 0.0096 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1981 |
| F_fleet_1_YR_1982_s_1 | 0.1455 | 0.0107 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1982 |
| F_fleet_1_YR_1983_s_1 | 0.1023 | 0.0078 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1983 |
| F_fleet_1_YR_1984_s_1 | 0.1713 | 0.0130 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1984 |
| F_fleet_1_YR_1985_s_1 | 0.0971 | 0.0070 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1985 |
| F_fleet_1_YR_1986_s_1 | 0.1389 | 0.0095 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1986 |
| F_fleet_1_YR_1987_s_1 | 0.1502 | 0.0102 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1987 |
| F_fleet_1_YR_1988_s_1 | 0.1389 | 0.0091 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1988 |
| F_fleet_1_YR_1989_s_1 | 0.1968 | 0.0130 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1989 |
| F_fleet_1_YR_1990_s_1 | 0.1636 | 0.0111 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1990 |
| F_fleet_1_YR_1991_s_1 | 0.1944 | 0.0134 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1991 |
| F_fleet_1_YR_1992_s_1 | 0.2054 | 0.0147 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1992 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_1_YR_1993_s_1 | 0.1441 | 0.0106 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1993 |
| F_fleet_1_YR_1994_s_1 | 0.1692 | 0.0131 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1994 |
| F_fleet_1_YR_1995_s_1 | 0.1031 | 0.0085 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1995 |
| F_fleet_1_YR_1996_s_1 | 0.0272 | 0.0023 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1996 |
| F_fleet_1_YR_1997_s_1 | 0.0336 | 0.0027 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1997 |
| F_fleet_1_YR_1998_s_1 | 0.0255 | 0.0020 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1998 |
| F_fleet_1_YR_1999_s_1 | 0.0462 | 0.0035 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 1999 |
| F_fleet_1_YR_2000_s_1 | 0.0455 | 0.0034 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2000 |
| F_fleet_1_YR_2001_s_1 | 0.0564 | 0.0042 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2001 |
| F_fleet_1_YR_2002_s_1 | 0.0459 | 0.0035 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2002 |
| F_fleet_1_YR_2003_s_1 | 0.0667 | 0.0051 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2003 |
| F_fleet_1_YR_2004_s_1 | 0.0460 | 0.0037 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2004 |
| F_fleet_1_YR_2005_s_1 | 0.0565 | 0.0046 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2005 |
| F_fleet_1_YR_2006_s_1 | 0.0432 | 0.0032 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2006 |
| F_fleet_1_YR_2007_s_1 | 0.0290 | 0.0023 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2007 |
| F_fleet_1_YR_2008_s_1 | 0.0345 | 0.0029 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2008 |
| F_fleet_1_YR_2009_s_1 | 0.0499 | 0.0044 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2009 |
| F_fleet_1_YR_2010_s_1 | 0.0316 | 0.0030 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2010 |
| F_fleet_1_YR_2011_s_1 | 0.0309 | 0.0031 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_GN 2011 |
| F_fleet_2_YR_1886_s_1 | 0.0001 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1886 |
| F_fleet_2_YR_1887_s_1 | 0.0001 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1887 |
| F_fleet_2_YR_1888_s_1 | 0.0002 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1888 |
| F_fleet_2_YR_1889_s_1 | 0.0004 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1889 |
| F_fleet_2_YR_1890_s_1 | 0.0005 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1890 |
| F_fleet_2_YR_1891_s_1 | 0.0001 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1891 |
| F_fleet_2_YR_1892_s_1 | 0.0001 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1892 |
| F_fleet_2_YR_1893_s_1 | 0.0001 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1893 |
| F_fleet_2_YR_1894_s_1 | 0.0001 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1894 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_2_YR_1895_s_1 | 0.0001 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1895 |
| F_fleet_2_YR_1896_s_1 | 0.0001 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1896 |
| F_fleet_2_YR_1897_s_1 | 0.0005 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1897 |
| F_fleet_2_YR_1898_s_1 | 0.0007 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1898 |
| F_fleet_2_YR_1899_s_1 | 0.0007 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1899 |
| F_fleet_2_YR_1900_s_1 | 0.0007 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1900 |
| F_fleet_2_YR_1901_s_1 | 0.0007 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1901 |
| F_fleet_2_YR_1902_s_1 | 0.0012 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1902 |
| F_fleet_2_YR_1903_s_1 | 0.0011 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1903 |
| F_fleet_2_YR_1904_s_1 | 0.0011 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1904 |
| F_fleet_2_YR_1905_s_1 | 0.0011 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1905 |
| F_fleet_2_YR_1906_s_1 | 0.0011 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1906 |
| F_fleet_2_YR_1907_s_1 | 0.0011 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1907 |
| F_fleet_2_YR_1908_s_1 | 0.0011 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1908 |
| F_fleet_2_YR_1909_s_1 | 0.0013 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1909 |
| F_fleet_2_YR_1910_s_1 | 0.0015 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1910 |
| F_fleet_2_YR_1911_s_1 | 0.0016 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1911 |
| F_fleet_2_YR_1912_s_1 | 0.0018 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1912 |
| F_fleet_2_YR_1913_s_1 | 0.0020 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1913 |
| F_fleet_2_YR_1914_s_1 | 0.0021 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1914 |
| F_fleet_2_YR_1915_s_1 | 0.0023 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1915 |
| F_fleet_2_YR_1916_s_1 | 0.0025 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1916 |
| F_fleet_2_YR_1917_s_1 | 0.0027 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1917 |
| F_fleet_2_YR_1918_s_1 | 0.0028 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1918 |
| F_fleet_2_YR_1919_s_1 | 0.0029 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1919 |
| F_fleet_2_YR_1920_s_1 | 0.0029 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1920 |
| F_fleet_2_YR_1921_s_1 | 0.0031 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1921 |
| F_fleet_2_YR_1922_s_1 | 0.0031 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1922 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_2_YR_1923_s_1 | 0.0032 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1923 |
| F_fleet_2_YR_1924_s_1 | 0.0033 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1924 |
| F_fleet_2_YR_1925_s_1 | 0.0035 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1925 |
| F_fleet_2_YR_1926_s_1 | 0.0037 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1926 |
| F_fleet_2_YR_1927_s_1 | 0.0041 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1927 |
| F_fleet_2_YR_1928_s_1 | 0.0028 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1928 |
| F_fleet_2_YR_1929_s_1 | 0.0030 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1929 |
| F_fleet_2_YR_1930_s_1 | 0.0035 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1930 |
| F_fleet_2_YR_1931_s_1 | 0.0020 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1931 |
| F_fleet_2_YR_1932_s_1 | 0.0024 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1932 |
| F_fleet_2_YR_1933_s_1 | 0.0026 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1933 |
| F_fleet_2_YR_1934_s_1 | 0.0029 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1934 |
| F_fleet_2_YR_1935_s_1 | 0.0035 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1935 |
| F_fleet_2_YR_1936_s_1 | 0.0044 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1936 |
| F_fleet_2_YR_1937_s_1 | 0.0034 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1937 |
| F_fleet_2_YR_1938_s_1 | 0.0035 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1938 |
| F_fleet_2_YR_1939_s_1 | 0.0036 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1939 |
| F_fleet_2_YR_1940_s_1 | 0.0031 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1940 |
| F_fleet_2_YR_1941_s_1 | 0.0007 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1941 |
| F_fleet_2_YR_1942_s_1 | 0.0007 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1942 |
| F_fleet_2_YR_1943_s_1 | 0.0007 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1943 |
| F_fleet_2_YR_1944_s_1 | 0.0007 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1944 |
| F_fleet_2_YR_1945_s_1 | 0.0001 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1945 |
| F_fleet_2_YR_1946_s_1 | 0.0006 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1946 |
| F_fleet_2_YR_1947_s_1 | 0.0006 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1947 |
| F_fleet_2_YR_1948_s_1 | 0.0007 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1948 |
| F_fleet_2_YR_1949_s_1 | 0.0029 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1949 |
| F_fleet_2_YR_1950_s_1 | 0.0020 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1950 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_2_YR_1951_s_1 | 0.0053 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1951 |
| F_fleet_2_YR_1952_s_1 | 0.0039 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1952 |
| F_fleet_2_YR_1953_s_1 | 0.0026 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1953 |
| F_fleet_2_YR_1954_s_1 | 0.0026 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1954 |
| F_fleet_2_YR_1955_s_1 | 0.0015 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1955 |
| F_fleet_2_YR_1956_s_1 | 0.0028 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1956 |
| F_fleet_2_YR_1957_s_1 | 0.0037 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1957 |
| F_fleet_2_YR_1958_s_1 | 0.0042 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1958 |
| F_fleet_2_YR_1959_s_1 | 0.0055 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1959 |
| F_fleet_2_YR_1960_s_1 | 0.0070 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1960 |
| F_fleet_2_YR_1961_s_1 | 0.0055 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1961 |
| F_fleet_2_YR_1962_s_1 | 0.0035 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1962 |
| F_fleet_2_YR_1963_s_1 | 0.0022 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1963 |
| F_fleet_2_YR_1964_s_1 | 0.0050 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1964 |
| F_fleet_2_YR_1965_s_1 | 0.0087 | 0.0005 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1965 |
| F_fleet_2_YR_1966_s_1 | 0.0106 | 0.0006 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1966 |
| F_fleet_2_YR_1967_s_1 | 0.0093 | 0.0005 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1967 |
| F_fleet_2_YR_1968_s_1 | 0.0087 | 0.0005 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1968 |
| F_fleet_2_YR_1969_s_1 | 0.0079 | 0.0005 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1969 |
| F_fleet_2_YR_1970_s_1 | 0.0103 | 0.0007 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1970 |
| F_fleet_2_YR_1971_s_1 | 0.0111 | 0.0007 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1971 |
| F_fleet_2_YR_1972_s_1 | 0.0187 | 0.0012 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1972 |
| F_fleet_2_YR_1973_s_1 | 0.0058 | 0.0004 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1973 |
| F_fleet_2_YR_1974_s_1 | 0.0320 | 0.0022 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1974 |
| F_fleet_2_YR_1975_s_1 | 0.0377 | 0.0027 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1975 |
| F_fleet_2_YR_1976_s_1 | 0.0409 | 0.0030 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1976 |
| F_fleet_2_YR_1977_s_1 | 0.0319 | 0.0023 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1977 |
| F_fleet_2_YR_1978_s_1 | 0.0283 | 0.0020 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1978 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_2_YR_1979_s_1 | 0.0033 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1979 |
| F_fleet_2_YR_1980_s_1 | 0.0047 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1980 |
| F_fleet_2_YR_1981_s_1 | 0.0097 | 0.0006 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1981 |
| F_fleet_2_YR_1982_s_1 | 0.0098 | 0.0007 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1982 |
| F_fleet_2_YR_1983_s_1 | 0.0089 | 0.0007 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1983 |
| F_fleet_2_YR_1984_s_1 | 0.0032 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1984 |
| F_fleet_2_YR_1985_s_1 | 0.0038 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1985 |
| F_fleet_2_YR_1986_s_1 | 0.0020 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1986 |
| F_fleet_2_YR_1987_s_1 | 0.0161 | 0.0010 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1987 |
| F_fleet_2_YR_1988_s_1 | 0.0019 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1988 |
| F_fleet_2_YR_1989_s_1 | 0.0045 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1989 |
| F_fleet_2_YR_1990_s_1 | 0.0014 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1990 |
| F_fleet_2_YR_1991_s_1 | 0.0121 | 0.0008 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1991 |
| F_fleet_2_YR_1992_s_1 | 0.0027 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1992 |
| F_fleet_2_YR_1993_s_1 | 0.0024 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1993 |
| F_fleet_2_YR_1994_s_1 | 0.0021 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1994 |
| F_fleet_2_YR_1995_s_1 | 0.0022 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1995 |
| F_fleet_2_YR_1996_s_1 | 0.0030 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1996 |
| F_fleet_2_YR_1997_s_1 | 0.0041 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1997 |
| F_fleet_2_YR_1998_s_1 | 0.0049 | 0.0004 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1998 |
| F_fleet_2_YR_1999_s_1 | 0.0052 | 0.0004 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_1999 |
| F_fleet_2_YR_2000_s_1 | 0.0033 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2000 |
| F_fleet_2_YR_2001_s_1 | 0.0061 | 0.0004 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2001 |
| F_fleet_2_YR_2002_s_1 | 0.0029 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2002 |
| F_fleet_2_YR_2003_s_1 | 0.0031 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2003 |
| F_fleet_2_YR_2004_s_1 | 0.0028 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2004 |
| F_fleet_2_YR_2005_s_1 | 0.0020 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2005 |
| F_fleet_2_YR_2006_s_1 | 0.0031 | 0.0002 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2006 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_2_YR_2007_s_1 | 0.0013 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2007 |
| F_fleet_2_YR_2008_s_1 | 0.0037 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2008 |
| F_fleet_2_YR_2009_s_1 | 0.0031 | 0.0003 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2009 |
| F_fleet_2_YR_2010_s_1 | 0.0056 | 0.0005 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2010 |
| F_fleet_2_YR_2011_s_1 | 0.0044 | 0.0004 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_COM_RR_2011 |
| F_fleet_3_YR_1955_s_1 | 0.0184 | 0.0012 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1955 |
| F_fleet_3_YR_1956_s_1 | 0.0210 | 0.0007 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1956 |
| F_fleet_3_YR_1957_s_1 | 0.0240 | 0.0008 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1957 |
| F_fleet_3_YR_1958_s_1 | 0.0274 | 0.0009 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1958 |
| F_fleet_3_YR_1959_s_1 | 0.0314 | 0.0011 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1959 |
| F_fleet_3_YR_1960_s_1 | 0.0357 | 0.0014 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1960 |
| F_fleet_3_YR_1961_s_1 | 0.0373 | 0.0015 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1961 |
| F_fleet_3_YR_1962_s_1 | 0.0389 | 0.0015 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1962 |
| F_fleet_3_YR_1963_s_1 | 0.0417 | 0.0017 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1963 |
| F_fleet_3_YR_1964_s_1 | 0.0443 | 0.0019 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1964 |
| F_fleet_3_YR_1965_s_1 | 0.0463 | 0.0021 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1965 |
| F_fleet_3_YR_1966_s_1 | 0.0485 | 0.0022 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1966 |
| F_fleet_3_YR_1967_s_1 | 0.0506 | 0.0022 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1967 |
| F_fleet_3_YR_1968_s_1 | 0.0536 | 0.0024 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1968 |
| F_fleet_3_YR_1969_s_1 | 0.0580 | 0.0027 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1969 |
| F_fleet_3_YR_1970_s_1 | 0.0621 | 0.0030 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1970 |
| F_fleet_3_YR_1971_s_1 | 0.0684 | 0.0033 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1971 |
| F_fleet_3_YR_1972_s_1 | 0.0754 | 0.0037 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1972 |
| F_fleet_3_YR_1973_s_1 | 0.0837 | 0.0042 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1973 |
| F_fleet_3_YR_1974_s_1 | 0.0938 | 0.0049 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1974 |
| F_fleet_3_YR_1975_s_1 | 0.1020 | 0.0055 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1975 |
| F_fleet_3_YR_1976_s_1 | 0.1037 | 0.0056 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1976 |
| F_fleet_3_YR_1977_s_1 | 0.1048 | 0.0056 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1977 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_3_YR_1978_s_1 | 0.1049 | 0.0055 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1978 |
| F_fleet_3_YR_1979_s_1 | 0.1068 | 0.0056 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1979 |
| F_fleet_3_YR_1980_s_1 | 0.1072 | 0.0055 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1980 |
| F_fleet_3_YR_1981_s_1 | 0.1010 | 0.0053 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1981 |
| F_fleet_3_YR_1982_s_1 | 0.1801 | 0.0105 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1982 |
| F_fleet_3_YR_1983_s_1 | 0.1342 | 0.0079 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1983 |
| F_fleet_3_YR_1984_s_1 | 0.0529 | 0.0031 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1984 |
| F_fleet_3_YR_1985_s_1 | 0.0632 | 0.0033 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1985 |
| F_fleet_3_YR_1986_s_1 | 0.3433 | 0.0179 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1986 |
| F_fleet_3_YR_1987_s_1 | 0.1127 | 0.0060 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1987 |
| F_fleet_3_YR_1988_s_1 | 0.1038 | 0.0055 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1988 |
| F_fleet_3_YR_1989_s_1 | 0.0799 | 0.0044 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1989 |
| F_fleet_3_YR_1990_s_1 | 0.0974 | 0.0053 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1990 |
| F_fleet_3_YR_1991_s_1 | 0.0957 | 0.0052 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1991 |
| F_fleet_3_YR_1992_s_1 | 0.1287 | 0.0073 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1992 |
| F_fleet_3_YR_1993_s_1 | 0.1478 | 0.0093 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1993 |
| F_fleet_3_YR_1994_s_1 | 0.1631 | 0.0111 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1994 |
| F_fleet_3_YR_1995_s_1 | 0.1422 | 0.0102 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1995 |
| F_fleet_3_YR_1996_s_1 | 0.1604 | 0.0113 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1996 |
| F_fleet_3_YR_1997_s_1 | 0.1447 | 0.0098 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1997 |
| F_fleet_3_YR_1998_s_1 | 0.1257 | 0.0080 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1998 |
| F_fleet_3_YR_1999_s_1 | 0.1488 | 0.0090 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_1999 |
| F_fleet_3_YR_2000_s_1 | 0.1552 | 0.0090 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2000 |
| F_fleet_3_YR_2001_s_1 | 0.2214 | 0.0130 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2001 |
| F_fleet_3_YR_2002_s_1 | 0.1755 | 0.0108 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2002 |
| F_fleet_3_YR_2003_s_1 | 0.1302 | 0.0085 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2003 |
| F_fleet_3_YR_2004_s_1 | 0.1673 | 0.0119 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2004 |
| F_fleet_3_YR_2005_s_1 | 0.0835 | 0.0061 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2005 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_3_YR_2006_s_1 | 0.1127 | 0.0084 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2006 |
| F_fleet_3_YR_2007_s_1 | 0.0843 | 0.0064 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2007 |
| F_fleet_3_YR_2008_s_1 | 0.1115 | 0.0089 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2008 |
| F_fleet_3_YR_2009_s_1 | 0.0853 | 0.0072 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2009 |
| F_fleet_3_YR_2010_s_1 | 0.0890 | 0.0080 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2010 |
| F_fleet_3_YR_2011_s_1 | 0.0773 | 0.0075 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_REC_2011 |
| F_fleet_4_YR_1945_s_1 | 0.0001 | 0.0000 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1945 |
| F_fleet_4_YR_1946_s_1 | 0.0007 | 0.0001 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1946 |
| F_fleet_4_YR_1947_s_1 | 0.0034 | 0.0005 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1947 |
| F_fleet_4_YR_1948_s_1 | 0.0089 | 0.0012 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1948 |
| F_fleet_4_YR_1949_s_1 | 0.0144 | 0.0019 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1949 |
| F_fleet_4_YR_1950_s_1 | 0.0257 | 0.0034 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1950 |
| F_fleet_4_YR_1951_s_1 | 0.0326 | 0.0043 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1951 |
| F_fleet_4_YR_1952_s_1 | 0.0385 | 0.0051 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1952 |
| F_fleet_4_YR_1953_s_1 | 0.0398 | 0.0053 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1953 |
| F_fleet_4_YR_1954_s_1 | 0.0518 | 0.0069 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1954 |
| F_fleet_4_YR_1955_s_1 | 0.0512 | 0.0068 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1955 |
| F_fleet_4_YR_1956_s_1 | 0.0657 | 0.0088 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1956 |
| F_fleet_4_YR_1957_s_1 | 0.0767 | 0.0102 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1957 |
| F_fleet_4_YR_1958_s_1 | 0.0993 | 0.0132 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1958 |
| F_fleet_4_YR_1959_s_1 | 0.1067 | 0.0142 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1959 |
| F_fleet_4_YR_1960_s_1 | 0.1066 | 0.0142 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1960 |
| F_fleet_4_YR_1961_s_1 | 0.0658 | 0.0088 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1961 |
| F_fleet_4_YR_1962_s_1 | 0.1132 | 0.0150 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1962 |
| F_fleet_4_YR_1963_s_1 | 0.1279 | 0.0170 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1963 |
| F_fleet_4_YR_1964_s_1 | 0.1502 | 0.0199 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1964 |
| F_fleet_4_YR_1965_s_1 | 0.0974 | 0.0129 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1965 |
| F_fleet_4_YR_1966_s_1 | 0.0822 | 0.0109 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1966 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_4_YR_1967_s_1 | 0.0982 | 0.0130 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1967 |
| F_fleet_4_YR_1968_s_1 | 0.1144 | 0.0151 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1968 |
| F_fleet_4_YR_1969_s_1 | 0.1244 | 0.0163 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1969 |
| F_fleet_4_YR_1970_s_1 | 0.0877 | 0.0115 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1970 |
| F_fleet_4_YR_1971_s_1 | 0.0986 | 0.0129 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1971 |
| F_fleet_4_YR_1972_s_1 | 0.1329 | 0.0169 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1972 |
| F_fleet_4_YR_1973_s_1 | 0.1342 | 0.0170 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1973 |
| F_fleet_4_YR_1974_s_1 | 0.1363 | 0.0172 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1974 |
| F_fleet_4_YR_1975_s_1 | 0.1052 | 0.0133 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1975 |
| F_fleet_4_YR_1976_s_1 | 0.1388 | 0.0171 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1976 |
| F_fleet_4_YR_1977_s_1 | 0.1610 | 0.0193 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1977 |
| F_fleet_4_YR_1978_s_1 | 0.1954 | 0.0221 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1978 |
| F_fleet_4_YR_1979_s_1 | 0.1884 | 0.0204 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1979 |
| F_fleet_4_YR_1980_s_1 | 0.1643 | 0.0191 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1980 |
| F_fleet_4_YR_1981_s_1 | 0.2493 | 0.0341 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1981 |
| F_fleet_4_YR_1982_s_1 | 0.2276 | 0.0301 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1982 |
| F_fleet_4_YR_1983_s_1 | 0.2489 | 0.0325 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1983 |
| F_fleet_4_YR_1984_s_1 | 0.2374 | 0.0296 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1984 |
| F_fleet_4_YR_1985_s_1 | 0.2509 | 0.0308 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1985 |
| F_fleet_4_YR_1986_s_1 | 0.2680 | 0.0341 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1986 |
| F_fleet_4_YR_1987_s_1 | 0.3030 | 0.0384 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1987 |
| F_fleet_4_YR_1988_s_1 | 0.2255 | 0.0288 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1988 |
| F_fleet_4_YR_1989_s_1 | 0.2793 | 0.0356 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1989 |
| F_fleet_4_YR_1990_s_1 | 0.3040 | 0.0410 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1990 |
| F_fleet_4_YR_1991_s_1 | 0.2954 | 0.0396 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1991 |
| F_fleet_4_YR_1992_s_1 | 0.2917 | 0.0429 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1992 |
| F_fleet_4_YR_1993_s_1 | 0.2445 | 0.0337 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1993 |
| F_fleet_4_YR_1994_s_1 | 0.2616 | 0.0356 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1994 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| F_fleet_4_YR_1995_s_1 | 0.2167 | 0.0292 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1995 |
| F_fleet_4_YR_1996_s_1 | 0.2358 | 0.0319 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1996 |
| F_fleet_4_YR_1997_s_1 | 0.2361 | 0.0315 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1997 |
| F_fleet_4_YR_1998_s_1 | 0.2509 | 0.0328 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1998 |
| F_fleet_4_YR_1999_s_1 | 0.2662 | 0.0351 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_1999 |
| F_fleet_4_YR_2000_s_1 | 0.2339 | 0.0307 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2000 |
| F_fleet_4_YR_2001_s_1 | 0.2259 | 0.0297 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2001 |
| F_fleet_4_YR_2002_s_1 | 0.2013 | 0.0269 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2002 |
| F_fleet_4_YR_2003_s_1 | 0.1615 | 0.0215 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2003 |
| F_fleet_4_YR_2004_s_1 | 0.1239 | 0.0166 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2004 |
| F_fleet_4_YR_2005_s_1 | 0.0728 | 0.0097 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2005 |
| F_fleet_4_YR_2006_s_1 | 0.0979 | 0.0131 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2006 |
| F_fleet_4_YR_2007_s_1 | 0.0948 | 0.0126 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2007 |
| F_fleet_4_YR_2008_s_1 | 0.0810 | 0.0107 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2008 |
| F_fleet_4_YR_2009_s_1 | 0.0939 | 0.0124 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2009 |
| F_fleet_4_YR_2010_s_1 | 0.0664 | 0.0088 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2010 |
| F_fleet_4_YR_2011_s_1 | 0.0620 | 0.0082 | _ | 0 | 8 | F | _ | _ | Estimated | A | F_SHRIMP BYCATCH_2011 |
| Q_base_4_Shrimp_Bycatch_4 | 1.9460 | 0.0460 | 1 | -10 | 20 | No_prior | _ | _ | Estimated | A | Q Shrimp Bycatch fishery |
| SizeSel_1P_1_Com_GN_1 | 45.0000 | 559.0140 | 45 | 20 | 70 | No_prior | _ | _ | Estimated | A | COM_GN size select peak |
| SizeSel_1P_2_Com_GN_1 | -0.0002 | 447.2100 | -1.5 | -20 | 20 | No_prior | _ | _ | Estimated | A | COM_GN size select top |
| SizeSel_1P_3_Com_GN_1 | -2.5000 | 391.3090 | 5 | -20 | 15 | No_prior | _ | _ | Estimated | A | COM_GN size select ascending width |
| SizeSel_1P_4_Com_GN_1 | 6.5000 | 190.0620 | 4 | -2 | 15 | No_prior | _ | _ | Estimated | A | COM_GN size select descending width |
| SizeSel_1P_5_Com_GN_1 | -999.0000 | _ | -999 | -1000 | 15 | No_prior | _ | _ | Fixed | NA | COM_GN select initial |
| SizeSel_1P_6_Com_GN_1 | -999.0000 | _ | -999 | -1000 | 15 | No_prior | _ | _ | Fixed | NA | COM_GN select final |
| SizeSel_2P_1_Com_RR_2 | 55.0000 | _ | 55 | 10 | 70 | No_prior | _ | _ | Fixed | NA | COM_RR size select peak |
| SizeSel_2P_2_Com_RR_2 | 10.0000 | _ | 10 | -20 | 15 | No_prior | _ | _ | Fixed | NA | COM_RR size select top |
| SizeSel_2P_3_Com_RR_2 | 5.0616 | 0.0509 | 6.1 | -20 | 12 | No_prior | _ | _ | Estimated | A | COM_RR size select ascending width |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| SizeSel_2P_4_Com_RR_2 | -4.0000 | _ | -4 | -5 | 15 | No_prior | _ | _ | Fixed | NA | COM_RR size select descending width |
| SizeSel_2P_5_Com_RR_2 | -999.0000 | _ | -999 | -1000 | 15 | No_prior | _ | _ | Fixed | NA | COM_RR select initial |
| SizeSel_2P_6_Com_RR_2 | 15.0000 | _ | 15 | -15 | 15 | No_prior | _ | _ | Fixed | NA | COM_RR select final |
| Retain_2P_1_Com_RR_2 | 30.0000 | _ | 30 | 7 | 99 | No_prior | _ | _ | Fixed | NA | COM_RR retention inflection Period 1 |
| Retain_2P_2_Com_RR_2 | 4.5000 | _ | 4.5 | -1 | 20 | No_prior | _ | _ | Fixed | NA | COM_RR retention inflection Period 2 |
| Retain_2P_3_Com_RR_2 | 0.9900 | _ | 0.99 | 0.1 | 1 | No_prior | _ | _ | Fixed | NA | COM_RR retention slope Period 1 |
| Retain_2P_4_Com_RR_2 | 0.0000 | _ | 0 | -1 | 2 | No_prior | _ | _ | Fixed | NA | COM_RR retention slope Period 2 |
| DiscMort_2P_1_Com_RR_2 | -4.0000 | _ | -4 | -10 | 30 | No_prior | _ | _ | Fixed | NA | COM_RR discard mortality Period 1 inflection |
| DiscMort_2P_2_Com_RR_2 | 1.0000 | _ | 1 | -1 | 2 | No_prior | _ | _ | Fixed | NA | COM_RR discard mortality Period 2 inflection |
| DiscMort_2P_3_Com_RR_2 | 0.1000 | _ | 0.1 | -1 | 2 | No_prior | _ | _ | Fixed | NA | COM_RR discard mortality Period 1 slope |
| DiscMort_2P_4_Com_RR_2 | 0.0000 | _ | 0 | -1 | 2 | No_prior | _ | _ | Fixed | NA | COM_RR discard mortality Period 2 slope |
| SizeSel_3P_1_REC_3 | 38.4093 | 1.0406 | 40 | 7 | 99 | No_prior | _ | _ | Estimated | A | REC size select peak |
| SizeSel_3P_2_REC_3 | 10.0000 | _ | 10 | -20 | 15 | No_prior | _ | _ | Fixed | NA | REC size select top |
| SizeSel_3P_3_REC_3 | 5.0377 | 0.1724 | 6.6 | -10 | 12 | No_prior | _ | _ | Estimated | A | REC size select ascending width |
| SizeSel_3P_4_REC_3 | -4.0000 | _ | -4 | -5 | 15 | No_prior | _ | _ | Fixed | NA | REC size select descending width |
| SizeSel_3P_5_REC_3 | -999.0000 | _ | -999 | -1000 | 15 | No_prior | _ | _ | Fixed | NA | REC select initial |
| SizeSel_3P_6_REC_3 | 15.0000 | _ | 15 | -15 | 15 | No_prior | _ | _ | Fixed | NA | REC select final |
| Retain_3P_1_REC_3 | 30.0000 | _ | 30 | 7 | 99 | No_prior | _ | _ | Fixed | NA | REC retention inflection Period 1 |
| Retain_3P_2_REC_3 | 4.5000 | _ | 4.5 | -1 | 15 | No_prior | _ | _ | Fixed | NA | Rec retention inflection Period 2 |
| Retain_3P_3_REC_3 | 0.9900 | _ | 0.99 | 0.1 | 1 | No_prior | _ | _ | Fixed | NA | REC retention slope Period 1 |
| Retain_3P_4_REC_3 | 0.0000 | _ | 0 | 0 | 2 | No_prior | _ | _ | Fixed | NA | REC retention slope Period 2 |
| DiscMort_3P_1_REC_3 | -4.0000 | _ | -4 | -10 | 30 | No_prior | _ | _ | Fixed | NA | REC discard mortality Period 1 inflection |
| DiscMort_3P_2_REC_3 | 1.0000 | _ | 1 | 0 | 2 | No_prior | _ | _ | Fixed | NA | REC discard mortality Period 2 inflection |
| DiscMort_3P_3_REC_3 | 0.2000 | _ | 0.2 | 0 | 2 | No_prior | _ | _ | Fixed | NA | REC discard mortality Period 1 slope |
| DiscMort_3P_4_REC_3 | 0.0000 | _ | 0 | -1 | 2 | No_prior | _ | _ | Fixed | NA | REC discard mortality Period 2 slope |
| SizeSel_4P_1_Shrimp_Bycatch_4 | 19.3447 | 0.8075 | 20 | 10 | 70 | No_prior | _ | _ | Estimated | A | SHRIMP BYCATCHJ size select peak |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| SizeSel_4P_2_Shrimp_Bycatch_4 | -11.3590 | 57.5102 | -12 | -15 | 3 | No_prior | _ | _ | Estimated | A | SHRIMP BYCATCH size select top |
| SizeSel_4P_3_Shrimp_Bycatch_4 | 4.1776 | 0.2128 | 3.9 | -20 | 12 | No_prior | _ | _ | Estimated | A | SHRIMP BYCATCH size select ascending width |
| SizeSel_4P_4_Shrimp_Bycatch_4 | 7.1720 | 0.1617 | 5 | -2 | 12 | No_prior | _ | _ | Estimated | A | SHRIMP BYCATCH size select descending width |
| SizeSel_4P_5_Shrimp_Bycatch_4 | -999.0000 | _ | -999 | -999 | 15 | No_prior | _ | _ | Fixed | NA | SHRIMP BYCACH select initial |
| SizeSel_4P_6_Shrimp_Bycatch_4 | -999.0000 | _ | -999 | -999 | 15 | No_prior | _ | _ | Fixed | NA | SHRIMP BYCATCH select final |
| SizeSel_5P_1_MRFSS_5 | 1.0000 | _ | 1 | 1 | 49 | No_prior | _ | _ | Mirror REC | NA | MRFFS SURVEY size select min length bin |
| SizeSel_5P_2_MRFSS_5 | 49.0000 | _ | 49 | 1 | 49 | No_prior | _ | _ | Mirror REC | NA | MRFFS SURVEY size select max length bin |
| SizeSel_8P_1_COM_FWC_VERT_LINE_8 | 1.0000 | _ | 1 | 1 | 49 | No_prior | _ | _ | Mirror COM_RR | NA | FWC SURVEY size select min length bin |
| SizeSel_8P_2_COM_FWC_VERT_LINE_8 | 49.0000 | _ | 49 | 1 | 49 | No_prior | _ | _ | Mirror COM_RR | NA | FWC SURVEY size select max length bin |
| SizeSel_9P_1_SEAMAP_Survey_9 | 1.0000 | _ | 1 | 1 | 49 | No_prior | _ | _ | Mirror Shrimp Bycatch | NA | SEAMAP SURVEY size select min length bin |
| SizeSel_9P_2_SEAMAP_Survey_9 | 49.0000 | _ | 49 | 1 | 49 | No_prior | _ | _ | Mirror Shrimp Bycatch | NA | SEAMAP SURVEY size select max length bin |
| AgeSel_1P_1_Com_GN_1 | 0.0000 | _ | 0 | 0 | 12 | No_prior | _ | _ | Fixed | NA | COM_GN age select min age |
| AgeSel_1P_2_Com_GN_1 | 12.0000 | _ | 12 | 0 | 12 | No_prior | _ | _ | Fixed | NA | COM_GN age select max age |
| SizeSel_1P_1_Com_GN_1_BLK1repl_1886 | 47.8903 | 1.0154 | 45 | 20 | 70 | No_prior | _ | _ | Estimated | A | COM_GN TIME BLOCK 1 PEAK |
| SizeSel_1P_1_Com_GN_1_BLK1repl_2006 | 39.3328 | 0.7705 | 45 | 20 | 70 | No_prior | _ | _ | Estimated | A | COM_GN TIME BLOCK 2 peak |
| SizeSel_1P_2_Com_GN_1_BLK1repl_1886 | 3.1249 | 436.4340 | -1.5 | -20 | 20 | No_prior | _ | _ | Estimated | A | COM_GN TIME BLOCK 1 top |
| SizeSel_1P_2_Com_GN_1_BLK1repl_2006 | -10.6749 | 111.5510 | -1.5 | -20 | 20 | No_prior | _ | _ | Estimated | A | COM_GN TIME BLOCK 2 top |
| SizeSel_1P_3_Com_GN_1_BLK1repl_1886 | 4.2679 | 0.1489 | 5 | -20 | 15 | No_prior | _ | _ | Estimated | A | COM_GN TIME BLOCK 1 ascending width |
| SizeSel_1P_3_Com_GN_1_BLK1repl_2006 | 3.7890 | 0.1680 | 5 | -20 | 15 | No_prior | _ | _ | Estimated | A | COM_GN TIME BLOCK W ascending width |
| SizeSel_1P_4_Com_GN_1_BLK1repl_1886 | 12.7205 | 88.2746 | 4 | -2 | 15 | No_prior | _ | _ | Estimated | A | COM_GN TIME BLOCK 1 descending width |
| SizeSel_1P_4_Com_GN_1_BLK1repl_2006 | 5.9846 | 0.2407 | 4 | -2 | 15 | No_prior | _ | _ | Estimated | A | COM_GN TIME BLOCK 2 descending width |
| Retain_2P_1_Com_RR_2_BLK2repl_1886 | 16.6124 | 23.1932 | 26 | 7 | 99 | No_prior | _ | _ | Estimated | A | COM_RR TIME BLOCK 1 Retention inflection |
| Retain_2P_1_Com_RR_2_BLK2repl_1993 | 32.0127 | 3.9123 | 30.5 | 7 | 55 | No_prior | _ | _ | Estimated | A | COM_RR TIME BLOCK 2 Retention inflection |
| Retain_2P_2_Com_RR_2_BLK2repl_1886 | 0.0500 | _ | 0.05 | 0.005 | 30 | No_prior | _ | _ | Fixed | NA | COM_RR TIME BLOCK 1 Retention slope |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Retain_2P_2_Com_RR_2_BLK2repl_1993 | 11.6318 | 2.7992 | 0.05 | 0.005 | 30 | No_prior | _ | _ | Estimated | A | COM_RR TIME BLOCK 2 Retention slope |
| Retain_3P_1_REC_3_BLK2repl_1886 | 31.0875 | 0.3253 | 26 | 7 | 75 | No_prior | _ | _ | Estimated | A | REC TIME BLOCK 1 Retention inflection |
| Retain_3P_1_REC_3_BLK2repl_1993 | 38.2588 | 0.3561 | 30.5 | 7 | 55 | No_prior | _ | _ | Estimated | A | REC TIME BLOCK 2 Retention inflection |
| Retain_3P_2_REC_3_BLK2repl_1886 | 1.7882 | 0.1629 | 2.05 | 0.005 | 30 | No_prior | _ | _ | Estimated | A | REC TIME BLOCK 1 Retention slope |
| Retain_3P_2_REC_3_BLK2repl_1993 | 4.2409 | 0.2907 | 2.05 | 0.005 | 30 | No_prior | _ | _ | Estimated | A | REC TIME BLOCK 2 Retention slope |

Table 3.2. Description of initial model runs and alternative runs (sensitivity, data exclusion, reweighting, and retrospective) conducted for the Gulf of Mexico Spanish mackerel SS evaluation.

| Run | Name | Key | Description |
|---|---|---|---|
| 1 | Run 1 Configuration | Initial Model, Estimated Steepness, M = DW point estimate ($0.3y^{-1}$) | Estimated growth, M=0.38 input into Lorenzen scaled to age 4, estimate steepness, estimate virgin stock (R0), estimate recruitment deviations (1985-2010), input discards as discards (thousands of fish 1 super period (shrimp bycatch fishery), fractions directed fishery (1 super period commercial line gears (COM_RR), 3 super periods (recreational (REC)), 2 time varying selectivity/retention blocks commercial line gear (COM_RR) and recreational all modes (REC): pre 1993, 1993-2011, 2 time varying selectivity blocks commercial gillnet fleet (COM_GN) pre 2006, 2006-2011. |
| 2 | Run 1 Configuration, Steepness=0.9 | Sensitivity on estimation of Steepness | Run 1 Configuration, M = $0.38y^{-1}$, except Beverton and Holt steepness parameter fixed at 0. 9. |
| 3 | Run 1 Configuration, Steepness=0.8 | Sensitivity on estimation of Steepness | Run 1 Configuration, M = $0.38y^{-1}$, except Beverton and Holt steepness parameter fixed at 0.8. |
| 4 | Run 1 Configuration, Steepness=0.7 | Sensitivity on estimation of Steepness | Run 1 Configuration, M = $0.38y^{-1}$, except Beverton and Holt steepness parameter fixed at 0.7. |
| 5 | Run 3 Configuration, M HI | Sensitivity on M | Run 3 Model Configuration (Steepness = 0.8), M SENS HI (M = $0.49y^{-1}$) sensitivity with M value input into Lorenzen function |
| 6 | Run 3 Configuration, M LO | Sensitivity on M | Run 3 Model Configuration (Steepness = 0.8), M SENS LO 2 (M = $0.27y^{-1}$) sensitivity with M value input into Lorenzen function. |
| 7 | Run 3 Configuration, M REF Age 3 | Sensitivity on M | Run 3 Model Configuration (Steepness = 0.8), M ($0.38y^{-1}$), Reference (REF) Age 3 with reference scaling age in Lorenzen function. |
| 8 | Run 3 Configuration, Discard Mortality | Sensitivity on Discard Mortality | Run 3 Model Configuration (Steepness parameter = 0.8), M = $0.38y^{-1}$, discard release mortality varied from 10% to 20% for COM_RR and from 20% 40% for REC) |
| 9 | Run 3 Configuration, NO MRFSS | Sensitivity on data exclusion | Run 3 Model Configuration (Steepness parameter = 0.8), M = $0.38y^{-1}$, exclusion of MRFSS index. |
| 10 | Run 3 Configuration, NO FWC | Sensitivity on data exclusion | Run 3 Model Configuration (Steepness parameter = 0.8), M = $0.38y^{-1}$, exclusion of FWC Trip Ticket index. |
| 11 | Run 3 Configuration, NO SEAMAP Survey | Sensitivity on data exclusion | Run 3 Model Configuration (Steepness parameter = 0.8), M = $0.38y^{-1}$, exclusion of SEAMAP Survey Index. |
| 12 | Run 1 Configuration, SS Reweighting | Sensitivity on data component weighting | Initial Model M ($0.38y^{-1}$), with SS reweighting of abundance indices, age composition, and length composition components. Steepness parameter estimated in this run. |
| 13 | Run 3 Configuration, RETRO_2010 | Retrospective Analysis | Run 3 Model Configuration (Steepness = 0.8, M =$0.38y^{-1}$), RETROSPECTIVE 2010, 2011 data excluded. |
| 14 | Run 3 Configuration, RETRO_2009 | Retrospective Analysis | Run 3 Model Configuration (Steepness = 0.8, M =$0.38y^{-1}$), 2010-2011 data excluded. |
| 15 | Run 3 Configuration, RETRO_2008 | Retrospective Analysis | Run 3 Model Configuration (Steepness = 0.8, M =$0.38y^{-1}$), 2009-2011 data excluded. |
| 16 | Run 3 Configuration, RETRO_2007 | Retrospective Analysis | Run 3 Model Configuration (Steepness = 0.8, M =$0.38y^{-1}$), 2008-2011 data excluded. |
| 17 | Run 3 Configuration, RETRO_2006 | Retrospective Analysis | Run 3 Model Configuration (Steepness = 0.8, M =$0.38y^{-1}$), 2007-2011 data excluded. |

Table 3.3. Mean and standard deviation of parameter estimates from 1,000 bootstrap samples for Gulf of Mexico Spanish mackerel for 1,000 bootstrap runs for Run 3 (Model is Run 1 configuration except steepness fixed at 0.8). Run 3 assumed M = 0.38 value was input into Lorenzen function.

| Parameter | Average | Standard error | Status |
|---|---|---|---|
| L_at_Amax_Fem_GP_1 | 59.9556 | 0.8473 | Estimated |
| L_at_Amin_Fem_GP_1 | 19.3014 | 0.4963 | Estimated |
| VonBert_K_Fem_GP_1 | 0.3004 | 0.0132 | Estimated |
| CV_old_Fem_GP_1 | 9.7682 | 0.3243 | Estimated |
| CV_young_Fem_GP_1 | 6.9883 | 0.2520 | Estimated |
| Wtlen_1_Fem | 0.0000 | - | Fixed |
| Wtlen_2_Fem | 2.8617 | - | Fixed |
| AgeSel_1P_2_Com_GN_1 | 12.0000 | - | Fixed |
| Eggs/kg_inter_Fem | 1.0000 | - | Fixed |
| Eggs/kg_slope_wt_Fem | 0.0000 | - | Fixed |
| SR_autocorr | 0.0000 | - | Fixed |
| SR_BH_steep | 0.8000 | - | Fixed |
| SR_envlink | 0.1000 | - | Fixed |
| SR_LN(R0) | 10.7914 | 0.0204 | Estimated |
| SR_R1_offset | 0.0000 | - | Fixed |
| SR_sigmaR | 0.7000 | - | Fixed |
| Main_RecrDev_1985 | 0.3274 | 0.0888 | Estimated |
| Main_RecrDev_1986 | -0.1076 | 0.0793 | Estimated |
| Main_RecrDev_1987 | -0.3025 | 0.0715 | Estimated |
| Main_RecrDev_1988 | -0.1257 | 0.0621 | Estimated |
| Main_RecrDev_1989 | 0.3444 | 0.0564 | Estimated |
| Main_RecrDev_1990 | 0.3130 | 0.0603 | Estimated |
| Main_RecrDev_1991 | 0.4148 | 0.0548 | Estimated |
| Main_RecrDev_1992 | -0.5065 | 0.0825 | Estimated |
| Main_RecrDev_1993 | -0.1727 | 0.0740 | Estimated |
| Main_RecrDev_1994 | -0.7947 | 0.0982 | Estimated |
| Main_RecrDev_1995 | 0.0062 | 0.0788 | Estimated |
| Main_RecrDev_1996 | 0.0680 | 0.0800 | Estimated |
| Main_RecrDev_1997 | -0.1781 | 0.0808 | Estimated |
| Main_RecrDev_1998 | 0.4302 | 0.0641 | Estimated |
| Main_RecrDev_1999 | -0.0543 | 0.0749 | Estimated |
| Main_RecrDev_2000 | 0.1123 | 0.0639 | Estimated |
| Main_RecrDev_2001 | 0.0629 | 0.0621 | Estimated |
| Main_RecrDev_2002 | -0.0579 | 0.0639 | Estimated |
| Main_RecrDev_2003 | 0.1803 | 0.0607 | Estimated |

| | | | |
|---|---|---|---|
| Main_RecrDev_2004 | 0.1062 | 0.0643 | Estimated |
| Main_RecrDev_2005 | 0.0338 | 0.0628 | Estimated |
| Main_RecrDev_2006 | -0.2962 | 0.0705 | Estimated |
| Main_RecrDev_2007 | 0.2547 | 0.0652 | Estimated |
| Main_RecrDev_2008 | 0.0009 | 0.0812 | Estimated |
| Main_RecrDev_2009 | -0.2599 | 0.1039 | Estimated |
| Main_RecrDev_2010 | 0.4654 | 0.1114 | Estimated |
| Main_RecrDev_2011 | -0.2646 | 0.2308 | Estimated |
| InitF_1Com_GN_1 | 0.0000 | - | Fixed |
| InitF_2Com_RR_2 | 0.0000 | - | Fixed |
| InitF_3REC_3 | 0.0000 | - | Fixed |
| InitF_4Shrimp_Bycatch_4 | 0.0000 | - | Fixed |
| Mat_slope_Fem | -0.0650 | - | Fixed |
| Mat50%_Fem | 31.0000 | - | Fixed |
| Q_base_4_Shrimp_Bycatch_4 | 2.0299 | 0.0493 | Estimated |
| RecrDist_Area_1 | 0.0000 | - | Fixed |
| RecrDist_GP_1 | 0.0000 | - | Fixed |
| RecrDist_Seas_1 | 0.0000 | - | Fixed |
| F_fleet_1_YR_1886_s_1 | 0.0008 | 0.0001 | Estimated |
| F_fleet_1_YR_1887_s_1 | 0.0017 | 0.0001 | Estimated |
| F_fleet_1_YR_1888_s_1 | 0.0033 | 0.0002 | Estimated |
| F_fleet_1_YR_1889_s_1 | 0.0064 | 0.0003 | Estimated |
| F_fleet_1_YR_1890_s_1 | 0.0074 | 0.0004 | Estimated |
| F_fleet_1_YR_1891_s_1 | 0.0078 | 0.0004 | Estimated |
| F_fleet_1_YR_1892_s_1 | 0.0078 | 0.0004 | Estimated |
| F_fleet_1_YR_1893_s_1 | 0.0079 | 0.0004 | Estimated |
| F_fleet_1_YR_1894_s_1 | 0.0079 | 0.0004 | Estimated |
| F_fleet_1_YR_1895_s_1 | 0.0079 | 0.0004 | Estimated |
| F_fleet_1_YR_1896_s_1 | 0.0079 | 0.0004 | Estimated |
| F_fleet_1_YR_1897_s_1 | 0.0082 | 0.0004 | Estimated |
| F_fleet_1_YR_1898_s_1 | 0.0106 | 0.0005 | Estimated |
| F_fleet_1_YR_1899_s_1 | 0.0106 | 0.0005 | Estimated |
| F_fleet_1_YR_1900_s_1 | 0.0107 | 0.0005 | Estimated |
| F_fleet_1_YR_1901_s_1 | 0.0107 | 0.0005 | Estimated |
| F_fleet_1_YR_1902_s_1 | 0.0174 | 0.0008 | Estimated |
| F_fleet_1_YR_1903_s_1 | 0.0169 | 0.0008 | Estimated |
| F_fleet_1_YR_1904_s_1 | 0.0170 | 0.0008 | Estimated |
| F_fleet_1_YR_1905_s_1 | 0.0171 | 0.0008 | Estimated |
| F_fleet_1_YR_1906_s_1 | 0.0171 | 0.0008 | Estimated |
| F_fleet_1_YR_1907_s_1 | 0.0172 | 0.0008 | Estimated |
| F_fleet_1_YR_1908_s_1 | 0.0167 | 0.0008 | Estimated |

| | | | |
|---|---|---|---|
| F_fleet_1_YR_1909_s_1 | 0.0175 | 0.0008 | Estimated |
| F_fleet_1_YR_1910_s_1 | 0.0204 | 0.0010 | Estimated |
| F_fleet_1_YR_1911_s_1 | 0.0233 | 0.0011 | Estimated |
| F_fleet_1_YR_1912_s_1 | 0.0263 | 0.0012 | Estimated |
| F_fleet_1_YR_1913_s_1 | 0.0293 | 0.0014 | Estimated |
| F_fleet_1_YR_1914_s_1 | 0.0324 | 0.0015 | Estimated |
| F_fleet_1_YR_1915_s_1 | 0.0356 | 0.0017 | Estimated |
| F_fleet_1_YR_1916_s_1 | 0.0388 | 0.0018 | Estimated |
| F_fleet_1_YR_1917_s_1 | 0.0409 | 0.0019 | Estimated |
| F_fleet_1_YR_1918_s_1 | 0.0418 | 0.0020 | Estimated |
| F_fleet_1_YR_1919_s_1 | 0.0428 | 0.0020 | Estimated |
| F_fleet_1_YR_1920_s_1 | 0.0445 | 0.0021 | Estimated |
| F_fleet_1_YR_1921_s_1 | 0.0462 | 0.0022 | Estimated |
| F_fleet_1_YR_1922_s_1 | 0.0466 | 0.0022 | Estimated |
| F_fleet_1_YR_1923_s_1 | 0.0470 | 0.0022 | Estimated |
| F_fleet_1_YR_1924_s_1 | 0.0501 | 0.0024 | Estimated |
| F_fleet_1_YR_1925_s_1 | 0.0536 | 0.0026 | Estimated |
| F_fleet_1_YR_1926_s_1 | 0.0572 | 0.0027 | Estimated |
| F_fleet_1_YR_1927_s_1 | 0.0595 | 0.0028 | Estimated |
| F_fleet_1_YR_1928_s_1 | 0.0412 | 0.0020 | Estimated |
| F_fleet_1_YR_1929_s_1 | 0.0444 | 0.0021 | Estimated |
| F_fleet_1_YR_1930_s_1 | 0.0520 | 0.0025 | Estimated |
| F_fleet_1_YR_1931_s_1 | 0.0293 | 0.0014 | Estimated |
| F_fleet_1_YR_1932_s_1 | 0.0358 | 0.0017 | Estimated |
| F_fleet_1_YR_1933_s_1 | 0.0390 | 0.0018 | Estimated |
| F_fleet_1_YR_1934_s_1 | 0.0429 | 0.0020 | Estimated |
| F_fleet_1_YR_1935_s_1 | 0.0532 | 0.0025 | Estimated |
| F_fleet_1_YR_1936_s_1 | 0.0648 | 0.0031 | Estimated |
| F_fleet_1_YR_1937_s_1 | 0.0495 | 0.0024 | Estimated |
| F_fleet_1_YR_1938_s_1 | 0.0511 | 0.0024 | Estimated |
| F_fleet_1_YR_1939_s_1 | 0.0535 | 0.0026 | Estimated |
| F_fleet_1_YR_1940_s_1 | 0.0460 | 0.0022 | Estimated |
| F_fleet_1_YR_1941_s_1 | 0.0010 | 0.0000 | Estimated |
| F_fleet_1_YR_1942_s_1 | 0.0010 | 0.0000 | Estimated |
| F_fleet_1_YR_1943_s_1 | 0.0010 | 0.0000 | Estimated |
| F_fleet_1_YR_1944_s_1 | 0.0010 | 0.0000 | Estimated |
| F_fleet_1_YR_1945_s_1 | 0.0010 | 0.0000 | Estimated |
| F_fleet_1_YR_1946_s_1 | 0.0009 | 0.0000 | Estimated |
| F_fleet_1_YR_1947_s_1 | 0.0009 | 0.0000 | Estimated |
| F_fleet_1_YR_1948_s_1 | 0.0099 | 0.0005 | Estimated |
| F_fleet_1_YR_1949_s_1 | 0.0434 | 0.0021 | Estimated |

| | | | |
|---|---|---|---|
| F_fleet_1_YR_1950_s_1 | 0.0299 | 0.0014 | Estimated |
| F_fleet_1_YR_1951_s_1 | 0.0783 | 0.0038 | Estimated |
| F_fleet_1_YR_1952_s_1 | 0.0571 | 0.0028 | Estimated |
| F_fleet_1_YR_1953_s_1 | 0.0388 | 0.0019 | Estimated |
| F_fleet_1_YR_1954_s_1 | 0.0384 | 0.0019 | Estimated |
| F_fleet_1_YR_1955_s_1 | 0.0221 | 0.0011 | Estimated |
| F_fleet_1_YR_1956_s_1 | 0.0410 | 0.0020 | Estimated |
| F_fleet_1_YR_1957_s_1 | 0.0538 | 0.0027 | Estimated |
| F_fleet_1_YR_1958_s_1 | 0.0606 | 0.0031 | Estimated |
| F_fleet_1_YR_1959_s_1 | 0.0789 | 0.0041 | Estimated |
| F_fleet_1_YR_1960_s_1 | 0.0995 | 0.0054 | Estimated |
| F_fleet_1_YR_1961_s_1 | 0.0771 | 0.0043 | Estimated |
| F_fleet_1_YR_1962_s_1 | 0.1448 | 0.0081 | Estimated |
| F_fleet_1_YR_1963_s_1 | 0.1229 | 0.0070 | Estimated |
| F_fleet_1_YR_1964_s_1 | 0.0912 | 0.0053 | Estimated |
| F_fleet_1_YR_1965_s_1 | 0.1162 | 0.0070 | Estimated |
| F_fleet_1_YR_1966_s_1 | 0.1752 | 0.0107 | Estimated |
| F_fleet_1_YR_1967_s_1 | 0.1519 | 0.0093 | Estimated |
| F_fleet_1_YR_1968_s_1 | 0.1917 | 0.0118 | Estimated |
| F_fleet_1_YR_1969_s_1 | 0.2364 | 0.0149 | Estimated |
| F_fleet_1_YR_1970_s_1 | 0.2465 | 0.0161 | Estimated |
| F_fleet_1_YR_1971_s_1 | 0.2344 | 0.0155 | Estimated |
| F_fleet_1_YR_1972_s_1 | 0.1974 | 0.0131 | Estimated |
| F_fleet_1_YR_1973_s_1 | 0.2023 | 0.0137 | Estimated |
| F_fleet_1_YR_1974_s_1 | 0.2668 | 0.0188 | Estimated |
| F_fleet_1_YR_1975_s_1 | 0.1772 | 0.0128 | Estimated |
| F_fleet_1_YR_1976_s_1 | 0.2613 | 0.0191 | Estimated |
| F_fleet_1_YR_1977_s_1 | 0.0755 | 0.0055 | Estimated |
| F_fleet_1_YR_1978_s_1 | 0.0410 | 0.0029 | Estimated |
| F_fleet_1_YR_1979_s_1 | 0.0752 | 0.0052 | Estimated |
| F_fleet_1_YR_1980_s_1 | 0.0672 | 0.0047 | Estimated |
| F_fleet_1_YR_1981_s_1 | 0.1323 | 0.0092 | Estimated |
| F_fleet_1_YR_1982_s_1 | 0.1358 | 0.0098 | Estimated |
| F_fleet_1_YR_1983_s_1 | 0.0948 | 0.0070 | Estimated |
| F_fleet_1_YR_1984_s_1 | 0.1586 | 0.0116 | Estimated |
| F_fleet_1_YR_1985_s_1 | 0.0901 | 0.0062 | Estimated |
| F_fleet_1_YR_1986_s_1 | 0.1296 | 0.0085 | Estimated |
| F_fleet_1_YR_1987_s_1 | 0.1415 | 0.0093 | Estimated |
| F_fleet_1_YR_1988_s_1 | 0.1317 | 0.0085 | Estimated |
| F_fleet_1_YR_1989_s_1 | 0.1862 | 0.0122 | Estimated |
| F_fleet_1_YR_1990_s_1 | 0.1543 | 0.0103 | Estimated |

| | | | |
|---|---|---|---|
| F_fleet_1_YR_1991_s_1 | 0.1842 | 0.0123 | Estimated |
| F_fleet_1_YR_1992_s_1 | 0.1955 | 0.0133 | Estimated |
| F_fleet_1_YR_1993_s_1 | 0.1381 | 0.0097 | Estimated |
| F_fleet_1_YR_1994_s_1 | 0.1619 | 0.0120 | Estimated |
| F_fleet_1_YR_1995_s_1 | 0.0981 | 0.0078 | Estimated |
| F_fleet_1_YR_1996_s_1 | 0.0256 | 0.0020 | Estimated |
| F_fleet_1_YR_1997_s_1 | 0.0312 | 0.0024 | Estimated |
| F_fleet_1_YR_1998_s_1 | 0.0235 | 0.0017 | Estimated |
| F_fleet_1_YR_1999_s_1 | 0.0425 | 0.0030 | Estimated |
| F_fleet_1_YR_2000_s_1 | 0.0420 | 0.0029 | Estimated |
| F_fleet_1_YR_2001_s_1 | 0.0521 | 0.0037 | Estimated |
| F_fleet_1_YR_2002_s_1 | 0.0423 | 0.0031 | Estimated |
| F_fleet_1_YR_2003_s_1 | 0.0615 | 0.0046 | Estimated |
| F_fleet_1_YR_2004_s_1 | 0.0426 | 0.0032 | Estimated |
| F_fleet_1_YR_2005_s_1 | 0.0529 | 0.0041 | Estimated |
| F_fleet_1_YR_2006_s_1 | 0.0398 | 0.0031 | Estimated |
| F_fleet_1_YR_2007_s_1 | 0.0266 | 0.0021 | Estimated |
| F_fleet_1_YR_2008_s_1 | 0.0316 | 0.0026 | Estimated |
| F_fleet_1_YR_2009_s_1 | 0.0458 | 0.0040 | Estimated |
| F_fleet_1_YR_2010_s_1 | 0.0289 | 0.0027 | Estimated |
| F_fleet_1_YR_2011_s_1 | 0.0282 | 0.0029 | Estimated |
| F_fleet_2_YR_1886_s_1 | 0.0001 | 0.0000 | Estimated |
| F_fleet_2_YR_1887_s_1 | 0.0001 | 0.0000 | Estimated |
| F_fleet_2_YR_1888_s_1 | 0.0002 | 0.0000 | Estimated |
| F_fleet_2_YR_1889_s_1 | 0.0004 | 0.0000 | Estimated |
| F_fleet_2_YR_1890_s_1 | 0.0005 | 0.0000 | Estimated |
| F_fleet_2_YR_1891_s_1 | 0.0001 | 0.0000 | Estimated |
| F_fleet_2_YR_1892_s_1 | 0.0001 | 0.0000 | Estimated |
| F_fleet_2_YR_1893_s_1 | 0.0001 | 0.0000 | Estimated |
| F_fleet_2_YR_1894_s_1 | 0.0001 | 0.0000 | Estimated |
| F_fleet_2_YR_1895_s_1 | 0.0001 | 0.0000 | Estimated |
| F_fleet_2_YR_1896_s_1 | 0.0001 | 0.0000 | Estimated |
| F_fleet_2_YR_1897_s_1 | 0.0005 | 0.0000 | Estimated |
| F_fleet_2_YR_1898_s_1 | 0.0007 | 0.0000 | Estimated |
| F_fleet_2_YR_1899_s_1 | 0.0007 | 0.0000 | Estimated |
| F_fleet_2_YR_1900_s_1 | 0.0007 | 0.0000 | Estimated |
| F_fleet_2_YR_1901_s_1 | 0.0007 | 0.0000 | Estimated |
| F_fleet_2_YR_1902_s_1 | 0.0012 | 0.0000 | Estimated |
| F_fleet_2_YR_1903_s_1 | 0.0011 | 0.0000 | Estimated |
| F_fleet_2_YR_1904_s_1 | 0.0011 | 0.0000 | Estimated |
| F_fleet_2_YR_1905_s_1 | 0.0011 | 0.0000 | Estimated |

| | | | |
|---|---|---|---|
| F_fleet_2_YR_1906_s_1 | 0.0011 | 0.0000 | Estimated |
| F_fleet_2_YR_1907_s_1 | 0.0011 | 0.0000 | Estimated |
| F_fleet_2_YR_1908_s_1 | 0.0011 | 0.0000 | Estimated |
| F_fleet_2_YR_1909_s_1 | 0.0013 | 0.0000 | Estimated |
| F_fleet_2_YR_1910_s_1 | 0.0015 | 0.0001 | Estimated |
| F_fleet_2_YR_1911_s_1 | 0.0016 | 0.0001 | Estimated |
| F_fleet_2_YR_1912_s_1 | 0.0018 | 0.0001 | Estimated |
| F_fleet_2_YR_1913_s_1 | 0.0020 | 0.0001 | Estimated |
| F_fleet_2_YR_1914_s_1 | 0.0021 | 0.0001 | Estimated |
| F_fleet_2_YR_1915_s_1 | 0.0023 | 0.0001 | Estimated |
| F_fleet_2_YR_1916_s_1 | 0.0025 | 0.0001 | Estimated |
| F_fleet_2_YR_1917_s_1 | 0.0027 | 0.0001 | Estimated |
| F_fleet_2_YR_1918_s_1 | 0.0028 | 0.0001 | Estimated |
| F_fleet_2_YR_1919_s_1 | 0.0029 | 0.0001 | Estimated |
| F_fleet_2_YR_1920_s_1 | 0.0029 | 0.0001 | Estimated |
| F_fleet_2_YR_1921_s_1 | 0.0031 | 0.0001 | Estimated |
| F_fleet_2_YR_1922_s_1 | 0.0031 | 0.0001 | Estimated |
| F_fleet_2_YR_1923_s_1 | 0.0032 | 0.0001 | Estimated |
| F_fleet_2_YR_1924_s_1 | 0.0033 | 0.0001 | Estimated |
| F_fleet_2_YR_1925_s_1 | 0.0035 | 0.0001 | Estimated |
| F_fleet_2_YR_1926_s_1 | 0.0037 | 0.0001 | Estimated |
| F_fleet_2_YR_1927_s_1 | 0.0040 | 0.0001 | Estimated |
| F_fleet_2_YR_1928_s_1 | 0.0028 | 0.0001 | Estimated |
| F_fleet_2_YR_1929_s_1 | 0.0030 | 0.0001 | Estimated |
| F_fleet_2_YR_1930_s_1 | 0.0035 | 0.0001 | Estimated |
| F_fleet_2_YR_1931_s_1 | 0.0020 | 0.0001 | Estimated |
| F_fleet_2_YR_1932_s_1 | 0.0024 | 0.0001 | Estimated |
| F_fleet_2_YR_1933_s_1 | 0.0026 | 0.0001 | Estimated |
| F_fleet_2_YR_1934_s_1 | 0.0029 | 0.0001 | Estimated |
| F_fleet_2_YR_1935_s_1 | 0.0035 | 0.0001 | Estimated |
| F_fleet_2_YR_1936_s_1 | 0.0044 | 0.0002 | Estimated |
| F_fleet_2_YR_1937_s_1 | 0.0034 | 0.0001 | Estimated |
| F_fleet_2_YR_1938_s_1 | 0.0035 | 0.0001 | Estimated |
| F_fleet_2_YR_1939_s_1 | 0.0036 | 0.0001 | Estimated |
| F_fleet_2_YR_1940_s_1 | 0.0031 | 0.0001 | Estimated |
| F_fleet_2_YR_1941_s_1 | 0.0007 | 0.0000 | Estimated |
| F_fleet_2_YR_1942_s_1 | 0.0007 | 0.0000 | Estimated |
| F_fleet_2_YR_1943_s_1 | 0.0007 | 0.0000 | Estimated |
| F_fleet_2_YR_1944_s_1 | 0.0007 | 0.0000 | Estimated |
| F_fleet_2_YR_1945_s_1 | 0.0001 | 0.0000 | Estimated |
| F_fleet_2_YR_1946_s_1 | 0.0006 | 0.0000 | Estimated |

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|---|---|---|---|
| F_fleet_2_YR_1947_s_1 | 0.0006 | 0.0000 | Estimated |
| F_fleet_2_YR_1948_s_1 | 0.0007 | 0.0000 | Estimated |
| F_fleet_2_YR_1949_s_1 | 0.0029 | 0.0001 | Estimated |
| F_fleet_2_YR_1950_s_1 | 0.0020 | 0.0001 | Estimated |
| F_fleet_2_YR_1951_s_1 | 0.0053 | 0.0002 | Estimated |
| F_fleet_2_YR_1952_s_1 | 0.0038 | 0.0001 | Estimated |
| F_fleet_2_YR_1953_s_1 | 0.0026 | 0.0001 | Estimated |
| F_fleet_2_YR_1954_s_1 | 0.0026 | 0.0001 | Estimated |
| F_fleet_2_YR_1955_s_1 | 0.0015 | 0.0001 | Estimated |
| F_fleet_2_YR_1956_s_1 | 0.0028 | 0.0001 | Estimated |
| F_fleet_2_YR_1957_s_1 | 0.0037 | 0.0001 | Estimated |
| F_fleet_2_YR_1958_s_1 | 0.0041 | 0.0002 | Estimated |
| F_fleet_2_YR_1959_s_1 | 0.0054 | 0.0002 | Estimated |
| F_fleet_2_YR_1960_s_1 | 0.0068 | 0.0003 | Estimated |
| F_fleet_2_YR_1961_s_1 | 0.0053 | 0.0003 | Estimated |
| F_fleet_2_YR_1962_s_1 | 0.0034 | 0.0002 | Estimated |
| F_fleet_2_YR_1963_s_1 | 0.0021 | 0.0001 | Estimated |
| F_fleet_2_YR_1964_s_1 | 0.0048 | 0.0003 | Estimated |
| F_fleet_2_YR_1965_s_1 | 0.0083 | 0.0005 | Estimated |
| F_fleet_2_YR_1966_s_1 | 0.0101 | 0.0006 | Estimated |
| F_fleet_2_YR_1967_s_1 | 0.0088 | 0.0005 | Estimated |
| F_fleet_2_YR_1968_s_1 | 0.0083 | 0.0005 | Estimated |
| F_fleet_2_YR_1969_s_1 | 0.0075 | 0.0005 | Estimated |
| F_fleet_2_YR_1970_s_1 | 0.0097 | 0.0006 | Estimated |
| F_fleet_2_YR_1971_s_1 | 0.0104 | 0.0007 | Estimated |
| F_fleet_2_YR_1972_s_1 | 0.0175 | 0.0012 | Estimated |
| F_fleet_2_YR_1973_s_1 | 0.0054 | 0.0004 | Estimated |
| F_fleet_2_YR_1974_s_1 | 0.0296 | 0.0021 | Estimated |
| F_fleet_2_YR_1975_s_1 | 0.0348 | 0.0026 | Estimated |
| F_fleet_2_YR_1976_s_1 | 0.0376 | 0.0028 | Estimated |
| F_fleet_2_YR_1977_s_1 | 0.0292 | 0.0022 | Estimated |
| F_fleet_2_YR_1978_s_1 | 0.0261 | 0.0019 | Estimated |
| F_fleet_2_YR_1979_s_1 | 0.0030 | 0.0002 | Estimated |
| F_fleet_2_YR_1980_s_1 | 0.0043 | 0.0003 | Estimated |
| F_fleet_2_YR_1981_s_1 | 0.0089 | 0.0006 | Estimated |
| F_fleet_2_YR_1982_s_1 | 0.0089 | 0.0007 | Estimated |
| F_fleet_2_YR_1983_s_1 | 0.0080 | 0.0006 | Estimated |
| F_fleet_2_YR_1984_s_1 | 0.0028 | 0.0002 | Estimated |
| F_fleet_2_YR_1985_s_1 | 0.0034 | 0.0002 | Estimated |
| F_fleet_2_YR_1986_s_1 | 0.0018 | 0.0001 | Estimated |
| F_fleet_2_YR_1987_s_1 | 0.0147 | 0.0010 | Estimated |

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|---|---|---|---|
| F_fleet_2_YR_1988_s_1 | 0.0018 | 0.0001 | Estimated |
| F_fleet_2_YR_1989_s_1 | 0.0042 | 0.0003 | Estimated |
| F_fleet_2_YR_1990_s_1 | 0.0013 | 0.0001 | Estimated |
| F_fleet_2_YR_1991_s_1 | 0.0112 | 0.0008 | Estimated |
| F_fleet_2_YR_1992_s_1 | 0.0025 | 0.0002 | Estimated |
| F_fleet_2_YR_1993_s_1 | 0.0023 | 0.0002 | Estimated |
| F_fleet_2_YR_1994_s_1 | 0.0019 | 0.0001 | Estimated |
| F_fleet_2_YR_1995_s_1 | 0.0020 | 0.0002 | Estimated |
| F_fleet_2_YR_1996_s_1 | 0.0027 | 0.0002 | Estimated |
| F_fleet_2_YR_1997_s_1 | 0.0037 | 0.0003 | Estimated |
| F_fleet_2_YR_1998_s_1 | 0.0044 | 0.0003 | Estimated |
| F_fleet_2_YR_1999_s_1 | 0.0046 | 0.0003 | Estimated |
| F_fleet_2_YR_2000_s_1 | 0.0030 | 0.0002 | Estimated |
| F_fleet_2_YR_2001_s_1 | 0.0055 | 0.0004 | Estimated |
| F_fleet_2_YR_2002_s_1 | 0.0026 | 0.0002 | Estimated |
| F_fleet_2_YR_2003_s_1 | 0.0028 | 0.0002 | Estimated |
| F_fleet_2_YR_2004_s_1 | 0.0025 | 0.0002 | Estimated |
| F_fleet_2_YR_2005_s_1 | 0.0018 | 0.0001 | Estimated |
| F_fleet_2_YR_2006_s_1 | 0.0029 | 0.0002 | Estimated |
| F_fleet_2_YR_2007_s_1 | 0.0012 | 0.0001 | Estimated |
| F_fleet_2_YR_2008_s_1 | 0.0034 | 0.0003 | Estimated |
| F_fleet_2_YR_2009_s_1 | 0.0029 | 0.0002 | Estimated |
| F_fleet_2_YR_2010_s_1 | 0.0052 | 0.0005 | Estimated |
| F_fleet_2_YR_2011_s_1 | 0.0040 | 0.0004 | Estimated |
| F_fleet_4_YR_1945_s_1 | 0.0001 | 0.0000 | Estimated |
| F_fleet_4_YR_1946_s_1 | 0.0006 | 0.0001 | Estimated |
| F_fleet_4_YR_1947_s_1 | 0.0032 | 0.0004 | Estimated |
| F_fleet_4_YR_1948_s_1 | 0.0082 | 0.0011 | Estimated |
| F_fleet_4_YR_1949_s_1 | 0.0133 | 0.0018 | Estimated |
| F_fleet_4_YR_1950_s_1 | 0.0238 | 0.0031 | Estimated |
| F_fleet_4_YR_1951_s_1 | 0.0301 | 0.0040 | Estimated |
| F_fleet_4_YR_1952_s_1 | 0.0357 | 0.0047 | Estimated |
| F_fleet_4_YR_1953_s_1 | 0.0369 | 0.0049 | Estimated |
| F_fleet_4_YR_1954_s_1 | 0.0482 | 0.0064 | Estimated |
| F_fleet_4_YR_1955_s_1 | 0.0476 | 0.0063 | Estimated |
| F_fleet_4_YR_1956_s_1 | 0.0607 | 0.0080 | Estimated |
| F_fleet_4_YR_1957_s_1 | 0.0710 | 0.0094 | Estimated |
| F_fleet_4_YR_1958_s_1 | 0.0912 | 0.0120 | Estimated |
| F_fleet_4_YR_1959_s_1 | 0.0995 | 0.0131 | Estimated |
| F_fleet_4_YR_1960_s_1 | 0.0992 | 0.0131 | Estimated |
| F_fleet_4_YR_1961_s_1 | 0.0614 | 0.0081 | Estimated |

| | | | |
|---|---|---|---|
| F_fleet_4_YR_1962_s_1 | 0.1051 | 0.0139 | Estimated |
| F_fleet_4_YR_1963_s_1 | 0.1192 | 0.0157 | Estimated |
| F_fleet_4_YR_1964_s_1 | 0.1394 | 0.0184 | Estimated |
| F_fleet_4_YR_1965_s_1 | 0.0908 | 0.0120 | Estimated |
| F_fleet_4_YR_1966_s_1 | 0.0764 | 0.0101 | Estimated |
| F_fleet_4_YR_1967_s_1 | 0.0905 | 0.0119 | Estimated |
| F_fleet_4_YR_1968_s_1 | 0.1066 | 0.0141 | Estimated |
| F_fleet_4_YR_1969_s_1 | 0.1148 | 0.0151 | Estimated |
| F_fleet_4_YR_1970_s_1 | 0.0815 | 0.0107 | Estimated |
| F_fleet_4_YR_1971_s_1 | 0.0915 | 0.0121 | Estimated |
| F_fleet_4_YR_1972_s_1 | 0.1232 | 0.0160 | Estimated |
| F_fleet_4_YR_1973_s_1 | 0.1249 | 0.0163 | Estimated |
| F_fleet_4_YR_1974_s_1 | 0.1259 | 0.0164 | Estimated |
| F_fleet_4_YR_1975_s_1 | 0.0975 | 0.0127 | Estimated |
| F_fleet_4_YR_1976_s_1 | 0.1281 | 0.0166 | Estimated |
| F_fleet_4_YR_1977_s_1 | 0.1487 | 0.0192 | Estimated |
| F_fleet_4_YR_1978_s_1 | 0.1805 | 0.0229 | Estimated |
| F_fleet_4_YR_1979_s_1 | 0.1745 | 0.0219 | Estimated |
| F_fleet_4_YR_1980_s_1 | 0.1526 | 0.0194 | Estimated |
| F_fleet_4_YR_1981_s_1 | 0.2299 | 0.0289 | Estimated |
| F_fleet_4_YR_1982_s_1 | 0.2116 | 0.0266 | Estimated |
| F_fleet_4_YR_1983_s_1 | 0.2303 | 0.0286 | Estimated |
| F_fleet_4_YR_1984_s_1 | 0.2222 | 0.0273 | Estimated |
| F_fleet_4_YR_1985_s_1 | 0.2330 | 0.0286 | Estimated |
| F_fleet_4_YR_1986_s_1 | 0.2497 | 0.0313 | Estimated |
| F_fleet_4_YR_1987_s_1 | 0.2842 | 0.0359 | Estimated |
| F_fleet_4_YR_1988_s_1 | 0.2094 | 0.0269 | Estimated |
| F_fleet_4_YR_1989_s_1 | 0.2598 | 0.0328 | Estimated |
| F_fleet_4_YR_1990_s_1 | 0.2831 | 0.0353 | Estimated |
| F_fleet_4_YR_1991_s_1 | 0.2736 | 0.0339 | Estimated |
| F_fleet_4_YR_1992_s_1 | 0.2706 | 0.0337 | Estimated |
| F_fleet_4_YR_1993_s_1 | 0.2269 | 0.0288 | Estimated |
| F_fleet_4_YR_1994_s_1 | 0.2449 | 0.0312 | Estimated |
| F_fleet_4_YR_1995_s_1 | 0.2030 | 0.0261 | Estimated |
| F_fleet_4_YR_1996_s_1 | 0.2187 | 0.0279 | Estimated |
| F_fleet_4_YR_1997_s_1 | 0.2201 | 0.0281 | Estimated |
| F_fleet_4_YR_1998_s_1 | 0.2332 | 0.0295 | Estimated |
| F_fleet_4_YR_1999_s_1 | 0.2478 | 0.0312 | Estimated |
| F_fleet_4_YR_2000_s_1 | 0.2176 | 0.0276 | Estimated |
| F_fleet_4_YR_2001_s_1 | 0.2078 | 0.0264 | Estimated |
| F_fleet_4_YR_2002_s_1 | 0.1863 | 0.0238 | Estimated |

| | | | |
|---|---|---|---|
| F_fleet_4_YR_2003_s_1 | 0.1498 | 0.0193 | Estimated |
| F_fleet_4_YR_2004_s_1 | 0.1152 | 0.0150 | Estimated |
| F_fleet_4_YR_2005_s_1 | 0.0672 | 0.0088 | Estimated |
| F_fleet_4_YR_2006_s_1 | 0.0906 | 0.0118 | Estimated |
| F_fleet_4_YR_2007_s_1 | 0.0880 | 0.0115 | Estimated |
| F_fleet_4_YR_2008_s_1 | 0.0750 | 0.0098 | Estimated |
| F_fleet_4_YR_2009_s_1 | 0.0872 | 0.0114 | Estimated |
| F_fleet_4_YR_2010_s_1 | 0.0614 | 0.0080 | Estimated |
| F_fleet_4_YR_2011_s_1 | 0.0572 | 0.0075 | Estimated |
| Retain_2P_1_Com_RR_2 | 30.0000 | - | Fixed |
| Retain_2P_1_Com_RR_2_BLK2repl_1886 | 20.1669 | 15.2547 | |
| Retain_2P_1_Com_RR_2_BLK2repl_1993 | 30.3991 | 7.0037 | |
| Retain_2P_2_Com_RR_2 | 4.5000 | - | Fixed |
| Retain_2P_2_Com_RR_2_BLK2repl_1886 | 0.0500 | | Fixed |
| Retain_2P_2_Com_RR_2_BLK2repl_1993 | 12.5286 | 5.0116 | |
| Retain_2P_3_Com_RR_2 | 0.9900 | - | Fixed |
| Retain_2P_4_Com_RR_2 | 0.0000 | - | Fixed |
| Retain_3P_1_REC_3 | 30.0000 | - | Fixed |
| Retain_3P_1_REC_3_BLK2repl_1886 | 30.9248 | 0.3293 | |
| Retain_3P_1_REC_3_BLK2repl_1993 | 38.2921 | 0.3227 | |
| Retain_3P_2_REC_3 | 4.5000 | - | Fixed |
| Retain_3P_2_REC_3_BLK2repl_1886 | 1.8394 | 0.2195 | |
| Retain_3P_2_REC_3_BLK2repl_1993 | 4.3462 | 0.2510 | |
| Retain_3P_3_REC_3 | 0.9900 | - | Fixed |
| Retain_3P_4_REC_3 | 0.0000 | - | Fixed |
| SizeSel_1P_1_Com_GN_1 | 45.0000 | 550.5697 | |
| SizeSel_1P_1_Com_GN_1_BLK1repl_1886 | 47.9997 | 0.7073 | |
| SizeSel_1P_1_Com_GN_1_BLK1repl_2006 | 39.4711 | 0.8399 | |
| SizeSel_1P_2_Com_GN_1 | -0.0069 | 440.4270 | |
| SizeSel_1P_2_Com_GN_1_BLK1repl_1886 | -1.4708 | 86.8076 | |
| SizeSel_1P_2_Com_GN_1_BLK1repl_2006 | -8.9516 | 70.9321 | |
| SizeSel_1P_3_Com_GN_1 | -2.4992 | 385.3976 | |
| SizeSel_1P_3_Com_GN_1_BLK1repl_1886 | 4.2890 | 0.1084 | |
| SizeSel_1P_3_Com_GN_1_BLK1repl_2006 | 3.8209 | 0.1793 | |
| SizeSel_1P_4_Com_GN_1 | 6.5003 | 187.0025 | |
| SizeSel_1P_4_Com_GN_1_BLK1repl_1886 | 5.5912 | 83.5751 | |
| SizeSel_1P_4_Com_GN_1_BLK1repl_2006 | 5.9615 | 0.3410 | |
| SizeSel_1P_5_Com_GN_1 | -999.0000 | - | Fixed |
| SizeSel_1P_6_Com_GN_1 | -999.0000 | - | Fixed |
| SizeSel_2P_1_Com_RR_2 | 55.0000 | - | Fixed |
| SizeSel_2P_2_Com_RR_2 | 10.0000 | - | Fixed |

| | | | |
|---|---|---|---|
| SizeSel_2P_3_Com_RR_2 | 5.0826 | 0.0677 | |
| SizeSel_2P_4_Com_RR_2 | -4.0000 | - | Fixed |
| SizeSel_2P_5_Com_RR_2 | -999.0000 | - | Fixed |
| SizeSel_2P_6_Com_RR_2 | 15.0000 | - | Fixed |
| SizeSel_3P_1_REC_3 | 39.5705 | 1.5942 | |
| SizeSel_3P_2_REC_3 | 10.0000 | - | Fixed |
| SizeSel_3P_3_REC_3 | 5.2031 | 0.2301 | |
| SizeSel_3P_4_REC_3 | -4.0000 | - | Fixed |
| SizeSel_3P_5_REC_3 | -999.0000 | - | Fixed |
| SizeSel_3P_6_REC_3 | 15.0000 | - | Fixed |
| SizeSel_4P_1_Shrimp_Bycatch_4 | 19.2485 | 1.1964 | |
| SizeSel_4P_2_Shrimp_Bycatch_4 | -8.5231 | 45.4199 | |
| SizeSel_4P_3_Shrimp_Bycatch_4 | 4.3293 | 0.3113 | |
| SizeSel_4P_4_Shrimp_Bycatch_4 | 7.1210 | 0.2288 | |
| SizeSel_4P_5_Shrimp_Bycatch_4 | -999.0000 | - | Fixed |
| SizeSel_4P_6_Shrimp_Bycatch_4 | -999.0000 | - | Fixed |

Table 3.4. Summary results for Gulf of Mexico Spanish mackerel for model convergence level, total likelihood, , unfished spawning biomass (R0), SSB@30%SPR (SSB_SPRTtgt), predicted spawning stock biomass in 2011 (SSB_2011, whole weight, mtons), predicted spawning potential ratio 2011 (SPR_2011), F_SPRTtgt (equals F30%SPR), Fcurrent), SSB_REF and F_REF from the SS jitter analysis for Run 3 Model Configuration (estimate steepness and M=0.38 $y^{-1}$). Fcurrent = geometric mean of F in 2009 through 2011. SSB_REF = SSB_2011 / SSB_MSST. MSST = (1.0-M) * SSB@30%SPR. F_REF= Fcurrent /F_SPRTtgt .

| Run_ID | Convergence | Likelihood | R0 | Virgin_Biomass | SSB_SPRTtgt | SSB_2011 | SPR_2011 | F_SPRTtgt | F_CURRENT | SSB_REF | F_REF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.0193208 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 2 | 0.025521 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 8 | 0.00735732 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 12 | 0.0084232 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 16 | 0.00112108 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 20 | 0.00448941 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 22 | 0.0247162 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 23 | 0.00283252 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 27 | 0.017825 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 35 | 0.0100494 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 38 | 0.0249437 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 41 | 0.0156508 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 42 | 0.00126917 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 48 | 0.00347047 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 51 | 0.0149252 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 52 | 0.0010587 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 54 | 0.00264981 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 56 | 0.00882105 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 57 | 0.0010074 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 58 | 0.00492613 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 59 | 0.0106461 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 60 | 0.000502046 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 61 | 0.00165795 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 63 | 0.00610258 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 65 | 0.00315178 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 68 | 0.00433998 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 72 | 0.0134151 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 73 | 0.00704818 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 74 | 0.0360098 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 77 | 0.0122285 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 79 | 0.00619656 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 80 | 0.00160841 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 82 | 0.00619887 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 89 | 0.0358414 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 90 | 0.00117738 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 92 | 0.00281103 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 93 | 0.0161329 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 94 | 0.0257107 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 95 | 0.00104386 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 96 | 0.0179732 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 98 | 0.00051994 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 99 | 0.00405368 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 5 | 0.0195468 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 10 | 0.00707724 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 15 | 0.00716685 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 18 | 0.00188561 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 25 | 0.0228218 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 33 | 0.00405331 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 44 | 0.0060942 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 49 | 0.00953289 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 0.00408325 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 62 | 0.0207567 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 66 | 0.010683 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 69 | 0.00229862 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 91 | 0.0951241 | 4252 | 10.7781 | 41800 | 10589 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 97 | 0.000652747 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 100 | 0.000870326 | 4252 | 10.7781 | 41801 | 10590 | 19419 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 7 | 0.0269314 | 4252 | 10.7781 | 41802 | 10590 | 19420 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 26 | 0.00584864 | 4252 | 10.7781 | 41802 | 10590 | 19420 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 37 | 0.0557999 | 4252 | 10.7781 | 41802 | 10590 | 19420 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 40 | 0.0060555 | 4252 | 10.7781 | 41802 | 10590 | 19420 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 64 | 0.0168041 | 4252 | 10.7781 | 41802 | 10590 | 19420 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 86 | 0.0211252 | 4252 | 10.7781 | 41802 | 10590 | 19420 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 88 | 0.0114211 | 4252 | 10.7781 | 41802 | 10590 | 19420 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 11 | 0.00118265 | 4252 | 10.7781 | 41804 | 10590 | 19423 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 29 | 0.00707389 | 4252 | 10.7781 | 41804 | 10590 | 19423 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 30 | 0.00572288 | 4252 | 10.7781 | 41804 | 10590 | 19423 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 43 | 0.0178268 | 4252 | 10.7781 | 41804 | 10590 | 19423 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 53 | 0.000777517 | 4252 | 10.7781 | 41804 | 10590 | 19423 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 84 | 0.00211714 | 4252 | 10.7781 | 41804 | 10590 | 19423 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 55 | 765.026 | 4252 | 10.7783 | 41818 | 10594 | 19430 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 19 | 0.00164353 | 4252 | 10.7782 | 41811 | 10592 | 19428 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 28 | 0.00129209 | 4252 | 10.7782 | 41811 | 10592 | 19428 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 31 | 0.0248992 | 4252 | 10.7782 | 41811 | 10592 | 19428 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 32 | 0.00833836 | 4252 | 10.7782 | 41811 | 10592 | 19428 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 34 | 0.00661328 | 4252 | 10.7782 | 41811 | 10592 | 19428 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 45 | 0.0225048 | 4252 | 10.7782 | 41811 | 10592 | 19428 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 81 | 0.0162646 | 4252 | 10.7782 | 41811 | 10592 | 19428 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0.00740524 | 4253 | 10.7783 | 41824 | 10596 | 19438 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 67 | 0.0125651 | 4253 | 10.7783 | 41824 | 10596 | 19438 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 70 | 0.0225829 | 4253 | 10.7783 | 41824 | 10596 | 19438 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 76 | 0.00176639 | 4253 | 10.7783 | 41824 | 10596 | 19438 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 46 | 0.0345288 | 4257 | 10.7751 | 41515 | 10517 | 19237 | 0.60 | 0.35 | 0.14 | 2.95 | 0.39 |
| 13 | 0.0789689 | 4258 | 10.7739 | 41368 | 10480 | 19224 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 24 | 0.044589 | 4258 | 10.774 | 41371 | 10481 | 19227 | 0.60 | 0.35 | 0.14 | 2.96 | 0.39 |
| 3 | 0.0139188 | 4262 | 10.7684 | 40812 | 10339 | 18998 | 0.60 | 0.36 | 0.14 | 2.96 | 0.39 |
| 4 | 0.029232 | 4262 | 10.7684 | 40812 | 10339 | 18998 | 0.60 | 0.36 | 0.14 | 2.96 | 0.39 |
| 6 | 0.0203405 | 4262 | 10.7684 | 40812 | 10339 | 18998 | 0.60 | 0.36 | 0.14 | 2.96 | 0.39 |
| 39 | 0.0105513 | 4262 | 10.7684 | 40812 | 10339 | 18998 | 0.60 | 0.36 | 0.14 | 2.96 | 0.39 |
| 47 | 0.0103614 | 4262 | 10.7684 | 40812 | 10339 | 18998 | 0.60 | 0.36 | 0.14 | 2.96 | 0.39 |
| 83 | 0.057487 | 4262 | 10.7684 | 40812 | 10339 | 18998 | 0.60 | 0.36 | 0.14 | 2.96 | 0.39 |
| 21 | 331.538 | 4262 | 10.7684 | 40812 | 10339 | 18997 | 0.60 | 0.36 | 0.14 | 2.96 | 0.39 |
| 14 | 0.0092814 | 4263 | 10.7684 | 40813 | 10339 | 18999 | 0.60 | 0.36 | 0.14 | 2.96 | 0.39 |
| 87 | 0.0735974 | 4263 | 10.7684 | 40814 | 10339 | 18999 | 0.60 | 0.36 | 0.14 | 2.96 | 0.39 |
| 75 | 0.00707711 | 4278 | 10.8439 | 44374 | 11242 | 21600 | 0.61 | 0.36 | 0.14 | 3.10 | 0.39 |
| 17 | 0.0299497 | 4713 | 10.8116 | 44214 | 11201 | 21831 | 0.64 | 0.37 | 0.11 | 3.14 | 0.30 |
| 71 | 0.0216508 | 14808 | 9.96449 | 17963 | 4551 | 3540 | 0.31 | 0.51 | 0.35 | 1.25 | 0.69 |
| 85 | 0.256915 | 16537 | 10.787 | 40793 | 10334 | 22788 | 0.67 | 0.37 | 0.10 | 3.56 | 0.28 |
| 36 | 0.103999 | 18592 | 10.8868 | 37471 | 9493 | 28724 | 0.77 | 0.43 | 0.08 | 4.88 | 0.18 |
| 78 | 2533350 | 20531 | 17.7961 | 30666000 | 7792330 | 70036900 | 1.00 | 0.54 | 0.00 | 14.50 | 0.00 |

Table 3.5. Predicted total biomass (whole weight mtons), spawning biomass (whole weight mtons), age-0 recruits (thousand fish), and fishing mortality for Gulf of Mexico Spanish mackerel from SS Model 3 Run.

| Year | Total Biomass | Spawning Biomass | Recruits | Fishing Mortality |
|---|---|---|---|---|
| Virgin | 55,126 | 40,812 | 47,495 | 0.0000 |
| 1886 | 55,126 | 40,812 | 47,495 | 0.0007 |
| 1887 | 55,098 | 40,790 | 47,494 | 0.0013 |
| 1888 | 55,047 | 40,748 | 47,491 | 0.0026 |
| 1889 | 54,953 | 40,670 | 47,485 | 0.0050 |
| 1890 | 54,776 | 40,524 | 47,474 | 0.0058 |
| 1891 | 54,602 | 40,379 | 47,464 | 0.0058 |
| 1892 | 54,465 | 40,264 | 47,455 | 0.0058 |
| 1893 | 54,358 | 40,173 | 47,448 | 0.0058 |
| 1894 | 54,274 | 40,102 | 47,443 | 0.0058 |
| 1895 | 54,210 | 40,047 | 47,439 | 0.0058 |
| 1896 | 54,160 | 40,005 | 47,436 | 0.0058 |
| 1897 | 54,122 | 39,972 | 47,433 | 0.0063 |
| 1898 | 54,072 | 39,930 | 47,430 | 0.0082 |
| 1899 | 53,953 | 39,832 | 47,422 | 0.0083 |
| 1900 | 53,859 | 39,753 | 47,416 | 0.0083 |
| 1901 | 53,784 | 39,690 | 47,412 | 0.0083 |
| 1902 | 53,726 | 39,641 | 47,408 | 0.0135 |
| 1903 | 53,467 | 39,428 | 47,391 | 0.0131 |
| 1904 | 53,278 | 39,270 | 47,379 | 0.0131 |
| 1905 | 53,128 | 39,144 | 47,369 | 0.0132 |
| 1906 | 53,011 | 39,044 | 47,361 | 0.0132 |
| 1907 | 52,920 | 38,967 | 47,355 | 0.0132 |
| 1908 | 52,850 | 38,907 | 47,351 | 0.0129 |
| 1909 | 52,812 | 38,874 | 47,348 | 0.0136 |
| 1910 | 52,754 | 38,825 | 47,344 | 0.0158 |
| 1911 | 52,620 | 38,716 | 47,335 | 0.0180 |
| 1912 | 52,426 | 38,556 | 47,322 | 0.0202 |
| 1913 | 52,184 | 38,355 | 47,306 | 0.0225 |
| 1914 | 51,903 | 38,122 | 47,287 | 0.0248 |
| 1915 | 51,592 | 37,864 | 47,265 | 0.0272 |
| 1916 | 51,258 | 37,586 | 47,242 | 0.0296 |
| 1917 | 50,906 | 37,293 | 47,217 | 0.0312 |

| | | | | |
|---|---|---|---|---|
| 1918 | 50,575 | 37,016 | 47,193 | 0.0318 |
| 1919 | 50,296 | 36,782 | 47,172 | 0.0326 |
| 1920 | 50,053 | 36,577 | 47,154 | 0.0338 |
| 1921 | 49,824 | 36,386 | 47,137 | 0.0352 |
| 1922 | 49,599 | 36,197 | 47,120 | 0.0354 |
| 1923 | 49,418 | 36,045 | 47,106 | 0.0358 |
| 1924 | 49,267 | 35,919 | 47,094 | 0.0380 |
| 1925 | 49,071 | 35,756 | 47,079 | 0.0405 |
| 1926 | 48,825 | 35,553 | 47,060 | 0.0432 |
| 1927 | 48,538 | 35,316 | 47,038 | 0.0450 |
| 1928 | 48,253 | 35,079 | 47,015 | 0.0313 |
| 1929 | 48,537 | 35,302 | 47,037 | 0.0337 |
| 1930 | 48,681 | 35,419 | 47,048 | 0.0394 |
| 1931 | 48,582 | 35,341 | 47,040 | 0.0224 |
| 1932 | 49,130 | 35,785 | 47,082 | 0.0273 |
| 1933 | 49,386 | 35,998 | 47,102 | 0.0297 |
| 1934 | 49,491 | 36,091 | 47,110 | 0.0327 |
| 1935 | 49,458 | 36,068 | 47,108 | 0.0403 |
| 1936 | 49,139 | 35,812 | 47,085 | 0.0490 |
| 1937 | 48,563 | 35,342 | 47,040 | 0.0375 |
| 1938 | 48,541 | 35,316 | 47,038 | 0.0388 |
| 1939 | 48,488 | 35,268 | 47,033 | 0.0405 |
| 1940 | 48,387 | 35,184 | 47,025 | 0.0349 |
| 1941 | 48,514 | 35,284 | 47,035 | 0.0012 |
| 1942 | 49,863 | 36,375 | 47,136 | 0.0012 |
| 1943 | 50,966 | 37,285 | 47,216 | 0.0012 |
| 1944 | 51,849 | 38,024 | 47,279 | 0.0011 |
| 1945 | 52,547 | 38,614 | 47,327 | 0.0008 |
| 1946 | 53,106 | 39,088 | 47,365 | 0.0015 |
| 1947 | 53,506 | 39,432 | 47,392 | 0.0030 |
| 1948 | 53,719 | 39,629 | 47,407 | 0.0127 |
| 1949 | 53,408 | 39,411 | 47,390 | 0.0413 |
| 1950 | 51,890 | 38,211 | 47,294 | 0.0374 |
| 1951 | 50,709 | 37,291 | 47,217 | 0.0770 |
| 1952 | 48,136 | 35,234 | 47,030 | 0.0650 |
| 1953 | 46,551 | 33,957 | 46,904 | 0.0524 |
| 1954 | 45,758 | 33,310 | 46,836 | 0.0590 |
| 1955 | 44,810 | 32,568 | 46,756 | 0.0629 |
| 1956 | 43,867 | 31,827 | 46,672 | 0.0872 |

| | | | | |
|---|---|---|---|---|
| 1957 | 42,182 | 30,512 | 46,514 | 0.1054 |
| 1958 | 40,191 | 28,948 | 46,309 | 0.1262 |
| 1959 | 37,864 | 27,141 | 46,046 | 0.1470 |
| 1960 | 35,458 | 25,245 | 45,733 | 0.1655 |
| 1961 | 33,233 | 23,459 | 45,397 | 0.1294 |
| 1962 | 32,879 | 23,051 | 45,313 | 0.1997 |
| 1963 | 30,725 | 21,380 | 44,942 | 0.1980 |
| 1964 | 29,126 | 20,161 | 44,638 | 0.1969 |
| 1965 | 27,837 | 19,208 | 44,376 | 0.1849 |
| 1966 | 27,469 | 18,827 | 44,265 | 0.2140 |
| 1967 | 26,871 | 18,265 | 44,093 | 0.2116 |
| 1968 | 26,505 | 17,963 | 43,997 | 0.2472 |
| 1969 | 25,473 | 17,190 | 43,739 | 0.2823 |
| 1970 | 24,044 | 16,111 | 43,342 | 0.2708 |
| 1971 | 23,515 | 15,635 | 43,153 | 0.2761 |
| 1972 | 23,091 | 15,293 | 43,010 | 0.2862 |
| 1973 | 22,422 | 14,842 | 42,813 | 0.2911 |
| 1974 | 21,793 | 14,397 | 42,609 | 0.3458 |
| 1975 | 20,510 | 13,429 | 42,127 | 0.2881 |
| 1976 | 20,686 | 13,512 | 42,170 | 0.3563 |
| 1977 | 19,709 | 12,801 | 41,781 | 0.2692 |
| 1978 | 20,069 | 13,132 | 41,967 | 0.2693 |
| 1979 | 20,028 | 13,194 | 42,001 | 0.2736 |
| 1980 | 19,865 | 13,104 | 41,951 | 0.2543 |
| 1981 | 20,130 | 13,278 | 42,046 | 0.3406 |
| 1982 | 18,702 | 12,299 | 41,485 | 0.3871 |
| 1983 | 17,113 | 11,122 | 40,704 | 0.3516 |
| 1984 | 16,498 | 10,680 | 40,376 | 0.3203 |
| 1985 | 16,708 | 10,706 | 56,448 | 0.3162 |
| 1986 | 18,325 | 11,660 | 35,246 | 0.5064 |
| 1987 | 14,975 | 9,623 | 27,792 | 0.3882 |
| 1988 | 13,175 | 8,612 | 32,320 | 0.3323 |
| 1989 | 13,127 | 8,404 | 52,435 | 0.4101 |
| 1990 | 14,457 | 8,889 | 51,677 | 0.4211 |
| 1991 | 15,698 | 9,578 | 58,146 | 0.4356 |
| 1992 | 16,816 | 10,422 | 23,534 | 0.4091 |
| 1993 | 14,456 | 9,389 | 31,107 | 0.3563 |
| 1994 | 13,330 | 8,806 | 15,973 | 0.3673 |
| 1995 | 11,004 | 7,347 | 34,627 | 0.3263 |

| | | | | |
|---|---|---|---|---|
| 1996 | 11,502 | 7,370 | 36,610 | 0.3159 |
| 1997 | 12,573 | 7,970 | 29,319 | 0.2984 |
| 1998 | 13,131 | 8,315 | 55,205 | 0.3247 |
| 1999 | 15,531 | 9,675 | 36,051 | 0.3309 |
| 2000 | 15,777 | 10,048 | 41,648 | 0.3137 |
| 2001 | 16,348 | 10,488 | 39,707 | 0.3494 |
| 2002 | 16,139 | 10,392 | 35,722 | 0.2961 |
| 2003 | 16,343 | 10,567 | 45,872 | 0.2595 |
| 2004 | 18,023 | 11,572 | 42,824 | 0.2401 |
| 2005 | 19,664 | 12,712 | 40,021 | 0.1516 |
| 2006 | 22,041 | 14,563 | 28,879 | 0.1776 |
| 2007 | 22,099 | 14,917 | 51,485 | 0.1525 |
| 2008 | 24,265 | 16,247 | 40,295 | 0.1611 |
| 2009 | 25,251 | 17,093 | 31,216 | 0.1572 |
| 2010 | 25,053 | 17,111 | 66,096 | 0.1401 |
| 2011 | 28,367 | 18,998 | 31,500 | 0.1197 |

Table 3.6. Fleet-specific estimates of fishing mortality rate in terms of exploitable biomass for Gulf of Mexico Spanish mackerel from SS for the Run 3 model (steepness =0.8, M=0.38).

| | | Fleet Continuous Fishing Mortality | | | |
|---|---|---|---|---|---|
| **Year** | **Annual Exploitation Rate** | **Com_GN** | **Com_RR** | **REC** | **Shrimp_Bycatch** |
| 1886 | 0.0007 | 0.0008 | 0.0001 | | |
| 1887 | 0.0013 | 0.0016 | 0.0001 | | |
| 1888 | 0.0026 | 0.0032 | 0.0002 | | |
| 1889 | 0.0050 | 0.0062 | 0.0004 | | |
| 1890 | 0.0058 | 0.0072 | 0.0005 | | |
| 1891 | 0.0058 | 0.0076 | 0.0001 | | |
| 1892 | 0.0058 | 0.0076 | 0.0001 | | |
| 1893 | 0.0058 | 0.0076 | 0.0001 | | |
| 1894 | 0.0058 | 0.0076 | 0.0001 | | |
| 1895 | 0.0058 | 0.0076 | 0.0001 | | |
| 1896 | 0.0058 | 0.0076 | 0.0001 | | |
| 1897 | 0.0063 | 0.0079 | 0.0005 | | |
| 1898 | 0.0082 | 0.0103 | 0.0007 | | |
| 1899 | 0.0083 | 0.0103 | 0.0007 | | |
| 1900 | 0.0083 | 0.0103 | 0.0007 | | |
| 1901 | 0.0083 | 0.0104 | 0.0007 | | |
| 1902 | 0.0135 | 0.0169 | 0.0012 | | |
| 1903 | 0.0131 | 0.0164 | 0.0011 | | |
| 1904 | 0.0131 | 0.0165 | 0.0011 | | |
| 1905 | 0.0132 | 0.0166 | 0.0011 | | |
| 1906 | 0.0132 | 0.0166 | 0.0011 | | |
| 1907 | 0.0132 | 0.0166 | 0.0011 | | |
| 1908 | 0.0129 | 0.0161 | 0.0011 | | |
| 1909 | 0.0136 | 0.0170 | 0.0013 | | |
| 1910 | 0.0158 | 0.0198 | 0.0015 | | |
| 1911 | 0.0180 | 0.0226 | 0.0016 | | |
| 1912 | 0.0202 | 0.0255 | 0.0018 | | |
| 1913 | 0.0225 | 0.0285 | 0.0020 | | |
| 1914 | 0.0248 | 0.0315 | 0.0021 | | |
| 1915 | 0.0272 | 0.0346 | 0.0023 | | |
| 1916 | 0.0296 | 0.0377 | 0.0025 | | |
| 1917 | 0.0312 | 0.0397 | 0.0027 | | |
| 1918 | 0.0318 | 0.0406 | 0.0028 | | |
| 1919 | 0.0326 | 0.0416 | 0.0029 | | |

| | | | | | |
|---|---|---|---|---|---|
| 1920 | 0.0338 | 0.0433 | 0.0029 | | |
| 1921 | 0.0352 | 0.0450 | 0.0031 | | |
| 1922 | 0.0354 | 0.0453 | 0.0031 | | |
| 1923 | 0.0358 | 0.0458 | 0.0032 | | |
| 1924 | 0.0380 | 0.0488 | 0.0033 | | |
| 1925 | 0.0405 | 0.0522 | 0.0035 | | |
| 1926 | 0.0432 | 0.0557 | 0.0037 | | |
| 1927 | 0.0450 | 0.0580 | 0.0041 | | |
| 1928 | 0.0313 | 0.0402 | 0.0028 | | |
| 1929 | 0.0337 | 0.0432 | 0.0030 | | |
| 1930 | 0.0394 | 0.0507 | 0.0035 | | |
| 1931 | 0.0224 | 0.0286 | 0.0020 | | |
| 1932 | 0.0273 | 0.0349 | 0.0024 | | |
| 1933 | 0.0297 | 0.0380 | 0.0026 | | |
| 1934 | 0.0327 | 0.0418 | 0.0029 | | |
| 1935 | 0.0403 | 0.0518 | 0.0035 | | |
| 1936 | 0.0490 | 0.0632 | 0.0044 | | |
| 1937 | 0.0375 | 0.0482 | 0.0034 | | |
| 1938 | 0.0388 | 0.0498 | 0.0035 | | |
| 1939 | 0.0405 | 0.0521 | 0.0036 | | |
| 1940 | 0.0349 | 0.0448 | 0.0031 | | |
| 1941 | 0.0012 | 0.0010 | 0.0007 | | |
| 1942 | 0.0012 | 0.0010 | 0.0007 | | |
| 1943 | 0.0012 | 0.0010 | 0.0007 | | |
| 1944 | 0.0011 | 0.0009 | 0.0007 | | |
| 1945 | 0.0008 | 0.0010 | 0.0001 | | 0.0001 |
| 1946 | 0.0015 | 0.0009 | 0.0006 | | 0.0007 |
| 1947 | 0.0030 | 0.0009 | 0.0006 | | 0.0034 |
| 1948 | 0.0127 | 0.0096 | 0.0007 | | 0.0089 |
| 1949 | 0.0413 | 0.0421 | 0.0029 | | 0.0144 |
| 1950 | 0.0374 | 0.0290 | 0.0020 | | 0.0257 |
| 1951 | 0.0770 | 0.0762 | 0.0053 | | 0.0326 |
| 1952 | 0.0650 | 0.0556 | 0.0039 | | 0.0385 |
| 1953 | 0.0524 | 0.0379 | 0.0026 | | 0.0398 |
| 1954 | 0.0590 | 0.0375 | 0.0026 | | 0.0518 |
| 1955 | 0.0629 | 0.0217 | 0.0015 | 0.0184 | 0.0512 |
| 1956 | 0.0872 | 0.0402 | 0.0028 | 0.0210 | 0.0657 |
| 1957 | 0.1054 | 0.0530 | 0.0037 | 0.0240 | 0.0767 |
| 1958 | 0.1262 | 0.0598 | 0.0042 | 0.0274 | 0.0993 |
| 1959 | 0.1470 | 0.0783 | 0.0055 | 0.0314 | 0.1067 |
| 1960 | 0.1655 | 0.0991 | 0.0070 | 0.0357 | 0.1066 |

| | | | | | |
|---|---|---|---|---|---|
| 1961 | 0.1294 | 0.0771 | 0.0055 | 0.0373 | 0.0658 |
| 1962 | 0.1997 | 0.1454 | 0.0035 | 0.0389 | 0.1132 |
| 1963 | 0.1980 | 0.1239 | 0.0022 | 0.0417 | 0.1279 |
| 1964 | 0.1969 | 0.0925 | 0.0050 | 0.0443 | 0.1502 |
| 1965 | 0.1849 | 0.1180 | 0.0087 | 0.0463 | 0.0974 |
| 1966 | 0.2140 | 0.1787 | 0.0106 | 0.0485 | 0.0822 |
| 1967 | 0.2116 | 0.1556 | 0.0093 | 0.0506 | 0.0982 |
| 1968 | 0.2472 | 0.1970 | 0.0087 | 0.0536 | 0.1144 |
| 1969 | 0.2823 | 0.2441 | 0.0079 | 0.0580 | 0.1244 |
| 1970 | 0.2708 | 0.2558 | 0.0103 | 0.0621 | 0.0877 |
| 1971 | 0.2761 | 0.2442 | 0.0111 | 0.0684 | 0.0986 |
| 1972 | 0.2862 | 0.2063 | 0.0187 | 0.0754 | 0.1329 |
| 1973 | 0.2911 | 0.2120 | 0.0058 | 0.0837 | 0.1342 |
| 1974 | 0.3458 | 0.2812 | 0.0320 | 0.0938 | 0.1363 |
| 1975 | 0.2881 | 0.1875 | 0.0377 | 0.1020 | 0.1052 |
| 1976 | 0.3563 | 0.2777 | 0.0409 | 0.1037 | 0.1388 |
| 1977 | 0.2692 | 0.0803 | 0.0319 | 0.1048 | 0.1610 |
| 1978 | 0.2693 | 0.0435 | 0.0283 | 0.1049 | 0.1954 |
| 1979 | 0.2736 | 0.0798 | 0.0033 | 0.1068 | 0.1884 |
| 1980 | 0.2543 | 0.0713 | 0.0047 | 0.1072 | 0.1643 |
| 1981 | 0.3406 | 0.1406 | 0.0097 | 0.1010 | 0.2493 |
| 1982 | 0.3871 | 0.1455 | 0.0098 | 0.1801 | 0.2276 |
| 1983 | 0.3516 | 0.1023 | 0.0089 | 0.1342 | 0.2489 |
| 1984 | 0.3203 | 0.1713 | 0.0032 | 0.0529 | 0.2374 |
| 1985 | 0.3162 | 0.0971 | 0.0038 | 0.0632 | 0.2509 |
| 1986 | 0.5064 | 0.1389 | 0.0020 | 0.3433 | 0.2680 |
| 1987 | 0.3882 | 0.1502 | 0.0161 | 0.1127 | 0.3030 |
| 1988 | 0.3323 | 0.1389 | 0.0019 | 0.1038 | 0.2255 |
| 1989 | 0.4101 | 0.1968 | 0.0045 | 0.0799 | 0.2793 |
| 1990 | 0.4211 | 0.1636 | 0.0014 | 0.0974 | 0.3040 |
| 1991 | 0.4356 | 0.1944 | 0.0121 | 0.0957 | 0.2954 |
| 1992 | 0.4091 | 0.2054 | 0.0027 | 0.1287 | 0.2917 |
| 1993 | 0.3563 | 0.1441 | 0.0024 | 0.1478 | 0.2445 |
| 1994 | 0.3673 | 0.1692 | 0.0021 | 0.1631 | 0.2616 |
| 1995 | 0.3263 | 0.1031 | 0.0022 | 0.1422 | 0.2167 |
| 1996 | 0.3159 | 0.0272 | 0.0030 | 0.1604 | 0.2358 |
| 1997 | 0.2984 | 0.0336 | 0.0041 | 0.1447 | 0.2361 |
| 1998 | 0.3247 | 0.0255 | 0.0049 | 0.1257 | 0.2509 |
| 1999 | 0.3309 | 0.0462 | 0.0052 | 0.1488 | 0.2662 |
| 2000 | 0.3137 | 0.0455 | 0.0033 | 0.1552 | 0.2339 |
| 2001 | 0.3494 | 0.0564 | 0.0061 | 0.2214 | 0.2259 |

| | | | | | |
|---|---|---|---|---|---|
| 2002 | 0.2961 | 0.0459 | 0.0029 | 0.1755 | 0.2013 |
| 2003 | 0.2595 | 0.0667 | 0.0031 | 0.1302 | 0.1615 |
| 2004 | 0.2401 | 0.0460 | 0.0028 | 0.1673 | 0.1239 |
| 2005 | 0.1516 | 0.0565 | 0.0020 | 0.0835 | 0.0728 |
| 2006 | 0.1776 | 0.0432 | 0.0031 | 0.1127 | 0.0979 |
| 2007 | 0.1525 | 0.0290 | 0.0013 | 0.0843 | 0.0948 |
| 2008 | 0.1611 | 0.0345 | 0.0037 | 0.1115 | 0.0810 |
| 2009 | 0.1572 | 0.0499 | 0.0031 | 0.0853 | 0.0939 |
| 2010 | 0.1401 | 0.0316 | 0.0056 | 0.0890 | 0.0664 |
| 2011 | 0.1197 | 0.0309 | 0.0044 | 0.0773 | 0.0620 |

Table 3.7. Summary of SS results from sensitivity and retrospective analysis runs for Gulf of Mexico Spanish mackerel. Results include steepness; virgin recruitment (thousand fish, R0), virgin total biomass (B0), total biomass 2011(Bcurrent), virgin spawning biomass (SSB_UNFISHED= SSB_BO), 2011 spawning biomass (SSB-2011), spawning potential ratio (SPR_2011). For the retrospective runs values for '2011" were the terminal year in the run (i.e., 2006 retrospective terminal year = 2006). Weight units are whole weight mtons.

| Run ID | Name | Steepness | R0 | B0 | B_2011 | SSB_UNFISHED | SSB_2011 | SSB_2011 / SB_BO | SPR-2011 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Run 1 Configuration | 0.52 | 83,068 | 96,695 | 17,280 | 71,934 | 11,195 | 0.16 | 0.51 |
| 2 | Run 1 Configuration, Steepness=0.9 | 0.9 | 47,495 | 55,126 | 28,367 | 40,812 | 18,998 | 0.47 | 0.60 |
| 3 | Run 1 Configuration, Steepness=0.8 | 0.8 | 43,839 | 51,390 | 29,262 | 38,217 | 19,645 | 0.51 | 0.60 |
| 4 | Run 1 Configuration, Steepness=0.7 | 0.7 | 54,514 | 63,852 | 27,248 | 47,517 | 18,235 | 0.38 | 0.59 |
| 5 | Run 3 Configuration, M HI | 0.8 | 77,242 | 49,253 | 35,562 | 34,525 | 23,551 | 0.68 | 0.73 |
| 6 | Run 3 Configuration, M LO | 0.8 | 37,402 | 91,707 | 19,441 | 72,171 | 13,150 | 0.18 | 0.41 |
| 7 | Run 3 Configuration, M REF Age 3 | 0.8 | 43,717 | 61,932 | 27,007 | 46,822 | 18,140 | 0.39 | 0.56 |
| 8 | Run 3 Configuration, Discard Mortality | 0.8 | 48,662 | 56,940 | 28,376 | 42,356 | 18,995 | 0.45 | 0.59 |
| 9 | Run 3 Configuration, NO MRFSS | 0.8 | 48,173 | 56,449 | 29,647 | 41,987 | 19,886 | 0.47 | 0.61 |
| 10 | Run 3 Configuration, NO FWC | 0.8 | 50,436 | 59,021 | 38,246 | 43,942 | 25,700 | 0.58 | 0.64 |
| 11 | Run 3 Configuration, NO SEAMAP Survey | 0.8 | 48,554 | 56,858 | 30,514 | 42,297 | 20,364 | 0.48 | 0.61 |
| 12 | Run 1 Configuration, SS Reweighting | 0.53 | 82,017 | 93,538 | 16,752 | 68,906 | 11,050 | 0.16 | 0.53 |
| 13 | Run 3 Configuration, RETROSPECITVE_2010 | 0.8 | 48,513 | 57,538 | 27,244 | 42,956 | 18,383 | 0.43 | 0.59 |
| 14 | Run 3 Configuration, RETROSPECTIVE_2009 | 0.8 | 48,269 | 58,062 | 25,842 | 43,508 | 17,503 | 0.40 | 0.52 |
| 15 | Run 3 Configuration, RETROSPECTIVE_2008 | 0.8 | 48,233 | 58,712 | 26,716 | 44,140 | 18,121 | 0.41 | 0.53 |
| 16 | Run 3 Configuration, RETROSPECTIVE_2007 | 0.8 | 48,407 | 59,510 | 24,697 | 44,849 | 16,832 | 0.38 | 0.56 |
| 17 | Run 3 Configuration, RETROSPECTIVE_2006 | 0.8 | 46,866 | 57,711 | 29,878 | 43,366 | 19,528 | 0.45 | 0.54 |

Table 3.8. Reference points and benchmarks from sensitivity runs for Gulf of Mexico Spanish mackerel from SS. Benchmarks are reported for SPR 30%. *Current* refers to geometric mean of 2009-2011 values. MSST is (1-M)*SSBref with M = 0.38, or M=0.27, or M=0.49 representing the M value from the Hoenig maximum age mortality estimator for fully recruited ages from the SEDAR DW corresponding to the Base Model M or the M_LO or M-HI scenario. Ref refers to reference metric, either F30% SPR or SSB 30% SPR. Fratio is Fcurrent / Fref. SSBratio is SSBcurrent / MSST. Spawning biomass units are weight in mtons, and yield units are mtons whole weight.

| Run ID | Name | Fcurrent | SSBcurrent | Yref | Fref | SSBref | MFMT | MSST | F/MFMT | SSB/MSST |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Run 1 Configuration | 0.19 | 11,195 | 3,563 | 0.37 | 6,626 | 0.37 | 4,108 | 0.51 | 2.73 |
| 2 | Run 1 Configuration, Steepness=0.9 | 0.14 | 18,998 | 3,090 | 0.39 | 10,701 | 0.35 | 6,634 | 0.39 | 2.86 |
| 3 | Run 1 Configuration, Steepness=0.8 | 0.14 | 19,645 | 3,053 | 0.39 | 10,339 | 0.36 | 6,410 | 0.38 | 3.06 |
| 4 | Run 1 Configuration, Steepness=0.7 | 0.14 | 18,235 | 3,056 | 0.41 | 10,264 | 0.35 | 6,363 | 0.41 | 2.87 |
| 5 | Run 3 Configuration, M HI | 0.10 | 23,551 | 3,682 | 0.20 | 8,746 | 0.50 | 4,461 | 0.20 | 5.28 |
| 6 | Run 3 Configuration, M LO | 0.20 | 13,150 | 4,040 | 0.83 | 18,283 | 0.24 | 13,347 | 0.83 | 0.99 |
| 7 | Run 3 Configuration, M REF Age 3 | 0.15 | 18,140 | 3,138 | 0.47 | 11,862 | 0.32 | 7,354 | 0.47 | 2.47 |
| 8 | Run 3 Configuration, Discard Mortality | 0.14 | 18,995 | 3,029 | 0.41 | 10,730 | 0.35 | 6,653 | 0.41 | 2.86 |
| 9 | Run 3 Configuration, NO MRFSS | 0.14 | 19,886 | 3,054 | 0.39 | 10,637 | 0.35 | 6,595 | 0.39 | 3.02 |
| 10 | Run 3 Configuration, NO FWC | 0.12 | 25,700 | 2,821 | 0.34 | 11,132 | 0.34 | 6,902 | 0.34 | 3.72 |
| 11 | Run 3 Configuration, NO SEAMAP Survey | 0.13 | 20,364 | 3,053 | 0.38 | 10,715 | 0.35 | 6,643 | 0.38 | 3.07 |
| 12 | Run 1 Configuration, SS Reweighting | 0.19 | 11,050 | 3,743 | 0.37 | 7,011 | 0.37 | 4,347 | 0.50 | 2.54 |
| 13 | Run 3 Configuration, RETROSPECITVE_2010 | 0.15 | 18,383 | 3,163 | 0.43 | 10,882 | 0.35 | 6,747 | 0.43 | 2.72 |
| 14 | Run 3 Configuration, RETROSPECTIVE_2009 | 0.16 | 17,503 | 2,991 | 0.46 | 11,022 | 0.34 | 6,834 | 0.46 | 2.56 |
| 15 | Run 3 Configuration, RETROSPECTIVE_2008 | 0.15 | 18,121 | 2,968 | 0.44 | 11,182 | 0.35 | 6,933 | 0.44 | 2.61 |
| 16 | Run 3 Configuration, RETROSPECTIVE_2007 | 0.15 | 16,832 | 3,072 | 0.46 | 11,362 | 0.33 | 7,044 | 0.46 | 2.39 |
| 17 | Run 3 Configuration, RETROSPECTIVE_2006 | 0.16 | 19,528 | 3,040 | 0.48 | 10,986 | 0.34 | 6,811 | 0.48 | 2.87 |

Table 3.9. Required SFA and MSRA evaluations using SPR 30% reference point for Gulf of Mexico Spanish mackerel SS Base Model Run 1 for 4 states of nature of steepness at 3 levels of natural mortality (M). Spawning biomass and yield units are mtons, whole weight.. FCURRENT AND SSBCURRENT calculated as geometric mean of 2009-2011 F and SSB.

| **Criteria** | **Definition** | **Steepness = 0.8** | **Steepness = 0.9** |
|---|---|---|---|
| | **Mortality Rate Criteria** | | |
| **FMSY or Proxy, Proxy=F30%SPR** | $F_{SPR30\%}$ | 0.36 | 0.35 |
| **MFMT** | $F_{SPR30\%}$ | 0.36 | 0.35 |
| **FOY** | 75% of $F_{SPR30\%}$ | 0.27 | 0.26 |
| **FCURRENT** | $F_{2009\text{-}F2011}$ | 0.13 | 0.14 |
| **FCURRENT/MFMT** | $F_{2009\text{-}F2011}$ | 0.50 | 0.52 |
| **BASE M=0.38** | | | |
| | **Biomass Criteria** | | |
| **SSB_MSY OR PROXY mtons** | Equilibrium SSB @ $F_{SPR30\%}$ | 10,339 | 10,701 |
| **MSST** | (1-M)*$SSB_{SPR30\%}$ | 6,410 | 6,634 |
| **SSB CURRENT (mtons)** | $SSB_{\_2011}$ | 18,998 | 19,645 |
| **SSB CURRENT/ MSST** | $SSB_{\_2011}$ | 2.96 | 2.96 |
| **EQUILIBRIUM MSY (mtons)** | Equilibrium Yield @ $F_{SPR30\%}$ | 3,149 | 3,084 |
| **EQUILIBRIUM OY (mtons)** | Equilibrium Yield @ $F_{OY}$ | 2,362 | 2,313 |
| **F30% SPR OFL** | **Annual Yield @ FMFMT (mtons)** | **Steepness = 0.8** | **Steepness = 0.9** |
| | **OFL 2013** | 6037 | 6016 |
| | **OFL 2014** | 5470 | 5383 |
| | **OFL 2015** | 5125 | 4983 |
| | **OFL 2016** | 4914 | 4741 |
| | **OFL 2017** | 4778 | 4594 |
| | **OFL 2018** | 4690 | 4506 |
| | **OFL 2019** | 4631 | 4451 |
| | **OFL 2020** | 4591 | 4416 |
| | **OFL 2021** | 4564 | 4395 |
| | **OFL 2022** | 4546 | 4382 |
| **Annual OY (ACT)** | **Annual Yield@ FOY (mtons) = 75%FMSY** | | |
| | **OFL 2013** | 4642 | 4623 |
| | **OFL 2014** | 4392 | 4319 |
| | **OFL 2015** | 4239 | 4118 |
| | **OFL 2016** | 4143 | 3990 |
| | **OFL 2017** | 4080 | 3908 |
| | **OFL 2018** | 4038 | 3857 |
| | **OFL 2019** | 4009 | 3823 |
| | **OFL 2020** | 3989 | 3802 |
| | **OFL 2021** | 3976 | 3788 |
| | **OFL 2022** | 3966 | 3779 |
| **Annual Yield** | **Annual Yield@Fcurrent (mtons)** | | |
| | **OFL 2013** | 2448 | 2438 |
| | **OFL 2014** | 2473 | 2431 |
| | **OFL 2015** | 2502 | 2429 |
| | **OFL 2016** | 2529 | 2430 |
| | **OFL 2017** | 2550 | 2431 |
| | **OFL 2018** | 2566 | 2433 |
| | **OFL 2019** | 2577 | 2434 |
| | **OFL 2020** | 2585 | 2435 |
| | **OFL 2021** | 2592 | 2436 |
| | **OFL 2022** | 2596 | 2436 |

## *3.7 Figures*

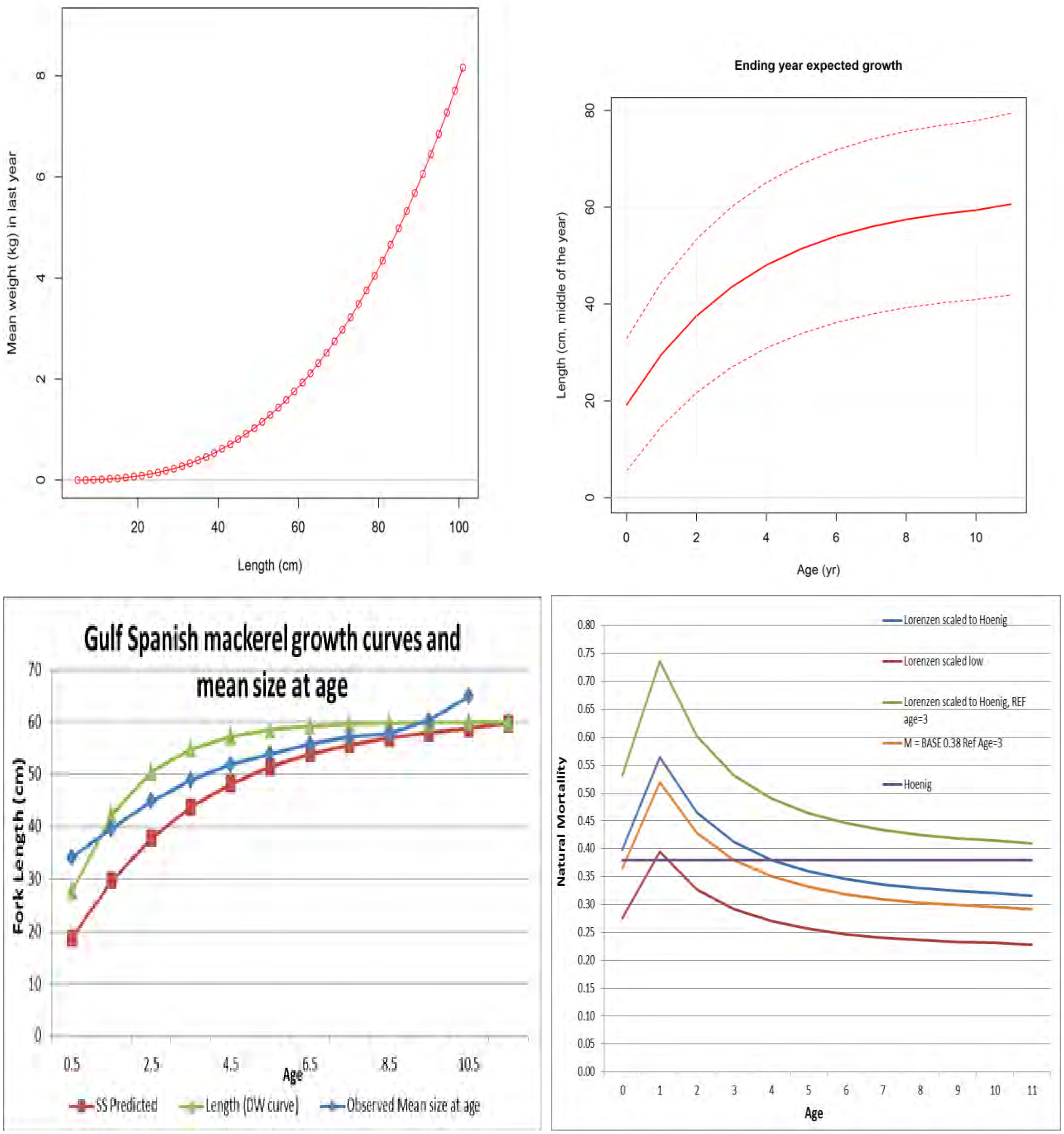



Figure 3.1. Life history characterization for Gulf of Mexico Spanish mackerel. Top Panel Left: Weight length relationship calculated using SEDAR 28 DW inputs. Top Panel Right: Estimated Von Bertalanffy SS growth curves and confidence intervals for Gulf of Mexico Spanish mackerel. Bottom Panel Left: SS estimated growth curve, growth curve estimated from SEDAR DW, and mean size at age from otolith age observations. Bottom Panel Right: Natural mortality at age used in stock assessment and input into Stock Synthesis model. The Lorenzen function scaled to Hoenig point estimate is SEDAR 28 DW Base M function ($M=0.38y^{-1}$) used in the SS stock assessment of Gulf Spanish mackerel (purple line).

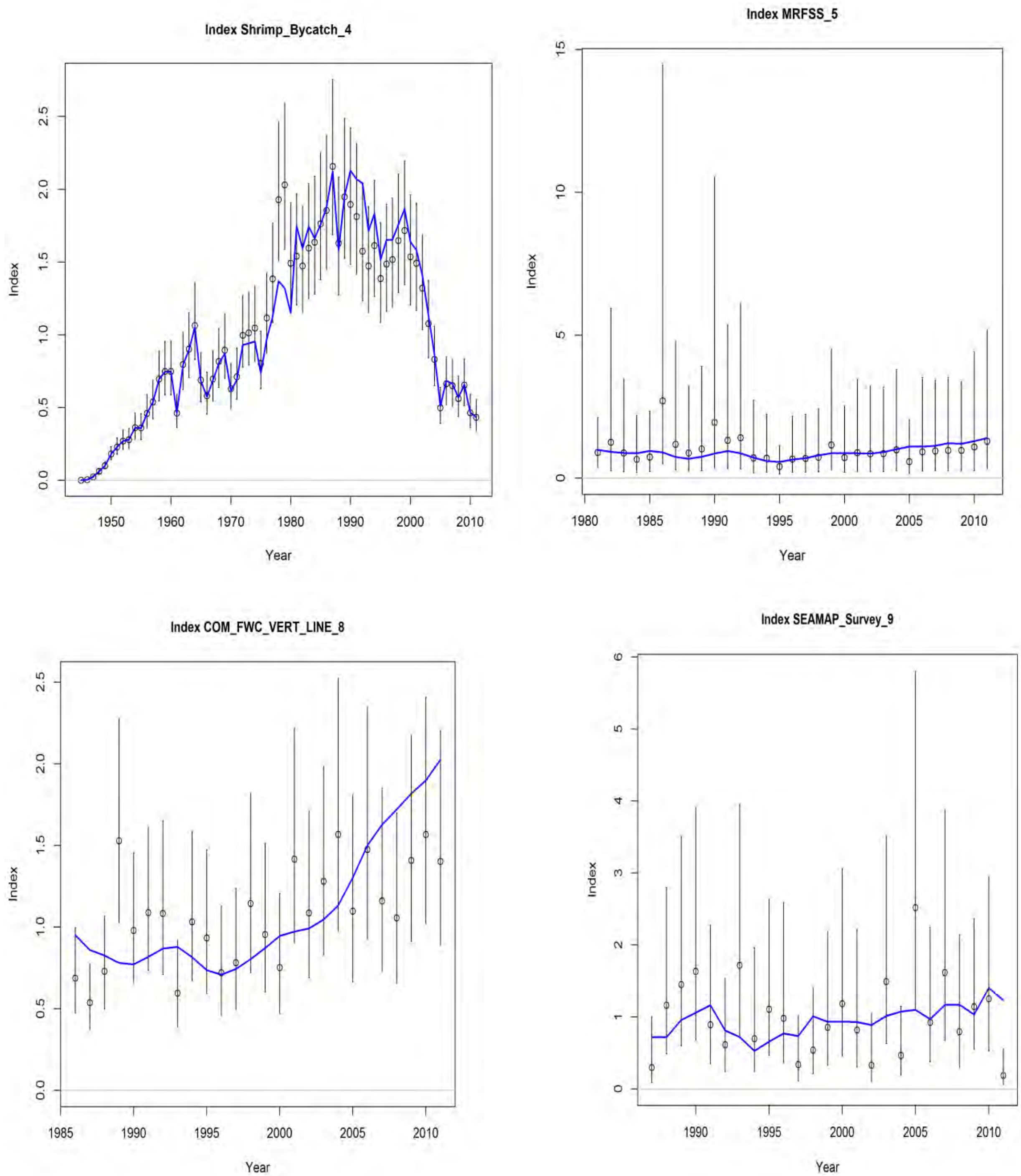
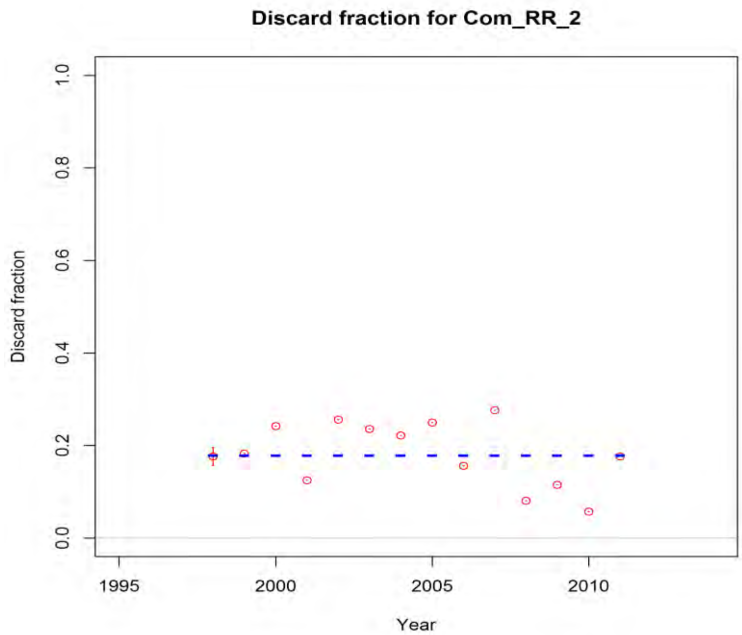



Figure 3.2. Observed and predicted index of CPUE for Gulf of Mexico Spanish mackerel from SS Model 3. Indices include the shrimp fishery effort series (Shrimp_Bycatch_4), the recreational (MRFSS), the commercial line gear (COM_FWC_ VERT_Line), and the SEAMAP trawl survey (SEAMAP_Survey). Error bars represent the observed log-scale standard errors.

A. COM_RR




B. REC

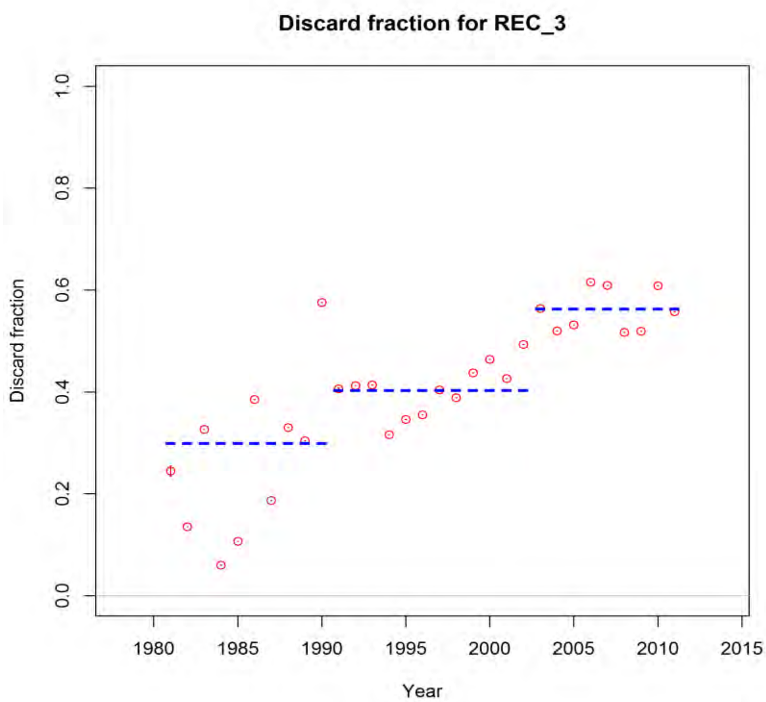



Figure 3.3a and b. SS input super period discard fraction for commercial line gear (COM_RR) and the recreational all modes (REC) fleets plotted against observed discard fraction. Super period definitions were: one period 1998-2011 for the commercial line gear fleet (COM_RR) and three (3) super periods for the recreational all modes (REC) fleet: 1892-1989, 1990-2002, and 2003-2011.

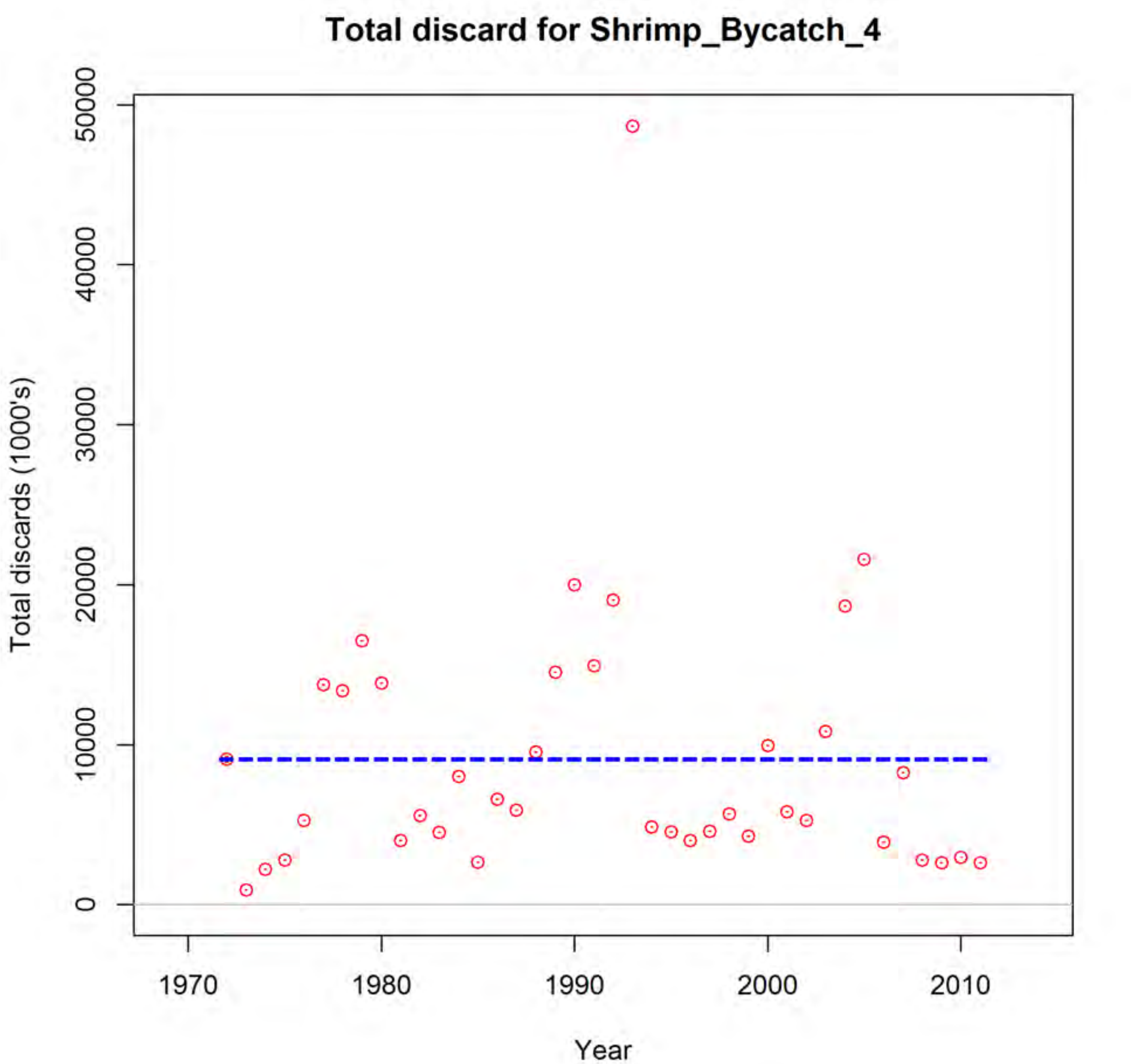



Figure 3.3c. SS input super period discards (thousands of fish) for the shrimp fishery bycatch against observed discards. One single super period (1972-2011) was specified for the shrimp bycatch fleet.

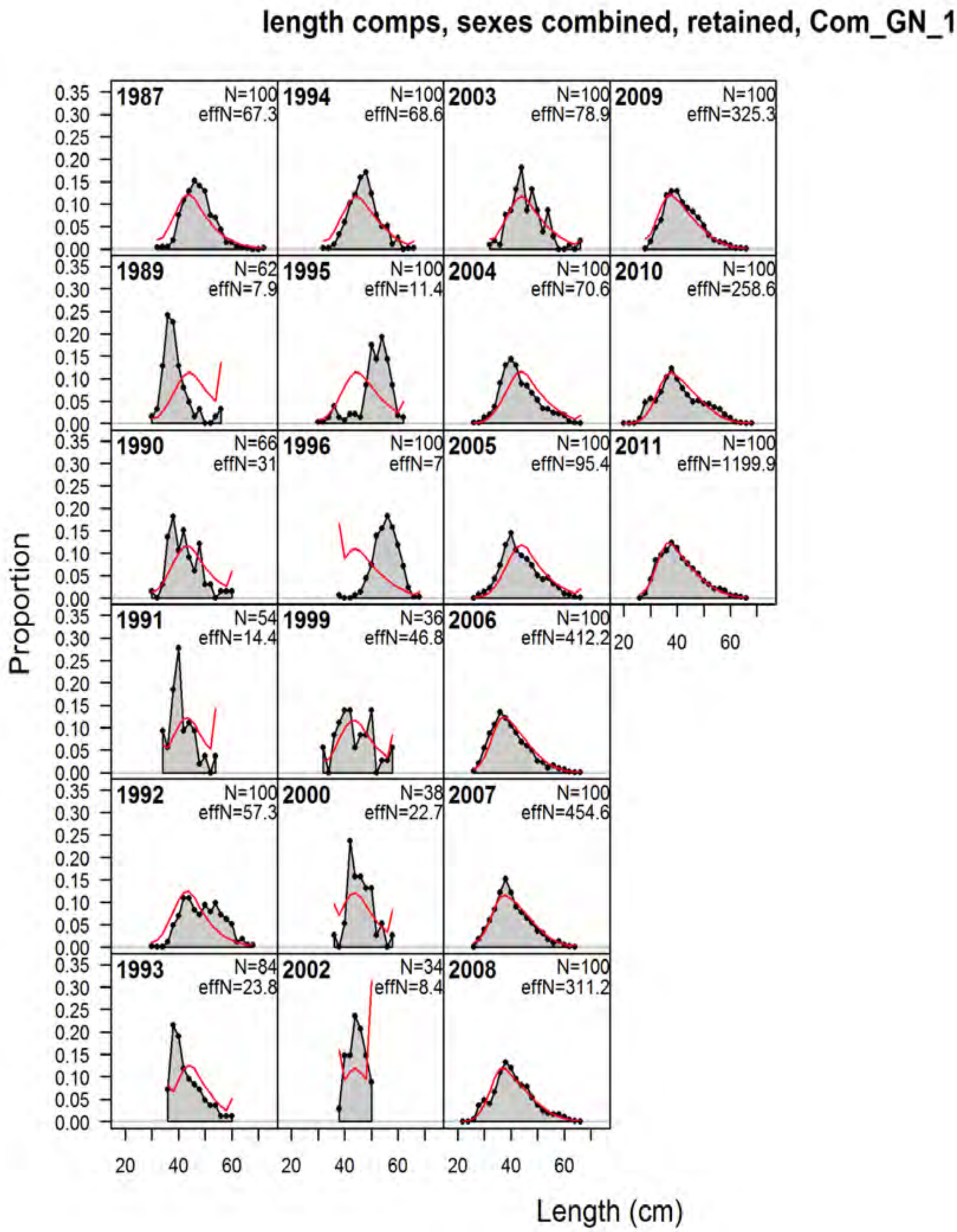



Figure 3.4. Observed and predicted (lines) length compositions for Gulf of Mexico Spanish mackerel commercial gillnet fishery from SS Base Run. Observed (N) sample sizes and effective sample sizes (effN) estimated by SS are also reported. Observed sample sizes were capped at a maximum of 100 fish.

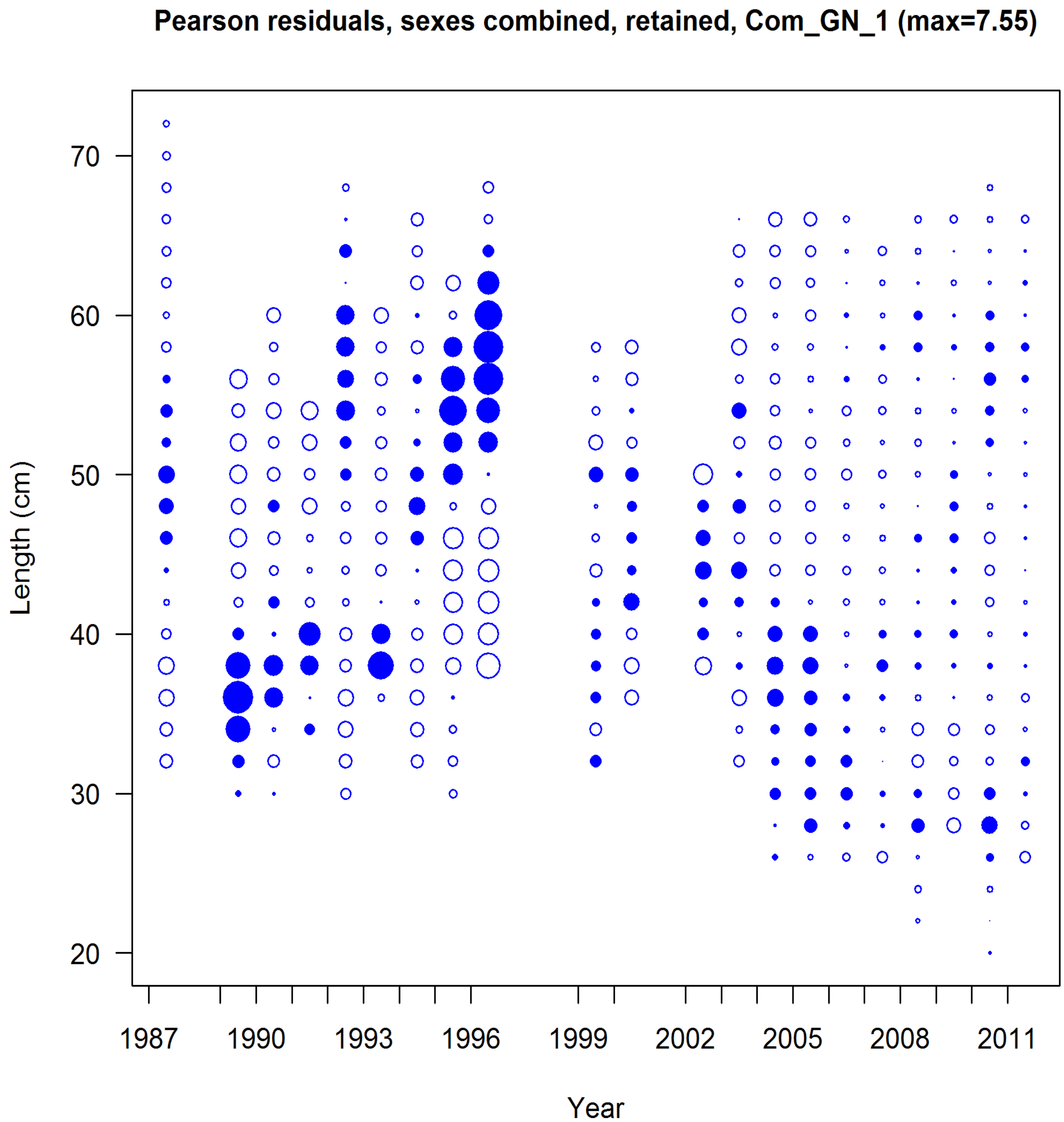



Figure 3.5. Pearson residuals of length composition fits for Gulf of Mexico Spanish mackerel in the commercial gillnet gear fishery from SS Base Run. Solid circles are positive residuals (i.e., observed greater than predicted) and open circles are negative residuals (i.e., predicted greater than observed).

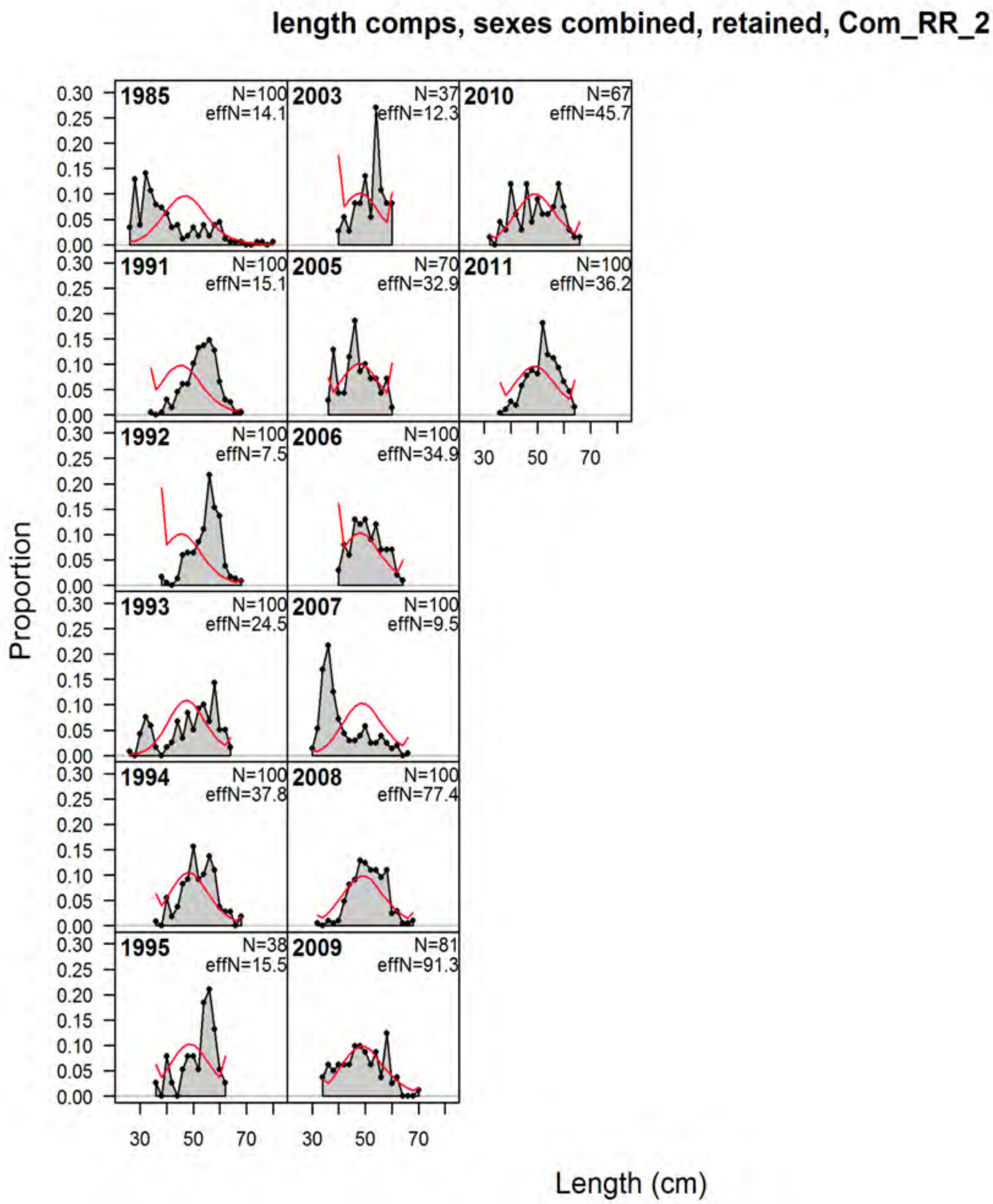



Figure 3.6. Observed and predicted (lines) length compositions for Gulf of Mexico Spanish mackerel commercial lie gear fishery (COM_RR) from SS Base Run. Observed (N) sample sizes and effective sample sizes (effN) estimated by SS are also reported. Observed sample sizes were capped at a maximum of 100 fish.

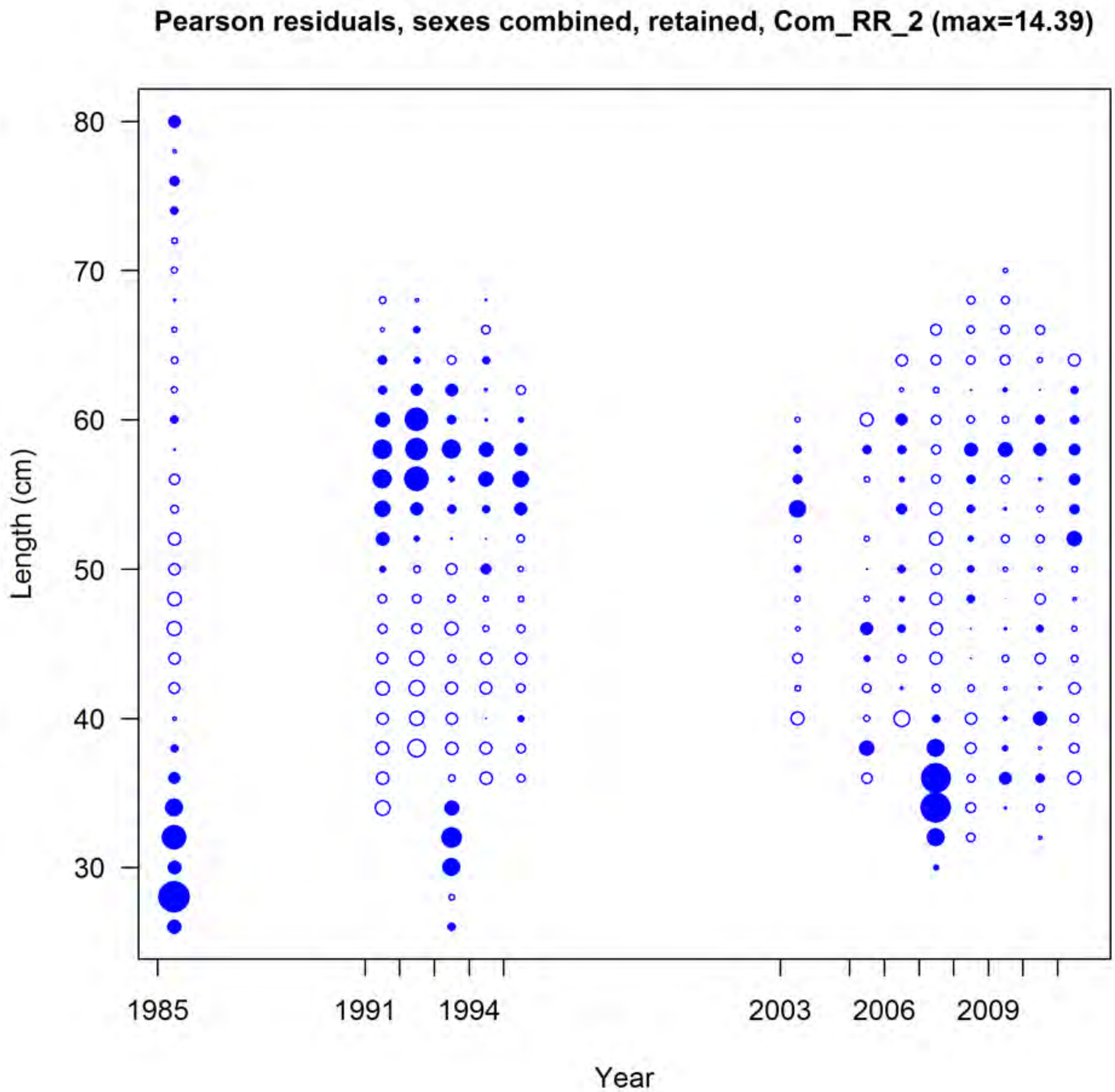



Figure 3.7. Pearson residual distributions of length composition fits for Gulf of Mexico Spanish mackerel in the commercial line gear fishery (COM_RR) from SS Base Run. Solid circles are positive residuals (i.e., observed greater than predicted) and open circles are negative residuals (i.e., predicted greater than observed).

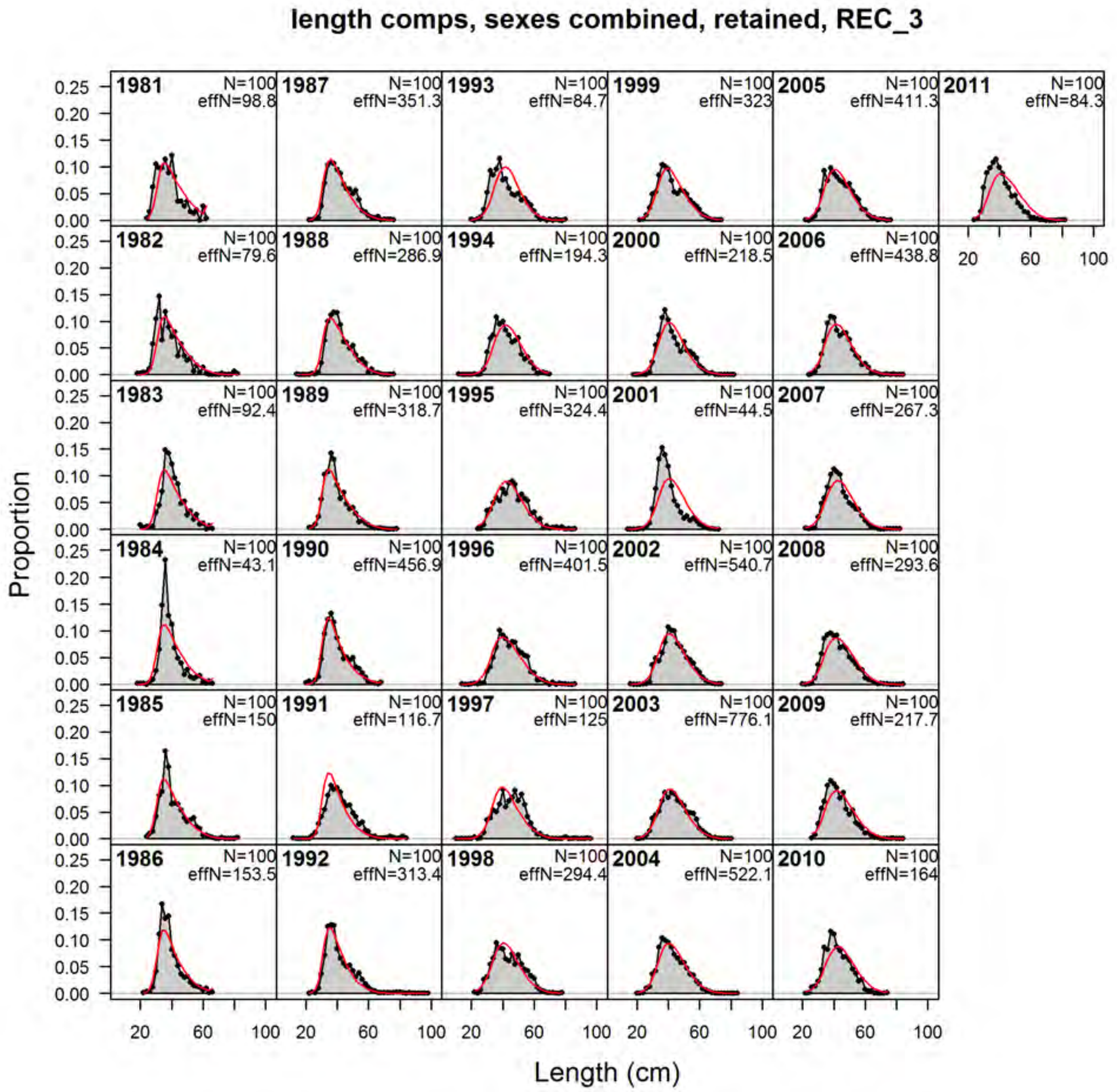



Figure 3. 8. Observed and predicted (lines) length compositions for Gulf of Mexico Spanish mackerel recreational all modes fishery from SS Base Run. Observed (N) sample sizes and effective sample sizes (effN) estimated by SS are also reported. Observed sample sizes were capped at a maximum of 100 fish.

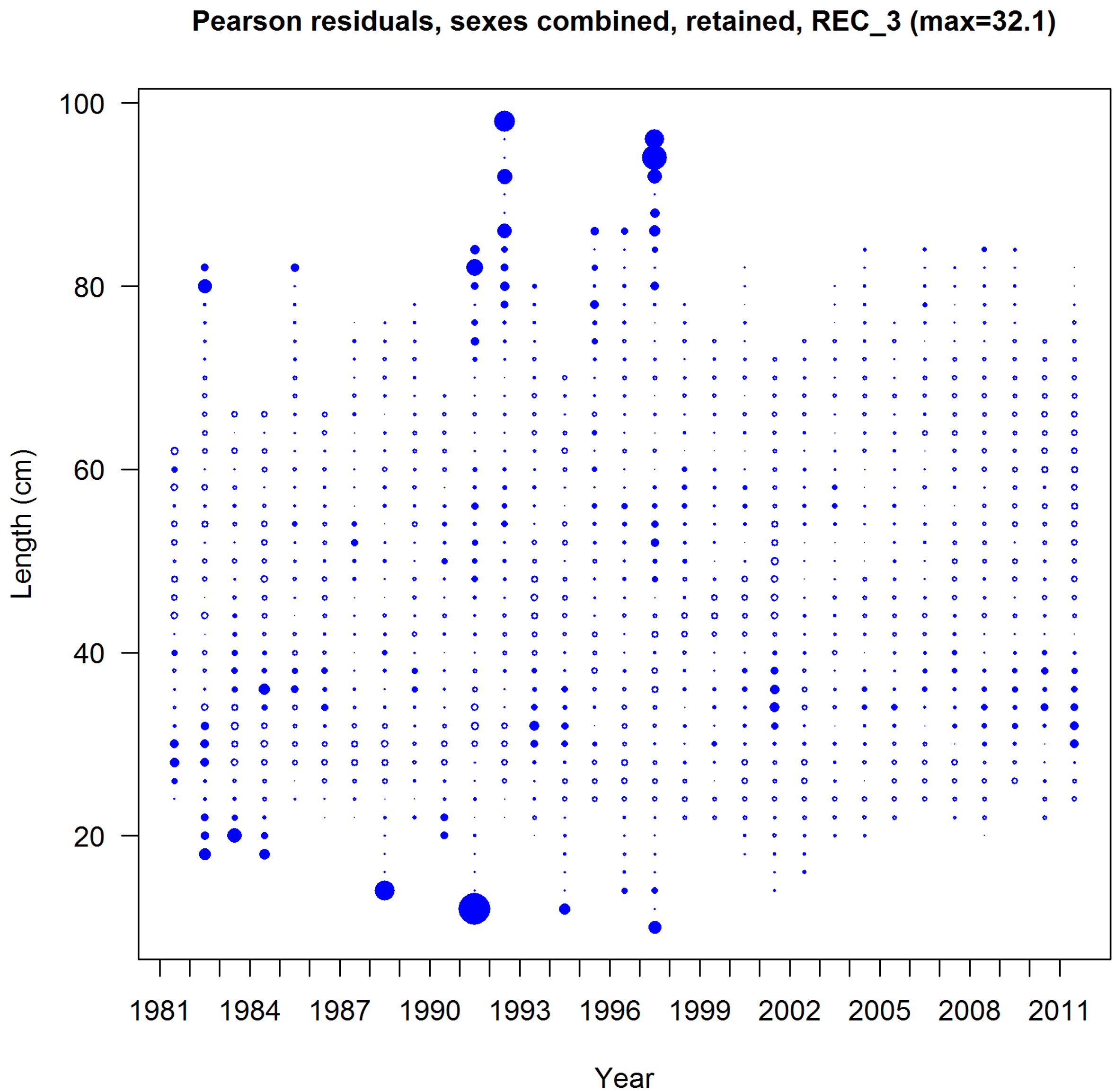



Figure 3.9. Pearson residual of length composition fits for Gulf of Mexico Spanish mackerel in the recreational all modes fishery from SS Base Run. Solid circles are positive residuals (i.e., observed greater than predicted) and open circles are negative residuals (i.e., predicted greater than observed).

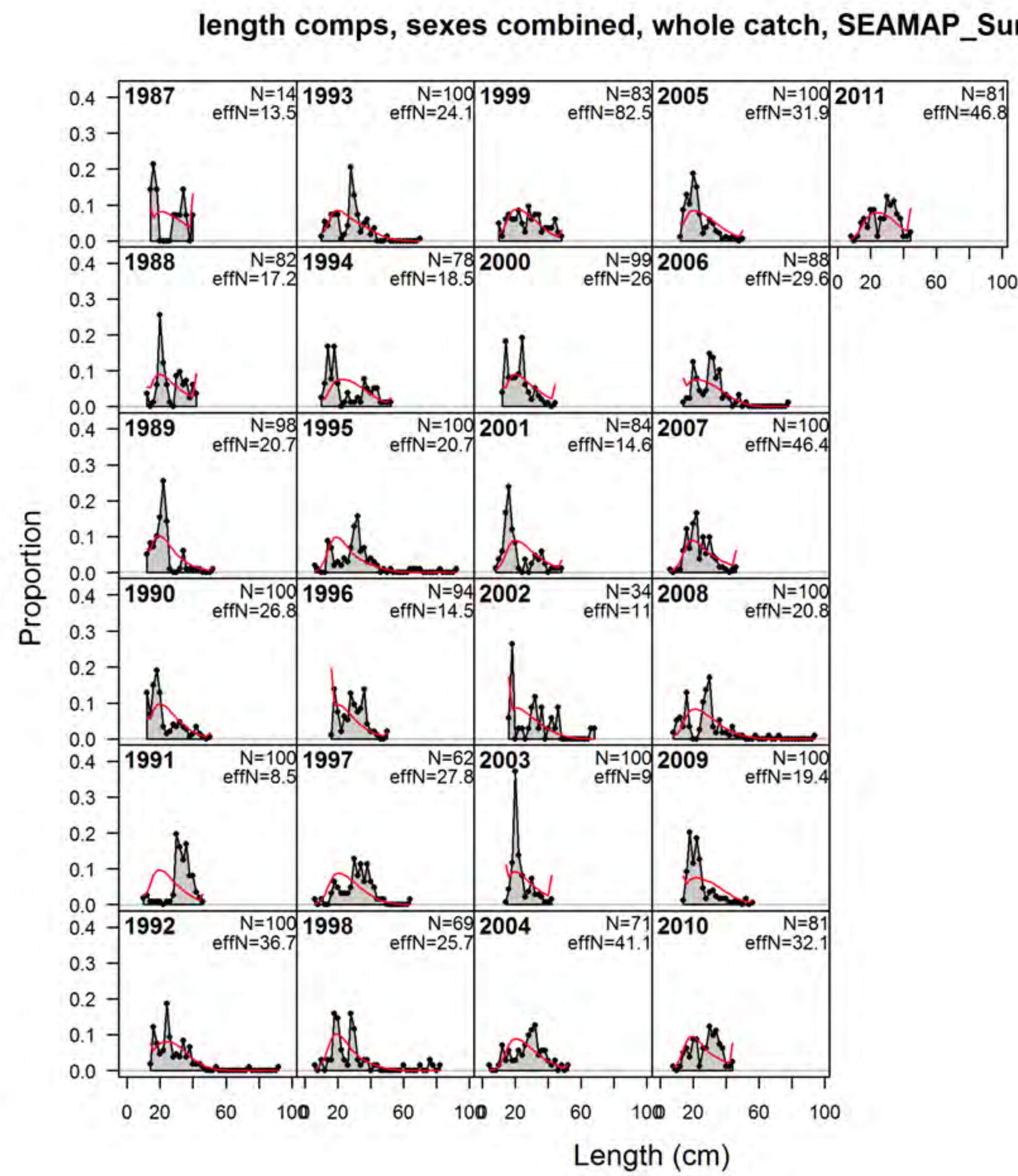



Figure 3.10. Observed and predicted (lines) length compositions for Gulf of Mexico Spanish mackerel from the SEAMAP trawl survey SS Base Run. Observed (N) sample sizes and effective sample sizes (effN) estimated by SS are also reported. Observed sample sizes were capped at a maximum of 100 fish.

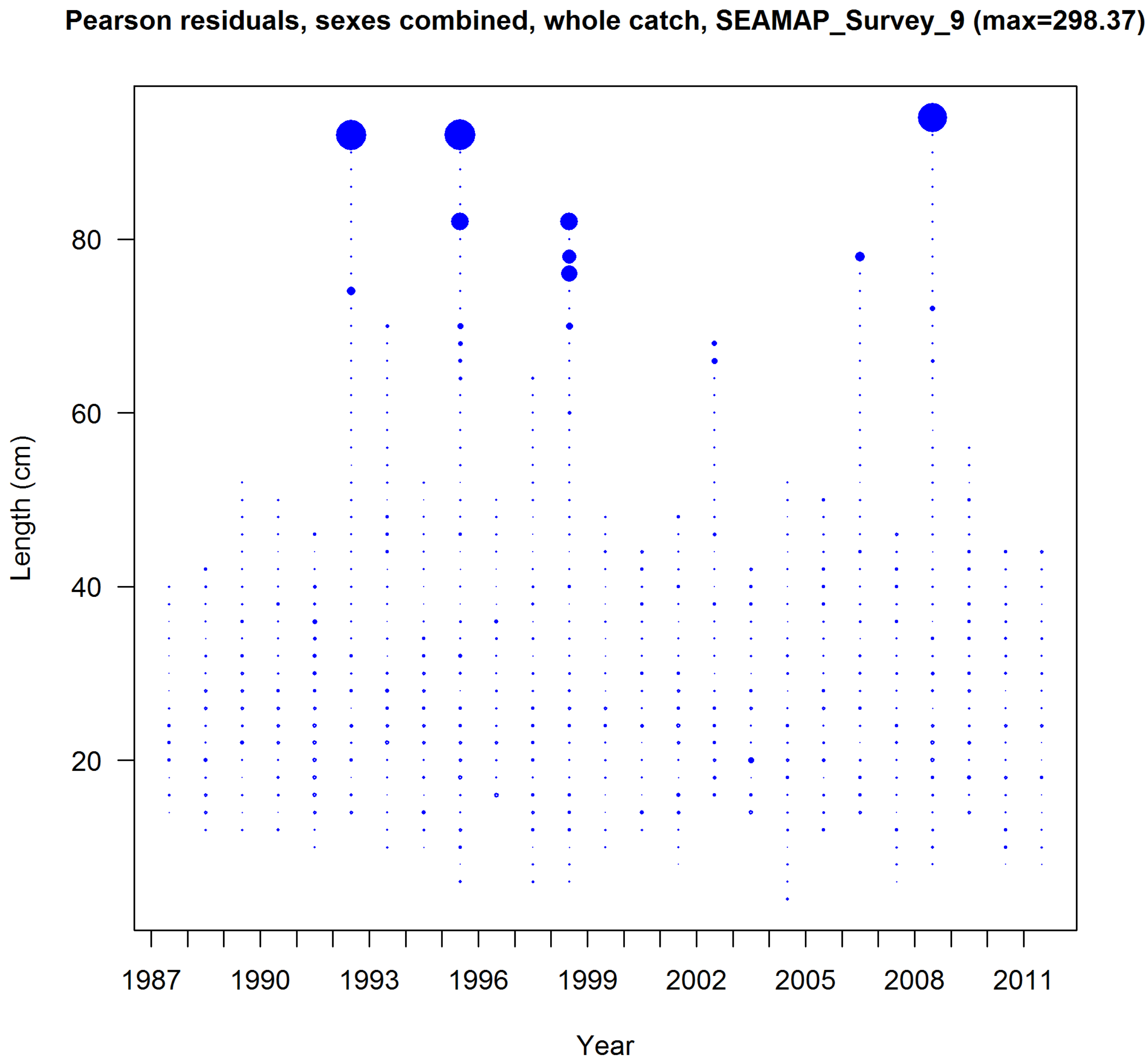



Figure 3.11. Pearson residuals of length composition fits for Gulf of Mexico Spanish mackerel in the SEAMAP trawl survey from SS Base Run. Solid circles are positive residuals (i.e., observed greater than predicted) and open circles are negative residuals (i.e., predicted greater than observed).

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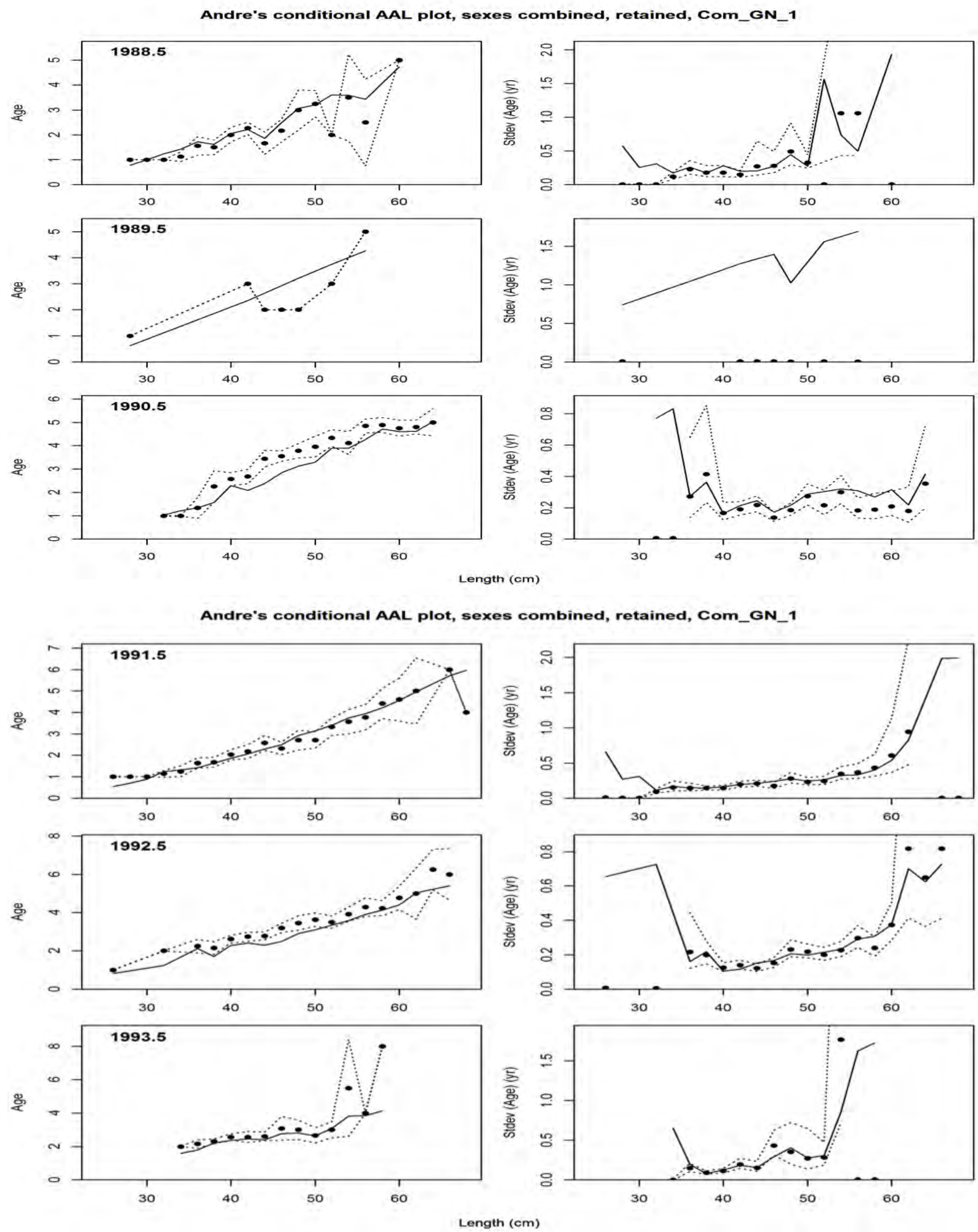



Figure 3.12. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 1988 – 1993 for the COM_GN fleet. Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.

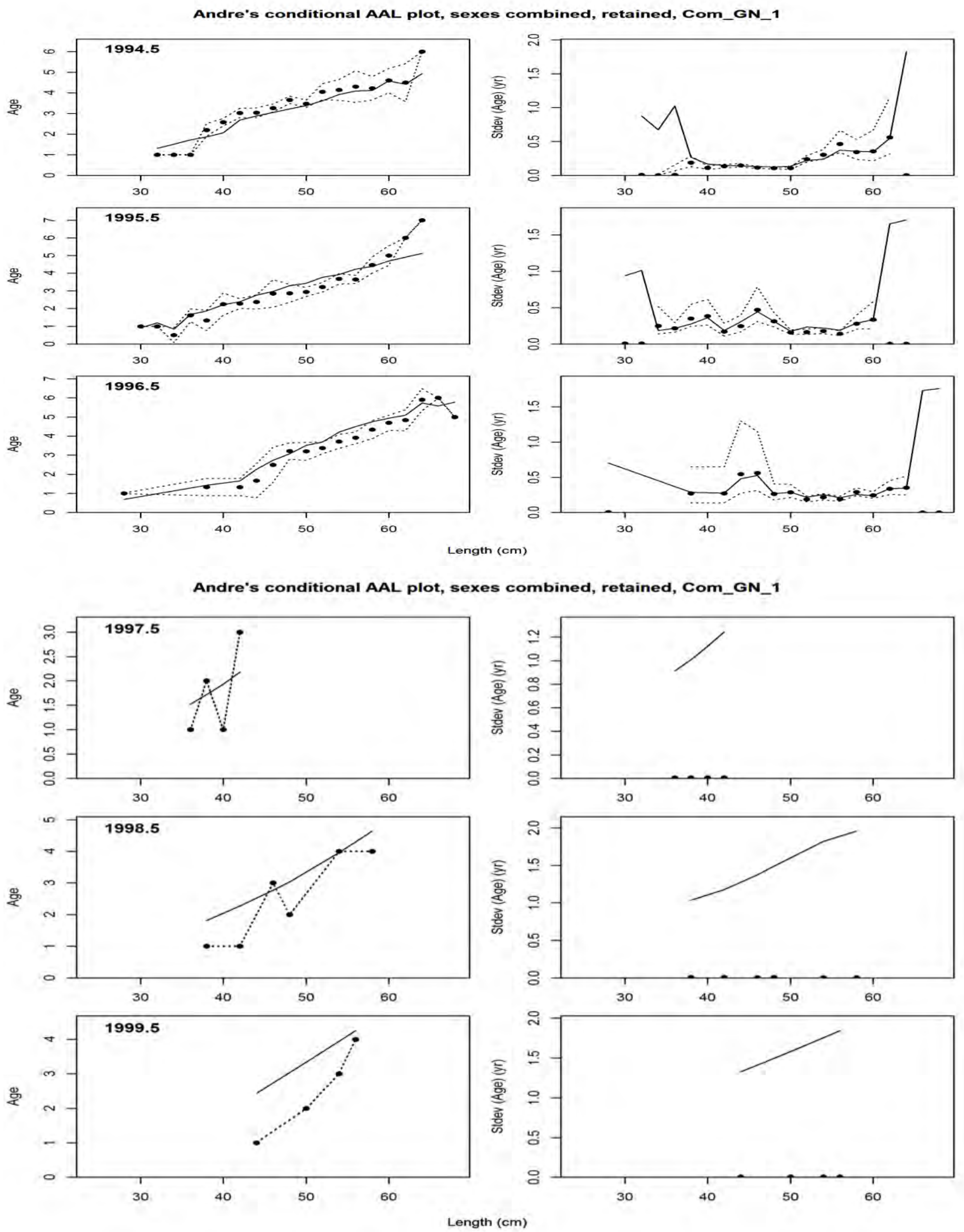
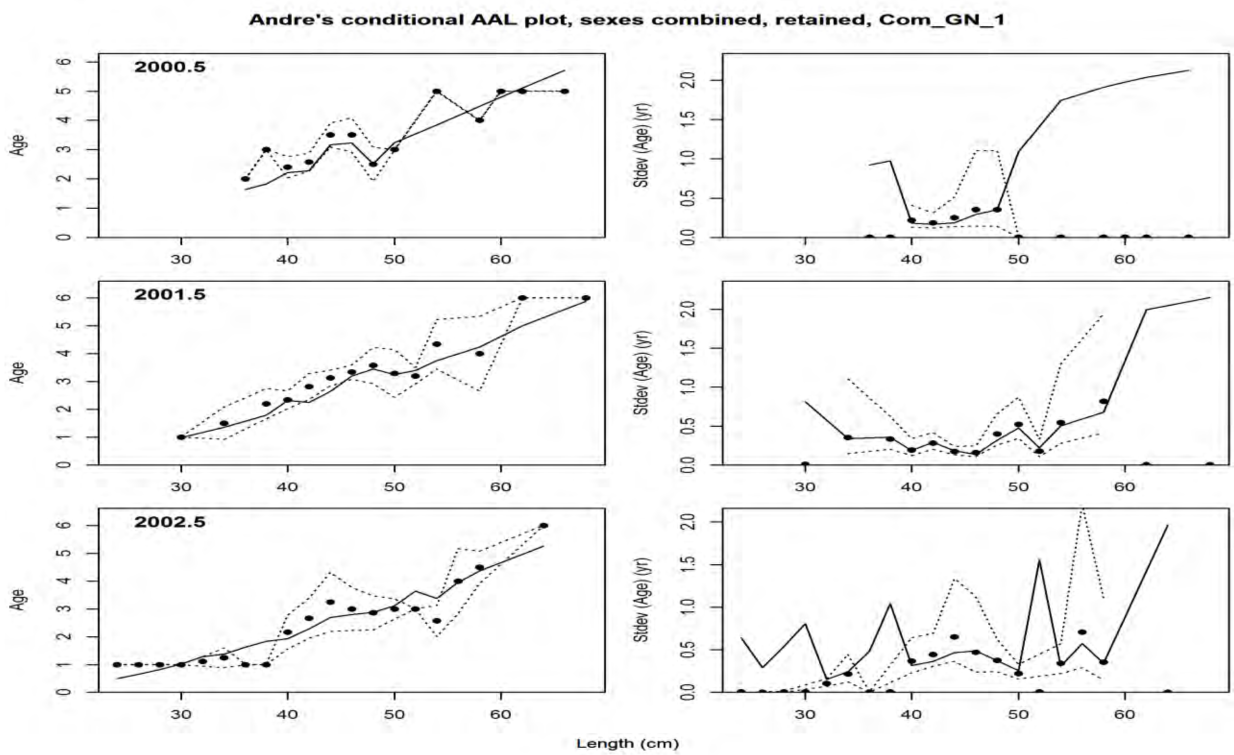



Figure 3.13. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 1994-1995 for the COM_GN fleet. . Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.



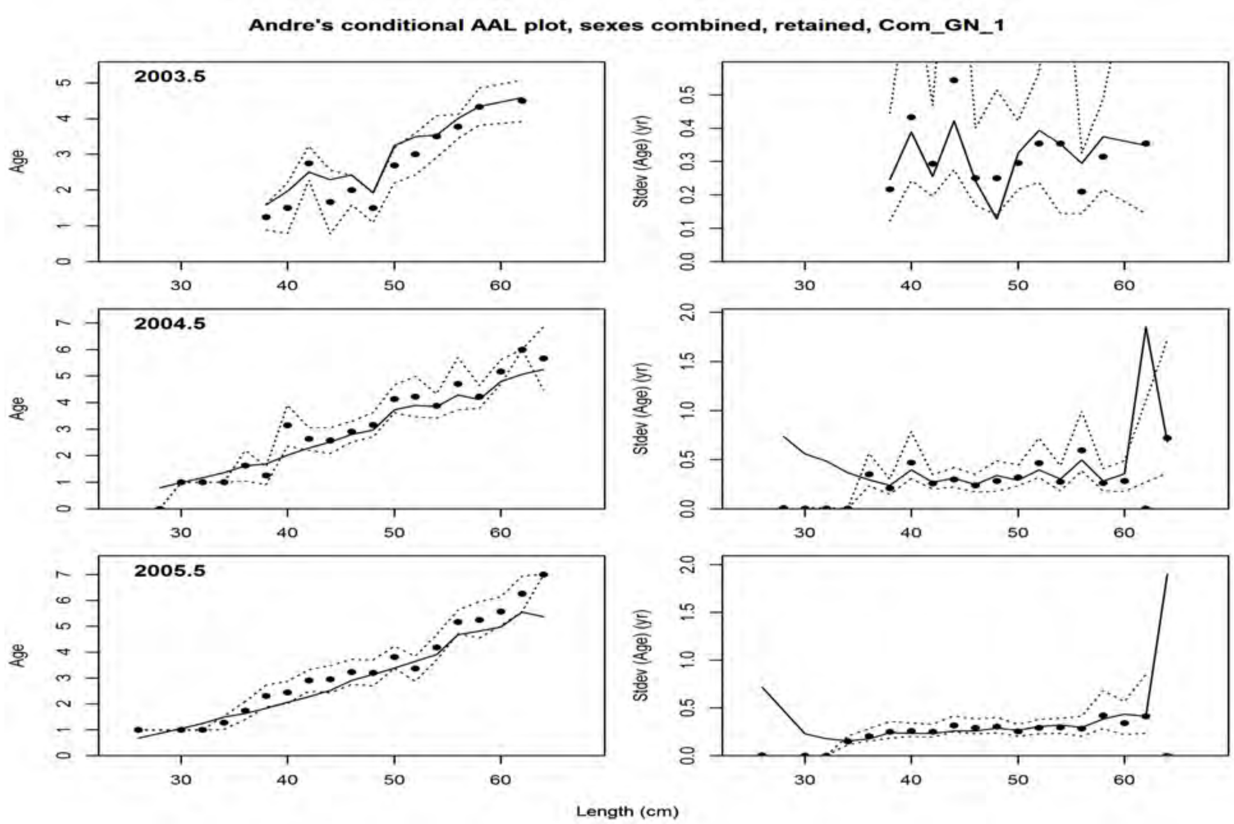




Figure 3.14. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 2000-2005 for the COM_GN fleet. Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.

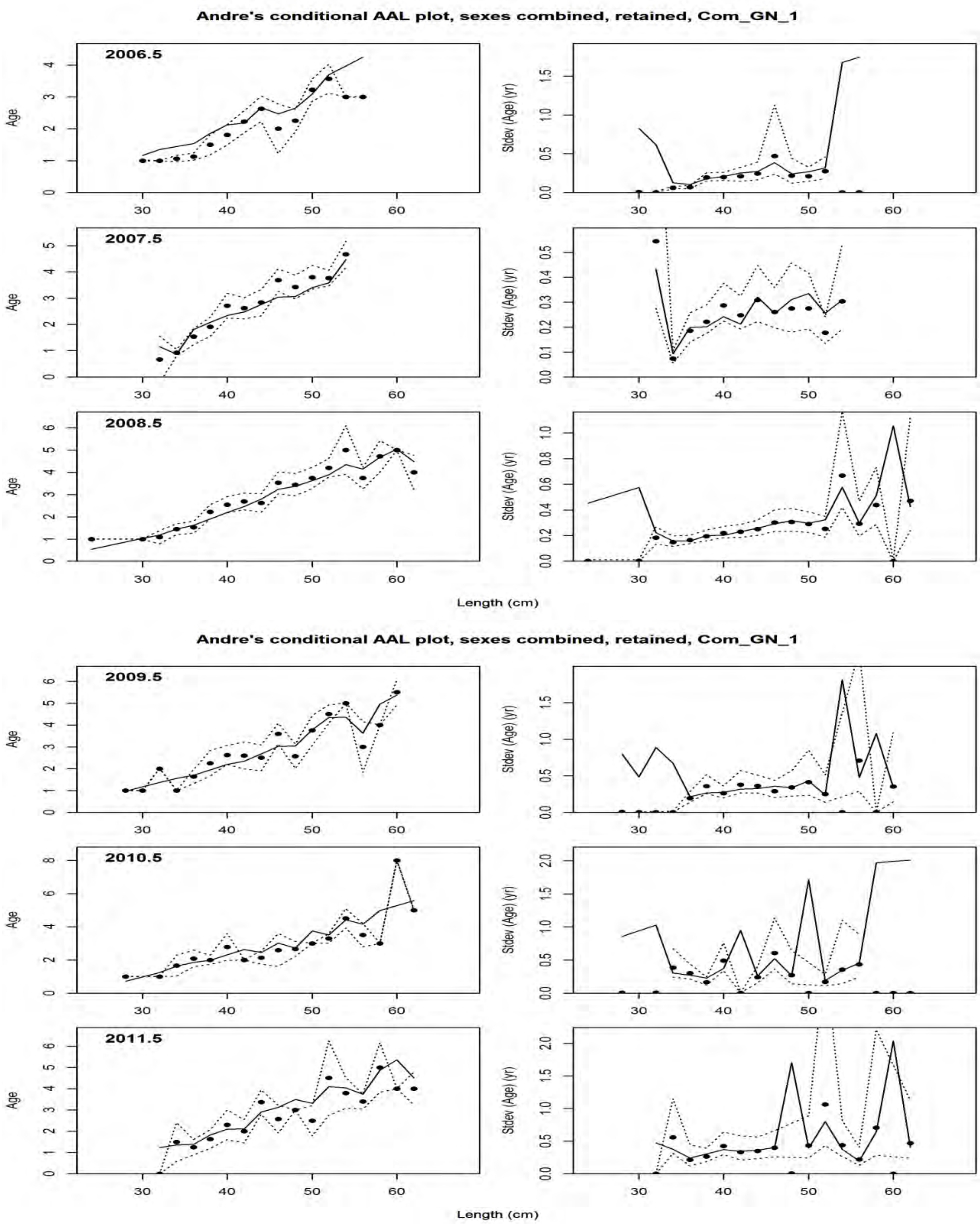



Figure 3.15. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 2006-2011 for the COM_GN fleet. Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.

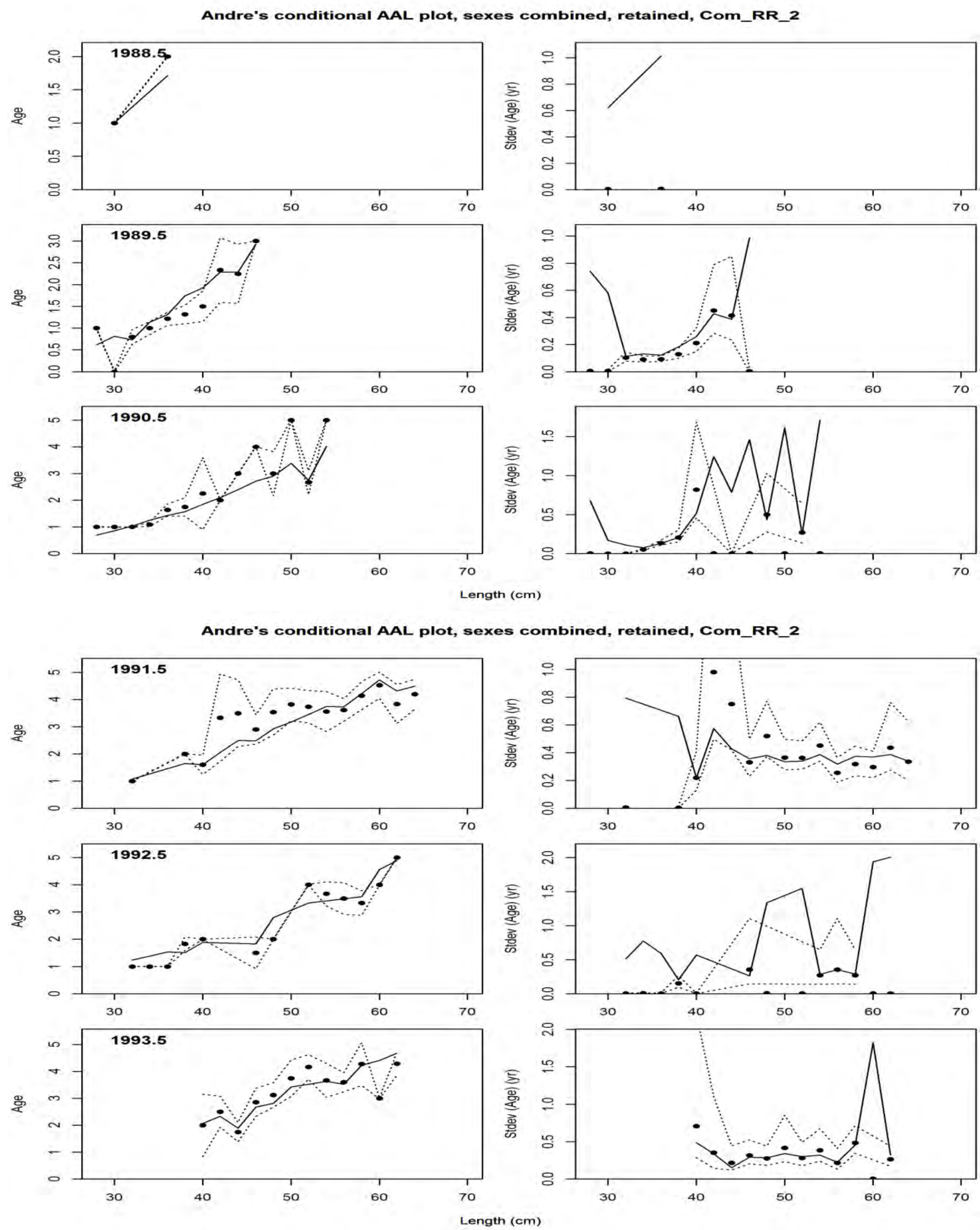



Figure 3.16. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 1988--1993 for the COM_RR fleet. Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.

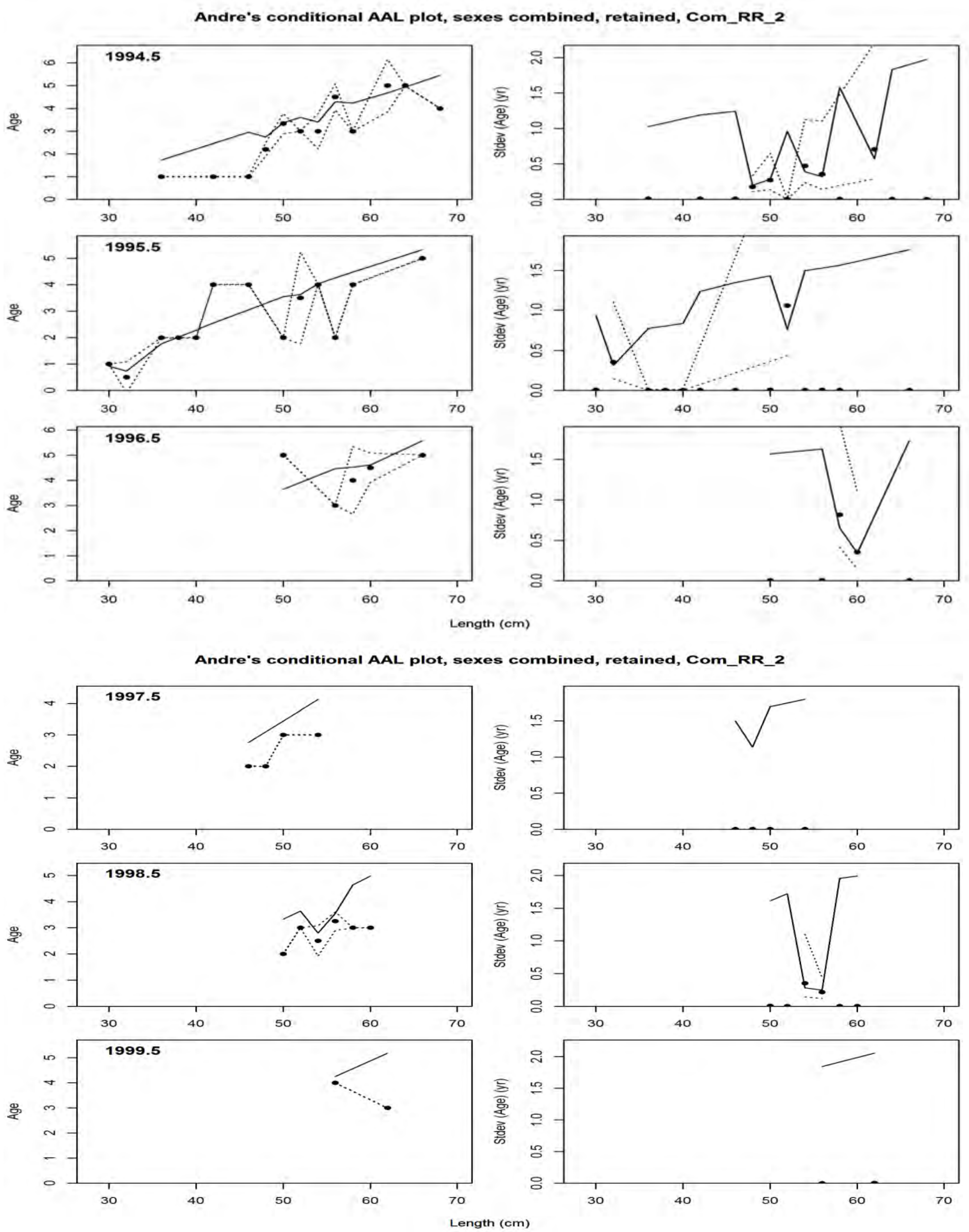



Figure 3.17. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 1994--1999 for the COM_RR fleet. Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.

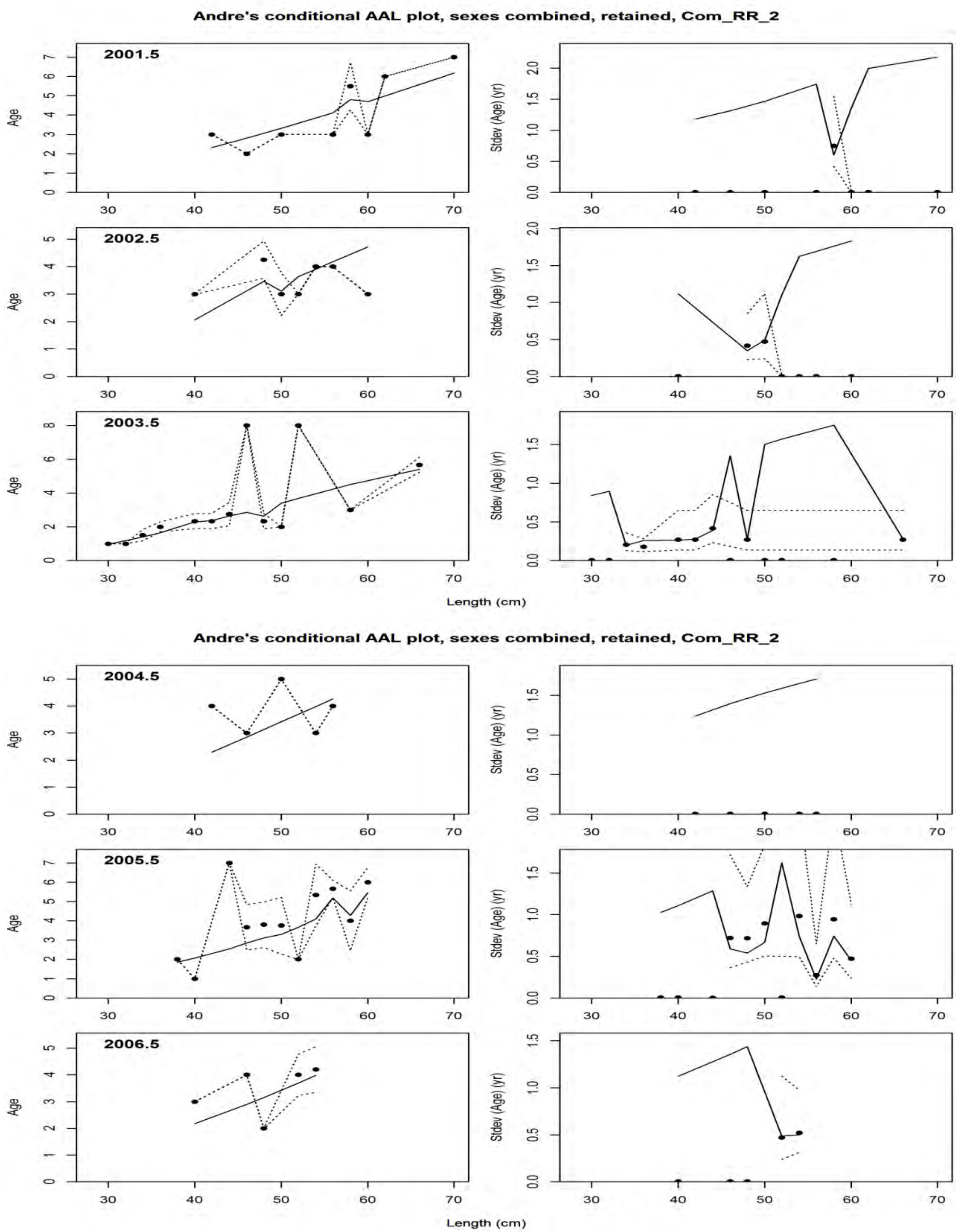



Figure 3.18. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 2001-2006 for the COM_RR fleet. Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.

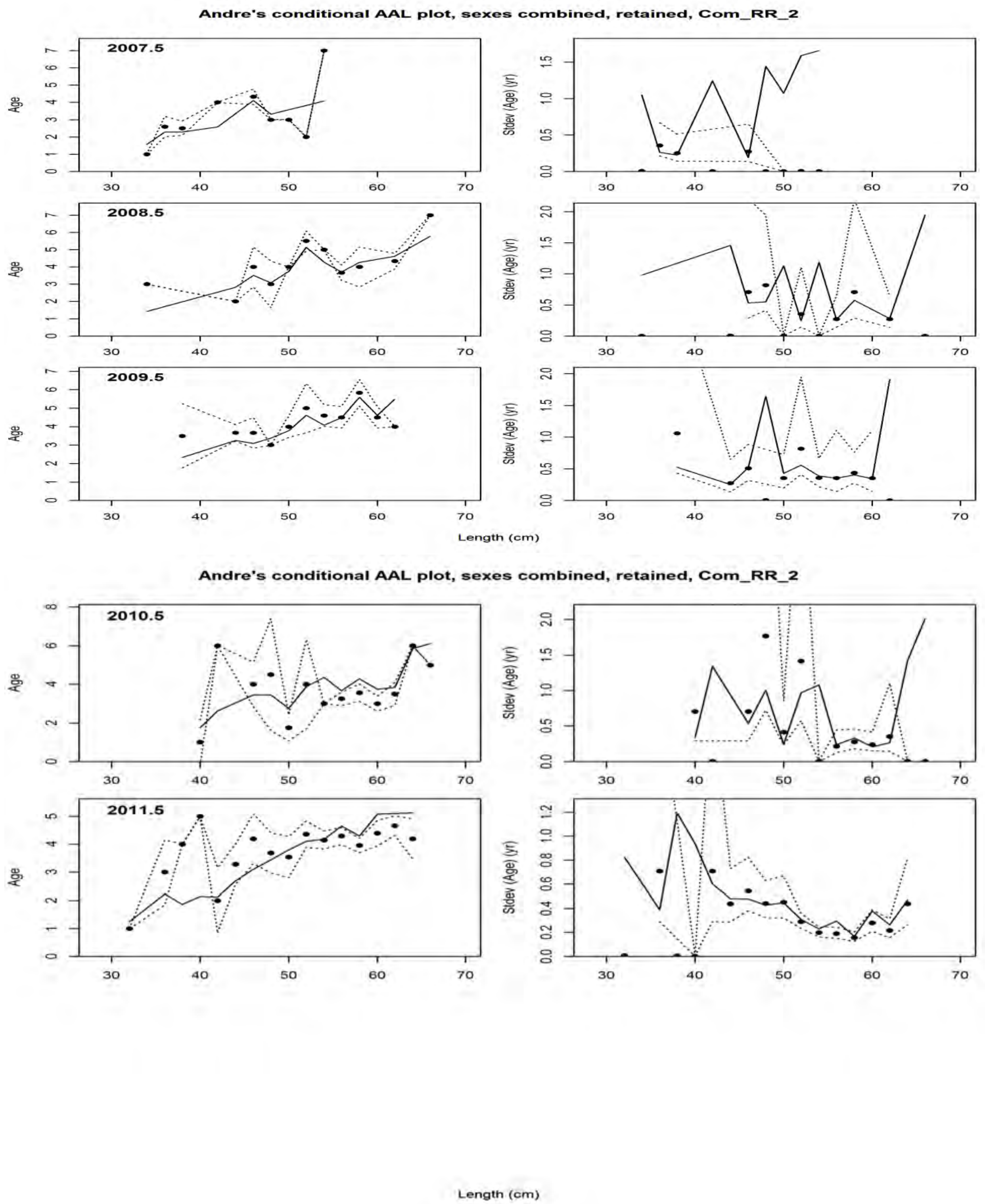



Figure 3.19. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 2007-2011 for the COM_RR fleet. Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.

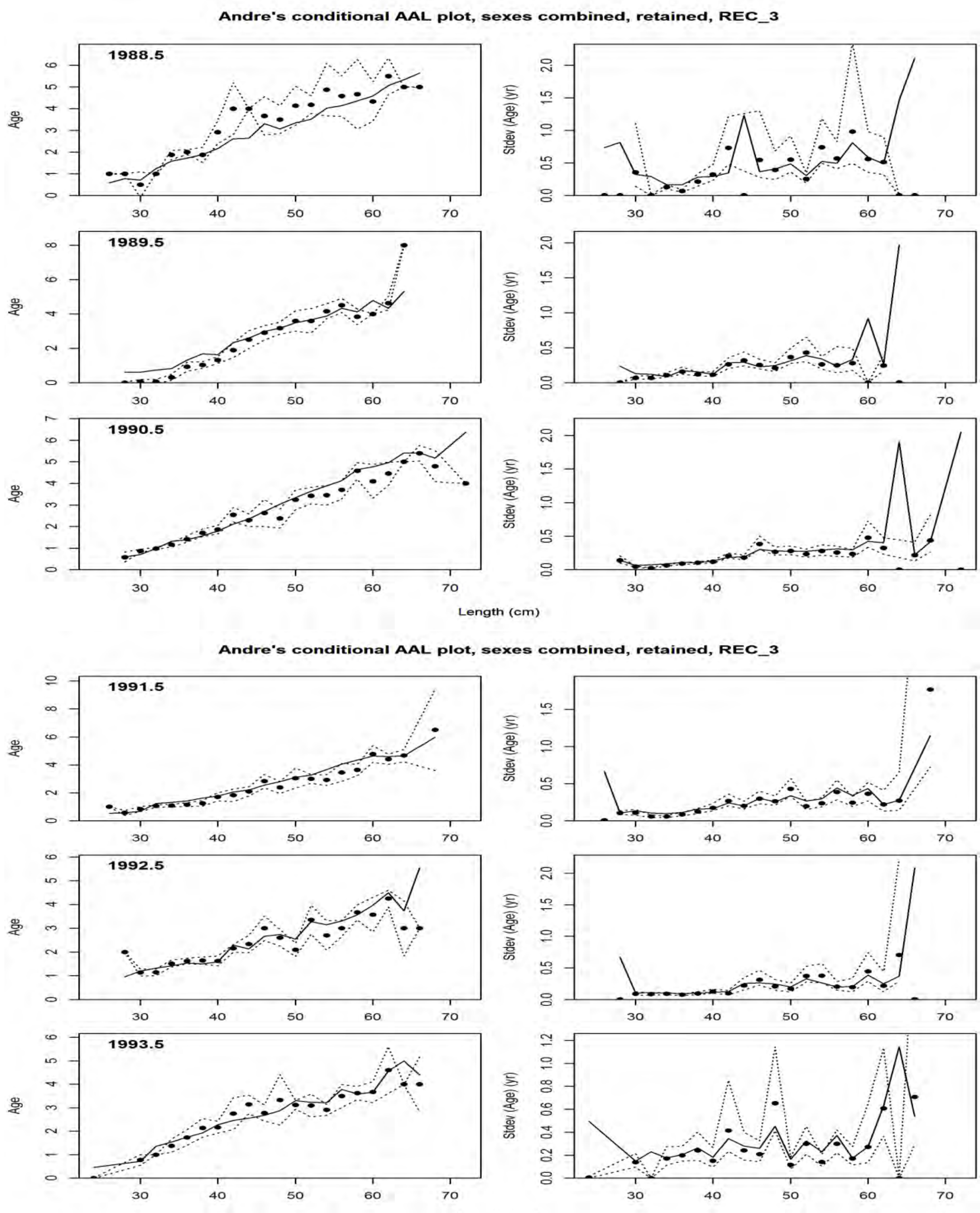
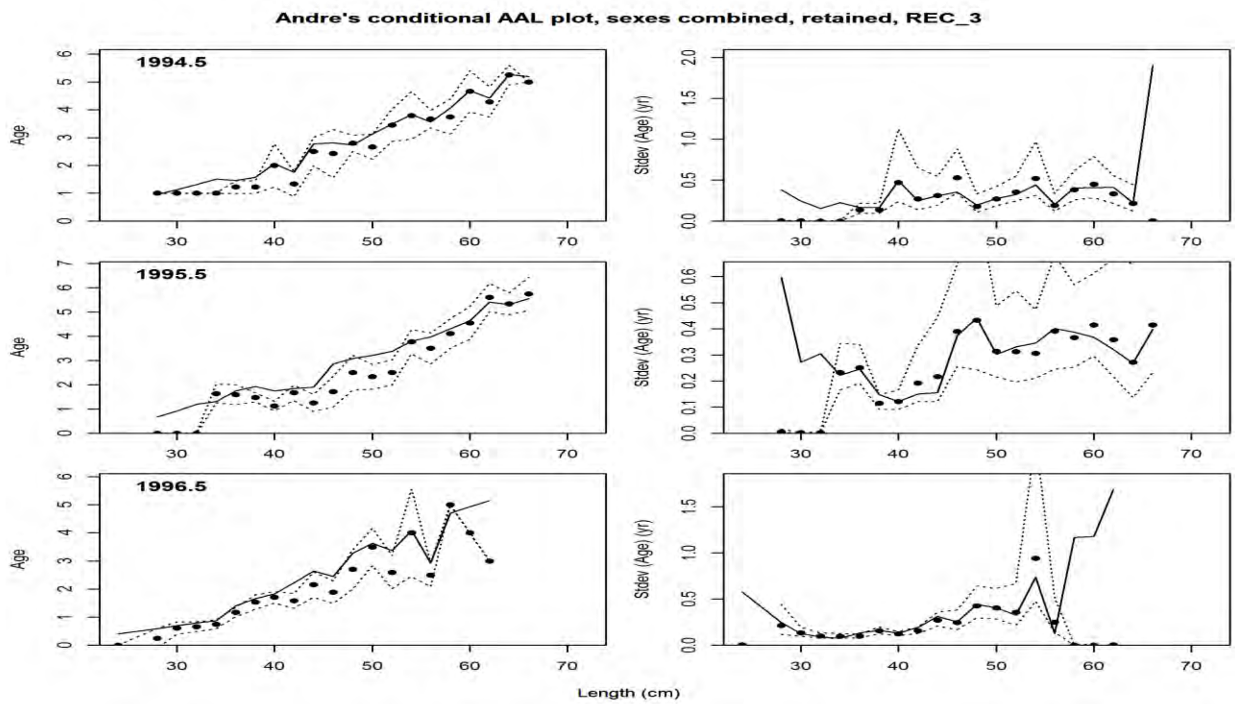



Figure 3.20. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 1988-1993 for the REC all modes . Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.



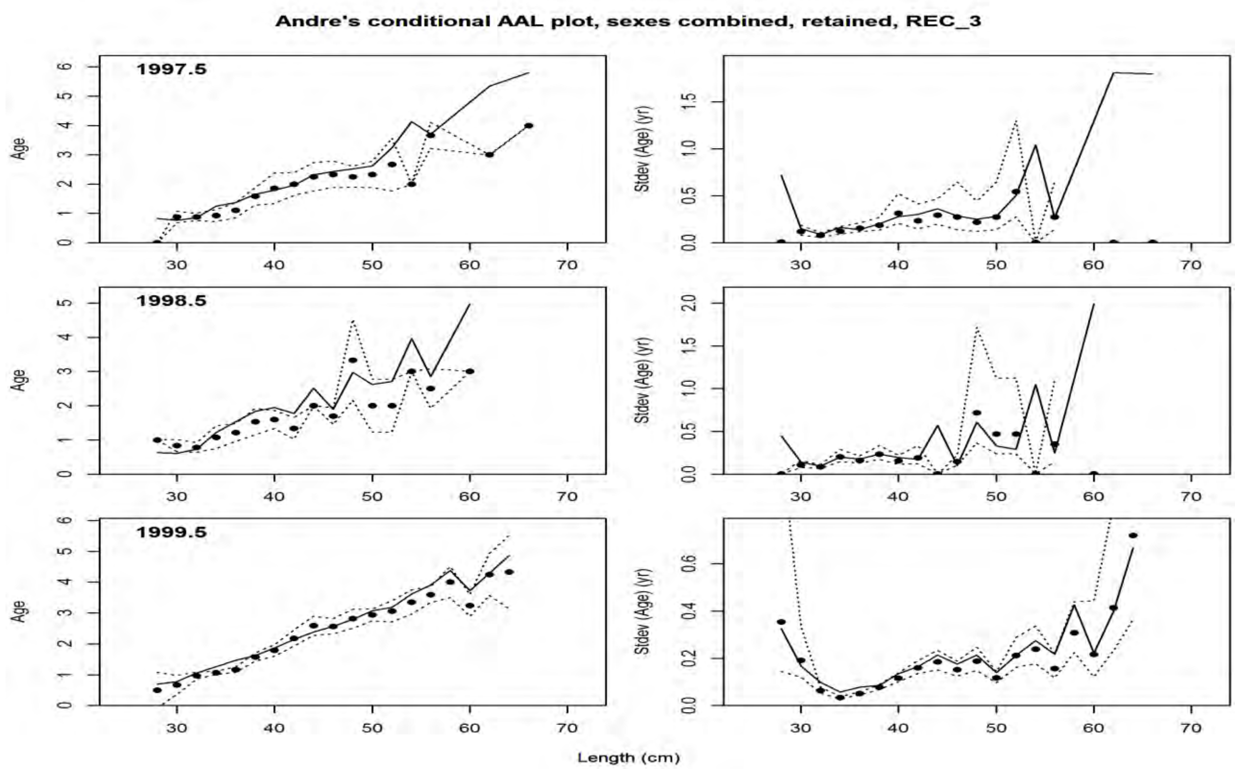
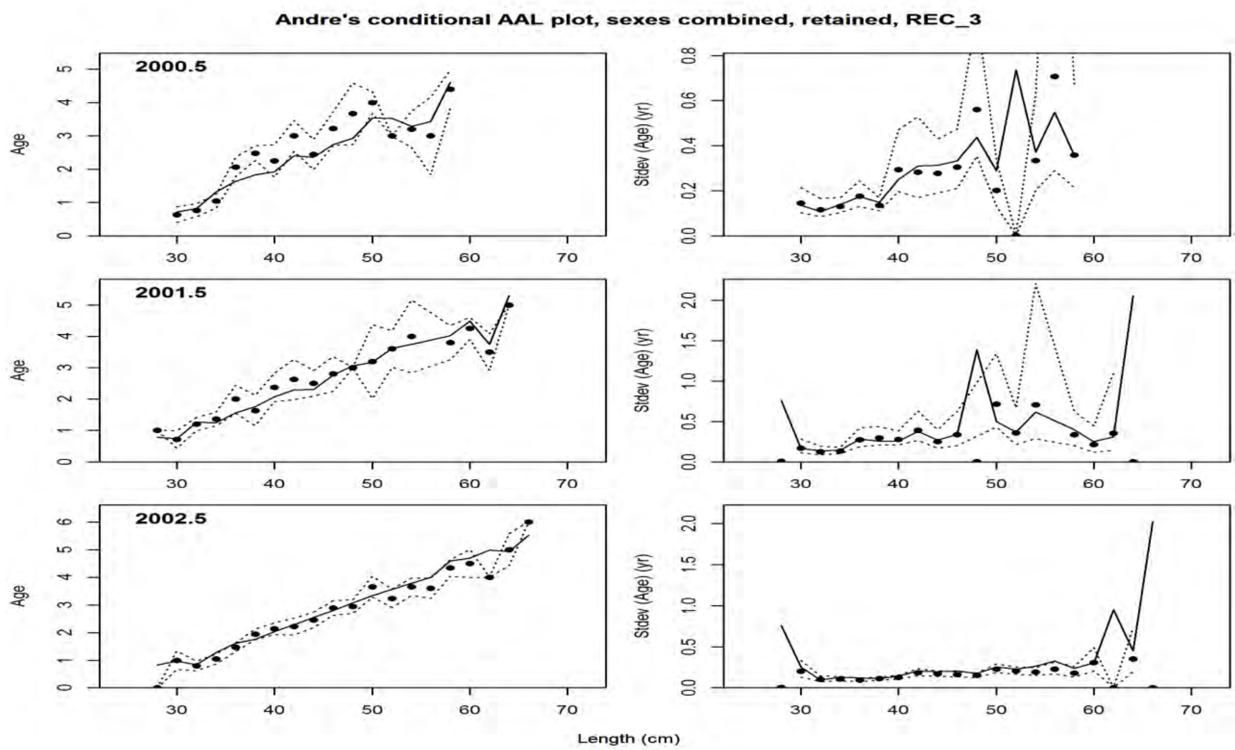




Figure 3.21. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base 1994-19991 for the REC all modes fleet. Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.



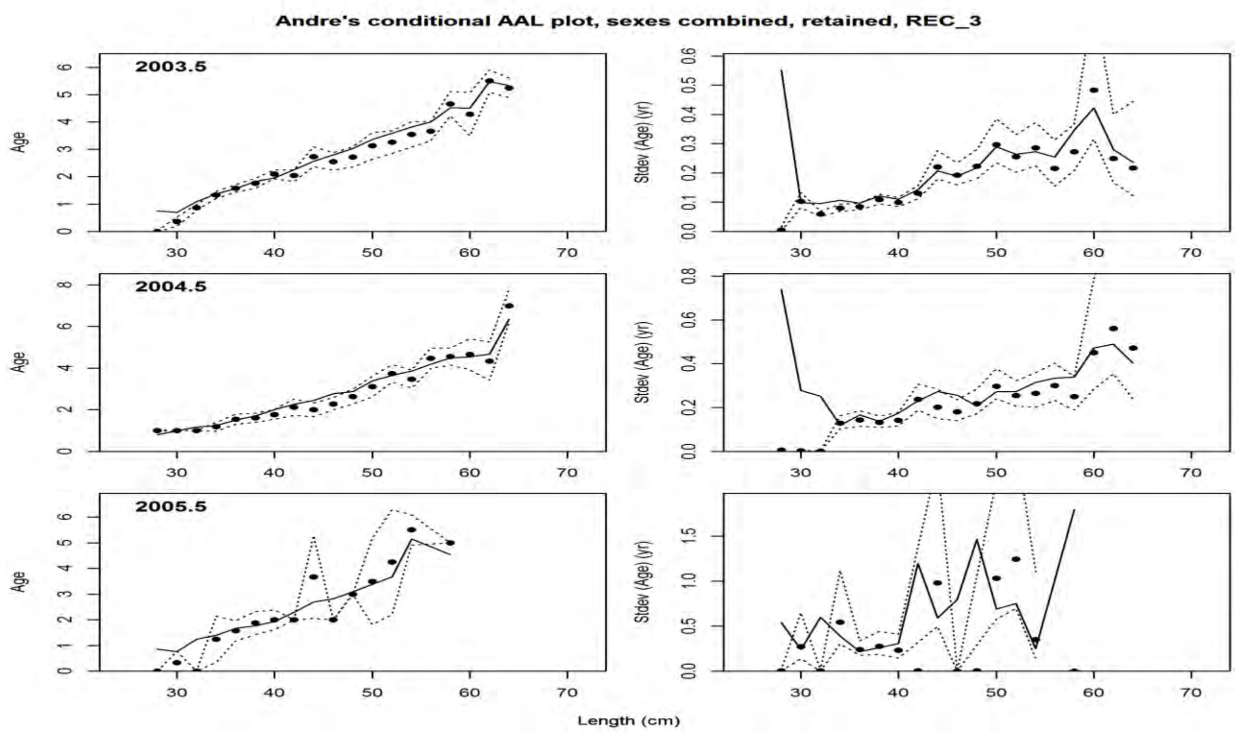
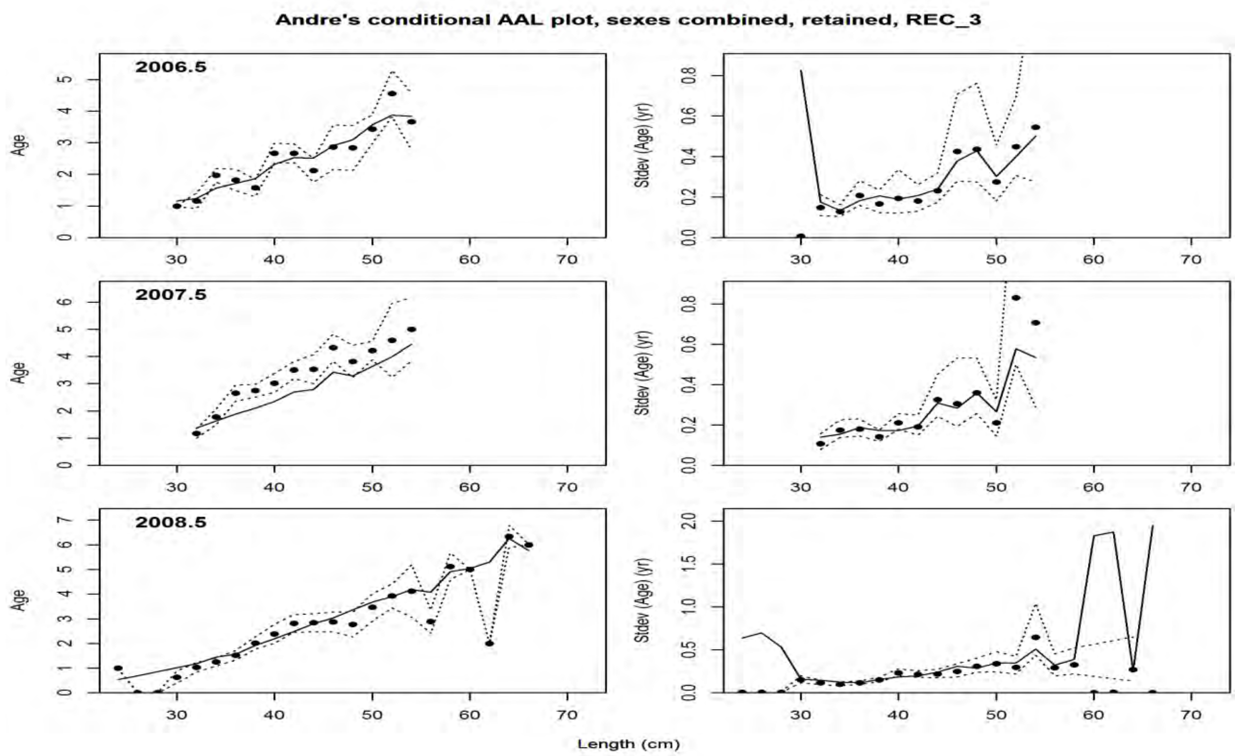




Figure 3.22. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 2000-2005 for the REC all modes fleet. Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.



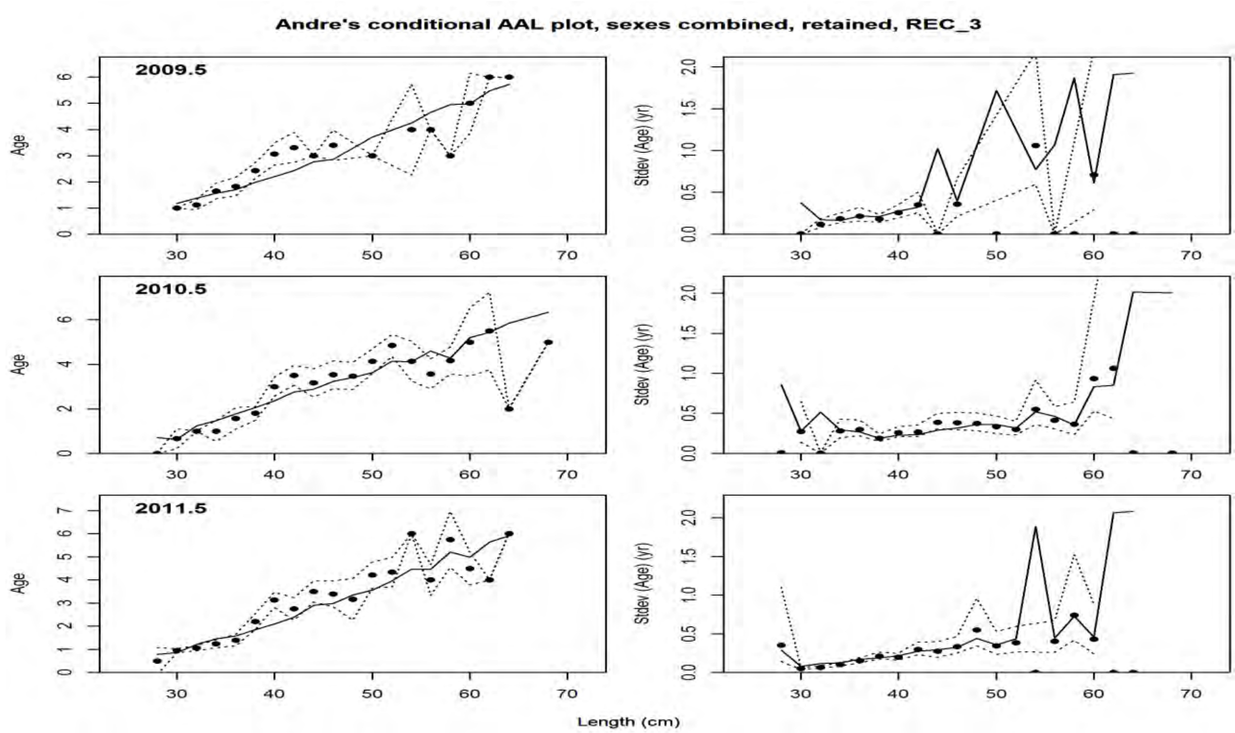




Figure 3.23. Conditional age composition fits for Gulf of Mexico Spanish mackerel from SS Run Base1 2007-2011. for the REC all modes fleet. Left panel is estimated age at length at 2cm fork length bin. Right panel is estimated standard deviation of age at 2 cm fork length bin.

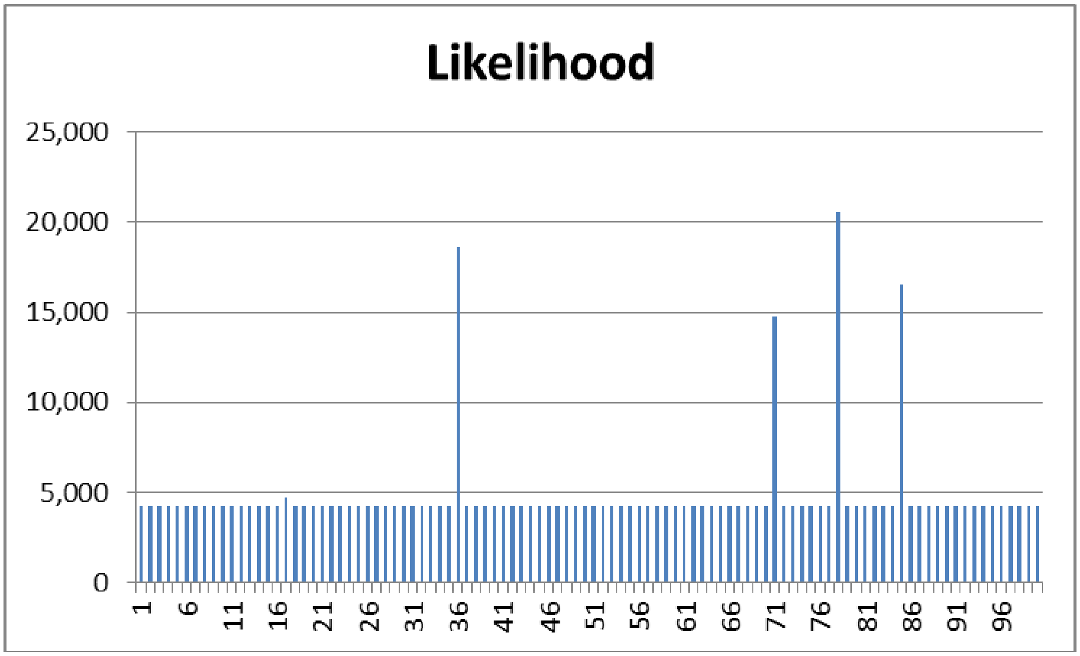



Figure 3.24. Summary results for model likelihood estimate for 100 jitter runs from the SS stock assessment model Run 3 (steepness = 0.8, M=0.38) for Gulf of Mexico Spanish mackerel.

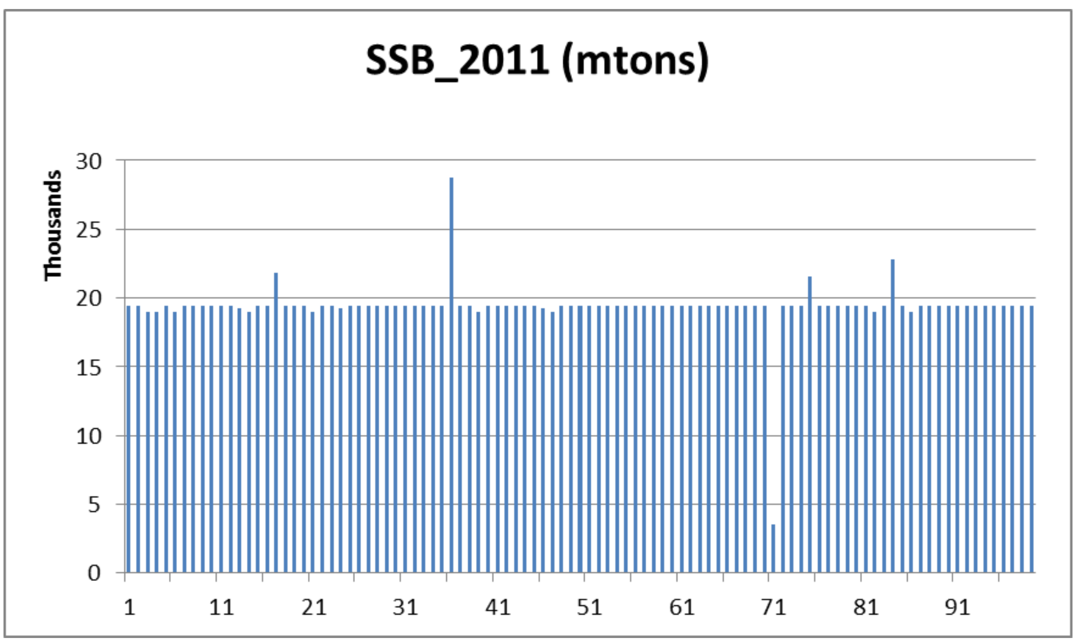



Figure 3.25. Summary results for predicted spawning stock biomass in 2011 (SSB) and spawning potential ratio in 2011 for 100 jitter runs from the SS stock assessment model Run 3 (steepness = 0.8, M=0.38) for Gulf of Mexico Spanish mackerel.


Figure 3.26. Summary results for model estimates of SPR_2011, F_CURRENT, F_REF, AND SSB_REF for 100 jitter runs from the SS stock assessment model Run 3 (steepness = 0.8, M=0.38) for Gulf of Mexico Spanish mackerel. F_CURRENT = geometric mean of F_2009-F_2011. SSB_REF = SSB_2011/MSST. MSST = 1.0 – M) * SSB_SPR30%SPR. F_REF = FCURRENT/F_30%SPR.

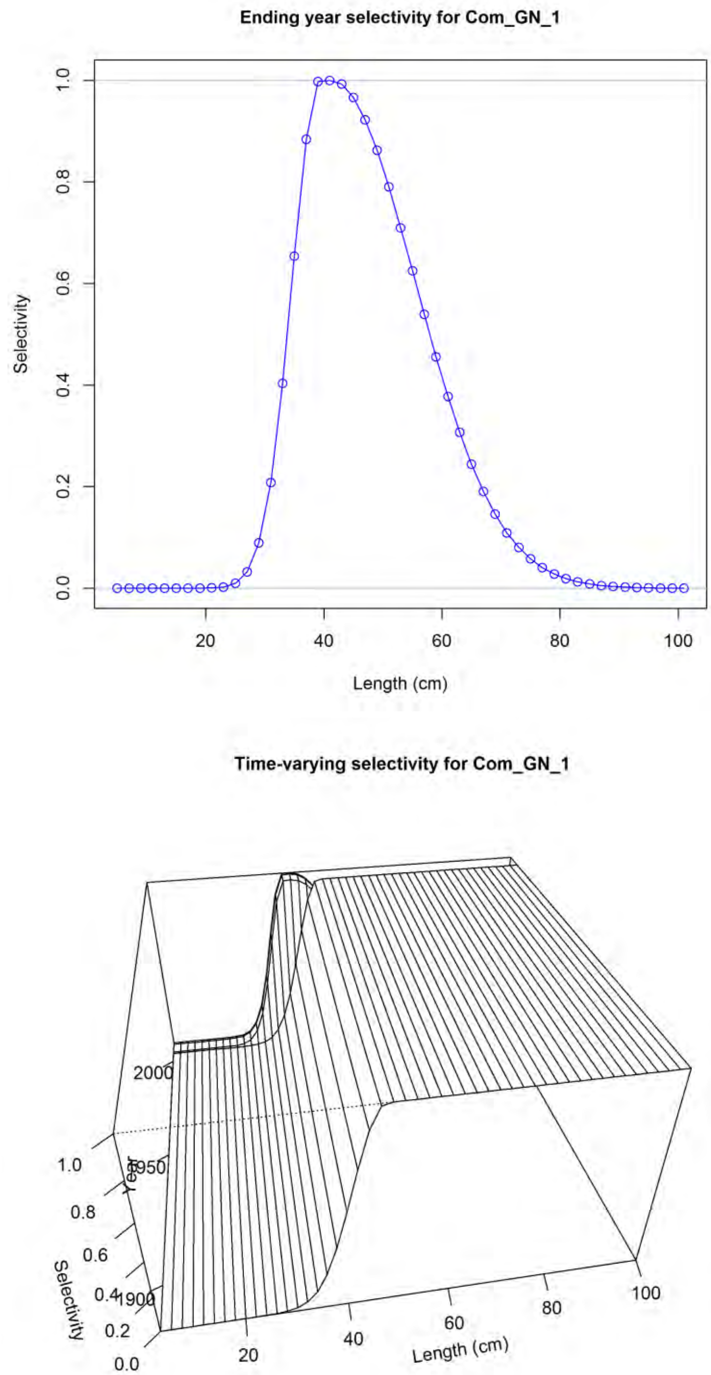



Figure 3.27. Predicted size selectivity for Gulf of Mexico Spanish mackerel from SS for the COM_GN fishery. Model configuration = Run 3, M=0.38 $y^{-1}$ and Steepness = 0.8.

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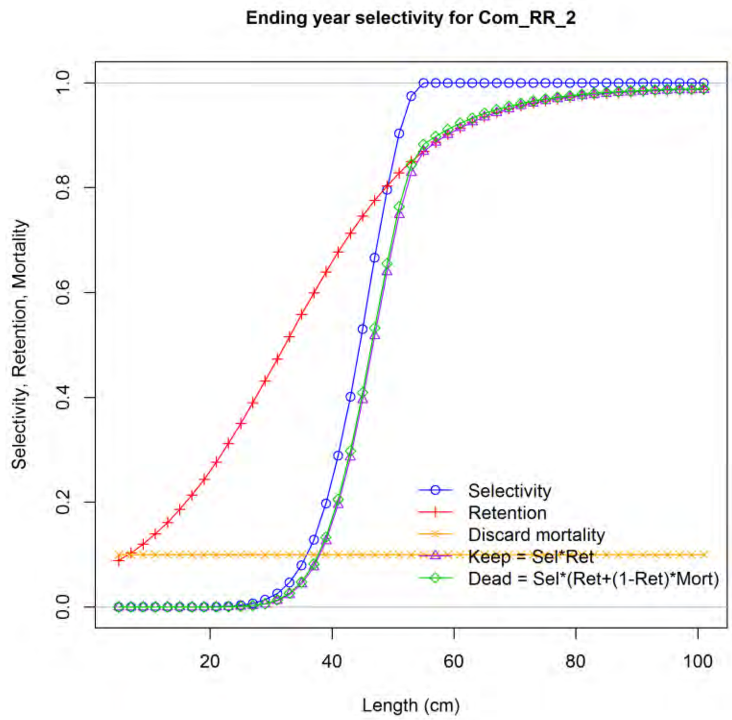


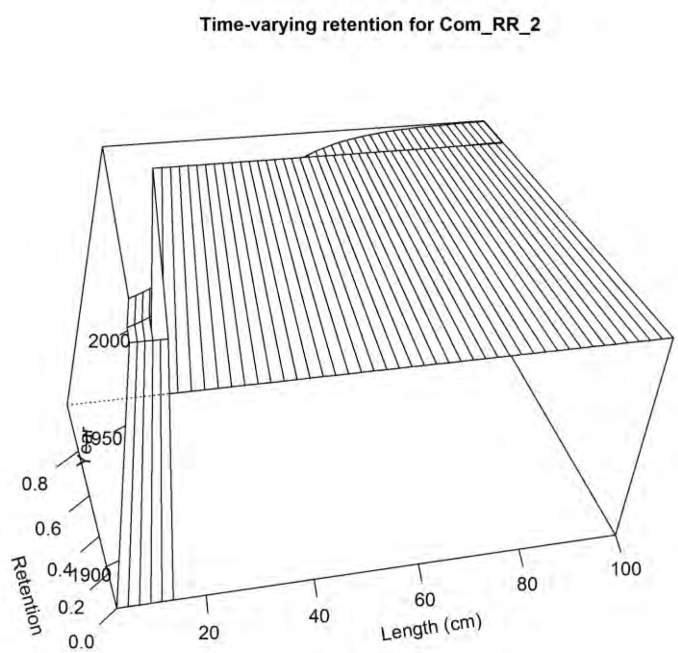


Figure 3.28. Predicted size selectivity for Gulf of Mexico Spanish mackerel from SS for the COM_RR fishery. Model configuration = Run 3, M=0.38 $y^{-1}$ and Steepness = 0.8.
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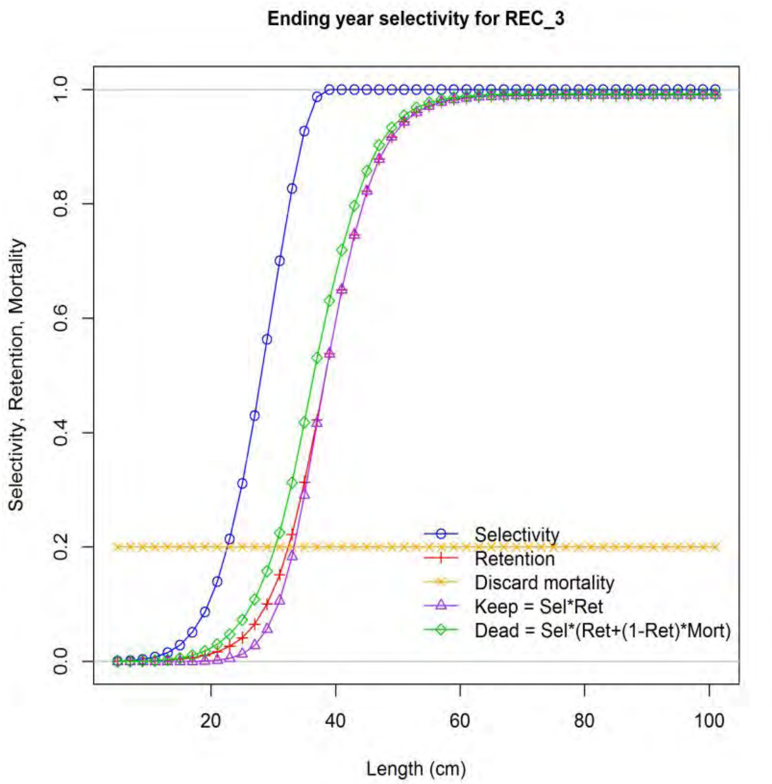


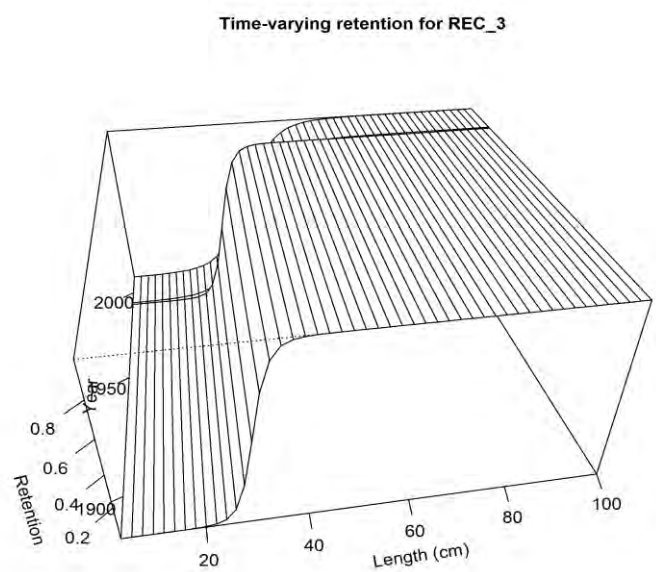




Figure 3.29. Predicted size selectivity for Gulf of Mexico Spanish mackerel from SS the REC (recreational all modes/. Model configuration = Run 3, M=0.38 $y^{-1}$ and Steepness = 0.8.

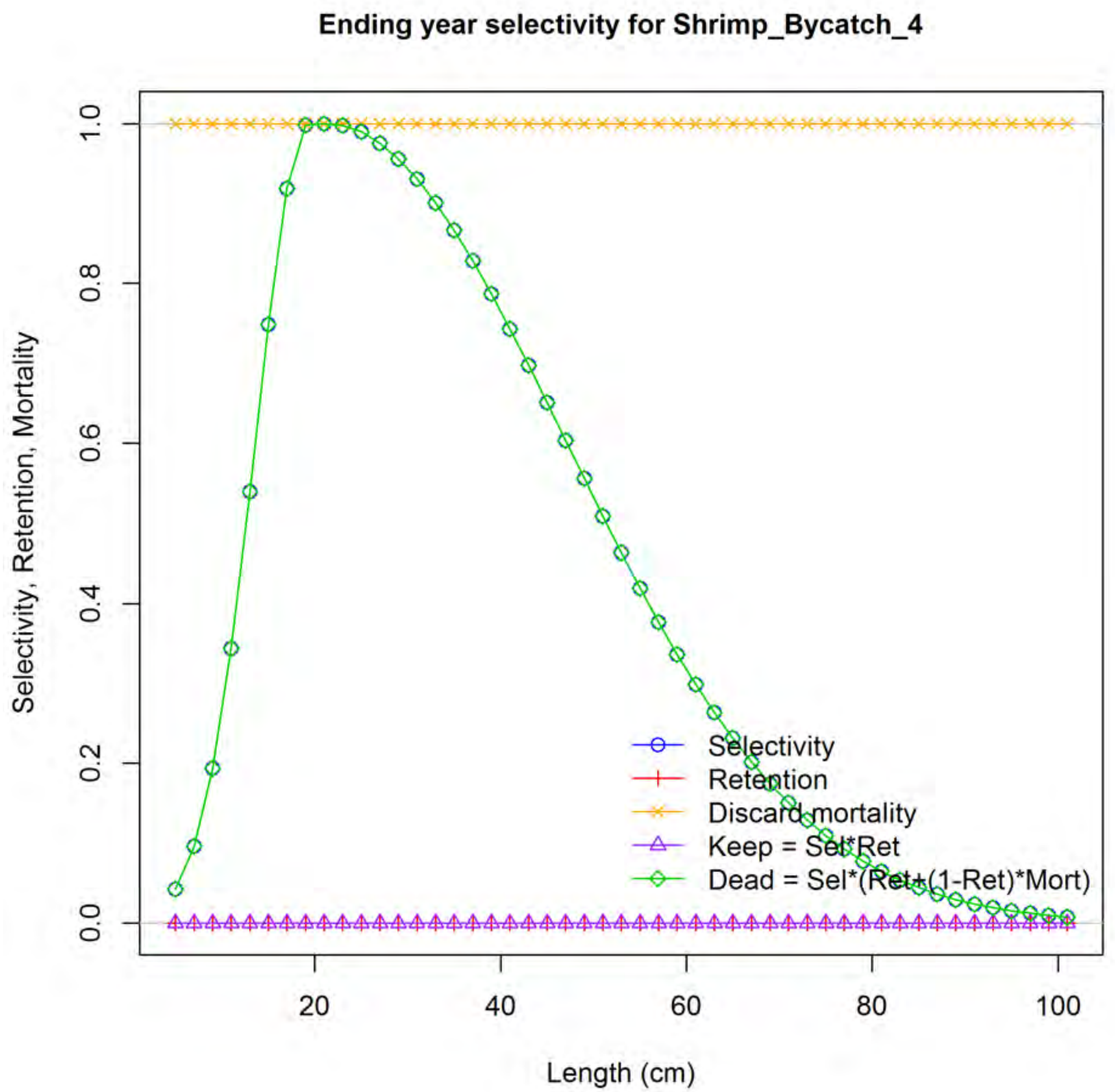



Figure 3.30. Predicted size selectivity for Gulf of Mexico Spanish mackerel from SS for the SEAMAP SURVEY. Model configuration = Run 3, M=0.38 $y^{-1}$ and Steepness = 0.8.

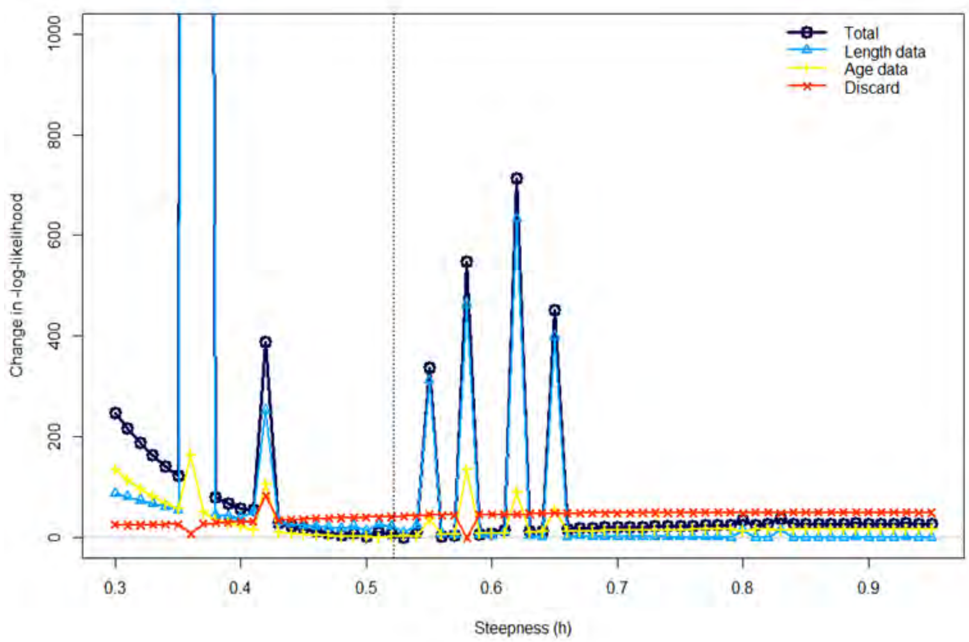



Figure 3.31. Profile of Steepness for Gulf of Mexico Spanish mackerel for Run 1 Model configuration. Model estimated steepness value= 0.5219, SD=0.0151.

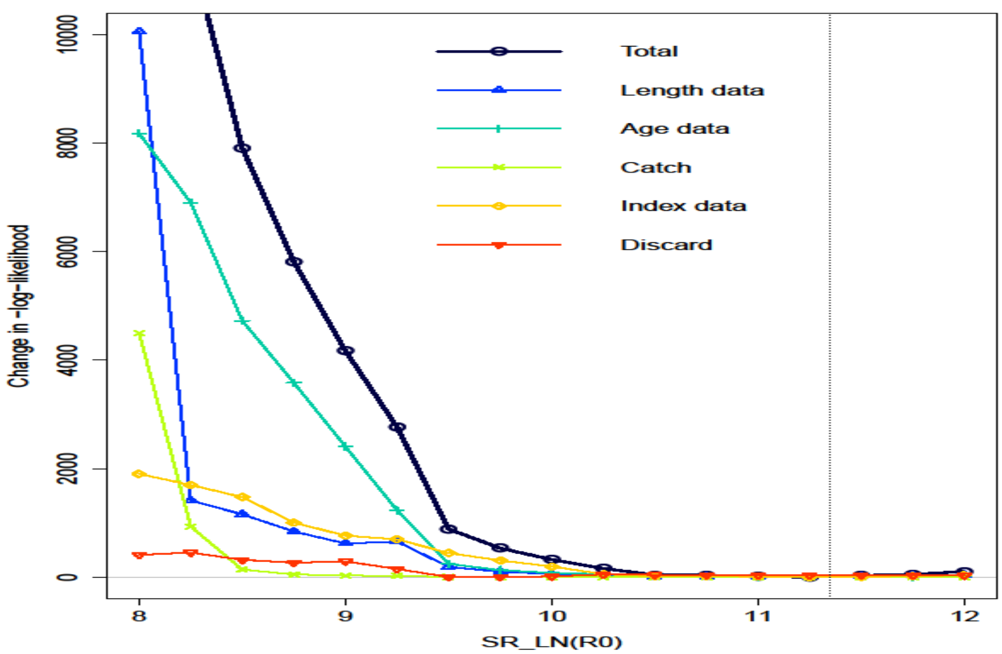



Figure 3.32. Profile of Virgin biomass (R0) for Gulf of Mexico Spanish mackerel for Run 1 Model configuration. Model estimated ln (R0) value=11.3274, SD = 0.052332. Blue line is change in length data likelihood, red line = change in discard data likelihood, aqua color line = change in age likelihood.

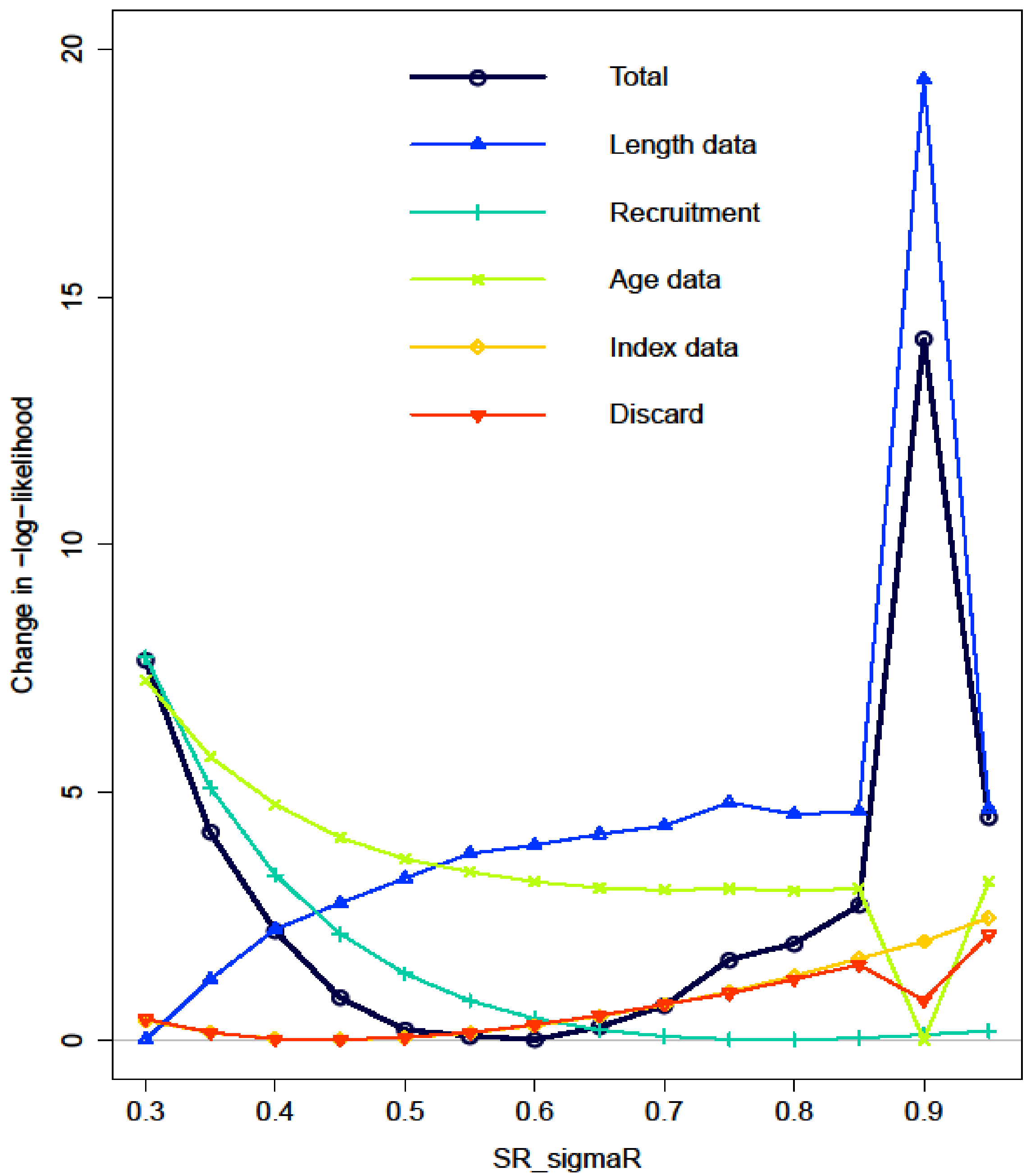



Figure 3.33. Profile of SigmaR of Gulf of Mexico Spanish mackerel for the Run 1 Model configuration. Model estimated sigmaR value=0.565754, SD=0.097579.

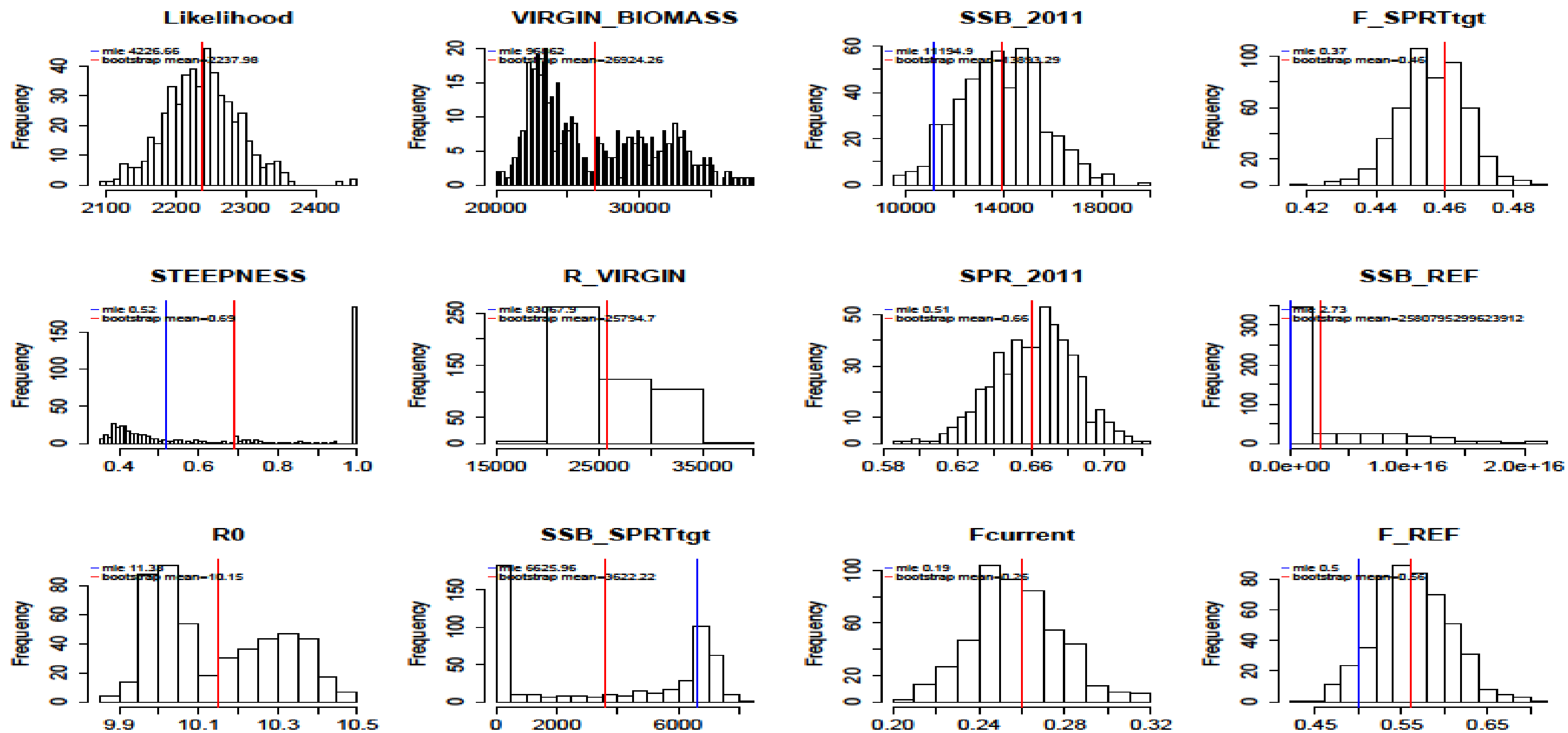



Figure 3.34. Distribution of key parameters estimated via SS from 500 bootstrap samples for the Run 1 model (steepness estimated and M =0.38y$^{-1}$ input in Lorenzen function). Red lines represent mean estimates from the bootstrap samples; blue lines represent the point estimate of the parameters from the Run 1 model. SSB REF = SSB_2011/SSB_SPRTtgt and F_REF = Fcurrent / F_SPRTtgt. Fcurrent = geometric mean for 2009-2011.

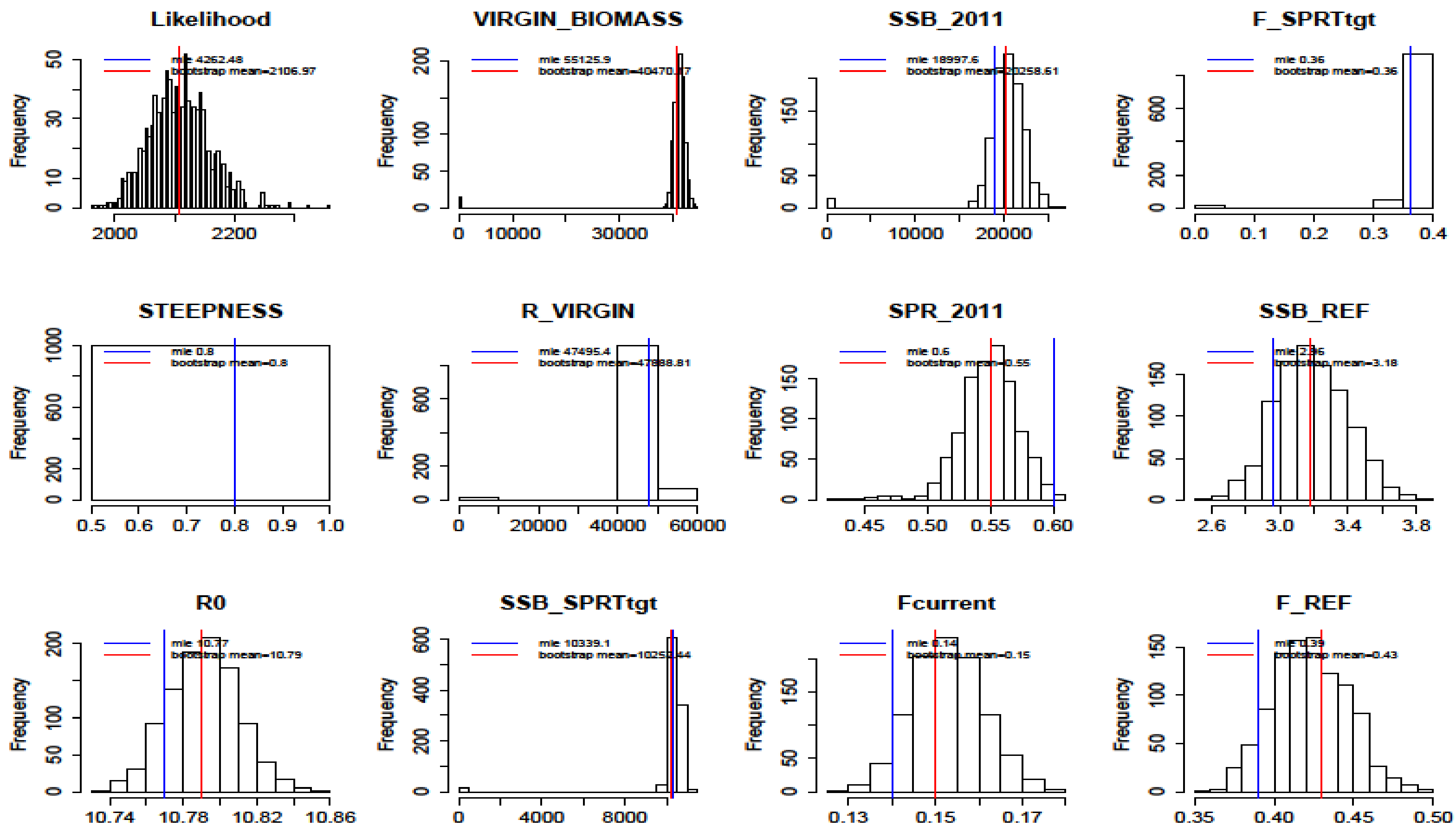



Figure 3.35. Distribution of key parameters estimated via SS from 1,000 bootstrap samples for the Run 1 model (steepness fixed at 0.8 and M =0.38$y^{-1}$ input in Lorenzen function). Red lines represent mean estimates from the bootstrap samples; blue lines represent the point estimate of the parameters from the Run 3 model. SSB REF = SSB_2011/SSB_SPRTtgt and F_REF = Fcurrent / F_SPRTtgt. Fcurrent = geometric mean for 2009-2011.

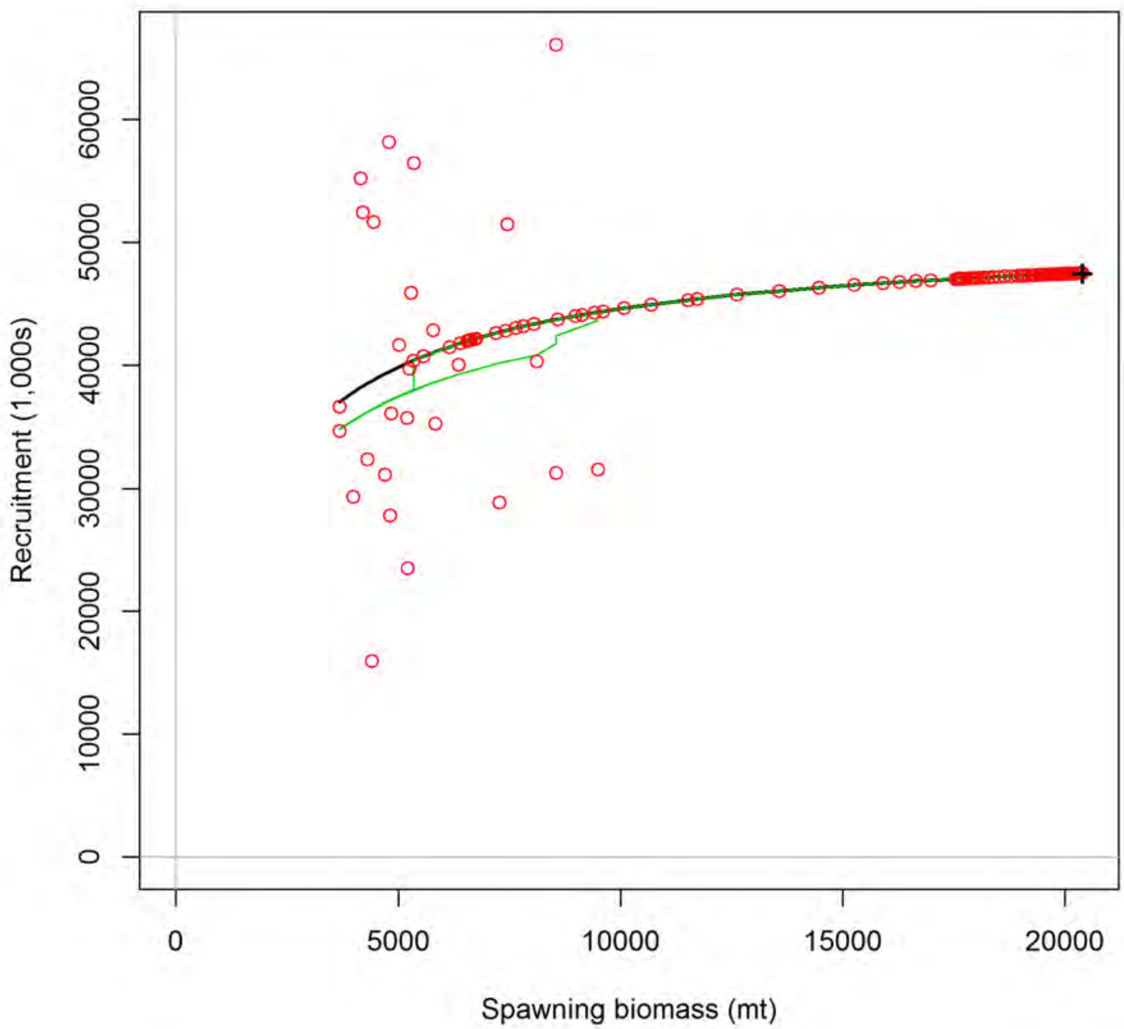



Figure 3.36. Predicted stock-recruitment relationship for Gulf of Mexico Spanish mackerel from SS Run 3 Model configuration (M=0.38 $y^{-1}$ and Steepness = 0.8). Plotted are predicted annual recruitments from SS (circles), expected recruitment from the stock recruit relationship (line), and bias adjusted recruitment from the stock-recruit relationship (line with X). Labels included on first, last, and years with (log) deviations > 0.5.

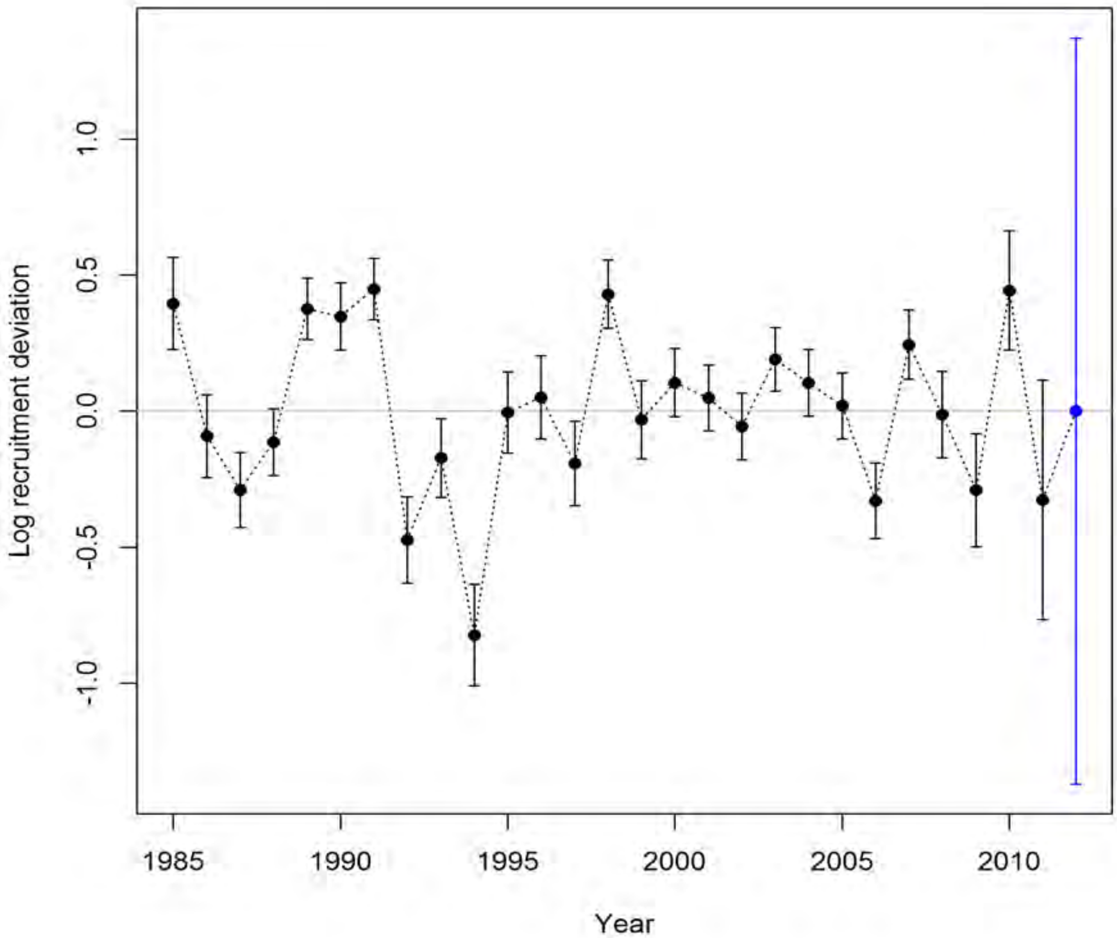



Figure 3.37. Asymptotic standard errors for recruitment deviations (1985-2010) for Gulf of Mexico Spanish mackerel from the SS Run 3 model (assuming steepness =0.8 and $M=0.38y^{-1}$) .

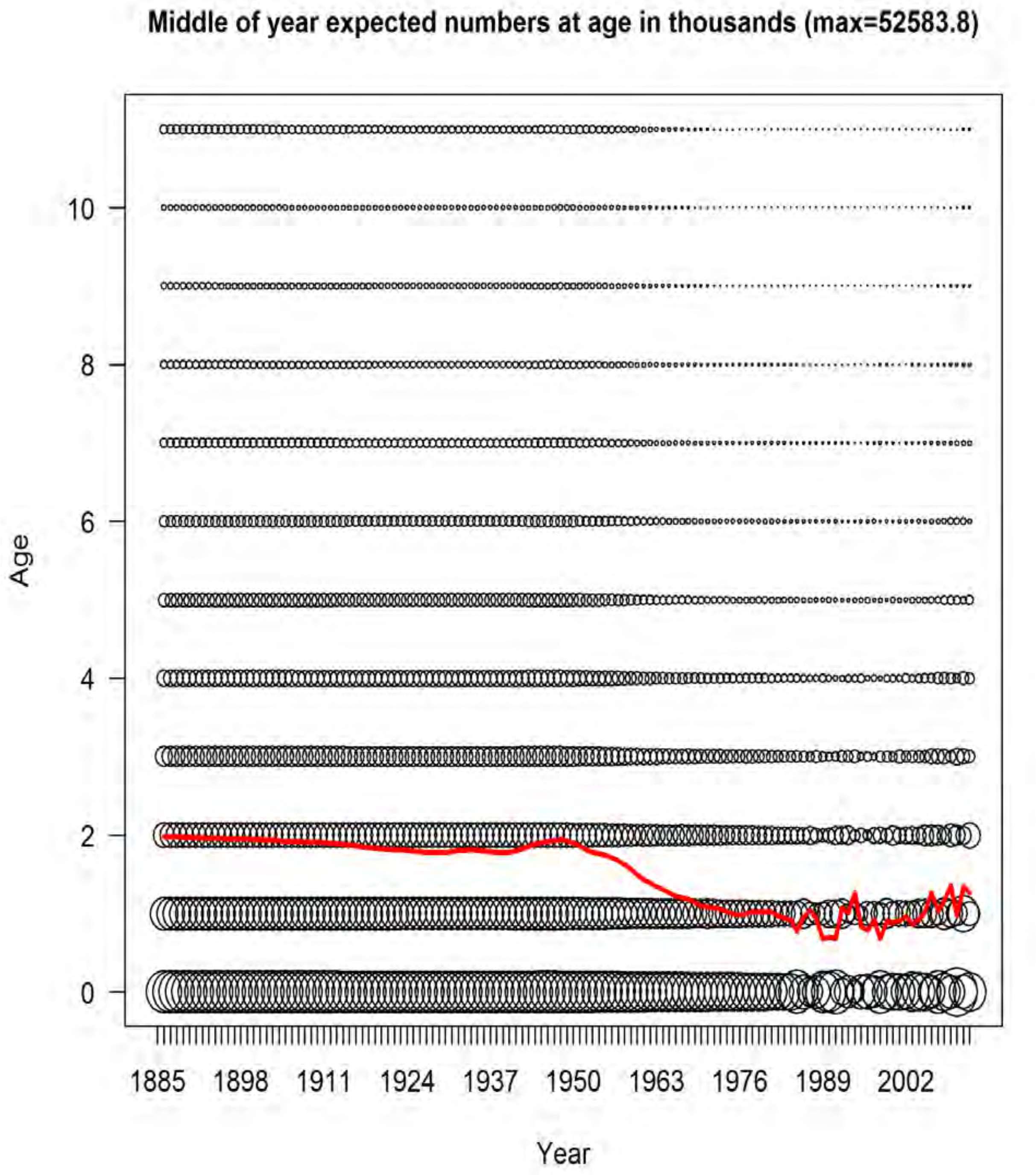



Figure 3.38. Predicted abundance at age (circles) and mean age (line) for Gulf of Mexico Spanish mackerel. Units are abundance in thousands of fish. Model configuration = Run 3, M=0.38 $y^{-1}$ and Steepness = 0.8.

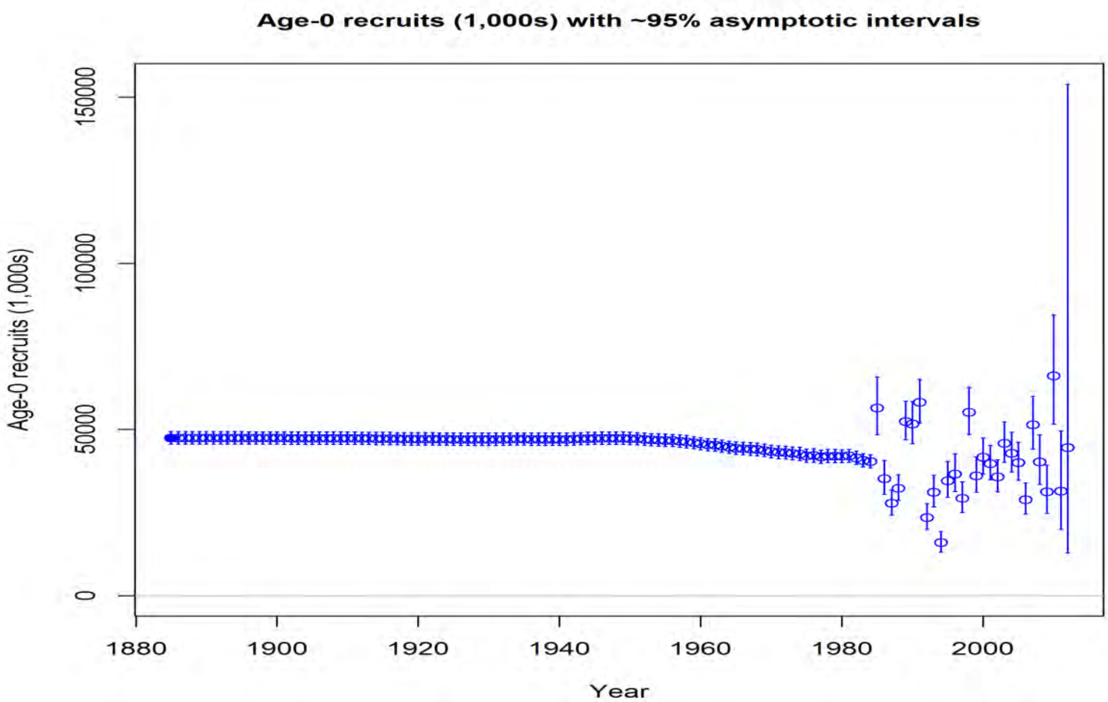



Figure 3.39. Predicted age-0 recruits in thousand fish and log recruitment deviations for Gulf of Mexico Spanish mackerel from SS. Model configuration = Run 3, M=0.38 $y^{-1}$ and Steepness=0.8.

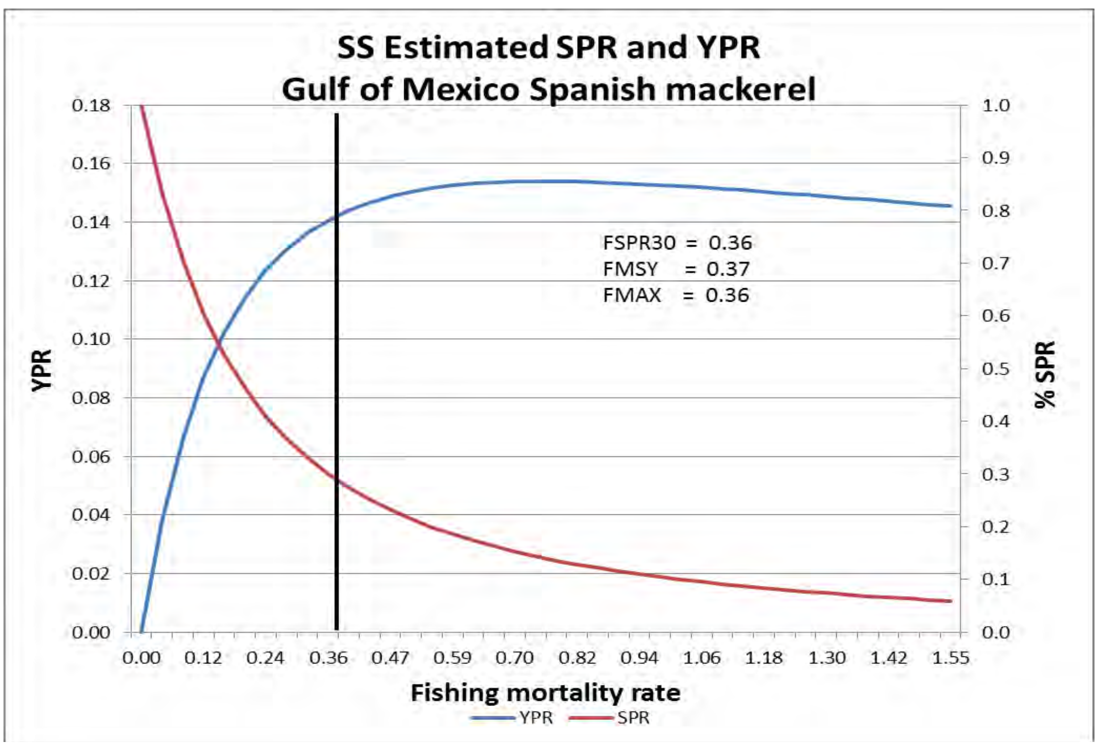



Figure 3.40. SS estimated yield per recruit and spawner per recruit.for Gulf Spanish mackerel.

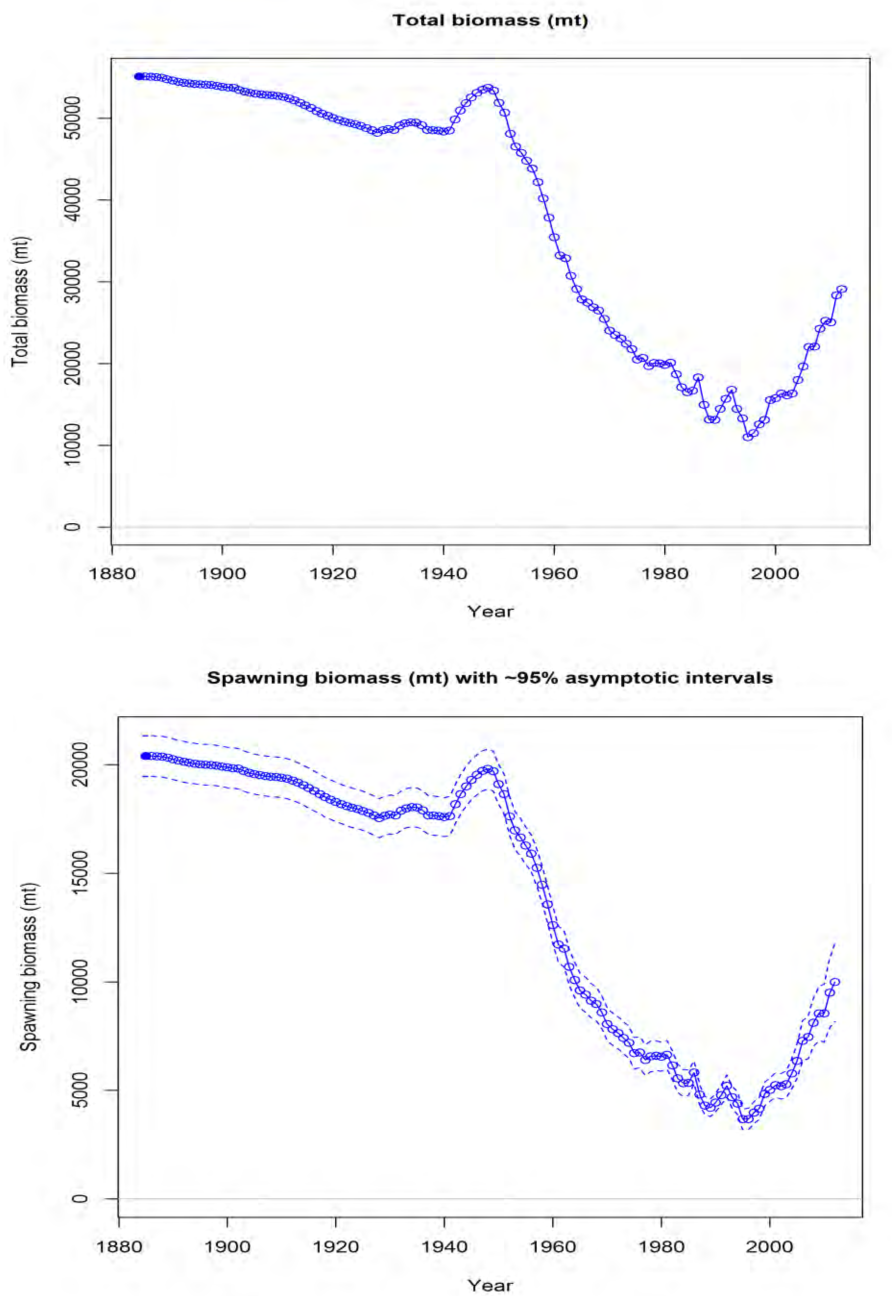



Figure 3. 41. Top Panel: SS predicted total biomass for Gulf of Mexico Spanish mackrel. Bottom Panel: SS predicted spawning biomass for Gulf of Mexico Spanish mackerel from SS. Units are mtons whole weight. Model configuration = Run 3, M=0.38 $y^{-1}$ and Steepness = 0.8.

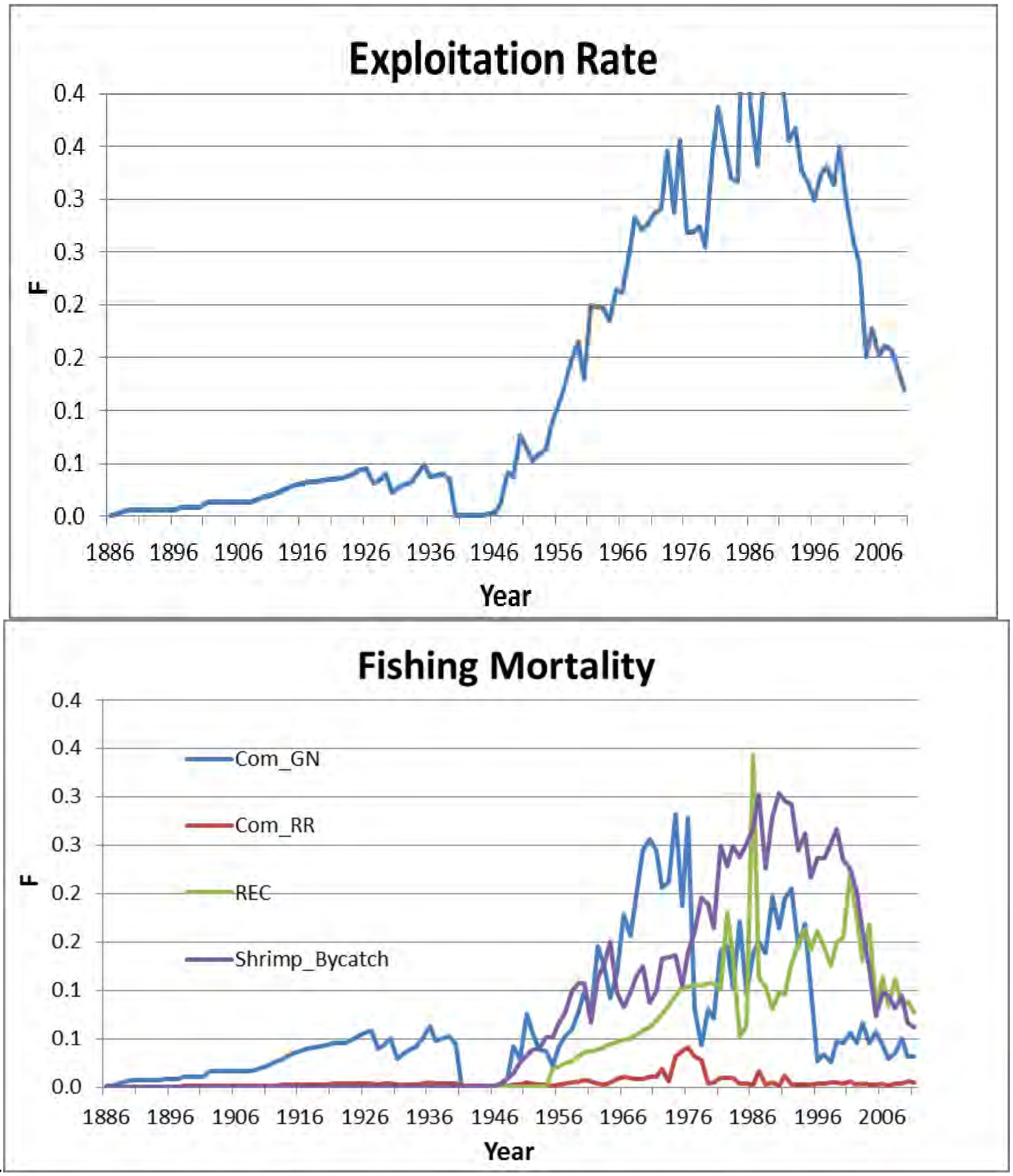



Figure 3.42. Predicted fishing mortality for Gulf of Mexico Spanish mackerel from SS. Model configuration = Run 3, M=0.38 $y^{-1}$ and Steepness = 0.8. Top panel is annual exploitation rate and bottom panel is fleet specific continuous fishing mortality. M=0.38 $y^{-1}$ and Steepness = 0.8).

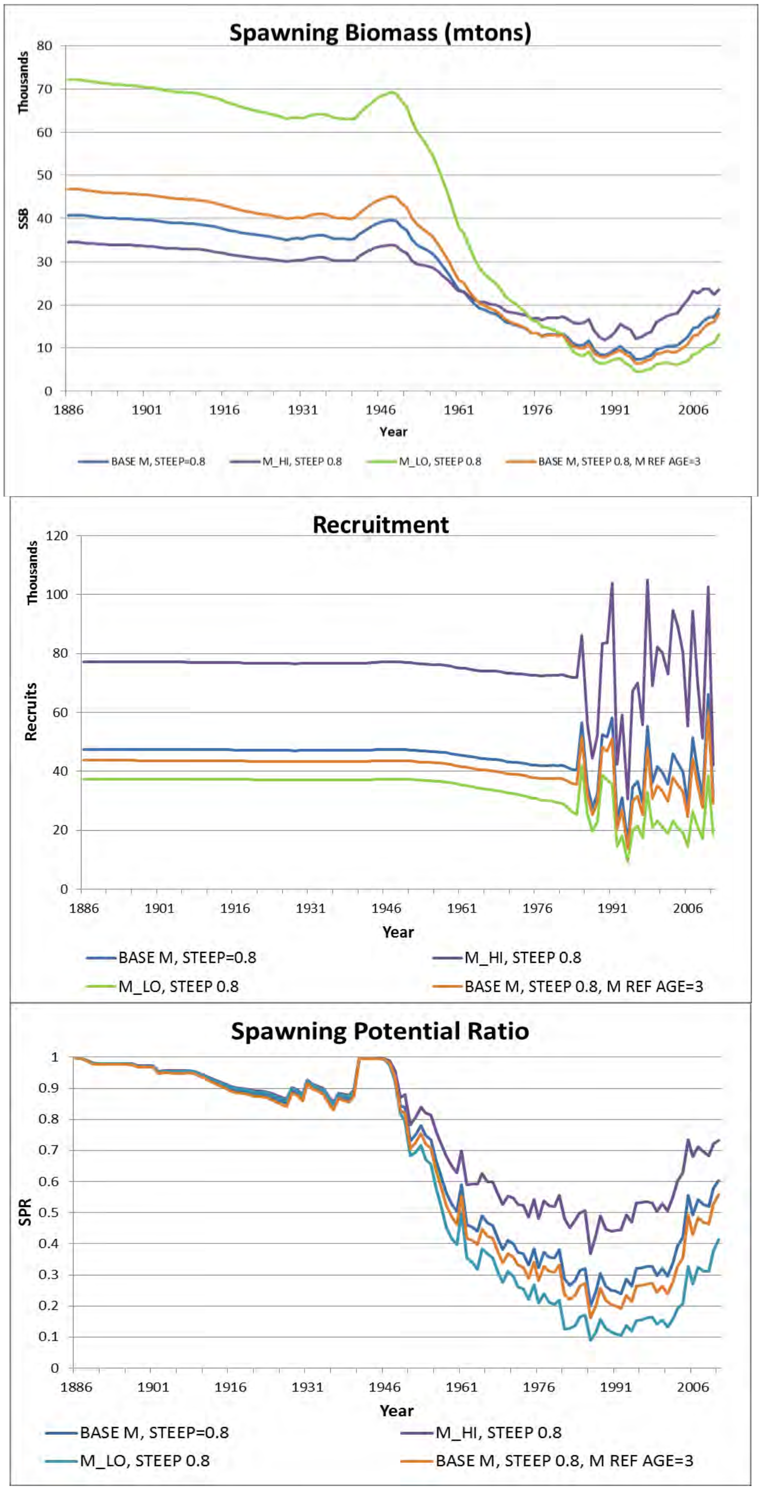



Figure 3.43. Sensitivity analyses for the Run 3 model configuration at three levels of natural mortality ranges (M = 0.38 and M_HI = 0.49 and M_LO = 0.27). Top Panel = spawning biomass (SSB), Middle Panel = Recruitment, Bottom Panel = spawning potential ratio (SPR). All Runs assuming steepness = 0.8.

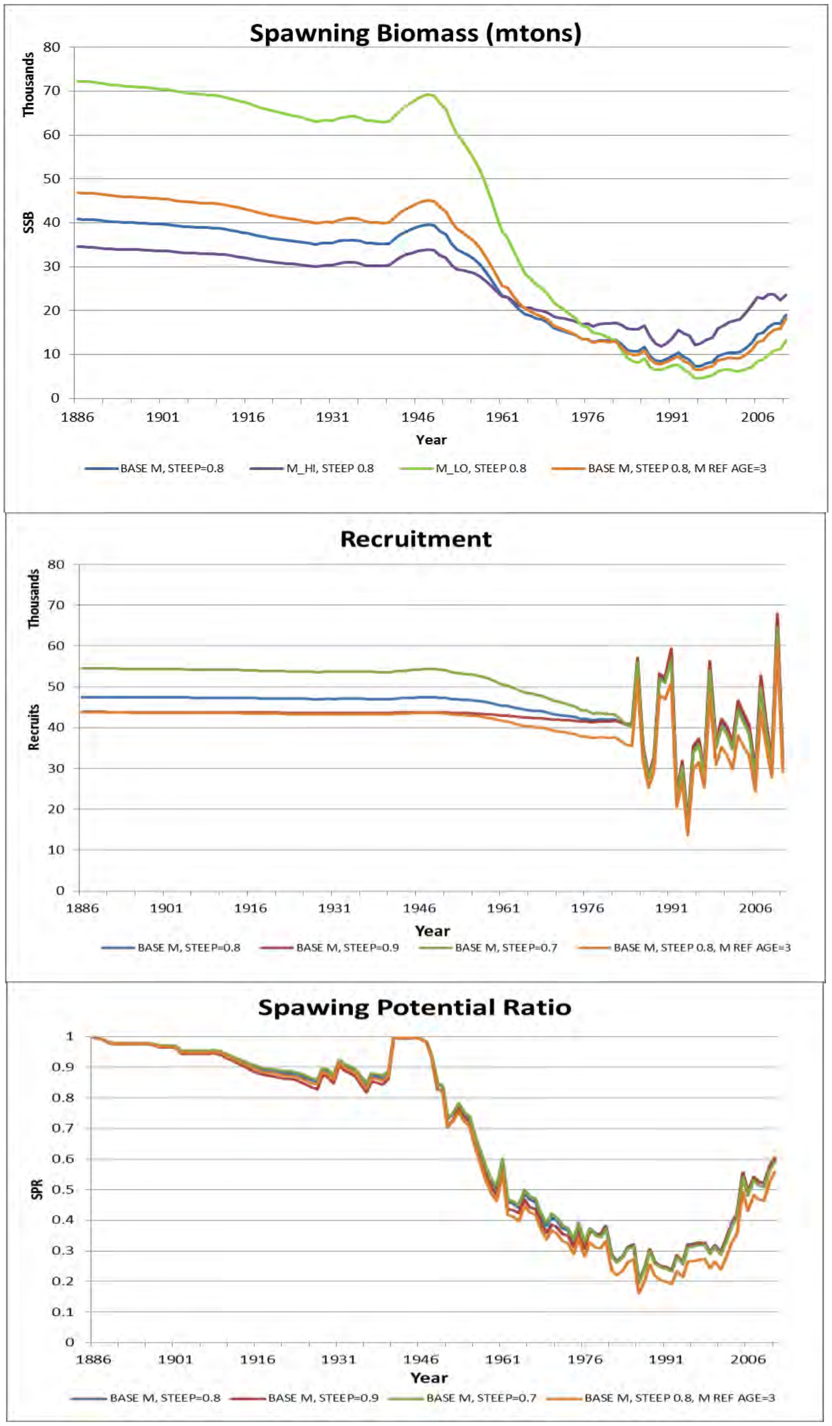



Figure 3.44. Sensitivity analysis for Gulf of Mexico Spanish mackerel with varying assumptions on the Beverton – Holt steepness parameter. Top Panel = spawning biomass (SSB), Middle Panel = Recruitment, Bottom Panel = spawning potential ratio (SPR). For the alternative steepness scenarios (0.7, 0.8, 0.9) the level of M assumed = 0.38 input into Lorenzen function. Metric shown are predicted spawning biomass (SSB), recruitment and spawning potential ratio (SPR).

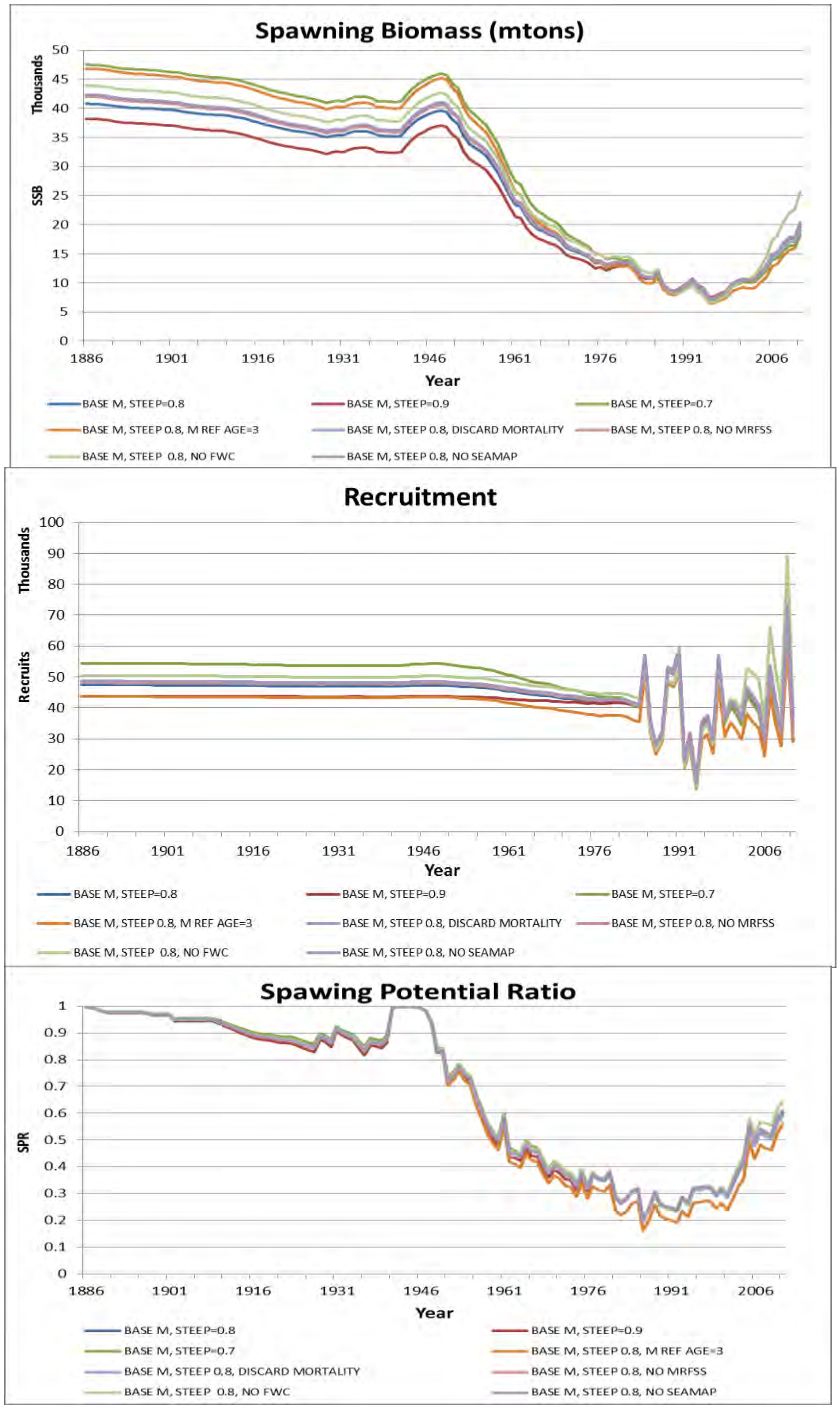



Figure 3.45. Sensitivity analysis for Gulf of Mexico Spanish mackerel with varying assumptions on the data inclusion and assumptions of release mortality. Top Panel = spawning biomass (SSB), Middle Panel = Recruitment, Bottom Panel = spawning potential ratio (SPR). For the alternative steepness scenarios (0.7, 0.8, 0.9) the level of M assumed = 0.38 input into Lorenzen function. Metric shown are predicted spawning biomass (SSB), recruitment and spawning potential ratio (SPR).

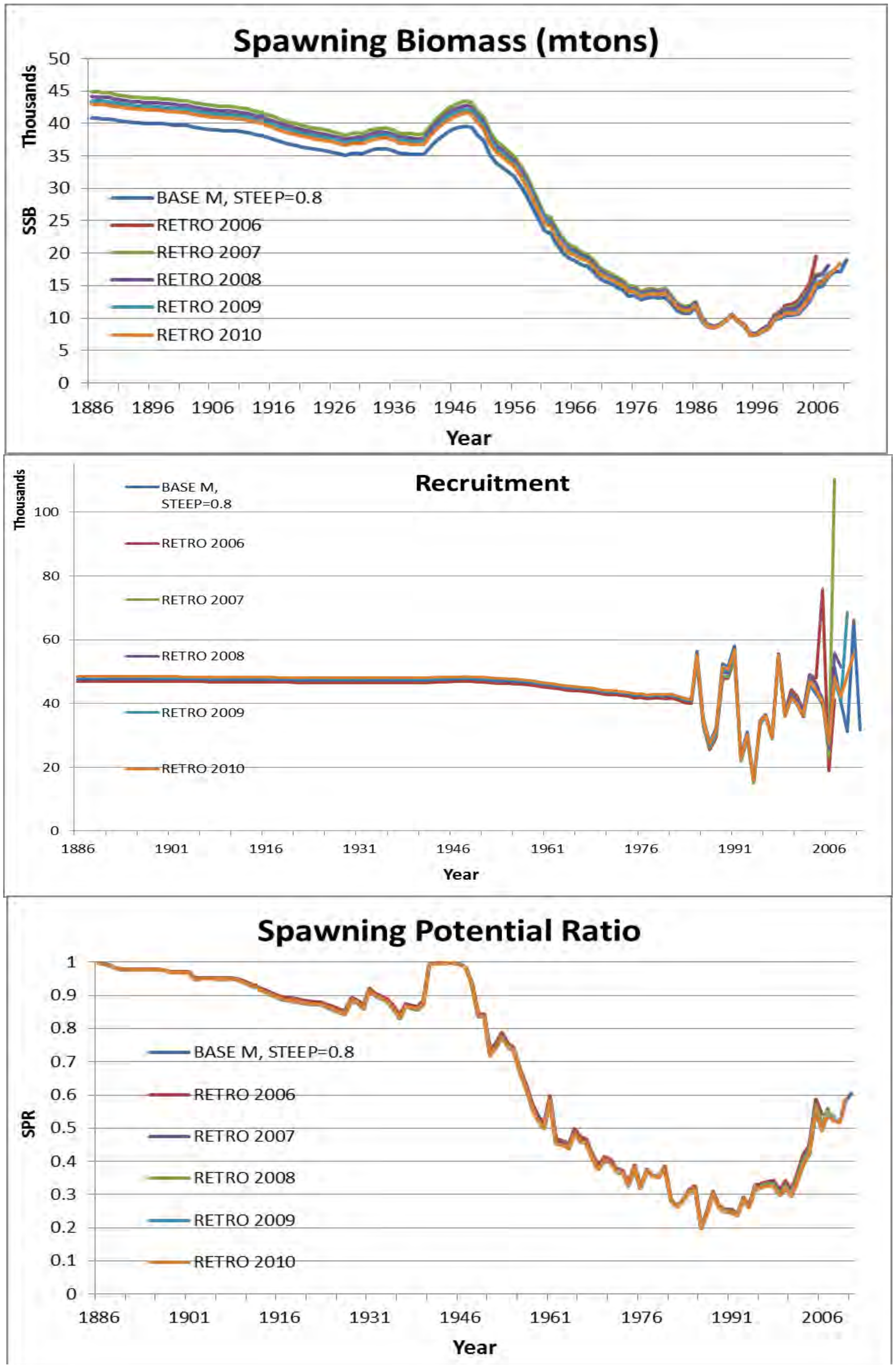



Figure 3.46. Retrospective analysis for Gulf of Mexico Spanish mackerel with last five years of data sequentially dropped from SS for Run 3model. Metrics shown are predicted spawning biomass, recruitment and spawning potential ratio. All retrospective runs assumed that M =0.38y $^{-1}$ was input into the Lorenzen function and steepness = 0.8.

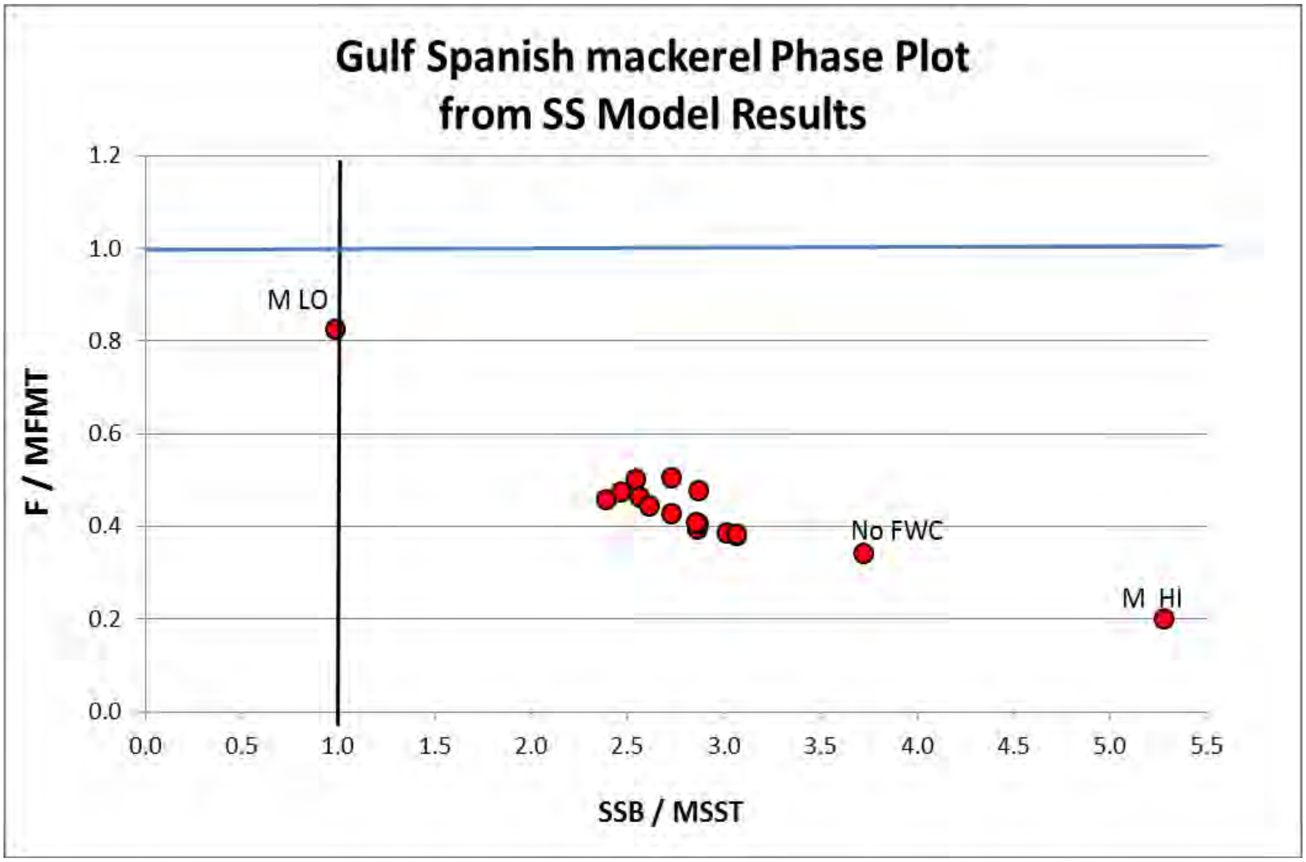



Figure 3.47. Phase plot of Stock Synthesis (SS) estimates of SSB/MSST and F/MFMT Benchmarks for Gulf of Mexico Spanish mackerel SEDAR 28 stock assessment res for varying assumptions for natural mortality at age (input into Lorenzen function), Beverton – Holt parameter, data inclusion, discard release mortality, and retrospective analysis. SSBRatio = SSB_2011 / MSST. MSST=(1-M) * SSB_MSY where SSB_MSY = SSB@F30%SPR. MFMT = F@30%SPR.

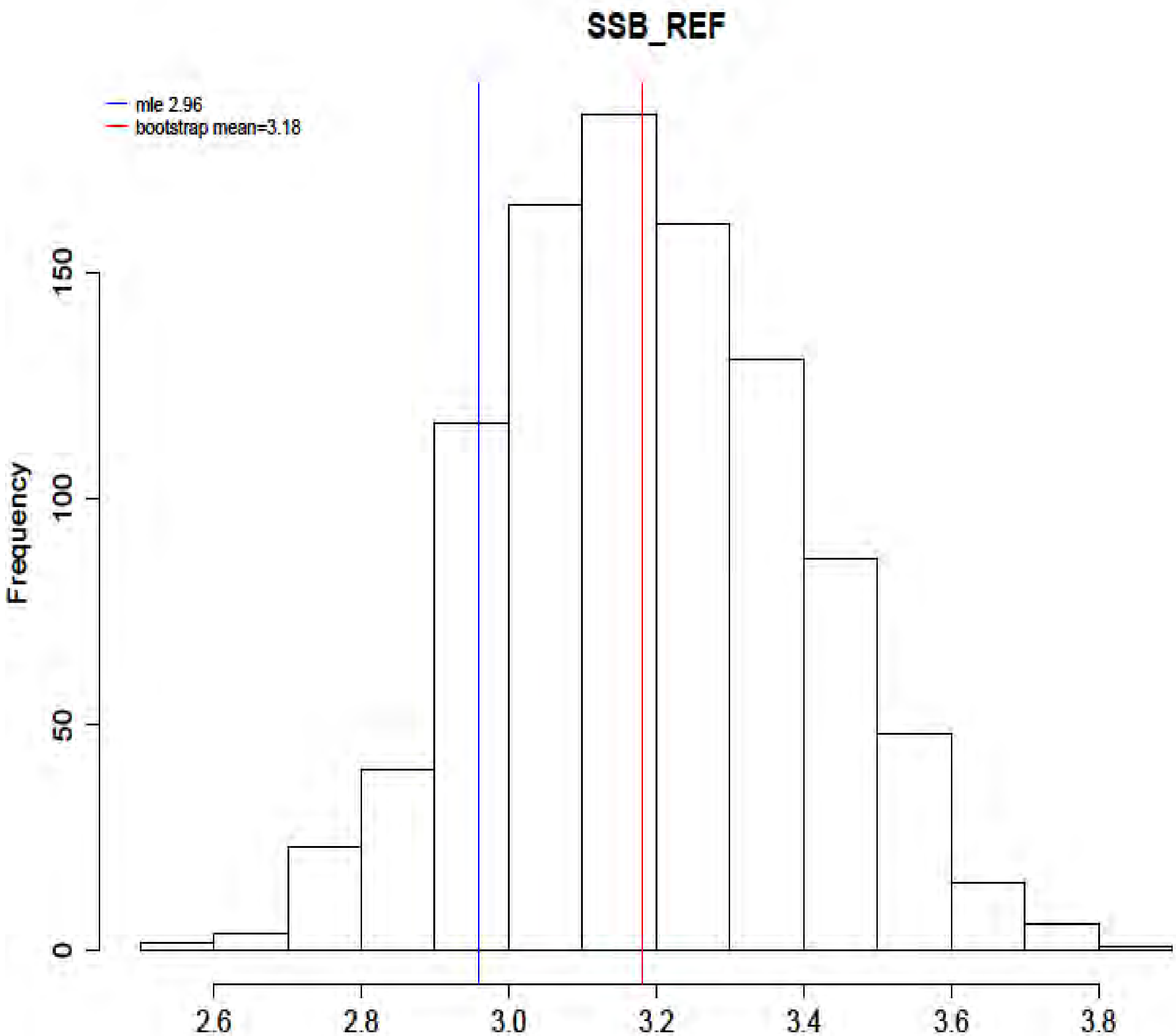



Figure 3.48. SS estimates of Fcurrent / FSPR30% from 1,000 bootstrap samples of the Run 3 model (steepness =0.8, M = $0.38y^{-1}$) for Gulf of Mexico Spanish mackerel. SSBR_REF = SSB_2011 / MSST. MSST = (1-M) * SSB_MSY where SSB_MSY = SSB@F30%SPR. Red lines represent mean estimates from the bootstrap samples; blue lines represent the point estimate of the parameters from the Run 1 model.

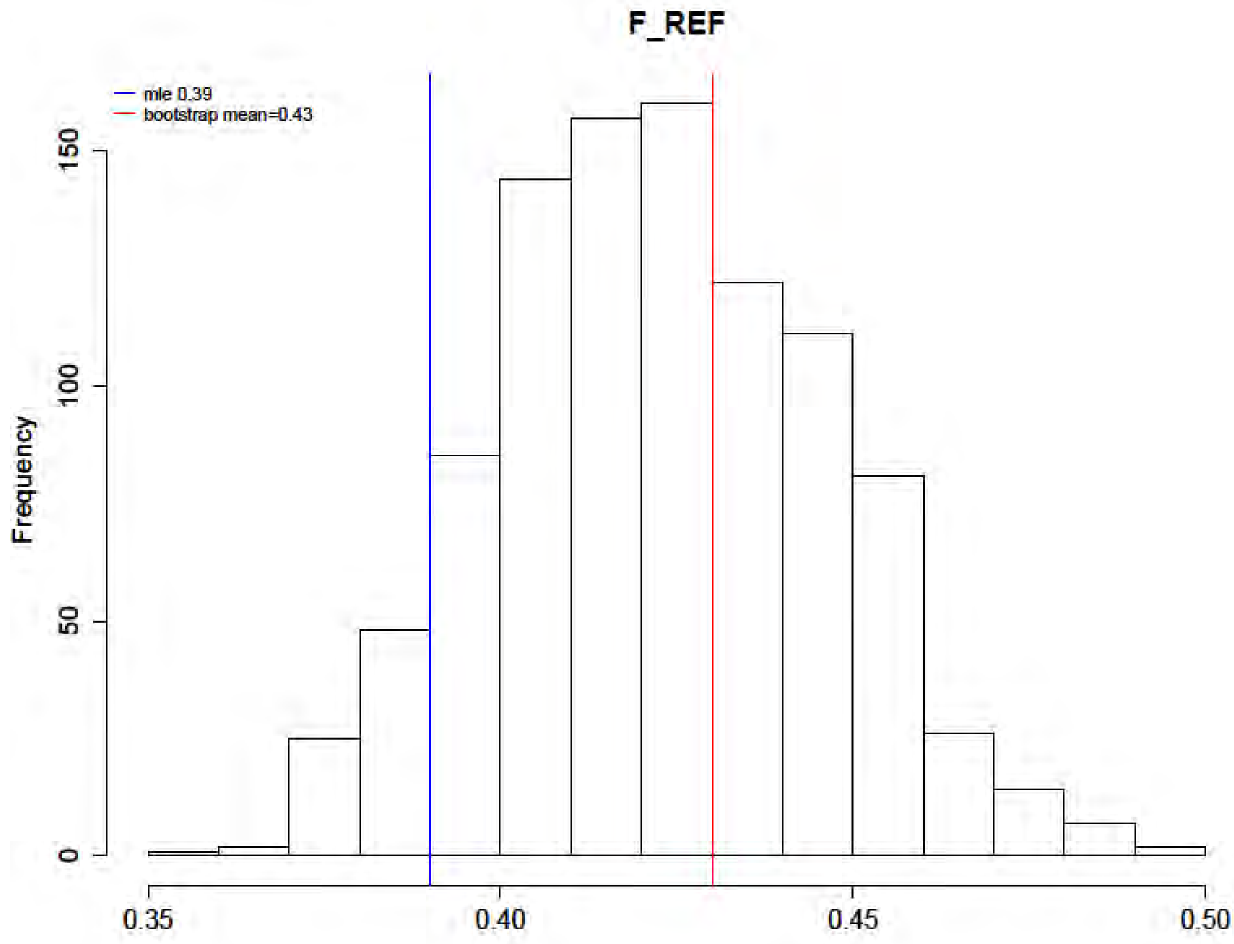



Figure 3.49. SS estimates of F_REF from 1,000 bootstrap samples of the Run 3 model (steepness =0.8, M = 0.38$y^{-1}$) for Gulf of Mexico Spanish mackerel. F_REF = Fcurrent / MFMT AND MFMT = F@30%SPR. MFMT = F@30%SPR. Fcurrent = geometric mean of F_2009 – F-2011. Red lines represent mean estimates from the bootstrap samples; blue lines represent the point estimate of the parameters from the Run 1 model.

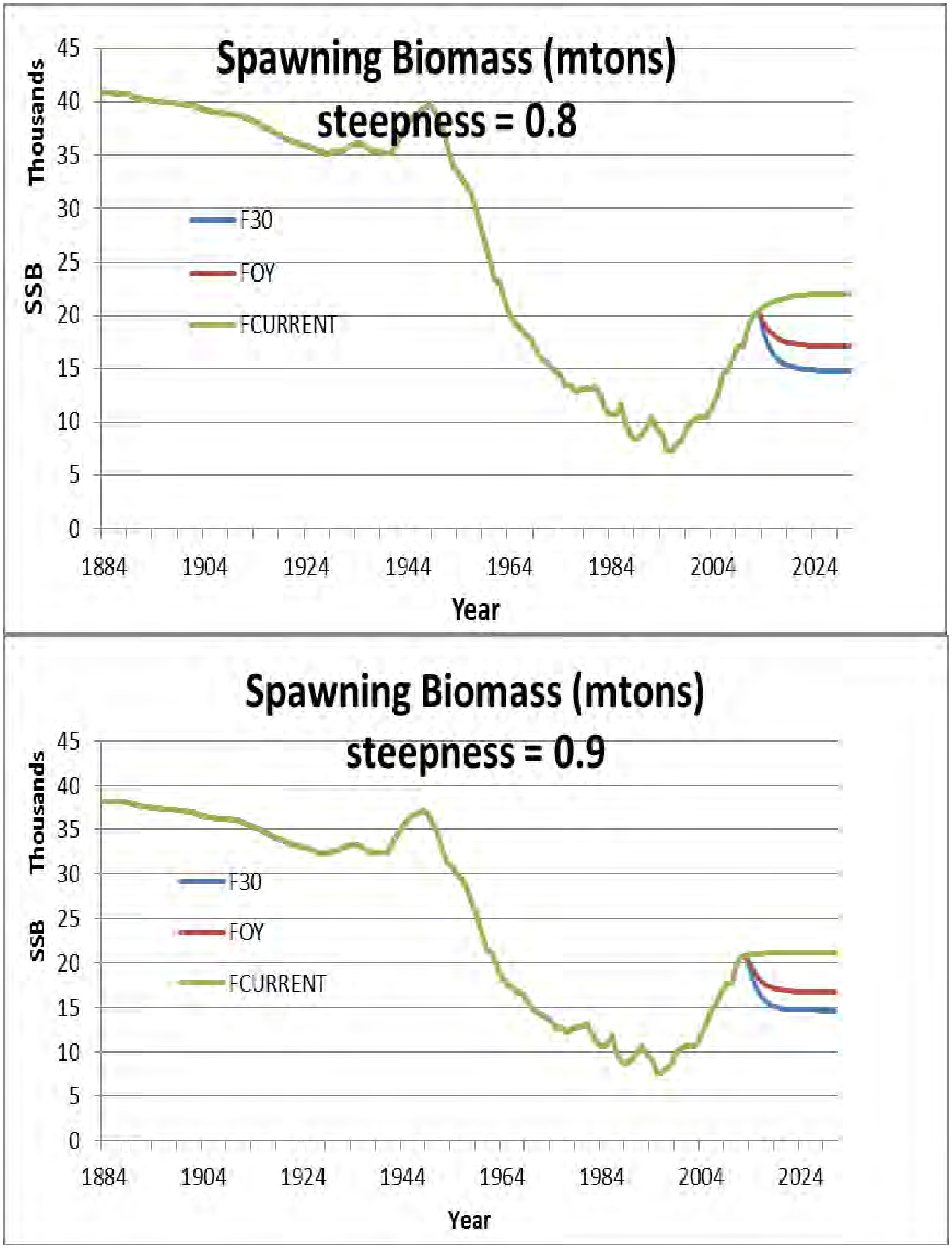
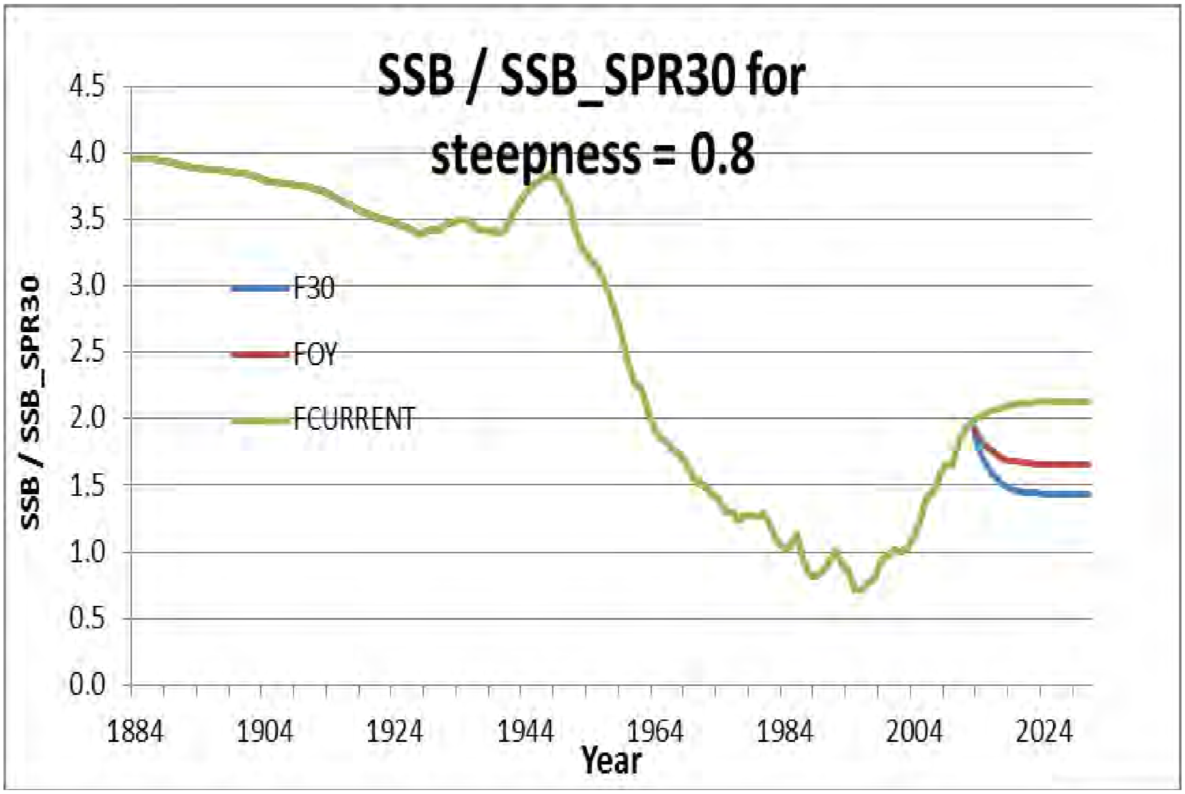



Figure 3.50. SS predicted spawning biomass (SSB) for the Run 3 model configuration (Top Panel) and Run 2 model (Bottom Panel) under three fishing mortality scenarios: $F_{CURRENT}$, $F_{SPR30}$, and $F_{OY}$. Both models assumed $M=0.38y^{-1}$ in the input Lorenzen function.



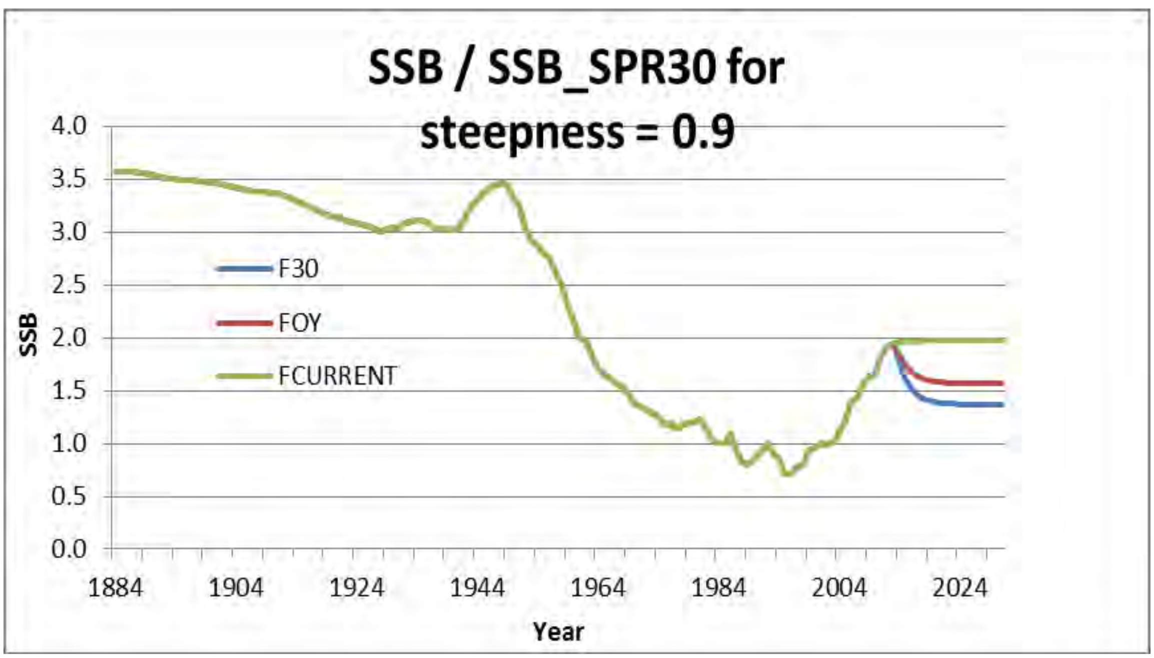




Figure 3.51. Predicted spawning biomass (SSB) relative to F30%SPR for the Run 3 model configuration (Top Panel) and Run 2 model (Bottom Panel) under three fishing mortality scenarios: $F_{CURRENT}$, $F_{SPR30}$, and $F_{OY}$. Both models assumed $M=0.38y^{-1}$ in the input Lorenzen function.

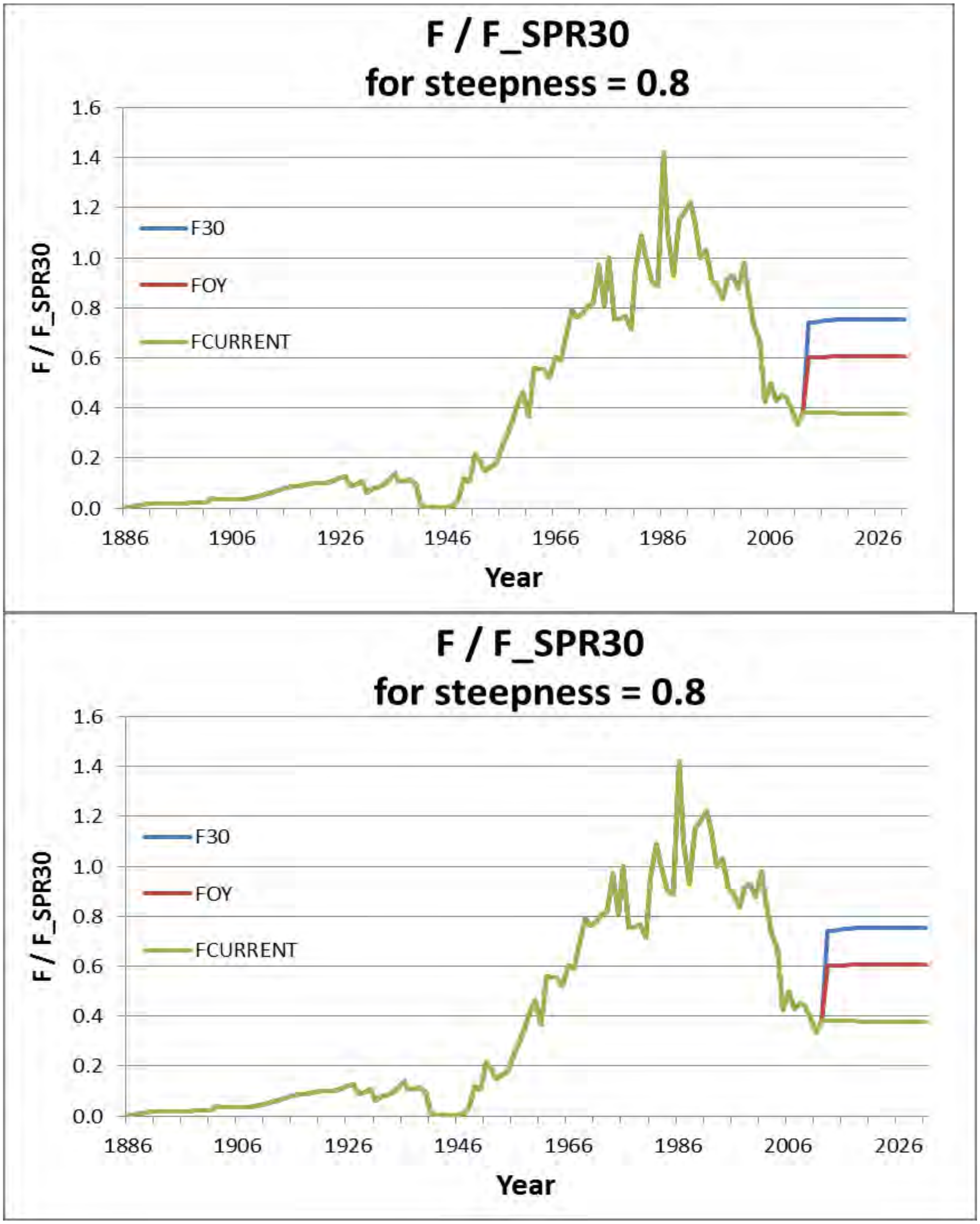



Figure 3.52. Projected fishing mortality rate relative to $F_{SPR30\%}$ for the Run 3 model configuration (Top Panel) and Run 2 model (Bottom Panel) under three fishing mortality scenarios: $F_{CURRENT}$, $F_{SPR30}$, and $F_{OY}$. Both models assumed $M=0.38y^{-1}$ in the input Lorenzen function.

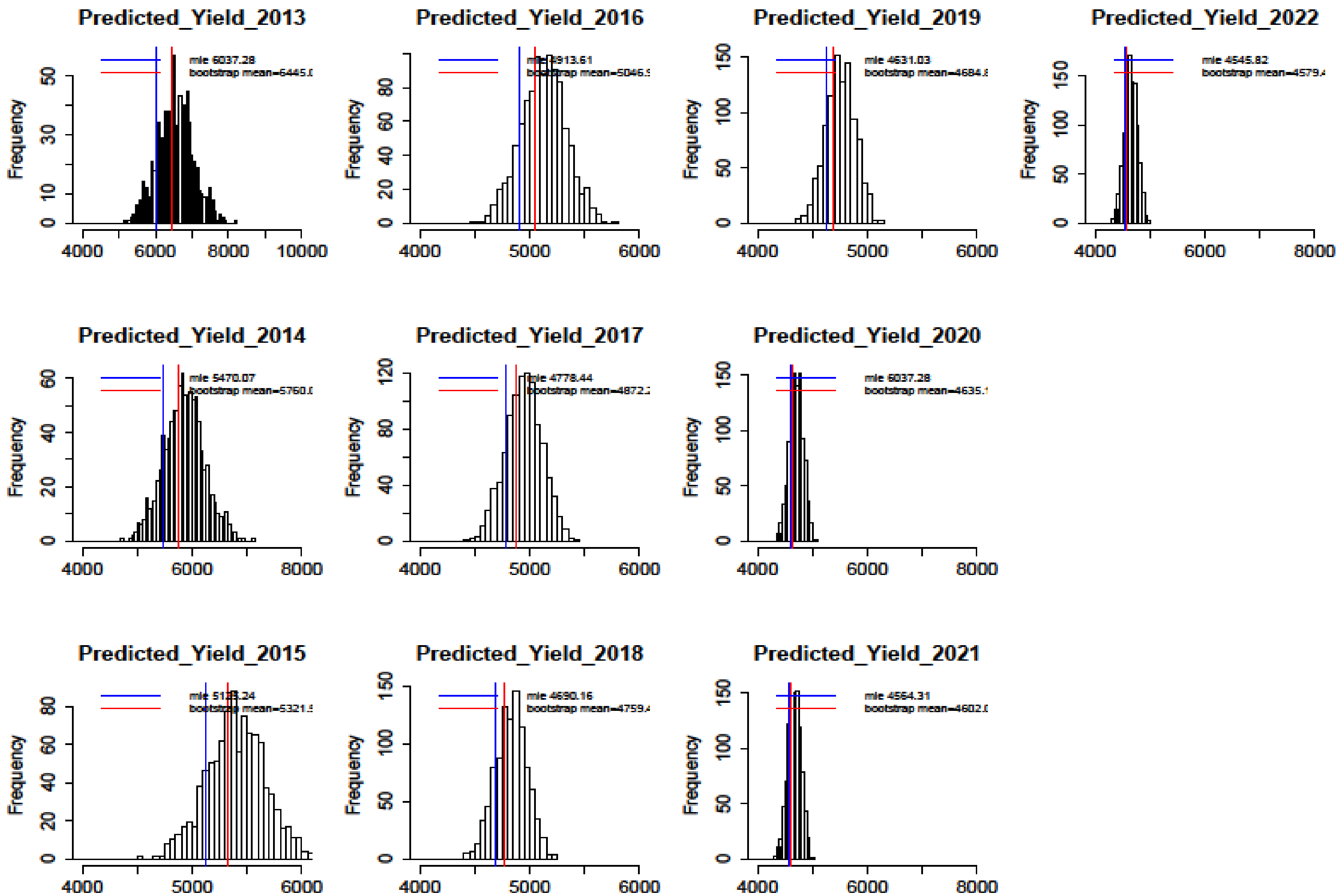



Figure 3.53. Summary for predicted retained yield (mtons, whole weight) for gulf of Mexico Spanish mackerel, from 1,000 bootstrap samples for the Run 3 mode (assuming steepness = 0.8 and M = $0.38y^{-1}$) . Red lines represent mean estimates from the bootstrap samples, blue lines represent the point estimate of the parameters from the Run 1 model.

## 3.8 Appendices

Appendix A. Length composition data for Gulf of Mexico Spanish mackerel. Fleet 1=COM_GN, Fleet 2=COM_RR, fleet 3=REC (recreational all modes), fleet 9 = SEAMAP SURVEY. Bin size=2 cm fork length widths.

| year | fleet | nsamp | Bin4 | Bin6 | Bin8 | Bin10 | Bin12 | Bin14 | Bin16 | Bin18 | Bin20 | Bin22 | Bin24 | Bin26 | Bin28 | Bin30 | Bin32 | Bin34 | Bin36 | Bin38 | Bin40 | Bin42 | Bin46 | Bin48 | Bin50 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1986 | 1 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 2 | 3 | 2 |
| 1987 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 11 | 42 | 60 | 72 | 85 | 79 |
| 1989 | 1 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 8 | 15 | 14 | 8 | 5 | 3 | 1 | 2 |
| 1990 | 1 | 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 9 | 12 | 7 | 10 | 6 | 4 | 8 |
| 1991 | 1 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 3 | 10 | 15 | 5 | 6 | 5 | 1 |
| 1992 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 22 | 31 | 49 | 49 | 37 | 32 |
| 1993 | 1 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 18 | 16 | 10 | 8 | 7 | 6 |
| 1994 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 5 | 16 | 30 | 51 | 60 | 79 | 85 |
| 1995 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4 | 11 | 4 | 2 | 6 | 6 | 4 | 24 |
| 1996 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 4 | 13 |
| 1997 | 1 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1999 | 1 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 4 | 5 | 5 | 2 | 3 | 3 |
| 2000 | 1 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 9 | 6 | 6 | 5 |
| 2001 | 1 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 5 | 5 | 2 | 3 |
| 2002 | 1 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 5 | 8 | 7 | 5 |
| 2003 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 8 | 9 | 14 | 19 | 9 | 14 |
| 2004 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 35 | 50 | 95 | 231 | 330 | 366 | 332 | 225 | 215 | 172 |
| 2005 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 20 | 32 | 52 | 100 | 171 | 276 | 338 | 251 | 221 | 203 | 169 |
| 2006 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 47 | 130 | 207 | 251 | 316 | 286 | 248 | 210 | 162 | 142 | 114 |
| 2007 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 59 | 123 | 192 | 268 | 387 | 481 | 389 | 288 | 245 | 207 | 174 |
| 2008 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 20 | 121 | 164 | 134 | 223 | 371 | 442 | 401 | 320 | 274 | 263 | 182 |
| 2009 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 48 | 130 | 173 | 325 | 348 | 348 | 282 | 248 | 227 | 188 |
| 2010 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 34 | 136 | 160 | 149 | 207 | 301 | 358 | 291 | 229 | 185 | 143 | 150 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 40 | 147 | 298 | 345 | 378 | 445 | 396 | 316 | 274 | 236 | 193 |
| 1983 | 2 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 2 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 2 | 1 | 2 |
| 1985 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 23 | 7 | 25 | 19 | 14 | 13 | 11 | 6 | 7 | 2 | 3 |
| 1986 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 6 | 3 | 9 | 12 | 12 |
| 1992 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 3 | 14 | 15 |
| 1993 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 9 | 7 | 2 | 0 | 2 | 3 | 8 | 4 | 10 |
| 1994 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 2 | 4 | 9 | 10 |
| 1995 | 2 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 1 | 0 | 2 | 3 |
| 1996 | 2 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 0 | 0 |
| 1997 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 2 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 2 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 7 |
| 2003 | 2 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 3 | 3 |
| 2004 | 2 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 2 |
| 2005 | 2 | 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 3 | 3 | 8 | 13 | 6 |
| 2006 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 6 | 13 | 12 |
| 2007 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 11 | 35 | 45 | 26 | 15 | 9 | 6 | 6 | 8 |
| 2008 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 2 | 10 | 17 | 19 | 27 |
| 2009 | 2 | 81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 5 | 4 | 5 | 5 | 5 | 8 | 8 |
| 2010 | 2 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 2 | 8 | 4 | 2 | 8 | 3 |
| 2011 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 5 | 15 | 20 | 23 |
| 1981 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 19 | 32 | 30 | 30 | 35 | 27 | 37 | 25 | 11 | 11 | 8 |
| 1982 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 5 | 26 | 47 | 66 | 29 | 53 | 40 | 32 | 36 | 16 | 26 | 16 |
| 1983 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 3 | 3 | 3 | 20 | 29 | 46 | 96 | 92 | 79 | 62 | 55 | 31 | 34 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 5 | 14 | 36 | 82 | 129 | 71 | 62 | 38 | 27 | 22 | 10 |
| 1985 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 6 | 18 | 35 | 38 | 71 | 58 | 28 | 29 | 28 | 23 | 17 |
| 1986 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 | 13 | 45 | 122 | 183 | 154 | 159 | 90 | 78 | 56 | 39 | 33 |
| 1987 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 5 | 8 | 39 | 104 | 156 | 165 | 160 | 144 | 133 | 101 | 90 | 88 |
| 1988 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 4 | 18 | 53 | 82 | 92 | 97 | 96 | 77 | 51 | 50 | 41 |
| 1989 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 9 | 24 | 57 | 104 | 109 | 145 | 133 | 84 | 58 | 70 | 48 | 39 |
| 1990 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 2 | 9 | 15 | 52 | 104 | 134 | 146 | 128 | 96 | 74 | 53 | 56 | 49 |
| 1991 | 3 | 100 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 7 | 15 | 36 | 52 | 70 | 103 | 126 | 117 | 121 | 111 | 87 | 78 | 80 |
| 1992 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 3 | 18 | 67 | 132 | 234 | 240 | 238 | 156 | 123 | 106 | 94 | 97 |
| 1993 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 5 | 16 | 42 | 75 | 68 | 77 | 93 | 61 | 62 | 48 | 39 | 38 |
| 1994 | 3 | 100 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 11 | 44 | 70 | 76 | 111 | 97 | 103 | 86 | 76 | 63 | 66 |
| 1995 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 8 | 33 | 35 | 46 | 56 | 50 | 70 | 62 | 81 | 84 | 79 |
| 1996 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 1 | 2 | 3 | 27 | 36 | 55 | 76 | 111 | 101 | 94 | 79 | 87 | 86 |
| 1997 | 3 | 100 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 4 | 1 | 2 | 15 | 45 | 50 | 68 | 64 | 82 | 117 | 76 | 90 | 97 | 114 |
| 1998 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 10 | 38 | 46 | 82 | 98 | 142 | 128 | 124 | 97 | 91 | 110 | 81 |
| 1999 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 30 | 68 | 143 | 155 | 246 | 304 | 295 | 280 | 218 | 155 | 146 | 167 |
| 2000 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 14 | 74 | 176 | 232 | 336 | 381 | 324 | 255 | 219 | 177 | 136 |
| 2001 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 3 | 16 | 38 | 132 | 265 | 460 | 533 | 488 | 411 | 282 | 185 | 155 | 113 |
| 2002 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 11 | 83 | 110 | 99 | 133 | 177 | 241 | 227 | 225 | 173 | 158 |
| 2003 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 13 | 29 | 74 | 86 | 100 | 138 | 168 | 151 | 169 | 165 | 140 | 132 |
| 2004 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 23 | 30 | 87 | 101 | 208 | 250 | 241 | 231 | 209 | 176 | 158 | 139 |
| 2005 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 11 | 29 | 80 | 135 | 109 | 143 | 128 | 119 | 109 | 103 | 93 |
| 2006 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 31 | 74 | 120 | 185 | 209 | 205 | 160 | 140 | 149 | 149 |
| 2007 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 4 | 4 | 42 | 88 | 107 | 145 | 189 | 207 | 198 | 188 | 128 | 111 |
| 2008 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 3 | 22 | 70 | 108 | 162 | 176 | 182 | 172 | 173 | 129 | 135 | 128 |
| 2009 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 14 | 50 | 99 | 122 | 175 | 191 | 181 | 168 | 133 | 151 | 98 |
| 2010 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 23 | 27 | 47 | 90 | 176 | 167 | 238 | 226 | 179 | 163 | 138 | 140 |
| 2011 | 3 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 | 46 | 171 | 249 | 275 | 305 | 322 | 279 | 247 | 194 | 172 | 125 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1987 | 9 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1988 | 9 | 82 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 5 | 21 | 10 | 5 | 1 | 0 | 7 | 8 | 5 | 6 | 2 | 5 | 3 | 0 | 0 | 0 |
| 1989 | 9 | 98 | 0 | 0 | 0 | 0 | 5 | 8 | 7 | 10 | 15 | 25 | 14 | 1 | 0 | 0 | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 1990 | 9 | 100 | 0 | 0 | 0 | 0 | 19 | 10 | 22 | 28 | 19 | 5 | 2 | 3 | 6 | 5 | 7 | 5 | 4 | 1 | 2 | 5 | 2 | 1 | 0 |
| 1991 | 9 | 100 | 0 | 0 | 0 | 2 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 3 | 22 | 18 | 14 | 19 | 9 | 9 | 4 | 2 | 1 | 0 |
| 1992 | 9 | 100 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 8 | 5 | 6 | 20 | 10 | 4 | 5 | 4 | 9 | 4 | 7 | 2 | 2 | 2 | 1 | 0 |
| 1993 | 9 | 100 | 0 | 0 | 0 | 2 | 9 | 7 | 12 | 12 | 12 | 1 | 3 | 7 | 34 | 21 | 12 | 4 | 8 | 10 | 3 | 6 | 0 | 0 | 0 |
| 1994 | 9 | 78 | 0 | 0 | 0 | 2 | 5 | 13 | 6 | 13 | 5 | 0 | 1 | 3 | 1 | 1 | 2 | 1 | 6 | 4 | 3 | 4 | 4 | 1 | 1 |
| 1995 | 9 | 100 | 0 | 2 | 1 | 0 | 0 | 9 | 7 | 2 | 3 | 2 | 4 | 3 | 7 | 13 | 16 | 6 | 7 | 3 | 4 | 3 | 2 | 0 | 1 |
| 1996 | 9 | 94 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 13 | 7 | 2 | 6 | 5 | 12 | 9 | 7 | 8 | 13 | 4 | 2 | 2 | 1 | 0 | 0 |
| 1997 | 9 | 62 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 4 | 3 | 2 | 2 | 2 | 3 | 8 | 5 | 7 | 4 | 7 | 4 | 3 | 1 | 1 | 1 |
| 1998 | 9 | 69 | 0 | 1 | 0 | 2 | 0 | 2 | 2 | 11 | 10 | 4 | 2 | 1 | 11 | 8 | 2 | 1 | 2 | 2 | 0 | 1 | 1 | 0 | 0 |
| 1999 | 9 | 83 | 0 | 0 | 0 | 4 | 1 | 5 | 6 | 5 | 5 | 7 | 4 | 2 | 8 | 5 | 6 | 6 | 2 | 3 | 3 | 3 | 5 | 2 | 1 |
| 2000 | 9 | 99 | 0 | 0 | 0 | 0 | 4 | 18 | 8 | 8 | 8 | 9 | 19 | 6 | 4 | 2 | 5 | 3 | 2 | 1 | 1 | 0 | 1 | 0 | 0 |
| 2001 | 9 | 84 | 0 | 0 | 1 | 3 | 5 | 14 | 20 | 10 | 7 | 1 | 0 | 3 | 0 | 2 | 4 | 3 | 5 | 2 | 0 | 1 | 1 | 1 | 1 |
| 2002 | 9 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 0 | 1 | 1 | 0 | 1 | 3 | 4 | 1 | 3 | 0 | 1 | 2 | 1 | 3 | 0 |
| 2003 | 9 | 100 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 16 | 51 | 19 | 11 | 3 | 5 | 10 | 4 | 4 | 3 | 1 | 1 | 2 | 0 | 0 | 0 |
| 2004 | 9 | 71 | 1 | 0 | 0 | 1 | 5 | 2 | 4 | 2 | 2 | 4 | 3 | 5 | 7 | 8 | 9 | 3 | 4 | 4 | 2 | 1 | 2 | 0 | 1 |
| 2005 | 9 | 100 | 0 | 0 | 0 | 0 | 2 | 16 | 24 | 19 | 35 | 28 | 14 | 4 | 7 | 11 | 9 | 5 | 4 | 1 | 2 | 1 | 2 | 1 | 0 |
| 2006 | 9 | 88 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 11 | 7 | 4 | 3 | 4 | 13 | 12 | 7 | 9 | 2 | 3 | 2 | 0 | 1 | 3 |
| 2007 | 9 | 100 | 0 | 1 | 0 | 1 | 1 | 8 | 16 | 9 | 18 | 22 | 5 | 13 | 7 | 13 | 6 | 5 | 2 | 2 | 1 | 0 | 1 | 2 | 0 |
| 2008 | 9 | 100 | 0 | 0 | 2 | 6 | 7 | 4 | 15 | 4 | 0 | 0 | 3 | 12 | 16 | 20 | 4 | 2 | 6 | 2 | 2 | 1 | 4 | 1 | 1 |
| 2009 | 9 | 100 | 0 | 0 | 0 | 0 | 0 | 2 | 16 | 35 | 20 | 32 | 22 | 8 | 3 | 6 | 7 | 4 | 3 | 3 | 3 | 1 | 1 | 2 | 1 |
| 2010 | 9 | 81 | 0 | 0 | 1 | 0 | 1 | 4 | 5 | 3 | 7 | 7 | 1 | 5 | 5 | 10 | 8 | 9 | 6 | 5 | 1 | 1 | 2 | 0 | 0 |
| 2011 | 9 | 81 | 0 | 0 | 1 | 0 | 1 | 4 | 5 | 3 | 7 | 7 | 1 | 5 | 5 | 10 | 8 | 9 | 6 | 5 | 1 | 1 | 2 | 0 | 0 |

Appendix A. Continued.

| year | fleet | nsamp | Bin52 | Bin54 | Bin56 | Bin58 | Bin60 | Bin62 | Bin64 | Bin66 | Bin68 | BIN70 | Bin72 | Bin74 | Bin76 | Bin78 | Bin80 | Bin82 | Bin84 | Bin86 | Bin88 | Bin90 | Bin92 | Bin94 | Bin96 | Bin98 | Bin100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1986 | 1 | 17 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 1 | 100 | 72 | 42 | 39 | 24 | 8 | 8 | 3 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 62 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 66 | 2 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 54 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 100 | 42 | 35 | 44 | 32 | 28 | 23 | 5 | 8 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 84 | 4 | 3 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 100 | 61 | 38 | 25 | 26 | 5 | 12 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 100 | 49 | 40 | 54 | 40 | 24 | 5 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 100 | 22 | 41 | 46 | 54 | 47 | 35 | 21 | 7 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 12 | 3 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 36 | 5 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 38 | 5 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 23 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 34 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 100 | 9 | 4 | 9 | 3 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 100 | 136 | 86 | 83 | 60 | 59 | 47 | 13 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 100 | 120 | 98 | 107 | 74 | 54 | 22 | 19 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 100 | 60 | 54 | 26 | 39 | 22 | 16 | 7 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 100 | 115 | 98 | 55 | 30 | 42 | 16 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 100 | 126 | 84 | 63 | 58 | 57 | 39 | 12 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 100 | 142 | 84 | 55 | 43 | 36 | 21 | 7 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 100 | 128 | 128 | 106 | 93 | 56 | 37 | 11 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 100 | 138 | 107 | 72 | 76 | 59 | 23 | 20 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 2 | 7 | 0 | 1 | 1 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 2 | 23 | 2 | 4 | 1 | 0 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 2 | 100 | 6 | 3 | 7 | 3 | 7 | 8 | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1986 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 2 | 100 | 20 | 26 | 27 | 29 | 25 | 13 | 6 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 2 | 100 | 15 | 20 | 26 | 51 | 36 | 32 | 9 | 4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 2 | 100 | 6 | 11 | 12 | 8 | 17 | 6 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 2 | 100 | 17 | 10 | 11 | 15 | 12 | 4 | 3 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 2 | 38 | 3 | 2 | 7 | 8 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 2 | 22 | 2 | 1 | 2 | 4 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 2 | 16 | 1 | 1 | 3 | 4 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 2 | 21 | 2 | 3 | 4 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 2 | 37 | 5 | 2 | 10 | 4 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 2 | 15 | 1 | 2 | 2 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 2 | 70 | 7 | 5 | 5 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 2 | 100 | 13 | 9 | 12 | 7 | 7 | 7 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 2 | 100 | 12 | 5 | 5 | 8 | 5 | 3 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 2 | 100 | 26 | 23 | 23 | 20 | 23 | 5 | 6 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 2 | 81 | 7 | 5 | 7 | 3 | 10 | 2 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 2 | 67 | 6 | 4 | 4 | 5 | 8 | 5 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 2 | 100 | 21 | 47 | 31 | 29 | 24 | 17 | 12 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 3 | 100 | 11 | 5 | 4 | 6 | 0 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 3 | 100 | 12 | 14 | 3 | 8 | 2 | 6 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 3 | 100 | 17 | 22 | 12 | 18 | 6 | 7 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 3 | 100 | 15 | 8 | 6 | 8 | 9 | 2 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 3 | 100 | 14 | 15 | 17 | 10 | 8 | 3 | 3 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 3 | 100 | 35 | 23 | 16 | 15 | 12 | 7 | 10 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 3 | 100 | 75 | 84 | 58 | 28 | 22 | 14 | 9 | 8 | 10 | 1 | 2 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 3 | 100 | 45 | 31 | 22 | 24 | 18 | 4 | 9 | 3 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1989 | 3 | 100 | 41 | 30 | 14 | 17 | 11 | 8 | 4 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 3 | 100 | 55 | 36 | 32 | 23 | 14 | 5 | 3 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 3 | 100 | 61 | 53 | 34 | 40 | 20 | 18 | 6 | 6 | 1 | 2 | 2 | 3 | 6 | 3 | 0 | 2 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 3 | 100 | 79 | 58 | 70 | 48 | 32 | 22 | 12 | 8 | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 2 | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1993 | 3 | 100 | 40 | 30 | 33 | 27 | 23 | 14 | 6 | 1 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 3 | 100 | 71 | 39 | 30 | 34 | 24 | 12 | 3 | 4 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 3 | 100 | 51 | 61 | 54 | 50 | 27 | 30 | 15 | 18 | 2 | 6 | 2 | 3 | 4 | 2 | 4 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 3 | 100 | 69 | 65 | 59 | 57 | 26 | 23 | 9 | 10 | 9 | 3 | 0 | 4 | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 3 | 100 | 90 | 105 | 81 | 52 | 37 | 21 | 11 | 12 | 5 | 5 | 0 | 1 | 1 | 1 | 0 | 4 | 0 | 1 | 2 | 1 | 0 | 1 | 2 | 1 | 0 |
| 1998 | 3 | 100 | 108 | 81 | 66 | 63 | 50 | 41 | 17 | 10 | 7 | 2 | 2 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 3 | 100 | 156 | 142 | 109 | 92 | 78 | 59 | 31 | 21 | 9 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 3 | 100 | 194 | 144 | 137 | 121 | 97 | 52 | 35 | 18 | 9 | 11 | 1 | 1 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 3 | 100 | 73 | 87 | 57 | 71 | 54 | 34 | 21 | 15 | 4 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 3 | 100 | 138 | 111 | 102 | 88 | 61 | 50 | 30 | 15 | 7 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 3 | 100 | 121 | 98 | 94 | 92 | 71 | 38 | 28 | 18 | 10 | 3 | 4 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 3 | 100 | 140 | 115 | 87 | 82 | 56 | 42 | 20 | 16 | 8 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 3 | 100 | 100 | 78 | 64 | 56 | 31 | 28 | 15 | 9 | 7 | 1 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 3 | 100 | 126 | 91 | 70 | 62 | 36 | 39 | 27 | 5 | 9 | 4 | 1 | 1 | 2 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 3 | 100 | 91 | 81 | 69 | 67 | 47 | 30 | 19 | 6 | 6 | 1 | 0 | 0 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 3 | 100 | 96 | 85 | 71 | 58 | 52 | 23 | 16 | 14 | 7 | 1 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 3 | 100 | 80 | 94 | 52 | 45 | 35 | 18 | 20 | 11 | 4 | 4 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 3 | 100 | 125 | 93 | 76 | 47 | 55 | 15 | 8 | 8 | 1 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 3 | 100 | 132 | 92 | 72 | 45 | 38 | 17 | 14 | 7 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 9 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 9 | 82 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 9 | 98 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 9 | 100 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 9 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 9 | 100 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1993 | 9 | 100 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 9 | 78 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 9 | 100 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1996 | 9 | 94 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 9 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 9 | 69 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 9 | 83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 9 | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 9 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 9 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 9 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 9 | 71 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 9 | 100 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 9 | 88 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 9 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 9 | 100 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 2009 | 9 | 100 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 9 | 81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 9 | 81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Appendix B. Age composition data for Gulf of Mexico Spanish mackerel. Fleet 1=COM_GN, Fleet 2=COM_RR, fleet 3=REC (recreational all modes), fleet 9 = SEAMAP SURVEY. Bin size=2 cm fork length widths. L_binLow and L_Bin_High denote bin id of length composition to which age sample refers.

| | | | | | | | | | AGE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | season | Fleet | Gender | Partition | Age_err_df | L_binLow | L_Bin_High | Nsamp | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 12 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 9 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 8 | 0 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 9 | 0 | 5 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 8 | 0 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 8 | 0 | 1 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 15 | 0 | 1 | 9 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 6 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 5 | 0 | 0 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 16 | 0 | 1 | 5 | 3 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 4 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 14 | 0 | 0 | 7 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 28 | 0 | 3 | 10 | 9 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 27 | 0 | 1 | 5 | 7 | 10 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 38 | 0 | 0 | 4 | 14 | 15 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 33 | 0 | 0 | 4 | 10 | 9 | 9 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 24 | 0 | 1 | 3 | 5 | 4 | 9 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 12 | 0 | 0 | 0 | 1 | 7 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 17 | 0 | 0 | 2 | 3 | 6 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 13 | 0 | 0 | 0 | 1 | 1 | 10 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 9 | 0 | 0 | 0 | 0 | 2 | 6 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 12 | 0 | 0 | 0 | 1 | 2 | 8 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 5 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 4 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 12 | 12 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 7 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 14 | 0 | 12 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 8 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 11 | 0 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 34 | 1 | 15 | 13 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 33 | 0 | 8 | 18 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 29 | 0 | 8 | 11 | 9 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 31 | 0 | 3 | 15 | 8 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 22 | 0 | 2 | 13 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 21 | 0 | 0 | 14 | 3 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 28 | 0 | 0 | 17 | 8 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 27 | 0 | 0 | 9 | 8 | 4 | 4 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 23 | 0 | 0 | 9 | 5 | 2 | 2 | 4 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 18 | 0 | 0 | 4 | 7 | 1 | 1 | 5 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 12 | 0 | 0 | 1 | 4 | 1 | 1 | 5 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 5 | 0 | 0 | 0 | 2 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 3 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 1 | 0 | 2 | 2 | 33 | 33 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 12 | 12 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 4 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 14 | 0 | 2 | 9 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 34 | 0 | 0 | 17 | 14 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 42 | 0 | 0 | 21 | 13 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 51 | 0 | 1 | 19 | 24 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 41 | 0 | 2 | 6 | 19 | 10 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 33 | 0 | 0 | 6 | 16 | 6 | 3 | 0 | 1 | 1 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 40 | 0 | 0 | 9 | 14 | 5 | 9 | 1 | 2 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 40 | 0 | 0 | 7 | 19 | 6 | 5 | 1 | 2 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 39 | 0 | 0 | 5 | 12 | 13 | 3 | 2 | 4 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 31 | 0 | 0 | 4 | 6 | 11 | 4 | 0 | 5 | 1 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 26 | 0 | 0 | 1 | 5 | 13 | 4 | 0 | 3 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 18 | 0 | 0 | 1 | 2 | 8 | 1 | 1 | 5 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 1 | 0 | 2 | 2 | 32 | 32 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 13 | 0 | 1 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 26 | 0 | 0 | 18 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 25 | 0 | 0 | 12 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 14 | 0 | 0 | 8 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 10 | 0 | 0 | 4 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 12 | 0 | 0 | 6 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 1993 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 3 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 7 | 0 | 0 | 2 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 10 | 0 | 1 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 26 | 0 | 1 | 9 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 32 | 0 | 0 | 8 | 16 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 52 | 0 | 0 | 16 | 24 | 9 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 67 | 0 | 0 | 11 | 33 | 20 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 77 | 0 | 0 | 5 | 32 | 28 | 10 | 0 | 2 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 63 | 0 | 0 | 7 | 26 | 24 | 5 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 35 | 0 | 0 | 1 | 13 | 14 | 2 | 2 | 2 | 0 | 1 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 27 | 0 | 0 | 0 | 11 | 10 | 3 | 1 | 0 | 0 | 2 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 13 | 0 | 0 | 0 | 5 | 5 | 0 | 2 | 0 | 0 | 1 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 9 | 0 | 0 | 0 | 3 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 5 | 0 | 0 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 4 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 16 | 3 | 1 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 9 | 3 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 8 | 1 | 0 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 7 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 8 | 0 | 0 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 1 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 1995 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 15 | 0 | 0 | 8 | 4 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 39 | 0 | 0 | 17 | 10 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 32 | 0 | 0 | 5 | 18 | 8 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 31 | 0 | 0 | 3 | 11 | 12 | 3 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 29 | 0 | 0 | 0 | 14 | 12 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 13 | 0 | 0 | 0 | 2 | 6 | 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 4 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 9 | 0 | 0 | 2 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 15 | 0 | 0 | 5 | 5 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 29 | 0 | 1 | 3 | 14 | 6 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 36 | 0 | 0 | 4 | 14 | 11 | 5 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 45 | 0 | 0 | 0 | 23 | 12 | 6 | 1 | 1 | 2 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 38 | 0 | 0 | 0 | 14 | 14 | 4 | 2 | 1 | 1 | 1 | 0 | 1 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 40 | 0 | 0 | 0 | 10 | 9 | 14 | 2 | 1 | 3 | 1 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 18 | 0 | 0 | 0 | 2 | 8 | 3 | 3 | 0 | 2 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 11 | 0 | 0 | 0 | 0 | 0 | 5 | 4 | 1 | 0 | 1 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 33 | 33 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 1998 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 5 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 7 | 0 | 0 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 5 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 6 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 11 | 0 | 1 | 3 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 16 | 0 | 0 | 3 | 8 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 9 | 0 | 0 | 0 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 7 | 0 | 0 | 0 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 7 | 0 | 1 | 0 | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 5 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 2001 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 33 | 33 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 11 | 11 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 12 | 12 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 9 | 0 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 6 | 0 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 9 | 0 | 2 | 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 7 | 0 | 1 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 11 | 0 | 0 | 3 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 7 | 0 | 1 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 4 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 8 | 0 | 0 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 8 | 0 | 2 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 13 | 0 | 1 | 6 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 8 | 0 | 0 | 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 2003 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 9 | 0 | 0 | 0 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 9 | 0 | 0 | 0 | 2 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 8 | 0 | 5 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 12 | 1 | 8 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 7 | 0 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 19 | 0 | 1 | 10 | 6 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 14 | 0 | 2 | 6 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 11 | 0 | 0 | 4 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 14 | 0 | 0 | 0 | 5 | 5 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 9 | 0 | 0 | 0 | 4 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 8 | 0 | 0 | 0 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 7 | 0 | 0 | 0 | 3 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 9 | 0 | 0 | 0 | 2 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 12 | 12 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 12 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 22 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 18 | 0 | 15 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 16 | 0 | 8 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 13 | 0 | 3 | 4 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 20 | 0 | 4 | 7 | 7 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 21 | 0 | 1 | 9 | 5 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 2005 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 21 | 0 | 4 | 5 | 5 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 21 | 0 | 0 | 8 | 6 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 20 | 0 | 0 | 7 | 8 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 26 | 0 | 0 | 5 | 6 | 7 | 6 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 22 | 0 | 0 | 6 | 10 | 1 | 3 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 21 | 0 | 0 | 2 | 6 | 4 | 5 | 3 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 12 | 0 | 0 | 0 | 0 | 3 | 6 | 1 | 2 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 8 | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 2 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 7 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 16 | 0 | 15 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 24 | 0 | 21 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 20 | 1 | 12 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 21 | 0 | 10 | 6 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 9 | 0 | 1 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 8 | 0 | 0 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 9 | 0 | 0 | 1 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 7 | 0 | 0 | 0 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 13 | 1 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 15 | 0 | 9 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 22 | 0 | 10 | 7 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 21 | 0 | 3 | 7 | 8 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 21 | 0 | 5 | 4 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 12 | 0 | 1 | 4 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 16 | 0 | 0 | 2 | 6 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 7 | 0 | 0 | 1 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 10 | 0 | 0 | 1 | 2 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 17 | 0 | 0 | 1 | 4 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 6 | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 11 | 11 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 12 | 1 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 20 | 0 | 13 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 38 | 3 | 22 | 5 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 32 | 1 | 8 | 11 | 8 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 37 | 0 | 11 | 9 | 6 | 9 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 29 | 0 | 5 | 9 | 9 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 27 | 0 | 6 | 8 | 6 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 19 | 0 | 0 | 4 | 7 | 5 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 18 | 0 | 2 | 2 | 4 | 7 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 20 | 0 | 1 | 2 | 6 | 5 | 4 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 15 | 0 | 0 | 1 | 2 | 6 | 5 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 6 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 8 | 0 | 0 | 0 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 7 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 3 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 11 | 0 | 5 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 12 | 0 | 5 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 16 | 0 | 2 | 6 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 10 | 0 | 3 | 1 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 14 | 0 | 5 | 2 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 10 | 0 | 0 | 2 | 1 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 7 | 0 | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 4 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 6 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 11 | 0 | 3 | 6 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 12 | 0 | 2 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 9 | 1 | 0 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 7 | 0 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 5 | 0 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 3 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 7 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 4 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 4 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 11 | 0 | 6 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 10 | 0 | 4 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 6 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 8 | 0 | 0 | 2 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 0 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 5 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 5 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 3 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 2 | 0 | 2 | 2 | 14 | 14 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 2 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 2 | 0 | 2 | 2 | 14 | 14 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 15 | 3 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 27 | 3 | 21 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 28 | 1 | 20 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 19 | 0 | 14 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 10 | 0 | 6 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 6 | 0 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 14 | 14 | 18 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 49 | 0 | 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 31 | 0 | 28 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 25 | 0 | 12 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 12 | 0 | 5 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 4 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 3 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 5 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 3 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 10 | 0 | 1 | 2 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 11 | 0 | 0 | 5 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 17 | 0 | 0 | 5 | 1 | 7 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 19 | 0 | 0 | 5 | 5 | 4 | 2 | 1 | 2 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 16 | 0 | 0 | 6 | 5 | 1 | 0 | 2 | 2 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 13 | 0 | 0 | 1 | 6 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 14 | 0 | 0 | 2 | 2 | 3 | 6 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 15 | 0 | 0 | 0 | 4 | 2 | 7 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 6 | 0 | 0 | 1 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 31 | 31 | 5 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 6 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 0 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 8 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 6 | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 6 | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 5 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 11 | 0 | 0 | 0 | 3 | 6 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 7 | 0 | 0 | 0 | 0 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 5 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 3 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 2 | 0 | 2 | 2 | 33 | 33 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 2 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 4 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2001 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 4 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 34 | 34 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 6 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 8 | 0 | 1 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 32 | 32 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 5 | 0 | 0 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 3 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 5 | 0 | 0 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 5 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 4 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 3 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 6 | 0 | 0 | 1 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 5 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 6 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 4 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 7 | 0 | 0 | 0 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 31 | 31 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 2 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 2011 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 7 | 0 | 1 | 0 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 10 | 0 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 13 | 0 | 1 | 2 | 3 | 4 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 11 | 0 | 0 | 3 | 4 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 30 | 0 | 1 | 3 | 5 | 6 | 8 | 5 | 1 | 1 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 32 | 0 | 0 | 2 | 7 | 12 | 6 | 5 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 24 | 0 | 0 | 0 | 3 | 15 | 3 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 23 | 0 | 0 | 0 | 7 | 10 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 15 | 0 | 0 | 0 | 1 | 11 | 1 | 0 | 2 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 12 | 0 | 0 | 0 | 0 | 6 | 4 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 31 | 31 | 5 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 12 | 12 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 10 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 23 | 0 | 5 | 17 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 21 | 0 | 1 | 19 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 8 | 0 | 2 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 12 | 0 | 2 | 1 | 6 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 7 | 0 | 0 | 3 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 0 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 7 | 0 | 0 | 1 | 1 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 16 | 0 | 0 | 1 | 2 | 8 | 3 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 8 | 0 | 0 | 0 | 1 | 5 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 12 | 0 | 0 | 1 | 2 | 5 | 1 | 2 | 0 | 0 | 0 | 1 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 6 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 2 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1988 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 14 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 14 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 19 | 13 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 14 | 3 | 9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 32 | 6 | 20 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 16 | 0 | 11 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 17 | 1 | 5 | 8 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 16 | 0 | 4 | 6 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 20 | 0 | 0 | 11 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 18 | 0 | 0 | 5 | 6 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 17 | 0 | 0 | 6 | 2 | 5 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 10 | 0 | 0 | 2 | 4 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 13 | 0 | 0 | 1 | 1 | 7 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 4 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 6 | 0 | 0 | 0 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 4 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 8 | 0 | 0 | 0 | 1 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 12 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 49 | 6 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 73 | 2 | 70 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 43 | 0 | 37 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 59 | 1 | 37 | 17 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 46 | 0 | 20 | 19 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 56 | 1 | 21 | 22 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 42 | 0 | 9 | 14 | 11 | 6 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 41 | 0 | 11 | 16 | 8 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 22 | 0 | 6 | 9 | 1 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 29 | 0 | 7 | 13 | 5 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 29 | 0 | 3 | 7 | 8 | 6 | 2 | 2 | 1 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 23 | 0 | 0 | 5 | 9 | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 20 | 0 | 0 | 7 | 2 | 7 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 17 | 0 | 0 | 1 | 8 | 5 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 24 | 0 | 0 | 0 | 4 | 8 | 8 | 3 | 0 | 1 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 10 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 11 | 0 | 0 | 0 | 2 | 4 | 4 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 5 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 33 | 33 | 5 | 0 | 0 | 0 | 1 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 35 | 35 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 12 | 12 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 23 | 10 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 12 | 2 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 17 | 0 | 16 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 24 | 0 | 22 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 19 | 0 | 16 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 19 | 0 | 15 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 20 | 0 | 10 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 17 | 0 | 8 | 7 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 22 | 0 | 6 | 11 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 18 | 0 | 1 | 7 | 7 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 26 | 0 | 6 | 13 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 19 | 0 | 3 | 8 | 2 | 2 | 1 | 1 | 2 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 19 | 0 | 0 | 6 | 8 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 23 | 0 | 0 | 11 | 7 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 13 | 0 | 0 | 4 | 3 | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 22 | 0 | 0 | 3 | 8 | 7 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 13 | 0 | 0 | 1 | 1 | 3 | 4 | 3 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 5 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 33 | 33 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 15 | 0 | 13 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 28 | 0 | 25 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 41 | 0 | 22 | 17 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 56 | 0 | 23 | 31 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 25 | 0 | 9 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 21 | 1 | 6 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 13 | 0 | 0 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 9 | 0 | 1 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 11 | 0 | 0 | 4 | 5 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 10 | 0 | 0 | 5 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 10 | 0 | 1 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 14 | 0 | 0 | 5 | 4 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 10 | 0 | 2 | 3 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 14 | 0 | 0 | 4 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 6 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 7 | 0 | 0 | 2 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 4 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 11 | 11 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 9 | 2 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 16 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 8 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 15 | 2 | 1 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 7 | 0 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 6 | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 4 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 7 | 0 | 0 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1993 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 9 | 0 | 0 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 1 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 8 | 0 | 0 | 0 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 10 | 0 | 0 | 3 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 12 | 0 | 0 | 2 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 14 | 0 | 0 | 1 | 8 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 8 | 0 | 0 | 0 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 5 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 11 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 33 | 0 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 18 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 9 | 0 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 9 | 0 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 6 | 0 | 0 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 3 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 5 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 9 | 0 | 1 | 2 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 9 | 0 | 0 | 2 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 5 | 0 | 0 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 6 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 8 | 0 | 0 | 1 | 2 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 7 | 0 | 0 | 0 | 1 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 11 | 2 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 17 | 3 | 4 | 8 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 25 | 0 | 14 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 16 | 1 | 12 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 6 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 4 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 9 | 0 | 2 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 6 | 0 | 0 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 9 | 0 | 0 | 1 | 2 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 6 | 0 | 0 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 9 | 0 | 0 | 1 | 1 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 11 | 0 | 0 | 0 | 4 | 1 | 3 | 2 | 1 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 5 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 4 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 11 | 11 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 13 | 5 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 21 | 7 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 20 | 5 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 40 | 4 | 26 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 26 | 0 | 17 | 4 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 48 | 1 | 24 | 11 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 31 | 0 | 20 | 5 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 19 | 0 | 6 | 7 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 9 | 0 | 3 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1996 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 10 | 0 | 2 | 2 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 10 | 0 | 0 | 2 | 5 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 5 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 4 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 8 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 17 | 2 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 14 | 2 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 18 | 3 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 12 | 0 | 6 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 7 | 0 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 6 | 0 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 8 | 0 | 1 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 12 | 2 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 23 | 5 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 13 | 3 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 23 | 4 | 11 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 13 | 0 | 8 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1998 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 15 | 0 | 7 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 6 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
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| 1998 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 10 | 0 | 3 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 3 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 6 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 35 | 3 | 30 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 58 | 0 | 54 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 83 | 0 | 72 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 80 | 0 | 44 | 26 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 52 | 0 | 24 | 16 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 49 | 0 | 16 | 15 | 14 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 29 | 0 | 4 | 9 | 13 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 35 | 0 | 4 | 13 | 12 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 22 | 0 | 2 | 5 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 34 | 0 | 0 | 9 | 18 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 17 | 0 | 2 | 0 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 14 | 0 | 0 | 2 | 7 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 15 | 0 | 0 | 0 | 7 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 13 | 0 | 0 | 1 | 2 | 8 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 4 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 4 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 11 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 13 | 3 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 23 | 4 | 14 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 15 | 0 | 3 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 31 | 0 | 2 | 15 | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 8 | 0 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 5 | 0 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 9 | 0 | 1 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 9 | 0 | 0 | 2 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 0 | 2 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 7 | 0 | 0 | 0 | 1 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 5 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 5 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 5 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 7 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 10 | 0 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 19 | 1 | 10 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 9 | 1 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 11 | 1 | 5 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 16 | 0 | 4 | 5 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 8 | 0 | 1 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 8 | 0 | 1 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 5 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 5 | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 5 | 0 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 5 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 4 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 7 | 1 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 15 | 3 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 24 | 3 | 17 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 34 | 0 | 19 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 46 | 0 | 15 | 19 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 44 | 0 | 10 | 21 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 28 | 0 | 6 | 14 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 37 | 0 | 3 | 22 | 7 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 36 | 0 | 1 | 13 | 13 | 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 35 | 0 | 0 | 13 | 13 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 29 | 0 | 1 | 3 | 9 | 12 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 30 | 0 | 0 | 9 | 11 | 5 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 23 | 0 | 0 | 2 | 8 | 10 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 15 | 0 | 0 | 1 | 6 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 12 | 0 | 0 | 0 | 0 | 9 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 8 | 0 | 0 | 0 | 0 | 6 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 4 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 4 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 22 | 14 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 54 | 9 | 43 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 61 | 2 | 40 | 16 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 75 | 5 | 28 | 36 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 62 | 4 | 19 | 28 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 54 | 1 | 9 | 28 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 47 | 1 | 12 | 21 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 30 | 0 | 4 | 11 | 8 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 38 | 0 | 7 | 15 | 7 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 29 | 0 | 4 | 11 | 6 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 23 | 0 | 1 | 9 | 5 | 5 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 23 | 0 | 0 | 8 | 7 | 3 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 22 | 0 | 0 | 6 | 7 | 2 | 5 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 12 | 0 | 0 | 0 | 6 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 18 | 0 | 0 | 0 | 3 | 4 | 9 | 1 | 0 | 1 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 7 | 0 | 0 | 0 | 3 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 8 | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 8 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 11 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 27 | 4 | 14 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 24 | 2 | 8 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 36 | 2 | 15 | 14 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 31 | 0 | 13 | 13 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 24 | 1 | 7 | 8 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 14 | 0 | 3 | 9 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 21 | 0 | 2 | 13 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 22 | 0 | 4 | 5 | 8 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 27 | 0 | 5 | 6 | 4 | 7 | 4 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 28 | 0 | 2 | 1 | 9 | 11 | 1 | 3 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 17 | 0 | 0 | 2 | 9 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 19 | 0 | 0 | 1 | 3 | 8 | 1 | 5 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 16 | 0 | 0 | 0 | 1 | 9 | 3 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 6 | 0 | 0 | 1 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 4 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 14 | 0 | 9 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 8 | 0 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 6 | 0 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 4 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 13 | 1 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 28 | 0 | 7 | 15 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 17 | 0 | 8 | 4 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 14 | 0 | 7 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 6 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 12 | 0 | 0 | 5 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 16 | 0 | 4 | 8 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 0 | 4 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 7 | 0 | 0 | 0 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 9 | 0 | 0 | 0 | 3 | 1 | 3 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 12 | 0 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 23 | 0 | 11 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 26 | 0 | 3 | 7 | 13 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 35 | 0 | 1 | 14 | 14 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 41 | 0 | 7 | 7 | 13 | 7 | 6 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 22 | 0 | 0 | 3 | 8 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 15 | 0 | 1 | 2 | 4 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 6 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 11 | 0 | 0 | 2 | 2 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 9 | 0 | 0 | 0 | 1 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 5 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 11 | 11 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 12 | 12 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 22 | 10 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 28 | 3 | 23 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 31 | 0 | 25 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 52 | 3 | 28 | 12 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 50 | 0 | 21 | 14 | 9 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 46 | 2 | 17 | 7 | 10 | 2 | 7 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 43 | 1 | 8 | 10 | 9 | 10 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 31 | 0 | 5 | 7 | 10 | 7 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 16 | 0 | 1 | 5 | 6 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 22 | 0 | 6 | 4 | 4 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 13 | 0 | 0 | 3 | 5 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 13 | 0 | 0 | 1 | 4 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 8 | 0 | 1 | 1 | 0 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 9 | 0 | 0 | 3 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 8 | 0 | 0 | 0 | 0 | 2 | 4 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 8 | 0 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 17 | 0 | 9 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 11 | 0 | 4 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 23 | 0 | 2 | 12 | 7 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 16 | 0 | 1 | 3 | 8 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 13 | 0 | 2 | 0 | 6 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 5 | 0 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 4 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 10 | 3 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 14 | 3 | 3 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 25 | 0 | 12 | 8 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 26 | 0 | 3 | 7 | 9 | 2 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 20 | 0 | 0 | 4 | 8 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 23 | 0 | 2 | 10 | 4 | 3 | 0 | 2 | 1 | 1 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 19 | 0 | 0 | 6 | 6 | 3 | 2 | 0 | 1 | 1 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 17 | 0 | 2 | 1 | 8 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 14 | 0 | 0 | 1 | 5 | 1 | 5 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 19 | 0 | 0 | 0 | 4 | 4 | 4 | 5 | 2 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 7 | 0 | 0 | 1 | 2 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 14 | 0 | 0 | 3 | 6 | 2 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 6 | 0 | 0 | 0 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 4 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | 1 | 3 | 0 | 2 | 2 | 33 | 33 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 19 | 1 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 36 | 1 | 33 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 41 | 0 | 35 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 30 | 1 | 21 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 33 | 0 | 13 | 7 | 8 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 29 | 0 | 2 | 6 | 10 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 20 | 0 | 6 | 2 | 4 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 12 | 0 | 0 | 2 | 4 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 15 | 0 | 2 | 2 | 2 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 0 | 3 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 9 | 0 | 0 | 1 | 1 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 9 | 0 | 0 | 1 | 1 | 2 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 7 | 0 | 0 | 0 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 4 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 4 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

## Appendix C. Starter File used in SS "Starter.SS"

```
## Stock Synthesis Version 3.24h
#
Span_dat.SS
span_ctl_RDM.SS
0 # 0=use init values in control file; 1=use ss3.par
1 # run display detail (0,1,2)
1 # detailed age-structured reports in REPORT.SSO (0,1)
1 # write detailed checkup.sso file (0,1)
1 # write parm values to ParmTrace.sso
2 # report level in CUMREPORT.SSO (0,1,2)
0 # Include prior_like for non-estimated parameters (0,1)
1 # Use Soft Boundaries to aid convergence
1 # Number of bootstrap datafiles to produce
7 # Turn off estimation for parameters entering after this phase
1000 # MCMC burn interval
100  # MCMC thin interval
0  # jitter initial parm value by this fraction
-1 # min yr for sdreport outputs (-1 for styr)
-2 # max yr for sdreport outputs (-1 for endyr; -2 for endyr+Nforecastyrs
0 # N individual STD years
0.0001 # final convergence criteria
0 # retrospective year relative to end year
1 # min age for calc of summary biomass
2 # Depletion basis:  denom is: 0=skip; 1=rel X*B0; 2=rel X*Bmsy; 3=rel X*B_styr
1.00 # Fraction (X) for Depletion denominator
4 # (1-SPR)_reporting:  0=skip; 1=rel(1-SPR); 2=rel(1-SPR_MSY); 3=rel(1-SPR_Btarget); 4=notrel
1 # F_std reporting: 0=skip; 1=exploit(Bio); 2=exploit(Num); 3=sum(frates)
2 # F_report_basis: 0=raw; 1=rel Fspr; 2=rel Fmsy ; 3=rel Fbtgt
999
```

Appendix D. Input Forecast File used in SS "Forecast.SS"

```
#V3.24h
#C generic forecast file
# for all year entries except rebuilder; enter either: actual year, -999 for styr, 0 for endyr, neg number for rel.endyr

1 # Benchmarks: 0=skip; 1=calc F_spr,F_btgt,F_msy
2 # MSY: 1= set to F(SPR); 2=calc F(MSY); 3=set to F(Btgt); 4=set to F(endyr)
0.3 # SPR target (e.g. 0.40)
0.3 # Biomass target (e.g. 0.40)
#_Bmark_years: beg_bio, end_bio, beg_selex, end_selex, beg_relF, end_relF (enter actual year, or values of 0 or -integer to be rel.
endyr)
0 0 -5 0 0 0 #this was njc setup as of October 10- tilefish below
#0 0 0 0 -2 0  #one from tilefish
# 2001 2001 2001 2001 2001 2001 # after processing
1 #Bmark_relF_Basis: 1 = use year range; 2 = set relF same as forecast below
#
2 # Forecast: 0=none; 1=F(SPR); 2=F(MSY) 3=F(Btgt); 4=Ave F (uses first-last relF yrs); 5=input annual F scalar
10 # N forecast years
0.2 # F scalar (only used for Do_Forecast==5)
#_Fcast_years: beg_selex, end_selex, beg_relF, end_relF (enter actual year, or values of 0 or -integer to be rel.endyr)
-5 0 -2 0  #this also changed back
# 2001 2001 1991 2001 # after processing
2     # Control rule method (1=catch=f(SSB) west coast; 2=F=f(SSB) )
0.01  # Control rule Biomass level for constant F (as frac of Bzero, e.g. 0.40)
0.005 # Control rule Biomass level for no F (as frac of Bzero, e.g. 0.10)
1.0   # Control rule target as fraction of Flimit (e.g. 0.75)#njc had it set to 0.75 for the Foy projection
3 #_N forecast loops (1-3) (fixed at 3 for now)
3 #_First forecast loop with stochastic recruitment
0 #_Forecast loop control #3 (reserved for future bells&whistles)
0 #_Forecast loop control #4 (reserved for future bells&whistles)
0 #_Forecast loop control #5 (reserved for future bells&whistles)
2012 #FirstYear for caps and allocations (should be after years with fixed inputs)
0 # stddev of log(realized catch/target catch) in forecast (set value>0.0 to cause active impl_error)
0 # Do West Coast gfish rebuilder output (0/1)
2012 # Rebuilder: first year catch could have been set to zero (Ydecl)(-1 to set to 1999)
2013 # Rebuilder: year for current age structure (Yinit) (-1 to set to endyear+1)
1 # fleet relative F: 1=use first-last alloc year; 2=read seas(row) x fleet(col) below
# Note that fleet allocation is used directly as average F if Do_Forecast=4
2 # basis for fcast catch tuning and for fcast catch caps and allocation (2=deadbio; 3=retainbio; 5=deadnum;6=retainnum)
#       Conditional input if relative F choice = 2
# Fleet relative F: rows are seasons, columns are fleets
#_Fleet: FISHERY1
# 1
# max totalcatch by fleet (-1 to have no max)
-1  -1 -1 -1
# max totalcatch by area (-1 to have no max)
-1
# fleet assignment to allocation group (enter group ID# for each fleet, 0 for not included in an alloc group)
0 0 0 0
```

```
#_Conditional on >1 allocation group
# allocation fraction for each of: 0 allocation groups
# no allocation groups
0 # Number of forecast catch levels to input (else calc catch from forecast F)
#Nancie total directed retained catch in 2011 was 1479.834969 mtons
2 # basis for input Fcast catch: 2=dead catch; 3=retained catch; 99=input Hrate(F) (units are from fleetunits; note new codes in
SSV3.20)
# Input fixed catch values
#Year Seas Fleet Catch(or_F)
#
999 # verify end of input
```

Appendix E. Control File used in SS "span_dat.SS"

```
#
#Gulf of Mexico Spanish Mackerel Full model control file
#_data_and_control_files: span.dat   //     span.ctl

#SS -V3.24h October 17 2012; Stock Synthiesis_by_Richard_Method
1 #_N_Growth_Patterns
1 #_N_Morphs_Within_GrowthPattern
#_Cond 1 #_Morph_between/within_stdev_ratio (no read if N_morphs=1)
#_Cond  1 #vector_Morphdist_(-1_in_first_val_gives_normal_approx)
#
#_Cond 0  #  N recruitment designs goes here if N_GP*nseas*area>1
#_Cond 0  #  placeholder for recruitment interaction request
#_Cond 1 1 1  # example recruitment design element for GP=1, seas=1, area=1
#
#_Cond 0 # N_movement_definitions goes here if N_areas > 1
#_Cond 1.0 # first age that moves (real age at begin of season, not integer) also cond on do_migration>0
#_Cond 1 1 1 2 4 10 # example move definition for seas=1, morph=1, source=1 dest=2, age1=4, age2=10
#
2 #_Nblock_Patterns
2 2 #_Cond 0 #_blocks_per_pattern
1886 2005 2006 2011 # begin and end years of block pattern 2 blocks 1 and 2, for gillnet fishery
1886   1992   1993   2011 # begin and end years of blocks - 1993 size limit, USING ONLY TIME BLOCK FOR COM AND REC SEL
#
0.5 #_fracfemale
3 #_natM_type:_0=1Parm; 1=N_breakpoints;_2=Lorenzen;_3=agespecific;_4=agespec_withseasinterpolate
0.40   0.56   0.47   0.41   0.38   0.36   0.35   0.34   0.33   0.32   0.32   0.32 # age specific Lorenzen M, estimated assuming
M=0.38, ref age = 4
#4 #_no additional input for selected M option; read 1P per morph
1 # GrowthModel: 1=vonBert with L1&L2; 2=Richards with L1&L2; 3=not implemented; 4=not implemented
0.5 #_Growth_Age_for_L1
999 #_Growth_Age_for_L2 (999 to use as Linf)
0 #_SD_add_to_LAA (set to 0.1 for SS2 V1.x compatibility)
2 #_CV_Growth_Pattern:  0 CV=f(LAA); 1 CV=F(A); 2 SD=F(LAA); 3 SD=F(A)
1 #_maturity_option:  1=length logistic; 2=age logistic; 3=read age-maturity matrix by growth_pattern; 4=read age-fecundity; 5=read
fec and wt from wtatage.ss
#_placeholder for empirical age-maturity by growth pattern
1 #_First_Mature_Age
1 #_fecundity option:(1)eggs=Wt*(a+b*Wt);(2)eggs=a*L^b;(3)eggs=a*Wt^b
0 #_hermaphroditism option:  0=none; 1=age-specific fxn
1 #_parameter_offset_approach (1=none, 2= M, G, CV_G as offset from female-GP1, 3=like SS2 V1.x)
2 #_env/block/dev_adjust_method (1=standard; 2=logistic transform keeps in base parm bounds; 3=standard w/ no bound check)
#
#_growth_parms
#_LO          HI        INIT        PRIOR  PR_type   SD      PHASE env-var use_dev dev_minyr dev_maxyr dev_stddev  Block Block_Fxn
#0.1          0.7        0.3          0.3     -1      99       -3       0       0       0         0         0          0       0
       # NatM_p_1_Fem_GP_1
```

```
2           30        10          10      -1      5         3       0       0       0         0          0.5        0       0
       # L_at_Amin_Fem_GP_1
40          90        56          56      -1      5         6       0       0       0         0          0.5        0       0
       # L_at_Amax_Fem_GP_1
0.1         1.2       0.61       0.61      -1      0.2       6       0       0       0         0          0.5        0       0
       # VonBert_K_Fem_GP_1

0.001        20        10         10       -1      99        7       0       0       0         0          0.5        0       0
       # CV_young_Fem_GP_1
0.001        45        10         10       -1      99        7       0       0       0         0          0.5        0       0
       # CV_old_Fem_GP_1


0.1          1       1.50E-05     1.50E-05  -1     0.8       -2       0       0       0         0          0.5         0       0
       # Wtlen_1_Fem  # WAS 1.1519E-05 FROM LITERATURE
2            4        2.8617       2.8617   -1     0.8       -2       0       0       0         0          0.5         0       0
       # Wtlen_2_Fem  # WAS 2.856 FROM LITERATURE
#      making  all     fish    mature
25          100         31           31     -1     0.8       -3       0       0       0         0          0           0       0 #
Mat50%_Fem
-1           0         -0.065       -0.065   -1     0.8       -3       0       0       0         0          0           0       0 #
Mat_slope_Fem
-3           3           1            1     -1     0.8       -3       0       0       0         0          0           0       0 #
Eg/kg_inter_Fem
-3           3           0            0     -1     0.8       -3       0       0       0         0          0           0       0 #
Eg/kg_slope_wt_Fem
 0           0           0            0     -1     0         -4       0       0       0         0          0           0       0 #
RecrDist_GP_1
 0           0           0            0     -1     0         -4       0       0       0         0          0           0       0 #
RecrDist_Area_1
 0           0           0            0     -1     0         -4       0       0       0         0          0           0       0 #
RecrDist_Seas_1
 0           0           0            0     -1     0         -4       0       0       0         0          0           0       0 #
CohortGrowDev
#
#_Cond 0  #custom_MG-env_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-environ parameters
#
#_Cond 0  #custom_MG-block_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-block parameters
#_Cond No MG parm trends
#
#_seasonal_effects_on_biology_parms
 0 0 0 0 0 0 0 0 0 0 #_femwtlen1,femwtlen2,mat1,mat2,fec1,fec2,Malewtlen1,malewtlen2,L1,K
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no seasonal MG parameters
#
#_Cond -4 #_MGparm_Dev_Phase

#_Spawner-Recruitment
3 #_SR_function
#_LO    HI      INIT    PRIOR   PR_type   SD     PHASE
```

```
1       20      10      10     -1       99       4      # SR_R0  #_RDM  start with larger value
#===================================================================================
#0.2     0.99    0.27    0.60    -1       99      -2      # SR_steep FOR PROFILING
#0.2     0.99    0.27    0.60    -1       99      -2      # SR_steep uniform/none
#0.2     0.99    0.8     0.80     0       0.80    -2      # SR_steep normal
#0.2     1       0.21445 0.60     2       2.5     -2      # SR_steep Full beta
#0.2     1       0.21445 0.60    -1       2.5     -2      # SR_steep symetrical beta
0.2      1       0.7     0.7     -1       2.5      4      # SR_steep
#======================================================================================
0        2       0.7     0.7     -1       0.8     -4       # SR_sigmaR
-5       5       0.1     0       -1       1       -3       # SR_envlink
-5       5       0       0       -1       1       -4       # SR_R1_offset
0        0       0       0       -1       0       -4       # SR_autocorr
0 #_SR_env_link
0 #_SR_env_target_0=none;1=devs;_2=R0;_3=steepness
1 #do_recdev:  0=none; 1=devvector; 2=simple deviations
1985 # first year of main recr_devs; early devs can preceed this era
2011 # last year of main recr_devs; forecast devs start in following year
3 #_recdev phase

#0# (0/1) to read 13 advanced options
1 # (0/1) to read 13 advanced options
0 #_recdev_early_start (0=none; neg value makes relative to recdev_start)
-4 #_recdev_early_phase
0 #_forecast_recruitment phase (incl. late recr) (0 value resets to maxphase+1)
1 #_lambda for Fcast_recr_like occurring before endyr+1
1984 #_last_early_yr_nobias_adj_in_MPD
1985 #_first_yr_fullbias_adj_in_MPD
2008 #_last_yr_fullbias_adj_in_MPD
2012 #_first_recent_yr_nobias_adj_in_MPD
0.25 #_max_bias_adj_in_MPD (-1 to override ramp and set biasadj=1.0 for all estimated recdevs)
0 #_period of cycles in recruitment (N parms read below)
-5 #min rec_dev
5 #max rec_dev
0 #_read_recdevs
#_end of advanced SR options

#
#
#Fishing Mortality info
0.3 # F ballpark for tuning early phases
-2001 # F ballpark year (neg value to disable)
2 # F_Method:  1=Pope; 2=instan. F; 3=hybrid (hybrid is recommended)
2.9 # max F or harvest rate, depends on F_Method
# no additional F input needed for Fmethod 1
##################################################
# if Fmethod=2; read overall start F value; overall phase; N detailed inputs to read
0.05  # RDM recommended to change to 0.05 from .1- this section is on page 75 in manual (njc)
1
4
1 1886  1  0.005  0.05   1
```

```
2 1886  1  0.005  0.05   1
3 1955  1  0.005  0.05   1
4 1945  1  0.005  0.05   1
####################################################
# if Fmethod=3; read N iterations for tuning for Fmethod 3
# 4  # N iterations for tuning F in hybrid method (recommend 3 to 7)

#_initial_F_parms
#_LO HI  INIT    PRIOR  PR_type SD  PHASE
 0    1   0.0      0.0    -1      99   -1 # InitF_1FISHERY1 COM_GN
 0    1   0.0      0.0    -1      99   -1 # InitF_1FISHERY2 COM_RR
 0    1   0.0      0.0    -1      99   -1 # InitF_1FISHERY3 REC
 0    1   0.0      0.0    -1      99   -1 # InitF_1FISHERY4 SHRIMP BYCATCH

#_Q_setup
 # A=do power, B=env-var, C=extra SD, D=devtype(<0=mirror, 0/1=none, 2=constant, 3=rand, 4=randwalk);
 #_A  B  C  D  E  F
 0 0 0 0  # 1 FISHERY1 COM_GN
 0 0 0 0  # 2 FISHERY2 COM_RR
 0 0 0 0  # 3 FISHERY3 REC
 0 0 0 2  # 4 FISHERY4 SHRIMP EFFORT

 0 0 0 0  # 1 SURVEY1  MRFSS
 0 0 0 0  # 2 SURVEY2  Headboat
 0 0 0 0  # 3 SURVEY3  Gillnet
 0 0 0 0  # 4 SURVEY4  FWC Vertical Line
 0 0 0 0  # 5 SURVEY5  SEAMAP Trawl

#
#_Cond 0 #_If q has random component, then 0=read one parm for each fleet with random q; 1=read a parm for each year of index
#_Q_parms(if_any)
# LO HI  INIT PRIOR  PR_type SD   PHASE
#-50 50 -13    0     -1       1    1   # Q_base_2_SURVEY5 SHRIMP EFFORT span
-10  20   1    0     -1       1    1   # Q_base_2_FISHERY1 cobia  #_RDM expanded range just in case

#_size_selex_types
#_Pattern Discard Male Special
  24 0 0 0 # 1 FISHERY1   COM_GN - double norm    ## discard code is 0 for GN since it is whole catch all are dead so only have
selectivy set
  24 2 0 0 # 2 FISHERY2   COM_RR - double normal  ## discard code is 2 for COM_RR = retained catch so read 4 retention and 4 discard
below
  24 2 0 0 # 3 FISHERY3   MRFSS  - logistic       ## discard code is 2 for REC = retained catch so read 4 retention and 4 discard
below
#  1 2 0 0 # 2 FISHERY2   COM_RR - logistic       ## discard code is 2 for COM_RR = retained catch so read 4 reention and 4 discard
below
#  1 2 0 0 # 3 FISHERY3   MRFSS  - logistic       ## discard code is 2 for REC = retained catch so read 4 retention and 4 discard
below
  24 3 0 0 # 4 FISHERY5   Shrimp Effort - double norm  #_RDM  change to option #1 because all are dead, change 2 by rdm, email to
Isely August 7 2012, change discard option to 3 per rdm

 5 0 0 3 # 1 SURVEY1 - MRFSS SURVEY mirror REC
```

```
 5 0 0 3 # 2 SURVEY2 - HB Survey mirror REC
 5 0 0 1 # 3 SURVEY3 - Gillnet Survey mirror COM_GN
 5 0 0 2 # 4 SURVEY4 - FWC Fish Ticket Vert Line mirror COM_RR
 5 0 0 4 # 5 SURVEY5 - SEAMAP Survey mirror Shrimp Bycatch
#
#_age_selex_types
#_Pattern ___ Male Special
 11 0 0 0 # 1 FISHERY1  COM_GN - double norm
 15 0 0 1 # 2 FISHERY2  COM_RR - logistic
 15 0 0 1 # 3 FISHERY3  MRFSS - logistic
 15 0 0 1 # 4 FISHERY4  Shrimp Effort - db norm

 15 0 0 1 # 1 SURVEY1  - MRFSS Survey
 15 0 0 1 # 2 SURVEY2  - HB  Survey
 15 0 0 1 # 3 SURVEY3  - Gillnet
 15 0 0 1 # 4 SURVEY4  - Vert Line
 15 0 0 1 # 5 SURVEY5  - SEAMAP

#_LENGTH SELEX PARMS
####################################################################################################################################
#COM_GN / double normal
#LO    HI    INIT     PRIOR  PR_type    SD  PHASE env-var  use_dev dev_minyr dev_maxyr dev_stddev  Block_Pattern Block_Type
 20    70     45       45     -1        99     3      0       0       0         0        0.5            1         2  # PEAK  value
-20    20    -1.5     -1.5    -1        99     4      0       0       0         0        0.5            1         2  # TOP logistic
-20    15.0   5         5     -1        99     3      0       0       0         0        0.5            1         2  # WIDTH exp
-2     15     4         4     -1        99     2      0       0       0         0        0.5            1         2  # WIDTH exp
-1000   15        -999        -15        -1        99              -3         0         0       0        0             0.5
0              0       #       INIT    logistic

-1000   15       -999    -15    -1        99              -4         0         0      0        0             0.5              0
0      #      FINAL   logistic

####################################################################################################################################
#COM_RR  / using double normal specified as logistic
#LO    HI    INIT     PRIOR  PR_type    SD  PHASE env-var  use_dev dev_minyr dev_maxyr dev_stddev  Block_Pattern Block_Type
10     70     55       55      -1       99     -3      0       0       0         0        0.5            0         0  # PEAK  value
RDM:  reduce max from 99 to reasonable value
-20    15     10      10       -1       99     -4      0       0       0         0        0.5            0         0  # TOP logistic
-20    12     6.1      2       -1       99      4      0       0       0         0        0.5            0         0  # WIDTH exp
-5     15.0  -4       -4       -1       99     -3      0       0       0         0        0.5            0         0  # WIDTH exp
-1000                 15      -999          -15          -1       99          -6       0       0       0         0              0.5
0              0       #       INIT    logistic

-15                   15            15                     15          -1       99          -6                 0           0       0
        0           0.5              0           0       #      FINAL   logistic

#
#COM_RR Retained Size
7      99    30       30       -1       99      -3       0       0       0         0        0.5            2         2  # P1 - inflection
-1     20    4.5    0.99       -1       99      -4       0       0       0         0        0.5            2         2  # P2 - slope
##njc changed to 0.99 fixed value to set knife edge
```

```
0.1     1    0.99    0.99     -1       99      -3       0       0       0       0         0.5          0        0  # P3 - asymptote -
use this to set non-selective mortality #_RDM allow estimate to get better fit to mean
-1      2    0       0        -1       99      -4       0       0       0       0         0.5          0        0  # P4 - male offset
to inflection (arithmetic, not multiplicative)
#
#COM_RR Release Mortality
-10     30     -4       -4     -1      99     -2       0       0       0       0         0.5          0        0  # P1 - inflection
-1      2       1        1     -1      99     -4       0       0       0       0         0.5          0        0  # P2 - slope
-1      2      0.1     0.1     -1      99     -2       0       0       0       0         0.5          0        0  # P3 - asymptote -
use this to set non-selective mortality
-1      2      0        0      -1      99     -4       0       0       0       0         0.5          0        0  # P4 - male offset
to inflection (arithmetic, not multiplicative)
#
###########################################################################################################################
#MRFSS / DOUBLE NORMAL SPECIFIED AS logistic
#LO    HI    INIT       PRIOR  PR_type   SD  PHASE env-var  use_dev dev_minyr dev_maxyr dev_stddev  Block_Pattern Block_Type
7      99     40        40      -1       99      3      0       0       0         0       0.5          0        0  # PEAK  value
-20    15     10        10      -1       99     -4      0       0       0         0       0.5          0        0  # TOP logistic
-10    12     6.6       2       -1       99      3      0       0       0         0       0.5          0        0  # WIDTH exp
-5     15     -4       -4       -1       99     -3      0       0       0         0       0.5          0        0  # WIDTH exp
-1000   15        -999      -15           -1       99     -6      0        0       0       0             0.5           0        0
#      INIT   logistic
-15       15      15        15           -1       99     -6      0        0       0       0             0.5             0        0
#      FINAL  logistic
#MRFSS Retained Size
7      99      30       30      -1        99    -3      0       0       0       0         0.5          2        2   # P1 -
inflection
-1     15      4.5      1       -1        99    -4      0       0       0       0         0.5          2        2   # P2 - slope
0.1    1     0.99      .99      -1        99    -3      0       0       0       0         0.5          0        0   # P3 - asymptote
- use this to set non-selective mortality #_RDM allow estimate to get better fit to mean
0      2       0        0       -1        99    -4      0       0       0       0         0.5          0        0   # P4 - male
offset to inflection (arithmetic, not multiplicative)
#
#MRFSS Released Mortality
-10   30     -4        -4       -1      99     -2      0       0       0       0         0.5          0        0    # P1 -
inflection
0     2       1         1       -1      99     -4      0       0       0       0         0.5          0        0    # P2 - slope
0     2     0.2        0.2      -1      99     -2      0       0       0       0         0.5          0        0    # P3 -
asymptote - use this to set non-selective mortality
-1    2       0         0       -1      99     -4      0       0       0       0         0.5          0        0    # P4 - male
offset to inflection (arithmetic, not multiplicative)
###########################################################################################################################
###
#Shrimp Bycatch / double normal
#LO    HI    INIT     PRIOR  PR_type SD  PHASE env-var  use_dev dev_minyr dev_maxyr dev_stddev  Block_Pattern Block_Type
 10    70     20       20       -1     99     3      0       0       0         0       0.5            0          0   # PEAK  value
-15     3    -12      -12       -1     99     4      0       0       0         0       0.5            0          0   # TOP logistic
-20    12    3.9      3.9       -1     99     3      0       0       0         0       0.5            0          0   # WIDTH exp
-2     12     5        5        -1     99     3      0       0       0         0       0.5            0          0   # WIDTH expS
-999   15   -999     -15        -1     99    -5      0       0       0         0       0.5            0          0   # WIDTH exp
```

```
-999   15   -999    -15        -1     99    -4      0       0       0         0        0.5             0          0   # FINAL
logistic
#Shrimp Retained
#1    30      4        4       -1      99    -2      0       0       0         0        0.5             0          0  # P1 -
inflection
#0    2       1        1       -1      99    -4      0       0       0         0        0.5             0          0  # P2 - slope
#0    1       0.0001   0.0001  -1      99    -2      0       0       0         0        0.5             0          0  # P3 - asymptote
- use this to set non-selective mortality
#0    2       0        0       -1      99    -4      0       0       0         0        0.5             0          0  # P4 - male
offset to inflection (arithmetic, not multiplicative)
#
###############################################################################################################################
# Size Selex MIRRORS For the Surveys
#_LO    HI  INIT PRIOR PR_type  SD   PHASE env-var use_dev dev_minyr dev_maxyr dev_stddev Block Block_Fxn
 1     49     1    1     -1     99     -2   0 0 0 0 0 0 0 # SizeSel_1P_1_FISHERY3 MRFSS Survey mirror fishery 3 REC
 1     49    49   49     -1     99     -2   0 0 0 0 0 0 0 # SizeSel_1P_2_FISHERY3 MRFSS Survey mirror fishery 3 REC
 1     49     1    1     -1     99     -2   0 0 0 0 0 0 0 # SizeSel_1P_1_FISHERY3 Hboat Survery mirror fishery 3 REC
 1     49    49   49     -1     99     -2   0 0 0 0 0 0 0 # SizeSel_1P_2_FISHERY3 Hboat Survey mirror fishery 3 REC
 1     49     1    1     -1     99     -2   0 0 0 0 0 0 0 # SizeSel_1P_1_FISHERY1 Gillnet index, mirror fishery 1
 1     49    49   49     -1     99     -2   0 0 0 0 0 0 0 # SizeSel_1P_2_FISHERY1 Gillnet index, mirror fishery 1
 1     49     1    1     -1     99     -2   0 0 0 0 0 0 0 # SizeSel_1P_1_FISHERY2 Vertical Line, mirror fishery 2
 1     49    49   49     -1     99     -2   0 0 0 0 0 0 0 # SizeSel_1P_2_FISHERY2 Vertical Line, mirror fishery 2
 1     49     1    1     -1     99     -2   0 0 0 0 0 0 0 # SizeSel_1P_1_FISHERY4 SEAMAP index, mirror fishery 4
 1     49    49   49     -1     99     -2   0 0 0 0 0 0 0 # SizeSel_1P_2_FISHERY4 SEAMAP index, mirror fishery 4
#####################################################################################################################################
####
# AGE Selex
 0     12     0     0    -1     99     -1   0 0 0 0 0 0 0 # AgeSel_1P_1_FISHERY1
 0     12    12    12    -1     99     -1   0 0 0 0 0 0 0 # AgeSel_1P_2_FISHERY1
#_Cond 0 #_custom_sel-env_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no enviro fxns
1 #_Cond 0 #_custom_sel-blk_setup (0/1)
#COM_GN FLEET 1 SELECTIVITY/ double normal
#LO    HI    INIT     PRIOR  PR_type    SD  PHASE
20     70     45       45     -1        99     3    # P1  PEAK  value PRE 2006
20     70     45       45     -1        99     3    # P1  PEAK  value  2006+
-20    20    -1.5     -1.5    -1        99     4    # P2  TOP logistic PRE 2006
-20    20    -1.5     -1.5    -1        99     4    # P2  TOP logistic 2006+
-20    15.0   5         5     -1        99     3    # P3  WIDTH exp  PRE 2006
-20    15.0   5         5     -1        99     3    # P3  WIDTH exp  2006+
-2     15     4         4     -1        99     4    # P4  WIDTH exp  PRE 2006
-2     15     4         4     -1        99     4    # P4  WIDTH exp  2006+
#Commercial RR Retention - Pre and Post 1993 Size limit
7              99      26        26       -1 99    3        #       P1      -      inflection pre size limit
7              55   30.5       30.5      -1   99    3        #       P1      -      inflection post size limit
0.005   30      0.05  0.05       -1   99      -6       #     P2      -      slope_block1 pre size limit   #njc changed  min and init
value to 0.05 from 5.5
0.005   30   0.05       0.05      -1   99    6   #     P2      -      slope_block2 post size limit   #njc changed  min and init value to
0.05 from 5.5, then to 0.1
#Recreational Retention - Pre and Post 1993 Size limit
7               75   26          26    -1   99       3      #     P1      -      inflection pre size limit
```

```
7               55    30.5   30.5    -1     99       3      #     P1      -      inflection post size limit
0.005  30  2.05   0.05   -1   99       6     #      P2      -      slope_block1 pre size limit    #njc changed  min and init value to
0.05 from 2.05
0.005  30      2.05    0.05   -1    99       6      #     P2      -      slope_block2 post size limit   #njc changed  min and init
value to 0.05 from 2.05
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no block usage
#_Cond No selex parm trends
#_Cond -4 # placeholder for selparm_Dev_Phase
1      #_Cond 0 #_env/block/dev_adjust_method (1=standard; 2=logistic trans to keep in base parm bounds; 3=standard w/ no bound check)
#
# Tag loss and Tag reporting parameters go next
0  # TG_custom:  0=no read; 1=read if tags exist
#_Cond -6 6 1 1 2 0.01 -4 0 0 0 0 0 0 0  #_placeholder if no parameters
#
1 #_Variance_adjustments_to_input_values
0      0      0      0 0 0 0 0 0 #_add_to_survey_CV
0      0      0      0      0      0      0      0      0      #_add_to_discard_stddev
0      0      0      0      0      0      0      0      0      #_add_to_bodywt_CV
1 1 1 1 1 1 1  1      1      #_mult_by_lencomp_N
1      1      1      1      1      1      1      1      1      #_mult_by_agecomp_N
1      1      1      1      1      1      1      1      1      #_mult_by_size-at-age
#
1 #_maxlambdaphase
1 #_sd_offset
#
0 # number of changes to make to default Lambdas (default value is 1.0)
# Like_comp codes:  1=surv; 2=disc; 3=mnwt; 4=length; 5=age; 6=SizeFreq; 7=sizeage; 8=catch;
# 9=init_equ_catch; 10=recrdev; 11=parm_prior; 12=parm_dev; 13=CrashPen; 14=Morphcomp; 15=Tag-comp; 16=Tag-negbin
#_comp  fleet phase val   sizefreq_method
#age comps
# 5       1     1   1   1    # COM_GN
# 5       2     1   1   1    # COM_RR
# 5       3     1   1   1    # REC
# 5       4     1 0.001  1
# Lengths
# 4       1     1   1   1    # COM_GN
# 4       2     1   1   1    # COM_RR
# 4       3     1   1   1    # REC
# 4       4     1   1   1    # SHRIMP BYCATCH
# discards
# 2       2    1    1   1    # COM_RR
# 2       3    1    1   1    # REC
# 2       4    1    1   1    # Shrimp Bycatch
#catch
# 8       1     1   1   1   #FISHERY COM_GN
# 8       2     1   1   1   #FISHERY COM_RR
# Surveys
# 1       5     1   1   1   #SURVEY1 MRFSS
# 1       6     1   1   1   #SURVEY2 Headboat
# 1       7     1   1   1   #SURVEY3 Com GN
# 1       8     1   1   1   #SURVEY4 Com RR
```

```
# 1       9     1   1   1   #SURVEY5 Shrimp Bycatch

0 # (0/1) read specs for more stddev reporting
 # 0 1 -1 5 1 5 1 -1 5 # placeholder for selex type, len/age, year, N selex bins, Growth pattern, N growth ages, NatAge_area(-1 for
all), NatAge_yr, N Natages
 # placeholder for vector of selex bins to be reported
 # placeholder for vector of growth ages to be reported
 # placeholder for vector of NatAges ages to be reported
999
```

Appendix F. Input data file used in SS "span_ctl.SS"

```
#C  Spanish mackerel 2011
#C  bootstrap file: 1
1886 #_styr
2011 #_endyr
1    #_nseas
12   #_months/season
1    #_spawn_seas
4    #_N_Fishing_fleet
5    #_Nsurveys
1    #_N_areas
Com_GN_1%Com_RR_2%REC_3%Shrimp_Bycatch_4%MRFSS_5%Headboat_6%Gillnet_7%COM_FWC_VERT_LINE_8%SEAMAP_Survey_9

 0.5 #_surveytiming_in_season
 0.5 #_surveytiming_in_season
 0.5 #_surveytiming_in_season
 0.5 #_surveytiming_in_season
 0.5 #_surveytiming_in_season
 0.5 #_surveytiming_in_season
 0.5 #_surveytiming_in_season
 0.5 #_surveytiming_in_season
 0.5 #_surveytiming_in_season

1 1 1 1 1 1 1 1 1    #_area_assignments_for_each_fishery_and_survey
1 1 2 2              #_units of catch:  1=bio; 2=num

0.01 0.01 0.01 -1.    #_se of log(catch) only used for init_eq_catch and for Fmethod 2 and 3
1      #_Ngenders
11     # Accumulator age per the manual not the number of ages (Nages)
0 0 0 0   #_init_equil_catch_for_each_fishery
126       # Number of Catch Observations
# COM_GN           COM_RR                REC        SHRIMP       YEAR      TYPE
34.0 2.0 0 0  1886  1
68.43016708   4.142723315          0            0        1887  1
133.4387113   8.078424994          0            0        1888  1
255.75756     15.48361782          0            0        1889  1
296.3881022   17.94322936          0            0        1890  1
310.3605292   1.884331784          0            0        1891  1
310.3605292   1.884331784          0            0        1892  1
310.3605292   1.884331784          0            0        1893  1
310.3605292   1.884331784          0            0        1894  1
310.3605292   1.884331784          0            0        1895  1
310.3605292   1.884331784          0            0        1896  1
321.1938757   19.44512857          0            0        1897  1
416.771671    25.46937989          0            0        1898  1
416.771671    25.46937989          0            0        1899  1
416.771671    25.46937989          0            0        1900  1
416.771671    25.46937989          0            0        1901  1
677.4588215   41.01324713          0            0        1902  1
```

| | | | | | |
|---|---|---|---|---|---|
| 655.5522883 | 39.3331373 | 0 | 0 | 1903 | 1 |
| 655.5522883 | 39.3331373 | 0 | 0 | 1904 | 1 |
| 655.5522883 | 39.3331373 | 0 | 0 | 1905 | 1 |
| 655.5522883 | 39.3331373 | 0 | 0 | 1906 | 1 |
| 655.5522883 | 39.3331373 | 0 | 0 | 1907 | 1 |
| 635.5450549 | 38.47566471 | 0 | 0 | 1908 | 1 |
| 667.6138941 | 44.50759294 | 0 | 0 | 1909 | 1 |
| 775.6532078 | 49.8634205 | 0 | 0 | 1910 | 1 |
| 883.6816654 | 55.23010409 | 0 | 0 | 1911 | 1 |
| 991.7028478 | 60.60406292 | 0 | 0 | 1912 | 1 |
| 1099.718917 | 65.98313502 | 0 | 0 | 1913 | 1 |
| 1207.731255 | 71.36593782 | 0 | 0 | 1914 | 1 |
| 1315.740789 | 76.751546 | 0 | 0 | 1915 | 1 |
| 1423.748159 | 82.13931686 | 0 | 0 | 1916 | 1 |
| 1485.872836 | 88.05172367 | 0 | 0 | 1917 | 1 |
| 1506.318634 | 91.1916619 | 0 | 0 | 1918 | 1 |
| 1535.148767 | 93.20546088 | 0 | 0 | 1919 | 1 |
| 1585.315785 | 92.93230469 | 0 | 0 | 1920 | 1 |
| 1638.880721 | 98.33284324 | 0 | 0 | 1921 | 1 |
| 1643.159783 | 98.58958696 | 0 | 0 | 1922 | 1 |
| 1653.015944 | 100.0729394 | 0 | 0 | 1923 | 1 |
| 1751.16886 | 103.9756511 | 0 | 0 | 1924 | 1 |
| 1863.460154 | 109.6153032 | 0 | 0 | 1925 | 1 |
| 1975.754083 | 115.2523215 | 0 | 0 | 1926 | 1 |
| 2040.875956 | 123.5497203 | 0 | 0 | 1927 | 1 |
| 1413.068858 | 85.54363835 | 0 | 0 | 1928 | 1 |
| 1528.988512 | 92.561101 | 0 | 0 | 1929 | 1 |
| 1794.326473 | 108.6240679 | 0 | 0 | 1930 | 1 |
| 1018.029223 | 61.62904973 | 0 | 0 | 1931 | 1 |
| 1255.005154 | 75.9748529 | 0 | 0 | 1932 | 1 |
| 1373.57888 | 82.41473285 | 0 | 0 | 1933 | 1 |
| 1512.095016 | 91.53861734 | 0 | 0 | 1934 | 1 |
| 1867.743971 | 109.8672924 | 0 | 0 | 1935 | 1 |
| 2251.966558 | 136.3287958 | 0 | 0 | 1936 | 1 |
| 1704.256198 | 103.1716367 | 0 | 0 | 1937 | 1 |
| 1759.588442 | 106.5213786 | 0 | 0 | 1938 | 1 |
| 1834.941259 | 111.0831073 | 0 | 0 | 1939 | 1 |
| 1580.208302 | 95.66211907 | 0 | 0 | 1940 | 1 |
| 36.24630533 | 22.26558755 | 0 | 0 | 1941 | 1 |
| 36.24630533 | 22.26558755 | 0 | 0 | 1942 | 1 |
| 36.24630533 | 22.26558755 | 0 | 0 | 1943 | 1 |
| 36.24630533 | 22.26558755 | 0 | 0 | 1944 | 1 |
| 39.64706553 | 2.400306428 | 0 | 0 | 1945 | 1 |
| 36.24630533 | 22.26558755 | 0 | 0.1 | 1946 | 1 |
| 36.24630533 | 22.26558755 | 0 | 0.1 | 1947 | 1 |
| 383.7653132 | 23.23252777 | 0 | 0.1 | 1948 | 1 |
| 1657.808971 | 100.3600147 | 0 | 0.1 | 1949 | 1 |
| 1109.040718 | 67.13859114 | 0 | 0.1 | 1950 | 1 |
| 2784.599066 | 168.5732772 | 0 | 0.1 | 1951 | 1 |
| 1931.915336 | 116.9534348 | 0 | 0.1 | 1952 | 1 |
| 1276.310359 | 77.26476291 | 0 | 0.1 | 1953 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| 1234.568037 | 74.73762103 | 0 | 0.1 | 1954 | 1 |
| 696.0213894 | 42.13562209 | 774.329 | 0.1 | 1955 | 1 |
| 1248.424966 | 75.57670272 | 858.972 | 0.1 | 1956 | 1 |
| 1560.510025 | 94.46938237 | 943.615 | 0.1 | 1957 | 1 |
| 1654.943512 | 100.1864837 | 1028.258 | 0.1 | 1958 | 1 |
| 2006.333205 | 121.4585833 | 1112.901 | 0.1 | 1959 | 1 |
| 2338.519559 | 141.5687079 | 1197.544 | 0.1 | 1960 | 1 |
| 1717.001379 | 103.9431567 | 1219.048 | 0.1 | 1961 | 1 |
| 3071.528135 | 63.12179139 | 1240.552 | 0.1 | 1962 | 1 |
| 2434.217912 | 36.52614134 | 1262.056 | 0.1 | 1963 | 1 |
| 1715.428671 | 78.89068647 | 1283.56 | 0.1 | 1964 | 1 |
| 2095.274878 | 129.7645834 | 1305.064 | 0.1 | 1965 | 1 |
| 3053.483264 | 151.6530827 | 1356.661 | 0.1 | 1966 | 1 |
| 2582.367971 | 128.2748432 | 1408.258 | 0.1 | 1967 | 1 |
| 3163.535515 | 116.4869825 | 1459.856 | 0.1 | 1968 | 1 |
| 3684.911877 | 98.94791266 | 1511.453 | 0.1 | 1969 | 1 |
| 3630.865374 | 120.1098237 | 1563.051 | 0.1 | 1970 | 1 |
| 3349.08911 | 124.4308569 | 1705.132 | 0.1 | 1971 | 1 |
| 2758.32349 | 204.4647598 | 1847.214 | 0.1 | 1972 | 1 |
| 2748.202882 | 61.41121132 | 1989.295 | 0.1 | 1973 | 1 |
| 3431.542543 | 318.2987038 | 2131.377 | 0.1 | 1974 | 1 |
| 2191.628777 | 358.0836524 | 2273.458 | 0.1 | 1975 | 1 |
| 3153.448217 | 376.7693205 | 2277.451 | 0.1 | 1976 | 1 |
| 904.9597517 | 290.8682143 | 2281.444 | 0.1 | 1977 | 1 |
| 505.3129052 | 268.0632764 | 2285.437 | 0.1 | 1978 | 1 |
| 931.1046676 | 31.38059107 | 2289.429 | 0.1 | 1979 | 1 |
| 831.7146714 | 44.53312872 | 2293.422 | 0.1 | 1980 | 1 |
| 1592.006749 | 90.35395561 | 2102.038 | 0.1 | 1981 | 1 |
| 1485.691109 | 81.6978089 | 3442.701 | 0.1 | 1982 | 1 |
| 960.017746 | 67.79082484 | 2430.193 | 0.1 | 1983 | 1 |
| 1566.665447 | 23.45874273 | 946.926 | 0.1 | 1984 | 1 |
| 904.115191 | 28.76168912 | 1177.354 | 0.1 | 1985 | 1 |
| 1225.099756 | 14.1535594 | 6397.814 | 0.1 | 1986 | 1 |
| 1190.630774 | 101.8198311 | 1794.555 | 0.1 | 1987 | 1 |
| 1038.640009 | 11.63168543 | 1459.955 | 0.1 | 1988 | 1 |
| 1388.061847 | 26.07807348 | 1135.6 | 0.1 | 1989 | 1 |
| 1161.126947 | 8.139340948 | 1597.435 | 0.1 | 1990 | 1 |
| 1488.327025 | 72.75712239 | 1738.578 | 0.1 | 1991 | 1 |
| 1682.054362 | 17.26254596 | 2393.032 | 0.1 | 1992 | 1 |
| 1167.933074 | 13.02606697 | 1488.351 | 0.1 | 1993 | 1 |
| 1249.588808 | 10.32238076 | 1427.593 | 0.1 | 1994 | 1 |
| 674.7322704 | 9.763892329 | 1073.448 | 0.1 | 1995 | 1 |
| 171.6726706 | 12.9178368 | 1260.391 | 0.1 | 1996 | 1 |
| 226.4684311 | 18.45872382 | 1261.861 | 0.1 | 1997 | 1 |
| 185.5482764 | 23.86442747 | 1180.977 | 0.1 | 1998 | 1 |
| 368.412134 | 27.16273403 | 1590.312 | 0.1 | 1999 | 1 |
| 394.2524232 | 18.93815317 | 1730.988 | 0.1 | 2000 | 1 |
| 500.4443274 | 36.1083695 | 2481.769 | 0.1 | 2001 | 1 |
| 412.7072599 | 17.42137548 | 1976.072 | 0.1 | 2002 | 1 |
| 627.9811197 | 19.77637795 | 1518.347 | 0.1 | 2003 | 1 |
| 469.4024284 | 18.92331502 | 2150.34 | 0.1 | 2004 | 1 |

```
662.4834388   15.69706811    1216.407            0.1      2005  1
614.0356686   28.29383044    1789.544            0.1      2006  1
413.7935981   13.25205018    1352.93             0.1      2007  1
521.225866    38.7007447     1905.216            0.1      2008  1
789.0971604   34.61240289    1518.817            0.1      2009  1
501.3432236   65.5186339     1601.134            0.1      2010  1
546.1829242    54.05135563       1547.069            0.1      2011  1
#
# Abundance Indices
188      # Number of Survey Observations
# Fleet Units (0=num, 1=bio, 2=F)                      error dist(-1=normal, 0=lognorm, >0=df_T)
 1  1 0   # COM_GN
 2  1 0   # COM_RR
 3  0 0   # REC
 4  2 0   # Shrimp Effort
 5  0 0   # MRFSS
 6  0 0   # Hboat
 7  1 0   # COM_GN LOGBOOK
 8  1 0   # COM_FWC_VERT_LINE
 9  0 0   # SEAMAP SURVEY

#Year   Season  FLEET   EFFORT  SD      Label
# represents shrimp effort of choice
#       year                  season                fleet               scaled effort                                 label
        1945                  1                     4                     0.001         0.125         # Shrimp Effort
        1946                  1                     4                     0.004669018    0.125                        #    Shrimp
Effort
        1947                  1                     4                     0.023811993      0.125                      #    Shrimp
Effort
        1948                  1                     4                     0.062564845    0.125                        #    Shrimp
Effort
        1949                  1                     4                     0.101084245    0.125                        #    Shrimp
Effort
        1950                  1                     4                     0.180224105    0.125                        #    Shrimp
Effort
        1951                  1                     4                     0.228548444      0.125                      #    Shrimp
Effort
        1952                  1                     4                     0.269869256      0.125                      #    Shrimp
Effort
        1953                  1                     4                     0.278506939    0.125                        #    Shrimp
Effort
        1954                  1                     4                     0.362549268    0.125                        #    Shrimp
Effort
        1955                  1                     4                     0.358814053    0.125                        #    Shrimp
Effort
        1956                  1                     4                     0.460598652      0.125                      #    Shrimp
Effort
        1957                  1                     4                     0.537637453      0.125                      #    Shrimp
Effort
        1958                  1                     4                     0.696150623    0.125                        #    Shrimp
Effort
```

| | | | | | | |
|---|---|---|---|---|---|---|
| 1959 | 1 | 4 | 0.748677078 | 0.125 | # | Shrimp Effort |
| 1960 | 1 | 4 | 0.748248745 | 0.125 | # | Shrimp Effort |
| 1961 | 1 | 4 | 0.461965464 | 0.125 | # | Shrimp Effort |
| 1962 | 1 | 4 | 0.796688961 | 0.125 | # | Shrimp Effort |
| 1963 | 1 | 4 | 0.901471045 | 0.125 | # | Shrimp Effort |
| 1964 | 1 | 4 | 1.062382853 | 0.125 | # | Shrimp Effort |
| 1965 | 1 | 4 | 0.688010649 | 0.125 | # | Shrimp Effort |
| 1966 | 1 | 4 | 0.580599779 | 0.125 | # | Shrimp Effort |
| 1967 | 1 | 4 | 0.696735062 | 0.125 | # | Shrimp Effort |
| 1968 | 1 | 4 | 0.816884814 | 0.125 | # | Shrimp Effort |
| 1969 | 1 | 4 | 0.894284436 | 0.125 | # | Shrimp Effort |
| 1970 | 1 | 4 | 0.628212137 | 0.125 | # | Shrimp Effort |
| 1971 | 1 | 4 | 0.711675645 | 0.125 | # | Shrimp Effort |
| 1972 | 1 | 4 | 0.995050076 | 0.125 | # | Shrimp Effort |
| 1973 | 1 | 4 | 1.012571097 | 0.125 | # | Shrimp Effort |
| 1974 | 1 | 4 | 1.0450401 | 0.125 | # | Shrimp Effort |
| 1975 | 1 | 4 | 0.802247483 | 0.125 | # | Shrimp Effort |
| 1976 | 1 | 4 | 1.115133225 | 0.125 | # | Shrimp Effort |
| 1977 | 1 | 4 | 1.384552149 | 0.125 | # | Shrimp Effort |
| 1978 | 1 | 4 | 1.92755231 | 0.125 | # | Shrimp Effort |
| 1979 | 1 | 4 | 2.029138408 | 0.125 | # | Shrimp Effort |
| 1980 | 1 | 4 | 1.491874379 | 0.125 | # | Shrimp Effort |
| 1981 | 1 | 4 | 1.540411951 | 0.125 | # | Shrimp Effort |
| 1982 | 1 | 4 | 1.473560859 | 0.125 | # | Shrimp Effort |
| 1983 | 1 | 4 | 1.595318307 | 0.125 | # | Shrimp Effort |

```
      1984          1          4          1.636084144     0.125          #    Shrimp
Effort
      1985          1          4          1.762284299     0.125          #    Shrimp
Effort
      1986          1          4          1.855517978     0.125          #    Shrimp
Effort
      1987          1          4          2.156347484     0.125          #    Shrimp
Effort
      1988          1          4          1.629358168     0.125          #    Shrimp
Effort
      1989          1          4          1.94696849      0.125          #    Shrimp
Effort
      1990          1          4          1.895500031     0.125          #    Shrimp
Effort
      1991          1          4          1.812570503     0.125          #    Shrimp
Effort
      1992          1          4          1.574425171   0.125            #    Shrimp
Effort
      1993          1          4          1.473319277     0.125          #    Shrimp
Effort
      1994          1          4          1.612885045     0.125          #    Shrimp
Effort
      1995          1          4          1.38522427      0.125          #    Shrimp
Effort
      1996          1          4          1.485346076     0.125          #    Shrimp
Effort
      1997          1          4          1.517712625     0.125          #    Shrimp
Effort
      1998          1          4          1.648277699     0.125          #    Shrimp
Effort
      1999          1          4          1.717437717   0.125            #    Shrimp
Effort
      2000          1          4          1.535732761     0.125          #    Shrimp
Effort
      2001          1          4          1.491186635   0.125            #    Shrimp
Effort
      2002          1          4          1.32140767      0.125          #    Shrimp
Effort
      2003          1          4          1.076364509     0.125          #    Shrimp
Effort
      2004          1          4          0.829801142     0.125          #    Shrimp
Effort
      2005          1          4          0.499034062   0.125            #    Shrimp
Effort
      2006          1          4          0.663099426     0.125          #    Shrimp
Effort
      2007          1          4          0.649566399     0.125          #    Shrimp
Effort
      2008          1          4          0.560997109     0.125          #    Shrimp
Effort
```

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       2009                  1                      4                      0.653462462      0.125                                  #     Shrimp
Effort
       2010                  1                      4                      0.463170413    0.125                                    #     Shrimp
Effort
       2011                  1                      4                      0.43360253       0.125                                  #     Shrimp
Effort
1981         1        5           0.8981     0.4377  # MRFSS   #se calculated as sqrt(loge(1+CV(index)**2))
1982         1        5           1.2552     0.7935  # MRFSS
1983         1        5           0.8820     0.6986  # MRFSS
1984         1        5           0.6564     0.6170  # MRFSS
1985         1        5           0.7353     0.5893  # MRFSS
1986         1        5           2.6980     0.8561  # MRFSS
1987         1        5           1.1851     0.7114  # MRFSS
1988         1        5           0.8780     0.6646  # MRFSS
1989         1        5           1.0244     0.6841  # MRFSS
1990         1        5           1.9452     0.8619  # MRFSS
1991         1        5           1.3235     0.7116  # MRFSS
1992         1        5     1.4129     0.7470  # MRFSS
1993         1        5           0.7096     0.6855  # MRFSS
1994         1        5           0.6942     0.5974  # MRFSS
1995         1        5           0.4094     0.5214  # MRFSS
1996         1        5           0.6716     0.5985  # MRFSS
1997         1        5           0.6881     0.6000  # MRFSS
1998         1        5           0.7264     0.6124  # MRFSS
1999         1        5           1.1596     0.6931  # MRFSS
2000         1        5           0.7170     0.6426  # MRFSS
2001         1        5           0.8873     0.6959  # MRFSS
2002         1        5           0.8451     0.6840  # MRFSS
2003         1        5           0.8580     0.6690  # MRFSS
2004         1        5           0.9920     0.6841  # MRFSS
2005         1        5           0.5725     0.6475  # MRFSS
2006         1        5           0.9179     0.6852  # MRFSS
2007         1        5           0.9469     0.6546  # MRFSS
2008         1        5           0.9681     0.6606  # MRFSS
2009         1        5     0.9646     0.6375  # MRFSS
2010         1        5     1.0875     0.7155  # MRFSS
2011         1        5           1.2902     0.7083  # MRFSS
-1986   1       6       0.73  0.25     # Headboat
-1987   1       6       1.91   0.25           # Headboat
-1988   1       6       0.63   0.25           # Headboat
-1989   1       6       0.96  0.25       # Headboat
-1990   1       6       1.04   0.25      # Headboat
-1991   1       6       2.44  0.25       # Headboat
-1992   1       6       1.41   0.25           # Headboat
-1993   1       6       0.96   0.25      # Headboat
-1994   1       6       1.33   0.25           # Headboat
-1995   1       6       0.91   0.25           # Headboat
-1996   1       6       0.85   0.25           # Headboat
-1997   1       6       0.67   0.25           # Headboat
-1998   1       6       0.34   0.25           # Headboat
-1999   1       6       0.66   0.25           # Headboat
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-2000   1       6       0.96    0.25            # Headboat
-2001   1       6       0.35    0.25            # Headboat
-2002   1       6       0.74    0.25            # Headboat
-2003   1       6       0.42  0.25              # Headboat
-2004   1       6       0.3     0.25            # Headboat
-2005   1       6       0.37    0.25            # Headboat
-2006   1       6       1.02    0.25    # Headboat
-2007   1       6       1.04  0.25        # Headboat
-2008   1       6       1.62    0.25            # Headboat
-2009   1       6       1.5     0.25            # Headboat
-2010   1       6       0.99    0.25            # Headboat
-2011   1       6       1.82    0.25            # Headboat
-1998   1       7       0.56137 1.402862166             # Gillnet
-1999   1       7       0.36191 0.754696424             # Gillnet
-2000   1       7       0.25462 0.607726803             # Gillnet
-2001   1       7       0.80905 0.482417492             # Gillnet
-2002   1       7       0.0705  0.636722669             # Gillnet
-2003   1       7       2.19239 1.045292238             # Gillnet
-2004   1       7       2.06259 1.29086811              # Gillnet
-2005   1       7       2.37125 0.96597585              # Gillnet
-2006   1       7       0.19907 0.715991358             # Gillnet
-2007   1       7       0.70306 0.652266994             # Gillnet
-2008   1       7       0.56617 0.828449353             # Gillnet
-2009   1       7       0.57952 1.293673735             # Gillnet
-2010   1       7       2.2685  0.868775614             # Gillnet
1986    1       8       0.687   0.1901                    # COM_FWC_VERT_LINE
1987    1       8       0.537   0.1854                    # COM_FWC_VERT_LINE
1988    1       8       0.729   0.1943                    # COM_FWC_VERT_LINE
1989    1       8       1.529   0.2029                    # COM_FWC_VERT_LINE
1990    1       8       0.979   0.2027                    # COM_FWC_VERT_LINE
1991    1       8       1.089   0.2005                    # COM_FWC_VERT_LINE
1992    1       8       1.083   0.2158                    # COM_FWC_VERT_LINE
1993    1       8       0.595   0.2220                    # COM_FWC_VERT_LINE
1994    1       8       1.032   0.2187                    # COM_FWC_VERT_LINE
1995    1       8       0.933   0.2325                    # COM_FWC_VERT_LINE
1996    1       8       0.721   0.2284                    # COM_FWC_VERT_LINE
1997    1       8       0.782   0.2340                    # COM_FWC_VERT_LINE
1998    1       8       1.145   0.2360                    # COM_FWC_VERT_LINE
1999    1       8       0.955   0.2350                          # COM_FWC_VERT_LINE
2000    1       8       0.752   0.2411                    # COM_FWC_VERT_LINE
2001    1       8       1.416   0.2290                          # COM_FWC_VERT_LINE
2002    1       8       1.087   0.2317                          # COM_FWC_VERT_LINE
2003    1       8       1.281   0.2227                          # COM_FWC_VERT_LINE
2004    1       8       1.568   0.2428                          # COM_FWC_VERT_LINE
2005    1       8       1.097   0.2556                          # COM_FWC_VERT_LINE
2006    1       8       1.475   0.2365                          # COM_FWC_VERT_LINE
2007    1       8       1.161    0.2384          # COM_FWC_VERT_LINE
2008    1       8       1.056   0.2425                          # COM_FWC_VERT_LINE
2009    1       8       1.408    0.2213          # COM_FWC_VERT_LINE
2010    1       8       1.567   0.2192                          # COM_FWC_VERT_LINE
2011    1       8       1.401    0.2311          # COM_FWC_VERT_LINE
```

```
1987  1  9  0.29632  0.6224     # SEAMAP Trawl
1988  1  9  1.16452  0.4463     # SEAMAP Trawl
1989  1  9  1.45153  0.4503     # SEAMAP Trawl
1990  1  9  1.63143  0.4452     # SEAMAP Trawl
1991  1  9  0.89001  0.4792     # SEAMAP Trawl
1992  1  9  0.61261  0.4670     # SEAMAP Trawl
1993  1  9  1.71736  0.4257     # SEAMAP Trawl
1994  1  9  0.69900  0.5265     # SEAMAP Trawl
1995  1  9  1.10658  0.4422     # SEAMAP Trawl
1996  1  9  0.97891  0.4968     # SEAMAP Trawl
1997  1  9  0.33724  0.5634     # SEAMAP Trawl
1998  1  9  0.54031  0.4832     # SEAMAP Trawl
1999  1  9  0.85572  0.4801     # SEAMAP Trawl
2000  1  9  1.18156  0.4850     # SEAMAP Trawl
2001  1  9  0.82051  0.5069     # SEAMAP Trawl
2002  1  9  0.32739  0.5947     # SEAMAP Trawl
2003  1  9  1.49226  0.4371     # SEAMAP Trawl
2004  1  9  0.46692  0.4575     # SEAMAP Trawl
2005  1  9  2.51801  0.4260     # SEAMAP Trawl
2006  1  9  0.92219  0.4536     # SEAMAP Trawl
2007  1  9  1.61528  0.4463     # SEAMAP Trawl
2008  1  9  0.79497  0.5053     # SEAMAP Trawl
2009  1  9  1.14124  0.3707     # SEAMAP Trawl
2010  1  9  1.25012  0.4371     # SEAMAP Trawl
2011  1  9  0.18800  0.5505     # SEAMAP Trawl
#
3       #_N_fleets     with    discard_obs
#       Fleet   Units   Error (1=biomass or numbers according to selection made for retained catch, 2= fraction (biomass or numbers) of
total catch discarded, 3= numbers of fish discarded, even if retained catch has units of biomass)
# Discard Error Structure (>=1 degrees of freedem for students T, 0=normal and value interperted as CV of observation, -1 normal and
value interperted as SE of observation)
2       2       -1
3       2       -1
4       3       -2
85      #       number  of      discard observations
# year  season  fleet   discard      error
1998     -1       2    0.17665   0.01   #COM_RR   value for 1998 was  0.20281, ave for 1998-2007 is   0.21503 AND ERROR WAS 0.35
1999      1      -2    0.18306   0.025   #COM_RR
2000      1      -2    0.24251   0.025   #COM_RR
2001      1      -2    0.12481   0.025   #COM_RR
2002      1      -2    0.25631   0.025   #COM_RR
2003      1      -2    0.23598   0.025   #COM_RR
2004      1      -2    0.22211   0.025   #COM_RR
2005      1      -2    0.24985   0.025   #COM_RR
2006      1      -2    0.15636   0.025   #COM_RR
2007      1      -2    0.27638   0.025   #COM_RR
2008      1      -2    0.08071   0.025   #COM_RR value for 2008 was 0.08290, ave for 2008-2011 is and error was 0.35
2009      1      -2    0.11538   0.025   #COM_RR
2010      1      -2    0.05754   0.025   #COM_RR
2011     -1      -2    0.17665   0.025   #COM_RR     value for 2011 was 0.06702
1981     -1       3    0.24473   0.005   #REC 1981 VALUE WAS 0.0358 AND AVE discard value for 1981-90 was  0.24473 AND ERROR WAS 0.001
```

```
1982      1     -3    0.1353    0.0001   #REC
1983      1     -3    0.3266    0.01   #REC
1984      1     -3    0.0600    0.01   #REC
1985      1     -3    0.1070    0.01   #REC
1986      1     -3    0.3853    0.01   #REC
1987      1     -3    0.1873    0.01   #REC
1988      1     -3    0.3298    0.01   #REC
1989      1     -3    0.3041    0.01   #REC
1990     -1     -3    0.5760    0.01   #REC
1991     -1      3    0.4062    0.001   #REC 1991 VALUE WAS 0.4158 AVE DISCARD value for 1991-2002 was 0.4062  AND ERROR WAS 0.001
1992      1     -3    0.4127    0.025  #REC
1993      1     -3    0.4138    0.025  #REC
1994      1     -3    0.3161    0.025  #REC
1995      1     -3    0.3463    0.025  #REC
1996      1     -3    0.3551    0.025  #REC
1997      1     -3    0.4043    0.025  #REC
1998      1     -3    0.3884    0.025  #REC
1999      1     -3    0.4376    0.025  #REC
2000      1     -3    0.4644    0.025  #REC
2001      1     -3    0.4265    0.025  #REC
2002     -1     -3    0.4932    0.025  #REC
2003     -1      3    0.5635    0.001   #REC 2003 VALUES WAS 0.59332003 AVE discard value FOR 2003-2011 was 0.5635  AND ERRO WAS 0.01
2004      1     -3    0.5196    0.025  #REC
2005      1     -3    0.5315    0.025  #REC
2006      1     -3    0.6156    0.025  #REC
2007      1     -3    0.6093    0.025  #REC
2008      1     -3    0.5174    0.025  #REC
2009      1     -3    0.5191    0.025  #REC
2010      1     -3    0.6083    0.025  #REC
2011     -1     -3    0.5575    0.025  #REC
1972     -1      4     9096     0.01  #SHRIMP BYCATCH  #_RDM  cahnge error to smaller value to force better fit
1973           1         -4          915.5    0.65  #SHRIMP BYCATCH
1974           1         -4      2230        0.65  #SHRIMP BYCATCH
1975       1      -4      2774          0.65  #SHRIMP BYCATCH
1976       1      -4      5264          0.65  #SHRIMP BYCATCH
1977       1      -4     13750          0.65  #SHRIMP BYCATCH
1978                 1              -4        13400          0.65  #SHRIMP BYCATCH
1979                 1         -4    16510    0.65  #SHRIMP BYCATCH
1980                 1         -4     13870        0.65  #SHRIMP BYCATCH
1981                 1         -4      4028         0.65  #SHRIMP BYCATCH
1982                 1         -4      5582         0.65  #SHRIMP BYCATCH
1983                 1         -4      4506         0.65  #SHRIMP BYCATCH
1984                 1         -4      8033         0.65  #SHRIMP BYCATCH
1985                 1         -4      2654         0.65  #SHRIMP BYCATCH
1986                 1         -4      6586         0.65  #SHRIMP BYCATCH
1987                 1         -4      5911         0.65  #SHRIMP BYCATCH
1988                 1         -4         9566      0.65  #SHRIMP BYCATCH
1989                 1         -4     14530         0.65  #SHRIMP BYCATCH
1990                 1         -4    20020    0.65  #SHRIMP BYCATCH
1991                 1         -4     14960         0.65  #SHRIMP BYCATCH
1992                 1         -4     19070         0.65  #SHRIMP BYCATCH
```

```
1993                  1          -4      48680          0.65  #SHRIMP BYCATCH
1994                  1          -4       4856          0.65  #SHRIMP BYCATCH
1995                  1          -4       4555          0.65  #SHRIMP BYCATCH
1996                  1          -4       4026          0.65  #SHRIMP BYCATCH
1997                  1          -4       4586          0.65  #SHRIMP BYCATCH
1998                  1          -4       5672          0.65  #SHRIMP BYCATCH
1999                  1          -4       4289          0.65  #SHRIMP BYCATCH
2000                  1          -4       9968          0.65  #SHRIMP BYCATCH
2001                  1          -4       5797        0.65  #SHRIMP BYCATCH
2002                  1          -4       5258        0.65  #SHRIMP BYCATCH
2003                  1          -4    10850    0.65  #SHRIMP BYCATCH
2004                  1          -4    18680    0.65  #SHRIMP BYCATCH
2005                  1          -4      21590          0.65  #SHRIMP BYCATCH
2006                  1          -4       3903          0.65  #SHRIMP BYCATCH
2007                  1          -4       8264          0.65  #SHRIMP BYCATCH
2008                  1          -4       2797          0.65  #SHRIMP BYCATCH
2009                  1    -4     2621          0.65  #SHRIMP BYCATCH
2010                  1          -4       2945          0.65  #SHRIMP BYCATCH
2011            -1       -4       2632          0.65  #SHRIMP BYCATCH
#
#
0  #_N_meanbodywt_obs
30 #degrees of freedom (must be here)

2 # length bin method: 1=use databins; 2=generate from binwidth,min,max below; 3=read vector
2 # binwidth for population size comp
4   # minimum size in the population (lower edge of first bin and size at age 0.00)
100 # maximum size in the population (lower edge of last bin)

0 #_comp_tail_compression note, set to 0 for tail compress and set to - value for no tail compressing
1e-007 #_add_to_comp


0       #_combine      males   into    females at      or      below   this    bin     number
49 #_N_LengthBins
4       6       8       10      12      14      16      18      20      22      24      26      28      30      32      34      36      38
        40      42      44      46      48      50      52      54      56      58      60      62      64      66      68      70      72
        74      76      78      80      82      84      86      88      90      92      94      96      98      100
104     #_N_Length_obs
#
#_year  season  fleet   gender  part    nsamp   Bin4    Bin6    Bin8    Bin10   Bin12   Bin14   Bin16   Bin18   Bin20   Bin22   Bin24   Bin26
        Bin28   Bin30   Bin32   Bin34   Bin36   Bin38   Bin40   Bin42   Bin46   Bin48   Bin50   Bin52   Bin54   Bin56   Bin58   Bin60   Bin62
        Bin64   Bin66   Bin68   BIN70   Bin72   Bin74   Bin76   Bin78   Bin80   Bin82   Bin84   Bin86   Bin88   Bin90   Bin92   Bin94   Bin96
        Bin98   Bin100


-1986   1       1       0       2       17      0       0       0       0       0       0       0       0       0       0       0       0
        0       0       0       0       0       0       0       6       2       3       2       1       2       0       1       0       0
        0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0
        0       0       0
```

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1987 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 2 | 3 | 3 | 11 | 42 | 60 | 72 | 85 | 79 | 72 | 42 | 39 | 24 | 8 | 8 |
| | 3 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 1 | 0 | 2 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 1 | 2 | 8 | 15 | 14 | 8 | 5 | 3 | 1 | 2 | 0 | 0 | 1 | 2 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 1 | 0 | 2 | 9 | 12 | 7 | 10 | 6 | 4 | 8 | 2 | 2 | 0 | 1 | 1 | 1 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 5 | 3 | 10 | 15 | 5 | 6 | 5 | 1 | 2 | 0 | 2 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 1 | 0 | 0 | 5 | 22 | 31 | 49 | 49 | 37 | 32 | 42 | 35 | 44 | 32 | 28 | 23 |
| | 5 | 8 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1993 | 1 | 1 | 0 | 2 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 6 | 18 | 16 | 10 | 8 | 7 | 6 | 4 | 3 | 3 | 1 | 1 | 1 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1994 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 1 | 1 | 5 | 16 | 30 | 51 | 60 | 79 | 85 | 61 | 38 | 25 | 26 | 5 | 12 |
| | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1995 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 1 | 1 | 4 | 11 | 4 | 2 | 6 | 6 | 4 | 24 | 49 | 40 | 54 | 40 | 24 | 5 |
| | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1996 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 4 | 13 | 22 | 41 | 46 | 54 | 47 | 35 |
| | 21 | 7 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -1997 | 1 | 1 | 0 | 2 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 4 | 3 | 1 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1999 | 1 | 1 | 0 | 2 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 2 | 0 | 3 | 4 | 5 | 5 | 2 | 3 | 3 | 5 | 0 | 1 | 1 | 2 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2000 | 1 | 1 | 0 | 2 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 9 | 6 | 6 | 5 | 5 | 1 | 2 | 0 | 1 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -2001 | 1 | 1 | 0 | 2 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 5 | 5 | 2 | 3 | 3 | 2 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2002 | 1 | 1 | 0 | 2 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 5 | 8 | 7 | 5 | 3 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 1 | 2 | 1 | 8 | 9 | 14 | 19 | 9 | 14 | 9 | 4 | 9 | 3 | 0 | 0 |
| | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| | 6 | 35 | 50 | 95 | 231 | 330 | 366 | 332 | 225 | 215 | 172 | 136 | 86 | 83 | 60 | 59 | 47 |
| | 13 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2005 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 20 | 32 | 52 | 100 | 171 | 276 | 338 | 251 | 221 | 203 | 169 | 120 | 98 | 107 | 74 | 54 | 22 |
| | 19 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| | 47 | 130 | 207 | 251 | 316 | 286 | 248 | 210 | 162 | 142 | 114 | 60 | 54 | 26 | 39 | 22 | 16 |
| | 7 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 59 | 123 | 192 | 268 | 387 | 481 | 389 | 288 | 245 | 207 | 174 | 115 | 98 | 55 | 30 | 42 | 16 |
| | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2008 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 20 |
| | 121 | 164 | 134 | 223 | 371 | 442 | 401 | 320 | 274 | 263 | 182 | 126 | 84 | 63 | 58 | 57 | 39 |
| | 12 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2009 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 48 | 130 | 173 | 325 | 348 | 348 | 282 | 248 | 227 | 188 | 142 | 84 | 55 | 43 | 36 | 21 |
| | 7 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 34 |
| | 136 | 160 | 149 | 207 | 301 | 358 | 291 | 229 | 185 | 143 | 150 | 128 | 128 | 106 | 93 | 56 | 37 |
| | 11 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 40 | 147 | 298 | 345 | 378 | 445 | 396 | 316 | 274 | 236 | 193 | 138 | 107 | 72 | 76 | 59 | 23 |
| | 20 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -1983 | 1 | 2 | 0 | 2 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 2 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -1984 | 1 | 2 | 0 | 2 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 2 | 1 | 2 | 2 | 4 | 1 | 0 | 2 | 2 |
| | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1985 | 1 | 2 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| | 23 | 7 | 25 | 19 | 14 | 13 | 11 | 6 | 7 | 2 | 3 | 6 | 3 | 7 | 3 | 7 | 8 |
| | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -1986 | 1 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 2 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 1 | 0 | 1 | 6 | 3 | 9 | 12 | 12 | 20 | 26 | 27 | 29 | 25 | 13 |
| | 6 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1992 | 1 | 2 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 3 | 14 | 15 | 15 | 20 | 26 | 51 | 36 | 32 |
| | 9 | 4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1993 | 1 | 2 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 0 | 5 | 9 | 7 | 2 | 0 | 2 | 3 | 8 | 4 | 10 | 6 | 11 | 12 | 8 | 17 | 6 |
| | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 2 | 4 | 9 | 10 | 17 | 10 | 11 | 15 | 12 | 4 |
| | 3 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1995 | 1 | 2 | 0 | 2 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 1 | 0 | 2 | 3 | 3 | 2 | 7 | 8 | 5 | 2 |
| | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -1996 | 1 | 2 | 0 | 2 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 0 | 0 | 2 | 1 | 2 | 4 | 2 | 2 |
| | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -1997 | 1 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -1998 | 1 | 2 | 0 | 2 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 4 | 2 | 0 |
| | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -1999 | 1 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -2001 | 1 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -2002 | 1 | 2 | 0 | 2 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 7 | 2 | 3 | 4 | 1 | 1 | 0 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 2 | 0 | 2 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 3 | 3 | 5 | 2 | 10 | 4 | 3 | 3 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| -2004 | 1 | 2 | 0 | 2 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 2 | 1 | 2 | 2 | 0 | 0 | 1 |
| | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2005 | 1 | 2 | 0 | 2 | 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 2 | 9 | 3 | 3 | 8 | 13 | 6 | 7 | 5 | 5 | 3 | 5 | 1 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 2 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 6 | 13 | 12 | 13 | 9 | 12 | 7 | 7 | 7 |
| | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 2 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 3 | 11 | 35 | 45 | 26 | 15 | 9 | 6 | 6 | 8 | 12 | 5 | 5 | 8 | 5 | 3 |
| | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2008 | 1 | 2 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 1 | 0 | 2 | 1 | 2 | 10 | 17 | 19 | 27 | 26 | 23 | 23 | 20 | 23 | 5 |
| | 6 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2009 | 1 | 2 | 0 | 2 | 81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 3 | 5 | 4 | 5 | 5 | 5 | 8 | 8 | 7 | 5 | 7 | 3 | 10 | 2 |
| | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 1 | 0 | 3 | 2 | 8 | 4 | 2 | 8 | 3 | 6 | 4 | 4 | 5 | 8 | 5 |
| | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 1 | 3 | 7 | 5 | 15 | 20 | 23 | 21 | 47 | 31 | 29 | 24 | 17 |
| | 12 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1981 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| | 19 | 32 | 30 | 30 | 35 | 27 | 37 | 25 | 11 | 11 | 8 | 11 | 5 | 4 | 6 | 0 | 8 |
| | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1982 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 5 |
| | 26 | 47 | 66 | 29 | 53 | 40 | 32 | 36 | 16 | 26 | 16 | 12 | 14 | 3 | 8 | 2 | 6 |
| | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1983 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 3 | 3 |
| | 3 | 20 | 29 | 46 | 96 | 92 | 79 | 62 | 55 | 31 | 34 | 17 | 22 | 12 | 18 | 6 | 7 |
| | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 2 |
| | 5 | 14 | 36 | 82 | 129 | 71 | 62 | 38 | 27 | 22 | 10 | 15 | 8 | 6 | 8 | 9 | 2 |
| | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1985 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 |
| | 6 | 18 | 35 | 38 | 71 | 58 | 28 | 29 | 28 | 23 | 17 | 14 | 15 | 17 | 10 | 8 | 3 |
| | 3 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1986 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| | 13 | 45 | 122 | 183 | 154 | 159 | 90 | 78 | 56 | 39 | 33 | 35 | 23 | 16 | 15 | 12 | 7 |
| | 10 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1987 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 5 |
| | 8 | 39 | 104 | 156 | 165 | 160 | 144 | 133 | 101 | 90 | 88 | 75 | 84 | 58 | 28 | 22 | 14 |
| | 9 | 8 | 10 | 1 | 2 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1988 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 1 |
| | 4 | 18 | 53 | 82 | 92 | 97 | 96 | 77 | 51 | 50 | 41 | 45 | 31 | 22 | 24 | 18 | 4 |
| | 9 | 3 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 9 |
| | 24 | 57 | 104 | 109 | 145 | 133 | 84 | 58 | 70 | 48 | 39 | 41 | 30 | 14 | 17 | 11 | 8 |
| | 4 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 2 | 9 |
| | 15 | 52 | 104 | 134 | 146 | 128 | 96 | 74 | 53 | 56 | 49 | 55 | 36 | 32 | 23 | 14 | 5 |
| | 3 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 7 | 15 |
| | 36 | 52 | 70 | 103 | 126 | 117 | 121 | 111 | 87 | 78 | 80 | 61 | 53 | 34 | 40 | 20 | 18 |
| | 6 | 6 | 1 | 2 | 2 | 3 | 6 | 3 | 0 | 2 | 6 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1992 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 3 |
| | 18 | 67 | 132 | 234 | 240 | 238 | 156 | 123 | 106 | 94 | 97 | 79 | 58 | 70 | 48 | 32 | 22 |
| | 12 | 8 | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 2 | 1 | 3 | 0 | 0 | 1 | 0 |
| | 0 | 1 | 0 | | | | | | | | | | | | | | |
| 1993 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 5 |
| | 16 | 42 | 75 | 68 | 77 | 93 | 61 | 62 | 48 | 39 | 38 | 40 | 30 | 33 | 27 | 23 | 14 |
| | 6 | 1 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | 11 | 44 | 70 | 76 | 111 | 97 | 103 | 86 | 76 | 63 | 66 | 71 | 39 | 30 | 34 | 24 | 12 |
| | 3 | 4 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 8 | 33 | 35 | 46 | 56 | 50 | 70 | 62 | 81 | 84 | 79 | 51 | 61 | 54 | 50 | 27 | 30 |
| | 15 | 18 | 2 | 6 | 2 | 3 | 4 | 2 | 4 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1996 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 1 | 2 |
| | 3 | 27 | 36 | 55 | 76 | 111 | 101 | 94 | 79 | 87 | 86 | 69 | 65 | 59 | 57 | 26 | 23 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 9 | 10 | 9 | 3 | 0 | 4 | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1997 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 4 | 1 | 2 |
| | 15 | 45 | 50 | 68 | 64 | 82 | 117 | 76 | 90 | 97 | 114 | 90 | 105 | 81 | 52 | 37 | 21 |
| | 11 | 12 | 5 | 5 | 0 | 1 | 1 | 1 | 0 | 4 | 0 | 1 | 2 | 1 | 0 | 1 | 2 |
| | 1 | 0 | 0 | | | | | | | | | | | | | | |
| 1998 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 10 |
| | 38 | 46 | 82 | 98 | 142 | 128 | 124 | 97 | 91 | 110 | 81 | 108 | 81 | 66 | 63 | 50 | 41 |
| | 17 | 10 | 7 | 2 | 2 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1999 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 30 |
| | 68 | 143 | 155 | 246 | 304 | 295 | 280 | 218 | 155 | 146 | 167 | 156 | 142 | 109 | 92 | 78 | 59 |
| | 31 | 21 | 9 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2000 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 |
| | 14 | 74 | 176 | 232 | 336 | 381 | 324 | 255 | 219 | 177 | 136 | 194 | 144 | 137 | 121 | 97 | 52 |
| | 35 | 18 | 9 | 11 | 1 | 1 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2001 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 3 | 16 |
| | 38 | 132 | 265 | 460 | 533 | 488 | 411 | 282 | 185 | 155 | 113 | 73 | 87 | 57 | 71 | 54 | 34 |
| | 21 | 15 | 4 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2002 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 |
| | 11 | 83 | 110 | 99 | 133 | 177 | 241 | 227 | 225 | 173 | 158 | 138 | 111 | 102 | 88 | 61 | 50 |
| | 30 | 15 | 7 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 13 |
| | 29 | 74 | 86 | 100 | 138 | 168 | 151 | 169 | 165 | 140 | 132 | 121 | 98 | 94 | 92 | 71 | 38 |
| | 28 | 18 | 10 | 3 | 4 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 23 |
| | 30 | 87 | 101 | 208 | 250 | 241 | 231 | 209 | 176 | 158 | 139 | 140 | 115 | 87 | 82 | 56 | 42 |
| | 20 | 16 | 8 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2005 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 |
| | 11 | 29 | 80 | 135 | 109 | 143 | 128 | 119 | 109 | 103 | 93 | 100 | 78 | 64 | 56 | 31 | 28 |
| | 15 | 9 | 7 | 1 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| | 10 | 31 | 74 | 120 | 185 | 209 | 205 | 160 | 140 | 149 | 149 | 126 | 91 | 70 | 62 | 36 | 39 |
| | 27 | 5 | 9 | 4 | 1 | 1 | 2 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 4 |
| | 4 | 42 | 88 | 107 | 145 | 189 | 207 | 198 | 188 | 128 | 111 | 91 | 81 | 69 | 67 | 47 | 30 |
| | 19 | 6 | 6 | 1 | 0 | 0 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2008 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 3 |
| | 22 | 70 | 108 | 162 | 176 | 182 | 172 | 173 | 129 | 135 | 128 | 96 | 85 | 71 | 58 | 52 | 23 |
| | 16 | 14 | 7 | 1 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 14 | 50 | 99 | 122 | 175 | 191 | 181 | 168 | 133 | 151 | 98 | 80 | 94 | 52 | 45 | 35 | 18 |
| | 20 | 11 | 4 | 4 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 23 |
| | 27 | 47 | 90 | 176 | 167 | 238 | 226 | 179 | 163 | 138 | 140 | 125 | 93 | 76 | 47 | 55 | 15 |
| | 8 | 8 | 1 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 3 | 0 | 2 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 |
| | 46 | 171 | 249 | 275 | 305 | 322 | 279 | 247 | 194 | 172 | 125 | 132 | 92 | 72 | 45 | 38 | 17 |
| | 14 | 7 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1987 | 1 | 9 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 2 | 0 | 0 | 0 | 0 |
| | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1988 | 1 9 | 0 | 0 | 82 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 5 | 21 | 10 | 5 | 1 | 0 |
| | 7 | 8 | 5 | 6 | 2 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | | | | | | | | | | | | | | | |
| 1989 | 1 | 9 | 0 | 0 | 98 | 0 | 0 | 0 | 0 | 5 | 8 | 7 | 10 | 15 | 25 | 14 | 1 |
| | 0 | 0 | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 9 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 19 | 10 | 22 | 28 | 19 | 5 | 2 | 3 |
| | 6 | 5 | 7 | 5 | 4 | 1 | 2 | 5 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 9 | 0 | 0 | 100 | 0 | 0 | 0 | 2 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| | 3 | 22 | 18 | 14 | 19 | 9 | 9 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1992 | 1 | 9 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 8 | 5 | 6 | 20 | 10 |
| | 4 | 5 | 4 | 9 | 4 | 7 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1993 | 1 | 9 | 0 | 0 | 100 | 0 | 0 | 0 | 2 | 9 | 7 | 12 | 12 | 12 | 1 | 3 | 7 |
| | 34 | 21 | 12 | 4 | 8 | 10 | 3 | 6 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1994 | 1 | 9 | 0 | 0 | 78 | 0 | 0 | 0 | 2 | 5 | 13 | 6 | 13 | 5 | 0 | 1 | 3 |
| | 1 | 1 | 2 | 1 | 6 | 4 | 3 | 4 | 4 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1995 | 1 | 9 | 0 | 0 | 100 | 0 | 2 | 1 | 0 | 0 | 9 | 7 | 2 | 3 | 2 | 4 | 3 |
| | 7 | 13 | 16 | 6 | 7 | 3 | 4 | 3 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1996 | 1 | 9 | 0 | 0 | 94 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 13 | 7 | 2 | 6 | 5 |
| | 12 | 9 | 7 | 8 | 13 | 4 | 2 | 2 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1997 | 1 | 9 | 0 | 0 | 62 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 4 | 3 | 2 | 2 | 2 |
| | 3 | 8 | 5 | 7 | 4 | 7 | 4 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1998 | 1 | 9 | 0 | 0 | 69 | 0 | 1 | 0 | 2 | 0 | 2 | 2 | 11 | 10 | 4 | 2 | 1 |
| | 11 | 8 | 2 | 1 | 2 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1999 | 1 | 9 | 0 | 0 | 83 | 0 | 0 | 0 | 4 | 1 | 5 | 6 | 5 | 5 | 7 | 4 | 2 |
| | 8 | 5 | 6 | 6 | 2 | 3 | 3 | 3 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2000 | 1 | 9 | 0 | 0 | 99 | 0 | 0 | 0 | 0 | 4 | 18 | 8 | 8 | 8 | 9 | 19 | 6 |
| | 4 | 2 | 5 | 3 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2001 | 1 | 9 | 0 | 0 | 84 | 0 | 0 | 1 | 3 | 5 | 14 | 20 | 10 | 7 | 1 | 0 | 3 |
| | 0 | 2 | 4 | 3 | 5 | 2 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2002 | 1 | 9 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 0 | 1 | 1 | 0 |
| | 1 | 3 | 4 | 1 | 3 | 0 | 1 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 9 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 16 | 51 | 19 | 11 | 3 |
| | 5 | 10 | 4 | 4 | 3 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 9 | 0 | 0 | 71 | 1 | 0 | 0 | 1 | 5 | 2 | 4 | 2 | 2 | 4 | 3 | 5 |
| | 7 | 8 | 9 | 3 | 4 | 4 | 2 | 1 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2005 | 1 | 9 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 2 | 16 | 24 | 19 | 35 | 28 | 14 | 4 |
| | 7 | 11 | 9 | 5 | 4 | 1 | 2 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 9 | 0 | 0 | 88 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 11 | 7 | 4 | 3 |
| | 4 | 13 | 12 | 7 | 9 | 2 | 3 | 2 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 9 | 0 | 0 | 100 | 0 | 1 | 0 | 1 | 1 | 8 | 16 | 9 | 18 | 22 | 5 | 13 |
| | 7 | 13 | 6 | 5 | 2 | 2 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2008 | 1 | 9 | 0 | 0 | 100 | 0 | 0 | 2 | 6 | 7 | 4 | 15 | 4 | 0 | 0 | 3 | 12 |
| | 16 | 20 | 4 | 2 | 6 | 2 | 2 | 1 | 4 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |

```
2009    1       9       0       0       100     0       0       0       0       0       2       16      35      20      32      22      8
        3       6       7       4       3       3       3       1       1       2       1       0       3       0       1       0       0
        0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0
        0       0       0
2010    1       9       0       0       81      0       0       1       0       1       4       5       3       7       7       1       5
        5       10      8       9       6       5       1       1       2       0       0       0       0       0       0       0       0
        0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0
        0       0       0
2011    1       9       0       0       81      0       0       1       0       1       4       5       3       7       7       1       5
        5       10      8       9       6       5       1       1       2       0       0       0       0       0       0       0       0
        0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0
        0       0       0
#
12 #_N_age_bins
0 1 2 3 4 5 6 7 8 9 10 11
2 #_N_ageerror_definitions

 0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5
 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
 0.5  1.5  2.5  3.5  4.5  5.5  6.5  7.5  8.5  9.5  10.5 11.5
 0.01 0.01  0.06  0.08   0.11  0.11  0.37  0.37   0.37   0.37  0.37   0.37  # values from C. Palmer (Panama City lab) August 8 2012

#0.01 0.27 0.96  1.37  1.65  1.88  2.06  2.21   2.35  2.46  2.57   2.66
# 2.0  2.5  2.75 3.0  3.25 3.5  3.75 3.85 3.95 3.5  3.65 3.75
#
1031    #_N_Agecomp_obs

2               #_Lbin_method: 1=poplenbins_index;   2=datalenbins_index;   3=lengths

1               #_combine      males   into    females at      or      below   this    bin     number

#_Year  season  Fleet   Gender  Partition       Age_err_df      L_binL  L_Bin_H Nsamp   0       1       2       3       4       5       6
        7       8       9       10      11
1988    1       1       0       2       2       13      13      2       0       2       0       0       0       0       0       0       0
        0       0       0
1988    1       1       0       2       2       14      14      12      0       12      0       0       0       0       0       0       0
        0       0       0
1988    1       1       0       2       2       15      15      9       0       9       0       0       0       0       0       0       0
        0       0       0
1988    1       1       0       2       2       16      16      8       0       7       1       0       0       0       0       0       0
        0       0       0
1988    1       1       0       2       2       17      17      9       0       5       3       1       0       0       0       0       0
        0       0       0
1988    1       1       0       2       2       18      18      8       0       4       4       0       0       0       0       0       0
        0       0       0
1988    1       1       0       2       2       19      19      8       0       1       6       1       0       0       0       0       0
        0       0       0
1988    1       1       0       2       2       20      20      15      0       1       9       5       0       0       0       0       0
        0       0       0
1988    1       1       0       2       2       21      21      3       0       1       2       0       0       0       0       0       0
        0       0       0
```

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1988 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 6 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1988 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 5 | 0 | 0 | 2 | 2 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1988 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 16 | 0 | 1 | 5 | 3 | 3 | 4 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1988 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1988 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1988 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1988 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 4 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 14 | 0 | 0 | 7 | 6 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 28 | 0 | 3 | 10 | 9 | 5 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 27 | 0 | 1 | 5 | 7 | 10 | 3 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 38 | 0 | 0 | 4 | 14 | 15 | 5 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 33 | 0 | 0 | 4 | 10 | 9 | 9 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 24 | 0 | 1 | 3 | 5 | 4 | 9 | 2 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 12 | 0 | 0 | 0 | 1 | 7 | 3 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 17 | 0 | 0 | 2 | 3 | 6 | 3 | 3 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 13 | 0 | 0 | 0 | 1 | 1 | 10 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 9 | 0 | 0 | 0 | 0 | 2 | 6 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 12 | 0 | 0 | 0 | 1 | 2 | 8 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 5 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1990 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 4 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 12 | 12 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 7 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 14 | 0 | 12 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 8 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 11 | 0 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 34 | 1 | 15 | 13 | 4 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 33 | 0 | 8 | 18 | 6 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 29 | 0 | 8 | 11 | 9 | 0 | 0 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 31 | 0 | 3 | 15 | 8 | 4 | 0 | 0 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 22 | 0 | 2 | 13 | 6 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 21 | 0 | 0 | 14 | 3 | 2 | 1 | 0 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 28 | 0 | 0 | 17 | 8 | 0 | 0 | 3 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 27 | 0 | 0 | 9 | 8 | 4 | 4 | 2 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 23 | 0 | 0 | 9 | 5 | 2 | 2 | 4 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 18 | 0 | 0 | 4 | 7 | 1 | 1 | 5 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 12 | 0 | 0 | 1 | 4 | 1 | 1 | 5 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 5 | 0 | 0 | 0 | 2 | 0 | 1 | 2 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 3 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | 1 | 1 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1991 | 1 | 1 | 0 | 2 | 2 | 33 | 33 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 12 | 12 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 4 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 14 | 0 | 2 | 9 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 34 | 0 | 0 | 17 | 14 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 42 | 0 | 0 | 21 | 13 | 7 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 51 | 0 | 1 | 19 | 24 | 5 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 41 | 0 | 2 | 6 | 19 | 10 | 4 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 33 | 0 | 0 | 6 | 16 | 6 | 3 | 0 | 1 | 1 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 40 | 0 | 0 | 9 | 14 | 5 | 9 | 1 | 2 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 40 | 0 | 0 | 7 | 19 | 6 | 5 | 1 | 2 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 39 | 0 | 0 | 5 | 12 | 13 | 3 | 2 | 4 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 31 | 0 | 0 | 4 | 6 | 11 | 4 | 0 | 5 | 1 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 26 | 0 | 0 | 1 | 5 | 13 | 4 | 0 | 3 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 18 | 0 | 0 | 1 | 2 | 8 | 1 | 1 | 5 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1992 | 1 | 1 | 0 | 2 | 2 | 32 | 32 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1993 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1993 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 13 | 0 | 1 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1993 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 26 | 0 | 0 | 18 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1993 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 25 | 0 | 0 | 12 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1993 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 14 | 0 | 0 | 8 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1993 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 10 | 0 | 0 | 4 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 12 | 0 | 0 | 6 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 3 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 7 | 0 | 0 | 2 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 10 | 0 | 1 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 26 | 0 | 1 | 9 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 32 | 0 | 0 | 8 | 16 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 52 | 0 | 0 | 16 | 24 | 9 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 67 | 0 | 0 | 11 | 33 | 20 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 77 | 0 | 0 | 5 | 32 | 28 | 10 | 0 | 2 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 63 | 0 | 0 | 7 | 26 | 24 | 5 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 35 | 0 | 0 | 1 | 13 | 14 | 2 | 2 | 2 | 0 | 1 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 27 | 0 | 0 | 0 | 11 | 10 | 3 | 1 | 0 | 0 | 2 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 13 | 0 | 0 | 0 | 5 | 5 | 0 | 2 | 0 | 0 | 1 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 9 | 0 | 0 | 0 | 3 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 5 | 0 | 0 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 4 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1994 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 16 | 3 | 1 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 9 | 3 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 8 | 1 | 0 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 7 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 8 | 0 | 0 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 1 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 15 | 0 | 0 | 8 | 4 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 39 | 0 | 0 | 17 | 10 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 32 | 0 | 0 | 5 | 18 | 8 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 31 | 0 | 0 | 3 | 11 | 12 | 3 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 29 | 0 | 0 | 0 | 14 | 12 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 13 | 0 | 0 | 0 | 2 | 6 | 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 4 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 9 | 0 | 0 | 2 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 15 | 0 | 0 | 5 | 5 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1996 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 29 | 0 | 1 | 3 | 14 | 6 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 36 | 0 | 0 | 4 | 14 | 11 | 5 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 45 | 0 | 0 | 0 | 23 | 12 | 6 | 1 | 1 | 2 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 38 | 0 | 0 | 0 | 14 | 14 | 4 | 2 | 1 | 1 | 1 | 0 | 1 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 40 | 0 | 0 | 0 | 10 | 9 | 14 | 2 | 1 | 3 | 1 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 18 | 0 | 0 | 0 | 2 | 8 | 3 | 3 | 0 | 2 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 11 | 0 | 0 | 0 | 0 | 0 | 5 | 4 | 1 | 0 | 1 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 1 | 0 | 2 | 2 | 33 | 33 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 2000 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 5 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 7 | 0 | 0 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 1 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 5 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 6 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 11 | 0 | 1 | 3 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 16 | 0 | 0 | 3 | 8 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 9 | 0 | 0 | 0 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 7 | 0 | 0 | 0 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 7 | 0 | 1 | 0 | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 5 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 1 | 0 | 2 | 2 | 33 | 33 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

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| 2002 | 1 | 1 | 0 | 2 | 2 | 11 | 11 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 12 | 12 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 9 | 0 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 6 | 0 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 9 | 0 | 2 | 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 7 | 0 | 1 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 11 | 0 | 0 | 3 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 7 | 0 | 1 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 4 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 8 | 0 | 0 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 8 | 0 | 2 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 2003 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 13 | 0 | 1 | 6 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 8 | 0 | 0 | 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 9 | 0 | 0 | 0 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 9 | 0 | 0 | 0 | 2 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 8 | 0 | 5 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 12 | 1 | 8 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 7 | 0 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 19 | 0 | 1 | 10 | 6 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 14 | 0 | 2 | 6 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 11 | 0 | 0 | 4 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 14 | 0 | 0 | 0 | 5 | 5 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 9 | 0 | 0 | 0 | 4 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 8 | 0 | 0 | 0 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 7 | 0 | 0 | 0 | 3 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 9 | 0 | 0 | 0 | 2 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | 1 | 1 | 0 | 2 | 2 | 12 | 12 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 12 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 22 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 18 | 0 | 15 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 16 | 0 | 8 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 13 | 0 | 3 | 4 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 20 | 0 | 4 | 7 | 7 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 21 | 0 | 1 | 9 | 5 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 21 | 0 | 4 | 5 | 5 | 3 | 3 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 21 | 0 | 0 | 8 | 6 | 3 | 3 | 0 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 20 | 0 | 0 | 7 | 8 | 2 | 1 | 1 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 26 | 0 | 0 | 5 | 6 | 7 | 6 | 1 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 22 | 0 | 0 | 6 | 10 | 1 | 3 | 1 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 21 | 0 | 0 | 2 | 6 | 4 | 5 | 3 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 12 | 0 | 0 | 0 | 0 | 3 | 6 | 1 | 2 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 8 | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 2 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 7 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 |
| 2005 | 1 | 1 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 16 | 0 | 15 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 24 | 0 | 21 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 20 | 1 | 12 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 21 | 0 | 10 | 6 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 2006 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 9 | 0 | 1 | 5 | 3 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 8 | 0 | 0 | 4 | 3 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 9 | 0 | 0 | 1 | 5 | 3 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 7 | 0 | 0 | 0 | 4 | 2 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2006 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 13 | 1 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 15 | 0 | 9 | 4 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 22 | 0 | 10 | 7 | 2 | 3 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 21 | 0 | 3 | 7 | 8 | 1 | 0 | 2 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 21 | 0 | 5 | 4 | 6 | 6 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 12 | 0 | 1 | 4 | 4 | 2 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 16 | 0 | 0 | 2 | 6 | 3 | 5 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 7 | 0 | 0 | 1 | 2 | 4 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 10 | 0 | 0 | 1 | 2 | 5 | 2 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 17 | 0 | 0 | 1 | 4 | 10 | 2 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2007 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 6 | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2008 | 1 | 1 | 0 | 2 | 2 | 11 | 11 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2008 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2008 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 12 | 1 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2008 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 20 | 0 | 13 | 5 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2008 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 38 | 3 | 22 | 5 | 6 | 2 | 0 | 0 | 0 | 0 |
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| 2008 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 32 | 1 | 8 | 11 | 8 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 37 | 0 | 11 | 9 | 6 | 9 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 29 | 0 | 5 | 9 | 9 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 27 | 0 | 6 | 8 | 6 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 19 | 0 | 0 | 4 | 7 | 5 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 18 | 0 | 2 | 2 | 4 | 7 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 20 | 0 | 1 | 2 | 6 | 5 | 4 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 15 | 0 | 0 | 1 | 2 | 6 | 5 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 6 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 8 | 0 | 0 | 0 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 7 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 3 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 14 | 14 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 11 | 0 | 5 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 12 | 0 | 5 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 16 | 0 | 2 | 6 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 10 | 0 | 3 | 1 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 14 | 0 | 5 | 2 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 10 | 0 | 0 | 2 | 1 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 7 | 0 | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 4 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2009 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2009 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2009 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2009 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 6 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 11 | 0 | 3 | 6 | 0 | 2 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 12 | 0 | 2 | 8 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 9 | 1 | 0 | 4 | 0 | 3 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 7 | 0 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 5 | 0 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 3 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 7 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 4 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 15 | 15 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 16 | 16 | 4 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 17 | 17 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | 1 | 1 | 0 | 2 | 2 | 18 | 18 | 11 | 0 | 6 | 4 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 19 | 19 | 10 | 0 | 4 | 2 | 2 | 1 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 20 | 20 | 6 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 21 | 21 | 8 | 0 | 0 | 2 | 2 | 3 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 0 | 5 | 1 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 26 | 26 | 5 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 27 | 27 | 5 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 28 | 28 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 1 | 0 | 2 | 2 | 30 | 30 | 3 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1988 | 1 | 2 | 0 | 2 | 2 | 14 | 14 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1988 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 2 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 2 | 0 | 2 | 2 | 14 | 14 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 15 | 3 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 27 | 3 | 21 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 28 | 1 | 20 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 19 | 0 | 14 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 10 | 0 | 6 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 6 | 0 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 1989 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 1 | 2 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 14 | 14 | 18 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 49 | 0 | 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 31 | 0 | 28 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 25 | 0 | 12 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 12 | 0 | 5 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 4 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 3 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 5 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 3 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 10 | 0 | 1 | 2 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 11 | 0 | 0 | 5 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 17 | 0 | 0 | 5 | 1 | 7 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 19 | 0 | 0 | 5 | 5 | 4 | 2 | 1 | 2 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 16 | 0 | 0 | 6 | 5 | 1 | 0 | 2 | 2 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 13 | 0 | 0 | 1 | 6 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 14 | 0 | 0 | 2 | 2 | 3 | 6 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 15 | 0 | 0 | 0 | 4 | 2 | 7 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 6 | 0 | 0 | 1 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 2 | 0 | 2 | 2 | 31 | 31 | 5 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 6 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 0 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 8 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 6 | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 6 | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1993 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 5 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1993 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 11 | 0 | 0 | 0 | 3 | 6 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1993 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1993 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 7 | 0 | 0 | 0 | 0 | 6 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 5 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 3 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1994 | 1 | 2 | 0 | 2 | 2 | 33 | 33 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1995 | 1 | 2 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1995 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1995 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1995 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1995 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1995 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1995 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1995 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | | | | | | | | | | | | | |
| 1995 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 2 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 2 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 4 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2001 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 4 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 2 | 0 | 2 | 2 | 34 | 34 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 6 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 8 | 0 | 1 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 2 | 0 | 2 | 2 | 32 | 32 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2004 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 5 | 0 | 0 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 2006 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 3 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 5 | 0 | 0 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 5 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 4 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 16 | 16 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 3 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 2 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 6 | 0 | 0 | 1 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 5 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 6 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 0 |
| 2009 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 4 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 7 | 0 | 0 | 0 | 4 | 2 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 1 | 4 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 31 | 31 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2010 | 1 | 2 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 15 | 15 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 17 | 17 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 18 | 18 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 19 | 19 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 20 | 20 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 21 | 21 | 7 | 0 | 1 | 0 | 3 | 2 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 22 | 22 | 10 | 0 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 23 | 23 | 13 | 0 | 1 | 2 | 3 | 4 | 1 | 1 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 24 | 24 | 11 | 0 | 0 | 3 | 4 | 1 | 2 | 0 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 25 | 25 | 30 | 0 | 1 | 3 | 5 | 6 | 8 | 5 | 1 | 1 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2011 | 1 | 2 | 0 | 2 | 2 | 26 | 26 | 32 | 0 | 0 | 2 | 7 | 12 | 6 | 5 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | 1 | 2 | 0 | 2 | 2 | 27 | 27 | 24 | 0 | 0 | 0 | 3 | 15 | 3 | 2 | 1 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 28 | 28 | 23 | 0 | 0 | 0 | 7 | 10 | 6 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 29 | 29 | 15 | 0 | 0 | 0 | 1 | 11 | 1 | 0 | 2 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 30 | 30 | 12 | 0 | 0 | 0 | 0 | 6 | 4 | 2 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 2 | 0 | 2 | 2 | 31 | 31 | 5 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 12 | 12 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 10 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 23 | 0 | 5 | 17 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 21 | 0 | 1 | 19 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 8 | 0 | 2 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 12 | 0 | 2 | 1 | 6 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 7 | 0 | 0 | 3 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 0 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 7 | 0 | 0 | 1 | 1 | 3 | 1 | 0 | 1 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 16 | 0 | 0 | 1 | 2 | 8 | 3 | 2 | 0 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 8 | 0 | 0 | 0 | 1 | 5 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 12 | 0 | 0 | 1 | 2 | 5 | 1 | 2 | 0 | 0 | 0 | 1 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 6 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 2 | 0 | 0 | 0 |
| 1988 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1988 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 14 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 14 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 19 | 13 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 14 | 3 | 9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 32 | 6 | 20 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 16 | 0 | 11 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 17 | 1 | 5 | 8 | 2 | 0 | 1 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 16 | 0 | 4 | 6 | 1 | 4 | 1 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 20 | 0 | 0 | 11 | 3 | 3 | 3 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 18 | 0 | 0 | 5 | 6 | 6 | 1 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 17 | 0 | 0 | 6 | 2 | 5 | 2 | 1 | 1 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 10 | 0 | 0 | 2 | 4 | 2 | 0 | 2 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 13 | 0 | 0 | 1 | 1 | 7 | 3 | 1 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 4 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 6 | 0 | 0 | 0 | 2 | 3 | 1 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 4 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 8 | 0 | 0 | 0 | 1 | 1 | 6 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1989 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1990 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 12 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1990 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 49 | 6 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1990 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 73 | 2 | 70 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1990 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 43 | 0 | 37 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1990 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 59 | 1 | 37 | 17 | 3 | 1 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 46 | 0 | 20 | 19 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 56 | 1 | 21 | 22 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 42 | 0 | 9 | 14 | 11 | 6 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 41 | 0 | 11 | 16 | 8 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 22 | 0 | 6 | 9 | 1 | 3 | 1 | 1 | 0 | 1 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 29 | 0 | 7 | 13 | 5 | 2 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 29 | 0 | 3 | 7 | 8 | 6 | 2 | 2 | 1 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 23 | 0 | 0 | 5 | 9 | 4 | 4 | 1 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 20 | 0 | 0 | 7 | 2 | 7 | 3 | 1 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 17 | 0 | 0 | 1 | 8 | 5 | 1 | 2 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 24 | 0 | 0 | 0 | 4 | 8 | 8 | 3 | 0 | 1 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 10 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 2 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 11 | 0 | 0 | 0 | 2 | 4 | 4 | 0 | 1 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 5 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 33 | 33 | 5 | 0 | 0 | 0 | 1 | 0 | 3 | 1 | 0 | 0 | 0 | 0 |
| 1990 | 1 | 3 | 0 | 2 | 2 | 35 | 35 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 12 | 12 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 23 | 10 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 12 | 2 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 17 | 0 | 16 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 24 | 0 | 22 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 19 | 0 | 16 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 19 | 0 | 15 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 20 | 0 | 10 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 17 | 0 | 8 | 7 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 22 | 0 | 6 | 11 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 18 | 0 | 1 | 7 | 7 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 26 | 0 | 6 | 13 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 19 | 0 | 3 | 8 | 2 | 2 | 1 | 1 | 2 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 19 | 0 | 0 | 6 | 8 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 23 | 0 | 0 | 11 | 7 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 13 | 0 | 0 | 4 | 3 | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 22 | 0 | 0 | 3 | 8 | 7 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 13 | 0 | 0 | 1 | 1 | 3 | 4 | 3 | 1 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 5 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 1 | 3 | 0 | 2 | 2 | 33 | 33 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 15 | 0 | 13 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 28 | 0 | 25 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 41 | 0 | 22 | 17 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 56 | 0 | 23 | 31 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 25 | 0 | 9 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 21 | 1 | 6 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 13 | 0 | 0 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 9 | 0 | 1 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 11 | 0 | 0 | 4 | 5 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 10 | 0 | 0 | 5 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 10 | 0 | 1 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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| 1992 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 14 | 0 | 0 | 5 | 4 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 10 | 0 | 2 | 3 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 14 | 0 | 0 | 4 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 6 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 7 | 0 | 0 | 2 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 4 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 11 | 11 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 9 | 2 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 16 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 8 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 15 | 2 | 1 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 7 | 0 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 6 | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 4 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 7 | 0 | 0 | 1 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 9 | 0 | 0 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 1 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 8 | 0 | 0 | 0 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 10 | 0 | 0 | 3 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 12 | 0 | 0 | 2 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 14 | 0 | 0 | 1 | 8 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 8 | 0 | 0 | 0 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1993 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1993 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 5 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1993 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1993 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 11 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 33 | 0 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 18 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 9 | 0 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 9 | 0 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 6 | 0 | 0 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 3 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 5 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 9 | 0 | 1 | 2 | 5 | 1 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 9 | 0 | 0 | 2 | 3 | 2 | 2 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 5 | 0 | 0 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 6 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 8 | 0 | 0 | 1 | 2 | 4 | 0 | 1 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 1 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 7 | 0 | 0 | 0 | 1 | 4 | 1 | 1 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1994 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 11 | 2 | 0 | 9 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 17 | 3 | 4 | 8 | 1 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 25 | 0 | 14 | 10 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 16 | 1 | 12 | 3 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 6 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 4 | 2 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 9 | 0 | 2 | 3 | 3 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 6 | 0 | 0 | 4 | 1 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 9 | 0 | 0 | 1 | 2 | 4 | 2 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 6 | 0 | 0 | 1 | 2 | 2 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 9 | 0 | 0 | 1 | 1 | 4 | 2 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 11 | 0 | 0 | 0 | 4 | 1 | 3 | 2 | 1 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 5 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 1 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1995 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 4 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1996 | 1 | 3 | 0 | 2 | 2 | 11 | 11 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1996 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1996 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 13 | 5 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1996 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 21 | 7 | 14 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1996 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 20 | 5 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1996 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 40 | 4 | 26 | 9 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |
| 1996 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 26 | 0 | 17 | 4 | 5 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1996 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 48 | 1 | 24 | 11 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 31 | 0 | 20 | 5 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 19 | 0 | 6 | 7 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 9 | 0 | 3 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 10 | 0 | 2 | 2 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 10 | 0 | 0 | 2 | 5 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 5 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 4 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 8 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 17 | 2 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 14 | 2 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 18 | 3 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 12 | 0 | 6 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 7 | 0 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 6 | 0 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 8 | 0 | 1 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 4 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1997 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 12 | 2 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 23 | 5 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 13 | 3 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 23 | 4 | 11 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 13 | 0 | 8 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 15 | 0 | 7 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 6 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 5 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 10 | 0 | 3 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 3 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 6 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 35 | 3 | 30 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 58 | 0 | 54 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 83 | 0 | 72 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1999 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 80 | 0 | 44 | 26 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 52 | 0 | 24 | 16 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 49 | 0 | 16 | 15 | 14 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 29 | 0 | 4 | 9 | 13 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 35 | 0 | 4 | 13 | 12 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 22 | 0 | 2 | 5 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 34 | 0 | 0 | 9 | 18 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 17 | 0 | 2 | 0 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 14 | 0 | 0 | 2 | 7 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 15 | 0 | 0 | 0 | 7 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 13 | 0 | 0 | 1 | 2 | 8 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 4 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 4 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 11 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 13 | 3 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 23 | 4 | 14 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 15 | 0 | 3 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 31 | 0 | 2 | 15 | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 8 | 0 | 2 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 5 | 0 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 9 | 0 | 1 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 9 | 0 | 0 | 2 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 0 | 2 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 7 | 0 | 0 | 0 | 1 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 5 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 5 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 5 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 7 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 10 | 0 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 19 | 1 | 10 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 9 | 1 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 11 | 1 | 5 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 16 | 0 | 4 | 5 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 8 | 0 | 1 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 8 | 0 | 1 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 5 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 5 | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 5 | 0 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 5 | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 4 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 7 | 1 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 15 | 3 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 24 | 3 | 17 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 34 | 0 | 19 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 46 | 0 | 15 | 19 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 44 | 0 | 10 | 21 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 28 | 0 | 6 | 14 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 37 | 0 | 3 | 22 | 7 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 36 | 0 | 1 | 13 | 13 | 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 35 | 0 | 0 | 13 | 13 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 29 | 0 | 1 | 3 | 9 | 12 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 30 | 0 | 0 | 9 | 11 | 5 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 23 | 0 | 0 | 2 | 8 | 10 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 15 | 0 | 0 | 1 | 6 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 12 | 0 | 0 | 0 | 0 | 9 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 8 | 0 | 0 | 0 | 0 | 6 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 4 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 4 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 1 | 3 | 0 | 2 | 2 | 32 | 32 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 22 | 14 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 54 | 9 | 43 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 61 | 2 | 40 | 16 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 75 | 5 | 28 | 36 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 62 | 4 | 19 | 28 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 54 | 1 | 9 | 28 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 47 | 1 | 12 | 21 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 30 | 0 | 4 | 11 | 8 | 3 | 4 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 38 | 0 | 7 | 15 | 7 | 6 | 3 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 29 | 0 | 4 | 11 | 6 | 5 | 3 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 23 | 0 | 1 | 9 | 5 | 5 | 1 | 1 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 23 | 0 | 0 | 8 | 7 | 3 | 4 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 22 | 0 | 0 | 6 | 7 | 2 | 5 | 2 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 12 | 0 | 0 | 0 | 6 | 4 | 2 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 18 | 0 | 0 | 0 | 3 | 4 | 9 | 1 | 0 | 1 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 7 | 0 | 0 | 0 | 3 | 1 | 1 | 2 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 8 | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2003 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 8 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 11 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 27 | 4 | 14 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 24 | 2 | 8 | 13 | 1 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 36 | 2 | 15 | 14 | 5 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 31 | 0 | 13 | 13 | 4 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 24 | 1 | 7 | 8 | 5 | 2 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 14 | 0 | 3 | 9 | 1 | 1 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 21 | 0 | 2 | 13 | 5 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 22 | 0 | 4 | 5 | 8 | 5 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 27 | 0 | 5 | 6 | 4 | 7 | 4 | 0 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 28 | 0 | 2 | 1 | 9 | 11 | 1 | 3 | 1 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| 2004 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 17 | 0 | 0 | 2 | 9 | 4 | 0 | 2 | 0 | 0 |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2004 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 19 | 0 | 0 | 1 | 3 | 8 | 1 | 5 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 16 | 0 | 0 | 0 | 1 | 9 | 3 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 29 | 29 | 6 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 30 | 30 | 6 | 0 | 0 | 1 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 1 | 3 | 0 | 2 | 2 | 31 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 13 | 13 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 4 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 14 | 0 | 9 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 8 | 0 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 6 | 0 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 3 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 4 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 4 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 1 | 3 | 0 | 2 | 2 | 28 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 14 | 14 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 13 | 1 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 28 | 0 | 7 | 15 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 17 | 0 | 8 | 4 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 14 | 0 | 7 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2006 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 6 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 12 | 0 | 0 | 5 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 16 | 0 | 4 | 8 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 7 | 0 | 0 | 4 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 6 | 0 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 7 | 0 | 0 | 0 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 9 | 0 | 0 | 0 | 3 | 1 | 3 | 1 | 1 | 0 | 0 | 0 |
| 2006 | 1 | 3 | 0 | 2 | 2 | 26 | 26 | 3 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 15 | 15 | 12 | 0 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 16 | 16 | 23 | 0 | 11 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 17 | 17 | 26 | 0 | 3 | 7 | 13 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 18 | 18 | 35 | 0 | 1 | 14 | 14 | 5 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 41 | 0 | 7 | 7 | 13 | 7 | 6 | 1 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 20 | 20 | 22 | 0 | 0 | 3 | 8 | 8 | 3 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 21 | 21 | 15 | 0 | 1 | 2 | 4 | 5 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 22 | 22 | 6 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 23 | 23 | 11 | 0 | 0 | 2 | 2 | 4 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 24 | 24 | 9 | 0 | 0 | 0 | 1 | 5 | 3 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 3 | 0 | 2 | 2 | 25 | 25 | 5 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
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| 2009 | 1 | 3 | 0 | 2 | 2 | 19 | 19 | 16 | 0 | 1 | 3 | 8 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
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| 2010 | 1 | 3 | 0 | 2 | 2 | 27 | 27 | 14 | 0 | 0 | 3 | 6 | 2 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
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        1       0       0

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0 #_N_environ_variables
0 # N sizefreq methods to read
0 # N super periods
0 # no tag data
0 # no morphcomp data
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999
ENDDATA
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# SEDAR

## Southeast Data, Assessment, and Review

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# SEDAR 28
# Gulf of Mexico Spanish Mackerel

## SECTION IV: Research Recommendations
## April 2013

SEDAR
4055 Faber Place Drive, Suite 201
North Charleston, SC 29405

# Section IV: Research Recommendations

## Contents

# Data Workshop Research Recommendations:
Gulf of Mexico Spanish Mackerel

## Life History

None provided.

## Commercial Statistics
The WG determined the following recommendations be added to any pending recommendations issued in SEDAR 17 that have not been addressed:

- Need expanded observer coverage for the fisheries for Spanish mackerel.
    - 5-10% allocated by strata within states
    - get maximum information from fish
- Need research methods that capture Spanish mackerel in large enough numbers to create a reasonable index for young (age 0) Spanish mackerel.
- Expand TIP sampling to better cover all statistical strata.
    - Predominantly from Florida and by gillnet
    - Greater emphasis on collecting unbiased samples
- Establish a mechanism for identifying age samples that were collected by length or market categories, so as to better address any potential bias in age compositions.
- Need better information on migration patterns.
- Need to address issue of fish retained for bait (undersized) or used for food by crew (how to capture in landings).
- Compiling commercial data is surprisingly complex. As this is the 28th SEDAR, one might expect that many of the complications would have been resolved by now through better coordination among NMFS, ACCSP, and the states. Increased attention should be given toward the goal of "one-stop shopping" for commercial data.

## Recreational Statistics

- Increase proportion of fish with biological data within MRFSS sampling.
- Continue to develop methods to collect a higher degree of information on released fish (length, condition, etc.) in the recreational fishery.
- Require mandatory reporting for all charter boats state and federal.
- Continue development of electronic mandatory reporting for for-hire sector.
- Continued research efforts to incorporate/require logbook reporting from recreational anglers.
- Establish a review panel to evaluate methods for reconstructing historical landings (SWAS, FWS, etc.).
- Quantify historical fishing photos for use in reconstructing recreational historical landings.

- Narrow down the sampling universe. Identify angler preference and effort. Require a reef fish stamp for anglers targeting reef fish, pelagic stamp for migratory species, and deepwater complex stamp for deep-water species. The program would be similar to the federal duck stamp required of hunters. This would allow the managers to identify what anglers were fishing for.
- Continue and expand fishery dependent at-sea-observer surveys to collect discard information, which would provide for a more accurate index of abundance.

**Indices**

None provided.

## **Assessment Workshop Research Recommendations:**
Gulf of Mexico Spanish Mackerel

Gulf of Mexico Spanish mackerel has a lengthy history of exploitation dating to the early late 1800s. Directed commercial gillnet fisheries have operated on this resource for well over a hundred years and recreational fisheries more than 65 years. However detailed catch statistics on size and individual weight of removals only exists for the recent time period, since the mid to late 1980's. In addition, management measures including size limits (30.5 cm FL beginning 1983) and quotas (beginning in 1987) have resulted in discards for both fisheries.

Gulf of Mexico Spanish mackerel are not a directed target of the commercial line gear fisheries (COM_RR fleet) therefore extensive samples for length and/or age-length key characterizations are not available. Efforts should be made to obtain samples from this fleet in order to better inform future stock assessment evaluations as relates length composition and discard levels. In particular, a review of the sampling protocols for length and age – length collections is needed to better characterize the catch length and age at length compositions. In addition, attention is needed to evaluate optimal spatial sampling factors in relation to overall removals throughout the year and region.

The magnitude of discards from the recreational fleet is high and very variable over the time series for which estimates exist from the MRFSS/MRIP survey (1981 forward). Hind casting was used to develop estimates of recreational removals and discards prior to 1981 however information on uncertainty in the hind casting was not incorporated into the stock assessment. Future assessments should consider uncertainty around hind casted data.

The indices of abundance are generally flat but variable yielding little information with which to characterize abundance. In addition the additional observations of length and conditional age at length are more recent thus providing only limited history of data with which to estimate the spawner- recruit relationship during the early part of the time period. The quantity and quality of length and age composition information directly impacts the ability to estimate recruitment.

There was difficulties with estimating steepness thus the AW felt that providing benchmarks at several levels and making projections using several levels of steepness was needed.

## Review Workshop Research Recommendations:
Gulf of Mexico Spanish Mackerel

### Reviewer #1:
The Spanish mackerel assessment would benefit from the development of an enhanced biological sampling program. For instance, the development of a research recruitment index would inform the model on the process and possibly preclude the introduction of such strong assumptions.

Increasing sample sizes for the length composition data in both extractions and surveys is recommended if this information is to be used in the assessment. Further, an expanded observer coverage in all Spanish mackerel fisheries would enhance data quality overall. The sensitivity to uncertainties in the catch data do need to be explored in the future. I agree with the Data Workshop recommendation that there is need of research-based data where Spanish mackerel are caught in sufficiently large numbers to provide a reasonable index of young fish (age 0) abundance. There is currently very little signal of recruitment strength to inform the assessment.

### Reviewer #2:
A number of research needs, which are listed below in priority order, were identified in the course of the desk review. As expected, these were highly consistent with, and thus overlap, a number of the research needs that had been identified by the Data and Assessment workshops.

1. Review or establish programs to collect data on the length composition and age-at-length compositions of landings and discards from each commercial gear and from each recreational fishing mode, and of bycatch of Spanish mackerel from the shrimp fishery.

2. Ensure that the statistical design and spatial coverage of survey or sampling programs are appropriate and that survey or sampling intensity is sufficient to produce estimates of the required precision for the Gulf of Mexico stock of Spanish mackerel. Set goals for performance and establish and monitor performance criteria to assess the quality and completeness of data collection programs. This research need is of the highest priority as it will provide information required by Stock Synthesis to determine the selectivity and retention curves for Spanish mackerel for the commercial, recreational, and shrimp fisheries, the lack of which is a key source of uncertainty in the model.

3. Undertake research to determine reliable relationships between the proportion of females that are mature and both length and age for the Gulf of Mexico stock of Spanish mackerel. This is also of high priority, as the maturity information that is currently used is imprecise. The calculation of spawning stock biomass, a crucial parameter in the calculation of benchmarks and assessment of stock status, should be based on reliable data.

4. Review programs that are used to collect discard data for Spanish mackerel (and data on the bycatch of Spanish mackerel by the shrimp fishery), and refine these programs to ensure that accurate and complete data estimates of the discards (and bycatch) are

collected. Ensure that the statistical design and spatial coverage of survey or sampling programs are appropriate and that survey or sampling intensity is sufficient to produce estimates of the required precision. Set goals for performance and establish and monitor performance criteria to assess the quality and completeness of data collection programs. While this research will not produce immediate improvement in the quality of the assessment, it is important that action is taken as soon as possible to improve the accuracy and precision of the data relating to the quantities of fish that are discarded from each of the fisheries, such that, in the future, the time series of discards become more reliable.

5. A comprehensive study of the stock structure of Spanish mackerel should be undertaken, with the following objectives:
   a. To determine stock structure and the areas occupied by each stock; and, assuming that the current view that there are two stocks, *i.e.,* a Gulf of Mexico and a South Atlantic stock, is substantiated,
   b. To determine more reliably the boundary between the Gulf of Mexico and South Atlantic stocks or the extent of overlap;
   c. To extend sampling into Mexican waters and thereby determine the southern boundary of the Gulf of Mexico stock;
   d. To ascertain whether, regardless of the time of year, catches of fish may be assigned reliably to either the Gulf of Mexico or South Atlantic stock on the basis of the area in which they are caught.

   As this study will take some time before completion, it has been assigned a lower priority than the previous items. Determination of the southern stock boundary, however, is important to ensure that other removals from the stock are not occurring in Mexican waters, as such removals are not taken into account in the current assessment.

6. Undertake research to determine the discard mortality of Gulf of Mexico Spanish mackerel that are discarded from the catches of each commercial fishing gear or each recreational fishing mode, recognizing that such mortality is likely to differ among different categories into which the discarded fish are classified, *e.g*., “alive”, “mostly alive”, and “mostly dead”.

7. In future stock assessments for the Gulf of Mexico stock of Spanish mackerel, explore whether the use of an age-dependent rather than constant $M$ results in a significant improvement in fit, considering the Lorenzen and alternative functional forms of the relationship with age and the alternative of estimating the value of the age-dependent $M$ at each age (or range of ages).

8. In future stock assessments, explore the sensitivity of the model to the uncertainty of the landings data.
9. As a low research priority, assess whether, in future refinement of the Stock Synthesis model, sexually dimorphic growth should be introduced. Note that the benefit of this

might only be realized if appropriate sex composition data for landings and discards are available for input, and length and age-at-length compositions are sexually disaggregated.

## Reviewer #3:

In the short-term, a new assessment is needed. There are data that may provide defensible abundance indices if analyzed properly (e.g., commercial logbook, vertical line data; Florida trip-ticket, hand-line/trolling data). It may also be possible to get something useful from the recreational data with appropriate filtering.

A workshop should be held to train people in the analysis and post-stratification of composition data.

My main recommendations are:

- Top priority should be given to the construction of defensible abundance indices for both cobia and Spanish mackerel from the commercial and recreational data. I suggest the following approach:
    - Discussion with some of the participants in the fisheries to get some understanding of how, when, and where, they target cobia and Spanish mackerel.
    - A full descriptive/exploratory analysis of the data to understand the temporal and spatial variation in the catches and all of the available explanatory variables.
    - Identification of regional and seasonal fisheries for which fishing effort is likely to catch the species of interest (cobia or Spanish mackerel). This is likely to involve the identification of vessels in each year which fish at the times and places of interest and catch the species on some of their trips. It does not require that individual vessels be tracked across years (although that would be ideal).
    - An analysis to determine if fishing regulations have impacted on the ability of the data to track abundance (time series may have to be split to account for different fishing behavior caused by regulation changes)
    - Production of standardized CPUE indices for each identified regional/seasonal fishery
    - Comparison of the trends across the different fisheries
    - Decide which if any of the CPUE indices are defensible as relative abundance indices (the length of the time series is not relevant to this decision).
- If defensible abundance indices can be constructed then assessments can be done as before except:
    - Composition data should be appropriately post-stratified and scaled; sample sizes should be based on the number of trips/landings sampled (not the number of fish measured or aged). This will require an analysis of the variability in length frequencies and proportion-at-age for given length across the various strata.
    - Recruitment deviates should only be estimated for cohorts which are well represented in the composition data (e.g., appear at least three times in the age data).
    - Steepness should be fixed or estimated with an informed prior.

# SEDAR

Southeast Data, Assessment, and Review

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## SEDAR 28

## Gulf of Mexico Spanish Mackerel

## SECTION V: Review Report
April 2013

SEDAR
4055 Faber Place Drive, Suite 201
North Charleston, SC 29405

**Table of Contents**

# 1. Review Proceedings

## 1.1 Introduction

### *1.1.1 Method of Review*

The SEDAR 28 Review for Gulf of Mexico Spanish mackerel (*Scomberomorus maculatus*) and Cobia (*Rachycentron canadum*) was conducted as a Center for Independent Experts (CIE) desk review. Three reviewers were provided with all information generated throughout the Data and Assessment Workshops and webinars, and each reviewer then provided an independent analysis of the stock.

### *1.1.2 Terms of Reference*

1. Evaluate the quality and applicability of data used in the assessment.
2. Evaluate the quality and applicability of methods used to assess the stock.
3. Recommend appropriate estimates of stock abundance, biomass, and exploitation.
4. Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.
5. Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.
6. Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.
    - Provide measures of uncertainty for estimated parameters
    - Ensure that the implications of uncertainty in technical conclusions are clearly stated
    - If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternate states of nature, presented for review.
        - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments
        - Provide justification for the weightings used in producing the combinations of models
7. If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.
8. Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.
9. Make any additional recommendations or prioritizations warranted.

- Clearly denote research and monitoring needs that could improve the reliability of future assessments

10. Prepare a Review Summary Report summarizing the Panel's evaluation of the stock assessment and addressing each Term of Reference. Develop a list of tasks to be completed following the workshop. Complete and submit the Review Summary Report no later than the date set by the Review Panel Chair at the conclusion of the workshop.

The review panel may request additional sensitivity analyses, evaluation of alternative assumptions, and correction of errors identified in the assessments provided by the assessment workshop panel; the review panel may not request a new assessment. Additional details regarding the latitude given the review panel to deviate from assessments provided by the assessment workshop panel are provided in the SEDAR Guidelines and the SEDAR Review Panel Overview and Instructions.

*The panel shall ensure that corrected estimates are provided by addenda to the assessment report in the event corrections are made, alternate model configurations are recommended, or additional analyses are prepared as a result of review panel findings regarding the TORs above.*

### *1.1.3 List of Participants*

**Reviewers**

| | | |
|---|---|---|
| Beatriz Roel | Reviewer | CIE |
| Patrick Cordue | Reviewer | CIE |
| Norm Hall | Reviewer | CIE |

### *1.1.4 List of Review Working Papers*

| **Documents Prepared for the Review** | | |
|---|---|---|
| SEDAR28-GRW01 | CIE Desk Review: SEDAR 28: Gulf of Mexico Spanish Mackerel and Cobia | Roel |
| SEDAR28-GRW02 | CIE Desk Review: SEDAR 28: Gulf of Mexico Spanish Mackerel and Cobia | Cordue |
| SEDAR28-GRW03 | CIE Desk Review: SEDAR 28: Gulf of Mexico Spanish Mackerel and Cobia | Hall |

## 2. CIE Reviewer Summary Reports

The following CIE reviewer summary reports are the express findings and opinions of the individual author of each report. Reviewers were not influenced by the findings and/or determinations of other reviewers involved in the SEDAR 28 review process for Spanish mackerel.

# Independent Peer Review Report on the SEDAR 28 Desk Review of the Gulf of Mexico Spanish Mackerel and Cobia Assessments

Dr. Beatriz A. Roel

*Prepared for*

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## Executive Summary

The assessments of Spanish mackerel and cobia in the Gulf of Mexico were reviewed independently for the Center for Independent Experts (CIE) without consultation with other reviewers or those who produced the assessments. The process extended from 9 January to 4 February 2013. The main conclusions are given separately by species.

The Gulf of Mexico Spanish mackerel stock assessment presented to the SEDAR 28 Assessment Workshop provided output and analysis of results from Stock Synthesis (SS), an integrated statistical catch-at-age model. The model was considered appropriate because it can make best use of the data available including a data-poor historical period. However, data limitations (a recruitment index and data that would inform the model on the stock's response to exploitation) have enforced the requirement for strong assumptions to be made on key parameters.

SS was used to estimate the stock status of Spanish mackerel in the Gulf of Mexico in relation to SPR30% reference points for the Base Run and each alternative model examined. The current stock status was estimated in the Base Run as $SSB_{2011}$ / MSST = 2.96, and exploitation status as $F_{2009-2011} / F_{SPR30\%} = 0.5$. Sensitivity tests carried out resulted in estimates of key parameters for management that suggest that the stock is above MSST and exploited below MFMT. The results suggest that the Gulf of Mexico Spanish mackerel stock is not overfished under any of the model scenarios examined and that it is not undergoing overfishing under any of the scenarios examined.

The Spanish mackerel assessment would benefit from the development of an enhanced biological sampling programme. For instance, the development of a research recruitment index would inform the model on the process and possibly preclude the introduction of such strong assumptions.

The Gulf of Mexico cobia assessment was based on results from SS. The assessment used data through 2011 and the time period of the assessment is 1926–2011. Model projections were run from 2013 to 2019. The estimated biomass trajectories showed a sharp decline as the fisheries developed, reaching levels below the minimum stock threshold (MSST) in the late 1980s and early 1990s. Since then the stock appears to have fluctuated above and below the target spawning stock biomass.

Benchmark and reference points for fishing mortality and stock biomass were estimated relative to SPR 30% which were presented for the base case and for each of the sensitivity runs. For cobia, SPR30% reference points are considered valid proxies for MSY. For the base model $F_{current\ (2009–2011)} / F_{SPR30\%}$ was 0.63, whereas the current spawning biomass (2011) relative to MSST was 1.73; on that basis the stock is not considered to be overfished nor undergoing overfishing.

The stock was considered neither overfished nor undergoing overfishing in most of the sensitivity scenarios explored. In the case of low natural mortality, the more pessimistic scenario, both the $F_{SPR30}$ and $F_{OY}$ scenarios led to future stock conditions where the stock was no longer overfished nor undergoing overfishing by 2014. However, fishing under current F predicted a stock undergoing overfishing throughout the projection period.

The lack of information on recruits of age 0 in the data increased the uncertainty of the assessment and the evaluation of the stock relative to reference points. The development of a fishery-independent recruitment index is recommended.

## Background

SEDAR 28 consisted of a compilation of data, an assessment of the stocks, and an assessment review conducted for Gulf of Mexico Spanish mackerel and cobia. The Center for Independent Experts (CIE) review for SEDAR 28 was scheduled from 9–24 January 2013, with the deadline for submission of the Peer Review Report on 4 February 2013. The CIE peer review is ultimately responsible for ensuring that the best possible assessment has been provided through the SEDAR process. The stocks assessed through SEDAR 28 are within the jurisdiction of the Gulf of Mexico Fisheries Management Council and states in the Gulf of Mexico region.

Three CIE reviewers with the requisite qualifications to complete an impartial and independent peer review in accordance with the statement of work (SoW) tasks and terms of reference (ToRs) specified herein participated in the process. They were selected on the basis of their expertise in stock assessment, statistics, fisheries science and marine biology being deemed sufficient to complete the tasks of the peer review described herein. Each CIE reviewer participated and conducted an independent peer review as a desk review, so travel was not required.

## Description of the Individual Reviewer's Role in the Review Activities

I participated in all aspects of the review. In particular, I conducted the necessary pre-review preparations, including reviewing background material and reports provided by the NMFS Project Contact in advance of the peer review. I then conducted an impartial and independent (of anyone else) peer review in accordance with the tasks and ToRs specified herein, focusing on the data analyses, parameter estimation and associated uncertainties and the implications for management advice.

## SPANISH MACKEREL

## Findings by ToR

*1. Evaluate the quality and applicability of data used in the assessment*

A wide range of commercial, recreational and research data was made available for the stock assessment. The data were explored extensively at the Data Workshop (DW).

<u>Life history</u>: The available life history information was reviewed and the main issues were considered carefully. The information does seem to be adequate to conduct a stock assessment. The DW followed the Life History Group recommendation to model the natural mortality rate (M) as a declining Lorenzen function of size consistent with previous SEDAR recommendations.

Discard mortality depends on the conditions of the catching process, including the type of gear utilised. Gillnets had few discards because of its selectivity patterns, but discard mortality does appear to be very high. The shrimp trawl fishery results in very high discard mortality (virtually 100%). There is in fact limited information available on discard mortality for Spanish mackerel, so the values for the gillnet, shrimp trawl and handline fisheries were agreed on the basis of fisher experience and “common sense” and recommended to the Assessment Workshop (AW). Testing the sensitivity to these assumptions would be appropriate here.

The growth models considered seemed to be appropriate, and the decision to combine sexes given practical considerations (the fishery does not distinguish them) is sensible. The scarcity of small fish in the samples did result in growth parameters being rather unrealistic, but the output was adjusted to more biologically reasonable values.

Based on different data sources, it appears that insufficient gonad samples are being collected for histological analyses.

Commercial fishery statistics:  Commercial landings data have been developed by gear for the period 1890–2010 and appear to be adequate to support the assessment, although the landings prior to 1950 are considered to be highly uncertain. Landings were aggregated by gillnet, handline and miscellaneous gears, but for assessment purposes, the category miscellaneous is assigned proportionally into gillnet and handline categories.

Shrimp fishery discards: A median value was assumed over the entire period 1945–2011. Initially, this seemed a somewhat questionable decision given that annual shrimp fishery effort was available and a catchability parameter estimated, allowing annual estimates of Spanish mackerel bycatch to be computed. However, bycatch in the shrimp fishery appeared difficult to determine given the low encounter rate between shrimp trawls and Spanish mackerel, and because of irregular observer coverage. As a consequence, the annual variability in shrimp bycatch appeared to be poorly estimated. The decision to impose a super-period based on an estimated mean bycatch seemed therefore to be appropriate.

Commercial discards: These were computed for the period 1998–2010 based on a gear-specific discard rate and effort data. The method seemed to be appropriate but cannot be applied prior to 1998. Discard estimates are, of course, more uncertain than the landings. A weakness here is that the calculated discards may only represent the minimum number of discards made by the commercial fisheries.

Biological sampling: Sample sizes for developing length compositions were inadequate for a considerable number of years and gear strata. This may jeopardise the use of length compositions to correct for potential biases in age compositions in those years.

Recreational fishery statistics: Landings appear to be adequately recorded or estimated for the period covered. For historical recreational landings, a period is defined as pre-1981, with removals for the years 1955–1981 based on a hindcast. It is difficult to assess the strengths and weaknesses of this data series based on the report of the Data Workshop.

Discards: Sample sizes for Spanish mackerel in the observer data are very small. Some extrapolations were applied and proxies used to calculate the discarded quanta from the different fisheries. There seem to be uncertainties here that need to be reconciled.

Biological sampling: The number of fish sampled is listed, but it is not possible to characterise the sample sizes because the sampling strategy and the targets are not shown. Size data appear to represent the landed catch for the charter and headboat sector adequately. Based on examination of the length composition histograms shown in Fig 4.12.21, sample sizes may have been rather small in recent years.

*2. Evaluate the quality and applicability of methods used to assess the stock.*

The assessment is carried out using Stock Synthesis (SS), a methodology widely used for stock assessment in the United States and elsewhere, including in Europe, where it is used to assess quite a few ICES stocks (ICES, 2012). Interaction with the model developer has contributed to correct implementation of the methodology, and it focused on the handling of discards, which were estimated according to “super periods”; however, the reasons and advantages of using this approach need to be stated more clearly. There is reference to a small CV associated with discards, but it is not clear how that was estimated.

Discard release mortality was incorporated in the model, but the rate seems to be based on rather few data.

A tool to conduct parametric bootstrap analyses was used to characterise uncertainty. This seems to have been a correct decision, because SS provides asymptotic standard errors only, which constitute a minimum estimate.

The model configuration seems to have been appropriate; it includes removals from three directed fisheries:

1. Commercial gillnet (COM-GN)
2. Commercial vertical line gears (Com_RR)
3. Recreational charter, private, headboat and shore anglers (REC)

Of these, the miscellaneous commercial category was apportioned into 1 and 2.

The model fits three indices of abundance (there is some confusion regarding the labelling of the fishery cpue indices on section 3.1.2 of the Assessment Workshop report):

1. Recreational (MRFSS),
2. Commercial line fishery (FWC Vertical line fishery),
3. SEAMAP fishery independent trawl survey.

The indices seem, however, to be very noisy generally, and varying without a trend.

Natural mortality is based on a declining Lorenzen function, and sensitivity to the various assumptions is explored throughout the stock assessment. This is an appropriate procedure because assumptions on the level of M are anticipated to be very influential.

Several parameters were fixed, namely steepness (h) and recruitment variability, but it is not that obvious that the sensitivity to such assumptions was explored sufficiently in the assessment process.

In terms of shrimp fishery discards, a median value was assumed over the entire period 1945–2011. It is not clear why this is done given that annual shrimp fishery effort was available and a catchability parameter estimated, allowing annual estimates of Spanish mackerel bycatch to have been computed.

<u>Model configuration and equations</u>: The shrimp effort index seems to be fitted well by the SS. The index is said to be used to derive annual estimates of F for the shrimp bycatch fleet. This seems to have been done by estimating the catchability Q parameter. However, F is then used to estimate the mackerel bycatch. Figure 3.3c shows the fit (straight line) to the "observed" discards. That procedure is not explained clearly, and specifying the equations would help understanding.

I believe that presentation of the likelihood function would go a long way towards interpreting the model fit to the data.

The fact that the model resulted in an unrealistic estimate for steepness needs further investigation. A plot of the time-series of total landings may provide some insight on the response of the stock to exploitation. Landings between the 1950s and the late 1990s were large, but abundance indices are only available from the 1980s on and do not seem to capture the response of the stock to the decrease in exploitation during recent years. In light of this, fixing steepness to a more realistic value would seem to be appropriate. The value assumed for steepness is the same as that assumed for South Atlantic Spanish mackerel, which would be expected to have similar dynamics.

There are obviously some poor fits to the length composition data, perhaps at least partly related to the model trying to fit the noisy data resulting from small sample sizes. The assessment team chose an assessment model that can make use of all data available, but it is a complex model that requires many assumptions, and the sensitivities to these were not always explored fully. Simpler age-structured production models (Restrepo and Legault 1998; De Oliveira *et al.*, 2007) run from 1981 on would require fewer assumptions, would be less labour-intensive, and may well perform adequately.

*3. Recommend appropriate estimates of stock abundance, biomass, and exploitation.*

A number of datasets were examined by the Data Workshop. Those considered appropriate for use in the assessment model were ranked according to their utility as indices of abundance.

1. SEAMAP Groundfish Survey (1987–2011). Recommended for use because it is a long time-series with good geographic coverage.
2. Florida Trip Ticket index (1986–2011) is recommended because it provides good spatial coverage. All indices are based on positive trips only, which is a limitation, and including zero trips would enhance the index's performance as

an indicator of abundance. The handline/trolling index is good because it covers a long period and samples the entire fishery, both inshore and offshore.

3. Recreational MRFSS Index (1981– 2011). This is a Cpue standardised index based on all trips.

The indices proposed are appropriate as indicators of abundance, representing both the commercial and the recreational fisheries as well as providing fishery-independent information. The recreational Headboat Index, based on all trips and standardised by means of a generalized linear model, was not used in the assessment. The reasons behind this decision are not clearly stated in the report.

A shrimp effort index was used to estimate Spanish mackerel mortality in the shrimp fishery.

4. *Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.*

The methods used to estimate population benchmarks and management parameters are based on MSY criteria and yield per recruit. MSY reference points are also supported by ICES, based on international agreements to achieve MSY for exploited stocks by 2015. MSY reference points are based on assumptions about the stock and recruitment functional form that may not be justified by the data. SPR reference points are well accepted proxies for MSY. For precautionary considerations, short-lived species and pelagic stocks should be kept above 30% virgin SPR (Caddy and Agnew, 2004).

The SS estimates of F_REF and SSB_REF (based on 30% SPR) from 1000 bootstrap samples (Figs 3.48-3.49) show that the probability of the stock being outside precautionary levels is very low. Results for the more pessimistic Run 1 also identify the stock as not overfished and not undergoing overfishing. Tables 3.7 and 3.8 provide the necessary values to assess the state of the stock relative to management benchmarks for all configurations presented for review.

5. *Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.*

Deterministic future population status were projected in terms of SSB and SSB and F relative to 30%SPR reference points for two values of steepness (0.8; 0.9) and three levels of exploitation. The projections are not sensitive to the steepness assumed. The results suggest that the stock is projected to remain within safe biological limits given the selected F, and will remain exploited below optimal levels. Note that the top and the bottom panels in Figure 3.52 are the same and that Figure 3.53 was not discussed in the Assessment Workshop report.

Figure 3.53 illustrates future yields for stochastic projections. Yields appear to be stabilising at levels above estimated MSY (Table 3.9).

6. *Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.*

    - *Verify that appropriate measures were provided*
    - *Verify that the implications of uncertainty in technical conclusions are clearly and acceptably stated*
    - *If there are significant changes to the base model, or to the choice of alternate states of nature, then verify that a probability distribution function for the base model, or a combination of models that represent alternate states of nature were provided.*

Asymptotic standard errors were computed for all the parameters estimated. As these tend to underestimate associated uncertainties, the results from a parametric bootstrap procedure (mean and standard error) are presented for key parameters. Mean and standard deviations resulting from bootstrapping were presented. Showing the median as a measure of central tendency and the CVs for comparison between parameters would probably have been a better choice of statistics.

Model estimates are highly sensitive to the value of steepness, which the model estimates poorly. Comparison of the distributions in Figures 3.34 and 3.35 shows that fixing steepness results in more sensible distributions for virgin biomass, SSB ref and R0.

Sensitivity tests were carried out to explore the impact of uncertainties in model parameters such as natural mortality (M) and steepness, data exclusion, data weighting and discard mortality, on parameters that have implications for management. The results from the analyses did not change the perception of the stock relative to reference points because none of the configurations explored suggested that the stock was outside safe biological limits. Interesting to note here is that the alternative exclusion of the abundance indices made little difference to the estimates of key parameters relative to the base run.

7. *If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.*

The stock assessment results are clearly stated in the Stock Assessment report. Table 3.9 addressed the MSRA evaluations requirements. Mortality rate and biomass criteria were estimated for steepness values of 0.8 and 0.9. Annual yields (2013–2022) are provided for $F_{MFMT}$, $F_{OY}$ and $F_{current}$.

In terms of the requirements for projections, these were all met, although only total yields were provided. Projections were made under three scenarios for fishing mortality: $F_{current}$, $F_{SPR30}$ ($F_{msy}$) and $F_{OY}$. Projections under $F_{rebuild}$ or $F_0$ were not necessary.

8. *Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.*

The SEDAR process results in a rigorous and in-depth review of the data made available and of the assessment. As this is a desk-based review, it lacks any possibility to include interaction with other reviewers of the same material or with the analysts, in my opinion undermining the quality of the review process. Succinctly, questions arising during the review cannot be addressed to those who conducted the analyses, nor was it possible for reviewers of varying skills to complement each others' skills in coming to an overall evaluation of the appropriateness of the methodology or outputs.

9. *Make any additional recommendations or prioritizations warranted.*

- *Clearly denote research and monitoring needs that could improve the reliability of future assessments*

Increasing sample sizes for the length composition data in both extractions and surveys is recommended if this information is to be used in the assessment. Further, an expanded observer coverage in all Spanish mackerel fisheries would enhance data quality overall.

The sensitivity to uncertainties in the catch data do need to be explored in future.

I agree with the Data Workshop recommendation that there is need of research-based data where Spanish mackerel are caught in sufficiently large numbers to provide a reasonable index of young fish (age 0) abundance. There is currently very little signal of recruitment strength to inform the assessment.

*Errata*
Assessment Workshop Report
Figure 3.6 caption 2$^{nd}$ line: mackerel commercial **vertical line** gear fishery.
Figure 3.42 upper panel the y-axis needs to be expanded to include all exploitation rate values.
Figure 3.47 define FWC in the figure caption.
Figure 3.49 MFMP definition repeated.

## Gulf of Mexico Cobia

### Findings by ToR

1. *Evaluate the quality and applicability of data used in the assessment.*

Life history data used in the assessment included natural mortality, growth, maturity and fecundity. There is some uncertainty regarding life history characteristics for this stock because of a general paucity of data, so some common sense decisions were made by the Data Workshop and the Assessment Workshop, such as assuming 50% maturity at age 2 despite recognizing that maturity is better correlated with size. Despite the differential growth of males and females the decision to conduct the stock assessment on the basis of both sexes combined seemed appropriate.

<u>Landings</u>
In terms of commercial landings, the Data Workshop apportioned commercial landings into handline, longline and miscellaneous. For the assessment, commercial landings data (1927– 2011) were aggregated across gears; handline landings represent ~67% of the total commercial landings since 1981. The reason for aggregation is not clearly stated in the workshop reports but presumably is related to inadequate samples sizes for developing length compositions for sufficient year and gear strata, along with inadequate age composition data for all years. Landings data before 1950 are considered to be very uncertain.

Discard estimates have greater uncertainty than the landings and they are likely to be underestimated. The year-specific age structure of cobia could not always be estimated.

The bycatch of cobia in the shrimp fishery was estimated from observer data and SEAMAP trawl data, then scaled using shrimp effort.

Recreational landings data (1950–2011) were aggregated across modes and regions for the assessment. Landings data were collected from 1981 but were hindcast to 1950. Uncertainties in the historical period were estimated, but it is not clear whether those were taken into account in the assessment.

Discard information from recreational fisheries is limited; in other words the discard information reported by anglers cannot be verified, as some surveys simply do not estimate discard levels. Discarded fish size is unknown for all modes covered by MRFSS.

Biological data
Length composition data were collected in both commercial and recreational fisheries with reasonable sample sizes for the recreational fishery. However, given the minimum size limit in operation and the variable growth patterns of cobia, length frequency data did not provide sufficient information on historical recruitment patterns. Age composition data were collected, but there was too little information to be able to track cohorts through time.

Having reviewed the information presented by the Data Workshop and the Assessment Workshop, it was concluded that, despite certain limitations such as those mentioned above, the data provided for assessment were the best available. Every effort had clearly been made to eliminate potential biases and to make the best possible decisions in cases where data were missing. Those decisions and assumptions are fully documented in the report of the Data Workshop.

*2. Evaluate the quality and applicability of methods used to assess the stock.*

The stock was assessed by means of Stock Synthesis (SS), Methot 2011. Model configurations of increasing complexity were explored, showing that trends in estimated stock biomass remained similar as model complexity increased. The selected model seems to have been appropriate because it allows the assessors to make best use of the information that was available.

The assessment used data through 2011 and the time period of the assessment is 1926–2011. Model projections were run from 2013 to 2019. The assessment was set up to include three fishing fleets and two indices of abundance. The stock was assumed to be at equilibrium at the start of the modelled period in 1926. Removals of cobia were not substantial until after World War II for any of the fisheries.

A single Beverton & Holt stock–recruitment function was estimated in SS, although the reason for selecting this function was not stated. The model was configured to estimate steepness and equilibrium recruitment; however, steepness is very poorly estimated. Variability in recruitment was constrained by fixing sigma R to 0.6. The reality is that there were few data to inform the Beverton & Holt function parameters, and there is concern that the assumptions on steepness may be driving model results. However, the perception of the stock relative to reference points did not change for the range of steepness explored in the sensitivity tests, rendering the assumption at least credible. Estimated parameter standard deviations were generally small and the convergence test results suggested that the model converged with high probability.

Patterns in the residuals from the fit to length frequency data suggest that the model underestimated the numbers of small and large fish in the early period of the commercial data. This is probably related to small sample sizes in which fish at the extremes of the distribution would have been generally under-represented, resulting in selectivity curves that would have driven model predictions for the entire period. Given the paucity of length data, the assumption of time-invariant selection for all fisheries was appropriate. The model seemed to have underestimated small, undersize fish in the recreational fishery, which was hardly surprising.

*3. Recommend appropriate estimates of stock abundance, biomass, and exploitation.*

Estimates of SSB, total biomass and fishing mortality were provided by SS. The model predicted the trends in the two indices of catch per unit effort (CPUE) reasonably well, but the uncertainty associated with point estimates appeared to be large. The SSB trajectories show a sharp decline as the fisheries developed, reaching levels below MSST in the late 1980s and early 1990s. Model-predicted SSB is shown with associated 80% asymptotic intervals rather than 90% or 95% confidence intervals, which might be slightly deceiving. Fishing mortality was estimated to have decreased in the early 1990s, and varying with a slightly declining trend thereafter. Whereas F in the recreational fishery has fluctuated quite widely since the late 1990s, fishing mortality in both the commercial fishery and the shrimp fishery declined during the same period. Results from bootstrap analysis show greater uncertainties around the estimated trajectory of F than reflected by 80% asymptotic intervals.

*4. Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.*

The state of the stock is primarily evaluated relative to 30% spawner-per-recruit population benchmarks. Those seem more appropriate in the case of Gulf of Mexico cobia than MSY reference points, which may be driven by assumptions about the stock–recruit relationship.

Stock status and benchmarks relative to SPR 30% were presented for the base case and each of the sensitivity runs. For the base model $F_{current\ (2009–2011)}$ / $F_{SPR30\%}$ was 0.63, whereas the current spawning biomass (2011) relative to MSST was 1.73; on that basis the stock is not considered to be overfished nor undergoing overfishing. Based on results from the bootstrap analysis for the base case, the $F_{current}$ /$F_{SPR30\%}$ ratio was estimated to be <1, with a high probability, and current SSB /MSST was estimated to be >1, also with a high probability.

The stock was considered neither overfished nor undergoing overfishing in most of the sensitivity scenarios explored. The exceptions were the low M scenario where the stock was considered both overfished and undergoing overfishing, and Run 7; for the latter, only the MRFSS index fitted, which suggested that the stock was overfished.

*5. Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.*

Model projections carried out with SS were run from 2013 to 2019. The stock was projected under constant fishing mortalities: $F_{current}$ , $F_{30\%SPR}$ and $F_{OY}$. Recruitment was projected by the fitted stock and recruit function. All scenarios explored show an increase in SSB and yields over the projection period as a result of predicting recruitment at a higher level than the recent average. A more pessimistic scenario of future recruitment, e.g., randomly selecting from the estimated recruitment between 2000 and 2009 (omitting 2010 and2011 as highly uncertain), would have been informative.

Fishing at $F_{current}$ , $F_{30\%SPR}$ and $F_{OY}$, the stock is predicted to be within safe biological limits for the base case. For the most pessimistic scenario, low M, the stock is predicted to undergo overfishing under $F_{current}$ but not under $F_{30\%SPR}$ or $F_{OY}$.

For the base model, under the assumptions made in the projections, fishing the stock at $F_{30\%SPR}$ (F = 0.378) seems to lead to a long-term equilibrium yield below the estimated MSY. Yield per recruit $F_{max}$ is estimated as well above $F_{msy}$.

*6. Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.*

- *Verify that appropriate measures were provided*
- *Verify that the implications of uncertainty in technical conclusions are clearly and acceptably stated*
- *If there are significant changes to the base model, or to the choice of alternate states of nature, then verify that a probability distribution function for the base model, or a combination of models that represent alternate states of nature were provided.*

Asymptotic standard errors were computed for all the parameters estimated. As these tend to underestimate associated uncertainties, the results from a parametric bootstrap procedure (mean and standard error) were presented for key parameters. In general, estimates of uncertainty were similar between the two methods. The distributions of F and SSB relative to benchmark parameters from bootstrap samples were shown for the base model, suggesting that there is a high probability that the stock is neither overfished nor undergoing overfishing.

A number of alternative model configurations and states of nature were investigated in sensitivity tests. Iteratively re-weighting the different components did not reveal any conflicting information among alternative data sources. However, this sensitivity run favoured the Headboat index, leading to a conclusion of a slightly more productive stock and experiencing lower fishing mortalities.

The model was only fit assuming a Beverton & Holt stock–recruit relationship but fitting it to an alternative such as a smooth hockey stick would have been informative as a sensitivity test. As a general point, exploring alternative assessment models that do not require strong assumptions on the stock and recruitment functional form would provide clues on the sensitivity of the assessment results to structural assumptions.

Results from the retrospective analysis suggest a stable assessment and show no indication of substantial bias in the assessment. The analysis for age 0 recruits illustrates the uncertainty associated with recruit estimates for the final few years in a given assessment. This is to be expected given the lack of information on recruitment strength for year classes that have not passed through the fishery.

*7. If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.*

Stock assessment results are accurately presented in the Stock Assessment Report and are consistent with the Panel recommendations.

*8. Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.*

This review was conducted as a desk review which, in the opinion of this reviewer, might have been undermined by the lack of direct interactions with other members of the Panel and the analysts. The data analyses and stock assessment presented for review were of high standard and state of the art. Terms of Reference were addressed appropriately during the assessment process.

*9. Make any additional recommendations or prioritizations warranted.*

- *Clearly denote research and monitoring needs that could improve the reliability of future assessments.*

I support the Research Recommendations presented by the Data Workshop. In particular and given the lack of information on cobia recruitment, the development of a recruitment (age 0) index for this important stock is recommended.

A tagging study to identify spawning areas and aggregations would be valuable if additional conservation measures were to be required.

The development of a fishery-independent index of abundance is recommended.

## References

Caddy, J. F. and Agnew, D. J. 2004. An overview of recent global experience with recovery plans for depleted marine resources and suggested guidelines for recovery planning. *Reviews in Fish Biology and Fisheries* **14**: 43–112.

De Oliveira, J. A. A., Boyer, H. J, and Kirchner, C. H. 2007. Developing age-structured production models as a basis for management procedure evaluations for Namibian sardine. *Fisheries Research* **85**: 148–158.

ICES. 2012. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim. ICES Document CM 2012/ACOM: 11.

Restrepo, V. R. and C. M. Legault 1998. A Stochastic Implementation of an Age-Structured Production Model. Alaska Sea Grant College Program • AK-SG-98-01. *Fishery Stock Assessment Models* pp 435 – 450.

## Appendix 1: **Bibliography of materials provided for review**


SEDAR 28 Gulf of Mexico Cobia Data Workshop Report, May 2012

SEDAR 28 Gulf of Mexico Spanish mackerel Data Workshop Report, May 2012

SEDAR 28 Gulf of Mexico Cobia, Assessment Workshop Report, Dec 2012

SEDAR 28 Gulf of Mexico Spanish Mackerel, Assessment Workshop Report, Dec 2012


### Working Papers


SEDAR28-AW01 Florida Trip Tickets

SEDAR28-AW02 Spanish mackerel bycatch estimates from US Atlantic coast shrimp trawls

Appendix 2: **Statement of Work**

# Statement of Work

## External Independent Peer Review by the Center for Independent Experts

SEDAR 28: Gulf of Mexico Cobia and Spanish Mackerel Assessment Desk Review

**Scope of Work and CIE Process:** The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Representative (COR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

**Project Description** SEDAR 28 will be a compilation of data, an assessment of the stocks, and an assessment review conducted for Gulf of Mexico Spanish mackerel and cobia. The CIE peer review is ultimately responsible for ensuring that the best possible assessment has been provided through the SEDAR process. The stocks assessed through SEDAR 28 are within the jurisdiction of the Gulf of Mexico Fisheries Management Councils and states in the Gulf of Mexico region. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

**Requirements for CIE Reviewers:** Three CIE reviewers shall have the necessary qualifications to complete an impartial and independent peer review in accordance with the statement of work (SoW) tasks and terms of reference (ToRs) specified herein. The CIE reviewers shall have expertise in stock assessment, statistics, fisheries science, and marine biology sufficient to complete the tasks of the peer-review described herein. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete all work tasks of the peer review described herein.

**Location of Peer Review:** Each CIE reviewer shall participate and conduct an independent peer review as a desk review, therefore travel will not be required.

**Statement of Tasks:** Each CIE reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer contact information to the COR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the assessment and other pertinent background documents for the peer review. Any changes to the SoW or ToRs must be made through the COR prior to the commencement of the peer review.

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Desk Review: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. Modifications to the SoW and ToRs shall not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COR and CIE Lead Coordinator. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

**Specific Tasks for CIE Reviewers:** The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Conduct an impartial and independent peer review in accordance with the tasks and ToRs specified herein, and each ToRs must be addressed (**Annex 2**).
3) No later than January 25, 2013, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to

shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to Dr. David Sampson david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in **Annex 1**, and address each ToR in **Annex 2**.

**Schedule of Milestones and Deliverables:** CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

| | |
|---|---|
| 21 December 2012 | CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact |
| 2 January 2013 | NMFS Project Contact sends the CIE Reviewers the assessment report and background documents |
| 9-24 January 2013 | Each reviewer conducts an independent peer review as a desk review |
| 25 January 2013 | CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator |
| 8 February 2013 | CIE submits CIE independent peer review reports to the COR |
| 15 February 2013 | The COR distributes the final CIE reports to the NMFS Project Contact and regional Center Director |

**Modifications to the Statement of Work:** This 'Time and Materials' task order may require an update or modification due to possible changes to the terms of reference or schedule of milestones resulting from the fishery management decision process of the NOAA Leadership, Fishery Management Council, and Council's SSC advisory committee. A request to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent changes. The Contracting Officer will notify the COR within 10 working days after receipt of all required information of the decision on changes. The COR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

**Acceptance of Deliverables:** Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COR (William Michaels, via William.Michaels@noaa.gov).

**Applicable Performance Standards:** The contract is successfully completed when the COR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) The CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) The CIE report shall address each ToR as specified in **Annex 2**,
(3) The CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

**Distribution of Approved Deliverables:** Upon acceptance by the COR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COR. The COR will distribute the CIE reports to the NMFS Project Contact and Center Director.

**Support Personnel:**

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**Key Personnel:**

NMFS Project Contact:

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**Annex 1: Format and Contents of CIE Independent Peer Review Report**

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

   The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work

## Annex 2a – Terms of Reference for

### SEDAR 28: Gulf of Mexico Cobia Assessment Desk Review

1. Evaluate the quality and applicability of data used in the assessment.
2. Evaluate the quality and applicability of methods used to assess the stock.
3. Recommend appropriate estimates of stock abundance, biomass, and exploitation.
4. Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.
5. Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.
6. Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.
    - Provide measures of uncertainty for estimated parameters
    - Ensure that the implications of uncertainty in technical conclusions are clearly stated
    - If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternative states of nature, presented for review.
        - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments
        - Provide justification for the weightings used in producing the combinations of models
7. If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.
8. Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.
9. Make any additional recommendations or prioritizations warranted.
    - Clearly denote research and monitoring needs that could improve the reliability of future assessments

# SEDAR 28:

# Gulf of Mexico

# Cobia and Spanish Mackerel

# Stock Assessment Review

**P.L. Cordue**

**Fisheries Consultant**

**New Zealand**

***For* CIE Independent System for Peer Review**

**19 February 2013**

## Executive summary

A desktop review of Gulf of Mexico cobia and Spanish mackerel stock assessments was conducted by three independent CIE reviewers, in January 2013, as part of SEDAR 28. This document presents my findings and recommendations, with regard to the assessments, based on a detailed review of the assessments as described in the Data and Assessment Workshop reports and supporting documents.

The cobia and Spanish mackerel stocks in the Gulf of Mexico were both assessed using the Stock Synthesis package SS3. This is a well-tested package which enables fully-integrated age-structured stock assessments using landings, discards, length, and age data from multiple fisheries.

Both assessments used very similar data sources: landings and discard data from recreational fisheries (the bulk of the landings) and some commercial fisheries; discard estimates from the shrimp fishery (substantial in some years); length and age data as available for each fishery; and standardized CPUE indices.

A simple and typical model structure was used in both assessments. Population in age-structured equilibrium before the start of the fisheries. Year-round fisheries with constant selectivity patterns (with some time-blocking). Constant age-specific natural mortality over time. A single von Bertalanffy growth curve estimated in the model and a Beverton Holt stock-recruitment relationship. Year class strengths (recruitment deviations) estimated for about 20 cohorts.

The assessments have common problems: the CPUE time series used in the assessment runs are not defensible as relative abundance indices; and the length and age data were not appropriately post-stratified or scaled. Primarily because of the lack of defensible abundance indices it would be unsafe to use the assessments to provide management advice.

My main conclusions are:

- Stock structure and fixed life history parameters were adequately considered.
- Landings history, discards, and discard mortalities were adequately determined and considered.
- Composition data were poorly treated at both the Data and Assessment Workshops. There was an absence of appropriate analysis and discussion with regard to post-stratification of the data to deal with inadequate sample sizes within some strata.
- The Index Working Group made very poor recommendations with regard to the time series to use in the stock assessments as relative abundance indices:
    - For cobia, two recreational CPUE time series were recommended but these both had very low proportions of successful trips and spanned a period when fishing regulations had become more restrictive.
    - For Spanish mackerel: a SEAMAP survey was recommended as a recruitment time series, but it caught very few Spanish mackerel each year; a recreational time series was recommended but it had a very low proportion of successful trips; and a commercial index based on catch-per-trip was recommended but it had not been standardized for trip duration or time fished.
- None of the abundance indices used in the stock assessment runs are defensible.

- The model structure used, the choice of runs, and the methods of projection and describing of uncertainty were adequate but could not overcome the flawed data inputs.
- None of the model runs should be used to determine biomass estimates or recommend stock status.

My main recommendations are:

- Top priority should be given to the construction of defensible abundance indices for both cobia and Spanish mackerel from the commercial and recreational data:
    - Talk to some of the participants in the fisheries to get an understanding of how, when, and where, they target cobia and Spanish mackerel (if at all).
    - Perform a full descriptive/exploratory analysis of the data to understand the temporal and spatial variation in the catches and the potential explanatory variables.
    - Identify regional and seasonal fisheries for which fishing effort is "likely" to catch cobia or Spanish mackerel.
    - Perform an analysis to determine if fishing regulations have impacted on the ability of the data to track abundance (time series may have to be split to account for different fishing behaviour caused by regulation changes)
    - Produce standardized CPUE indices for each identified regional/seasonal fishery and consider which if any can defensibly be used as abundance indices.

- If defensible abundance indices can be constructed then assessments can be done as before except:
    - Composition data should be appropriately post-stratified and scaled; sample sizes should be based on the number of trips/landings sampled (not the number of fish measured or aged).
    - Recruitment deviates should only be estimated for cohorts which are well-represented in the composition data (e.g., appear at least three times in the age data).

## Background

The South-East, Data, Assessment, Review (SEDAR) process was initiated in 2002 to improve the reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and US Caribbean. This review is part of SEDAR 28 and covers the Gulf of Mexico Spanish mackerel and cobia stock assessments.

I am one of three CIE reviewers who performed a desktop review during January 2013. The three reviews are meant to be independent and I have had no contact or discussion with the other two reviewers. This report presents my findings and recommendations in accordance with the Terms of Reference (ToRs) for the review (Appendix 2, annex 2).

## Review Activities

The main documents provided for the review were made available in a timely manner through an ftp site. Also, a link was provided to the SEDAR website which contained many workshop, background, and reference documents (Appendix 1).

I noted, that in the original ToRs, it was assumed that a normal review was being conducted and that the reviewers would jointly write a Summary Report. I contacted CIE and they supplied me with amended ToRs which were specific to a desktop review (Appendix 2, annex 2).

The main documents for the review were the Data Workshop and Assessment Workshop reports (Appendix 1). I read these four reports in detail, a number of times, over the period of the review and consulted specific workshop or reference documents as needed. I also searched the Web to obtain information on current and past federal and state recreational fishing regulations for cobia (in particular).

## Summary of findings

Cobia and Spanish mackerel were both assessed using the Stock Synthesis package SS3. This is a well-tested package that allows data from a range of sources to be fitted to obtain estimates of population parameters and management quantities. Estimates of uncertainty were obtained by performing sensitivity runs and bootstrapping the main runs.

The two assessments use very similar methods and data sources (estimated catch histories for commercial and recreational fisheries, abundance indices, and length and age data). For this reason they share a number of strengths and weaknesses.

Before considering the specific ToRs for each assessment I will discuss some problems which are common to both assessments.

***Obtaining abundance indices from recreational CPUE data***

For both assessments standardized CPUE indices were calculated for the headboat survey and for the MRFSS data (although the headboat time series was not used in the mackerel assessment). In each case a delta-lognormal model was used (binomial for success/failure and lognormal for positive catches). This approach was applied to the whole of each dataset with limited or no filtering of records to remove irrelevant effort. As a consequence, the proportions of successful trips (those that caught the species of interest) were very low (mackerel: MRFSS 5%, headboat <5%; cobia: MRFSS <1%, headboat 7%).

These success rates are so low that one would think that it was very unlikely that the CPUE indices could be tracking abundance. The Index Working Groups (IWG) had attempted to filter the data to obtain relevant effort using Stephens and MacCall (2004) and a number of ad hoc approaches. However, they were unable to find a satisfactory subset of the data to use and defaulted to the full data set. (The failure of Stephens and MacCall (2004) is interesting and bears further investigation at a later date – why did the method fail so completely?)

I have no faith in any of these CPUE time series as indices of *relative abundance* because the very low success rates show that most of the effort is irrelevant to cobia and Spanish mackerel. This means that the basic assumption of catch being proportional to effort is violated. The standardization of the indices does not help. To get a defensible abundance index from these data requires that relevant effort is identified – e.g., so that a doubling of effort (in a given "stratum") will result in a doubling of catch – or a doubling of biomass for a given amount of effort will double the catch.

In order to subset these data and identify relevant effort it is necessary to obtain an understanding of the different recreational fisheries that are operating on cobia and Spanish mackerel. This will not be an easy process. It will probably require that additional information on the operation of the fisheries be obtained by interviewing the participants (e.g. headboat skippers). Cobia and Spanish mackerel are probably targeted by recreational fishers in some places at some times during the year (e.g., cobia during a known migration wave). It may be possible to identify vessels which fish in certain areas at certain times and to use their data (positive catches and success/failure in the given areas and times) to obtain defensible abundance indices. Alternatively, it may be that additional information needs to be routinely collected from recreational fishers before any reliable abundance indices can be produced from the recreational fisheries for these species.

Using the positive catches is a possibility, which was explored by the IWG. The concern is that such indices will be hyperstable. However, with sufficient descriptive analysis it may be possible to justify the use of just the positive trips (e.g., showing that there is no shrinkage in the area and the season from which successful trips occur over time).

***Changes in recreational fishing regulations***

Changes in fishing regulations have to be considered when recreational CPUE data are being analysed for abundance indices.

For cobia, the Data Workshop report contains no information on changes in regulations or the variation in regulations between state and federal waters. This is a serious omission because the federal daily bag limit of 2 per person did not come into effect until August 1990 and in Florida state waters the limit was reduced to 1 per person (with no more than 6 per vessel) on 22 March 2001. The only abundance indices used in the cobia assessment are the headboat and MRFSS time series which both span the period of regulation changes (headboat: 1986-2010; MRFSS: 1981-2010). The implementation of a minimum legal size for cobia in 1984 is mentioned in the Data Workshop report and the potential change in selectivity is modelled in the assessment. In the Assessment Workshop report the imposition of the federal bag limit in 1990 is noted, but only in the discussion of the fit to discard rates. The Florida state regulation is not mentioned in the Assessment Workshop report.

For Spanish mackerel there were numerous changes in bag limits over the period covered by the MRFSS CPUE indices. The fact that there were changes is noted in the reports but no analysis or discussion of the potential effect on catch rates is given. The changes were generally increases in the daily bag limit, so it may be that they are not particularly important in terms of affecting catch rates. However, there should have been an analysis of the data to see if there were effects such as a limiting of catch before the bag limits were increased.

***Modelling of year interactions as random effects***
The standard approach taken by the Index Working Group when standardizing the commercial and recreational CPUE data was to fit two-way interactions involving year as a random effect. The software will let this be done, but it is inappropriate because year interactions are probably not random (in the sense of random effects, where the values can be considered as random samples from a particular distribution). For example, consider a year-area interaction. If there are very different trends in different areas then this is a sign that there are groups of fish associated with each area which have different abundance trajectories – not a random effect at all (the changes in abundance are correlated within each area and perhaps across areas). Also, it is a sign of a fundamental problem with the CPUE analysis. A valid abundance index can only be obtained in this case if the number of records in each area is a good approximation to the relative abundance across areas (so that the different trends are appropriately weighted). Fitting the year-area interactions as a random effect does not change the mean effects (Venables and Dichmont, 2004) and merely hides the potential problem. This is not to say that mixed models should not be used – there are factors which can be appropriately modelled as random effects (e.g., individual vessel effects).

***Scaling of length and age (composition) data***
It is important to try to make of the most of whatever composition data are available. These are the data that provide information on growth, selectivity, and year class strength. If they are not properly stratified and scaled then legitimate signals in the data will be obscured.

There should be little debate about how length and age data are scaled. If there was an appropriate sampling design, then this includes the stratification and how to scale the data. For length samples, normally, there is a two-stage scaling procedure: sample scaled to catch or landing; and then the combined samples within a stratum are scaled to the stratum catch (and then combined across strata without any further weighting). For age data, sampled at random, the same scaling procedure applies. For age data, collected to construct an age-length key, the length frequency is first constructed (by appropriate scaling) and then the age-length key(s) is applied to produce the age frequency.

The recommendation of the Data Working Group, for both cobia and mackerel, to scale the age data “using the length frequency” is very worrying. I first heard of this method when reviewing SEDAR 17 and on investigation I found that it was invalid. Simple examples were enough to show that the method did not achieve its stated intent (Cordue 2008). That the same method is still being recommended is very disappointing. They cite a paper which apparently uses the method when estimating growth curves (Chih 2009). It may have some utility in the situation the author considered but the method should not be used to produce age frequencies.

When composition data are sampled in an ad hoc basis (or there are inadequate sample sizes in the original stratification) it is important to post-stratify in such a way that the full (spatial and temporal) extent of the fishery is covered with adequate sample sizes in each stratum (for the years, or groups of years, in which there are adequate data). It is also important to exclude data in years when the coverage is inadequate – it should not just be "thrown in" in the hope that the model can account for non-representative samples (because it cannot).

***Using age data as conditional age-at-length***

This appears to have become the norm for assessments using SS3. It has advantages and disadvantages. It stops the worry about the double-use of age and length data, where the age data came from a subset of the fish that were measured. Also, it allows non-randomly collected age samples to be used in the assessment in a natural fashion and facilitates the estimation of growth parameters. However, it does not preclude the necessity for a careful analysis of the age data in terms of where samples came from, when they were collected, and how they were collected.

One problem is the timing of the sampling. It is important to consider how fast the fish grow and at what size they are recruited to each fishery. If fish are growing rapidly during the year in which they were sampled then there is the problem that the age proportions at given length change during the year (e.g., sample for age at 20 cms: on 1 February the proportions at age are 70% 1 year old and 30% 2 year old; but on 1 November the expected proportions are 100% 1 year old).

Another issue is that age-proportions at given length can also vary spatially. For example, a recreational fishery in one area may be catching spawning fish, while in another area the same "fishery" (in the model at least) is capturing non-spawning fish. The age-proportions at length will be very different between the two areas. A similar effect could occur because of spatial variation in growth. Yet another issue is the variation in growth between cohorts. At a given time of year, the age-proportions at a given length could be dramatically different for fast and slow growing cohorts. If there is only patchy conditional age-at-length data in the model then fast growing cohorts could be estimated as strong cohorts and slow-growing cohorts as weak cohorts.

Because of all of these issues it is by no means certain that it is best to incorporate age data into SS3 as conditional age-at-length and to estimate growth in the model. Certainly, it is always important to analyse the age data with regard to these potential issues and to make sure that the data are appropriately stratified and scaled.

None of the issues relating to the problems of using conditional age-at-length data appear to have been considered in the cobia and Spanish mackerel assessments. The paucity of data is not an excuse for ignoring these issues – it does, in some ways, make it more important that they are considered.

***Data weighting***

There are various methods for obtaining relative weights (CVs and effective sample sizes) for the different data sets fitted in a stock assessment model. In both assessments, fairly arbitrary weights are used in the base models and iterative re-weighting methods (Francis 2011, SS3 re-weighting) are only considered in sensitivity runs. This is the wrong way round. The base runs should be using a formal weighting scheme and alternative schemes investigated in sensitivity runs. As it happens, it appears that the results are not particularly sensitive to the relative weights.

***Effective sample sizes for composition data***

This is partly covered under the data weighting heading (the method of Francis will give much lower sample sizes for composition data than SS3 re-weighting). However, in the cobia and mackerel assessments, the effective sample sizes that are used are based on the number of fish measured or aged (with a cap for sample size on length frequencies). This is not good practice. Best practice is to bootstrap the data to determine an effective sample size for each year based on how many fish were sampled in each trip and hence the within and between trip variability (and to use these sample sizes as initial values in iterative reweighting). Alternatively, if a rule-of-thumb is used, then the initial sample sizes should be based on the number of trips sampled rather than the total number of fish measured/aged. For example, if 100 fish were measured from 1 trip, the effective sample size should be closer to 1 than to 100 (e.g., Pennington et al. 2002). For age data the scaling down shouldn't be as extreme as for length data. For example, 100 fish aged from 10 trips could be worth 3-5 fish per trip, but almost certainly not 10 per trip.

That covers the joint problems.

Each of the ToRs are specifically considered below.

## Cobia

1. *Evaluate the quality and applicability of data used in the assessment.*

**Life history**
The Life History Working Group covered the definition of stock boundaries and the estimation of fixed biological parameters. They considered appropriate data and made sensible recommendations with the exception of recommending 60% females at birth. They based this on the skewed sex ratios observed in the fisheries. However, the sex ratio in the population is hopelessly confounded with the fishing selectivities. It will make little difference, but the fishery dependent data considered do not give a reasonable basis to move from a 50-50 sex ratio at birth.

**Catch history**
The catch history was estimated for the commercial fishery starting in 1926 for three gear types (hand-line, long-line, and other). Recreational landings (which are much larger than the commercial landings) were calculated by mode and region (to some extent). Modes included charter-boat, headboat, private/rental boat, and shore based. Landings for Texas were calculated separately from the Gulf. Discard data for commercial and recreational fisheries were also compiled. The bycatch from the shrimp fishery, which was very substantial in some years, was also estimated (SEDAR28-DW6).

It is usually a difficult and tedious job to reconstruct full catch histories for stock assessment purposes and I think that a good job was done in this case. However, it would have been useful to provide the assessment team with an envelope of potential landings and discards so that they could have easily performed sensitivity runs with “low” and “high” levels of landings and discards.

**Composition data**
Available length and age data from the recreational and commercial fisheries were compiled by the Data Workshop (DW).

There was very little commercial length data and almost no commercial age data. The DW report says that the length data were “weighted by the landings in numbers by strata (state, year, gear)”. This is not appropriate as many of the strata contained no samples. In order to get sensible length frequencies for the assessment there needed to have been an attempt to identify period of years which could be combined to provide adequate samples across a sensible post-stratification (e.g., combining some states). To determine an appropriate post-stratification requires an analysis of the variability of length frequencies across the various strata (e.g., it may be that some gear types could be combined). With so few samples the best that can probably be done is to construct a combined-year length frequency for each fishery.

The recreational sample sizes are also very low with many strata having zero or close to zero fish measured. Again it raises the issue of having to conduct a detailed analysis of the length data to determine how strata should be combined before scaling and production of annual or combined-year length frequencies. This is not discussed in the DW report at all so I must assume that no such analysis was done and that strata with low sample sizes (including zero) were just mechanically scaled.

**Abundance indices**

The Index Working Group (IWG) considered five potential abundance time series and recommended two of them for use in the assessment.

The SEAMAP data were not recommended because of the very low occurrence of cobia in the catch. A time series was developed from a delta-lognormal model. There is no mention in the DW report or the document they cite for details (SEDAR28-DW03) of why the indices were not constructed in the normal way for a trawl survey. Certainly, the original design was a random stratified trawl survey – so it makes no sense to use a delta-lognormal model which only measures density when abundance/biomass could have been measured. However, given the index was not used, my point is academic.

The Texas Parks and Wildlife Survey (TPWS) was analyzed using a delta-lognormal model where the data were restricted to an area that had relatively high cobia catches (SEDAR28-DW10). However, even for this area the proportion of positive trips was only 3.1% and the IWG did not recommend its use. The very low success rate does mean it is very unlikely to be tracking abundance.

A commercial vertical line index was constructed using the usual delta-lognormal model and no descriptive analysis at all (SEDAR28-DW16). The IWG did not recommend the time series because of the restrictive trip limit of two fish per person per day. The proportion of successful trips was also very low (2-4% each year). Certainly the derived indices could not be recommended. However, this dataset deserves more analysis. There may be a subset of trips which could provide some useful qualitative information on abundance from the proportion of positive trips.

The headboat and MRFSS datasets were analyzed to produce recreational CPUE indices (SEDAR28-DW28). Different filtering methods were considered and implemented but none were successful in identifying a subset of relevant cobia effort. Indices were calculated from just positive trips and also, using the delta-lognormal model, from all trips. Eventually the decision was made to base the index on all trips: “The working group also noted that there was little difference in the indices that were estimated for the entire dataset and the indices estimated for the subset of only positive trips. Therefore, it was reluctantly decided at the data workshop, that fishing effort for cobia and Spanish mackerel would be based on all trips”.

I assume that the IWG felt that they had to recommend at least one time series for use as a relative abundance index in the stock assessment. However, the low level of successful trips for the headboat (7%) and MRFSS (<1%) datasets should have led to the same conclusion as for the TPWS. Additionally, there is the issue of the change in regulations in the period spanned by the time series and the different regulations in Florida state waters. These data may be able to provide useful abundance indices. However, an analysis based on an understanding of the various fisheries which occur over the region, will be needed to deliver defensible indices.

The two time series recommended by the IWG are not defensible in my opinion.

2. *Evaluate the quality and applicability of methods used to assess the stock.*

The stock assessment modeling was adequate but the assessment overall cannot recover from the poor data inputs. In the Data Workshop, there was inadequate attention to detail in regard to the composition data, and the recommended CPUE indices were not defensible as relative abundance indices.

**Stock Synthesis 3**
The Data Working Group recommended that the assessment be updated using ASPIC because of the paucity of composition data. This was a poor recommendation because the important fisheries for the stock have very different size/age based selectivities. It is not clear how the bycatch in the shrimp fishery could have been modeled satisfactorily in ASPIC or how a minimum legal size would have been implemented.

Perhaps an assessment could have been done in ASPIC, but then an equivalent assessment could also be done in SS3 – which can be run as an “age-based production model”. The advantage of using SS3 is that there are numerous options for exploring the effect of fitting the available composition data and estimating or not estimating selectivity patterns and year class strengths.

**Model structure**
A simple and typical model structure was used. Population in age-structured equilibrium before the start of the fisheries. Year-round fisheries with constant selectivity patterns (with some time-blocking). Constant age-specific natural mortality over time. A single von Bertalanffy growth curve estimated in the model and a Beverton Holt stock-recruitment relationship. Year class strengths (recruitment deviations) were estimated from 1982-2010 (which is probably far too many given the paucity of composition data).

The shrimp fishery was modeled as a bycatch fishery with the catch driven by an effort time series and fitted to the median estimate of cobia bycatch from 1972-2011 using the “super-year” feature of SS3. Modeling the shrimp fishery in this way is a good approach.

Only a single commercial and a single recreational fishery were modeled despite the Data Working group providing landings histories for a number of fisheries. I assume the lumping of these data was because of the paucity of composition data but no explanation was provided in the Assessment Report. I have not considered whether it was justified or not – it would depend on whether the fisheries had similar selectivity patterns and whether their landings histories varied in a similar way over time.

**Treatment of the data**
The catch/landings histories were combined into single commercial and recreational fisheries which may or may not have been justified. The raw composition data, assembled by the Data Working group, seems to have been used in the assessment without any stratification or scaling (e.g., see Table 2.11 in the Assessment report – the number of fish measured is given in each year and then the number of fish in each 3cm bin is given; it looks like raw un-scaled data).

To get the most out of the limited composition data requires that it is very carefully post-stratified and scaled. The data are just there to help with estimation of growth, selectivities, and year class strength so it is unlikely to be fatal if they are not properly prepared; rather there is just a loss of information. Of course, if they are over-weighted relative to the abundance indices, then properly prepared or not they can severely distort an assessment.

The likelihood profile on virgin recruitment in the Assessment report (Figure 3.32) suggests that the age and length data are dominating the abundance indices in terms of a biomass signal (although it is a bit hard to tell – a “zoom in” would have been useful). The sample sizes, based on the number of fish measured or aged are too large. However, the abundance time series appear to be consistent with the biomass signal from the composition data so re-weighting of the data is unlikely to change the result.

**Model runs**
The base model used all of the available data and estimated steepness as well as numerous recruitment deviations. Given the paucity of composition data (and the fact it was not prepared properly) it is unlikely that there is good information on year class strength. The model will have no trouble coming up with estimates and will even provide good precision for those estimates because of the relatively high effective sample sizes assumed – but, in reality, the model is over-parameterized (and year class strengths are not well estimated).

Estimating steepness in these models is almost always the wrong thing to do. To get a good estimate requires excellent information on year class strengths over a wide range of relative spawning biomass. A glance at the available data tells us that steepness should not be estimated in this model.

A good range of sensitivity runs were performed, including low and high natural mortality and using one or other of the abundance time series. The only runs missing were those exploring the effects of different catch histories and discard rates. Certainly, the early catch history is very uncertain as are the discards from the shrimp fishery.

3. *Recommend appropriate estimates of stock abundance, biomass, and exploitation.*

I cannot recommend any of the model runs for this assessment. The abundance indices are not defensible. The composition data were not properly prepared (and are over-weighted). The model was over-parameterized.

4. *Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.*

The methods used to estimate the SPR-based benchmarks are standard and done within SS3 which has been thoroughly tested. However, I cannot recommend any of the model runs and therefore do not provide any declarations of stock status.

5. *Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.*

   The base run and the low and high natural mortality runs were projected forward under three levels of fishing mortality ($F_{CURRENT}$, $FSPR_{30}$, and $F_{OY}$) using 1000 bootstrap replicates. The method is appropriate but I cannot recommend any of the runs.

6. *Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.*

   Uncertainty in the assessment was characterized by sensitivity runs and a parametric bootstrap on the base run. A good range of sensitivities were performed. The use of the bootstrap would not be my preferred choice but it is an acceptable approach. Calculation of Bayesian posteriors is generally preferable (even with uninformed priors). Also, uncertainty is badly under-estimated because of all the structural assumptions in the model (which is always the case) and the relatively large sample sizes used for the composition data (which does not have to be the case).

   - *Provide measures of uncertainty for estimated parameters*

     Confidence intervals from the bootstrap are provided in the Assessment report.

   - *Ensure that the implications of uncertainty in technical conclusions are clearly stated*

     The Assessment Report does not conclude that the assessment is highly uncertain and should be treated with extreme caution. This is my conclusion, mainly because of the lack of defensible abundance indices, but also because of the poor treatment of the composition data and the over-parameterization in the model.

   - *If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternative states of nature, presented for review.*
     - *Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments*
     - *Provide justification for the weightings used in producing the combinations of models*

     Not applicable for this desktop review.

7. *If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.*

   Not applicable for this desktop review.

8. *Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.*

   In general, the SEDAR process is a useful process for developing good quality stock assessments. However, the Data and Assessment Workshops in this case have not delivered good assessments.

   Problems with the cobia assessment should have been identified at the Data Workshop – someone should have had the courage to say "we don't have a defensible abundance index" and they should have been listened to. The changes in fishing regulations and the variation between state and federal rules should have been noted by somebody.

   The ToRs of the Data Workshop were each addressed. Of course, some were done better than others as I have already noted. The preparation of the composition data was very poor. The recommendation to scale the age data using the length frequencies was unfortunate.

   ToR 5 for the Data Workshop requires them to recommend the assessment method. I don't think this is the role of a data workshop. They should get all the data together, in a form that provides options for the stock assessment (e.g., finer scale than that which might eventually be used in the stock assessment) but they shouldn't be telling the scientists who have to do the stock assessment modeling how to do it. Of course, ideally the person who has to do the modeling should be closely involved in all aspects of the Data Workshop.

   The ToRs of the Assessment Workshop were each addressed. They used SS3 instead of ASPIC, which was a good choice. They didn't adequately document their reasons for some choices, such as using only a single commercial fishery and a single recreational fishery. They also appear to have used completely un-stratified and un-scaled composition data – certainly there is no explanation of how the data were scaled.

   The review process normally involves a meeting where questions can be asked and answered and additional analyses used to explore issues. A desktop review, where the reviewers are not able to ask questions or discuss issues with the assessment scientists and each other, is not as good. Desktop reviewers only comment on the issues that they notice. In a meeting, issues that are noticed by each reviewer (and other meeting participants) come to the attention of all reviewers.

9. *Make any additional recommendations or prioritizations warranted.*
   - *Clearly denote research and monitoring needs that could improve the reliability of future assessments*

   In the short-term, a new assessment is needed. There are no defensible abundance indices and it will hard to produce any quickly. Therefore, an assessment which looks at worst case scenarios should be considered. If the stock is in reasonable shape even at biomass levels that would only just allow the estimated catch to have been taken, then there is no rush to produce a full assessment.

   Of course, a reliable assessment generally requires a defensible abundance time series. The development of such a series should be the top priority. Pursuit of such an index should also provide some answers on what other data need to be collected to provide defensible indices for cobia.

A workshop should be held to train people in the analysis and post-stratification of composition data.

## Spanish Mackerel

10. *Evaluate the quality and applicability of data used in the assessment.*

**Life history**

The Life History Working Group covered the definition of stock boundaries and the estimation of fixed biological parameters. They considered appropriate data and made sensible recommendations with the exception of a strange recommendation on sex ratio: "Over all ages and gears, weighted percent females 66%". This was derived from their analysis of sex ratio data from fisheries. The Assessment Workshop took this as a recommendation for 50-50 at birth in 1886 (apparently): "Sex ratio at the start time of the population analysis (1886) was assumed to be 1:1 as recommended by the SEDAR 28 DW". It is strangely worded as 50-50 at birth in 1886 means 50-50 every year at birth.

**Catch history**

The catch history was estimated for the commercial fishery starting in 1880 for three gear types (gill nets, hand-line, and other). Recreational landings (which are much larger than the commercial landings) were calculated by mode and region (to some extent): MRFSS/MRIP estimates of landings from charter, private angler; Texas Parks and Wildlife (charter, private and headboat); and the for-hire headboat fishery. Discard data for commercial and recreational fisheries were also compiled. The bycatch from the shrimp fishery, which was very substantial in some years, was also estimated (SEDAR28-DW6).

It is usually a difficult and tedious job to reconstruct full catch histories for stock assessment purposes and I think that a good job was done in this case (no doubt building on the work done in previous assessments). However, it would have been useful to provide the assessment team with an envelope of potential landings and discards so that they could have easily performed sensitivity runs with "low" and "high" levels of landings and discards.

**Composition data**

Available length and age data from the recreational and commercial fisheries were compiled by the Data Workshop.

There were few commercial length and age data. The DW report says that the length data "were weighted by the trip landings in numbers and the landings in numbers by strata (state, year, gear).". This is not appropriate when many of the strata contained no samples. In order to get sensible length frequencies for the assessment there needed to have been an attempt to identify period of years which could be combined to provide adequate samples across a sensible post-stratification (e.g., combining some states). To determine an appropriate post-stratification requires an analysis of the variability of length frequencies across the various strata.

The recreational sample sizes are much higher but there are still a number of strata having zero or close to zero fish measured. Again it raises the issue of having to conduct a detailed analysis of the length data to determine how strata should be combined before scaling and production of annual or combined-year length frequencies. This is not discussed in the DW report at all so I must assume that no such analysis was done and that strata with low sample sizes (including zero) were just mechanically scaled. This is not a big issue for the MRFSS data, but for the headboat survey the sampling is very patchy and the data need to be carefully post-stratified.

**Abundance indices**

The Index Working Group (IWG) considered nine potential abundance time series and recommended three of them for use in the assessment.

The SEAMAP data were analyzed to produce an abundance time series for 0-1 year old Spanish mackerel (SEDAR28-DW03). The IWG recommended the time series for use because " it is a fisheries independent survey across a long time series (1987-2010), with very good spatial converge (TX/Mexico border to Mobile Bay)". Their statement is true but does not provide sufficient justification to include this time series in a stock assessment. In total, the two surveys each year caught between 32 and 487 fish. Typically, about 50-200 fish are caught each year. The proportion of positive stations was about 4% in summer and 8% in fall (SEDAR28-DW03). Basically, the survey doesn't catch much Spanish mackerel and the variability in the index is probably unrelated to the abundance of Spanish mackerel.

The three recreational surveys (Texas sport-boat angler survey, headboat, and MRFSS) all have very few successful trips. The IWG rejected the Texas and headboat surveys on this basis but recommended the use of the MRFSS time series although they didn't give any reasons other than: "This index was particularly favored because it presents a long time series." With less than 5% positive trips it is not reasonable to accept the unfiltered delta-lognormal time series as an abundance index.

Of the commercial data sets considered the IWG preferred the Florida State ticket data to the commercial logbook data for vertical lines and gillnets. I agree that the "run-around" gillnet method is likely to produce hyper-stable indices. Also, if Florida covers most of the fishery and has a longer time series then it is probably to be preferred to the shorter time series from the vertical line index (though, perhaps not in this case – see below).

The Florida trip-ticket data were used to construct cast net, hand-line/trolling, and gillnet indices split into time periods when trip limits were (assumed to be) not too restrictive. The IWG identified various problems with the "interpretation of data from trips using gill nets (e.g., deployment methods, mesh sizes, configuration of panels, and changes in state/federal waters restrictions) and cast nets (e.g., configuration, depth, bottom types)". I agree with their recommendation not to use these time series in stock assessment.

The IWG did recommend the Florida trip-ticket hand-line/trolling index (which shows an increasing trend over time) for use in stock assessment. This is a standardized index of catch-per-trip for trips that caught some Spanish mackerel (SEDAR28-AW01). The standardization approach is unusual as 8 of 11 explanatory variables are dummy variables which indicate whether a species-group was caught on the trip or not (this is slightly problematic as these are random variables and, strictly speaking, should not be used as explanatory variables). The remaining variables are year, month, and Florida sub-region. The documentation for this analysis does not mention using any measure of trip duration or "actual time fished" (which is a field on the Trip Ticket). They also do not make use of "number of crew" another field on the trip ticket (available since 2000). The response variable is given as "catch per trip" and not as "catch per trip per hour". Perhaps this is just a documentation error? It is very hard to tell because there is no descriptive analysis to give a context to the standardization analysis. There is some discussion of outliers in the response variable: "those with landings greater than 1,223 pounds were excluded". This tends to support "catch per trip", but also it seems odd to exclude data on this basis – again the length of trip and the size of the vessel/number of crew, are important because longer trips and bigger vessels may catch more fish.

If "actual time fished" was not used in the standardization, and/or it is not properly reported on the form, then it is wrong to use this time series in stock assessment. The increasing trend could simply be the result of longer trips over time. It could also be the result of a change in the fleet with vessels that used to make short trips and/or not catch many fish, dropping out of the fishery over time. In a proper standardization these effects would be accounted for. It is also important when doing a standardization to first fully understand the data by doing a descriptive/exploratory analysis – it is very bad practice, as appears to have been done here, to simply "throw the data into the machine and turn the handle". Not using "actual time fished" in the analysis is very hard to understand.

Unfortunately, I have found fatal faults with each of the three abundance times series used in the Spanish mackerel stock assessment.

11. *Evaluate the quality and applicability of methods used to assess the stock.*

The stock assessment modeling was adequate but the assessment overall cannot recover from the poor data inputs. In the Data Workshop, there was inadequate attention to detail in regard to the composition data, and the recommended CPUE indices were not defensible as relative abundance indices.

**Stock Synthesis 3**
The use of this package was appropriate given the available data.

**Model structure**
A simple and typical model structure was used. Population in age-structured equilibrium before the start of the fisheries. Year-round fisheries with constant selectivity patterns (with some time-blocking). Constant age-specific natural mortality over time. A single von Bertalanffy growth curve estimated in the model and a Beverton Holt stock-recruitment relationship. Year class strengths (recruitment deviations) were estimated from 1985-2010.

The shrimp fishery was modeled as a bycatch fishery with the catch driven by an effort time series and fitted to the median estimate of Spanish mackerel bycatch from 1972-2011 using the "super-year" feature of SS3. Modeling the shrimp fishery in this way is a good approach.

Two commercial fisheries were modeled but only a single recreational fishery was used despite the Data Working group providing landings histories for a number of fisheries. No explanation for this was provided in the Assessment Report. I have not considered whether it was justified or not – it would depend on whether the fisheries had similar selectivity patterns and whether their landings histories varied in a similar way over time.

**Treatment of the data**
The catch/landings histories were combined into two commercial fisheries and a single recreational fishery which may or may not have been justified. The raw length data, assembled by the Data Working group, seems to have been used in the assessment without

state in the stratification: “Length data were stratified by calendar year, fishery/survey (commercial gillnet fleet (COM_GN), commercial line gears (COM_RR), and recreational all fisheries combined (headboat, private angler, charter, shore = REC)”. There should have been scaling from sample to trip and stratification needed to include state (unless there was an analysis showing that length frequencies were similar across states).

To get the most out of the limited composition data requires that it is very carefully post-stratified and scaled. The data are just there to help with estimation of growth, selectivities, and year class strength so it is unlikely to be fatal if they are not properly prepared; rather there is just a loss of information. Of course, if they are over-weighted relative to the abundance indices, then properly prepared or not they can severely distort an assessment.

The likelihood profile on virgin recruitment in the Assessment report (Figure 3.32) suggests that the age and length data are dominating the abundance indices in terms of a biomass signal (though it is a bit hard to tell – a “zoom in” would have been useful). The sample sizes, based on the number of fish measured or aged are too large. However, the abundance time series appear to be consistent with the biomass signal from the composition data so re-weighting of the data is unlikely to change the result.

**Model runs**

The base model (Run 3) used all of the available data and sensibly fixed steepness (0.8). Estimating steepness in these models is almost always the wrong thing to do. To get a good estimate requires excellent information on year class strengths over a wide range of relative spawning biomass.

A good range of sensitivity runs were performed, including low and high natural mortality and alternative values of steepness. The only runs missing were those exploring the effects of different catch histories and discard rates. Certainly, the early catch history is very uncertain as are the discards from the shrimp fishery.

12. *Recommend appropriate estimates of stock abundance, biomass, and exploitation.*

I cannot recommend any of the model runs for this assessment. The abundance indices are not defensible. The composition data were not properly prepared (and are over-weighted).

13. *Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.*

The methods used to estimate the SPR-based benchmarks are standard and done within SS3 which has been thoroughly tested. However, I cannot recommend any of the model runs and therefore do not provide any declarations of stock status.

14. *Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.*

The base run and a sensitivity run on steepness were projected forward deterministically under three levels of fishing mortality (FCURRENT, FSPR30, and $F_{OY}$). Stochastic projections using 1000 bootstrap replicates were also done for the base model. The method is adequate but I cannot recommend any of the runs.

15. *Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.*

Uncertainty in the assessment was characterized by sensitivity runs and a parametric bootstrap on the base run. A good range of sensitivities were performed. The use of the bootstrap would not be my preferred choice but it is an acceptable approach. Calculation of Bayesian posteriors is generally preferable (even with uninformed priors). Also, uncertainty is badly under-estimated because of all the structural assumptions in the model (which is always the case) and the relatively large assumed sample sizes for the composition data (which does not have to be the case).

- *Provide measures of uncertainty for estimated parameters*

  Confidence intervals from the bootstrap are provided in the Assessment report.

- *Ensure that the implications of uncertainty in technical conclusions are clearly stated*

  The Assessment Report does not conclude that the assessment is highly uncertain and should be treated with extreme caution. This is my conclusion, mainly because of the lack of defensible abundance indices, but also because of the poor treatment of the composition data.

- *If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternative states of nature, presented for review.*
  - *Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments*
  - *Provide justification for the weightings used in producing the combinations of models*

  Not applicable for this desktop review.

16. *If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.*

Not applicable for this desktop review.

17. *Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.*

In general, the SEDAR process is a useful process for developing good quality stock assessments.

The ToRs of the Data Workshop were each addressed. Of course, some were done better than others as I have already noted. The preparation of the composition data was poor. The recommendation to scale the age data using the length frequencies was very poor.

ToR 5 for the Data Workshop requires them to recommend the assessment method. I don't think this is the role of a data workshop. They should get all the data together, in a form that provides options for the stock assessment (e.g., finer scale than that which might eventually be used in the stock assessment) but they shouldn't be telling the scientists who have to do the stock assessment modeling how to do it. Of course, ideally the person who has to do the modeling should be closely involved in all aspects of the Data Workshop.

The ToRs of the Assessment Workshop were each addressed. They didn't adequately document their reasons for some choices, such as using only a single recreational fishery. The stratification of the length data was very poor (state should have been included or a full justification given for ignoring it).

The review process normally involves a meeting where questions can be asked and answered and additional analyses used to explore issues. A desktop review, where the reviewers are not able to ask questions or discuss issues with the assessment scientists and each other, is not as good. Desktop reviewers only comment on the issues that they notice. In a meeting, issues that are noticed by each reviewer (and other meeting participants) come to the attention of all reviewers.

18. *Make any additional recommendations or prioritizations warranted.*
    - *Clearly denote research and monitoring needs that could improve the reliability of future assessments*

In the short-term, a new assessment is needed. There are data that may provide defensible abundance indices if analyzed properly (e.g., commercial logbook, vertical line data; Florida trip-ticket, hand-line/trolling data). It may also be possible to get something useful from the recreational data with appropriate filtering.

A workshop should be held to train people in the analysis and post-stratification of composition data.

## Conclusions and Recommendations

The reviewed cobia and Spanish mackerel assessments are not suitable to be used to provide management advice because of the flawed data inputs used in the models.

My main conclusions are:

- Stock structure and fixed life history parameters were adequately considered.
- Landings history, discards, and discard mortalities were adequately determined and considered.
- Composition data were poorly treated at both the Data and Assessment Workshops. There was an absence of appropriate analysis and discussion with regard to post-stratification of the data to deal with inadequate sample sizes within some strata.
- The Index Working Group made very poor recommendations with regard to time series to use in the stock assessments as relative abundance indices:
    - For cobia, two recreational CPUE time series were recommended but these both had very low proportions of successful trips and spanned a period when fishing regulations had become more restrictive.
    - For Spanish mackerel: a SEAMAP survey was recommended as a recruitment time series, but it caught very few Spanish mackerel each year; a recreational time series was recommended but it had a very low proportion of successful trips; and a commercial index based on catch-per-trip was recommended but it had not been standardized for trip duration or time fished.
- None of the abundance indices used in the stock assessment runs were defensible.
- The model structure used, the choice of runs, and the methods of projection and capturing of uncertainty were adequate but could not overcome the flawed data inputs.
- None of the model runs should be used to determine biomass estimates or recommend stock status.

My main recommendations are:

- Top priority should be given to the construction of defensible abundance indices for both cobia and Spanish mackerel from the commercial and recreational data. I suggest the following approach:
    - Discussion with some of the participants in the fisheries to get some understanding of how, when, and where, they target cobia and Spanish mackerel.
    - A full descriptive/exploratory analysis of the data to understand the temporal and spatial variation in the catches and all of the available explanatory variables.
    - Identification of regional and seasonal fisheries for which fishing effort is likely to catch the species of interest (cobia or Spanish mackerel). This is likely to involve the identification of vessels in each year which fish at the times and places of interest and catch the species on some of their trips. It does not require that individual vessels be tracked across years (although that would be ideal).
    - An analysis to determine if fishing regulations have impacted on the ability of the data to track abundance (time series may have to be split to account for different fishing behaviour caused by regulation changes)
    - Production of standardized CPUE indices for each identified regional/seasonal fishery
    - Comparison of the trends across the different fisheries

- Decide which if any of the CPUE indices are defensible as relative abundance indices (the length of the time series is not relevant to this decision).

- If defensible abundance indices can be constructed then assessments can be done as before except:
    - Composition data should be appropriately post-stratified and scaled; sample sizes should be based on the number of trips/landings sampled (not the number of fish measured or aged). This will require an analysis of the variability in length frequencies and proportion-at-age for given length across the various strata.
    - Recruitment deviates should only be estimated for cohorts which are well-represented in the composition data (e.g., appear at least three times in the age data).
    - Steepness should be fixed or estimated with an informed prior.

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## Appendix 1: Bibliography of supplied material

The following data and assessment workshop reports were supplied for the desktop review.

SEDAR 28: Gulf of Mexico cobia, SECTION II: Data Workshop Report, May 2012. 239 p.
SEDAR 28: Gulf of Mexico Spanish mackerel, SECTION II: Data Workshop Report, May 2012. 268 p.
SEDAR 28: Gulf of Mexico cobia, SECTION III: Assessment Process Report, December 2012. 208 p.
SEDAR 28: Gulf of Mexico Spanish mackerel, SECTION III: Assessment Workshop Report, December 2012. 274 p.

The numerous workshop, background, and reference documents listed below were made available through the SEDAR website and were consulted as needed.

| Document | Title | Authors |
|---|---|---|
| SEDAR28-DW01 | Cobia preliminary data analyses – US Atlantic and GOM genetic population structure | Darden 2012 |
| SEDAR28-DW02 | South Carolina experimental stocking of cobia *Rachycentron canadum* | Denson 2012 |
| SEDAR28-DW03 | Spanish Mackerel and Cobia Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of Mexico | Pollack and Ingram, 2012 |
| SEDAR28-DW04 | Calculated discards of Spanish mackerel and cobia from commercial fishing vessels in the Gulf of Mexico and US South Atlantic | K. McCarthy |
| SEDAR28-DW05 | Evaluation of cobia movement and distribution using tagging data from the Gulf of Mexico and South Atlantic coast of the United States | M. Perkinson and M. Denson 2012 |
| SEDAR28-DW06 | Methods for Estimating Shrimp Bycatch of Gulf of Mexico Spanish Mackerel and Cobia | B. Linton 2012 |
| SEDAR28-DW07 | Size Frequency Distribution of Spanish Mackerel from Dockside | N.Cummings, J. Isely |

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| | Sampling of Recreational and Commercial Landings in the Gulf of Mexico 1981-2011 | |
| SEDAR28-DW08 | Size Frequency Distribution of Cobia from Dockside Sampling of Recreational and Commercial Landings in the Gulf of Mexico 1986-2011 | J. Isely and N. Cummings |
| SEDAR28-DW09 | Texas Parks and Wildlife Catch Per unit of Effort Abundance Information for Spanish mackerel | N. Cummings, J. Isely |
| SEDAR28-DW10 | Texas Parks and Wildlife Catch Per unit of Effort Abundance Information for cobia | J. Isely, N. Cummings |
| SEDAR28-DW11 | Size Frequency Distribution of Cobia and Spanish Mackerel from the Galveston, Texas, Reef Fish Observer Program 2006-2011 | J Isely and N Cummings |
| SEDAR28-DW12 | Estimated conversion factors for calibrating MRFSS charterboat landings and effort estimates for the South Atlantic and Gulf of Mexico in 1981-1985 with For Hire Survey estimates with application to Spanish mackerel and cobia landings | V. Matter, N Cummings, J Isely, K Brennen, and K Fitzpatrick |
| SEDAR28-DW13 | Constituent based tagging of cobia in the Atlantic and Gulf of Mexico waters | E. Orbesen |

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|---|---|---|
| SEDAR28-DW14 | Recreational Survey Data for Spanish Mackerel and Cobia in the Atlantic and the Gulf of Mexico from the MRFSS and TPWD Surveys | V. Matter |
| SEDAR28-DW15 | Commercial Vertical Line and Gillnet Vessel Standardized Catch Rates of Spanish Mackerel in the US Gulf of Mexico, 1998-2010 | N. Baertlein, K. McCarthy |
| SEDAR28-DW16 | Commercial Vertical Line Vessel Standardized Catch Rates of Cobia in the US Gulf of Mexico, 1993-2010 | K. McCarthy |
| SEDAR28-DW17 | Standardized Catch Rates of Spanish Mackerel from Commercial Handline, Trolling and Gillnet Fishing Vessels in the US South Atlantic, 1998-2010 | K. McCarthy |
| SEDAR28-DW18 | Standardized catch rates of cobia from commercial handline and trolling fishing vessels in the US South Atlantic, 1993-2010 | K. McCarthy |
| SEDAR28-DW19 | MRFSS Index for Atlantic Spanish mackerel and cobia | Drew et al. |
| SEDAR28-DW20 | Preliminary standardized catch rates of Southeast US Atlantic cobia (*Rachycentron canadum*) from headboat data. | NMFS Beaufort |
| SEDAR28-DW21 | Spanish mackerel preliminary data summary: SEAMAP-SA Coastal Survey | Boylan and Webster |
| SEDAR28-DW22 | Recreational indices for cobia and Spanish mackerel in the Gulf of Mexico | Bryan and Saul |
| SEDAR28-DW23 | A review of Gulf of Mexico and Atlantic Spanish mackerel (*Scomberomorus* | Palmer, DeVries, and Fioramonti |

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|---|---|---|
| | *maculatus*) age data, 1987-2011, from the Panama City Laboratory, Southeast Fisheries Science Center, NOAA Fisheries Service | |
| SEDAR28-DW24 | SCDNR Charterboat Logbook Program Data, 1993 - 2010 | Errigo, Hiltz, and Byrd |
| SEDAR28-DW25 | South Carolina Department of Natural Resources State Finfish Survey (SFS) | Hiltz and Byrd |
| SEDAR28-DW26 | Cobia bycatch on the VIMS elasmobranch longline survey:1989-2011 | Parsons et al. |
| SEDAR28-RW01 | The Beaufort Assessment Model (BAM) with application to cobia: mathematical description, implementation details, and computer code | Craig |
| SEDAR28-RW02 | Development and diagnostics of the Beaufort assessment model applied to Cobia | Craig |
| SEDAR28-RW03 | The Beaufort Assessment Model (BAM) with application to Spanish mackerel: mathematical description, implementation details, and computer code | Andrews |
| SEDAR28-RW04 | Development and diagnostics of the Beaufort assessment model applied to Spanish mackerel | Andrews |
| SEDAR28-RD01 | List of documents and working papers for SEDAR 17 (South Atlantic Spanish mackerel) – all documents available on the SEDAR website | SEDAR 17 |
| SEDAR28-RD02 | 2003 Report of the mackerel Stock Assessment Panel | GMFMC and SAFMC, 2003 |
| SEDAR28-RD03 | Assessment of cobia, Rachycentron canadum, in the waters of the U.S. Gulf of Mexico | Williams, 2001 |

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|---|---|---|
| SEDAR28-RD04 | Biological-statistical census of the species entering fisheries in the Cape Canaveral area | Anderson and Gehringer, 1965 |
| SEDAR28-RD05 | A survey of offshore fishing in Florida | Moe 1963 |
| SEDAR28-RD06 | Age, growth, maturity, and spawning of Spanish mackerel, Scomberomorus maculates (Mitchill), from the Atlantic Coast of the southeastern United States | Schmidt et al. 1993 |
| SEDAR28-RD07 | Omnibus amendment to the Interstate Fishery Management Plans for Spanish mackerel, spot, and spotted seatrout | ASMFC 2011 |
| SEDAR28-RD08 | Life history of Cobia, Rachycentron canadum (Osteichthyes: Rachycentridae), in North Carolina waters | Smith 1995 |
| SEDAR28-RD09 | Population genetics of cobia Rachycentron canadum: Management implications along the Southeastern US coast | Darden et al, 2012 |
| SEDAR28-RD10 | Inshore spawning of cobia (Rachycentron canadum) in South Carolina | Lefebvre and Denson, 2012 |
| SEDAR28-RD11 | A review of age, growth, and reproduction of cobia Rachycentron canadum, from US water of the Gulf of Mexico and Atlantic ocean | Franks and Brown-Peterson, 2002 |
| SEDAR28-RD12 | An assessment of cobia in Southeast US waters | Thompson 1995 |
| SEDAR28-RD13 | Reproductive biology of cobia, Rachycentron canadum, from coastal waters of the southern United States | Brown-Peterson et al. 2001 |
| SEDAR28-RD14 | Larval development, distribution, and ecology of cobia Rachycentron canadum (Family: Rachycentridae) in the northern Gulf of Mexico | Ditty and Shaw 1992 |

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| SEDAR28-RD15 | Age and growth of cobia, Rachycentron canadum, from the northeastern Gulf of Mexico | Franks et al 1999 |
| SEDAR28-RD16 | Age and growth of Spanish mackerel, Scomberomorus maculates, in the Chesapeake Bay region | Gaichas, 1997 |
| SEDAR28-RD17 | Status of the South Carolina fisheries for cobia | Hammond, 2001 |
| SEDAR28-RD18 | Age, growth and fecundity of the cobia, Rachycentron canadum, from Chesapeake Bay and adjacent Mid-Atlantic waters | Richards 1967 |
| SEDAR28-RD19 | Cobia (Rachycentron canadum) tagging within Cheasapeake Bay and updating of growth equations | Richards 1977 |
| SEDAR28-RD20 | Synopsis of biological data on the cobia Rachycentron canadum (Pisces: Rachycentridae) | Shaffer and Nakamura 1989 |
| SEDAR28-RD21 | South Carolina marine game fish tagging program 1978-2009 | Wiggers, 2010 |
| SEDAR28-RD22 | Cobia (Rachycentron canadum), amberjack (Seriola dumerili), and dolphin (Coryphaena hipurus) migration and life history study off the southwest coast of Florida | MARFIN 1992 |
| SEDAR28-RD23 | Sport fish tag and release in Mississippi coastal water and the adjacent Gulf of Mexico | Hendon and Franks 2010 |
| SEDAR28-RD24 | VMRC Cobia otolith preparation protocol | VMRC |
| SEDAR28-RD25 | VMRC Cobia otolith ageing protocol | VMRC |
| SEDAR28-RD26 | Age, growth, and reproductive biology of greater amberjack and cobia from Louisiana waters | Thompson et al. 1991 |

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|---|---|---|
| SEDAR28-RD27 | Gonadal maturation in the cobia, Rachycentron canadum, from the northcentral Gulf of Mexico | Lotz et al. 1996 |
| SEDAR28-RD28 | Cobia (Rachycentron canadum) stock assessment study in the Gulf of Mexico and in the South Atlantic | Burns et al. 1998 |
| SEDAR28-RD29 | Total mortality estimates for Spanish mackerel captured in the Gulf of Mexico commercial and recreational fisheries 1983 to 2011 | Bryan 2012 |

| | | |
|---|---|---|
| SEDAR28-AW01 | Florida Trip Tickets | S. Brown |
| SEDAR28-AW02 | SEDAR 28 Spanish mackerel bycatch estimates | NMFS Beaufort |

## Appendix 2: Statement of Work for Patrick Cordue

# Amended Statement of Work

### External Independent Peer Review by the Center for Independent Experts

SEDAR 28: Gulf of Mexico Cobia and Spanish Mackerel Assessment Desk Review

**Scope of Work and CIE Process:** The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Representative (COR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

**Project Description** SEDAR 28 will be a compilation of data, an assessment of the stocks, and an assessment review conducted for Gulf of Mexico Spanish mackerel and cobia. The CIE peer review is ultimately responsible for ensuring that the best possible assessment has been provided through the SEDAR process. The stocks assessed through SEDAR 28 are within the jurisdiction of the Gulf of Mexico Fisheries Management Councils and states in the Gulf of Mexico region. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

**Requirements for CIE Reviewers:** Three CIE reviewers shall have the necessary qualifications to complete an impartial and independent peer review in accordance with the statement of work (SoW) tasks and terms of reference (ToRs) specified herein. The CIE reviewers shall have expertise in stock assessment, statistics, fisheries science, and marine biology sufficient to complete the tasks of the peer-review described herein. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete all work tasks of the peer review described herein.

**Location of Peer Review:** Each CIE reviewer shall participate and conduct an independent peer review as a desk review, therefore travel will not be required.

**Statement of Tasks:** Each CIE reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer contact information to the COR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the assessment and other pertinent background documents for the peer review. Any changes to the SoW or ToRs must be made through the COR prior to the commencement of the peer review.

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Desk Review: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. Modifications to the SoW and ToRs shall not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COR and CIE Lead Coordinator. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

**Specific Tasks for CIE Reviewers:** The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Conduct an impartial and independent peer review in accordance with the tasks and ToRs specified herein, and each ToRs must be addressed (**Annex 2**).
3) No later than January 25, 2013, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to Dr. David Sampson david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in **Annex 1**, and address each ToR in **Annex 2**.

**Schedule of Milestones and Deliverables:** CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

| | |
|---|---|
| 21 December 2012 | CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact |
| 2 January 2013 | NMFS Project Contact sends the CIE Reviewers the assessment report and background documents |
| 9-24 January 2013 | Each reviewer conducts an independent peer review as a desk review |
| 25 January 2013 | CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator |
| 8 February 2013 | CIE submits CIE independent peer review reports to the COR |
| 15 February 2013 | The COR distributes the final CIE reports to the NMFS Project Contact and regional Center Director |

**Modifications to the Statement of Work:** This 'Time and Materials' task order may require an update or modification due to possible changes to the terms of reference or schedule of milestones resulting from the fishery management decision process of the NOAA Leadership, Fishery Management Council, and Council's SSC advisory committee. A request to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent changes. The Contracting Officer will notify the COR within 10 working days after receipt of all required information of the decision on changes. The COR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

**Acceptance of Deliverables:** Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COR (William Michaels, via William.Michaels@noaa.gov).

**Applicable Performance Standards:** The contract is successfully completed when the COR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) The CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) The CIE report shall address each ToR as specified in **Annex 2**,
(3) The CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

**Distribution of Approved Deliverables:** Upon acceptance by the COR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COR. The COR will distribute the CIE reports to the NMFS Project Contact and Center Director.

**Support Personnel:**

William Michaels, Program Manager, COR
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-427-8155

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Roger W. Peretti, Executive Vice President
Northern Taiga Ventures, Inc. (NTVI)
22375 Broderick Drive, Suite 215, Sterling, VA 20166
RPerretti@ntvifederal.com Phone: 571-223-7717

**Key Personnel:**

NMFS Project Contact:

Ryan Rindone, SEDAR Coordinator
2203 N. Lois Avenue, Suite 1100
Tampa, FL 33607
Ryan.Rindone@gulfcouncil.org Phone: 813-348-1630

## Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

   The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work

## Annex 2a – Terms of Reference for

### SEDAR 28: Gulf of Mexico Cobia Assessment Desk Review

1. Evaluate the quality and applicability of data used in the assessment.
2. Evaluate the quality and applicability of methods used to assess the stock.
3. Recommend appropriate estimates of stock abundance, biomass, and exploitation.
4. Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.
5. Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.
6. Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.
   - Provide measures of uncertainty for estimated parameters
   - Ensure that the implications of uncertainty in technical conclusions are clearly stated
   - If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternative states of nature, presented for review.
     - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments
     - Provide justification for the weightings used in producing the combinations of models
7. If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.
8. Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.
9. Make any additional recommendations or prioritizations warranted.
   - Clearly denote research and monitoring needs that could improve the reliability of future assessments

Table 1. Required MSRA Evaluations for cobia assessment:

| Criteria | Definition* (2001) | Current Value* (2001) |
|---|---|---|
| **Mortality Rate Criteria** | | |
| **$F_{MSY}$** | $F_{MSY}$ | 0.34 |
| **MFMT** | $F_{MSY}$ | 0.34 |
| **$F_{OY}$** | 75% of $F_{MSY}$ | 0.26 |
| **$F_{CURRENT}$** | $F_{2000}$ | 0.30 |
| **$F_{CURRENT}$/ $F_{MSY}$** | Percentage of $F_{Current}/F_{MSY}$ > MFMT | 0.40 |
| **Base M** | | 0.30 |
| **Biomass Criteria** | | |
| **$SSB_{MSY}$** | Equilibrium $SSB_{MSY}$ @ $F_{MSY}$ | 3.02 mp |
| **MSST** | (1-M)*$SSB_{MSY}$: M=0.30 | 2.11 mp |
| **$SSB_{CURRENT}$** | $SSB_{2000}$ | |
| **$SSB_{CURRENT}$/ $SSB_{MSY}$** | Percentage of $SSB_{Current}/SSB_{MSY}$ < MSST | 0.30 |
| **Equilibrium MSY** | Equilibrium Yield @ $F_{MSY}$ | 1.50 mp |
| **Equilibrium OY** | Equilibrium Yield @ $F_{OY}$ | 1.45 mp |
| **OFL** | Annual Yield @ MFMT | |
| | 2013 | |
| | 2014 | |
| | 2015 | |
| | 2016 | |
| | 2017 | |
| | 2018 | |
| **Annual OY**** | Annual Yield @ $F_{OY}$ | |
| | 2013 | |
| | 2014 | |
| | 2015 | |
| | 2016 | |
| | 2017 | |
| | 2018 | |

*Definitions and values are subject to change as per guidance from this assessment.

**Based upon current definitions of OY, where OY = 75% of $F_{MSY}$

Table 2. Projection Scenario Details for cobia assessment

2.1 Initial Assumptions:

| OPTION | Value |
|---|---|
| 2012 base TAC | TBD |
| 2012 Recruits | TBD by Panel |
| 2012 Selectivity | TBD by Panel |
| Projection Period | 6 yrs (2013-2018) |
| $1^{st}$ year of change F, Yield | 2013 |

2.2 Scenarios to Evaluate (preliminary, to be modified as appropriate)

1. Landings fixed at 2013 target
2. $F_{OY}$= 65%, 75%, 85% $F_{MSY}$ (project when OY will be achieved)
3. $F_{MSY}$
4. $F_{REBUILD}$ (if necessary)
5. F=0 (if necessary)

2.3 Output values

1. Landings
2. Discards (including dead discards)
3. Exploitation
4. $F/F_{MSY}$
5. $B/B_{MSY}$

10. Evaluate the quality and applicability of data used in the assessment.
11. Evaluate the quality and applicability of methods used to assess the stock.
12. Recommend appropriate estimates of stock abundance, biomass, and exploitation.
13. Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.
14. Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.
15. Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.
    - Provide measures of uncertainty for estimated parameters
    - Ensure that the implications of uncertainty in technical conclusions are clearly stated
    - If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternate states of nature, presented for review.
        - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments
        - Provide justification for the weightings used in producing the combinations of models
16. If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.
17. Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.
18. Make any additional recommendations or prioritizations warranted.
    - Clearly denote research and monitoring needs that could improve the reliability of future assessments

Table 1. Required MSRA Evaluations for Spanish mackerel assessment:

Note: te = trillion eggs

| Criteria | Definition* (as of 2002/2003) | Current Value* (2002/03) |
|---|---|---|
| **Mortality Rate Criteria** | | |
| **$F_{MSY}$** | $F_{30\%SPR}$ | |
| **MFMT** | $F_{30\%SPR}$ | |
| **$F_{OY}$** | 75% of $F_{30\%SPR}$ | 0.40 |
| **$F_{CURRENT}$** | $F_{2002/03}$ | |
| **$F_{CURRENT}$/MFMT** | | 0.53 |
| **Base M** | | 0.30 |
| **Biomass Criteria** | | |
| **$SSB_{MSY}$** | Equilibrium $SSB_{MSY}$ @ $F_{30\%SPR}$ | 19.10 te |
| **MSST** | (1-M)*$SSB_{MSY}$: M=0.30 | 13.40 te |
| **$SSB_{CURRENT}$** | $SSB_{2003}$ | 17.96 te |
| **$SSB_{CURRENT}$/ MSST** | | 1.34 |
| **Equilibrium MSY** | Equilibrium Yield @ $F_{30\%SPR}$ | 8.7 mp |
| **Equilibrium OY** | Equil. Yield @ 75% of $F_{30\%SPR}$ | 8.3 mp |
| **OFL** | Annual Yield @ MFMT | |
| | 2013 | |
| | 2014 | |
| | 2015 | |
| | 2016 | |
| | 2017 | |
| | 2018 | |
| **Annual OY**** | Annual Yield @ $F_{OY}$ | |
| | 2013 | |
| | 2014 | |
| | 2015 | |
| | 2016 | |
| | 2017 | |
| | 2018 | |

*Definitions and values are subject to change as per guidance from this assessment.

**Based upon current definitions of OY, where OY = 75% of $F_{MSY}$

Table 2. Projection Scenario Details for Spanish mackerel assessment

2.1 Initial Assumptions:

| OPTION | Value |
|---|---|
| 2012 base TAC | TBD |
| 2012 Recruits | TBD by Panel |
| 2012 Selectivity | TBD by Panel |
| Projection Period | 6 yrs (2013-2018) |
| 1st year of change F, Yield | 2013 |

2.2 Scenarios to Evaluate (preliminary, to be modified as appropriate)

1. Landings fixed at 2013 target
2. $F_{OY}$= 65%, 75%, 85% $F_{MSY}$ (project when OY will be achieved)
3. $F_{MSY}$
4. $F_{REBUILD}$ (if necessary)
5. F=0 (if necessary)

2.3 Output values

1. Landings
2. Discards (including dead discards)
3. Exploitation
4. $F/F_{MSY}$
5. $B/B_{MSY}$

-

# Report on the SEDAR 28 Desk Review of the Stock Assessments for Gulf of Mexico Cobia and Spanish Mackerel

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**February 2013**

# Contents

## 1. Executive Summary

Between 9 and 24 January 2013, a Center for Independent Experts (CIE) desk review of the SEDAR 28 Gulf of Mexico cobia (*Rachycentron canadum*) and Spanish mackerel (*Scomberomorus maculates*) stock assessments was undertaken. The key findings of that review are summarised below.

Prior to the development of assessment models by the Assessment Workshops, the Data Workshops had collated the biological data for the Gulf of Mexico stocks of cobia and Spanish mackerel and constructed time series of reliable data for the landings made by the commercial and recreational fisheries. Despite some deficiencies of the data collection programs, the Workshops had developed time series of discards from these fisheries and of the bycatch of the two species from the shrimp fishery. Although imprecise, these time series, together with the time series of landings data, had been considered appropriate for use in the assessments. Length composition data sufficient to characterize the landings data, and, in the case of the Spanish mackerel stock, one of the survey indices, had been collated, together with those age-at-length data that were available. The Data Workshop for cobia had also recommended two fishery-dependent survey indices, while that for Spanish mackerel had recommended one fishery-independent index of abundance and two fishery-dependent indices. Each of the survey indices had been standardized using an appropriate statistical approach.

Although both maturity at age and the various time series of discard data for both species were imprecise, and there was a lack of length and age-at-length composition data for those fish that had been discarded from the commercial and recreational fisheries, the data that the Data Workshops had collated for the Gulf of Mexico stocks of both cobia and Spanish mackerel represented the best data that were available and were considered adequate for use in stock assessment. It should be noted, however, that the imprecision of the input data and limited age composition data are reflected in uncertainty in the results of each assessment. In the case of cobia, the lack of a fishery-independent index of abundance is also likely to have influenced the results that were obtained from the assessment.

Assessments for both cobia and Spanish mackerel had been undertaken by the Assessment Workshops using Stock Synthesis 3, a versatile and well-tested program that has been employed in numerous stock assessments both in the U.S. and elsewhere. The methods employed by this program are of high quality and the software provides tools that facilitate exploration of uncertainty, calculation of benchmarks, projection of yields with specified fishing rates to assess future stock status, and, through bootstrapping, either within Stock Synthesis (in the case of cobia) or using auxiliary software (in the case of Spanish mackerel), generation of probability distributions of parameters, benchmarks, and other variables. The ease with which alternative values of parameters can be set up within Stock Synthesis had facilitated (1) the exploration by the Assessment Workshops of the sensitivity of the results produced by the cobia and Spanish mackerel models to a number of alternative assumptions regarding values of natural mortality, steepness, and discard mortality, (2) the conducting of retrospective analyses, and (3) investigation of alternative data weighting options.

For both cobia and Spanish mackerel, estimates of the steepness of the stock-recruitment relationship had been found to be imprecise. The key uncertainty reflected in the choice by the Assessment Workshop for Gulf of Mexico cobia of a set of models to represent alternative states of nature was the value of steepness. For Spanish mackerel, the Assessment Workshop chose to explore the effects of a range of values for the base level of natural mortality $M$ when proposing alternative states of nature. Sensitivity analysis had also indicated that the results of the assessment for cobia were sensitive to this parameter.

The base model for the Gulf of Mexico stock of cobia assumed a base level of natural mortality of 0.38 $y^{-1}$, which, when fitted, resulted in an estimated steepness of 0.925. Based on the sensitivity analyses and explorations of uncertainty that had been carried out by the Assessment Workshop, this model and two alternative models were accepted as suitable for use as alternative states of nature when assessing the condition of the cobia stock. The alternative models assumed base levels of natural mortality of 0.26 and 0.5 $y^{-1}$, and, when fitted, resulted in steepness estimates of 0.96 and 0.92, respectively. On fitting the base model for the Gulf of Mexico stock of cobia, it was estimated that $SSB_{2011}/MSST=1.73$ and that $F_{current}/$ MFMT = 0.63, where the benchmarks MSST and MFMT had been calculated as MFMT = $F_{30\%SPR}$ and MSST = $(1 - M)$ $SSB_{30\%SPR}$. Based on this result and the examination of the results of the various sensitivity runs for Gulf of Mexico cobia, it is highly likely that the stock of cobia is not overfished and is not experiencing overfishing.

Exploration of parameter estimates, sensitivity runs, likelihood profiles, and results from bootstrapping led the Assessment Workshop for the Gulf of Mexico stock of Spanish mackerel to accept an alternative to the initial model as the new base model for this species. While this new model had an identical structure to that of the original base model, the value of steepness was fixed at 0.8, rather than estimated. An alternative model with similar structure to that of the new base model, but with steepness fixed at 0.9, was chosen by the Assessment Workshop to represent an alternative state of nature. Estimates obtained from the fitted base model indicated that $SSB_{2011}/MSST=3.06$ and that $F_{current}/$ MFMT = 0.38, where the benchmarks MSST and MFMT had been calculated as MFMT = $F_{30\%SPR}$ and MSST = $(1 - M)$ $SSB_{30\%SPR}$. Based on this result and examination of the results of the various sensitivity runs, it is highly likely that the Gulf of Mexico stock of Spanish mackerel is not overfished and is not experiencing overfishing.

The assessments produced by the Assessment Workshops for the Gulf of Mexico stocks of cobia and Spanish mackerel are based on the best data that are available, and the models that have been developed in Stock Synthesis are appropriate given the input data that are available for each stock. The results of these assessments provide the best scientific advice regarding the status of these two stocks that is currently available. While the limitations of the data and the uncertainty reflected in the sensitivity analyses and in the values calculated by the assessment models should be recognized when considering future management options, the explorations described in the Assessment Workshop Reports suggest that the conclusions regarding current stock status and levels of fishing mortality are likely to be robust despite the uncertainty associated with the assessments. Future stock assessments would benefit from improvement in the programs used (1) to collect discard data from the commercial and recreational fisheries and bycatch data from the shrimp fishery, and (2) to collect length and age-at-length data from landings and discards from both the commercial and recreational fisheries and from the bycatch of cobia and Spanish mackerel by the shrimp fishery.

The individuals involved in collating the input data and in developing the stock assessments are commended for their efforts.

# 2. Background

### *2.1. Overview*

Between 9 and 24 January, 2013, a Center for Independent Experts (CIE) desk review was undertaken of the SEDAR 28 Gulf of Mexico cobia and Spanish mackerel stock assessments.

The Statement of Work provided to Dr Norm Hall by the CIE is attached as Appendix 2. This CIE report, which is prepared in accordance with the Statement of Work, describes his evaluation of the assessments and the review process.

Prior to the Review, stock assessment documents and other background documentation were made available to CIE Reviewers. A list of these documents is presented in Appendix 1. Note that, in the text of this review report, the "Gulf of Mexico – Cobia – Assessment Process Report" is referred to as the "Workshop Assessment Report" for the Gulf of Mexico stock of cobia.

### *2.2. Terms of Reference*

The terms of reference for the desk review of the stock assessments of the Gulf of Mexico stocks of cobia and Spanish mackerel are presented in the Statement of Work (Appendix 2).

# 3. Description of Reviewer's role in review activities

Prior to undertaking the desk review, the Reviewer familiarised himself with the background documentation and the assessment reports for the two species that were the subject of the review (Appendix 1). Subsequently, he examined the Data Workshop and Assessment Workshop Reports for each species in greater detail, focussing on the preparation of this document, *i.e.*, the CIE report describing his evaluation of the two stock assessments and the SEDAR process.

# 4. Summary of findings relevant to the SEDAR 28 stock assessments for Gulf of Mexico cobia and Spanish mackerel

Because of the similarity of the models and many aspects of the data for the Gulf of Mexico stocks of cobia and Spanish mackerel, common issues in both assessments were often identified. There is thus some duplication of the text used when discussing those issues under the Terms of Reference for the separate stocks.

## *4.1 Gulf of Mexico Cobia (*Rachycentron canadum*).*

**ToR 1. Evaluate the quality and applicability of data used in the assessment.**

*Conclusions*

The data that the Data Workshop has compiled for the Gulf of Mexico stock of cobia are the best that are available. Although limited, and imprecise in some aspects, the data are of a quality that allows a broad assessment of the likely condition of the stock.

*Strengths*

- The collation of life history data for the Gulf of Mexico stock of cobia.
- The collation of commercial landings data to produce time series of landings by handline, longline, and other gears from 1927, and, particularly, more precise data from 1950.
- The collation of a time series of estimates of bycatch of cobia by the shrimp fishery from 1972, using a Bayesian model to estimate catch per unit of effort.
- The collation of recreational fisheries data from different sources to produce sound time series of landings by fishing mode from 1955, and, particularly, more precise data from 1981.
- The collation of data to produce time series of discards from the commercial gears and recreational fishing modes.
- The collation of length composition data to characterize the landings by the commercial and recreational fisheries.
- The collation of two fishery-dependent indices of abundance, and the use of appropriate statistical analyses to standardize those indices of abundance.

*Weaknesses*

- Lack of definition of the southern boundary of the Gulf of Mexico stock of cobia.
- Paucity of data on the relationship of the proportion mature with age.
- The unreliable nature of the discard data due to low reporting, low intercept rates, and inadequate data collection programs.
- Inadequate sampling of length and age composition data from commercial landings and from bycatch of cobia from the shrimp fishery.

- Lack of length and age composition sampling from commercial and recreational discards.

***Specific comments***

*Stock structure*

The decision that, during the spawning season, mature individuals of cobia in the Gulf of Mexico are genetically distinct from those on the Atlantic coast north of Florida appears sound given the genetic and tagging data that are available. While the number of cobia in the sample collected in waters off Texas for the genetic study appears adequate, samples from the north of the Gulf of Mexico and from waters off the west coast of Florida are small. Further research to collect additional data from within the Gulf and to confirm the preliminary genetic findings would be valuable.

Despite the overall conclusion that the Gulf of Mexico stock is distinct from the South Atlantic stock of cobia, the genetic and tagging data indicate that there is some gene flow and a small amount of movement between the stock in the Gulf and those stocks in the stock complex off the South Atlantic coast, the latter complex being considered as the South Atlantic "stock" of cobia. There is also an inconsistency between the findings reported in SEDAR28-DW01 and those reported in SEDAR28-RD09, which needs to be reconciled. The former report advises that the collections from offshore in the Gulf of Mexico were genetically distinct from those offshore in the South Atlantic region, while the latter reports that "Based on our U.S. collections of *R. canadum* encountered along the SA and GOM coasts, tests of both genotypic distributions and pairwise hierarchical RST statistics suggest the offshore groups are genetically homogenous, even between the SA and GOM" and that "information gathered from the offshore collections … shows high levels of movement between the SA and GOM".

From the Data Workshop Report, it appears that the majority of tag recoveries have been made in locations that are consistent with the location of release of the tagged fish and the results of genetic studies of fish collected during the spawning season. Although not stated in this Report, the temporal distribution of recaptures of tagged fish presumably reflects the temporal distribution of catches in both spawning and non-spawning periods. The tag recovery data thus suggest that, despite the migrations that cobia undertake, regardless of the time of year and with the exception of fish caught in the waters off Brevard County, catches of fish may be assigned reliably to one or other of the two stocks on the basis of the area in which they are caught. Genetic studies should be undertaken to confirm this hypothesis, however.

As concluded in the Data Workshop Report, the genetic and tagging data indicate that Gulf of Mexico and South Atlantic stocks of cobia overlap in the waters to the east of Florida, and there is thus no distinct boundary that separates the stocks. For assessment and management, and for allocation of catches to one or other of the two stocks, the boundary between Florida and Georgia was selected (for convenience and because it was consistent with genetic, tagging and life history data) as the line separating the two stocks. Consideration should be given to whether catches within the area of overlap are of sufficient magnitude that assessment results could be sensitive to this decision, *i.e.*, whether an assessment based on an alternative line of separation at, say, the southern edge of the zone of overlap of the two stocks would be likely to yield results that differ greatly from those reported for the current assessment.

Unfortunately, maps of the distribution of the species and stocks of cobia, which were requested in the terms of reference for the Data Workshop, were not prepared. FishBase (Froese and Pauly, 2012) advises, however, that cobia has a worldwide distribution, which extends south of U.S. waters into waters off South America. The genetic study provides no information to suggest that the Gulf of Mexico stock does not extend into waters off Mexico, where it may also experience the effects of fishing. Further genetic research to determine the southern extent of the Gulf of Mexico stock of cobia appears necessary.

*Biological data*

The Life History Working Group's recommendation to base its estimate of the average value of the instantaneous rate of natural mortality *M* for fully-selected fish (ages 3-11) on the value determined from the Hoenig (1983) equation for fish using a maximum age of 11 years, *i.e.*, 0.38 $y^{-1}$, is endorsed. The range of estimates of *M* ultimately used to explore the sensitivity of the assessment model to imprecision in the estimate of natural mortality, *i.e.*, 0.26 to 0.5 $y^{-1}$, was broader than that initially proposed by the Life History Working Group (LHWG), *i.e.*, 0.26 to 0.42 $y^{-1}$. While the LHWG also recommended that a range of values of *M* based on a CV of 0.54 (MacCall, 2011), or other CVs, should also be explored, such exploration does not appear to have been undertaken by the Assessment Workshop. The basis for the use of 0.5 $y^{-1}$ as a high value of *M* is not explained in the Assessment Workshop Report, but it is noted that the difference between this high value and the base level of 0.38 $y^{-1}$ is equal to the difference between that latter value and the low value of 0.26 $y^{-1}$. Research is needed to determine methods by which an appropriate range of feasible values of *M* for a species might be selected for use in stock assessment as alternate plausible states of nature.

For Gulf of Mexico cobia, estimates of *M* from the Lorenzen equation were scaled such that the average value of *M* over the fully-selected ages 3 to 11 years was equal to the estimate from Hoenig's (1983) equation for fish, *i.e.*, 0.38 $y^{-1}$. It is unclear, however, whether the same approach as used for Run 1 was applied in sensitivity runs 2 and 3 when, as advised in the Assessment Workshop Report, the Lorenzen-based age dependent mortalities were scaled to achieve the same cumulative survivals over all ages as that expected for constant mortalities equal to the low and high values of *M*, respectively. It is likely that the cumulative survival was calculated over only ages 3-11, rather than all ages, to ensure consistency with the approach used in Run 1 when average *M* was set to 0.38 $y^{-1}$.

Use of the Lorenzen (1996) equation to derive age-dependent estimates of natural mortality *M* is not endorsed. In his report to the CIE on the stock assessments conducted for yellowtail flounder and Atlantic herring at Woods Hole in 2012, Francis (2012) advised that prediction of *M*, and, through body weight, its variation with age for an individual species, using Lorenzen's (1996) equation was likely to be highly imprecise, as was evident in the wide scatter about the regression line in Lorenzen's Figure 1. Francis observed that, for about one-third of Lorenzen's data points, predicted and observed *M*s appeared to differ by a factor of more than 2. Furthermore, in the case of both herring and yellowtail, the values of *M* estimated by Lorenzen's (1996) equation differed markedly from the values estimated using Hoenig's (1983) equation and had to be scaled substantially for use in the yellowtail flounder and Atlantic herring assessments. If it is assumed that the length measure used for Gulf of Mexico cobia in the growth equation, the parameters of which are presented in Table 2.7.1 of the Data Workshop Report, is fork length rather than total length (not advised in the text or table but inferred from Fig. 2.7.2), the value of *M* at age 3 is estimated by the Lorenzen (1996) equation to be 0.21 $y^{-1}$. This suggests that the estimates for the Gulf of Mexico stock of cobia calculated using Lorenzen's (1996) method were scaled up by a factor of at least 1.8 to produce the estimates of age-dependent natural mortality used in the assessment. Francis (2012) raised the valid point that, if the estimates produced for a species by Lorenzen's (1996) equation provide such unreliable estimates that the mean *M* differs from the estimate calculated using Hoenig's (1983) equation by a factor that differs markedly from 1, can it be considered sufficiently reliable to estimate how *M* varies with age within these species?

There has been no test to assess whether the introduction of the additional complexity associated with age-dependent natural mortality was justified by the resultant improvement in fit that was obtained for the Gulf of Mexico cobia model. It is recommended that a model employing a constant value of *M* is fitted to the cobia data. If this model fits just as well as the model that employs an age-dependent *M*, then the simpler model should be used. If the age-dependent model produces a significantly better fit, it would probably be better to estimate age-dependent *M* within the assessment model rather than assuming that it is of the form predicted by the Lorenzen (1996) equation.

The Data Workshop's decision, that cobia are hardy and unlikely to suffer barotrauma-associated post-release mortality, is subjective. Further research on discard mortality would be useful.

The Data Workshop correctly identified that, because of bias introduced into biological samples by the 33 inch minimum legal size, an allowance would need to be made when fitting von Bertalanffy growth curves to length-at-age data. By fitting the growth curves in Stock Synthesis, the influence of the selection curves on the observed length-at-age data is automatically taken into account and uncertainty associated with fitting the growth curves is carried through to the estimates of parameters and benchmarks that are produced by Stock Synthesis.

Because of the paucity of the youngest ages of fish in samples, the advice relating to maturity at age, which was reported in the Data Workshop Report, was subjective. Research based on fishery-independent samples is needed to provide more reliable estimates of the parameters of the maturity-length relationship and the proportion mature at age.

Although the Data Workshop noted that cobia exhibit sexually dimorphic growth, the Stock Synthesis model used in the assessment employed only the growth curve for the pooled sexes. In future refinement of the assessment model, consideration should be given to including sexually dimorphic growth, noting that the benefit of this might only be realised if appropriate sex composition data for landings and discards become available for input, and length and age-at-length compositions are sexually disaggregated.

*Commercial landings*

The decision by the Data Workshop to extend the historical time series of commercial landings of Gulf of Mexico cobia as far as possible into the past is endorsed, as catches from that earlier time period are likely to have influenced current stock status. It was noted that the Data Workshop reported that "Landings prior to 1950 are considered highly uncertain" and that the precision of landings improved following the introduction of the trip ticket system in each state. The tables that are presented provide no estimates of the precision likely to be associated with the annual landings data, nor is any information provided as to whether the commercial landings for cobia, which were reported by the Data Workshop, were likely to be biased, and, if so, the magnitude and direction of such bias.

Without an alternative time series, such as fishing effort, to provide information on fishing mortality, Stock Synthesis assumes that the catches are known sufficiently well to estimate the fishing mortalities required to take those catches (Methot and Wetzel, 2012), and thus estimated catches match the values that were input. In the current assessment, there has been no evaluation of the implications of the greater imprecision of the commercial landings data prior to 1950. Such evaluation may have required a sensitivity run with an alternative time series of commercial landings encompassing the imprecision of the landings data.

The Data Workshop has reported that, because few trips with cobia discards were observed by the Reeffish Observer Program and the NMFS logbook does not provide coverage of the entire fishery, discards of cobia by the commercial fishery have greater uncertainty than commercial landings and are likely to underestimate the true quantities of discarded fish. No estimate is provided of the likely magnitude of such underestimation.

The Working group advised that discards reported as "kept, not sold" should be added to the landings, and not included in the discards. This recommendation does not appear to have been accepted by the Assessment Workshop as Table 3.6 of the Data Workshop Report includes these fish within the discards, and the same values are carried over and used in the assessment (Table 2.5 and Appendix A, Assessment Workshop Report). The value for 2011 in Table 2.5 differs from that reported in Appendix A in the Assessment Workshop Report.

The estimates of the annual bycatch of cobia in the Gulf of Mexico by the shrimp fishery, which are reported in Table 2.7 of the Assessment Workshop Report, differ from the values in Table 3.10 of the Data Workshop Report. The latter values match those reported in SEDAR-DW06. There is no explanation in the Assessment Workshop Report to explain this inconsistency. Although the Assessment Workshop Report refers to a data workshop report for SEDAR 22 for details of the methods employed to obtain these bycatch estimates, frequent other references to SEDAR 22 in the Assessment Workshop Report suggest that the references to SEDAR 22 are erroneous and that the correct citation should have been the Data Workshop Report for SEDAR 28. This last report provides no explanation for the inconsistency between the values presented in the two reports.

The Assessment Workshop Report presents a table (Table 2.8) of annual standardized estimates of effort for 1945-2011 by the shrimp fishery. These effort values are inconsistent with the effort (days fished) for 1981-2010, which are reported in Table 3 of SEDAR-DW06. While this could possibly have been explained by the fact that the values in Table 2.8 of the Assessment Workshop Report have been standardized, there is no explanation as to how the data for these estimates were collected, nor the method employed to standardize the values. As a further complication, the Assessment Workshop Report advises that the values of effort for the shrimp fishery were input as an index of fishing mortality for the shrimp fishery and. while it would therefore have been expected that the effort values used in the Stock Synthesis model would have been those values reported in Table 2.8 of the Assessment Workshop Report, this is not the case. While there is a broad degree of similarity, the values that are actually input into Stock Synthesis 3, as shown in the data file listed in Appendix A of the Assessment Workshop Report, differ considerably from those presented in Table 2.8. No explanation for this inconsistency is to be found in the cobia Assessment Workshop Report, however the time series of values of effort used in the Stock Synthesis data file for cobia appears to match the time series of scaled effort for the shrimp fishery presented in Table 2.8 of the Assessment Workshop Report for Spanish mackerel. Although this inconsistency thus appears to have a possible explanation, it is important that the results of the stock synthesis runs, estimates of benchmarks, and determinations of current stock status, which have been reported for cobia in the cobia Assessment Workshop Report, are based on the input data for Stock Synthesis that were described in the appendices of that assessment report. Inconsistencies between the data inputs for cobia that have been described and the Stock Synthesis data files for that species need to be reconciled.

The Data Workshop noted that the CVs of the estimates of bycatch of cobia by the shrimp fishery ranged from 66 to 208%, with only 4 of the 39 years having CVs less than 100%. An issue that may have been resolved after the Data Workshop was that a number of the estimates of bycatch calculated by the Bayesian model became stuck on bounds, although the Data Workshop Report does not identify which of the 39 years encountered such problems. As a consequence of these issues, bycatch estimates for the shrimp fishery were recognised by the Assessment Workshop as being very imprecise. For this reason, shrimp fishery effort was used as a proxy for the trends present in the point estimates of bycatch by the shrimp fishery. The median of the 1972 to 2011 estimates of bycatch was used, however, to provide an estimate of the magnitude of the bycatch. An estimate of the catchability coefficient relating shrimp effort to fishing mortality was then calculated within Stock Synthesis using 1972 to 2011 as a super period. A similar super period approach was employed in Stock Synthesis to accommodate the small sample sizes of the length composition data from the SEAMAP program, which were considered to be representative of the length compositions of cobia caught by the shrimp fishery. Use of such a super period to deal with the imprecision of the bycatch estimates of cobia from the shrimp fishery is an appropriate modelling approach. It would have been preferable, however, to have used a reliable time series of precise estimates of discards of the bycatch of cobia from the shrimp fishery in the Stock Synthesis model if such a time series had been available, rather than having to "work around" the problem. Consideration therefore should be given to establishing a well-designed program to monitor the bycatch of cobia by the shrimp fishery such that reliable estimates can be collected in the future.

Very few samples of landed fish were available from catches taken by commercial miscellaneous gears, and thus reliable characterization of the length composition of these landings is not possible, The Data Workshop advised that sample sizes for developing length compositions of commercial landings were inadequate for a considerable number of gears and years. It is reasonable to conclude that length composition data collected from the commercial landings are imprecise. Low sample sizes may also affect the extent to which the resultant length compositions are representative of total annual landings. After filtering, too few measurements of discarded cobia were available from the Reeffish Observer Program to characterize the length composition of discarded fish. The Data Workshop Report advised that age compositions of commercial catches were inadequate for all years and that no aging error matrix could be generated for these ageing data because 86% of the age readings were from a period 15-20 years earlier and thus reader comparisons were not possible. Well-designed monitoring programmes to collect length and age composition data from the landings and discards by each of the principal gear types used by commercial fishers should be established.

*Recreational landings*

When combining the time series of data collected by different approaches for the same fishing mode, calibration factors were calculated using the data collected during a period of overlap. No comment is made in the Data Workshop Report, but it should be recognised that imprecision of the calculated calibration factor adds to the imprecision of the data that are adjusted and should be carried through into the resulting time series.

While CVs of the estimates of the recreational landings for a fishing mode are calculated and reported in summaries for a number of the data collection programs, estimates of the uncertainty of the values in the resulting time series of the total recreational landings are not provided (Table 2.4, Assessment Workshop Report), and thus are not considered in the assessment.

The collection of age data from the landings of the recreational fishery appears opportunistic, judging from the description provided in the Data Workshop Report. A well-designed program to collect length and age composition data for Gulf of Mexico cobia from the landings and discards of the recreational fishery should be established.

*Survey indices*

The decisions made by the Data Workshop when selecting indices of abundance appear sound. Despite the fact that both were derived from fishery-dependent data, the time series of headboat and MRFSS catch-per-unit-of-effort (cpue) data were endorsed by the Data Workshop as acceptable indices of abundance for Gulf of Mexico cobia. The time series of data for these indices were standardized using the delta lognormal model.

*Adjustment by Assessment Workshop*

Although the Data Workshop produced time series of commercial landings by gear type, the Assessment Workshop pooled these data to create a single time series, which was input to Stock Synthesis. Similarly, the Assessment Workshop combined the recreational landings, which had been tabulated by mode, into a single time series of recreational landings. Such pooling obviously suited the incremental approach that was used when developing the assessment model, *i.e.*, first developing a simple production model, then an age-structured production model, and finally a length-structured catch-at-age model. By pooling the data into the two time series, the number of parameters to be estimated was reduced but, as a common selection curve is applied to each time series of combined data within Stock Synthesis, it is assumed that annual length and age-at-length data for the pooled data were representative of those combined data.

**ToR 2. Evaluate the quality and applicability of methods used to assess the stock.**

*Conclusions*

Stock Synthesis 3, the software within which the model for the Gulf of Mexico stock of cobia was developed, has gained international recognition for its quality and the applicability of the methods it uses to assess the condition of fish stocks. The model for cobia was of an appropriate structure given the data that were available. Values predicted by the model, including those of benchmarks, were imprecise, however, due to the nature of the input data. Further imprecision of model outputs due to alternative values of key parameters, such as natural mortality and steepness of the stock-recruitment relationship, was explored. Recognising the types of data that were available for input and the uncertainty of model outputs that arose as a consequence of the nature of those input data, the Stock Synthesis model for cobia is of a quality consistent with that which would be considered "best practice", and is able to provide a valuable assessment of the likely condition of the stock in 2011, and, when projected, the likely trajectory of yields and stock condition over the next five to six years.

*Strengths*

- The decision to use Stock Synthesis 3 as the modelling framework.
- The structure of the model for cobia, which was developed within the Stock Synthesis framework, was appropriate given the data that were available.
- The enhancement of Stock Synthesis to allow modelling of a fishery for which the only source of mortality is that associated with discarding of bycatch.
- The assessment of the uncertainty of parameter estimates was thorough.
- Selectivity runs explored key uncertainties and demonstrated appropriateness of conclusions regarding the current condition of the stock.
- Benchmarks were appropriately calculated.
- Projections were undertaken using two states of nature.

*Weaknesses*

- Subjective decision to set effective sample size to actual sample size capped at a maximum of 100 rather than to use iterative reweighting, such as proposed by Francis (2011).
- Lack of exploration of sensitivity to the assumption of logistic selectivity for the recreational and commercial fisheries.
- Lack of length and age composition data to provide information on the length compositions of discards and the shape of the retention curves
- Failure of model to match the trends in discards from the commercial and recreational fisheries
- Imprecision in the estimate of steepness of the stock-recruitment relationship.
- Lack of exploration of uncertainty associated with time series of commercial and recreational landings.
- Errors in Stock Synthesis files in the Appendices.

Both the decision by the Assessment Workshop to employ Stock Synthesis 3 as the modelling framework and the structure of the model for the Gulf of Mexico stock of cobia that was developed within this framework are appropriate. Stock Synthesis has been extensively tested, and has the flexibility to be applied to fisheries with data qualities ranging from poor to rich. The software has been equipped with tools to explore uncertainty, to estimate benchmarks, and to undertake projections using alternative harvest policies. Because of its versatility, Stock Synthesis is well suited to explorations of the sensitivities of model outputs to a broad range of alternative model structures or use of alternative sets of data inputs. The enhancement of Stock Synthesis to allow modelling of a fishery for which the only source of mortality is that associated with discarding of bycatch is a particular strength of the assessment that was developed for the Gulf of Mexico stock of cobia. While some deficiencies were identified in the fit of the base model, the overall fit was regarded as adequate.

The Stock Synthesis model for the Gulf of Mexico stock of cobia included three fishing fleets, *i.e.*, commercial, recreational and discards of bycatch from the shrimp trawl fishery, and two fishery-dependent abundance indices, *i.e.*, cpue data from the MRFSS survey and from the headboat survey. Time series of discards from the commercial, recreational, and shrimp fisheries were input, together with length composition data of cobia from the commercial and recreational fisheries, and, combining the data into a super period, from the bycatch from the shrimp fishery. Age composition data were input for the recreational fishery and considered within the model as age compositions that were conditional on length.

The model employed 3-cm bins for the length composition of cobia, and the lower bounds of the length intervals within these bins ranged from 6 to 165 cm. It was pleasing to note that the Assessment Workshop had reported exploration of the effect of bin size on estimation of selectivity parameters, at least to a limited extent, and concluded that use of a bin width of 3 cm was preferable to use of one that was 5 cm. Methot (2011) notes that, on occasion, wide bin widths can cause problems when the slope of a selectivity or retention curve becomes so steep that all change occurs within a single length class.

Although the Assessment Workshop reported that, as its value is typically unable to be estimated within the assessment model, the standard deviation of recruitment was fixed at 0.6, no justification for the choice of this particular value is provided in the Assessment Workshop Report. It might be useful to note that the use of this value has been proposed in a number of studies (*e.g.*, Smith and Punt 1998; Maunder and Deriso, 2003), which typically advise that the value 0.6 is supported by the results of the meta-analyses undertaken by Beddington and Cooke (1983), and later by Mertz and Myers (1996).

When developing the base model for cobia, a subjective decision was made to employ an effective sample size for the length composition data of cobia, which was set equal to annual sample size but capped at a maximum of 100 when the number of fish in the annual sample exceeded this number. Rather than using this subjective approach, the iterative re-weighting approach that was explored in sensitivity run 10, *i.e.*, the method proposed by Francis (2011), is recommended.

The decisions by the Assessment Panel to use asymptotic, logistic, size-based selectivity curves for the recreational and commercial fisheries and a double-normal selectivity curve to represent the selectivity of cobia by the shrimp fishery, and to keep these selectivity curves constant over time, are endorsed. It would have been expected, however, that sensitivity to this choice of selectivity patterns would have been explored. As was appropriate, to accommodate the introduction in 1984 of a minimum size limit of 33 inches, separate retention curves were assumed for the time blocks 1927-1984 and 1985-2011. Because of the lack of data prior to 1993, however, it was necessary to assume the shape and parameters of the retention curve for the earlier time block. This represents a source of uncertainty, and it would therefore be appropriate to consider whether assessment results are likely to be sensitive to the assumptions made regarding the form and values of parameters of this retention curve.

The base model was fitted to the data for Gulf of Mexico stock of cobia and reported as Run 1. All estimated parameters were assumed to have uniform, non-informative priors, with wide bounds. The results of the jitter test, with 48 of 50 trials converging to within 2 likelihood units of the minimum, suggested that the model was not particularly sensitive to the initial values of the parameters that were estimated.

While model predictions were broadly consistent with the commercial and recreational discards, the trends of the predictions did not match those of the observed data, suggesting some structural deficiency of the model or, if the model structure was correct, inadequacy of the discard data or overriding influence of other data. In the case of discards by the commercial fishery, the possibility that the discard data were inadequate cannot be discounted as the Data Workshop had identified that these estimates were likely to be both imprecise, as few trips with cobia discards had been recorded in the Reeffish Observer Program, and erroneously low, as the NMFS logbooks do not provide coverage of the entire fishery. In the case of the recreational fishery, however, it is likely that the failure to fit the trend in recreational discards was due to the competing influence of other datasets on model predictions.

It would be useful to advise in the captions of Figures 3.7 and 3.8 of the Assessment Workshop Report that these are plots of the MRFSS and headboat cpue data, respectively. As noted in the Report, the fits to these indices and to the effort data for the shrimp fishery are quite good, although runs of positive and negative deviations were present in the headboat cpue data. Some structure also appeared present in the Pearson residual plots for the commercial (Fig. 3.11) and recreational (Fig. 3.13) length composition data.

In the base model represented by Run 1, estimates of both the log of unexploited equilibrium recruitment (1,033,130 fish) and the steepness of the stock recruitment curve, *i.e.*, 0.925, were calculated by Stock Synthesis when the model was fitted to the input data. The Assessment Workshop provided a well-considered evaluation of the reliability of the estimate of steepness, noting that a large proportion of bootstrap estimates of steepness approached the upper bound of 1, and that, although probably greater than 0.8, the distribution of estimates between 0.85 and 1 was relatively uniform. The likelihood profile for steepness was relatively flat between 0.8 and 1, but suggested a minimum between 0.85 and 0.95. Tension was exhibited in the values of steepness that were most consistent with recruitment data (favouring a value of ~1), length and discard data (favouring a value of ~0.8), and age composition (favouring a value of ~0.65), with little information relating to steepness evident in the abundance indices. The fact that the input data were more consistent with lower values of steepness, while the assumption regarding recruitment deviations appeared to be providing the support for higher values of steepness, is interesting as it raises the question of whether, in the case of Gulf of Mexico cobia, the influence of recruitment deviations on the resultant parameter estimates was excessive. The assessment Workshop Report advised that steepness may not be well estimated by the Stock Synthesis model, a conclusion that appears sound. The recent study by Lee *et al.* (2012), which demonstrated the difficulty that is typically encountered when attempting to estimate steepness, concluded that “steepness is reliably estimable inside the stock assessment model only when the model is correctly specified for relatively low productive stocks with good contrast in spawning biomass”. This conclusion is relevant to the cobia assessment, for which the results of fitting the base model to cobia, a species that, on the basis of its natural mortality, would be considered of medium productivity, indicated that biomass had been relatively stable over the last 30 years, the period covered by the abundance indices and much of the more reliable input data.

The question of how to respond when the steepness of the stock-recruitment relationship is imprecise or cannot be estimated reliably should be considered. Francis (2012) has suggested that, in such circumstances, he considers it better to fix steepness at a value, such as 0.75, *i.e*., the default value recommended in Francis (1993), and which is frequently used in Australia and New Zealand, or the average of published values for the same or similar species. Francis (2012) advises that the uncertainty associated with this parameter should then be explored using sensitivity runs with lower and higher values of steepness.

There would have been value in assessing whether the value of steepness estimated from the base model, *i.e*., 0.925, is consistent with published values for cobia or similar species. The fact that this value of steepness for the base model, and the values of steepness estimated when fitting the models using the low and high values of the base level of natural mortality, which were subsequently used as alternative states of nature, ranged from 0.92 to 0.96 (Table 3.7, Assessment Workshop Report) was initially of concern to the Reviewer, as such values of steepness reflect a robust stock that is able to maintain recruitment despite considerable decline in stock size. It was noted subsequently, however, that the Assessment Workshop had explored sensitivity runs with lower steepness, *i.e*., 0.7 and 0.8, and that these runs had produced very similar conclusions regarding the condition of the stock with respect to benchmark levels as were determined using the base model (Table 3.8, Stock Assessment Report). Accordingly, after considering the results of the other sensitivity runs, it is concluded that, despite imprecision in the estimate of steepness, the base model accepted by the Assessment Workshop, *i.e*., the model associated with Run 1, is appropriate for determination of the current condition of the Gulf of Mexico stock of cobia and for use in projecting the fishery over a short time period to assess the likely outcomes of fishing with specified levels of fishing mortality.

There are errors in the stock synthesis files listed in the appendices. For example, there are actually 91 length observations in the data file, not 85, where this inconsistency would cause Stock Synthesis to abort when it attempted to read the data. Also, the number of length bins is specified as 54 in the data file, but the specification of the selectivity for MRFSS data attempts to use 57, which would cause Stock Synthesis to abort when it attempted to run following data input. The listings should be those associated with the base model, but appear to be those of a model that was still under development.

**ToR 3. Recommend appropriate estimates of stock abundance, biomass, and exploitation.**

*Conclusions*

Estimates of stock abundance, biomass, and exploitation are produced when the Stock Synthesis model is fitted. The values of total biomass and annual exploitation in 2011, which were estimated when the base model for the Gulf of Mexico stock of cobia was fitted, were 3,030 mt and 0.29, respectively.

*Strengths*

Stock Synthesis 3 is able to calculate time series of abundance, total biomass, and annual exploitation.

*Stock abundance*:

The report file that is produced by Stock Synthesis, report.sso, contains a time series section, in which the time series of abundance, recruitment and catch for each of the areas are reported. Output quantities include summary biomass and summary numbers for each gender and growth pattern. The Assessment Workshop Report for the Gulf of Mexico cobia stock has not reported these abundance estimates, but they will be available in the output file for Run 1.

*Biomass:*

Stock Synthesis produces an estimate of total annual biomass (Table 3.4, Fig. 3.33). The estimate (for Run 1) of total biomass for 2011 was 3,030 mt.

*Exploitation:*

Although not reported in the text of the Assessment Workshop Report, the code within the Starter.SS file presented in Appendix C of this report specifies that, for the Gulf of Mexico stock of cobia, Stock synthesis is to set the value of fishing mortality, $F$, to the value of annual exploitation, calculated as the ratio of the weight of the total catch (including discards) to the total biomass. The estimate (for Run 1) of the annual exploitation rate for 2011 was 0.29 (Table 3.6, Assessment Workshop Report).

**ToR 4. Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.**

*Conclusion*

Stock Synthesis calculates a range of population benchmarks and management parameters. Benchmarks calculated for cobia were MFMT = $F_{30\%SPR}$ and MSST = (1 – $M$) $SSB_{30\%SPR}$. The estimates of $F_{current}$ and $SSB_{current}$, which were calculated for 2011 using the base model for cobia, were 0.24 and 2,213 mt, respectively. The ratios $F_{current}/MFMT$ and $SSB_{current}/MSST$, which were calculated using the base model, were 0.63 and 1.73, respectively. These results, which were consistent with those produced by all but one (the model with natural mortality set to 0.26 $y^{-1}$) of the models used in the various sensitivity runs, imply that, in 2011, the Gulf of Mexico stock of cobia was not experiencing overfishing and was not overfished.

*Strengths*

Stock Synthesis possesses well-tested procedures to calculate and output a range of population benchmarks and management parameters.

*Summary*

Stock Synthesis provides estimates of population benchmarks and management parameters. In particular, it is able to produce estimates for indicator variables and reference points based on maximum sustainable yield (MSY), spawning potential ratio (SPR), and spawning stock biomass (SSB), and taking the stock-recruitment relationship into account. SPR is calculated as the equilibrium spawning biomass per recruit that would result from a given year's pattern and the levels of $F$'s and selectivities for that year. For MSY-based reference points, Stock Synthesis searches for a fishing mortality that would maximise the equilibrium yield. For SPR-based reference points, the computer program searches for an $F$ that would produce the specified level of SPR. For spawning biomass-based reference points, the software searches for an $F$ that would produce the specified level of spawning biomass relative to the unfished value.

The management benchmarks, *i.e.*, the Maximum Fishing Mortality Threshold (MFMT) and Minimum Stock Size Threshold (MSST), which were proposed for the Gulf of Mexico stock of cobia by the Assessment Workshop, are appropriate for use in determining the status of that stock. These benchmarks, which were based on the level of fishing mortality and equilibrium spawning stock biomass associated with a spawning potential ratio of 30%, are

$$MFMT = F_{30\%SPR} \quad \text{and} \quad MSST = (1 - M)\, SSB_{30\%SPR},$$

where it was concluded that overfishing was occurring if $F_{\text{current}}$ > MFMT, *i.e.*, $F_{\text{current}}/\text{MFMT} > 1$, and the stock was considered to be overfished if $\text{SSB}_{\text{current}}$ < MSST, *i.e.*, $\text{SSB}_{\text{current}}/\text{MSST} < 1$.These benchmarks are approximations for

$$\text{MFMT} = F_{\text{MSY}} \quad \text{and} \quad \text{MSST} = (1 - M)\,\text{SSB}_{\text{MSY}},$$

where $F_{\text{MSY}}$ is the fishing mortality that produces the maximum sustainable yield MSY, $M$ is the point estimate of natural mortality for fully recruited ages, and $\text{SSB}_{\text{MSY}}$ is the equilibrium spawning stock biomass that produces MSY. The benchmarks for the Gulf of Mexico stock of cobia use proxies, where these proxies were based on a spawning potential ratio SPR of 30%. Thus, the proxy that was used for $F_{\text{MSY}}$ was the fishing mortality, $F_{30\%\text{SPR}}$, which produces a spawning stock biomass per recruit that is 30% of the spawning stock biomass per recruit produced when the stock is not fished, *i.e.* an SPR of 30%. The proxy that was used for $\text{SSB}_{\text{MSY}}$ was the corresponding value of equilibrium spawning stock biomass, *i.e.* the spawning stock biomass $\text{SSB}_{30\%\text{SPR}}$ that is produced with a fishing mortality of $F_{30\%\text{SPR}}$.

Although Stock Synthesis is able to estimate MSY-based rather than SPR-based reference points, the Assessment Panel chose to use the proxies $F_{30\%\text{SPR}}$ and $\text{SSB}_{30\%\text{SPR}}$ rather than $F_{\text{MSY}}$ and $\text{SSB}_{\text{MSY}}$. The latter two reference points are likely to be more appropriate if assessing "the capacity of a fishery to produce the maximum sustainable yield on a continuing basis" (Magnuson-Stevens Fishery Conservation and Management Act, May 2007).

$F_{\text{current}}$ was calculated as the geometric mean of the estimates of the three most recent annual fishing mortalities, *i.e.*, the fishing mortalities for 2009-2011, where annual fishing mortality was estimated by its proxy, exploitation rate, calculated as the ratio of the total catch (including discards) to estimated total biomass. $\text{SSB}_{\text{current}}$ was the estimate of spawning stock biomass for 2011.

Table 3.8 of the Assessment Workshop Report, a subset of which is reproduced below, contains the values of the current (2011) fishing mortality and spawning stock biomass for Gulf of Mexico cobia, the values of the MFMT and MSST benchmarks for this stock, and the results of the stock determination for each of the models that were explored in the assessment. The only one of these models, for which the current fishing mortality exceeded MFMT (*i.e.*, overfishing was occurring) or the current SSB was less than MSST (*i.e.*, the stock was overfished), was the sensitivity trial in which a low value of natural mortality was employed as the base level when scaling the Lorenzen (1996) estimates to determine age-dependent estimates of natural mortality.

Quoted from Assessment Workshop Report: "Table 3.8, Assessment Workshop Report. Reference points and benchmarks from sensitivity runs for Gulf of Mexico cobia from SS. Benchmarks are reported for SPR 30%. Current refers to the geometric mean of 2009-2011 for F. MSST = (1-M)*SSBSPR30% with M = 0.38 $y^{-1}$ for all models except runs 2 (M = 0.26 $y^{-1}$) and 3 (M = 0.50 $y^{-1}$)".

| Run | Model | Fcurrent | SSB2011 | MFMT | MSST | F/MFMT | SSB/MSST | Overfishing occurring? | Overfished? |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Base model | 0.24 | 2213 | 0.38 | 1280 | 0.63 | 1.73 | No | No |
| 2 | M_Low | 0.3 | 1872 | 0.29 | 2443 | **1.05** | **0.77** | **Yes** | **Yes** |
| 3 | M_High | 0.18 | 2587 | 0.45 | 804 | 0.4 | 3.22 | No | No |
| 4 | D_High | 0.24 | 2197 | 0.37 | 1302 | 0.65 | 1.69 | No | No |
| 5 | Steepness=0.7 | 0.24 | 2121 | 0.39 | 1174 | 0.63 | 1.81 | No | No |
| 6 | Steepness=0.8 | 0.24 | 2168 | 0.38 | 1257 | 0.64 | 1.73 | No | No |
| 7 | MRFSS only | 0.26 | 1921 | 0.37 | 1277 | 0.7 | 1.5 | No | No |
| 8 | HB only | 0.19 | 2940 | 0.37 | 1301 | 0.52 | 2.26 | No | No |
| 9 | Stock synthesis weighted | 0.22 | 2340 | 0.35 | 1273 | 0.58 | 1.85 | No | No |
| 10 | Francis (2011) weighting | 0.22 | 2415 | 0.38 | 1305 | 0.61 | 1.84 | No | No |

**ToR 5. Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.**

*Conclusions*

Stock Synthesis provides a well-tested procedure to project the model through a range of future years, using a fishing rate based on MSY, SPR, a specified target biomass, or a multiple of the recent average fishing rate, and producing estimates of yield and key management parameters, thereby allowing assessment of future stock condition. The methods used, which are recognised as being of high quality, are designed to produce the estimates of future population status that are needed by managers. For the base model, fishing mortality would be increased from $F_{\text{current}}$ if adjusted to $F_{\text{OY}}$ or $F_{30\%\text{SPR}}$. Projections from 2013 to 2019 suggest that spawning stock biomass would increase from $\text{SSB}_{\text{current}}$ if fishing mortality was maintained at $F_{\text{current}}$, increase to a lesser extent if fishing mortality was increased to $F_{\text{OY}}$, and decline very slightly if fishing mortality was increased to $F_{30\%\text{SPR}}$. Yield would be expected to increase under each of these three fishing mortalities. The condition of the stock would be expected to continue to be classified as "not overfished, with overfishing not occurring".

*Strengths*

Projections are undertaken using the well-tested procedures within Stock Synthesis.

*Weaknesses*

It would have been useful to have undertaken a projection using a model with a lower steepness, such as 0.8.

*Summary*

Stock Synthesis includes a well-tested procedure to project the future stock status that would be expected to result when using a fishing rate based on MSY, SPR, a specified target biomass, or a multiple of the recent average fishing rate. Use of this procedure ensures consistency of model predictions with the assumptions, with the parameter estimates obtained by fitting the model, and with the length and age structure predicted as the current state of the stock. It is thus highly applicable for use with the Gulf of Mexico stock of cobia.

Deterministic projections for 2013 to 2019 were run for the Gulf of Mexico stock of cobia using three models, *i.e.*, the base model (Run 1), and the low and high mortality models (Runs 2 and 3, respectively), which the Assessment Panel considered representative of possible alternative states of nature. The projections were made using fishing rates set to MFMT (*i.e.*, the proxy $F_{30\%SPR}$ for $F_{MSY}$), $F_{OY}$ (*i.e.*, 75% of $F_{30\%SPR}$), and $F_{current}$, where this last value was calculated as the geometric mean of the annual values of $F$ for the last three years, *i.e.*, 2009-2011. The fishing mortality of the shrimp fishery during the projection period was assumed to remain constant, and was set to the geometric mean of the annual fishing mortalities for this fishery over the last three years, *i.e.*, 2009-2011. Selectivity, discarding, and retention patterns were assumed to be the same as those experienced in the five most recent years, *i.e.*, 2007-2011, while the distribution of catches among the fishing fleets, *i.e.*, fisheries, reflected the distribution of average fishing intensities among those fleets in 2009-2011. Recruitment during the projection period was calculated as the value predicted by the stock-recruitment relationship. The base model was also projected using a fishing mortality of $F_{30\%SPR}$ for 1000 samples generated using the bootstrap facility within Stock Synthesis to produce distributions of the estimated yields predicted by the model for each year between 2012 and 2019 (Fig. 3.63, Assessment Workshop Report).

The final year of the time series of data used in the assessment for the Gulf of Mexico stock of cobia was 2011. In order to carry out projections, it was therefore necessary to estimate the removals that were likely to have occurred in 2012. Accordingly, removals of cobia for each of the fisheries in 2012 were estimated using a fixed fishing mortality set to the geometric average of the annual fishing mortalities in 2009-2011.

The methods used in Stock Synthesis to predict the outcomes expected between 2013 and 2019 were considered to be of a high quality. The quality of the resulting projections depends, however, on the extent to which the alternative states of nature represented by the different models used in the projection are likely to be representative of the true state of nature, and the extent to which each of those alternative models provides a reliable representation of the dynamics of the stock. The results of the projections should thus be considered in the context of the accuracy and precision of the predictions made by the model with respect to the input data they were intended to represent.

Although the three models used in the projections bracket the range of estimates of natural mortality for cobia, the estimates of steepness for these models range only between 0.92 and 0.96, *i.e.*, there will be little reduction in recruitment as spawning stock biomass declines, until the depletion in spawning stock biomass becomes severe. There would have been value in considering a model with a considerably lower value of steepness, *e.g.*, 0.8, to represent an alternative state of nature, which, given the nature of the input data and the uncertainty of the estimate of steepness, appears feasible.

The results obtained from the projections are presented in Table 3.9 and Figures 3.59-3.70 of the Assessment Workshop Report. Estimates of stock condition depend on which of the states of nature explored in the assessment is most likely to reflect the true state of nature. Of the three scenarios considered in the assessment, that represented by the base model (Run 1) would be considered to provide the best description of the data that were available, given the assumptions that were made regarding those data, the biology of the cobia stock, and the fisheries exploiting this stock. For the base model, fishing mortality would be increased from $F_{\text{current}}$ if adjusted to $F_{\text{OY}}$ or $F_{30\%\text{SPR}}$. The base model predicts that spawning stock biomass would be expected to increase from $\text{SSB}_{\text{current}}$ if fishing mortality was maintained at $F_{\text{current}}$, increase to a lesser extent if fishing mortality was increased to $F_{\text{OY}}$, and decline very slightly if fishing mortality was increased to $F_{30\%\text{SPR}}$. Yield would increase under each of these three fishing mortalities. If the model with the lower natural mortality, *i.e.*, Run 2, represented the true state of nature, continued fishing with a fishing mortality of $F_{\text{current}}$ is predicted to allow the spawning biomass to increase beyond the MSST by 2014, *i.e.*, become no longer overfished, despite the fact that overfishing was continuing. The reduction in fishing mortality associated with $F_{\text{OY}}$ or $F_{30\%\text{SPR}}$ would result in overfishing no longer occurring and would produce an increase in spawning stock biomass such that, by 2014, the stock would no longer be classified as being overfished. If natural mortality was greater, *i.e.*, Run 3, spawning stock biomass would increase if fishing mortality was maintained at $F_{\text{current}}$ but would decline if it was set to $F_{\text{OY}}$, and would decline to an even greater extent if fishing mortality was set to $F_{30\%\text{SPR}}$.

It would have been informative to explore the consequences (for each pair of putative states of nature) of incorrectly assuming that one of these alternative states of nature was true, and setting allowable catches accordingly, when in fact one of the alternative states of nature was the "true" state. Such an analysis allows an assessment of the robustness of an incorrect decision relating to which of the alternative models is considered most likely to represent the true state of nature.

**ToR 6. Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.**

- **Provide measures of uncertainty for estimated parameters**
- **Ensure that the implications of uncertainty in technical conclusions are clearly stated**
- **If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternative states of nature, presented for review.**
- **Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments**
- **Provide justification for the weightings used in producing the combinations of models**

*Conclusions*

The methods within Stock Synthesis that may be used to explore uncertainty include calculation of estimates of asymptotic standard errors, calculation of likelihood profiles, MCMC analyses, and bootstrapping. These tools are complemented by auxiliary routines that allow production of diagnostic plots, which also assist in communicating the uncertainty of estimates. The software encourages exploration of alternative model structures and sensitivity to alternative values of parameters or functional forms. The model that was developed for the Gulf of Mexico stock of cobia employed an appropriate set of these methods. Probability distributions were produced for initial equilibrium biomass and steepness, unfished total and spawning biomass, and spawning biomass in 2011. As the iterative approach required to calculate $P^*$ cannot be implemented in Stock Synthesis, Stock Synthesis "calculates the expected time series of probabilities that the $F$ resulting from a specified harvest policy would exceed a specified level" (Methot and Wetzel, 2012).

*Strengths*

- Stock Synthesis provides an extensive suite of methods that may be used to explore uncertainty.
- The retrospective analysis revealed no strong systematic patterns.
- Bootstrapping was used to produce probability distributions

*Summary*

Stock Synthesis provides a number of methods that may be used to characterize the uncertainty associated with the estimates of parameters, benchmark estimates, and predicted values of parameters. These include options to generate likelihood profiles and to run a bootstrapping or Markov Chain Monte Carlo (MCMC) analysis. The software is well suited for use in exploring the uncertainty associated with the models that were fitted to the Gulf of Mexico stock of cobia. Thus, for each run of the Stock Synthesis model for this stock, estimates of asymptotic standard errors would have been calculated for each of the parameters that were estimated (see Table 3.1, Assessment Workshop Report, for parameter estimates and estimates of asymptotic standard errors for the base model, Run 1, for which the average value of natural mortality for fully-selected cobia was $M$ = 0.38 $y^{-1}$ and estimated steepness = 0.925). These standard errors may be considered to represent minimum values for the uncertainty of the estimated parameters. The uncertainty of selected parameter estimates for the Gulf of Mexico cobia stock was also characterized using the results from bootstrapping (Table 3.2, Figs 3.26 and 3.27). Additional uncertainties (sensitivities) arising from differences in model structure or data input for the cobia model were also assessed by re-running Stock Synthesis using those alternative model structures or data sets.

The initial run (Run 1) was carried out using the model structure that had been proposed for the Gulf of Mexico stock of cobia and estimating the steepness parameter of the Beverton and Holt stock-recruitment relationship. Bootstrapping of this model demonstrated that, given the data that were available, the steepness of the stock recruitment relationship was estimated imprecisely, a result which was confirmed by constructing likelihood profiles for this parameter. A number of sensitivity runs of Stock Synthesis were then run to explore the effect of varying this and other parameters, or the methods employed in the analysis.

As is typical in stock assessment, exploratory runs for the Gulf of Mexico stock of cobia were first employed to determine a base model for the assessment, *i.e.*, a model that is considered the most likely of the alternative model configurations that have been proposed. Despite the imprecision of the estimate of steepness, the decision was made at the Assessment Workshop to retain Run 1 as the base model as parameter estimates and patterns of stock dynamics were similar for the models using alterative estimates of steepness.

The Assessment Workshop selected the models with low $M$ (Run 2) and high $M$ (Run 3) as representative of alternative states of nature. Projections using these models were explored.

While the iterative approach required to calculate $P^*$ cannot be implemented in Stock Synthesis, a complementary approach has been developed to produce estimates of the probability that $F$, the fishing rate based on MSY, SPR, a specified target biomass, or a multiple of the recent average fishing rate that is employed in the projection, exceeds the OFL (Methot and Wetzel, 2012). These authors advise that, whereas the $P^*$ approach calculates the future stream of annual catches that would have a specified annual probability of $F >$ OFL, Stock Synthesis "calculates the expected time series of probabilities that the $F$ resulting from a specified harvest policy would exceed a specified level".

The models were not combined, but presented as alternatives for consideration by the Review Panel.

**ToR 7. If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.**

The Review was undertaken as a desktop review, rather than a review within a workshop setting. Accordingly, it was not possible for the recommendations made in review reports to be acted upon, nor to ensure that the results were incorporated accurately in the resultant Stock Assessment Report.

**ToR 8. Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.**

The SEDAR Process provides a very sound basis for stock assessment. It has ensured that all aspects of the assessment process for the Gulf of Mexico cobia, from collation of data through to model development, exploration, and production of management advice, have been documented in detail, including the underlying reasons for decisions that were made concerning data to be used and model structure to be employed. For the reviewer, it has thus provided a thorough understanding of the details of the assessment and assisted in identifying opportunities for improvement and in detecting errors or inadequacies.

The Terms of Reference for the Assessment Process, which are presented below, are now examined and comment is made on the degree to which these were addressed.

1. Review and provide justifications for any changes in data following the data workshop and any analyses suggested by the data workshop. Summarize data as used in each assessment model.

   Accomplished.

2. Recommend a model configuration which is deemed most reliable for providing management advice using available compatible data. Document all input data, assumptions, and equations.

   The configuration of the model for cobia that was set up within the Stock Synthesis framework was described. The equations used within Stock Synthesis were not described in the Assessment Workshop Report. This is understandable as, to some extent, the rate of development of this software has outpaced the development of the technical descriptions relating to the features within the Stock Synthesis software. Methot and Wetzel (2012) have recently addressed this issue, however, and their recent paper should be cited in the Assessment Workshop Report.

3. Incorporate known applicable environmental covariates into the selected model, and provide justification for why any of those covariates cannot be included at the time of the assessment.

   No environmental covariates were identified by the Data or Assessment Workshops.

4. Provide estimates of stock population parameters.
   • Include fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship, and other parameters as appropriate given data availability and modeling approaches
   • Include appropriate and representative measures of precision for parameter estimates

   Accomplished.

5. Characterize uncertainty in the assessment and estimated values.
   • Consider components such as input data, modeling approach, and model configuration
   • Provide appropriate measures of model performance, reliability, and 'goodness of fit'

   Accomplished.

6. Provide yield-per-recruit, spawner-per-recruit, and stock-recruitment evaluations.

   Accomplished.

7. Provide estimates of stock status relative to management criteria consistent with applicable FMPs, proposed FMPs and Amendments, other ongoing or proposed management programs, and National Standards for each model run presented for review.

   Accomplished.

8. Project future stock conditions and develop rebuilding schedules if warranted, including estimated generation time. Develop stock projections in accordance with the following:
   A) If stock is overfished:
      F=0, FCurrent, FMSY, FOY
      F=FRebuild (max that permits rebuild in allowed time)
   B) If stock is undergoing overfishing:
      F= FCurrent, FMSY, FOY
   C) If stock is neither overfished nor undergoing overfishing:
      F= FCurrent, FMSY, FOY
   D) If data limitations preclude classic projections (i.e. A, B, C above), explore alternate models to provide management advice

   Accomplished.

9. Provide a probability distribution function for the base model, or a combination of models that represent alternate states of nature, presented for review.
   - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments for use with the Tier 1 ABC control rule
   - Provide justification for the weightings used in producing combinations of models

   The Assessment Workshop Report noted that three of the sensitivity runs had been considered as alternate states of nature, and projections had been run for each of these The Assessment Workshop Report advised that probability distribution functions had been developed for the subset of three runs and would "be made available to the Scientific and Statistical Committee (SSC) for the development of management advice, including OFL and ABC". No information relating to these probability distribution functions was presented in the Report.

10. Provide recommendations for future research and data collection. Be as specific as possible in describing sampling design and intensity, and emphasize items which will improve assessment capabilities and reliability. Recommend the interval and type for the next assessment.

    Attention was directed to the research recommendations that were made in the Data Workshop Report. The Workshop Assessment Report identified gaps in data, which, if addressed, would improve the assessment capabilities and reliability. Specific sampling design and intensity were not discussed. No recommendations relating to the interval and type for the next assessment were made by the Assessment Workshop.

11. Prepare a spreadsheet containing all model parameter estimates and all relevant population information resulting from model estimates and projection and simulation exercises. Include all data included in assessment report tables and all data that support assessment workshop figures.

    A spreadsheet was not provided in the documentation that was circulated to the Review Panel. The Assessment Workshop addressed this Term of Reference in its Report by providing a table listing the estimates for all parameters used in the model and presenting a listing of each of the input files required to run the Stock Synthesis model for Gulf of Mexico cobia.

12. Complete the Assessment Workshop Report (Section III: SEDAR Stock Assessment Report).

    Accomplished.

**ToR 9. Make any additional recommendations or prioritizations warranted.**

- **Clearly denote research and monitoring needs that could improve the reliability of future assessments**

A number of research needs, which are listed below in order of priority, were identified in the course of the desk review. As expected, these were highly consistent with, and thus overlap, many of the research needs that had been identified by the Data and Assessment workshops.

1. Review or establish programs to collect data on the length composition and age-at-length compositions of landings and discards from each commercial gear and from each recreational fishing mode, and of bycatch of cobia from the shrimp fishery. Ensure that the statistical design and spatial coverage of survey or sampling programs are appropriate and that survey or sampling intensity is sufficient to produce estimates of the required precision for Gulf of Mexico cobia. Set goals for performance and establish and monitor performance criteria to assess the quality and completeness of data collection programs. This item is of the highest priority as it will provide information required by Stock Synthesis to determine the selectivity and retention curves for cobia for the commercial, recreational, and shrimp fisheries, the lack of which is a key source of uncertainty in the model.
2. Undertake research to determine reliable relationships between the proportion of females that are mature and both length and age for the Gulf of Mexico stock of cobia. This item is also of high priority, as the maturity information that is currently used is imprecise. The calculation of spawning stock biomass, a crucial parameter in the calculation of benchmarks and assessment of stock status, should be based on reliable data.
3. Review programs that are used to collect discard data for cobia (and data on the bycatch of cobia by the shrimp fishery), and refine these programs to ensure that accurate and complete data estimates of the discards (and bycatch) are collected. Ensure that the statistical design and spatial coverage of survey or sampling programs are appropriate

and that survey or sampling intensity is sufficient to produce estimates for Gulf of Mexico cobia that are of the required precision. Set goals for performance and establish and monitor performance criteria to assess the quality and completeness of data collection programs and provide feedback regarding performance to those programs. While this research item will not provide immediate improvement in the quality of the assessment, it is important that action is taken as soon as possible to improve the accuracy and precision of the data relating to the quantities of fish that are discarded from each of the fisheries, such that, in the future, the time series of discards become more reliable.

4. A comprehensive genetic study of cobia should be undertaken, with the following objectives:
    a. to confirm the preliminary genetic findings of Darden for cobia in the Gulf of Mexico and US Atlantic Coast, using samples with sample sizes greater than 100 at all sites, thereby addressing the issue in that earlier study that sizes of samples from the north of the Gulf of Mexico and from waters off the west coast of Florida had been small;
    b. to increase the spatial resolution of the genetic sampling in the region of overlap of the two stocks, such that the boundary between the stocks or extent of overlap can be determined;
    c. to extend sampling into Mexican waters and thereby determine the southern boundary of the Gulf of Mexico stock;
    d. to reconcile the differences in the findings reported in SEDAR28-DW01 and those reported in SEDAR28-RD09, where the former advises that collections from offshore in the Gulf of Mexico were genetically distinct from those offshore in the South Atlantic region while the latter reports that the results of the study "suggest the offshore groups are genetically homogenous, even between the SA and GOM";
    e. to extend sampling beyond the spawning season and ascertain whether catches of fish may be assigned reliably to either the Gulf of Mexico or South Atlantic stock on the basis of the area in which they are caught.

    Some of the objectives of this study, *e.g.*, identification of the southern boundary of the stock, would also benefit from tagging or other studies. As this study will take some time before completion, it has been assigned a lower priority than the previous items. Determination of the southern stock boundary, however, is important to ensure that other removals from the stock are not occurring in Mexican waters, as such removals are not taken into account in the current assessment.
5. Undertake research to determine the discard mortality of Gulf of Mexico cobia that are discarded from the catches of each commercial fishing gear or each recreational fishing mode, recognising that such mortality is likely to differ among different categories into which the discarded fish are classified, *e.g.*, "alive", "mostly alive", and "mostly dead".
6. In future stock assessments for the Gulf of Mexico stock of cobia, explore whether the use of an age-dependent rather than constant $M$ results in a significant improvement in fit, considering the Lorenzen and alternative functional forms of the relationship with age and the alternative of estimating the value of the age-dependent $M$ at each age (or range of ages).

7. In future stock assessments, explore the sensitivity of the model to the uncertainty of the landings data.
8. Develop an ageing error matrix for Gulf of Mexico cobia.
9. A research study should be undertaken to determine an approach (or approaches) by which an appropriate range (or ranges) of feasible values of *M* for a species might be selected for use in stock assessment as alternate plausible states of nature. The need to determine an appropriate range for sensitivity runs arose in both the cobia and Spanish mackerel assessments, but the final decisions on the range to use were rather arbitrary and subjective. The issue arises in almost all assessments and it would be useful to establish an objective protocol to determine an appropriate range of values of *M* to be explored.
10. Develop a fishery-independent survey for Gulf of Mexico cobia, or investigate what changes would be required to make data from an existing fishery-independent survey appropriate for use as an index of abundance.
11. As a low research priority, assess whether, in future refinement of the Stock Synthesis model, sexually dimorphic growth should be introduced. Note that the benefit of this might only be realised if appropriate sex composition data for landings and discards are available for input, and length and age-at-length compositions are sexually disaggregated.

## *4.2 Gulf of Mexico Spanish Mackerel (***Scomberomorus maculates***)*

### ToR 10. Evaluate the quality and applicability of data used in the assessment.

*Conclusions*

The data compiled for the Gulf of Mexico stock of Spanish mackerel by the Data Workshop are the best that are available. Certainly, some aspects of the data are imprecise, *e.g.*, discards from commercial catches, and there are data gaps, such as the lack of length and age-at-length composition data for discards. Nevertheless, the data that are available are of a quality that would allow a broad assessment of the likely condition of the stock, which, although uncertain, would be useful to fisheries managers.

*Strengths*

- The collation of life history data for the Gulf of Mexico stock of Spanish mackerel.
- The collation of commercial landings data to produce time series of landings by gillnet, handline, and other gears from 1887, and, particularly, more precise data from 1950.
- The collation of a time series of estimates of bycatch of Spanish mackerel by the shrimp fishery from 1972, using a Bayesian model.
- The collation of recreational fisheries data from different sources to produce sound time series of landings by fishing mode from 1955, and, particularly, more precise data from 1981.
- The collation of data to produce time series of discards from the commercial gears and recreational fishing modes.

- The collation of length composition data to characterize the landings by the commercial and recreational fisheries.
- The collation of a fishery-independent and two fishery-dependent indices of abundance, and the use of appropriate statistical analyses to standardize those indices of abundance.

*Weaknesses*

- Lack of definition of the southern boundary of the Gulf of Mexico stock of Spanish mackerel.
- Uncertainty of the age at which 50% of Spanish mackerel are mature.
- The unreliable nature of the discard data due to low reporting, low intercept rates, and inadequate data collection programs.
- Inadequate sampling of length and age composition data from commercial landings and from bycatch of Spanish mackerel from the shrimp fishery.
- Lack of length and age composition sampling from commercial and recreational discards.

***Specific comments***

*Stock structure*

Spanish mackerel from US waters within the Gulf of Mexico and to the north of Highway 1 in Monroe County, Florida, which have been designated the “Gulf of Mexico stock”, were the subject of the stock assessment. The Data Workshop Report acknowledged that studies of stock structure for Spanish mackerel in the Gulf of Mexico and off the US South Atlantic coast have produced conflicting results. The Report advised that, while early morphometric, meristic, allozyme, and electrophoresis studies and a more recent study of otolith shape and chemistry identify differences between fish from the Gulf of Mexico and those from the South Atlantic coast, a recent mitochondrial and nuclear DNA study did not detect a difference, which suggests at least a small amount of genetic flow between the two regions sufficient to homogenize allele frequencies. Based on results of the earlier studies, and taking into account spawning locations, stock distribution patterns, and catch history, the two groups of fish were recognized as separate management units, with a boundary at US Highway 1 in Monroe County, Florida, which has served as the boundary for data collection from the commercial and recreational fisheries. The evidence supporting the proposed stock structure and, in particular, the boundary separating the two putative stocks is not strong. Further studies to improve understanding of stock composition, *e.g.*, genetic, otolith microchemistry, species composition of parasites, tagging studies, should be initiated.

In the review of data relating to stock structure for Spanish mackerel, the Data Workshop Report makes no mention of the southern boundary of the putative Gulf of Mexico stock, and whether this stock extends into Mexican waters. If such extension is the case, failure to take into account Mexican catches of Spanish mackerel would result in bias in assessment results. The stock assessment that has been undertaken implicitly assumes that the Gulf of Mexico stock of Spanish mackerel is confined to US waters, and thus conclusions from the assessment must be considered conditional on the validity of this assumption.

*Biological data*

The use of Hoenig's (1983) equation for fish and maximum age to produce an estimate of natural mortality *M* for a fish stock is accepted practice when no data are available from the stock to allow direct estimation of this parameter. Thus, noting also that other methods of estimating *M* from life history data were investigated, its use of Hoenig's (1983) equation to estimate the base value of *M* for Gulf of Mexico Spanish mackerel is endorsed. The Data and Assessment Workshops also correctly recognized that this estimate of *M* was imprecise, and that the results of stock assessment were likely to be sensitive to this uncertainty.

For the reasons noted earlier when discussing the assessment for Gulf of Mexico cobia, use of the Lorenzen (1996) equation to derive age-dependent estimates of natural mortality *M* for Gulf of Mexico Spanish mackerel is not endorsed. In his report to the CIE on the stock assessments conducted for yellowtail flounder and Atlantic herring at Woods Hole in 2012, Francis (2012) advised that prediction of *M*, and, through body weight, its variation with age for an individual species, using Lorenzen's (1996) equation was likely to be highly imprecise, as was evident in the wide scatter about the regression line in Lorenzen's Figure 1. Francis observed that, for about one-third of Lorenzen's data points, predicted and observed *M*s appeared to differ by a factor of more than 2. Furthermore, in the case of both herring and yellowtail, the values of *M* estimated by Lorenzen's equation differed markedly from the values estimated using Hoenig's (1983) equation and had to be scaled substantially for use in the yellowtail flounder and Atlantic herring assessments. Francis (2012) raised the very valid point that, if the estimates produced for a species by Lorenzen's equation provide such unreliable estimates that the mean *M* differs from the estimate calculated using Hoenig's (1983) equation by a factor that differs markedly from 1, can it be considered sufficiently reliable to estimate how *M* varies with age within these species?

There has been no test to assess whether the introduction of the additional complexity associated with age-dependent natural mortality to the model for Gulf of Mexico Spanish mackerel is justified by the resultant improvement in fit that was obtained. It is recommended that a model employing a constant value of *M* is fitted to the Spanish mackerel data. If this model fits just as well as the model that employs an age-dependent *M*, then the simpler model should be used. If the age-dependent model produces a better fit, it would be better to estimate age-dependent *M* within the assessment model rather than assuming that it is of the form predicted by the Lorenzen (1996) equation.

Data on the rate of mortality for discarded hook and line caught Spanish mackerel are limited, and thus the estimates of discard mortality are imprecise. It was pleasing to note that the Assessment Workshop investigated the implications of uncertainty in the estimate of discard mortality by conducting a sensitivity run. Further research is required to produce a more reliable estimate.

Although only the parameter estimates of the von Bertalanffy growth curve fitted to the length at age data using the Diaz *et al.* (2004) model are input to Stock Synthesis to provide the initial values of the growth curve fitted within the assessment model, the growth curve developed for the Data Workshop is of value as a basis of comparison with the growth curve fitted by Stock Synthesis. Fitting the growth curve within Stock Synthesis ensures that the assumptions regarding selectivity are consistent with those employed in other parts of the model and that uncertainty in the estimates of growth is reflected in the estimates of the spawning stock biomass, fishing mortality and benchmarks.

Spanish mackerel exhibit dimorphic growth, yet the Stock Synthesis model considers only pooled data. In future refinement of the model, consideration should be given to modelling both females and males rather than combined sexes, noting that the benefit of this might only be realised if appropriate sex composition data for landings and discards are available for input, and length and age-at-length compositions are sexually disaggregated.

The Data Workshop Report advises that, due to a paucity of age data, percentage maturity was related to size class rather than age. It is not clear whether the data reported in Tables 2.3 and 2.4 represent only fish collected during the spawning season, *i.e.*, when mature fish can be distinguished readily from immature fish on the basis of macroscopic examination of their gonads. It is unclear how the age at 50% maturity for females was estimated, *i.e.*, was this obtained by transforming from length to age using the fitted growth curve. Further details are required. The value of 0.2 y seems surprisingly low for the age at 50% maturity of females. This low value drew comment from the Data Workshop, which suggested that it might have been due to identification of mature fish using macroscopic examination and recommended the use of the age at 50% maturity that was determined for the Atlantic stock of Spanish mackerel, *i.e.*, 0.7 y. Using the relationship between age at maturity and maximum age determined by Froese and Binohlan (2000), a species with an age at maturity of 0.2 y would be expected to have a maximum age of 0.8 y, a value far lower than the 11 years that the Data Workshop employed when estimating *M*. Further research to determine the relationship between percentage mature and age appears to be necessary given this unusually low value and the statement in Section 2.8 of the Data Workshop Report that there is a paucity of age data for Gulf of Mexico Spanish mackerel.

*Commercial landings*

The decision to extend the time series of landings data as far back in time as possible was endorsed, although it is noted that (1) the data in Table 3.2 of the Data Workshop Report were very sparse until 1927, and (2) the reliability of commercial data improved substantially in 1950. Note that it would be useful to state in the heading of Table 3.2 whether the gaps in data prior to 1927 represent missing years, or, as reported in Table 3.4, represent zero landings. As an alternative to using data extending back to 1887, it might be interesting to compare the results obtained from the model by using a shorter time series ranging from 1927 to 2011, noting that the imprecision associated with imputing the missing landings between 1887 and 1926 should also be considered.

The decision made by the Data Workshop to combine landings from commercial fishing gears other than gillnets and handlines was not explained. Was it to reduce the number of time series of landings considered in Stock Synthesis, and thereby reduce complexity, or was the decision made in recognition of a lack of data to characterize the length composition of each of the miscellaneous gears? A decision made because of the latter reason would indicate an inadequacy of the data collection programs, which might need to be addressed.

Until 1996, the annual landings of the combined commercial gears, other than gillnets and handlines, were typically of a greater magnitude than the landings made by handlines, and subsequently were of similar magnitude. As recommended by the Data Workshop, the Assessment Workshop apportioned these combined landings of the miscellaneous commercial gears to the landings of the two primary gears in proportion to the annual landings of those last two gears. The length composition of the resultant time series of landings thus reflect a weighted combination of the length compositions of the catches from the different fishing gears, each of which would have reflected the selectivity curve of that gear. Length composition data collected from the landings taken using gillnets or those taken using handlines will therefore fail to reflect the length compositions of the mixtures of landings of those primary gears and the contribution from the landings of the miscellaneous gears, particularly in the case of the length composition data for the handline landings.

Comment is made in Section 3.3.5 of the Data Workshop Report that there was a precipitous decrease in landings in 1977 and subsequent years following cold weather in Florida in 1976-77. This environmental event was not explored by the Assessment Workshop, but it might be interesting to consider whether the cold weather caused increased mortality or reduced growth, and whether this could explain the reduced landings that followed the 1977 event.

The Data Workshop is commended for its collation of the commercial landings data from the various sources and development of a time series of commercial landings suitable for use in the stock assessment process for the Gulf of Mexico stock of Spanish mackerel. It would be useful to assess and report the imprecision of the annual estimates.

Although the Data Workshop Report advised that the decision was made that discarded fish, which were designated as “kept”, should be removed from the amount of discards and added to landings, it is unclear whether this was done when preparing the landings and discard data for the Assessment Workshop.

Discards recorded for the commercial fisheries are highly uncertain due to low reporting rates and are likely to represent minimum values. Programs to collect discard data from commercial fishers need to be reviewed to identify ways in which more reliable discard data might be obtained.

The Bayesian model, which assumed that counts within cells had a negative binomial distribution, appeared an appropriate approach to estimating the bycatch of Spanish mackerel by the shrimp fishery. The Data Workshop advised, however, that, as a consequence of low encounter rate of Spanish mackerel by the shrimp fishery and irregular observer coverage, estimates of bycatch of Spanish mackerel are imprecise, although the mean is likely to be of the appropriate scale.

The Data Workshop Report advised that “sample sizes for developing length compositions were inadequate for a considerable number of year and gear strata”. Sampling to determine the age compositions of commercial landings has also been sparse, particularly for gillnet landings in recent years. There appear to be no data that could be used to characterize the length or age compositions of discards from the commercial fisheries. Data collection programs should be reviewed to identify how they could be improved to collect representative samples of length and age compositions from the landings and discards of the commercial fisheries.

*Recreational landings*

As with the commercial landings data, the Data Workshop is commended for its collation of the recreational landings of Gulf of Mexico Spanish mackerel from the various data sources, and, in particular, the extension of this time series of data back to 1955.

The Assessment Workshop reported that the estimates of discards of Spanish mackerel from the recreational fishery were highly uncertain, due to low intercept rates and the changes in quality control and assurance that had occurred between 1981 and 2011.

Age samples for the recreational fishery were collected by the Southeast Region Headboat Survey (SRHS), as lengths but not ages are typically collected within the MRFSS. No samples were available to characterize the length and age compositions of discards of Spanish mackerel by recreational fishers. Consideration should be given to developing a program to collect representative length and age data from Spanish mackerel that are discarded by the recreational fishery.

*Survey indices*

The recommendation reported in the Data Workshop Report that the fishery-independent SEAMAP survey and the fishery-dependent MRFSS, and FL trip ticket handline/trolling indices, are appropriate for use in the assessment, and that other putative indices should not be used, appears sound. Both the SEAMAP and MRFSS surveys used a delta lognormal model to standardize the data and thereby determine annual indices of abundance. The trip ticket data were standardized using a general linear model with forward stepwise selection.

In Section 5.4.4.6 of the Data Workshop Report, the Working Group advised that the index of abundance based on data from headboats was adequate for use in the assessment, yet the report card for the index advises that, because of the small proportion of observations that reported catches of Spanish mackerel, the Working Group did not endorse the use of the index in the assessment. Table 5.4.4.1 in the Data Workshop Report incorrectly divides total trips by total positive trips and reports the result, 38.89, as the overall percentage of positive trips instead of 2.6%. The incorrect value is then taken from the table and reported as 38.89% in Section 5.4.4.2 of the Data Workshop Report. The overall summary in section 5.1 correctly advises that the headboat index was not recommended for use. Accordingly, the Assessment Workshop did not include this as a survey to be used by Stock Synthesis.

**ToR 11. Evaluate the quality and applicability of methods used to assess the stock.**

*Conclusions*

Stock Synthesis 3, the software within which the model for the Gulf of Mexico stock of Spanish mackerel was developed, has gained international recognition for its quality and the applicability of the methods it uses to assess the condition of fish stocks. The model for Spanish mackerel was of an appropriate structure given the data that were available. Values predicted by the model for Spanish mackerel, including those of benchmarks, were imprecise, however, due to the nature of the input data. Further imprecision of model outputs due to alternative values of key parameters, such as natural mortality and steepness of the stock-recruitment relationship, was explored. Recognising the types of data that were available for input and the uncertainty of model outputs that arose as a consequence of the nature of those input data, the Stock Synthesis base model for Spanish mackerel is of a quality consistent with that which would be considered "best practice", and is able to provide a valuable assessment of the likely condition of the stock in 2011, and, when projected, the likely trajectory of yields and stock condition over the next five to six years.

*Strengths*

- The decision to use Stock Synthesis 3 as the modelling framework and to complement this with the Fishery Simulation Graphics User Interface (Lee *et al*., 2012).
- The structure of the model developed within the Stock Synthesis framework was appropriate given the data that were available.
- The enhancement of Stock Synthesis to allow modelling of a fishery for which the only source of mortality is that associated with discarding of bycatch.
- Use of super periods when data are too imprecise to fit individual values but the median value is considered to be informative.
- The assessment of the uncertainty of parameter estimates was thorough.
- Selectivity runs explored key uncertainties and demonstrated appropriateness of conclusions regarding the current condition of the stock.
- Benchmarks were appropriately calculated.
- Projections were undertaken using two states of nature.

*Weaknesses*

- Subjective decision to set effective sample size to actual sample size capped at a maximum of 100 rather than to use iterative reweighting, such as proposed by Francis (2011).
- Lack of information in abundance indices, and shortness of history of length and age-at-length data.
- Lack of length and age composition data to provide information on the length and age compositions of discards and the shape of the retention curves.
- The assumption that natural mortality is age-dependent and has a form that is proportional to the values predicted by the Lorenzen (1996) has not been tested against the simpler assumption of constant natural mortality over age.
- Imprecision in the estimate of steepness of the stock-recruitment relationship.
- Lack of exploration of uncertainty associated with the time series of commercial and recreational landings.

The assessment was undertaken using Stock Synthesis 3, a fully integrated model that allowed use of all available data for Spanish mackerel in the Gulf of Mexico, including life history data, removals, discards, length compositions of catches, conditional age-at length compositions, and survey indices. Other software packages, which were used in the assessment of the Gulf of Mexico Spanish mackerel stock, were r4SS, which produces graphic displays and explores output from Stock Synthesis, and the "Fishery Simulation" Graphics User Interface (GUI) software (Lee *et al*., 2012), which adds bootstrapping analysis support to Stock Synthesis. Stock Synthesis, supported by these software packages, provides a very flexible assessment framework that produces estimates of key population parameters and their uncertainty. The software allowed exploration of the sensitivity of parameters, stock status indicators, and reference points to changes in the structure of the Spanish mackerel model and its assumptions, and to the exclusion of various survey indices when fitting. It also allowed investigation of yield per recruit, spawner per recruit, and stock-recruitment relationships for Spanish mackerel, and produced estimates of reference points to be used when determining stock status. The Stock Synthesis model was also employed to project the effect of different levels of fishing mortality on future catches and condition of the Gulf of Mexico Spanish mackerel stock. Through bootstrapping, Stock Synthesis was used to develop probability distributions for various variables of interest.

The Assessment Workshop Report advised that, apart from the FWC trip ticket vertical line index, which showed a slight increase in abundance after 2003, predicted values of the abundance indices, which exhibited considerable imprecision, were relatively constant over the periods for which abundance indices were available. As noted by the Assessment Workshop, this implies that the survey indices carry little information regarding trends in abundance. The Assessment Workshop also noted that length and conditional length-at-age data cover only a limited recent period, and thus provide limited information on recruitment to inform the model.

Concern that the estimate of steepness produced when fitting the initial model, *i.e.*, 0.52, was too low, led the Assessment Panel to profile log-likelihood over a range of values of steepness (Fig. 3.31, Assessment Workshop Report), thereby to assess whether the data were sufficiently informative to allow reliable estimation of this parameter. After examining the results of this and other sensitivity runs, retrospective analyses, profiling, and bootstrap runs, the Assessment Panel concluded that a value of 0.8 for steepness "was more reasonable for this species than that estimated by the model (0.52)" (see further comment regarding this decision below), and adopted this configuration (Run 3) as the base model for the assessment. That is, Run 3 was recommended by the Assessment Panel for final projections and status determinations.

The use within Stock Synthesis of super periods when fitting discards of Spanish mackerel from the commercial line gear fishery, the recreational fishery, and the shrimp fishery, is very appropriate given the high uncertainty associated with the estimates of the annual discards for these three fisheries. By fitting estimates of discards to the average value of discards over these super periods, the model "accepts" the overall level but "ignores" inter-annual variability within the discard time series.

The assumption that was made in the assessment that age data were conditional on length is very appropriate. If it had been assumed that the length and age composition data were independent, the fact that some fish were included in both the length and age composition data would introduce bias. Such potential bias is removed by considering ages to be conditional on length.

The decision that, because of a lack of strong evidence that selectivity was dome-shaped and the fact that little improvement in fit was obtained when using such a selectivity pattern, selectivity functions for the commercial line gears and recreational fisheries would be constrained to those with an asymptotic pattern is endorsed. It was good to note that some exploration had been undertaken before coming to this conclusion, but it would have been useful if the results of that exploration had been presented in the Assessment Workshop Report. The representation of the retention curves using two time blocks, *i.e.* the period before 1993 and the period from 1993 onward, to reflect the change in size limit in 1993, is appropriate.

It would have been appropriate to explore whether the improvement in likelihood of the fitted model justified the additional complexity of considering mortality to be age dependent rather than constant. If not justified, the simpler model would be preferred. If use of an age-dependent model was justified, it would be better to estimate the values of the age-dependent mortalities directly, rather than assuming that the relationship has a form that is a scaled version of the values of mortality at age calculated using Lorenzen's (1996) equation.

The use of a maximum effective sample size of 100 fish is arbitrary, however, it is noted that Sensitivity Run 12 explored the effect of reweighting using the MacAllister and Ianelli (1997) approach. It is recommended that, in future analyses, consideration should be given to the methods described by Francis (2011), such that, for example, effective sample sizes for length compositions are calculated using iterative reweighting based on mean length, and possibly reflecting the relative magnitudes of initial sample sizes.

No length or age composition data were available to characterize the discards from the commercial or recreational catches, thus little information was available to estimate the parameters of the logistic retention curves for these fisheries.

The use of a Beverton and Holt stock-recruitment curve is endorsed, but the choice of the value of 0.7 as the value of the standard deviation in recruitment appears arbitrary. The Assessment Workshop Report advised that the profile of likelihoods over a range of values "did not indicate disparity" with the value chosen (Fig. 3.33). It might be pertinent to note, however, that both Smith and Punt (1998) and Maunder and Deriso set $\sigma^2_{\log_e R} = 0.6$. Beddington and Cooke (1983) are cited as reporting from a meta-analysis over many fish species that recruitment is typically log-normally distributed with the average of $\sigma^2_{\log_e R}$ being around 0.6. Mertz and Myers (1996) are reported to have conducted a further meta-analysis and again found that the average value of $\sigma^2_{\log_e R}$ was around 0.6. Interestingly, the likelihood profile (Fig 3.33) suggests that 0.6 might be slightly more appropriate than 0.7.

As advised in the Assessment Workshop Report, Stock Synthesis effectively treats landings as being known without error and thus fits them precisely. Imprecision associated with the early values within the time series of commercial or recreational landings is thus not assessed unless explored through sensitivity runs using alternative scenarios of landings data. It is not apparent from the Assessment Workshop Report that such sensitivity runs were made and thus the implications of the uncertainty associated with the landings data have not been assessed.

In describing Fig. 3.35, it is unclear whether the 14 of the 1000 bootstrap runs, which produced "large convergence values and illogical estimates of virgin biomass" were not simply the results of poor choices of initial values for the parameters used in Stock Synthesis, given that the jitter analysis produced four out of 100 results that failed to converge to the expected values.

The vertical scale used in the profile of change in log-likelihood over the range of values of steepness (Fig. 3.31, Assessment Workshop Report) compresses the range of values of log-likelihood change for values of steepness ranging from (say) 0.4 to 0.9, which is the region of interest. A maximum value on the y-axis of (say) 100, would have more clearly revealed the trend in log-likelihood change.

The conclusion by the Assessment Workshop that the estimate of steepness is imprecise is valid, however, although the range of values that, given the model structure and data, might be considered to fall within a 95% confidence region would probably extend from about 0.4 to about 0.8. The basis for the decision by the Assessment Panel that a value of steepness of 0.8 is “more reasonable” than the estimated value of 0.52 for the Gulf of Mexico stock of Spanish mackerel is not stated. In this context, it is possibly pertinent to note that Francis (2012) has suggested that, when the steepness of the stock-recruitment relationship is imprecise or cannot be estimated reliably, he considers it better to fix the value of steepness at a value, such as 0.75, *i.e.*, the default value recommended in Francis (1993), and which is frequently used in Australia and New Zealand, or the average of published values for the same or similar species. Francis (2012) advises that the uncertainty associated with this parameter should then be explored using sensitivity runs with lower and higher values of steepness. The value of steepness selected by the Assessment Workshop, *i.e.*, 0.8, is of similar magnitude to the value suggested by Francis (2012), *i.e.*, 0.75. Thus, the decision by the Workshop to use a model with a structure similar to that of the original base model but with a fixed value of steepness of 0.8, *i.e.*, the model of Run 3, as the new base model for the Spanish mackerel stock, and to explore the uncertainty associated with this steepness using sensitivity runs with alternative values of steepness, is consistent with best practice, and is therefore endorsed.

The use of the base model, and of a model with similar structure but with steepness fixed at 0.9, as alternative states of nature is endorsed. Given the results of the sensitivity runs, however, it might also have been useful to include a low natural mortality version of the base model as a third state of nature.

**ToR 12. Recommend appropriate estimates of stock abundance, biomass, and exploitation.**

*Conclusions*

Estimates of stock abundance, biomass, and exploitation are produced when the Stock Synthesis model is fitted. The estimates of total biomass and annual exploitation in 2011, which were estimated when the base model for the Gulf of Mexico stock of Spanish mackerel was fitted, were 28,367 mt and 0.1197, respectively.

*Strengths*

Stock Synthesis 3 calculates time series of abundance, total biomass, and annual exploitation.

*Stock abundance*:

The report file that is produced by Stock Synthesis, report.sso, contains a time series section, in which the time series of abundance, recruitment and catch for each of the areas are reported. Output quantities include summary biomass and summary numbers for each gender and growth pattern. The Assessment Workshop Report for the Gulf of Mexico Spanish Mackerel stock has not reported these abundance estimates, but they will be available in the output file for the base model, *i.e.*, Run 3.

*Biomass:*

Stock Synthesis produces an estimate of total annual biomass (Table 3.5, Fig. 3.41). The estimate (for the base model, *i.e.*, Run 3) of total biomass for 2011 was 28,367 mt.

*Exploitation:*

Stock synthesis calculates the value of annual exploitation rate as the ratio of the weight of the total catch (including discards) to the total biomass (Section 3.26, Assessment Workshop Report; Table 3.6, Fig. 3.42). The calculated value of the annual exploitation rate is used as a proxy for the annual value of fishing mortality, *F*. The estimate (for the base model, *i.e.*, Run 3) of the annual exploitation rate for 2011 was 0.1197.

**ToR 13. Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.**

*Conclusions*

Stock Synthesis calculates a range of population benchmarks and management parameters. Benchmarks calculated for Spanish mackerel were MFMT = $F_{30\%\text{SPR}}$ and MSST = (1 – *M*) $\text{SSB}_{30\%\text{SPR}}$. The estimates of $F_{\text{current}}$ and $\text{SSB}_{\text{current}}$, which were calculated for 2011 using the base model, were 0.14 and 19,645 mt, respectively. The ratios $F_{\text{current}}/\text{MFMT}$ and $\text{SSB}_{\text{current}}/\text{MSST}$, which were calculated using the base model, were 0.38 and 3.06, respectively. These results, which were consistent with those produced by all but one (the model with natural mortality set to 0.27 $y^{-1}$) of the models used in the various sensitivity runs, imply that, in 2011, the Gulf of Mexico stock of Spanish mackerel was not experiencing overfishing and was not overfished.

*Strengths*

Stock Synthesis possesses well-tested procedures to calculate and output a range of population benchmarks and management parameters.

*Weaknesses*

Inconsistencies in the values recorded in one of the columns in Table 3.8 made it difficult to assess, with full confidence, whether or not the stock was experiencing overfishing.

*Summary*

The methods used by Stock Synthesis to estimate population benchmarks and management parameters are sound. Stock Synthesis is able to produce estimates for indicator variables and reference points based on maximum sustainable yield (MSY), spawning potential ratio (SPR), and spawning stock biomass (SSB), and taking the stock-recruitment relationship into account. SPR is calculated as the equilibrium spawning biomass per recruit that would result from a given year's pattern and the levels of $F$'s and selectivities for that year. For MSY-based reference points, Stock Synthesis searches for a fishing mortality that would maximise the equilibrium yield. For SPR-based reference points, the computer program searches for an $F$ that would produce the specified level of SPR. For spawning biomass-based reference points, the software searches for an $F$ that would produce the specified level of spawning biomass relative to the unfished value.

The management benchmarks, *i.e.*, the Maximum Fishing Mortality Threshold (MFMT) and Minimum Stock Size Threshold (MSST), which were proposed for the fishery by the Assessment Workshop, are appropriate for use in determining the status of the Gulf of Mexico stock of Spanish mackerel. These two benchmarks were

$$\mathrm{MFMT} = F_{\mathrm{MSY}} \quad \text{and} \quad \mathrm{MSST} = (1 - M)\ \mathrm{SSB}_{\mathrm{MSY}},$$

where $F_{\mathrm{MSY}}$ is the fishing mortality that produces the maximum sustainable yield MSY, $M$ is the point estimate of natural mortality for fully recruited ages calculated using Hoenig's (1983) equation, *i.e.* 0.38 $\mathrm{y}^{-1}$, and $\mathrm{SSB}_{\mathrm{MSY}}$ is the equilibrium spawning stock biomass that produces MSY. The Assessment Workshop Report advises that proxies were used when calculating the above benchmarks, where these proxies were based on a spawning potential ratio (SPR) of 30%. Thus, the proxy that was used for $F_{\mathrm{MSY}}$ was the fishing mortality, $F_{30\%\mathrm{SPR}}$, which produces a spawning stock biomass per recruit that is 30% of the spawning stock biomass per recruit produced when the stock is not fished, *i.e.* an SPR of 30%. The proxy that was used for $\mathrm{SSB}_{\mathrm{MSY}}$ was the corresponding value of equilibrium spawning stock biomass, *i.e.* the spawning stock biomass $\mathrm{SSB}_{30\%\mathrm{SPR}}$ that is produced with a fishing mortality of $F_{30\%\mathrm{SPR}}$.

It is surprising to note that, although Stock Synthesis was able to estimate MSY-based rather than SPR-based reference points, the Assessment Panel chose to use the proxies $F_{30\%\mathrm{SPR}}$ and $\mathrm{SSB}_{30\%\mathrm{SPR}}$ rather than $F_{\mathrm{MSY}}$ and $\mathrm{SSB}_{\mathrm{MSY}}$. The latter two benchmarks are possibly more appropriate.

For the Gulf of Mexico stock of Spanish mackerel, the benchmarks that were used in determining stock status by the Assessment Workshop were

$$\mathrm{MFMT} = F_{30\%\mathrm{SPR}} \quad \text{and} \quad \mathrm{MSST} = (1 - M)\ \mathrm{SSB}_{30\%\mathrm{SPR}},$$

where it was concluded that overfishing was occurring if $F_{\mathrm{current}} > \mathrm{MFMT}$, *i.e.*, $F_{\mathrm{current}}/\mathrm{MFMT} > 1$, and the stock was considered to be overfished if $\mathrm{SSB}_{\mathrm{current}} < \mathrm{MSST}$, *i.e.*, $\mathrm{SSB}_{\mathrm{current}}/\mathrm{MSST} < 1$. $F_{\mathrm{current}}$ was calculated as the geometric mean of the estimates of the three most recent annual fishing mortalities, *i.e.*, the fishing mortalities for 2009-2011, where annual fishing mortality was estimated by its proxy, exploitation rate, calculated as the ratio of the total catch (including discards) to estimated total biomass. $\mathrm{SSB}_{\mathrm{current}}$ was the estimate of spawning stock biomass for 2011.

Note that the specification of the reference points in Section 3.1.9 of the Assessment Workshop Report could be improved, *e.g.* overfished is currently defined as the value of the ratio of $\mathrm{SSB}_{\mathrm{current}}$ to MSST rather than a logical expression.

Table 3.8 of the Assessment Workshop Report, which is reproduced below, contains the values of the current (2011) fishing mortality and spawning stock biomass of the Gulf of Mexico stock of Spanish mackerel, and purports to contain the values of the MFMT and MSST benchmarks, and the results of stock determination for each of the models that were explored in the assessment. According to the caption for this table in the Assessment Workshop Report, $F_{\text{ref}}$ represents $F_{30\%\text{SPR}}$ , and thus, as MFMT has been set to $F_{30\%\text{SPR}}$, the values of MFMT should be equal to those of $F_{\text{ref}}$. As is evident in Table 3.8, this is clearly not the case. There are inconsistencies between the values of $F_{\text{ref}}$ and MFMT for all but three of the 17 runs presented in the Table, Quite frequently, however, the values of $F_{\text{ref}}$ and the ratio of $F_{\text{current}}$ to MFMT in the rows of this Table are equal. The caption to Figure 3.9 advises that, for this figure, the value of $F_{\text{ref}}$ represents the ratio of $F_{\text{current}}$ to MFMT, and it appears likely that this inconsistency between definitions of $F_{\text{ref}}$ has led to the inconsistent values presented in Table 3.8. The fact that there is such inconsistency makes it difficult to accept the accuracy of the estimates of the ratio of $F_{\text{current}}$ to MFMT for any of the runs. Accordingly, while it is not possible from the reported data to assess with complete confidence whether or not the stock is experiencing overfishing, if the values in the column headed "F/MFMT" are correct, then $F_{\text{current}}/\text{MFMT} = 0.38$. From this, and noting the values for this ratio for other selectivity runs, it is very likely that the Gulf of Mexico stock of Spanish mackerel is not currently being subjected to overfishing.

Quoted from Assessment Workshop Report: "Table 3.8. Reference points and benchmarks from sensitivity runs for Gulf of Mexico Spanish mackerel from SS. Benchmarks are reported for SPR 30%. Current refers to geometric mean of 2009-2011 values. MSST is (1-M)*SSBref with M = 0.38, or M=0.27, or M=0.49 representing the M value from the Hoenig maximum age mortality estimator for fully recruited ages from the SEDAR DW corresponding to the Base Model M or the M_LO or M-HI scenario. Ref refers to reference metric, either F30% SPR or SSB 30% SPR. Fratio is Fcurrent / Fref. SSBratio is SSBcurrent / MSST. Spawning biomass units are weight in mtons, and yield units are mtons whole weight".

| Name | Fcurrent | SSBcurrent | Yref | Fref | SSBref | MFMT | MSST | F/MFMT | SSB/MSST |
|---|---|---|---|---|---|---|---|---|---|
| Run 1 Configuration | 0.19 | 11,195 | 3,563 | 0.37 | 6,626 | 0.37 | 4,108 | 0.51 | 2.73 |
| Run 1 Configuration, Steepness=0.9 | 0.14 | 18998 | 3090 | 0.39 | 10701 | 0.35 | 6634 | 0.39 | 2.86 |
| Run 1 Configuration, Steepness=0.8 | 0.14 | 19,645 | 3,053 | 0.39 | 10,339 | 0.36 | 6,410 | 0.38 | 3.06 |
| Run 1 Configuration, Steepness=0.7 | 0.14 | 18,235 | 3,056 | 0.41 | 10,264 | 0.35 | 6,363 | 0.41 | 2.87 |
| Run 3 Configuration, M HI | 0.1 | 23,551 | 3,682 | 0.2 | 8,746 | 0.5 | 4,461 | 0.2 | 5.28 |
| Run 3 Configuration, M LO | 0.2 | 13,150 | 4,040 | 0.83 | 18,283 | 0.24 | 13,347 | 0.83 | **0.99** |
| Run 3 Configuration, M REF Age 3 | 0.15 | 18,140 | 3,138 | 0.47 | 11,862 | 0.32 | 7,354 | 0.47 | 2.47 |
| Run 3 Configuration, Discard Mortality | 0.14 | 18,995 | 3,029 | 0.41 | 10,730 | 0.35 | 6,653 | 0.41 | 2.86 |
| Run 3 Configuration, NO MRFSS | 0.14 | 19,886 | 3,054 | 0.39 | 10,637 | 0.35 | 6,595 | 0.39 | 3.02 |
| Run 3 Configuration, NO FWC | 0.12 | 25,700 | 2,821 | 0.34 | 11,132 | 0.34 | 6,902 | 0.34 | 3.72 |
| Run 3 Configuration, NO SEAMAP Survey | 0.13 | 20,364 | 3,053 | 0.38 | 10,715 | 0.35 | 6,643 | 0.38 | 3.07 |
| Run 1 Configuration, SS Reweighting | 0.19 | 11,050 | 3,743 | 0.37 | 7,011 | 0.37 | 4,347 | 0.5 | 2.54 |
| Run 3 Configuration, RETROSPECITVE_2010 | 0.15 | 18,383 | 3,163 | 0.43 | 10,882 | 0.35 | 6,747 | 0.43 | 2.72 |
| Run 3 Configuration, RETROSPECTIVE_2009 | 0.16 | 17,503 | 2,991 | 0.46 | 11,022 | 0.34 | 6,834 | 0.46 | 2.56 |
| Run 3 Configuration, RETROSPECTIVE_2008 | 0.15 | 18,121 | 2,968 | 0.44 | 11,182 | 0.35 | 6,933 | 0.44 | 2.61 |
| Run 3 Configuration, RETROSPECTIVE_2007 | 0.15 | 16,832 | 3,072 | 0.46 | 11,362 | 0.33 | 7,044 | 0.46 | 2.39 |
| Run 3 Configuration, RETROSPECTIVE_2006 | 0.16 | 19,528 | 3,040 | 0.48 | 10,986 | 0.34 | 6,811 | 0.48 | 2.87 |

The point estimates of the ratio of $\text{SSB}_{\text{current}}/\text{MSST}$ exceed 1 in all but one case of Table 3.8 of the Assessment Workshop Report, *i.e.*, that for the run in which *M* was set at the lower value, MLO = 0.27 $y^{-1}$, when this ratio became 0.99, *i.e.*, the SSB was only just below MSST. Apart from this run, the results of the model runs that were undertaken indicate that that it is highly likely that the stock of Spanish mackerel is currently not overfished.

The value of $F_{\text{current}}$ for the model with steepness set to 0.8 is reported as 0.14 in Table 3.8 and 0.13 in Table 3.9 of the Assessment Workshop Report. The ratio of $F_{\text{current}}$ to MFMT is reported in Tables 3.8 and 3.9 as 0.38 and, 0.50, respectively for this model, and, for the model with steepness of 0.9, as 0.39 and 0.52, respectively. The values of $\text{SSB}_{\text{current}}$ reported in Table 3.8 for the models with steepness values of 0.8 and 0.9 are transposed in Table 3.9. The values of the ratio of $\text{SSB}_{\text{current}}/\text{MSST}$ in Table 3.9 do not match the values reported in Table 3.8 for either model. These inconsistencies should be resolved.

**ToR 14. Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.**

*Conclusions*

Stock Synthesis provides a well-tested procedure to project the model through a range of future years, using a fishing rate based on MSY, SPR, a specified target biomass, or a multiple of the recent average fishing rate and producing estimates of yield and key management parameters, thereby allowing assessment of future stock condition. The methods used, which are recognised as being of high quality, are designed to produce the estimates of future population status that are needed by managers. If the current fishing rate is maintained over the next 10 years, the projections produced for the base model for the Gulf of Mexico Spanish mackerel stock suggest that there will be little change in spawning stock biomass. If, however, fishing mortality is increased to the level that is estimated as required to produce OY, or further increased to that which would produce a spawning potential ratio of 30%, the spawning stock biomass would be expected to be reduced by approximately 20%. The condition of the stock would be expected to continue to be classified as “not overfished, with overfishing not occurring”.

*Strengths*

Projections are undertaken using the well-tested procedures provided within Stock Synthesis.

*Summary*

Stock Synthesis includes a well-tested procedure to project the future stock status that would result when using a fishing rate based on MSY, SPR, a specified target biomass, or a multiple of the recent average fishing rate. Use of this procedure ensures consistency of model predictions with assumptions and parameter estimates used in fitting the model and the age structure predicted as the current state of the stock from which the projection commences. It is thus highly applicable for use with the Gulf of Mexico stock of Spanish mackerel.

For the Gulf of Mexico stock of Spanish mackerel, deterministic projections were run by the Assessment Panel for the models with steepness of 0.8 and 0.9 and using fishing rates set to MFMT (*i.e.*, the proxy $F_{30\%\text{SPR}}$ for $F_{\text{MSY}}$), $F_{\text{OY}}$ (*i.e.*, 75% of $F_{30\%\text{SPR}}$), and $F_{\text{current}}$. Using the bootstrapping facility provided by the Fishery Simulation GUI software, stochastic projections were also run for the two models with the fishing rate set to MFMT (the Assessment Workshop report only presents the results for the model with steepness set to 0.8).

The final year of the time series of data used in the assessment for the Gulf of Mexico stock of Spanish mackerel was 2011. In order to carry out projections for 20 years from 2013 (only results from 2013 to 2022 being reported), the 2012 landings "were characterized as the landings [of the different fisheries] from the most recent three years (2009-2011)" (Assessment Workshop Report). Stock Synthesis was used to estimate the fishing mortality for 2012 required to achieve these landings, and used the 2012 estimate of SSB to calculate an estimate of age 0 recruitment from the fitted stock-recruitment relationship.

If the current fishing rate is maintained over the next 10 years, the projections produced for the models with steepness set to 0.8 and 0.9 suggest that there will be little change in spawning stock biomass. If, however, fishing mortality is increased to the level that is estimated as required to produce OY, or further increased to that which would produce a spawning potential ratio of 30%, the spawning stock biomass would be expected to be reduced by approximately 20 or 30%, respectively.

**ToR 15. Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.**

- **Provide measures of uncertainty for estimated parameters**
- **Ensure that the implications of uncertainty in technical conclusions are clearly stated**
- **If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternate states of nature, presented for review.**
- **Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments**
- **Provide justification for the weightings used in producing the combinations of models**

*Conclusions*

The methods within Stock Synthesis that may be used to explore uncertainty include calculation of estimates of asymptotic standard errors, calculation of likelihood profiles, MCMC analyses, and bootstrapping. These tools are complemented by auxiliary software that allows production of diagnostic plots, which also assist in communicating the uncertainty of estimates. The software encourages exploration of alternative model structures and sensitivity to alternative values of parameters of functional forms. The model that was developed for the Gulf of Mexico stock of Spanish mackerel employed an appropriate set of these methods. As a result of the exploration of the uncertainty of the estimate of steepness, the base model was modified by fixing steepness to 0.8. Probability distributions were produced for a set of key parameters using both the original and new base models. As the iterative approach required to calculate $P^*$ cannot be implemented in Stock Synthesis, Stock Synthesis "calculates the expected time series of probabilities that the *F* resulting from a specified harvest policy would exceed a specified level" (Methot and Wetzel, 2012).

*Strengths*

- Stock Synthesis provides an extensive suite of methods that may be used to explore uncertainty.
- Bootstrapping was used to produce probability distributions

*Summary*

Stock Synthesis provides a number of methods that may be used to characterize the uncertainty associated with the estimates of parameters, benchmark estimates, and predicted values of parameters. These are supplemented by the bootstrapping tools provided by the Fishery Simulation GUI. Together, the software is well suited for use in exploring the uncertainty associated with the models that were fitted to the Gulf Of Mexico Spanish mackerel stock. Thus, for each run of the Stock Synthesis model for the Gulf of Mexico Spanish mackerel, asymptotic standard errors were calculated for each of the parameters that were estimated (see Table 3.1, Assessment Workshop Report, for parameter estimates and estimates of asymptotic standard errors for the base model, with $M = 0.38$ $y^{-1}$ and steepness = 0.8). These estimates of asymptotic standard errors may be considered to represent minimum values for the uncertainty of the estimated parameters. The uncertainty of selected parameter estimates for the Gulf of Mexico Spanish mackerel stock was also characterized using the results from bootstrapping.

The initial run (Run 1) was carried out using the model structure that had been proposed for the Gulf of Mexico stock of Spanish mackerel and estimating the steepness parameter of the Beverton and Holt stock-recruitment relationship. This demonstrated that, given the data that were available, the steepness of the stock recruitment relationship was estimated very imprecisely. A number of sensitivity runs of Stock Synthesis were then run to explore the effect of varying the configuration or methods employed in the analysis.

As is typical in stock assessment, exploratory runs for the Gulf of Mexico Spanish mackerel stock were first employed to determine a base model for the assessment, *i.e*., a model that is considered the most likely of the alternative model configurations that have been proposed. The decision was made at the Assessment Workshop to reject Run 1 and use Run 3 as the base model. As noted above, a justification for this decision, *i.e*., to use the initial model structure, *i.e*., that for Run 1, and to fix the value of steepness at 0.8, was not reported in the Assessment Workshop Report other than to state that the Assessment Workshop found the low estimate of steepness produced when fitting the model in Run 1 to be unacceptable. Probability distributions of the key parameters estimated for the initial model, Run 1, and the new base model, Run 3, were produced and plotted (Figs 3.34 and 3.35 of the Assessment Workshop Report).

The level to which the initial spawning stock biomass had been depleted by 2011 was far less for Run 1, *i.e*., 0.16 $SSB_{B0}$ than for Run 3, *i.e*., 0.51 $SSB_{B0}$ (Table 3.7, Assessment Workshop Report). A similar level of depletion, *i.e*., 0.18 $SSB_{B0}$ as that of Run 1 was estimated to have resulted when the value of natural mortality used in the Run 3 configuration was lowered to 0.27 $y^{-1}$. When Run 1 was re-fitted, estimating steepness (with a resulting value of 0.53) and iteratively adjusting the weights of the survey indices and the length and age compositions to match the estimated variances of the input data with those of the fitted model, the level of depletion was again low, *i.e*., 0.16 $SSB_{B0}$. The level of depletion of spawning stock biomass appears sensitive to reduced values of steepness and/or natural mortality. Given the estimated level of depletion of spawning stock biomass for these runs, it is interesting to note that SPR had been reduced in these three model configurations to only 0.51, 0.41, and 0.53, respectively (Table 3.7, Assessment Workshop Report). Again, these results suggest that, when MSY-based reference points are available, these should be used in preference to SPR-based proxies.

While the Assessment Workshop Report provided a comparison of the key parameters, benchmarks, and projections for the base model that was adopted at the workshop, *i.e*., Run 3, with steepness of 0.8, and an alternative model, which had an identical configuration but used a steepness of 0.9, the relative probabilities of the two models was not assessed. The base model was subjected to a bootstrapping analysis, however, and distributions of the resulting estimates of the benchmark estimates are provided in Figures 3.48 and 3.49 of the Assessment Workshop Report, while distributions of projected yields for 2013-2022 are plotted in Fig. 3.53.

The caption of Table 3.9 advises that the table provides results of the required SFA and MSRA evaluations using a SPR 30% reference point for "4 states of nature of steepness at 3 levels of natural mortality". The table, however, only presents results for models representing two values of steepness for one value of natural mortality.

While the iterative approach required to calculate *P** cannot be implemented in Stock Synthesis, a complementary approach has been developed to produce estimates of the probability that *F*, the fishing rate based on MSY, SPR, a specified target biomass, or a multiple of the recent average fishing rate that is employed in the projection, exceeds the OFL (Methot and Wetzel, 2012). These authors advise that, whereas the *P** approach calculates the future stream of annual catches that would have a specified annual probability of *F* > OFL, Stock Synthesis "calculates the expected time series of probabilities that the *F* resulting from a specified harvest policy would exceed a specified level".

**ToR 16. If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.**

The Review was undertaken as a desktop review, rather than in a Workshop setting. Accordingly, it was not possible for the recommendations made in review reports to be acted upon, nor to ensure that the results were incorporated accurately in the resultant Stock Assessment Report.

**ToR 17. Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.**

The SEDAR Process has ensured that all aspects of the assessment process for the Gulf of Mexico stock of Spanish mackerel, from collation of data through to model development, exploration, and production of management advice, have been documented in detail, including the underlying reasons for the decisions that were made concerning data to be used and model structure to be employed. The structure imposed on the Data and Assessment Workshops by their Terms of Reference has assisted by providing a logical framework for the process, and thereby ensuring that key aspects of the assessment were not overlooked. For the reviewer, the documentation of the Spanish mackerel assessment, which was produced through the SEDAR process, proved invaluable in gaining an understanding of the details of the assessment and assisted in identifying opportunities for improvement and in detecting errors or inadequacies.

The Terms of Reference for the Assessment Process, which are presented below, are now examined and comment is made on the degree to which these were addressed.

1. Review and provide justification for any changes in data following the data workshop and any analyses suggested by the data workshop. Summarize data as used in each assessment model.

   Accomplished.

2. Recommend a model configuration which is deemed most reliable for providing management advice using available compatible data. Document all input data, assumptions, and equations.

   Accomplished.

3. Incorporate known applicable environmental covariates into the selected model, and provide justification for why any of those covariates cannot be included at the time of the assessment.

   No environmental covariates were identified by either the Data or Assessment Workshops.

4. Provide estimates of stock population parameters.
   - Include fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship, and other parameters as appropriate given data availability and modeling approaches
   - Include appropriate and representative measures of precision for parameter estimates

   Accomplished.

5. Characterize uncertainty in the assessment and estimated values.
   - Considering components such as input data, modeling approach, and model configuration
   - Provide appropriate measures of model performance, reliability, and 'goodness of fit'

   Accomplished.

6. Provide yield-per-recruit, spawner-per-recruit, and stock-recruitment evaluations.

   Accomplished.

7. Provide estimates of stock status relative to management criteria consistent with applicable FMPs, proposed FMPs and Amendments, other ongoing or proposed management programs, and National Standards for each model run presented for review.

   Accomplished.

8. Project future stock conditions and develop rebuilding schedules if warranted, including estimated generation time. Develop stock yield projections in both biomass and numbers of fish in accordance with the following:
   A) If stock is overfished:
      F=0, FCurrent, FMSY, FOY
      F=FRebuild (max that permits rebuild in allowed time)
   B) If stock is undergoing overfishing:
      F= FCurrent, FMSY, FOY
   C) If stock is neither overfished nor undergoing overfishing:
      F= FCurrent, FMSY, FOY
   D) If data limitations preclude classic projections (i.e. A, B, C above), explore alternate models to provide management advice

   Accomplished.

9. Provide a probability distribution function for the base model, or a combination of models that represent alternate states of nature, presented for review.
   - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments for use with the Tier 1 ABC control rule
   - Provide justification for the weightings used in producing combinations of models

   The Assessment Workshop Report noted that ten sensitivity runs had been considered, one of which had been subjected to stochastic projection. The Assessment Workshop Report advised that “probability distribution functions will be developed for the subset of model recommended by the SEDAR AP for projections … and made available to the Scientific and Statistical Committee (SSC) for the development of management advice, including OFL and ABC”. No information relating to these probability distribution functions was presented in the Report.

10. Provide recommendations for future research and data collection. Be as specific as possible in describing sampling design and intensity, and emphasize items which will improve assessment capabilities and reliability. Recommend the interval and type for the next assessment.

Attention was directed to the research recommendations that were made in the Data Workshop Report. The Workshop Assessment Report identified gaps in data, which, if addressed, would improve the assessment capabilities and reliability. Specific sampling design and intensity were not discussed. No recommendations relating to the interval and type for the next Assessment were made by the Assessment Workshop

11. Prepare a spreadsheet containing all model parameter estimates and all relevant population information resulting from model estimates and projection and simulation exercises. Include all data included in assessment report tables and all data that support assessment workshop figures.

    A spreadsheet was not provided in the documentation that was circulated to the Review Panel. The Assessment Workshop addressed this Term of Reference in its Report by providing a table listing the estimates for all parameters used in the model and presenting a listing of each of the input files required to run the Stock Synthesis model for Gulf of Mexico Spanish mackerel.

12. Complete the Assessment Workshop Report (Section III: SEDAR Stock Assessment Report).

    Accomplished.

**ToR 18. Make any additional recommendations or prioritizations warranted.**
- **Clearly denote research and monitoring needs that could improve the reliability of future assessments**

A number of research needs, which are listed below in priority order, were identified in the course of the desk review. As expected, these were highly consistent with, and thus overlap, a number of the research needs that had been identified by the Data and Assessment workshops.

1. Review or establish programs to collect data on the length composition and age-at-length compositions of landings and discards from each commercial gear and from each recreational fishing mode, and of bycatch of Spanish mackerel from the shrimp fishery. Ensure that the statistical design and spatial coverage of survey or sampling programs are appropriate and that survey or sampling intensity is sufficient to produce estimates of the required precision for the Gulf of Mexico stock of Spanish mackerel. Set goals for performance and establish and monitor performance criteria to assess the quality and completeness of data collection programs. This research need is of the highest priority as it will provide information required by Stock Synthesis to determine the selectivity and retention curves for Spanish mackerel for the commercial, recreational, and shrimp fisheries, the lack of which is a key source of uncertainty in the model.
2. Undertake research to determine reliable relationships between the proportion of females that are mature and both length and age for the Gulf of Mexico stock of Spanish mackerel. This is also of high priority, as the maturity information that is currently used is imprecise. The calculation of spawning stock biomass, a crucial

parameter in the calculation of benchmarks and assessment of stock status, should be based on reliable data.

3. Review programs that are used to collect discard data for Spanish mackerel (and data on the bycatch of Spanish mackerel by the shrimp fishery), and refine these programs to ensure that accurate and complete data estimates of the discards (and bycatch) are collected. Ensure that the statistical design and spatial coverage of survey or sampling programs are appropriate and that survey or sampling intensity is sufficient to produce estimates of the required precision. Set goals for performance and establish and monitor performance criteria to assess the quality and completeness of data collection programs. While this research will not produce immediate improvement in the quality of the assessment, it is important that action is taken as soon as possible to improve the accuracy and precision of the data relating to the quantities of fish that are discarded from each of the fisheries, such that, in the future, the time series of discards become more reliable.
4. A comprehensive study of the stock structure of Spanish mackerel should be undertaken, with the following objectives:
    a. to determine stock structure and the areas occupied by each stock;

    and, assuming that the current view that there are two stocks, *i.e.*, a Gulf of Mexico and a South Atlantic stock, is substantiated,

    b. to determine more reliably the boundary between the Gulf of Mexico and South Atlantic stocks or the extent of overlap;
    c. to extend sampling into Mexican waters and thereby determine the southern boundary of the Gulf of Mexico stock;
    d. to ascertain whether, regardless of the time of year, catches of fish may be assigned reliably to either the Gulf of Mexico or South Atlantic stock on the basis of the area in which they are caught.

    As this study will take some time before completion, it has been assigned a lower priority than the previous items. Determination of the southern stock boundary, however, is important to ensure that other removals from the stock are not occurring in Mexican waters, as such removals are not taken into account in the current assessment.
5. Undertake research to determine the discard mortality of Gulf of Mexico Spanish mackerel that are discarded from the catches of each commercial fishing gear or each recreational fishing mode, recognising that such mortality is likely to differ among different categories into which the discarded fish are classified, *e.g.*, “alive”, “mostly alive”, and “mostly dead”.
6. In future stock assessments for the Gulf of Mexico stock of Spanish mackerel, explore whether the use of an age-dependent rather than constant $M$ results in a significant improvement in fit, considering the Lorenzen and alternative functional forms of the relationship with age and the alternative of estimating the value of the age-dependent $M$ at each age (or range of ages).
7. In future stock assessments, explore the sensitivity of the model to the uncertainty of the landings data.
8. As a low research priority, assess whether, in future refinement of the Stock Synthesis model, sexually dimorphic growth should be introduced. Note that the benefit of this might only be realised if appropriate sex composition data for landings and discards are

available for input, and length and age-at-length compositions are sexually disaggregated.

## 5. Conclusions and recommendations

After considering the information relating to stock structure, the data that were available for the Gulf of Mexico stocks of cobia and Spanish mackerel, and the details of the assessment for each species, the base model that had been proposed by the Assessment Workshop for each assessment was accepted for use in assessing stock status and in projecting the potential yield and likely stock status over the next six years. The results of the accepted base models, which had been developed using the Stock Synthesis 3 framework, suggested that both stocks were currently (in 2011) not overfished and that overfishing was not currently occurring. While the results of the assessment were imprecise, reflecting the quality and nature of the input data, the results of sensitivity runs for each model suggested that the conclusions drawn regarding stock status were likely to be robust to the uncertainty of the base model results.

Although some of the components of the data for the Gulf of Mexico stocks of cobia and Spanish mackerel were limited and/or uncertain, the datasets that had been collated by the Data Workshops represented the best data currently available for those stocks and appeared adequate for use in assessing, albeit imprecisely, the condition of the two stocks. The models that were developed within Stock Synthesis using these datasets were of appropriate structure and were of a standard that would be considered "best practice" given the types and quality of the data that were available. The explorations of uncertainty and decisions made in the assessments were appropriate. The advice regarding the condition of each stock, *i.e.*, that it is not overfished and overfishing is not occurring, appears sound.

Improvement of the assessments will require the collection of adequate and appropriate data sufficient to characterize the length and age-at-length compositions of catches and discards from both the commercial and recreational fisheries and of bycatches of cobia and Spanish mackerel by the shrimp fishery. These data are essential if selectivity and retention curves are to be accurately determined within the assessment models. Reliable data on maturity are also essential if reliable estimates of spawning stock biomass are to be calculated by the models. Further improvement of the models will require the collection of discard and bycatch data of higher quality from the commercial and recreational fisheries and from the shrimp fishery, and determination of the southern boundaries of both the Gulf of Mexico stocks of cobia and Spanish mackerel.

## 6. References


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Froese, R. and Binohlan, C. 2000. Empirical relationships to estimate asymptotic length, length at first maturity and length at maximum yield per recruit in fishes, with a simple method to evaluate length frequency data. *Journal of Fish Biology* **56**:758-773.

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Hoenig, J. M. 1983. Empirical use of longevity data to estimate mortality rates. *Fishery Bulletin*, **82**: 898-903.

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Lee, Hua-hui, Cheng-Yu Yang, R., and Taylor, I. 2012. User manual for Fishery Simulation Tool. Joint Institute for Marine and Atmospheric Research, University of Hawaii, Pacific Islands Fisheries Science Center, NOAA Fisheries Honolulu, HI USA, 7pp.

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Smith, A. D. M., and Punt, A. E. 1998. Stock assessment of gemfish (*Rexea solandri*) in eastern Australia using maximum likelihood and Bayesian methods. *In* Fisheries stock assessment models. Edited by T. J. Quinn II, F. Funk, J. Heifetz, J. N. Ianelli, J. E. Powers, J. F. Schweigert, P. J. Sullivan, and C-I. Zhang. Alaska Sea Grant College Program, AK-SG-98-01. pp. 245–286.

# Appendix 1: Bibliography of all material provided

SEDAR 28 - Gulf and South Atlantic -- Spanish Mackerel and Cobia
Workshop Document List

| Document # | Title | Authors |
|---|---|---|
| | **Data and Assessment Workshop Reports considered in CIE Desktop Review** | |
| | SEDAR 28 – Gulf of Mexico Cobia – Data Workshop Report – May 2012 | |
| | SEDAR 28 – Gulf of Mexico Spanish Mackerel – Data Workshop Report – May 2012 | |
| | SEDAR 28 – Gulf of Mexico Cobia – Assessment Process Report – December 2012 | |
| | SEDAR 28 – Gulf of Mexico Spanish – Mackerel Assessment Workshop Report – December 2012 | |
| | **Documents Prepared for the Data Workshop** | |
| SEDAR28-DW01 | Cobia preliminary data analyses – US Atlantic and GOM genetic population structure | Darden 2012 |
| SEDAR28-DW02 | South Carolina experimental stocking of cobia *Rachycentron canadum* | Denson 2012 |
| SEDAR28-DW03 | Spanish Mackerel and Cobia Abundance Indices from SEAMAP Groundfish Surveys in the Northern Gulf of Mexico | Pollack and Ingram, 2012 |
| SEDAR28-DW04 | Calculated discards of Spanish mackerel and cobia from commercial fishing vessels in the Gulf of Mexico and US South Atlantic | K. McCarthy |
| SEDAR28-DW05 | Evaluation of cobia movement and distribution using tagging data from the Gulf of Mexico and South Atlantic coast of the United States | M. Perkinson and M. Denson 2012 |
| SEDAR28-DW06 | Methods for Estimating Shrimp Bycatch of Gulf of Mexico Spanish Mackerel and Cobia | B. Linton 2012 |
| SEDAR28-DW07 | Size Frequency Distribution of Spanish Mackerel from Dockside Sampling of Recreational and Commercial Landings in the Gulf of Mexico 1981-2011 | N.Cummings, J. Isely |
| SEDAR28-DW08 | Size Frequency Distribution of Cobia from Dockside Sampling of Recreational and Commercial Landings in the Gulf of Mexico 1986-2011 | J. Isely and N. Cummings |
| SEDAR28-DW09 | Texas Parks and Wildlife Catch Per unit of Effort Abundance Information for Spanish mackerel | N. Cummings, J. Isely |

| Document # | Title | Authors |
|---|---|---|
| SEDAR28-DW10 | Texas Parks and Wildlife Catch Per unit of Effort Abundance Information for cobia | J. Isely, N. Cummings |
| SEDAR28-DW11 | Size Frequency Distribution of Cobia and Spanish Mackerel from the Galveston, Texas, Reef Fish Observer Program 2006-2011 | J Isely and N Cummings |
| SEDAR28-DW12 | Estimated conversion factors for calibrating MRFSS charterboat landings and effort estimates for the South Atlantic and Gulf of Mexico in 1981-1985 with For Hire Survey estimates with application to Spanish mackerel and cobia landings | V. Matter, N Cummings, J Isely, K Brennen, and K Fitzpatrick |
| SEDAR28-DW13 | Constituent based tagging of cobia in the Atlantic and Gulf of Mexico waters | E. Orbesen |
| SEDAR28-DW14 | Recreational Survey Data for Spanish Mackerel and Cobia in the Atlantic and the Gulf of Mexico from the MRFSS and TPWD Surveys | V. Matter |
| SEDAR28-DW15 | Commercial Vertical Line and Gillnet Vessel Standardized Catch Rates of Spanish Mackerel in the US Gulf of Mexico, 1998-2010 | N. Baertlein, K. McCarthy |
| SEDAR28-DW16 | Commercial Vertical Line Vessel Standardized Catch Rates of Cobia in the US Gulf of Mexico, 1993-2010 | K. McCarthy |
| SEDAR28-DW17 | Standardized Catch Rates of Spanish Mackerel from Commercial Handline, Trolling and Gillnet Fishing Vessels in the US South Atlantic, 1998-2010 | K. McCarthy |
| SEDAR28-DW18 | Standardized catch rates of cobia from commercial handline and trolling fishing vessels in the US South Atlantic, 1993-2010 | K. McCarthy |
| SEDAR28-DW19 | MRFSS Index for Atlantic Spanish mackerel and cobia | Drew et al. |
| SEDAR28-DW20 | Preliminary standardized catch rates of Southeast US Atlantic cobia (*Rachycentron canadum*) from headboat data | NMFS Beaufort |
| SEDAR28-DW21 | Spanish mackerel preliminary data summary: SEAMAP-SA Coastal Survey | Boylan and Webster |
| SEDAR28-DW22 | Recreational indices for cobia and Spanish mackerel in the Gulf of Mexico | Bryan and Saul |
| SEDAR28-DW23 | A review of Gulf of Mexico and Atlantic Spanish mackerel (*Scomberomorus maculatus*) age data, 1987-2011, from the Panama City Laboratory, Southeast Fisheries Science Center, NOAA Fisheries Service | Palmer, DeVries, and Fioramonti |

| Document # | Title | Authors |
|---|---|---|
| SEDAR28-DW24 | SCDNR Charterboat Logbook Program Data, 1993 - 2010 | Errigo, Hiltz, and Byrd |
| SEDAR28-DW25 | South Carolina Department of Natural Resources State Finfish Survey (SFS) | Hiltz and Byrd |
| SEDAR28-DW26 | Cobia bycatch on the VIMS elasmobranch longline survey:1989-2011 | Parsons et al. |
| | **Documents Prepared for the Assessment Workshop** | |
| SEDAR28-AW01 | Florida Trip Tickets | S. Brown |
| SEDAR28-AW02 | SEDAR 28 Spanish mackerel bycatch estimates from US Atlantic coast shrimp trawls | NMFS Beaufort |
| | **Documents Prepared for the Review Workshop** | |
| SEDAR28-RW01 | The Beaufort Assessment Model (BAM) with application to cobia: mathematical description, implementation details, and computer code | Craig |
| SEDAR28-RW02 | Development and diagnostics of the Beaufort assessment model applied to Cobia | Craig |
| SEDAR28-RW03 | The Beaufort Assessment Model (BAM) with application to Spanish mackerel: mathematical description, implementation details, and computer code | Andrews |
| SEDAR28-RW04 | Development and diagnostics of the Beaufort assessment model applied to Spanish mackerel | Andrews |
| | **Final Assessment Reports (Not available at time of desktop review)** | |
| SEDAR28-SAR1 | Assessment of Spanish mackerel in the US South Atlantic | To be prepared by SEDAR 28 |
| SEDAR28-SAR2 | Assessment of Spanish mackerel in the US Gulf of Mexico | To be prepared by SEDAR 28 |
| SEDAR28-SAR3 | Assessment of cobia in the US South Atlantic | To be prepared by SEDAR 28 |
| SEDAR28-SAR4 | Assessment of cobia in the US Gulf of Mexico | To be prepared by SEDAR 28 |
| | **Reference Documents** | |
| SEDAR28-RD01 | List of documents and working papers for SEDAR17 (South Atlantic Spanish mackerel) – all documents available on the SEDAR website | SEDAR 17 |
| SEDAR28-RD02 | 2003 Report of the mackerel Stock Assessment Panel | GMFMC and SAFMC, 2003 |
| SEDAR28-RD03 | Assessment of cobia, *Rachycentron canadum*, in the waters of the U.S. Gulf of Mexico | Williams, 2001 |
| SEDAR28-RD04 | Biological-statistical census of the species entering fisheries in the Cape Canaveral area | Anderson and Gehringer, 1965 |

| Document # | Title | Authors |
|---|---|---|
| SEDAR28-RD05 | A survey of offshore fishing in Florida | Moe 1963 |
| SEDAR28-RD06 | Age, growth, maturity, and spawning of Spanish mackerel, *Scomberomorus maculates* (Mitchill), from the Atlantic Coast of the southeastern United States | Schmidt et al. 1993 |
| SEDAR28-RD07 | Omnibus amendment to the Interstate Fishery Management Plans for Spanish mackerel, spot, and spotted seatrout | ASMFC 2011 |
| SEDAR28-RD08 | Life history of Cobia, *Rachycentron canadum* (Osteichthyes: Rachycentridae), in North Carolina waters | Smith 1995 |
| SEDAR28-RD09 | Population genetics of cobia *Rachycentron canadum*: Management implications along the Southeastern US coast | Darden et al, 2012 |
| SEDAR28-RD10 | Inshore spawning of cobia (*Rachycentron canadum*) in South Carolina | Lefebvre and Denson, 2012 |
| SEDAR28-RD11 | A review of age, growth, and reproduction of cobia *Rachycentron canadum*, from US water of the Gulf of Mexico and Atlantic ocean | Franks and Brown-Peterson, 2002 |
| SEDAR28-RD12 | An assessment of cobia in Southeast US waters | Thompson 1995 |
| SEDAR28-RD13 | Reproductive biology of cobia, *Rachycentron canadum*, from coastal waters of the southern United States | Brown-Peterson et al. 2001 |
| SEDAR28-RD14 | Larval development, distribution, and ecology of cobia *Rachycentron canadum* (Family: Rachycentridae) in the northern Gulf of Mexico | Ditty and Shaw 1992 |
| SEDAR28-RD15 | Age and growth of cobia, *Rachycentron canadum*, from the northeastern Gulf of Mexico | Franks et al 1999 |
| SEDAR28-RD16 | Age and growth of Spanish mackerel, *Scomberomorus maculates*, in the Chesapeake Bay region | Gaichas, 1997 |
| SEDAR28-RD17 | Status of the South Carolina fisheries for cobia | Hammond, 2001 |
| SEDAR28-RD18 | Age, growth and fecundity of the cobia, *Rachycentron canadum*, from Chesapeake Bay and adjacent Mid-Atlantic waters | Richards 1967 |
| SEDAR28-RD19 | Cobia (*Rachycentron canadum*) tagging within Cheasapeake Bay and updating of growth equations | Richards 1977 |
| SEDAR28-RD20 | Synopsis of biological data on the cobia *Rachycentron canadum* (Pisces: Rachycentridae) | Shaffer and Nakamura 1989 |
| SEDAR28-RD21 | South Carolina marine game fish tagging program 1978-2009 | Wiggers, 2010 |

| Document # | Title | Authors |
|---|---|---|
| SEDAR28-RD22 | Cobia (*Rachycentron canadum*), amberjack (*Seriola dumerili*), and dolphin (*Coryphaena hipurus*) migration and life history study off the southwest coast of Florida | MARFIN 1992 |
| SEDAR28-RD23 | Sport fish tag and release in Mississippi coastal water and the adjacent Gulf of Mexico | Hendon and Franks 2010 |
| SEDAR28-RD24 | VMRC Cobia otolith preparation protocol | VMRC |
| SEDAR28-RD25 | VMRC Cobia otolith ageing protocol | VMRC |
| SEDAR28-RD26 | Age, growth, and reproductive biology of greater amberjack and cobia from Louisiana waters | Thompson et al. 1991 |
| SEDAR28-RD27 | Gonadal maturation in the cobia, *Rachycentron canadum*, from the northcentral Gulf of Mexico | Lotz et al. 1996 |
| SEDAR28-RD28 | Cobia (*Rachycentron canadum*) stock assessment study in the Gulf of Mexico and in the South Atlantic | Burns et al. 1998 |
| SEDAR28-RD29 | Total mortality estimates for Spanish mackerel captured in the Gulf of Mexico commercial and recreational fisheries 1983 to 2011 | Bryan 2012 |

# Appendix 2: Copy of the CIE Statement of Work

## Attachment A: Statement of Work for Dr. Norm Hall

## Amended Statement of Work

### External Independent Peer Review by the Center for Independent Experts

SEDAR 28: Gulf of Mexico Cobia and Spanish Mackerel Assessment Desk Review

**Scope of Work and CIE Process:** The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Representative (COR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

**Project Description** SEDAR 28 will be a compilation of data, an assessment of the stocks, and an assessment review conducted for Gulf of Mexico Spanish mackerel and cobia. The CIE peer review is ultimately responsible for ensuring that the best possible assessment has been provided through the SEDAR process. The stocks assessed through SEDAR 28 are within the jurisdiction of the Gulf of Mexico Fisheries Management Councils and states in the Gulf of Mexico region. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

**Requirements for CIE Reviewers:** Three CIE reviewers shall have the necessary qualifications to complete an impartial and independent peer review in accordance with the statement of work (SoW) tasks and terms of reference (ToRs) specified herein. The CIE reviewers shall have expertise in stock assessment, statistics, fisheries science, and marine biology sufficient to complete the tasks of the peer-review described herein. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete all work tasks of the peer review described herein.

**Location of Peer Review:** Each CIE reviewer shall participate and conduct an independent peer review as a desk review, therefore travel will not be required.

**Statement of Tasks:** Each CIE reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer contact information to the COR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The

NMFS Project Contact is responsible for providing the CIE reviewers with the assessment and other pertinent background documents for the peer review. Any changes to the SoW or ToRs must be made through the COR prior to the commencement of the peer review.

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Desk Review: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. Modifications to the SoW and ToRs shall not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COR and CIE Lead Coordinator. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

**Specific Tasks for CIE Reviewers:** The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Conduct an impartial and independent peer review in accordance with the tasks and ToRs specified herein, and each ToRs must be addressed (**Annex 2**).
3) No later than January 25, 2013, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to Dr. David Sampson david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in **Annex 1**, and address each ToR in **Annex 2**.

**Schedule of Milestones and Deliverables:** CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

| | |
|---|---|
| 21 December 2012 | CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact |
| 2 January 2013 | NMFS Project Contact sends the CIE Reviewers the assessment report and background documents |
| 9-24 January 2013 | Each reviewer conducts an independent peer review as a desk review |
| 25 January 2013 | CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator |
| 8 February 2013 | CIE submits CIE independent peer review reports to the COR |
| 15 February 2013 | The COR distributes the final CIE reports to the NMFS Project Contact and regional Center Director |

**Modifications to the Statement of Work:** This 'Time and Materials' task order may require an update or modification due to possible changes to the terms of reference or schedule of milestones resulting from the fishery management decision process of the NOAA Leadership, Fishery Management Council, and Council's SSC advisory committee. A request to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent changes. The Contracting Officer will notify the COR within 10 working days after receipt of all required information of the decision on changes. The COR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

**Acceptance of Deliverables:** Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COR (William Michaels, via William.Michaels@noaa.gov).

**Applicable Performance Standards:** The contract is successfully completed when the COR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) The CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) The CIE report shall address each ToR as specified in **Annex 2**,
(3) The CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

**Distribution of Approved Deliverables:** Upon acceptance by the COR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COR. The COR will distribute the CIE reports to the NMFS Project Contact and Center Director.

**Support Personnel:**

William Michaels, Program Manager, COR
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**Key Personnel:**

NMFS Project Contact:

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Ryan.Rindone@gulfcouncil.org Phone: 813-348-1630

## Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

   The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work

## Annex 2a – Terms of Reference for

### SEDAR 28: Gulf of Mexico Cobia Assessment Desk Review

1. Evaluate the quality and applicability of data used in the assessment.
2. Evaluate the quality and applicability of methods used to assess the stock.
3. Recommend appropriate estimates of stock abundance, biomass, and exploitation.
4. Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.
5. Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.
6. Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.
   - Provide measures of uncertainty for estimated parameters
   - Ensure that the implications of uncertainty in technical conclusions are clearly stated
   - If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternative states of nature, presented for review.
     - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments
     - Provide justification for the weightings used in producing the combinations of models
7. If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.
8. Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.
9. Make any additional recommendations or prioritizations warranted.
   - Clearly denote research and monitoring needs that could improve the reliability of future assessments

Table 1. Required MSRA Evaluations for cobia assessment:

| Criteria | Definition* (2001) | Current Value* (2001) |
|---|---|---|
| **Mortality Rate Criteria** | | |
| **$F_{MSY}$** | $F_{MSY}$ | 0.34 |
| **MFMT** | $F_{MSY}$ | 0.34 |
| **$F_{OY}$** | 75% of $F_{MSY}$ | 0.26 |
| **$F_{CURRENT}$** | $F_{2000}$ | 0.30 |
| **$F_{CURRENT}$/ $F_{MSY}$** | Percentage of $F_{Current}/F_{MSY}$ > MFMT | 0.40 |
| **Base M** | | 0.30 |
| **Biomass Criteria** | | |
| **$SSB_{MSY}$** | Equilibrium $SSB_{MSY}$ @ $F_{MSY}$ | 3.02 mp |
| **MSST** | (1-M)*$SSB_{MSY}$: M=0.30 | 2.11 mp |
| **$SSB_{CURRENT}$** | $SSB_{2000}$ | |
| **$SSB_{CURRENT}$/ $SSB_{MSY}$** | Percentage of $SSB_{Current}/SSB_{MSY}$ < MSST | 0.30 |
| **Equilibrium MSY** | Equilibrium Yield @ $F_{MSY}$ | 1.50 mp |
| **Equilibrium OY** | Equilibrium Yield @ $F_{OY}$ | 1.45 mp |
| **OFL** | Annual Yield @ MFMT | |
| | 2013 | |
| | 2014 | |
| | 2015 | |
| | 2016 | |
| | 2017 | |
| | 2018 | |
| **Annual OY**** | Annual Yield @ $F_{OY}$ | |
| | 2013 | |
| | 2014 | |
| | 2015 | |
| | 2016 | |
| | 2017 | |
| | 2018 | |

*Definitions and values are subject to change as per guidance from this assessment.

**Based upon current definitions of OY, where OY = 75% of $F_{MSY}$

Table 2. Projection Scenario Details for cobia assessment

2.1 Initial Assumptions:

| OPTION | Value |
|---|---|
| 2012 base TAC | TBD |
| 2012 Recruits | TBD by Panel |
| 2012 Selectivity | TBD by Panel |
| Projection Period | 6 yrs (2013-2018) |
| $1^{st}$ year of change F, Yield | 2013 |

2.2 Scenarios to Evaluate (preliminary, to be modified as appropriate)

1. Landings fixed at 2013 target
2. $F_{OY}$= 65%, 75%, 85% $F_{MSY}$ (project when OY will be achieved)
3. $F_{MSY}$
4. $F_{REBUILD}$ (if necessary)
5. F=0 (if necessary)

2.3 Output values

1. Landings
2. Discards (including dead discards)
3. Exploitation
4. $F/F_{MSY}$
5. $B/B_{MSY}$

10. Evaluate the quality and applicability of data used in the assessment.
11. Evaluate the quality and applicability of methods used to assess the stock.
12. Recommend appropriate estimates of stock abundance, biomass, and exploitation.
13. Evaluate the methods used to estimate population benchmarks and management parameters. Recommend and provide estimated values for appropriate management benchmarks and declarations of stock status for each model run presented for review.
14. Evaluate the quality and applicability of the methods used to project future population status. Recommend appropriate estimates of future stock condition.
15. Evaluate the quality and applicability of methods used to characterize uncertainty in estimated parameters.
    - Provide measures of uncertainty for estimated parameters
    - Ensure that the implications of uncertainty in technical conclusions are clearly stated
    - If there are significant changes to the base model, or to the choice of alternate states of nature, then provide a probability distribution function for the base model, or a combination of models that represent alternate states of nature, presented for review.
        - Determine the yield associated with a probability of exceeding OFL at P* values of 30% to 50% in single percentage increments
        - Provide justification for the weightings used in producing the combinations of models
16. If available, ensure that stock assessment results are accurately presented in the Stock Assessment Report and that stated results are consistent with Review Panel recommendations.
17. Evaluate the quality and applicability of the SEDAR Process as applied to the reviewed assessment and identify the degree to which Terms of Reference were addressed during the assessment process.
18. Make any additional recommendations or prioritizations warranted.
    - Clearly denote research and monitoring needs that could improve the reliability of future assessments

Table 1. Required MSRA Evaluations for Spanish mackerel assessment:

Note: te = trillion eggs

| Criteria | Definition* (as of 2002/2003) | Current Value* (2002/03) |
|---|---|---|
| **Mortality Rate Criteria** | | |
| **$F_{MSY}$** | $F_{30\%SPR}$ | |
| **MFMT** | $F_{30\%SPR}$ | |
| **$F_{OY}$** | 75% of $F_{30\%SPR}$ | 0.40 |
| **$F_{CURRENT}$** | $F_{2002/03}$ | |
| **$F_{CURRENT}$/MFMT** | | 0.53 |
| **Base M** | | 0.30 |
| **Biomass Criteria** | | |
| **$SSB_{MSY}$** | Equilibrium $SSB_{MSY}$ @ $F_{30\%SPR}$ | 19.10 te |
| **MSST** | (1-M)*$SSB_{MSY}$: M=0.30 | 13.40 te |
| **$SSB_{CURRENT}$** | $SSB_{2003}$ | 17.96 te |
| **$SSB_{CURRENT}$/ MSST** | | 1.34 |
| **Equilibrium MSY** | Equilibrium Yield @ $F_{30\%SPR}$ | 8.7 mp |
| **Equilibrium OY** | Equil. Yield @ 75% of $F_{30\%SPR}$ | 8.3 mp |
| **OFL** | Annual Yield @ MFMT | |
| | 2013 | |
| | 2014 | |
| | 2015 | |
| | 2016 | |
| | 2017 | |
| | 2018 | |
| **Annual OY**** | Annual Yield @ $F_{OY}$ | |
| | 2013 | |
| | 2014 | |
| | 2015 | |
| | 2016 | |
| | 2017 | |
| | 2018 | |

*Definitions and values are subject to change as per guidance from this assessment.

**Based upon current definitions of OY, where OY = 75% of $F_{MSY}$

Table 2. Projection Scenario Details for Spanish mackerel assessment

2.1 Initial Assumptions:

| OPTION | Value |
|---|---|
| 2012 base TAC | TBD |
| 2012 Recruits | TBD by Panel |
| 2012 Selectivity | TBD by Panel |
| Projection Period | 6 yrs (2013-2018) |
| $1^{st}$ year of change F, Yield | 2013 |

2.2 Scenarios to Evaluate (preliminary, to be modified as appropriate)

1. Landings fixed at 2013 target
2. $F_{OY}$= 65%, 75%, 85% $F_{MSY}$ (project when OY will be achieved)
3. $F_{MSY}$
4. $F_{REBUILD}$ (if necessary)
5. F=0 (if necessary)

2.3 Output values

1. Landings
2. Discards (including dead discards)
3. Exploitation
4. $F/F_{MSY}$
5. $B/B_{MSY}$