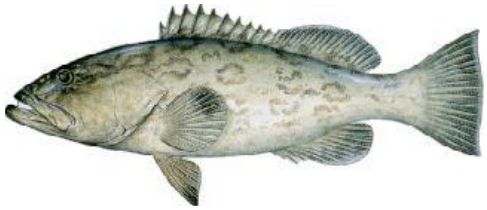

SEDAR 72 Gulf of Mexico Gag Grouper Operational Assessment Report Amendment State Reef Fish Survey (SRFS) Run

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Contents

1. Introduction

1.1. Gulf of Mexico Fishery Management Council (GMFMC) Request for a SRFS Run

In response to a region-wide need for more precise and timely estimates of recreational catch, Florida's State Reef Fish Survey (SRFS) was developed in collaboration with NOAA Fisheries and implemented in May 2015 (see Sauls et al. 2019 for detailed methodology). The SRFS runs concurrent with the MRIP survey in Florida (FL) and produces estimates that are consistently lower for the FL Private mode (Cross et al. 2020). During SEDAR 72, a ratio-based method for calibrating SRFS and MRIP-FCAL estimates for FL Private mode landings and discards was presented (SEDAR72-WP-04; Cross et al. 2020). The resulting dataset was subsequently used in a sensitivity run during SEDAR 72 (SEDAR 2021).

At the October 2021 GMFMC meeting, following review and approval of the SEDAR 72 base model, the Council requested that the SEDAR 72 base model be modified to use the SRFS-calibrated time series of landings and discards for the FL private mode in place of the same data collected by MRIP-FES. To that end, the SEFSC outlined a process for developing, reviewing, and approving a historical calibration of recreational catch and effort for the SRFS data. In February 2022, an independent expert review panel was formed and the review proceeded as a series of meetings with the MRIP Transition Team. In May 2022, the calibration was approved.

1.2. SRFS Run Scope of Work

The Scope of Work approved by the Gulf of Mexico Fishery Management Council (GMFMC) is detailed below.

1. Update the approved SEDAR 72 Gulf of Mexico Gag Grouper base model (sexes combined) through 2019:

- Use the State of Florida's State Reef Fish Survey (SRFS) to inform private recreational landings data once historical SRFS landings have been calibrated and certified by the NOAA Office of Science and Technology.
- Document any changes or corrections made to the model and input datasets, and provide updated input data tables.

2. Update model parameter estimates and their variances, model uncertainties, estimates of stock status and management benchmarks, and provide the probability of overfishing occurring at specified future harvest and exploitation levels. Provide commercial and recreational landings and discards in pounds and numbers.

- Use the following status determination criteria (SDC):
  - MSY or MSY proxy = yield at F_{MSY} or $F_{Rebuild}$ (if overfished)
    - F_{MSY}: F_{SPR30} and F_{MAX}
  - MSST = $0.5 * SSB_{MSY}$
  - MFMT = F_{MSY} (or proxy) and $F_{Rebuild}$ (if overfished)
  - OY = 75% of F_{MSY}

  - If different SDC are recommended, provide outputs for both the current and recommended SDC.
- Unless otherwise recommended, use the geometric mean of the previous three years' fishing mortality to determine $F_{Current}$. If an alternative approach is recommended, provide justification and outputs for the current and alternative approach.
- Provide yield and spawning stock biomass streams for the overfishing limit and acceptable biological catch in pounds:
  - Annually for five years
  - Under a "constant catch" scenario for both three and five years
  - For the equilibrium yield at F_{MSY}, when estimable
  - For interim projection years, use finalized or preliminary data; for incomplete interim years, use the mean of the previous three years.

3. Develop a stock assessment report to address these TORS and fully document the input data and results of the stock assessment model.

1.3. Overview of Changes and Decisions made regarding the SEDAR 72 Base Model Run

The SEDAR 72 Gulf of Mexico (GOM) Gag Grouper Stock Assessment Report was originally released on August 27th, 2021 (SEDAR 2021a). The report detailed model configurations and results for a base run that used female-only SSB as the measure of reproductive potential, with benchmarks and reference points calculated for two alternative model runs: one defining SSB as female-only and another defining SSB as males and females combined. For benchmarks and stock status, F_{MAX} was used as the F_{MSY} proxy as per the original TORs.

The Stock Assessment Report was reviewed at the September 2021 Standing, Reef Fish, Socioeconomic and Ecosystem (SSC) meeting. During the meeting, the SSC discussed which metric should be used to best characterize the reproductive potential of the stock in the base run (i.e., female-only SSB or SSB combined). To aid in deliberations, diagnostics were presented for the SSB combined run. Upon review of model diagnostics and guidance from Brooks et al. (2008), the SSC motioned that *the SEDAR 72 operational assessment of Gulf of Mexico Gag (based on the combined sexes SSB) represents the best scientific information available*. This decision was based on the consideration that gag grouper are a protogynous hermaphroditic species whose population exhibits a highly skewed sex ratio (~1-5% males) and for which there remains considerable uncertainty surrounding the relative contribution of males to the reproductive output of the stock.

On October 25th 2021, the SEDAR 72 GOM Gag Grouper Stock Assessment Report was updated to include diagnostic plots for the SSB combined scenario (SEDAR 2021b).

At the November 2021 SSC meeting, the SSB combined base model run projections and rebuilding scenarios were reviewed. Projections based on both F_{MAX} and F_{SPR30} were presented and discussed, with three alternative scenarios for the strength of the 2021 red tide event based on the ecosystem modeling work of Vilas et al. (2020). The SSC retraced the origins of the choice of F_{MAX} as the F_{MSY} proxy for the stock. In 2001, SSB female-only models were being used for GOM Gag Grouper. Since Spawning Potential Ratio (SPR) does not include males but

F_{MAX} does (the maximum yield per recruit depends on the average weight of all landed animals, male and female combined), F_{MAX} was used as a way to ensure that male biomass was also preserved so that the yield could be maximized over the entire population, not just the female biomass (if one is only measuring female biomass, long term F may result in the relatively low biomass levels of males, which in turn affects long term yield). In the 2001 assessment model, F_{MAX} was found to be approximately equivalent to an F_{SPR} of 45-60%. However, given that models now allow SSB to be modeled using both sexes combined and given that in SEDAR 72 F_{MAX} was not any more conservative than F_{SPR30} (F_{MAX} for the SSB female only model was approximately equivalent to an F_{SPR} of 30% and for the SSB combined model approximately equivalent to an F_{SPR} of 13%), the SSC motioned that F_{MAX} is *no longer appropriate for use as a proxy for MSY*. For projections, the SSC recommended that *projections based on F_{SPR30} and the medium red tide scenario be used to establish OFL, ABC, and rebuilding schedules.*

At the May 2022 SSC meeting, the TORs for the SRFS model run (**see Section 1.2.**) were reviewed and agreed upon.

In June 2022, an error was detected in the time series of landings and discards from the Southeast Region Headboat Survey (SRHS) that had been originally submitted to the SEDAR 72 assessment team (Cheshire, 2022). Both the SEDAR 72 base model run and the SRFS model run were therefore updated with the corrected Recreational Headboat data (**see Section 2.1.**). Model results and projections were reviewed during the July 2022 SSC meeting. While the correction had no discernible impacts on model fits and resulting trends in estimated SSB, fishing mortality and recruitment, they did impact rebuilding timelines. During the July 2022 SSC meeting, the group revisited the work of Harford et al. 2019, which provides guidance on the level of SPR that would maximize the probability of achieving long-term MSY in hermaphroditic stocks, and recommended *40%SPR as the appropriate F_{MSY} proxy and the basis for stock status determination criteria for Gulf of Mexico gag grouper.* The SSC carried the following motion: *The SSC determines that the SEDAR 72 Gulf of Mexico Gag Operational Assessment State Reef Fish Survey Run, based on the combined-sexes SSB, the corrected SRHS data, an MSY proxy of F_{SPR40}, and the "medium" red tide scenario is consistent with the best scientific information available and should be used as the basis for stock status determination and management advice. Based on this assessment model, the stock is determined to be overfished and undergoing overfishing.*

The intent of this report is therefore to detail any changes made to the formerly approved SEDAR 72 base model to accommodate the SRFS data and Headboat time series corrections, present updated model results and diagnostics, including comparisons with the SEDAR 33U assessment, as well as the previously approved SEDAR 72 base model (SEDAR 2021) with corrected Headboat time series, and generate new management benchmarks, stock status estimates and projections for Gulf of Mexico Gag Grouper using F_{MAX}, F_{SPR30} and F_{SPR40}. This alternative model run, from here on out, will be referred to as the SRFS Run.

2. Data Review and Update

A detailed review of the data sources used in the SEDAR 72 Operational Assessment are presented in *SEDAR (2021b)*. The only modifications made here concern the Private mode time

series of catches and discards, the Headboat mode time series of catches and discards, and the time series of historical recreational catches (1963-1980).

2.1. Headboat Mode Catches and Discards

The error in the Recreational Headboat data were the result of a flawed data pull that omitted Headboat area 23 from the query (i.e., northwest FL and AL) (Cheshire, 2022). Differences between the originally used Recreational Headboat time series of landings and discards vs. the corrected time series are shown in **Figures 1 and 2** for the SRFS Run and the SEDAR 72 Base Model Run, respectively. The error resulted in minor changes to the time series but required that both model runs be updated to reflect those changes. Changes in the time series of Recreational Headboat landings caused small changes in the apportionment by mode of the historical time series of Recreational landings (**see Section 2.3.** and **Figures 1-4**).

2.2. Private Mode Catches and Discards

In the SEDAR 72 Stock Synthesis (SS) assessment model, the Recreational Private + Shore fleet is composed of two modes (Private and Shore) with data from all Gulf States (FL, AL, MS, LA, TX). Across the years, the FL Private mode makes up, on average, 95% of the Recreational Private + Shore fleet total catches in numbers (range: 76%-99.9%). To update the SEDAR 72 base model, MRIP-FES catches and discards pertaining to FL Private mode were replaced by the SRFS calibrated time series (**Tables 1 and 2**, **Figure 5**). All other data sources contained in the Recreational Private + Shore fleet (i.e. Shore mode dataset and Private mode datasets from AL, MS, LA and TX) remained unaltered.

As detailed in the SEDAR 72 stock assessment report (SEDAR, 2021b), the fully calibrated (MRIP-FES) time series originally submitted for the Private mode exhibited a very strong peak in 1983. This peak was discussed during the SEDAR 72 Data Workshop (DW). Given that: 1. the peak was beyond the range of the rest of the data series, 2. it was largely driven by a single intercept survey of 1 angler trip with four contributors to group catch that harvested 36 Black Grouper (SEDAR72-WP-02), and 3. it had a major influence on the historical time series (which uses the average CPUE from 1981-1985 as a scalar, see SEDAR72-WP-05), the decision was made to replace the 1983 peak landings for MRIP-FES private mode with the geometric mean of 1981, 1982, 1984, and 1985 private mode landings. Since the SRFS time series is a scalar of the MRIP-FES time series, the same issue was apparent in the SRFS time series. As such, the 1983 peak landings for FL Private mode in SRFS currency (1,668,261 fish) was replaced with the geometric mean of SRFS Private mode landings for 1981, 1982, 1984, and 1985 (349,616 fish).

CVs for landings and discards obtained from the SRFS time series were input into the assessment as log-scaled standard errors ($\sqrt{(ln(1+CV^2))}$) for the Recreational Private + Shore fleet (**Tables 3 and 4**).

2.3. Calibration and Apportionment of Historical Recreational Landings

Historical values (1963-1980) for recreational landings estimated using the National Survey of Fishing, Hunting & Wildlife-Associated Recreation (FHWAR) method (SEDAR72-WP-05) had to be calibrated to the new time series of recreational landings. Following the FHWAR approach,

estimates of effort for 1963-1980 are multiplied by the average recreational sector CPUE for Gulf of Mexico Gag Grouper from 1981 to 1985 to obtain annual landings estimates for the historical time period (1963-1980).

This required recalculating the average recreational sector CPUE from 1981-1985. However, given that there were no SRFS operating in those early years, assumptions had to be made to approximate what would have been the SRFS calibrated effort for those years. Since both SRFS and MRIP calculate total catch (effort*CPUE) using similar values for CPUE, SRFS effort for 1981-1985 FL Private mode was back-calculated by dividing SRFS yearly catch estimates with MRIP yearly CPUE for FL private mode. The mean total CPUE for the recreational sector for 1981-1985 (0.026) was used as the new reference CPUE for multiplying the historical effort series to obtain total historical recreational landings in each year (1963-1980).

Total historical recreational landings were then apportioned by mode using the ratios 4.7% Headboat, 19.7% Charterboat, and 75.6% Private + Shore (compared with 2.5%, 10.6%, and 86.9%, respectively in the SEDAR 72 base model run). These ratios were based on the average proportion of landings by fleet over the period 1981-2019, given the updated time series for the Recreational Private + Shore fleet. Differences between the time series of recreational landings from the SEDAR 72 base model run and the SRFS Run are shown in **Figures 5 and 6**.

3. Stock Assessment Model - Results

3.1. Estimated Parameters and Derived Quantities

Table 5 contains a summary of model parameters for the SRFS Run. Results included are estimated parameter values and their associated CVs from SS, initial parameter values, minimum and maximum bounds on parameters, and the prior densities assigned to each parameter (if a prior was used). Most parameter estimates and variances were reasonably well estimated (i.e., CV < 1). Of the 373 active parameters, 21 exhibited CVs above one and were poorly estimated. Poorly estimated parameters included 16 recruitment deviations, the asymptote of the Recreational Headboat retention curve for the 2013-2015 time block, the asymptote of the Recreational Private + Shore retention curve for the 2011-2012 and 2016-2019 time blocks, the parameter defining the downslope of the selectivity for the Panama City (PC) Video Survey, and the red tide mortality in 2018.

3.2. Fishing Mortality

The exploitation rate (total biomass killed / total biomass age 3+) for the entire stock are provided in **Table 6** and **Figure 7**. Since 1963, the exploitation rate for the stock has averaged around 0.24, and ranged between 0.064 in 1963 to 0.625 in 2008. The exploitation rate gradually increased from low levels (less than ~0.1) to approximately 0.2 in the early 1980s. It then plateaued until the mid-1990's after which rates started to increase again with larger inter-annual variations. From 2008-2011, the stock experienced a sharp decline in exploitation rate, followed by a variable increase from 2011 to the end of the time series. The red tide years (2005, 2014, and 2018) show clear peaks in exploitation with relatively higher uncertainty about the estimate

compared to neighboring years. The terminal year (2019) exploitation rate for the entire stock was 0.374, which is slightly above the time series mean (0.24).

Table 7 and **Figure 8** provide estimates of exploitation rate by fleet and year. The results show that the exploitation rate for the stock was driven largely by the Recreational Private + Shore fleet throughout most of the time series, including prior to 1980. In contrast, in the SEDAR33 Update (pre-FES calibration) the Commercial Vertical Line fleet had the largest exploitation rates of the fleets prior to 1985. The next largest exploitation rates were that of Commercial Vertical Line + Other. The Recreational Private + Shore fleet has generally exhibited an increasing pattern of exploitation rate from the beginning of the time series to 2008 where it peaked at 0.39. This was followed by a sharp decline from 2008 to 2012 and variable rates from 2012 onward. Commercial Vertical Line + Other exploitation rates were relatively more stable across the time series. The fleet exhibited a sharp decline from 2008 to 2011 (first year post-IFQ) after which it began to rise again. The Commercial Vertical Line + Other and Recreational Charter exploitation rates were fairly close in magnitude across the time series. In the most recent years (2013+), Commercial Longline and Commercial Vertical Line + Other exploitation rates have been very similar. Generally, the Recreational Headboat exhibits consistently low levels of exploitation (averaged 0.008), peaking at 0.027 in 1985. The terminal year (2019) fishing mortality rates for the Commercial Vertical Line + Other, Commercial Longline, Recreational Headboat, Recreational Charter and Recreational Private + Shore fleets were 0.06, 0.031, 0.005, 0.044 and 0.236, respectively (**Table 7**).

3.3. Selectivity

A comparison of the SS estimated length-based selectivity functions for each directed fleet for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U models is shown in **Figure 9**. The top panel shows the results from using the logistic function to model selectivity of the Commercial Vertical Line + Other fleet in the SRFS Run assessment instead of the double normal function applied in SEDAR 33U. The logistic function allowed the length composition observation data to be fit better than the double normal. **Figures 10-14** provide fleet specific terminal year (2019) selectivity, retention, discard mortality and fraction of fish kept, dead and discarded for the 5 directed fisheries for both the SRFS Run and SEDAR 33U assessments. **Figure 15** presents SS derived age-based selectivity for each fleet in 2019. The Commercial Vertical Line + Other fleet reached 50% selectivity at age 5, while the Commercial Longline fleet reached 50% selectivity at age 7. The Recreational Headboat and Recreational Charter fleets both attain maximum selection at age 4, while the Recreational Private + Shore fleet attains maximum selection at age 3. All recreational fleets indicate higher selection for younger fish with the Recreational Headboat and Recreational Charter fleets showing 50% selectivity around age 2 and Recreational Private + Shore around age 0. In addition, selectivity plateaus starting around age 12 for both the Recreational Headboat and Recreational Charter fleets, which differs from SEDAR 33U where selectivities were forced to go to 0 at the oldest ages. Corrections to the Recreational Headboat data (**see Section 2.1**) originally resulted in bounding issues in two selectivity parameters of the Recreational Private + Shore fleet. As such, the parameter values of the ascending and descending limbs of the Recreational Private + Shore fleet selectivity function were fixed at the values previously estimated. These changes had no discernible impacts on model fits and resulting trends in SSB, fishing mortality and recruitment but allowed for greater model stability.

The estimated length-based selectivity functions for the SEAMAP Video Survey and PC Video Survey for the SRFS Run vs. SEDAR 33U are shown in **Figure 16**. The derived age-based selectivity functions are shown in **Figure 17**. The estimated selectivity of the SEAMAP survey from the SRFS Run is considerably different than that of SEDAR 33U. The SRFS Run shows 50% selection at age five instead of 27 in SEDAR 33U. Maximum (full) selectivity occurred at around nine in the SRFS Run while SEDAR 33U selectivity reached just above 50% at the oldest age group. The shapes of the PC Video Survey selectivity from SEDAR 33U and the SRFS Run are similar due to the constraints imposed on the selectivity parameters in the SRFS Run.

All selectivity parameter estimates and associated uncertainty are listed in **Table 5** with the Label prefix "Size_".

3.4. Retention

Time-varying retention functions, by time block, are provided for each directed fleet and are shown in **Figures 18-22**. All retention parameter estimates and associated uncertainty are listed in **Table 5** with the Label prefix "Retain_".

Most retention parameters appeared well estimated except for the asymptotes for the 2011-2012 and 2016-2019 time blocks on the Recreational Private + Shore (**Table 5**). The post-IFQ asymptote for Commercial Vertical Line + Other was slightly higher than that of Commercial Longline (**Figures 18 and 19**) which is in line with our understanding of the discarding behavior of each fleet. The asymptotes of the Recreational Headboat and Recreational Charter were estimated as gradually higher values for each consecutive block (**Figures 20 and 21**), which is in line with the easing of restrictions on the recreational fishing season. For Recreational Private + Shore, however, the model was only able to estimate an asymptote lower than one for the first two block (most restrictive fishing seasons). The asymptote for the 2016-2019 block was estimated around one with very high variance, likely due to the lack of data on size composition of the discards to inform its height (**Figure 22, Table 5**).

3.5. Recruitment

As noted in the description of the SS model configuration, two of three of the S/R parameters were fixed at values agreed upon during SEDAR 33: steepness (0.855) and *sigmaR* the recruit variance parameter (0.6). The corresponding Beverton-Holt stock recruit relationship is shown in **Figure 23**. Estimated annual recruitment of age-0 fish (1000s) from 1963-2019 including recruitment deviations and variance are shown in **Table 8** and **Figures 24-26**. Virgin recruitment in log-space (lnR_0) was estimated at 9.094 (**Table 5**), which equates to 8.9 million age-0 Gag Grouper. The estimated (and applied) recruitment bias adjustment ramp is shown in **Figure 27**.

During the main recruitment period (1984-2019), estimated recruitment averaged 5.47 million Gag Grouper and was lowest in 2011 at 1.3 million Gag Grouper and highest in 1996 at 13.81 million Gag Grouper (**Figure 24**). Recruitment deviations were characterized by a period of lower than average recruitment in the late 1980's followed by a period of above average recruitment from the mid-1990s to the late 2000s and near average recruitment from 2013-2017. There was a noticeable drop in recruitment in 2011 (an 75% drop from the previous year), which coincides with a strong signal of recruitment failure in the age-0 survey index (**Figure 28**) and

the age composition of the Commercial Vertical Line + Other, Commercial Longline, Recreational Headboat and Recreational Charter fleets (**Figures 29-32**).

CVs for recruitment deviations during the main recruitment period averaged 0.103 between 2017 and 2016, and ranged from 0.04 in 1996 to 0.211 in 2014 (**Figure 26**). For the last two years of the assessment (2018, 2019), recruitment deviations were largely informed by the age-0 index, as age-0 and age-1 fish had not yet fully recruited to the fisheries. Estimated recruitment for those terminal years were below average, their estimated values and associated CVs were 1.517 million Gag Grouper (CV=0.247) and 2.158 million Gag Grouper (CV=0.408), respectively.

3.6. Biomass and Abundance Trajectories

The estimated annual total biomass (metric tons), exploitable biomass (ages 3+, metric tons), SSB (metric tons), SSB ratio (SSB/virgin SSB) and exploitable abundance (1,000s of fish) from 1963 to 2019 are provided in **Table 8**. Total biomass averaged 13,431 metric tons, and ranged from 3,150 metric tons in 2015 to 33,737 metric tons in 1963 (**Figure 33**). Exploitable biomass and numbers, which were comprised of Gag Grouper age-3 or older, averaged 11,438 metric tons and 2,845,137 Gag Grouper, respectively. Exploitable biomass was lowest in 2015 at 2,415 metric tons and peaked in 1963 at 30,975 metric tons, whereas exploitable numbers ranged from 703,081 Gag Grouper in 2015 to 5,821,546 Gag Grouper in 1963 (**Table 8**). SSB averaged 9,389 metric tons, and ranged from 1,695 metric tons in 2017 to 27,796 metric tons in 1963 (**Figure 34**). Both total biomass and SSB show a steady decline from 1963 to the late 1970s, followed by a plateauing off in the 1980s to early 1990s. Starting in the mid-1990s, biomass trends show a sharper increase followed by a drop in 2005 (coinciding with the red tide event), followed by a small increase in the early 2010s again and by a second drop in 2014 (red tide event). Since 2014, the biomass trends have remained relatively flat, at levels well below the average of the time series.

The SSB ratio averaged 0.14, and ranged from 0.03 in 2017 to 0.41 in 1963 (**Table 8**). Estimated SSB ratio has stayed below 10% since 2005, with estimated spawning stock biomass in the most recent year (2019) predicted to be at 3% of the corresponding unfished spawning stock biomass (**Table 8**).

Estimated SSB (metric tons), exploitable biomass (ages 3+, metric tons), and exploitable abundance (1,000s of fish) by sex are provided in **Table 9**. Also included is the predicted sex ratio of exploitable male to female Gag Grouper, which averaged 9.3% and ranged from 0.9% in 2010 to 28% in 1971, 1972. The predicted sex ratio of exploitable male to female Gag Grouper equaled 1.8% in the terminal year of the assessment. The sex ratios predicted by the model were close to those observed in the field (see SEDAR72-WP-08). The predicted numbers-at-age and biomass-at-age of female and male Gag Grouper at virgin conditions are shown in **Figure 35**. The sex ratio predicted by the model at virgin conditions was 32%. At virgin conditions, age-0 and age-6 female Gag Grouper dominated in numbers and biomass, respectively, whereas age 20+ male Gag Grouper were most abundant and dominated biomass (**Figure 35**). Predicted numbers at age and mean age over the entire time series for both SEDAR 33U and the SRFS Run is shown in **Figure 36**.

3.7. Model Fit and Residual Analysis

3.7.1. Landings

Landings for the Commercial Vertical Line + Other and Commercial Longline fleets were fit almost exactly given their relatively small SEs (**Tables 10 - 11**, **Figure 37**). The model expected slightly lower catches for Commercial Longline from 2001-2004. Given the large SEs assigned to the recreational fleet landings, there were considerable differences between input and predicted landings in numbers (**Tables 12-14**, **Figure 37**). For Recreational Headboat, observed and predicted values matched well until 1985, after which there were noticeable departures, particularly at the peaks and troughs where the model expected more variability than was observed. From 2007-2010, the model expected slightly higher catches. For Recreational Charter, observations and predictions matched well up until the mid 1990s. From 1996 to 2015, the model generally expected higher catches than observed. For Recreational Private + Shore, the model expected lower catches from 1980 to 1995, after which the departures from observed to expected were more randomly distributed, alternating between the model expecting relatively lower and higher catches than observed, except for 2008-2014 where the model generally expected higher catches than observed. Many of the differences in observed and predicted landings coincided with the model being better able to fit to the discard data (see **Figure 38**). In general, there was a closer fit to the landings data in SEDAR 33U compared with the SRFS Run due to increased CVs.

3.7.2. Discards

The time series of commercial discards begins in 1993, three years after the implementation of the first minimum size limit. Observed and expected values are summarized in **Tables 15-16** and **Figure 38**. Generally, the discards were relatively low for both the Commercial Vertical Line + Other and Commercial Longline fleets, though the Commercial Longline had fewer discards than the Commercial Vertical Line + Other. Discards were estimated with a large assumed uncertainty, and therefore were characterized by large confidence intervals for both commercial fleets (**Figures 39-40**). For the Commercial Vertical Line + Other fleet, the model expected fewer discards than observed in 2000 and 2011. There was a noticeable peak in expected discards in 2008, where the model expected twice as many discards as were observed. For the Commercial Longline fleet, the model expected higher discards than observed from 2001-2009, and again in 2016. The model expected lower discards than observed in 1993, 1994, 2000, and again from 2010-2011. There were two noticeable peaks in expected discards in 2001-2005 and 2016, where the model expected twice as many discards as were observed. The difference in discard rates between 2010-2011 and the remainder of the time series may be indicative of a change in selectivity of the fleets as a response to the IFQ. However, such a change was not modeled here.

The time series of discards for the recreational fleets begins in 1981 (**Tables 17-19**, **Figures 41-43**). The model was able to fit discard observations very well throughout the time series for the Recreational Private + Shore fleet (**Figure 43**). For Recreational Headboat and Recreational Charter fleets (**Figures 41 and 42**) the model was able to fit discard observations relatively well except in 2009-2010, where the model expected Recreational Charter discards were well below observed values. Recreational Headboat discards were highly variable from year to year with no apparent trend.

Looking at discards as a percent of total catch, increases in discard rates from the Recreational Headboat and Recreational Charter appear consistent with implementation of size limits and reductions in fishing seasons (**Figures 44 and 45**). Discard rates for the Recreational Charter fleet were generally estimated below observed values. For the Recreational Private + Shore fleet, there is a sharp increase in discard rate in 1990, coinciding with the first minimum size limit. In 2000 and 2017 there is another smaller increase corresponding to the increase in the minimum size limit from 20 to 22 to 24 inches TL (**Figure 46**). However, the impact of the shortened fishing season post 2011 is less apparent than it is in the Recreational Headboat and Recreational Charter fleets.

3.7.3. Indices

Observed and predicted CPUE are provided in **Tables 20 and 21** and **Figure 47**.

The model fit best to the Charter + Private Index and Recreational Headboat (root mean squared error [RMSE] = 0.353 and 0.367, respectively; with variance adjustment recommended of 0.112 and 0.106, respectively). Both indices had similar trends (**Figure 47**), with the index generally decreasing from 1985-1990, staying relatively flat from 1990-1995, then increasing to the late 1990s. From 1999 to 2010, the truncated Headboat CPUE index generally decreases and the Charter + Private CPUE index continues decreasing until 2015. Since 2015, the Charter + Private CPUE has shown a somewhat increasing trend.

Both commercial CPUE indices showed a gradually increasing trend from 1990 to 2005 but the fit to the index was relatively flat over that time period given the relatively high variance adjustment factor (0.322 for VL and 0.288 for LL). Both indices exhibited a drop from 2005 to 2009 coinciding with the drop in catches. The decline in the indices was steeper than that of the fitted values (**Figure 47**).

Of the two video indices, the model fit better to the PC Video Survey (RMSE= 0.493) than to the SEAMAP Video Survey (RMSE= 0.822) (**Figure 47**). The fits to the fishery-independent indices were much improved between SEDAR 33U and the SRFS Run, particularly in the last 5 years of the time series.

The age-0 survey had the highest suggested variance adjustment (0.531), likely to counter the very small values of the index, where input CVs made uncertainty appear unrealistically small (**Figure 47**). The RMSE for the age-0 index was 0.797.

With the added variance adjustment, the SRFS Run base model admits more uncertainty in the indices than was assumed during SEDAR 33U. Fits to the various indices over the last 5 years of the assessment are much improved in the SRFS Run compared to the fits from SEDAR 33U (**Figure 47**).

3.7.4. Length Compositions

Model fits to the retained and discarded length composition data are provided in **Figures 48-53**. Fits to retained length compositions were generally better than to discarded length compositions for each fleet, which is to be expected given that sample sizes were notably smaller for discard length compositions.

The aggregate fit to the retained length composition data were fairly similar between SEDAR 33U and the SRFS Run (**Figure 54**), but unlike the SEDAR 33U, no strong residual pattern in the tails was evident and residuals were generally smaller across fleets (**Figure 53**). The fit to the SEAMAP Video Survey length compositions was improved with the inclusion of additional samples (**Figure 55**). The fit to the PC Video Survey length compositions degraded but the number of available samples was small and the chosen selectivity pattern was thought to be more in line with the true selectivity of the survey than what SS would have estimated freely (**Figure 56**).

Though residuals were generally small, there was a persistent trend in residuals in the last 5 years of fit to the commercial fleets' length compositions (**Figures 48 and 49**), most apparent in the Commercial Vertical Line + Other. There was also a strong pattern of positive residuals at the largest lengths from 1998-2008 in the Commercial Longline fleet, where the model expected younger fish than observed.

The Recreational Headboat showed fairly distinct patterns in residuals pre-1996 and post-1996 (**Figure 50**). Residual patterns were more randomly distributed for the Recreational Charter (**Figure 51**). The length composition of the Recreational Private + Shore fleet showed individuals being retained below the size limit and a consistent increase in mean length of the retained catch across the time series (**Figure 52**).

3.7.5. Age Compositions

Model fits to the age composition data are provided in **Figures 57-63**. Generally, the fits to the age composition were similar between SEDAR 33U and the SRFS Run. In both cases, Recreational Private + Shore had the poorest fit with the model expecting a greater proportion of larger fish than observed (**Figure 61**).

Across all fleets, there was a tradeoff between fitting to the weighted retained length compositions and fitting to the nominal age compositions. Overall, the model fit more closely to the length compositions due to the larger sample sizes and larger contribution to the total likelihood.

3.7.6. Red Tide Mortality

Red tide was detected in all three years pre-specified in the assessment model as being potentially active red tide years: 2005, 2014 and 2018 (**Figure 8**). Red tide mortality (apical F) was estimated at 0.74, 0.91, and 0.07, respectively. This corresponds to removals of 7.78, 4.78, 0.28, and million Gag Grouper, respectively.

3.8. Model Diagnostics

3.8.1. Correlation Analysis

A summary of correlations for the base model parameters considered as outliers is contained in **Table 22**. Given the highly parameterized nature of this model, some parameters were mildly correlated (correlation coefficient > 70%) and two combinations displayed a strong correlation (> 90%; **Table 22**). Correlation among many of these parameters is not surprising, especially for the selectivity parameters, because the parameters of selectivity functions are inherently

correlated (i.e., as the value of one parameter changes the other value will compensate). The same can be said for the von Bertalanffy growth parameters (K and L_{Amax}), which are by their very nature correlated. Moderate correlations occurred between the parameters defining the peak and the width of the ascending and/or descending limb of the double normal selectivity functions for all recreational fleets. A number of the recruitment deviations were also moderately correlated.

3.8.2. Likelihood Profiles

The total likelihood component from the lnR_0 likelihood profile indicates that the global solution for this parameter is at 9.094 (CV = 0.006) (**Figure 64**; **Table 5**). lnR_0 = 9 and 9.2 were within 2 negative log-likelihood units of the global minimum. There was a noticeable conflict between datasets with the length datasets favoring a smaller lnR_0 (8.5) and the age datasets favoring a larger lnR_0 (10.4+). The other data sources were generally in agreement with the index data favoring a lnR_0 between 9.2-9.6, the catches favoring a lnR_0 9.1-10.3, the discards favoring a lnR_0 > 9.6, and the recruitment favoring a lnR_0 between 8.8-9.1.

3.8.3. Jitter Analysis

A jitter analysis was conducted using a jitter value of 0.1. With this procedure, the starting model parameter values are randomly adjusted by 10% from the SRFS Run best fit over 100 runs. The model converged to the same likelihood of the SRFS Run Base Model in 83% of runs, with no runs demonstrating a lower negative log-likelihood solution (**Figure 65**). For the 17 remaining runs, given that the total negative log-likelihood values were much higher than that of the base run, it is probable that non-optimal solutions were found (i.e., the model search was stuck in local minima). Given these results, the jitter analysis indicates that the base model is relatively stable and reached the global solution.

3.8.4. Retrospective Analysis

Results from the retrospective analysis do not indicate any directional retrospective patterns. As the last few years of data are peeled off, the model estimates of SSB, recruitment and F in each successive terminal year do not change by a large margin (and remain within the confidence intervals; **Figures 66-68**). The year with the largest differences in SSB between peels is 2014. This is a red tide year. As the model is given additional information on the impact of the red tide with additional years of data, the estimate of SSB for 2014 is brought down to lower levels.

4. Comparing the SRFS Run to the SEDAR 72 base model

4.1. Fits to the data

The overall fits to the data were nearly identical between SEDAR 72 and the SRFS Run (see SEDAR 2021).

4.2. Trends in Biomass, Recruitment and Fishing Mortality

The trends in SSB were very similar between the two runs over the time frame of the assessment (1963-2019; **Figure 69**). One major difference between the two runs however is the estimates of virgin conditions. The SRFS Run estimates a much smaller initial population size (SSB_0=67052

mt; R_0=8.9 million fish) compared to SEDAR 72 (SSB_0=100891 mt; R_0=13.6 million fish) (**Figure 69**). Nonetheless, current levels of depletions estimated by each model are similar: 2.54% of SSB_0 for the SRFS Run vs. 2.28 % of SSB_0 for the SEDAR 72 run.

Trends in fishing mortality were also very similar between the two runs over most of the assessment time frame with the SRFS Run estimating slightly lower rates of fishing mortality over most of the time series (**Figure 69**), with the exclusion of the 2014 red tide year where the SRFS Run estimated a much higher rate of mortality coming from the red tide event in that year (exploitation rate associated with the 2014 red tide event = 0.79) compared with SEDAR 72 (0.29).

4.3. Diagnostics

Both models performed equally well in terms of the jitters (**Figures 65 and 70**) and retrospective analysis diagnostics (**Figures 66-68 and 71-73**). However, SEDAR 72 showed better diagnostics in the R0 profile (**Table 23**, **Figures 64 and 74**) compared with the SRFS Run. The age and length data components showed a much higher level of disagreement in the SRFS Run than they had in SEDAR 72, and a higher level of disagreement with the rest of the data inputs overall.

5. Projections

5.1. Introduction

The SRFS Run projections were carried for the F_{MAX}, F_{SPR30}, and F_{SPR40} key fishing mortality scenarios: F_0 and F_{OFL}. Where applicable, rebuilding projections are also presented. Corresponding projection results from the SEDAR 72 base run are shown for comparison.

5.2. Projection Methods

The simulated dynamics used for projections assumed nearly identical parameter values and population dynamics as the SS base model. **Table 24** provides a summary of projection settings for the SRFS Run. Projections were run assuming that selectivity, discarding and retention were the same as the most recent year (to accommodate the fact that a block is imposed in 2019 due to the recent change in minimum size limit for the commercial fleet). Forecast recruitment values were derived from the model-estimated Beverton-Holt stock-recruitment relationship. The catch allocation among fleets used for the projections was unchanged from SEDAR 33U (0.39 commercial: 0.61 recreational; Reef Fish Amendment 30B). The same projection settings were used on the SEDAR 72 model except that the private recreational interim landings were in FES currency (**Table 25**).

The terminal year of the SRFS Run was 2019 and the first year of management advice was 2023. Retained catch for the interim years (2020-2022) used landings statistics when available and the average of the last three years of retained catches when not. For 2020, finalized landings statistics were available for all fleets. For 2021, finalized landings statistics were available for the Recreational Headboat fleet, with preliminary estimates available for all other fleets (Recreational Charter and Recreational Private + Shore are currently missing Texas catch estimates for the last wave of 2021; while commercial landings are complete but will undergo a minor adjustment next year). Given that only minor changes expected for 2021 landings,

preliminary estimates were used as the 2021 interim landings. For the last interim year (2022), the average of the last three years of available landings, by fleet, were used as interim catch (i.e. 2019-2021), see **Tables 24 and 25**. For the SRFS Run, the FES-SRFS conversion factor of 0.420811 (Cross et al. 2020) was used to convert interim landings of the Private FL sector into SRFS currency.

$F_{MSYproxy}$ was determined using a long-term 100-year projection assuming that equilibrium was obtained over the last 10 years (2109-2119). For the OFL projection, the $F_{MSYproxy}$ was applied to the stock starting in 2023 while maintaining the pre-specified fleet allocation fixed. The minimum stock size threshold (MSST) was determined by multiplying the reference spawning stock biomass, $SSB_{FMSYproxy}$, by 0.5 (per the SRFS Run TORS) and was used to determine stock status (**Table 26**). The maximum fishing mortality threshold (MFMT) was equivalent to the harvest rate ($F_{MSYproxy}$; total biomass killed / total biomass age 3+) that achieved $SSB_{FMSYproxy}$, and was used to assess whether overfishing was occurring in a given year (**Table 26**).

Once the proxy values were calculated, 2019 stock status was used to determine whether a rebuilding plan was required (i.e., if SSB < MSST then Gulf of Mexico Gag Grouper would be considered overfished and a rebuilding plan would be required). F_0 projections were run to determine the year in which the stock would rebuild in the absence of fishing mortality ($SSB_y >= SSB_{FMSYproxy}$; using beginning of year (Jan 1) SSB estimates to determine if stock is rebuilt in year *y*), which helps to determine the rebuilding time frame.

5.3. Red Tide

The Gulf of Mexico Gag Grouper ecosystem model presented during the SEDAR 72 Operational Assessment (SEDAR 72 WP-01; Vilas et al., 2020) was updated with data through October 2021 to provide estimates of red tide strength for the 2021 interim year. The M associated with the 2021 red tide event was estimated at 0.103 (95% CI: 0.027-0.290) by the Ecospace model. This point estimate was termed the "Medium Red Tide" scenario, with the limits of the 95% confidence interval surrounding that estimate were referred to as the "Low" and "High" scenarios. The Reef Fish AP and the SSC agreed that the Medium Red Tide scenario was most appropriate for projections.

The following steps were taken to convert the ecosystem model point estimate of red tide M for 2021 to a point estimate of F for input for the Stock Synthesis Red Tide bycatch-only fleet:

1. The strength of the 2021 red tide relative to the 2005 red tide (resulting from the ecosystem model) was calculated as $\frac{M_{2021}}{M_{2005}} = \frac{0.103}{0.428} = 0.241$
2. This number was multiplied by the Stock Synthesis estimate of Red Tide apical F in 2005 to obtain an F for 2021: $F_{RedTide2005} * 0.241 = 0.741 * 0.241 = 0.179$ (or in the case of the SEDAR 72 model : $F_{RedTide2005} * 0.241 = 0.614 * 0.241 = 0.148$)

For SS, this translates into a red tide that is 24% the strength of the 2005 red tide in both assessment model runs.

5.4. Projection Results

Benchmarks and reference points were calculated in three ways: assuming an $F_{MSYproxy}$ equal to F_{SPR30}, F_{SPR40}, and F_{MAX}.

5.4.1. Biological Reference Points

The following Status Determination Criteria (SDC) were adopted for Gulf of Mexico Gag Grouper:

- MSST = 0.5*$SSB_{FMSYproxy}$ (Amendment 44),
- MFMT = $F_{MSYproxy}$ or $F_{rebuild}$ if overfished.

The harvest rate that results in SSB_{FSPR30} over the long-term (100 years) was 0.144 for the SRFS Run and 0.148 for SEDAR 72 (**Table 26**). The resulting SSB_{FSPR30} was 18035 metric tons for the SRFS Run and 27140 for SEDAR 72. The minimum stock size threshold (MSST) was 9018 metric tons and 13570 metric tons, respectively (**Figure 75**).

The harvest rate that results in SSB_{FSPR40} over the long-term (100 years) was 0.098 for the SRFS Run and 0.101 for SEDAR 72 (**Table 26**). The resulting SSB_{FSPR40} was 25039 metric tons for the SRFS Run and 37675 for SEDAR 72. The minimum stock size threshold (MSST) was 12520 metric tons and 18838 metric tons, respectively (**Figure 76**).

The harvest rate that results in SSB_{FMAX} over the long-term (100 years) was 0.327 for the SRFS Run and 0.322 for SEDAR 72 (**Table 26**). The resulting SSB_{FMAX} was 6062 metric tons for the SRFS Run and 9753 for SEDAR 72. The minimum stock size threshold (MSST) was 3031 metric tons and 4876 metric tons, respectively (**Figure 77**).

5.4.2. Stock Status

Benchmarks and reference points for the two model specifications (the SRFS Run and SEDAR 72) are shown in **Table 26**. Detailed time series are presented in **Tables 27-32**.

Both model specifications give similar estimates of stock status when comparing results from the same $F_{MSYproxy}$. In all scenarios, the Gulf of Mexico Gag Grouper stock is undergoing overfishing ($F_{current} > MFMT$) and is overfished ($SSB_{2019} < MSST$) based on the definition of MSST ($0.5 * SSB_{FMSYproxy}$), $F_{current}$ (geometric mean of the harvest rate over 2017-2019, excluding the 2018 red tide) and MFMT ($F_{MSYproxy}$) (**Table 26**). The terminal year SSB is well below the recovery target, $SSB_{FMSYproxy}$ in all scenarios (**Figures 75, 76 and 77**), with the stock being more severely depleted in the $F_{MSYproxy} = F_{SPR40}$ scenarios.

For the SRFS Run F_{SPR30} scenario, in 2019 SSB was only 9% of the biomass level needed to support MSY (vs. 8% under the SEDAR 72 model run). From 2017 to 2019 the estimated stock harvest rate, using the geometric mean, was 0.353 (vs. 0.416 for SEDAR 72), which was equivalent to 245% of F_{SPR30} (vs. 281% for SEDAR 72) (**Table 26**, **Figure 75**).

For the SRFS Run F_{SPR40} scenario, in 2019 SSB was only 7% of the biomass level needed to support MSY (vs. 6% under the SEDAR 72 model run). From 2017 to 2019 the estimated stock

harvest rate, using the geometric mean, was 0.352 (vs. 0.414 for SEDAR 72), which was equivalent to 359% of F_{SPR40} (vs. 409% for SEDAR 72) (**Table 26**, **Figure 76**).

For the SRFS Run F_{MAX} scenario, in 2019 SSB was only 28% of the biomass level needed to support MSY (vs. 24% under the SEDAR 72 model run). From 2017 to 2019 the estimated stock harvest rate, using the geometric mean, was 0.352 (vs. 0.414 for SEDAR 72), which was equivalent to 108% of F_{MAX} (vs. 128% for SEDAR 72) (**Table 26**, **Figure 77**).

The Kobe plot for the SRFS Run F_{SPR30} scenario (**Figure 78**) indicates that over the time horizon of the assessment (i.e., 1963 - 2019), the stock has experienced overfishing for 46 of the 57 assessment years and has experienced overfishing consistently since 1985, including the terminal (2019) year of the assessment. The Kobe plot for the SEDAR 72 scenario (**Figure 79**) similarly indicates that over the time horizon of the assessment (i.e., 1963 - 2019), the stock has experienced overfishing for 48 of the 57 assessment years and is experiencing overfishing in the terminal (2019) year of the assessment.

The Kobe plot for the SRFS Run F_{SPR40} scenario (**Figure 80**) indicates that over the time horizon of the assessment (i.e., 1963 - 2019), the stock has experienced overfishing for 51 of the 57 assessment years and has experienced overfishing consistently since 1969, including the terminal (2019) year of the assessment. The Kobe plot for the SEDAR 72 scenario (**Figure 81**) similarly indicates that over the time horizon of the assessment (i.e., 1963 - 2019), the stock has experienced overfishing for 52 of the 57 assessment years and is experiencing overfishing in the terminal (2019) year of the assessment.

The Kobe plot for the SRFS Run F_{MAX} scenario (**Figure 82**) indicates that over the time horizon of the assessment (i.e., 1963 - 2019), the stock has experienced overfishing for 15 of the 57 assessment years and has experienced overfishing consistently since 2016, including the terminal (2019) year of the assessment. The Kobe plot for the SEDAR 72 scenario (**Figure 83**) indicates that over the time horizon of the assessment (i.e., 1963 - 2019), the stock has experienced overfishing for 19 of the 57 assessment years and has experienced overfishing consistently since 2016, including the terminal (2019) year of the assessment.

As expected, prolonged overfishing reduced stock biomass below $SSB_{FMSYproxy}$ for 48 of the 57 assessment years in the F_{SPR30} scenario and 19 years in the F_{MAX} scenario of the SRFS Run (51 and 33 respectively in the SEDAR 72 base run). In the F_{SPR30} scenario, using the MSST definition for Gulf of Mexico Gag Grouper, the stock has been in a consistent overfished state since 1978 (1975 for SEDAR 72) dipping to just 3% of SSB_0 in 2017 (2% for SEDAR 72 in 2019). In the F_{MAX} scenario, using the MSST definition for Gulf of Mexico Gag Grouper, the stock has been in a consistent overfished state since 2015 (2014 for SEDAR 72).

Across the time series, there have been brief periods of moderate improvements in SSB, in the late 1990's/early 2000s and again around 2010, but each were followed by sharp declines in SSB (**Figures 75 - 77**) often following large red tide events.

5.4.3. Overfishing Limits, F_0 projections and $F_{rebuild}$ scenarios

OFL projection results for the SRFS Run and SEDAR 72 base model run are provided in **Tables 33-38**. Forecasts begin in 2023 because management based on this stock assessment is not

expected to begin until 2023. Since the stock is overfished (**Table 26**), rebuilding projection were conducted.

The F_0 projections for the F_{SPR30} scenario show the stock rebuilding in 2033 in the SRFS Run and 2033 in the SEDAR 72 scenario (**Tables 39 and 40**).

The F_0 projections for the F_{SPR40} scenario show the stock rebuilding in 2035 in the SRFS Run and 2036 in the SEDAR 72 scenario (**Tables 41 and 42**).

The F_0 projections for the F_{MAX} scenario show the stock rebuilding in 2027 in the SRFS Run and 2029 in the SEDAR 72 scenario (**Tables 43 and 44**).

T_{min}, calculated as the amount of time the stock or stock complex is expected to take to rebuild to its MSY biomass level in the absence of any fishing mortality (F=0), was used to determine the rebuilding time frame options:

- $T_{min} = 10$ years: 10 years (i.e. $F_{rebuild}$=0)
- $T_{min} < 10$ years:
  - T_{min} (i.e. $F_{rebuild}$=0)
  - Halfway between T_{min} and 10 years, rounded to the nearest year
  - 10 years
- $T_{min} > 10$ years:
  - T_{min} + the length of time associated with one generation time (8 years)
  - Amount of time stock expected to take to rebuild to Bmsy proxy if fished at $75\% MFMT$
  - $T_{min} * 2$

For the SRFS Run and SEDAR 72 F_{SPR30} scenarios, $T_{min} = 10$ years. As such, $F_{rebuild} = 0$ so no additional rebuilding options are presented beyond F=0 projections.

The rebuilding options for the SRFS Run under the F_{SPR40} scenario are presented in **Tables 45-47**. Details regarding the impact to retained yield and discards is shows in **Tables 48-50**.

The rebuilding options for the SEDAR 72 base run under the F_{SPR40} scenario are presented in **Tables 51-53**. Details regarding the impact to retained yield and discards is shows in **Tables 54-56**.

The rebuilding options for the SRFS Run under the F_{MAX} scenario are presented in **Tables 57 and 58**. Details regarding the impact to retained yield and discards is shows in **Tables 59 and 60**.

The rebuilding options for the SEDAR 72 base run under the F_{MAX} scenario are presented in **Tables 61 and 62**. Details regarding the impact to retained yield and discards is shows in **Tables 63 and 64**.

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Tables

Table 1. Gulf of Mexico Gag Grouper recreational landings in numbers. Relative contributions from the SRFS FL Private time series (Private SRFS) vs. all other Private + Shore data sources (Private + Shore Non-SRFS) to the final Recreational Private + Shore fleet (Private + Shore Total) is shown.

Year	Charter	Headboat	Private SRFS	Private + Shore Non-SRFS	Private + Shore Total
1963	97,585	23,007			374,170
1964	100,546	23,705			385,523
1965	103,507	24,403			396,876
1966	106,677	25,150			409,032
1967	109,847	25,898			421,187
1968	113,017	26,645			433,343
1969	116,187	27,393			445,498
1970	119,357	28,140			457,653
1971	130,431	30,751			500,111
1972	141,504	33,361			542,569
1973	152,577	35,972			585,027
1974	163,650	38,583			627,485
1975	174,723	41,193			669,943
1976	175,431	41,360			672,658
1977	176,139	41,527			675,373
1978	176,847	41,694			678,088
1979	177,555	41,861			680,802
1980	178,263	42,028			683,517
1981	117,237	73,757	248,523	81,517	330,039
1982	106,427	66,110	799,074	50,892	849,967

Table 1 Continued. Gulf of Mexico Gag Grouper recreational landings in numbers. Relative contributions from the SRFS FL Private time series (Private SRFS) vs. all other Private + Shore data sources (Private + Shore Non-SRFS) to the final Recreational Private + Shore fleet (Private + Shore Total) is shown.

Year	Charter	Headboat	Private SRFS	Private + Shore Non-SRFS	Private + Shore Total
1983	99,849	61,752	349,616*	79,061	428,677
1984	69,957	43,780	217,183	37,118	254,301
1985	164,180	103,116	346,407	255,729	602,137
1986	367,116	42,495	320,720	109,257	429,977
1987	106,620	32,156	366,673	34,870	401,543
1988	86,865	26,336	378,249	45,618	423,866
1989	74,357	35,145	305,923	47,215	353,138
1990	26,279	19,097	224,510	232	224,742
1991	35,079	11,453	230,749	28,098	258,847
1992	156,110	13,789	185,454	30,712	216,166
1993	137,481	19,335	272,856	65,200	338,057
1994	66,607	20,561	176,343	23,686	200,029
1995	112,353	17,816	359,098	42,233	401,331
1996	199,052	16,062	174,145	62,702	236,847
1997	139,119	15,623	331,393	4,238	335,630
1998	199,321	36,316	369,254	90,351	459,605
1999	137,899	32,117	461,781	86,829	548,611
2000	127,608	30,824	533,963	52,788	586,751
2001	84,576	14,494	419,619	22,866	442,486
2002	114,051	11,615	474,833	45,952	520,785

*The 1983 peak in SRFS Private landings (1,668,261 fish) was replaced by the geometric mean of SRFS Private mode landings for 1981, 1982, 1984, 1985. The new value is 349,616 fish.

Table 1 Continued. Gulf of Mexico Gag Grouper recreational landings in numbers. Relative contributions from the SRFS FL Private time series (Private SRFS) vs. all other Private + Shore data sources (Private + Shore Non-SRFS) to the final Recreational Private + Shore fleet (Private + Shore Total) is shown.

Year	Charter	Headboat	Private SRFS	Private + Shore Non-SRFS	Private + Shore Total
2003	92,980	16,381	362,593	25,423	388,017
2004	134,341	24,670	583,521	25,468	608,989
2005	126,872	16,784	445,103	88,860	533,962
2006	70,445	6,764	271,208	14,327	285,535
2007	33,991	11,141	213,576	22,665	236,240
2008	89,110	10,521	355,829	23,870	379,698
2009	46,692	9,483	161,018	35,569	196,587
2010	60,233	11,094	217,547	34,217	251,765
2011	10,632	5,099	126,462	6,920	133,382
2012	46,754	5,253	98,223	3,424	101,646
2013	24,939	5,276	185,441	788	186,230
2014	12,425	6,203	131,229	1,338	132,567
2015	12,977	3,626	110,900	103	111,003
2016	17,623	2,490	81,612	655	82,266
2017	25,424	2,932	106,763	178	106,941
2018	19,823	3,026	117,749	4,103	121,852
2019	28,537	2,650	92,492	5,507	97,999

Table 2. Gulf of Mexico Gag Grouper recreational discards in numbers input into the assessment model. Relative contributions from the SRFS FL Private time series (Private SRFS) vs. all other Private + Shore data sources (Private + Shore Non-SRFS) to the final Recreational Private + Shore fleet (Private + Shore Total) is shown. Discards refer to the total number of fish discarded before applying the discard mortality rate.

Year	Charter	Headboat	Private SRFS	Private + Shore Non-SRFS	Private + Shore Total
1981	89,783	56,153	160,759	240,014	400,773
1982	14,601	9,132	189,336	7,669	197,005
1983	15,011	9,388	350,940	4,986	355,926
1984	6,215	3,887	69,684	13,784	83,468
1985	22,980	14,373	88,136	51,104	139,240
1986	91,324	9,728	326,765	33,937	360,702
1987	17,620	4,854	278,064	0	278,064
1988	20,296	5,637	194,228	0	194,228
1989	46,217	20,373	392,943	158,704	551,647
1990	71,078	47,962	362,306	0	362,306
1991	3,502	1,142	922,993	130,939	1,053,932
1992	86,121	7,035	591,085	240,379	831,464
1993	97,098	12,530	1,194,732	742,999	1,937,731
1994	113,478	35,298	1,348,670	198,943	1,547,613
1995	308,655	45,146	1,706,575	354,185	2,060,760
1996	240,693	18,025	821,802	215,666	1,037,469
1997	168,734	17,505	1,468,975	170,011	1,638,986
1998	351,124	57,554	2,014,714	255,662	2,270,377
1999	233,276	50,491	1,719,038	331,877	2,050,916
2000	134,811	30,406	1,102,353	256,812	1,359,165
2001	201,966	33,250	2,078,321	247,709	2,326,030

Table 2 Continued. Gulf of Mexico Gag Grouper recreational discards in numbers input into the assessment model. Relative contributions from the SRFS FL Private time series (Private SRFS) vs. all other Private + Shore data sources (Private + Shore Non-SRFS) to the final Recreational Private + Shore fleet (Private + Shore Total) is shown. Discards refer to the total number of fish discarded before applying the discard mortality rate.

Year	Charter	Headboat	Private SRFS	Private + Shore Non-SRFS	Private + Shore Total
2002	246,969	25,685	2,173,640	728,071	2,901,711
2003	296,289	49,603	2,684,510	502,524	3,187,033
2004	337,988	57,962	3,602,436	510,158	4,112,594
2005	339,608	42,711	2,089,756	730,972	2,820,729
2006	140,619	12,765	1,445,373	307,616	1,752,989
2007	113,324	35,028	1,766,537	946,203	2,712,740
2008	313,363	53,173	3,519,835	922,580	4,442,415
2009	267,022	52,392	2,280,090	656,464	2,936,554
2010	325,174	46,592	1,832,813	481,925	2,314,738
2011	190,736	45,679	1,381,476	213,224	1,594,700
2012	170,375	37,878	936,718	203,067	1,139,785
2013	234,277	34,756	909,339	281,515	1,190,854
2014	67,971	20,162	690,267	335,414	1,025,681
2015	72,623	15,967	411,978	250,096	662,074
2016	104,765	20,739	700,995	401,685	1,102,680
2017	145,159	16,555	1,264,093	263,610	1,527,703
2018	126,194	21,040	829,209	207,141	1,036,349
2019	99,177	18,297	722,632	647,633	1,370,264

Table 3. Log-scale standard error (SE) inputs associated with landings for each Gulf of Mexico Gag Grouper recreational fleet.

Year	Headboat	Charter	Private + Shore
1981	0.200	0.200	0.383
1982	0.200	0.200	0.245
1983	0.200	0.200	0.503
1984	0.200	0.200	0.382
1985	0.200	0.200	0.527
1986	0.200	0.200	0.434
1987	0.200	0.200	0.432
1988	0.200	0.200	0.377
1989	0.200	0.200	0.316
1990	0.200	0.200	0.316
1991	0.200	0.200	0.247
1992	0.200	0.200	0.201
1993	0.200	0.200	0.238
1994	0.200	0.200	0.232
1995	0.200	0.200	0.263
1996	0.200	0.200	0.194
1997	0.200	0.200	0.207
1998	0.200	0.200	0.166
1999	0.200	0.200	0.144
2000	0.200	0.200	0.155
2001	0.200	0.200	0.155

Table 3 Continued. Log-scale standard error (SE) inputs associated with landings for each Gulf of Mexico Gag Grouper recreational fleet.

Year	Headboat	Charter	Private + Shore
2002	0.200	0.200	0.184
2003	0.200	0.200	0.150
2004	0.200	0.200	0.166
2005	0.200	0.200	0.209
2006	0.200	0.200	0.249
2007	0.200	0.200	0.171
2008	0.200	0.200	0.182
2009	0.200	0.200	0.172
2010	0.200	0.200	0.188
2011	0.200	0.200	0.250
2012	0.200	0.200	0.243
2013	0.200	0.200	0.196
2014	0.200	0.200	0.238
2015	0.200	0.200	0.260
2016	0.200	0.200	0.280
2017	0.200	0.200	0.247
2018	0.200	0.200	0.234
2019	0.200	0.200	0.310

Table 4. Log-scale standard error (SE) inputs associated with each Gulf of Mexico Gag Grouper recreational discard fleets. Discards refer to the total number of fish discarded before applying the discard mortality rate.

Year	Charter	Headboat	Private + Shore
1981	0.844	1.046	0.786
1982	0.808	1.004	0.345
1983	0.617	0.731	0.493
1984	0.764	0.833	0.086
1985	0.562	0.827	0.834
1986	0.421	0.198	0.469
1987	0.367	0.198	0.336
1988	0.547	0.198	0.340
1989	0.514	0.198	0.182
1990	0.514	0.198	0.325
1991	0.744	0.198	0.280
1992	0.421	0.198	0.199
1993	0.489	0.198	0.189
1994	0.376	0.198	0.132
1995	0.284	0.198	0.158
1996	0.294	0.198	0.123
1997	0.275	0.198	0.131
1998	0.159	0.198	0.141
1999	0.090	0.198	0.120
2000	0.237	0.198	0.108
2001	0.376	0.198	0.145

Table 4 Continued. Log-scale standard error (SE) inputs associated with each Gulf of Mexico Gag Grouper recreational discard fleets. Discards refer to the total number of fish discarded before applying the discard mortality rate.

Year	Charter	Headboat	Private + Shore
2002	0.188	0.198	0.119
2003	0.129	0.198	0.107
2004	0.090	0.198	0.118
2005	0.090	0.198	0.119
2006	0.159	0.198	0.134
2007	0.188	0.198	0.115
2008	0.179	0.198	0.123
2009	0.256	0.198	0.114
2010	0.275	0.198	0.117
2011	0.149	0.198	0.176
2012	0.120	0.198	0.146
2013	0.322	0.198	0.141
2014	0.237	0.198	0.148
2015	0.256	0.198	0.135
2016	0.198	0.198	0.229
2017	0.294	0.198	0.167
2018	0.217	0.198	0.181
2019	0.246	0.198	0.182

Table 5. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
L_at_Amin_Fem_GP_1	28.21	(10,40)	0.514	0.018	Sym_Beta(0.8)	3
L_at_Amax_Fem_GP_1	119.87	(80,160)	2.33	0.019	Sym_Beta(0.8)	3
VonBert_K_Fem_GP_1	0.127	(0.05,0.3)	0.006	0.045	Sym_Beta(0.8)	3
CV_young_Fem_GP_1	0.107					Fixed
CV_old_Fem_GP_1	0.108					Fixed
Wtlen_1_Fem_GP_1	8.75e-06					Fixed
Wtlen_2_Fem_GP_1	3.08					Fixed
Mat50%_Fem_GP_1	3.89					Fixed
Mat_slope_Fem_GP_1	-2.51					Fixed
Eggs_scalar_Fem_GP_1	1					Fixed
Eggs_exp_wt_Fem_GP_1	1					Fixed
Herm_Infl_age	13.83					Fixed
Herm_stdev	4.51					Fixed
Herm_asymptote	1					Fixed
CohortGrowDev	1					Fixed
FracFemale_GP_1	1					Fixed
SR_LN(R0)	9.09	(1,40)	0.057	0.006		1
SR_BH_steep	0.855					Fixed
SR_sigmaR	0.6					Fixed
SR_regime	0.00e+00					Fixed
SR_autocorr	0.00e+00					Fixed
SR_regime_BLK4add_1962	-0.201	(-5,5)	0.086	-		1
Early_RecrDev_1963	-0.526	(-5,5)	0.486	-		6
Early_RecrDev_1964	-0.547	(-5,5)	0.483	-		6
Early_RecrDev_1965	-0.563	(-5,5)	0.481	-		6
Early_RecrDev_1966	-0.574	(-5,5)	0.479	-		6
Early_RecrDev_1967	-0.578	(-5,5)	0.479	-		6
Early_RecrDev_1968	-0.573	(-5,5)	0.48	-		6

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
Early_RecrDev_1969	-0.559	(-5,5)	0.483	-		6
Early_RecrDev_1970	-0.529	(-5,5)	0.488	-		6
Early_RecrDev_1971	-0.476	(-5,5)	0.497	-		6
Early_RecrDev_1972	-0.385	(-5,5)	0.507	-		6
Early_RecrDev_1973	-0.255	(-5,5)	0.513	-		6
Early_RecrDev_1974	-0.081	(-5,5)	0.508	-		6
Early_RecrDev_1975	-0.044	(-5,5)	0.495	-		6
Early_RecrDev_1976	-0.109	(-5,5)	0.467	-		6
Early_RecrDev_1977	-0.202	(-5,5)	0.44	-		6
Early_RecrDev_1978	0.181	(-5,5)	0.29	1.600		6
Early_RecrDev_1979	-0.305	(-5,5)	0.314	-		6
Early_RecrDev_1980	-0.307	(-5,5)	0.245	-		6
Early_RecrDev_1981	0.201	(-5,5)	0.148	0.739		6
Early_RecrDev_1982	-0.4	(-5,5)	0.196	-		6
Early_RecrDev_1983	-0.127	(-5,5)	0.146	-		6
Main_RecrDev_1984	-0.289	(-5,5)	0.126	-		3
Main_RecrDev_1985	-0.102	(-5,5)	0.091	-		3
Main_RecrDev_1986	-0.977	(-5,5)	0.119	-		3
Main_RecrDev_1987	-0.591	(-5,5)	0.092	-		3
Main_RecrDev_1988	-1.05	(-5,5)	0.116	-		3
Main_RecrDev_1989	0.374	(-5,5)	0.065	0.173		3
Main_RecrDev_1990	-0.625	(-5,5)	0.095	-		3
Main_RecrDev_1991	-0.4	(-5,5)	0.088	-		3
Main_RecrDev_1992	-0.247	(-5,5)	0.088	-		3
Main_RecrDev_1993	0.757	(-5,5)	0.061	0.081		3
Main_RecrDev_1994	0.379	(-5,5)	0.074	0.196		3
Main_RecrDev_1995	0.1	(-5,5)	0.081	0.810		3

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
Main_RecrDev_1996	1.03	(-5,5)	0.053	0.052		3
Main_RecrDev_1997	0.399	(-5,5)	0.063	0.156		3
Main_RecrDev_1998	-0.28	(-5,5)	0.079	-		3
Main_RecrDev_1999	0.615	(-5,5)	0.058	0.095		3
Main_RecrDev_2000	0.503	(-5,5)	0.063	0.125		3
Main_RecrDev_2001	0.28	(-5,5)	0.075	0.267		3
Main_RecrDev_2002	0.596	(-5,5)	0.084	0.141		3
Main_RecrDev_2003	0.22	(-5,5)	0.103	0.470		3
Main_RecrDev_2004	0.183	(-5,5)	0.104	0.572		3
Main_RecrDev_2005	0.476	(-5,5)	0.097	0.203		3
Main_RecrDev_2006	0.45	(-5,5)	0.049	0.109		3
Main_RecrDev_2007	0.554	(-5,5)	0.052	0.094		3
Main_RecrDev_2008	0.056	(-5,5)	0.067	1.190		3
Main_RecrDev_2009	-0.153	(-5,5)	0.08	-		3
Main_RecrDev_2010	0.355	(-5,5)	0.087	0.246		3
Main_RecrDev_2011	-1.15	(-5,5)	0.128	-		3
Main_RecrDev_2012	-0.341	(-5,5)	0.121	-		3
Main_RecrDev_2013	-0.013	(-5,5)	0.121	-		3
Main_RecrDev_2014	0.014	(-5,5)	0.125	9.050		3
Main_RecrDev_2015	-0.208	(-5,5)	0.097	-		3
Main_RecrDev_2016	0.07	(-5,5)	0.11	1.570		3
Main_RecrDev_2017	0.023	(-5,5)	0.146	6.410		3
Main_RecrDev_2018	-0.669	(-5,5)	0.217	-		3
Main_RecrDev_2019	-0.341	(-5,5)	0.387	-		3
InitF_seas_1_flt_1Com_VL_OTH_1	0.035	(0,1)	0.008	0.236		1
InitF_seas_1_flt_5Rec_PRIV_SH_5	0.071	(0,1)	0.021	0.289		1
F_fleet_1_YR_1963_s_1	0.031	(0,2.9)	0.007	0.230		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_1_YR_1964_s_1	0.039	(0,2.9)	0.009	0.228		1
F_fleet_1_YR_1965_s_1	0.044	(0,2.9)	0.01	0.226		1
F_fleet_1_YR_1966_s_1	0.038	(0,2.9)	0.009	0.224		1
F_fleet_1_YR_1967_s_1	0.031	(0,2.9)	0.007	0.221		1
F_fleet_1_YR_1968_s_1	0.034	(0,2.9)	0.007	0.218		1
F_fleet_1_YR_1969_s_1	0.042	(0,2.9)	0.009	0.217		1
F_fleet_1_YR_1970_s_1	0.044	(0,2.9)	0.009	0.217		1
F_fleet_1_YR_1971_s_1	0.048	(0,2.9)	0.01	0.217		1
F_fleet_1_YR_1972_s_1	0.057	(0,2.9)	0.012	0.219		1
F_fleet_1_YR_1973_s_1	0.047	(0,2.9)	0.01	0.218		1
F_fleet_1_YR_1974_s_1	0.059	(0,2.9)	0.013	0.216		1
F_fleet_1_YR_1975_s_1	0.083	(0,2.9)	0.018	0.213		1
F_fleet_1_YR_1976_s_1	0.076	(0,2.9)	0.015	0.205		1
F_fleet_1_YR_1977_s_1	0.069	(0,2.9)	0.013	0.190		1
F_fleet_1_YR_1978_s_1	0.066	(0,2.9)	0.011	0.170		1
F_fleet_1_YR_1979_s_1	0.111	(0,2.9)	0.017	0.150		1
F_fleet_1_YR_1980_s_1	0.12	(0,2.9)	0.016	0.134		1
F_fleet_1_YR_1981_s_1	0.134	(0,2.9)	0.016	0.122		1
F_fleet_1_YR_1982_s_1	0.127	(0,2.9)	0.014	0.113		1
F_fleet_1_YR_1983_s_1	0.106	(0,2.9)	0.011	0.107		1
F_fleet_1_YR_1984_s_1	0.114	(0,2.9)	0.011	0.100		1
F_fleet_1_YR_1985_s_1	0.142	(0,2.9)	0.014	0.095		1
F_fleet_1_YR_1986_s_1	0.096	(0,2.9)	0.009	0.091		1
F_fleet_1_YR_1987_s_1	0.074	(0,2.9)	0.006	0.088		1
F_fleet_1_YR_1988_s_1	0.067	(0,2.9)	0.006	0.084		1
F_fleet_1_YR_1989_s_1	0.107	(0,2.9)	0.009	0.081		1
F_fleet_1_YR_1990_s_1	0.108	(0,2.9)	0.009	0.080		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_1_YR_1991_s_1	0.101	(0,2.9)	0.008	0.080		1
F_fleet_1_YR_1992_s_1	0.106	(0,2.9)	0.008	0.080		1
F_fleet_1_YR_1993_s_1	0.148	(0,2.9)	0.012	0.078		1
F_fleet_1_YR_1994_s_1	0.137	(0,2.9)	0.011	0.077		1
F_fleet_1_YR_1995_s_1	0.14	(0,2.9)	0.011	0.077		1
F_fleet_1_YR_1996_s_1	0.129	(0,2.9)	0.01	0.077		1
F_fleet_1_YR_1997_s_1	0.114	(0,2.9)	0.009	0.076		1
F_fleet_1_YR_1998_s_1	0.172	(0,2.9)	0.013	0.073		1
F_fleet_1_YR_1999_s_1	0.139	(0,2.9)	0.01	0.074		1
F_fleet_1_YR_2000_s_1	0.152	(0,2.9)	0.011	0.074		1
F_fleet_1_YR_2001_s_1	0.187	(0,2.9)	0.014	0.074		1
F_fleet_1_YR_2002_s_1	0.17	(0,2.9)	0.013	0.077		1
F_fleet_1_YR_2003_s_1	0.132	(0,2.9)	0.011	0.084		1
F_fleet_1_YR_2004_s_1	0.159	(0,2.9)	0.016	0.098		1
F_fleet_1_YR_2005_s_1	0.215	(0,2.9)	0.019	0.089		1
F_fleet_1_YR_2006_s_1	0.203	(0,2.9)	0.015	0.075		1
F_fleet_1_YR_2007_s_1	0.199	(0,2.9)	0.016	0.080		1
F_fleet_1_YR_2008_s_1	0.283	(0,2.9)	0.025	0.088		1
F_fleet_1_YR_2009_s_1	0.206	(0,2.9)	0.022	0.105		1
F_fleet_1_YR_2010_s_1	0.113	(0,2.9)	0.012	0.110		1
F_fleet_1_YR_2011_s_1	0.055	(0,2.9)	0.007	0.129		1
F_fleet_1_YR_2012_s_1	0.068	(0,2.9)	0.01	0.149		1
F_fleet_1_YR_2013_s_1	0.058	(0,2.9)	0.01	0.178		1
F_fleet_1_YR_2014_s_1	0.076	(0,2.9)	0.01	0.134		1
F_fleet_1_YR_2015_s_1	0.1	(0,2.9)	0.008	0.076		1
F_fleet_1_YR_2016_s_1	0.192	(0,2.9)	0.018	0.093		1
F_fleet_1_YR_2017_s_1	0.128	(0,2.9)	0.016	0.123		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_1_YR_2018_s_1	0.136	(0,2.9)	0.018	0.131		1
F_fleet_1_YR_2019_s_1	0.164	(0,2.9)	0.044	0.270		1
F_fleet_2_YR_1979_s_1	9.74e-05	(0,2.9)	1.84e	0.189		1
F_fleet_2_YR_1980_s_1	0.009	(0,2.9)	0.002	0.172		1
F_fleet_2_YR_1981_s_1	0.045	(0,2.9)	0.007	0.156		1
F_fleet_2_YR_1982_s_1	0.106	(0,2.9)	0.015	0.143		1
F_fleet_2_YR_1983_s_1	0.078	(0,2.9)	0.01	0.131		1
F_fleet_2_YR_1984_s_1	0.053	(0,2.9)	0.006	0.119		1
F_fleet_2_YR_1985_s_1	0.046	(0,2.9)	0.005	0.110		1
F_fleet_2_YR_1986_s_1	0.065	(0,2.9)	0.007	0.103		1
F_fleet_2_YR_1987_s_1	0.084	(0,2.9)	0.008	0.097		1
F_fleet_2_YR_1988_s_1	0.049	(0,2.9)	0.005	0.091		1
F_fleet_2_YR_1989_s_1	0.052	(0,2.9)	0.005	0.087		1
F_fleet_2_YR_1990_s_1	0.08	(0,2.9)	0.007	0.085		1
F_fleet_2_YR_1991_s_1	0.067	(0,2.9)	0.006	0.084		1
F_fleet_2_YR_1992_s_1	0.083	(0,2.9)	0.007	0.084		1
F_fleet_2_YR_1993_s_1	0.076	(0,2.9)	0.006	0.084		1
F_fleet_2_YR_1994_s_1	0.059	(0,2.9)	0.005	0.084		1
F_fleet_2_YR_1995_s_1	0.066	(0,2.9)	0.006	0.084		1
F_fleet_2_YR_1996_s_1	0.072	(0,2.9)	0.006	0.084		1
F_fleet_2_YR_1997_s_1	0.071	(0,2.9)	0.006	0.083		1
F_fleet_2_YR_1998_s_1	0.092	(0,2.9)	0.007	0.082		1
F_fleet_2_YR_1999_s_1	0.088	(0,2.9)	0.007	0.081		1
F_fleet_2_YR_2000_s_1	0.091	(0,2.9)	0.007	0.080		1
F_fleet_2_YR_2001_s_1	0.129	(0,2.9)	0.01	0.081		1
F_fleet_2_YR_2002_s_1	0.135	(0,2.9)	0.011	0.083		1
F_fleet_2_YR_2003_s_1	0.144	(0,2.9)	0.013	0.089		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_2_YR_2004_s_1	0.146	(0,2.9)	0.015	0.103		1
F_fleet_2_YR_2005_s_1	0.178	(0,2.9)	0.017	0.094		1
F_fleet_2_YR_2006_s_1	0.199	(0,2.9)	0.016	0.081		1
F_fleet_2_YR_2007_s_1	0.19	(0,2.9)	0.016	0.086		1
F_fleet_2_YR_2008_s_1	0.184	(0,2.9)	0.017	0.094		1
F_fleet_2_YR_2009_s_1	0.091	(0,2.9)	0.01	0.112		1
F_fleet_2_YR_2010_s_1	0.066	(0,2.9)	0.008	0.118		1
F_fleet_2_YR_2011_s_1	0.046	(0,2.9)	0.006	0.136		1
F_fleet_2_YR_2012_s_1	0.052	(0,2.9)	0.008	0.154		1
F_fleet_2_YR_2013_s_1	0.059	(0,2.9)	0.011	0.181		1
F_fleet_2_YR_2014_s_1	0.086	(0,2.9)	0.012	0.137		1
F_fleet_2_YR_2015_s_1	0.164	(0,2.9)	0.013	0.080		1
F_fleet_2_YR_2016_s_1	0.281	(0,2.9)	0.027	0.097		1
F_fleet_2_YR_2017_s_1	0.142	(0,2.9)	0.018	0.127		1
F_fleet_2_YR_2018_s_1	0.154	(0,2.9)	0.021	0.135		1
F_fleet_2_YR_2019_s_1	0.181	(0,2.9)	0.05	0.274		1
F_fleet_3_YR_1963_s_1	0.005	(0,2.9)	6.46e	0.139		1
F_fleet_3_YR_1964_s_1	0.005	(0,2.9)	0.001	0.253		1
F_fleet_3_YR_1965_s_1	0.006	(0,2.9)	0.001	0.258		1
F_fleet_3_YR_1966_s_1	0.006	(0,2.9)	0.002	0.270		1
F_fleet_3_YR_1967_s_1	0.007	(0,2.9)	0.002	0.282		1
F_fleet_3_YR_1968_s_1	0.008	(0,2.9)	0.002	0.291		1
F_fleet_3_YR_1969_s_1	0.009	(0,2.9)	0.003	0.297		1
F_fleet_3_YR_1970_s_1	0.01	(0,2.9)	0.003	0.302		1
F_fleet_3_YR_1971_s_1	0.012	(0,2.9)	0.004	0.307		1
F_fleet_3_YR_1972_s_1	0.014	(0,2.9)	0.004	0.312		1
F_fleet_3_YR_1973_s_1	0.016	(0,2.9)	0.005	0.317		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_3_YR_1974_s_1	0.017	(0,2.9)	0.005	0.319		1
F_fleet_3_YR_1975_s_1	0.018	(0,2.9)	0.006	0.315		1
F_fleet_3_YR_1976_s_1	0.017	(0,2.9)	0.005	0.301		1
F_fleet_3_YR_1977_s_1	0.016	(0,2.9)	0.005	0.282		1
F_fleet_3_YR_1978_s_1	0.016	(0,2.9)	0.004	0.263		1
F_fleet_3_YR_1979_s_1	0.016	(0,2.9)	0.004	0.247		1
F_fleet_3_YR_1980_s_1	0.016	(0,2.9)	0.004	0.237		1
F_fleet_3_YR_1981_s_1	0.031	(0,2.9)	0.007	0.226		1
F_fleet_3_YR_1982_s_1	0.025	(0,2.9)	0.006	0.227		1
F_fleet_3_YR_1983_s_1	0.022	(0,2.9)	0.005	0.221		1
F_fleet_3_YR_1984_s_1	0.015	(0,2.9)	0.003	0.223		1
F_fleet_3_YR_1985_s_1	0.036	(0,2.9)	0.008	0.219		1
F_fleet_3_YR_1986_s_1	0.013	(0,2.9)	0.002	0.165		1
F_fleet_3_YR_1987_s_1	0.01	(0,2.9)	0.002	0.166		1
F_fleet_3_YR_1988_s_1	0.011	(0,2.9)	0.002	0.162		1
F_fleet_3_YR_1989_s_1	0.03	(0,2.9)	0.005	0.156		1
F_fleet_3_YR_1990_s_1	0.021	(0,2.9)	0.003	0.152		1
F_fleet_3_YR_1991_s_1	0.001	(0,2.9)	3.00e	0.203		1
F_fleet_3_YR_1992_s_1	0.006	(0,2.9)	9.99e	0.157		1
F_fleet_3_YR_1993_s_1	0.01	(0,2.9)	0.002	0.156		1
F_fleet_3_YR_1994_s_1	0.014	(0,2.9)	0.002	0.155		1
F_fleet_3_YR_1995_s_1	0.013	(0,2.9)	0.002	0.152		1
F_fleet_3_YR_1996_s_1	0.007	(0,2.9)	0.001	0.154		1
F_fleet_3_YR_1997_s_1	0.005	(0,2.9)	8.40e	0.155		1
F_fleet_3_YR_1998_s_1	0.015	(0,2.9)	0.002	0.152		1
F_fleet_3_YR_1999_s_1	0.016	(0,2.9)	0.002	0.149		1
F_fleet_3_YR_2000_s_1	0.011	(0,2.9)	0.002	0.153		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_3_YR_2001_s_1	0.008	(0,2.9)	0.001	0.153		1
F_fleet_3_YR_2002_s_1	0.006	(0,2.9)	9.54e	0.154		1
F_fleet_3_YR_2003_s_1	0.01	(0,2.9)	0.002	0.158		1
F_fleet_3_YR_2004_s_1	0.013	(0,2.9)	0.002	0.168		1
F_fleet_3_YR_2005_s_1	0.015	(0,2.9)	0.002	0.160		1
F_fleet_3_YR_2006_s_1	0.008	(0,2.9)	0.001	0.155		1
F_fleet_3_YR_2007_s_1	0.015	(0,2.9)	0.002	0.154		1
F_fleet_3_YR_2008_s_1	0.018	(0,2.9)	0.003	0.155		1
F_fleet_3_YR_2009_s_1	0.017	(0,2.9)	0.003	0.158		1
F_fleet_3_YR_2010_s_1	0.017	(0,2.9)	0.003	0.165		1
F_fleet_3_YR_2011_s_1	0.017	(0,2.9)	0.003	0.194		1
F_fleet_3_YR_2012_s_1	0.017	(0,2.9)	0.003	0.208		1
F_fleet_3_YR_2013_s_1	0.014	(0,2.9)	0.003	0.220		1
F_fleet_3_YR_2014_s_1	0.016	(0,2.9)	0.003	0.192		1
F_fleet_3_YR_2015_s_1	0.018	(0,2.9)	0.003	0.172		1
F_fleet_3_YR_2016_s_1	0.014	(0,2.9)	0.003	0.175		1
F_fleet_3_YR_2017_s_1	0.014	(0,2.9)	0.003	0.192		1
F_fleet_3_YR_2018_s_1	0.015	(0,2.9)	0.003	0.194		1
F_fleet_3_YR_2019_s_1	0.014	(0,2.9)	0.004	0.284		1
F_fleet_4_YR_1963_s_1	0.022	(0,2.9)	0.003	0.145		1
F_fleet_4_YR_1964_s_1	0.023	(0,2.9)	0.006	0.257		1
F_fleet_4_YR_1965_s_1	0.026	(0,2.9)	0.007	0.260		1
F_fleet_4_YR_1966_s_1	0.03	(0,2.9)	0.008	0.271		1
F_fleet_4_YR_1967_s_1	0.034	(0,2.9)	0.01	0.283		1
F_fleet_4_YR_1968_s_1	0.039	(0,2.9)	0.011	0.293		1
F_fleet_4_YR_1969_s_1	0.044	(0,2.9)	0.013	0.300		1
F_fleet_4_YR_1970_s_1	0.049	(0,2.9)	0.015	0.306		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_4_YR_1971_s_1	0.057	(0,2.9)	0.018	0.311		1
F_fleet_4_YR_1972_s_1	0.067	(0,2.9)	0.021	0.317		1
F_fleet_4_YR_1973_s_1	0.076	(0,2.9)	0.025	0.322		1
F_fleet_4_YR_1974_s_1	0.084	(0,2.9)	0.027	0.325		1
F_fleet_4_YR_1975_s_1	0.088	(0,2.9)	0.028	0.321		1
F_fleet_4_YR_1976_s_1	0.084	(0,2.9)	0.026	0.308		1
F_fleet_4_YR_1977_s_1	0.08	(0,2.9)	0.023	0.287		1
F_fleet_4_YR_1978_s_1	0.08	(0,2.9)	0.021	0.267		1
F_fleet_4_YR_1979_s_1	0.079	(0,2.9)	0.02	0.250		1
F_fleet_4_YR_1980_s_1	0.079	(0,2.9)	0.019	0.237		1
F_fleet_4_YR_1981_s_1	0.057	(0,2.9)	0.013	0.223		1
F_fleet_4_YR_1982_s_1	0.045	(0,2.9)	0.01	0.225		1
F_fleet_4_YR_1983_s_1	0.041	(0,2.9)	0.009	0.217		1
F_fleet_4_YR_1984_s_1	0.027	(0,2.9)	0.006	0.222		1
F_fleet_4_YR_1985_s_1	0.063	(0,2.9)	0.013	0.211		1
F_fleet_4_YR_1986_s_1	0.162	(0,2.9)	0.031	0.194		1
F_fleet_4_YR_1987_s_1	0.05	(0,2.9)	0.01	0.195		1
F_fleet_4_YR_1988_s_1	0.047	(0,2.9)	0.01	0.205		1
F_fleet_4_YR_1989_s_1	0.053	(0,2.9)	0.01	0.197		1
F_fleet_4_YR_1990_s_1	0.026	(0,2.9)	0.005	0.200		1
F_fleet_4_YR_1991_s_1	0.024	(0,2.9)	0.005	0.218		1
F_fleet_4_YR_1992_s_1	0.09	(0,2.9)	0.017	0.189		1
F_fleet_4_YR_1993_s_1	0.084	(0,2.9)	0.016	0.190		1
F_fleet_4_YR_1994_s_1	0.05	(0,2.9)	0.009	0.188		1
F_fleet_4_YR_1995_s_1	0.094	(0,2.9)	0.016	0.172		1
F_fleet_4_YR_1996_s_1	0.111	(0,2.9)	0.02	0.177		1
F_fleet_4_YR_1997_s_1	0.064	(0,2.9)	0.011	0.176		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_4_YR_1998_s_1	0.118	(0,2.9)	0.016	0.135		1
F_fleet_4_YR_1999_s_1	0.115	(0,2.9)	0.011	0.096		1
F_fleet_4_YR_2000_s_1	0.056	(0,2.9)	0.009	0.161		1
F_fleet_4_YR_2001_s_1	0.048	(0,2.9)	0.009	0.186		1
F_fleet_4_YR_2002_s_1	0.069	(0,2.9)	0.01	0.145		1
F_fleet_4_YR_2003_s_1	0.076	(0,2.9)	0.01	0.127		1
F_fleet_4_YR_2004_s_1	0.105	(0,2.9)	0.013	0.123		1
F_fleet_4_YR_2005_s_1	0.164	(0,2.9)	0.018	0.110		1
F_fleet_4_YR_2006_s_1	0.106	(0,2.9)	0.014	0.136		1
F_fleet_4_YR_2007_s_1	0.06	(0,2.9)	0.009	0.150		1
F_fleet_4_YR_2008_s_1	0.156	(0,2.9)	0.023	0.148		1
F_fleet_4_YR_2009_s_1	0.089	(0,2.9)	0.015	0.173		1
F_fleet_4_YR_2010_s_1	0.102	(0,2.9)	0.019	0.181		1
F_fleet_4_YR_2011_s_1	0.069	(0,2.9)	0.012	0.167		1
F_fleet_4_YR_2012_s_1	0.105	(0,2.9)	0.018	0.173		1
F_fleet_4_YR_2013_s_1	0.097	(0,2.9)	0.026	0.266		1
F_fleet_4_YR_2014_s_1	0.059	(0,2.9)	0.012	0.211		1
F_fleet_4_YR_2015_s_1	0.105	(0,2.9)	0.021	0.198		1
F_fleet_4_YR_2016_s_1	0.093	(0,2.9)	0.016	0.169		1
F_fleet_4_YR_2017_s_1	0.132	(0,2.9)	0.028	0.210		1
F_fleet_4_YR_2018_s_1	0.105	(0,2.9)	0.021	0.198		1
F_fleet_4_YR_2019_s_1	0.114	(0,2.9)	0.034	0.300		1
F_fleet_5_YR_1963_s_1	0.059	(0,2.9)	0.008	0.132		1
F_fleet_5_YR_1964_s_1	0.067	(0,2.9)	0.017	0.259		1
F_fleet_5_YR_1965_s_1	0.078	(0,2.9)	0.021	0.273		1
F_fleet_5_YR_1966_s_1	0.09	(0,2.9)	0.026	0.287		1
F_fleet_5_YR_1967_s_1	0.102	(0,2.9)	0.03	0.298		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_5_YR_1968_s_1	0.114	(0,2.9)	0.035	0.306		1
F_fleet_5_YR_1969_s_1	0.126	(0,2.9)	0.039	0.312		1
F_fleet_5_YR_1970_s_1	0.136	(0,2.9)	0.043	0.316		1
F_fleet_5_YR_1971_s_1	0.156	(0,2.9)	0.05	0.320		1
F_fleet_5_YR_1972_s_1	0.175	(0,2.9)	0.057	0.324		1
F_fleet_5_YR_1973_s_1	0.189	(0,2.9)	0.062	0.327		1
F_fleet_5_YR_1974_s_1	0.196	(0,2.9)	0.064	0.324		1
F_fleet_5_YR_1975_s_1	0.194	(0,2.9)	0.06	0.311		1
F_fleet_5_YR_1976_s_1	0.182	(0,2.9)	0.052	0.288		1
F_fleet_5_YR_1977_s_1	0.178	(0,2.9)	0.047	0.264		1
F_fleet_5_YR_1978_s_1	0.181	(0,2.9)	0.045	0.248		1
F_fleet_5_YR_1979_s_1	0.173	(0,2.9)	0.041	0.236		1
F_fleet_5_YR_1980_s_1	0.182	(0,2.9)	0.042	0.228		1
F_fleet_5_YR_1981_s_1	0.089	(0,2.9)	0.033	0.369		1
F_fleet_5_YR_1982_s_1	0.123	(0,2.9)	0.028	0.229		1
F_fleet_5_YR_1983_s_1	0.1	(0,2.9)	0.036	0.364		1
F_fleet_5_YR_1984_s_1	0.024	(0,2.9)	0.003	0.123		1
F_fleet_5_YR_1985_s_1	0.077	(0,2.9)	0.036	0.471		1
F_fleet_5_YR_1986_s_1	0.114	(0,2.9)	0.035	0.305		1
F_fleet_5_YR_1987_s_1	0.11	(0,2.9)	0.028	0.258		1
F_fleet_5_YR_1988_s_1	0.108	(0,2.9)	0.027	0.248		1
F_fleet_5_YR_1989_s_1	0.109	(0,2.9)	0.017	0.158		1
F_fleet_5_YR_1990_s_1	0.085	(0,2.9)	0.02	0.229		1
F_fleet_5_YR_1991_s_1	0.166	(0,2.9)	0.029	0.174		1
F_fleet_5_YR_1992_s_1	0.137	(0,2.9)	0.019	0.139		1
F_fleet_5_YR_1993_s_1	0.18	(0,2.9)	0.025	0.139		1
F_fleet_5_YR_1994_s_1	0.15	(0,2.9)	0.017	0.117		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_5_YR_1995_s_1	0.253	(0,2.9)	0.035	0.138		1
F_fleet_5_YR_1996_s_1	0.091	(0,2.9)	0.01	0.112		1
F_fleet_5_YR_1997_s_1	0.148	(0,2.9)	0.017	0.117		1
F_fleet_5_YR_1998_s_1	0.258	(0,2.9)	0.029	0.113		1
F_fleet_5_YR_1999_s_1	0.208	(0,2.9)	0.02	0.097		1
F_fleet_5_YR_2000_s_1	0.145	(0,2.9)	0.014	0.096		1
F_fleet_5_YR_2001_s_1	0.209	(0,2.9)	0.023	0.110		1
F_fleet_5_YR_2002_s_1	0.232	(0,2.9)	0.026	0.111		1
F_fleet_5_YR_2003_s_1	0.238	(0,2.9)	0.026	0.109		1
F_fleet_5_YR_2004_s_1	0.338	(0,2.9)	0.042	0.125		1
F_fleet_5_YR_2005_s_1	0.36	(0,2.9)	0.045	0.126		1
F_fleet_5_YR_2006_s_1	0.301	(0,2.9)	0.037	0.123		1
F_fleet_5_YR_2007_s_1	0.352	(0,2.9)	0.036	0.102		1
F_fleet_5_YR_2008_s_1	0.653	(0,2.9)	0.065	0.099		1
F_fleet_5_YR_2009_s_1	0.435	(0,2.9)	0.047	0.108		1
F_fleet_5_YR_2010_s_1	0.359	(0,2.9)	0.048	0.133		1
F_fleet_5_YR_2011_s_1	0.359	(0,2.9)	0.072	0.202		1
F_fleet_5_YR_2012_s_1	0.273	(0,2.9)	0.059	0.215		1
F_fleet_5_YR_2013_s_1	0.247	(0,2.9)	0.055	0.224		1
F_fleet_5_YR_2014_s_1	0.237	(0,2.9)	0.042	0.175		1
F_fleet_5_YR_2015_s_1	0.228	(0,2.9)	0.033	0.146		1
F_fleet_5_YR_2016_s_1	0.228	(0,2.9)	0.041	0.179		1
F_fleet_5_YR_2017_s_1	0.388	(0,2.9)	0.068	0.176		1
F_fleet_5_YR_2018_s_1	0.432	(0,2.9)	0.086	0.200		1
F_fleet_5_YR_2019_s_1	0.471	(0,2.9)	0.141	0.300		1
F_fleet_6_YR_2005_s_1	0.741	(0,2.9)	0.122	0.164		1
F_fleet_6_YR_2014_s_1	0.912	(0,2.9)	0.198	0.218		1

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
F_fleet_6_YR_2018_s_1	0.074	(0,2.9)	0.246	3.300		1
LnQ_base_Com_VL_OTH_1(1)	-8.34	(-25,25)				Float
LnQ_base_Com_LL_2(2)	-7.82	(-25,25)				Float
LnQ_base_Rec_HBT_3(3)	-7.42	(-25,25)				Float
LnQ_base_Srv_CBT_PRIV_7(7)	-7.93	(-25,25)				Float
LnQ_base_Srv_AGE0_8(8)	-8.71	(-25,25)				Float
LnQ_base_Srv_SEAMAP_VIDEO_9(9)	-6.48	(-25,25)				Float
LnQ_base_Srv_PC_VIDEO_10(10)	-8.39	(-25,25)				Float
Size_inflection_Com_VL_OTH_1(1)	67.77	(20,125)	0.684	0.010		3
Size_95%width_Com_VL_OTH_1(1)	23.27	(0,50)	0.526	0.023		3
Retain_L_infl_Com_VL_OTH_1(1)	40.64					Fixed
Retain_L_width_Com_VL_OTH_1(1)	5					Fixed
Retain_L_asymptote_logit_Com_VL_OTH_1	10					Fixed
DiscMort_L_infl_Com_VL_OTH_1(1)	-10					Fixed
DiscMort_L_width_Com_VL_OTH_1(1)	1					Fixed
DiscMort_L_level_old_Com_VL_OTH_1(1)	0.25					Fixed
Size_inflection_Com_LL_2(2)	79.64	(20,125)	0.47	0.006		3
Size_95%width_Com_LL_2(2)	17.04	(0,50)	0.257	0.015		3
Retain_L_infl_Com_LL_2(2)	40.64					Fixed
Retain_L_width_Com_LL_2(2)	5					Fixed
Retain_L_asymptote_logit_Com_LL_2(2)	10					Fixed
DiscMort_L_infl_Com_LL_2(2)	-10					Fixed
DiscMort_L_width_Com_LL_2(2)	1					Fixed
DiscMort_L_level_old_Com_LL_2(2)	0.25					Fixed
Size_DblN_peak_Rec_HBT_3(3)	63.22	(20,100)	1.79	0.028		3
Size_DblN_top_logit_Rec_HBT_3(3)	-9					Fixed
Size_DblN_ascend_se_Rec_HBT_3(3)	7.79	(-15,15)	0.432	0.055		4

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
Size_DblN_descend_se_Rec_HBT_3(3)	5.83	(-15,15)	0.338	0.058		4
Size_DblN_start_logit_Rec_HBT_3(3)	-5.37	(-15,15)	0.561	-		3
Size_DblN_end_logit_Rec_HBT_3(3)	-0.991	(-15,15)	0.332	-		3
Retain_L_infl_Rec_HBT_3(3)	39.43	(10,85)	0.77	0.020		3
Retain_L_width_Rec_HBT_3(3)	5					Fixed
Retain_L_asymptote_logit_Rec_HBT_3(3)	10					Fixed
DiscMort_L_infl_Rec_HBT_3(3)	-10					Fixed
DiscMort_L_width_Rec_HBT_3(3)	1					Fixed
DiscMort_L_level_old_Rec_HBT_3(3)	0.12					Fixed
Size_DblN_peak_Rec_CBT_4(4)	67.38	(20,100)	1.52	0.023		3
Size_DblN_top_logit_Rec_CBT_4(4)	-9					Fixed
Size_DblN_ascend_se_Rec_CBT_4(4)	7.12	(-15,15)	0.195	0.027		4
Size_DblN_descend_se_Rec_CBT_4(4)	5.43	(-15,15)	0.409	0.075		4
Size_DblN_start_logit_Rec_CBT_4(4)	-15					Fixed
Size_DblN_end_logit_Rec_CBT_4(4)	-1	(-15,15)	0.349	-		3
Retain_L_infl_Rec_CBT_4(4)	39.56	(10,85)	1.57	0.040		3
Retain_L_width_Rec_CBT_4(4)	5					Fixed
Retain_L_asymptote_logit_Rec_CBT_4(4)	10					Fixed
DiscMort_L_infl_Rec_CBT_4(4)	-10					Fixed
DiscMort_L_width_Rec_CBT_4(4)	1					Fixed
DiscMort_L_level_old_Rec_CBT_4(4)	0.12					Fixed
Size_DblN_peak_Rec_PRIV_SH_5(5)	52.75	(20,100)	0.91	0.017		3
Size_DblN_top_logit_Rec_PRIV_SH_5(5)	-2					Fixed
Size_DblN_ascend_se_Rec_PRIV_SH_5(5)	9.84					Fixed
Size_DblN_descend_se_Rec_PRIV_SH_5(5)	5.65					Fixed
Size_DblN_start_logit_Rec_PRIV_SH_5(5)	-999					Fixed
Size_DblN_end_logit_Rec_PRIV_SH_5(5)	-999					Fixed

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
Retain_L_infl_Rec_PRIV_SH_5(5)	35.17	(10,85)	1.57	0.045		3
Retain_L_width_Rec_PRIV_SH_5(5)	5					Fixed
Retain_L_asymptote_logit_Rec_PRIV_SH_5	10					Fixed
DiscMort_L_infl_Rec_PRIV_SH_5(5)	-10					Fixed
DiscMort_L_width_Rec_PRIV_SH_5(5)	1					Fixed
DiscMort_L_level_old_Rec_PRIV_SH_5(5)	0.12					Fixed
Size_inflection_Srv_SEAMAP_VIDEO_9(9)	65.4	(20,125)	1.89	0.029		3
Size_95%width_Srv_SEAMAP_VIDEO_9(9)	12.68	(0,50)	1.94	0.153		3
SizeSel_P1_Srv_PC_VIDEO_10(10)	20					Fixed
SizeSel_P2_Srv_PC_VIDEO_10(10)	0.561	(0,1)	0.074	0.132	Sym_Beta(2)	4
SizeSel_P3_Srv_PC_VIDEO_10(10)	-2.08	(-15,15)	1.88	-	Sym_Beta(2)	4
SizeSel_P4_Srv_PC_VIDEO_10(10)	0.169	(-15,15)	8.44	49.93	Sym_Beta(2)	4
ln(DM_theta)_1	7.11					Fixed
ln(DM_theta)_2	6.94					Fixed
ln(DM_theta)_3	6.24					Fixed
ln(DM_theta)_4	5.46					Fixed
ln(DM_theta)_5	4.8	(-5,20)	0.705	0.147	Normal(0,1.81	3
ln(DM_theta)_6	2.92	(-5,20)	0.569	0.195	Normal(0,1.81	3
ln(DM_theta)_7	4.69	(-5,20)	0.714	0.152	Normal(0,1.81	3
ln(DM_theta)_8	4.24	(-5,20)	0.679	0.160	Normal(0,1.81	3
Retain_L_infl_Com_VL_OTH_1(1)_BLK1re	49.38					Fixed
Retain_L_infl_Com_VL_OTH_1(1)_BLK1re	59.24					Fixed
Retain_L_infl_Com_VL_OTH_1(1)_BLK1re	54.31					Fixed
Retain_L_infl_Com_VL_OTH_1(1)_BLK1re	59.24					Fixed
Retain_L_width_Com_VL_OTH_1(1)_BLK1	1					Fixed
Retain_L_width_Com_VL_OTH_1(1)_BLK1	1					Fixed
Retain_L_width_Com_VL_OTH_1(1)_BLK1	1					Fixed

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
Retain_L_width_Com_VL_OTH_1(1)_BLK1	1					Fixed
Retain_L_asymptote_logit_Com_VL_OTH_1	3.11	(-10,10)	0.173	0.056		4
Retain_L_infl_Com_LL_2(2)_BLK1repl_199	49.38					Fixed
Retain_L_infl_Com_LL_2(2)_BLK1repl_200	59.24					Fixed
Retain_L_infl_Com_LL_2(2)_BLK1repl_201	54.31					Fixed
Retain_L_infl_Com_LL_2(2)_BLK1repl_201	59.24					Fixed
Retain_L_width_Com_LL_2(2)_BLK1repl_1	1					Fixed
Retain_L_width_Com_LL_2(2)_BLK1repl_2	1					Fixed
Retain_L_width_Com_LL_2(2)_BLK1repl_2	1					Fixed
Retain_L_width_Com_LL_2(2)_BLK1repl_2	1					Fixed
Retain_L_asymptote_logit_Com_LL_2(2)_B	1.32	(-10,10)	0.085	0.065		4
Retain_L_infl_Rec_HBT_3(3)_BLK2repl_19	49.38					Fixed
Retain_L_infl_Rec_HBT_3(3)_BLK2repl_20	54.31					Fixed
Retain_L_infl_Rec_HBT_3(3)_BLK2repl_20	59.24					Fixed
Retain_L_width_Rec_HBT_3(3)_BLK2repl_	1					Fixed
Retain_L_width_Rec_HBT_3(3)_BLK2repl_	1					Fixed
Retain_L_width_Rec_HBT_3(3)_BLK2repl_	1					Fixed
Retain_L_asymptote_logit_Rec_HBT_3(3)_B	-0.814	(-10,10)	0.264	-		4
Retain_L_asymptote_logit_Rec_HBT_3(3)_B	0.03	(-10,10)	0.273	9.060		4
Retain_L_asymptote_logit_Rec_HBT_3(3)_B	0.408	(-10,10)	0.253	0.620		4
Retain_L_infl_Rec_CBT_4(4)_BLK2repl_19	49.38					Fixed
Retain_L_infl_Rec_CBT_4(4)_BLK2repl_20	54.31					Fixed
Retain_L_infl_Rec_CBT_4(4)_BLK2repl_20	59.24					Fixed
Retain_L_width_Rec_CBT_4(4)_BLK2repl_	1					Fixed
Retain_L_width_Rec_CBT_4(4)_BLK2repl_	1					Fixed
Retain_L_width_Rec_CBT_4(4)_BLK2repl_	1					Fixed
Retain_L_asymptote_logit_Rec_CBT_4(4)_B	-1.15	(-10,10)	0.214	-		4

Table 5 Continued. List of Stock Synthesis parameters for Gulf of Mexico Gag Grouper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, the prior type and densities (value, SE) assigned to the parameters as applicable, and phases (if estimated). Parameters designated as fixed were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
Retain_L_asymptote_logit_Rec_CBT_4(4)_B	-0.907	(-10,10)	0.228	-		4
Retain_L_asymptote_logit_Rec_CBT_4(4)_B	0.731	(-10,10)	0.282	0.386		4
Retain_L_infl_Rec_PRIV_SH_5(5)_BLK2re	49.38					Fixed
Retain_L_infl_Rec_PRIV_SH_5(5)_BLK2re	54.31					Fixed
Retain_L_infl_Rec_PRIV_SH_5(5)_BLK2re	59.24					Fixed
Retain_L_width_Rec_PRIV_SH_5(5)_BLK2	1					Fixed
Retain_L_width_Rec_PRIV_SH_5(5)_BLK2	1					Fixed
Retain_L_width_Rec_PRIV_SH_5(5)_BLK2	1					Fixed
Retain_L_asymptote_logit_Rec_PRIV_SH_5	0.153	(-10,10)	0.447	2.930		4
Retain_L_asymptote_logit_Rec_PRIV_SH_5	1.64	(-10,10)	0.825	0.502		4
Retain_L_asymptote_logit_Rec_PRIV_SH_5	8.44	(-10,10)	40.47	4.800		4

Table 6. Estimates of annual exploitation rate (total biomass killed / total biomass age 3+) combined across all fleets (excluding red tide) for Gulf of Mexico Gag Grouper, which was used as the proxy for annual fishing mortality rate. Estimates are provided for the SRFS Run and SEDAR 33U.

Year	SRFS Run	SEDAR 33U
1963	0.064	0.055
1964	0.074	0.067
1965	0.081	0.078
1966	0.083	0.078
1967	0.082	0.076
1968	0.089	0.086
1969	0.100	0.104
1970	0.107	0.114
1971	0.121	0.133
1972	0.140	0.164
1973	0.145	0.168
1974	0.166	0.201
1975	0.195	0.258
1976	0.196	0.268
1977	0.198	0.207
1978	0.204	0.203
1979	0.235	0.247
1980	0.261	0.268
1981	0.218	0.239
1982	0.255	0.330
1983	0.222	0.408
1984	0.137	0.213
1985	0.231	0.348
1986	0.282	0.331
1987	0.202	0.276
1988	0.172	0.283
1989	0.214	0.271
1990	0.180	0.262
1991	0.209	0.310

Table 6 Continued. Estimates of annual exploitation rate (total biomass killed / total biomass age 3+) combined across all fleets (excluding red tide) for Gulf of Mexico Gag Grouper, which was used as the proxy for annual fishing mortality rate. Estimates are provided for the SRFS Run and SEDAR 33U.

Year	SRFS Run	SEDAR 33U
1992	0.227	0.261
1993	0.279	0.350
1994	0.241	0.329
1995	0.352	0.422
1996	0.235	0.294
1997	0.240	0.298
1998	0.404	0.401
1999	0.329	0.299
2000	0.254	0.353
2001	0.305	0.408
2002	0.304	0.397
2003	0.301	0.347
2004	0.388	0.451
2005	0.322	0.351
2006	0.393	0.443
2007	0.406	0.484
2008	0.625	0.698
2009	0.438	0.339
2010	0.368	0.211
2011	0.221	0.117
2012	0.201	0.131
2013	0.207	0.129
2014	0.144	0.079
2015	0.252	0.072
2016	0.341	
2017	0.340	
2018	0.342	
2019	0.374	

Table 7. Estimates of annual exploitation rate (total biomass killed / total biomass age 3+) by fleet and red tide mortality for Gulf of Mexico Gag Grouper.

Year	Com VL	Com LL	Rec Hbt	Rec Char	Rec Pri	Red Tide	Total
1963	0.024	0.000	0.003	0.012	0.026	0	0.065
1964	0.030	0.000	0.003	0.013	0.029	0	0.075
1965	0.033	0.000	0.003	0.014	0.032	0	0.082
1966	0.029	0.000	0.003	0.015	0.035	0	0.084
1967	0.024	0.000	0.004	0.017	0.038	0	0.083
1968	0.027	0.000	0.004	0.019	0.041	0	0.091
1969	0.033	0.000	0.005	0.021	0.043	0	0.102
1970	0.034	0.000	0.005	0.023	0.046	0	0.108
1971	0.037	0.000	0.006	0.027	0.053	0	0.123
1972	0.044	0.000	0.007	0.031	0.060	0	0.142
1973	0.036	0.000	0.008	0.036	0.068	0	0.148
1974	0.045	0.000	0.009	0.040	0.075	0	0.169
1975	0.061	0.000	0.009	0.044	0.083	0	0.197
1976	0.055	0.000	0.010	0.045	0.089	0	0.198
1977	0.048	0.000	0.010	0.046	0.097	0	0.200
1978	0.044	0.000	0.010	0.047	0.104	0	0.206
1979	0.072	0.000	0.010	0.049	0.106	0	0.237
1980	0.077	0.004	0.011	0.051	0.120	0	0.264
1981	0.082	0.020	0.021	0.037	0.059	0	0.219
1982	0.076	0.044	0.018	0.031	0.088	0	0.257
1983	0.065	0.032	0.017	0.030	0.079	0	0.224
1984	0.068	0.021	0.011	0.020	0.019	0	0.138
1985	0.084	0.018	0.027	0.046	0.058	0	0.233
1986	0.056	0.025	0.009	0.112	0.082	0	0.284
1987	0.046	0.035	0.008	0.036	0.079	0	0.203
1988	0.041	0.021	0.008	0.032	0.071	0	0.173
1989	0.068	0.023	0.020	0.035	0.069	0	0.216
1990	0.071	0.038	0.013	0.016	0.045	0	0.182
1991	0.068	0.033	0.001	0.015	0.094	0	0.212

Table 7 Continued. Estimates of annual exploitation rate (total biomass killed / total biomass age 3+) by fleet and red tide mortality for Gulf of Mexico Gag Grouper.

Year	Com VL	Com LL	Rec Hbt	Rec Char	Rec Pri	Red Tide	Total
1992	0.059	0.032	0.004	0.056	0.079	0.000	0.229
1993	0.083	0.028	0.007	0.054	0.109	0.000	0.281
1994	0.080	0.022	0.009	0.034	0.097	0.000	0.243
1995	0.079	0.024	0.009	0.066	0.176	0.000	0.355
1996	0.062	0.020	0.005	0.081	0.068	0.000	0.237
1997	0.054	0.019	0.004	0.049	0.115	0.000	0.241
1998	0.084	0.024	0.012	0.089	0.198	0.000	0.406
1999	0.061	0.021	0.012	0.083	0.153	0.000	0.330
2000	0.073	0.023	0.008	0.042	0.109	0.000	0.255
2001	0.093	0.037	0.006	0.033	0.138	0.000	0.307
2002	0.078	0.037	0.004	0.044	0.143	0.000	0.306
2003	0.059	0.037	0.006	0.050	0.150	0.000	0.302
2004	0.070	0.037	0.009	0.067	0.207	0.000	0.390
2005	0.064	0.030	0.006	0.072	0.154	0.633	0.960
2006	0.086	0.047	0.005	0.068	0.189	0.000	0.395
2007	0.085	0.045	0.010	0.039	0.230	0.000	0.408
2008	0.101	0.036	0.011	0.091	0.390	0.000	0.628
2009	0.068	0.015	0.011	0.057	0.289	0.000	0.440
2010	0.037	0.010	0.012	0.068	0.243	0.000	0.369
2011	0.022	0.008	0.005	0.019	0.168	0.000	0.221
2012	0.034	0.011	0.005	0.028	0.123	0.000	0.201
2013	0.028	0.014	0.005	0.025	0.135	0.000	0.208
2014	0.029	0.017	0.004	0.011	0.088	0.788	0.937
2015	0.056	0.051	0.007	0.027	0.115	0.000	0.254
2016	0.094	0.076	0.006	0.040	0.127	0.000	0.343
2017	0.059	0.034	0.005	0.051	0.192	0.000	0.342
2018	0.056	0.031	0.005	0.040	0.213	0.104	0.449
2019	0.060	0.031	0.005	0.044	0.236	0.000	0.375

Table 8. Expected biomass (metric tons) for all Gag Grouper and exploited Gag Grouper (3+ years), spawning stock biomass (SSB, metric tons), exploited numbers (3+years, 1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 67,045 metric tons for Gulf of Mexico Gag Grouper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
1963	33,737	30,974	27,795	5,822	4,828	0.42
1964	33,218	30,789	27,622	5,786	4,697	0.41
1965	32,136	30,302	27,156	5,704	4,585	0.41
1966	30,618	28,840	26,394	5,074	4,495	0.39
1967	28,977	27,247	25,227	4,576	4,431	0.38
1968	27,332	25,641	23,762	4,171	4,395	0.35
1969	25,558	23,896	22,110	3,818	4,396	0.33
1970	23,662	22,016	20,310	3,499	4,452	0.30
1971	21,849	20,201	18,557	3,226	4,612	0.28
1972	20,023	18,349	16,769	2,965	4,949	0.25
1973	18,211	16,463	14,937	2,719	5,501	0.22
1974	16,765	14,869	13,362	2,535	6,381	0.20
1975	15,523	13,397	11,849	2,417	6,431	0.18
1976	14,404	12,095	10,421	2,389	5,832	0.16
1977	13,667	11,427	9,490	2,534	5,168	0.14
1978	13,095	11,035	8,965	2,638	7,431	0.13
1979	12,770	10,588	8,621	2,589	4,496	0.13
1980	12,088	9,816	8,050	2,426	4,382	0.12
1981	11,266	9,606	7,421	2,684	7,073	0.11
1982	11,185	9,175	7,271	2,503	3,832	0.11
1983	10,752	8,576	6,930	2,352	4,937	0.10
1984	10,767	9,166	6,840	2,843	4,157	0.10
1985	11,412	9,601	7,573	2,756	5,129	0.11
1986	11,117	9,426	7,536	2,712	2,121	0.11
1987	9,978	8,504	6,885	2,342	3,022	0.10
1988	9,587	8,668	6,857	2,472	1,904	0.10
1989	9,239	8,183	6,980	2,016	7,951	0.10
1990	9,125	7,567	6,502	1,840	2,865	0.10
1991	9,307	6,983	6,068	1,612	3,511	0.09

Table 8 Continued. Expected biomass (metric tons) for all Gag Grouper and exploited Gag Grouper (3+ years), spawning stock biomass (SSB, metric tons), exploited numbers (3+years, 1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 67,045 metric tons for Gulf of Mexico Gag Grouper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
1992	9,434	8,220	5,702	2,740	4,005	0.09
1993	9,313	7,782	5,893	2,298	11,058	0.09
1994	9,696	7,140	5,706	2,070	7,490	0.09
1995	10,768	7,077	5,483	2,120	5,592	0.08
1996	11,233	8,543	5,085	3,429	13,812	0.08
1997	13,079	9,756	6,214	3,707	7,867	0.09
1998	14,533	10,139	7,462	3,456	4,216	0.11
1999	13,886	11,353	6,927	4,628	10,098	0.10
2000	13,782	11,302	7,521	4,180	9,246	0.11
2001	14,538	10,805	8,482	3,412	7,642	0.13
2002	14,912	11,568	8,069	4,169	10,343	0.12
2003	15,348	12,075	8,067	4,439	7,099	0.12
2004	15,482	12,039	8,550	4,223	6,946	0.13
2005	14,408	11,731	7,869	4,378	9,109	0.12
2006	6,190	4,774	3,264	1,734	6,403	0.05
2007	6,359	4,416	3,079	1,598	6,910	0.05
2008	6,877	4,445	2,866	1,732	4,051	0.04
2009	6,331	4,269	2,213	1,955	2,858	0.03
2010	6,422	5,091	2,634	2,344	5,226	0.04
2011	6,516	5,159	3,290	2,064	1,297	0.05
2012	6,857	5,466	4,115	1,874	3,222	0.06
2013	7,200	6,403	4,562	2,275	4,662	0.07
2014	7,437	5,996	4,902	1,708	4,924	0.07
2015	3,150	2,414	1,959	703	2,517	0.03
2016	3,375	2,532	1,834	829	3,195	0.03
2017	3,555	2,499	1,695	893	2,899	0.03
2018	3,828	2,696	1,727	1,039	1,517	0.03
2019	3,636	2,821	1,706	1,154	2,158	0.03

Table 9. Expected spawning stock biomass (SSB, metric tons), exploitable biomass (3+ years, metric tons) and exploitable abundance (3+ years, 1,000s of fish) by sex and associated sex ratio (exploitable male:female) for Gulf of Mexico Gag Grouper.

Year	SSB (female)	SSB (male)	Biomass (female)	Biomass (male)	Abundance (female)	Abundance (male)	Sex ratio
1963	15,301	12,493	18,481	12,493	4,915.49	906.06	18.4
1964	15,178	12,444	18,345	12,444	4,884.28	901.95	18.5
1965	14,881	12,275	18,027	12,275	4,815.33	888.77	18.5
1966	14,375	12,019	16,820	12,019	4,205.29	868.75	20.7
1967	13,437	11,790	15,457	11,790	3,725.83	849.72	22.8
1968	12,180	11,582	14,059	11,582	3,342.39	828.97	24.8
1969	10,846	11,264	12,631	11,264	3,019.39	798.32	26.4
1970	9,525	10,784	11,232	10,784	2,743.62	755.15	27.5
1971	8,337	10,220	9,980	10,220	2,519.56	706.06	28.0
1972	7,233	9,535	8,813	9,535	2,315.54	649.02	28.0
1973	6,228	8,709	7,754	8,709	2,135.47	583.71	27.3
1974	5,432	7,930	6,938	7,930	2,012.06	523.38	26.0
1975	4,791	7,057	6,339	7,057	1,958.05	459.32	23.5
1976	4,332	6,088	6,006	6,088	1,996.84	391.98	19.6
1977	4,207	5,282	6,144	5,282	2,195.42	338.08	15.4
1978	4,347	4,617	6,417	4,617	2,342.14	295.64	12.6
1979	4,565	4,056	6,531	4,056	2,327.14	262.00	11.3
1980	4,617	3,433	6,383	3,433	2,200.20	226.00	10.3
1981	4,535	2,886	6,720	2,886	2,488.73	194.90	7.8
1982	4,895	2,376	6,798	2,376	2,335.43	167.48	7.2
1983	5,004	1,926	6,650	1,926	2,207.52	144.61	6.6
1984	5,144	1,696	7,469	1,696	2,708.03	135.23	5.0
1985	5,970	1,602	7,999	1,602	2,620.02	135.75	5.2
1986	6,041	1,495	7,931	1,495	2,577.81	133.86	5.2
1987	5,478	1,407	7,097	1,407	2,213.47	128.45	5.8
1988	5,438	1,418	7,250	1,418	2,340.68	131.72	5.6
1989	5,489	1,491	6,692	1,491	1,877.31	138.65	7.4
1990	5,007	1,495	6,071	1,495	1,700.93	138.89	8.2
1991	4,584	1,484	5,498	1,484	1,475.04	136.54	9.3

Table 9 Continued. Expected spawning stock biomass (SSB, metric tons), exploitable biomass (3+ years, metric tons) and exploitable abundance (3+ years, 1,000s of fish) by sex and associated sex ratio (exploitable male:female) for Gulf of Mexico Gag Grouper.

Year	SSB (female)	SSB (male)	Biomass (female)	Biomass (male)	Abundance (female)	Abundance (male)	Sex ratio
1992	4,224	1,477	6,743	1,477	2,606.81	133.38	5.1
1993	4,501	1,391	6,390	1,391	2,175.78	122.66	5.6
1994	4,443	1,262	5,877	1,262	1,957.49	112.82	5.8
1995	4,294	1,188	5,888	1,188	2,012.53	107.01	5.3
1996	4,018	1,066	7,477	1,066	3,333.00	95.58	2.9
1997	5,226	987	8,768	987	3,616.72	89.97	2.5
1998	6,489	972	9,166	972	3,360.72	95.34	2.8
1999	6,053	873	10,479	873	4,538.18	89.51	2.0
2000	6,690	831	10,471	831	4,093.45	86.92	2.1
2001	7,624	858	9,947	858	3,315.46	96.44	2.9
2002	7,217	852	10,716	852	4,069.66	99.35	2.4
2003	7,224	843	11,232	843	4,341.94	97.04	2.2
2004	7,686	863	11,175	863	4,123.28	100.04	2.4
2005	7,043	826	10,904	826	4,282.99	95.15	2.2
2006	2,929	334	4,439	334	1,696.53	37.92	2.2
2007	2,779	299	4,116	299	1,563.70	34.71	2.2
2008	2,593	273	4,172	273	1,700.48	31.88	1.9
2009	2,013	199	4,069	199	1,932.78	22.57	1.2
2010	2,448	185	4,906	185	2,323.06	21.27	0.9
2011	3,089	201	4,958	201	2,039.80	24.65	1.2
2012	3,847	268	5,198	268	1,838.65	35.41	1.9
2013	4,206	355	6,047	355	2,227.78	47.33	2.1
2014	4,448	454	5,542	454	1,650.59	57.61	3.5
2015	1,733	225	2,188	225	675.40	27.68	4.1
2016	1,583	250	2,281	250	800.21	28.89	3.6
2017	1,466	228	2,271	228	868.19	25.17	2.9
2018	1,504	222	2,474	222	1,015.64	23.74	2.3
2019	1,510	195	2,625	195	1,133.37	20.64	1.8

Table 10. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Vertical Line + Other fleet in weight (B, million pounds gutted weight) and number (1,000s of fish) for Gulf of Mexico Gag Grouper. The mean body weight (MW, gutted pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1963	0.05	1.635	1.637	87.144	18.8
1964	0.05	2.042	2.043	108.544	18.8
1965	0.05	2.232	2.235	117.619	19.0
1966	0.05	1.871	1.873	96.574	19.4
1967	0.05	1.446	1.447	72.542	19.9
1968	0.05	1.511	1.512	73.620	20.5
1969	0.05	1.749	1.751	83.153	21.1
1970	0.05	1.665	1.667	77.778	21.4
1971	0.05	1.659	1.661	76.631	21.7
1972	0.05	1.769	1.772	81.290	21.8
1973	0.05	1.306	1.307	60.034	21.8
1974	0.05	1.464	1.466	68.071	21.5
1975	0.05	1.804	1.808	86.479	20.9
1976	0.05	1.449	1.452	73.299	19.8
1977	0.05	1.197	1.199	64.783	18.5
1978	0.05	1.070	1.072	61.605	17.4
1979	0.05	1.676	1.679	101.700	16.5
1980	0.05	1.653	1.656	105.909	15.6
1981	0.05	1.722	1.726	117.063	14.7
1982	0.05	1.535	1.537	110.422	13.9
1983	0.05	1.231	1.234	92.896	13.3
1984	0.05	1.358	1.363	106.133	12.8
1985	0.05	1.757	1.769	139.033	12.7
1986	0.05	1.153	1.159	89.556	12.9
1987	0.05	0.850	0.854	64.754	13.2
1988	0.05	0.786	0.790	58.346	13.5
1989	0.05	1.225	1.233	87.492	14.1
1990	0.05	1.165	1.173	78.515	14.9
1991	0.05	1.037	1.045	69.727	15.0

Table 10 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Vertical Line + Other fleet in weight (B, million pounds gutted weight) and number (1,000s of fish) for Gulf of Mexico Gag Grouper. The mean body weight (MW, gutted pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1992	0.05	1.047	1.057	77.074	13.7
1993	0.05	1.363	1.412	106.401	13.3
1994	0.05	1.258	1.248	94.261	13.2
1995	0.05	1.255	1.218	95.196	12.8
1996	0.05	1.164	1.154	102.763	11.2
1997	0.05	1.171	1.163	108.534	10.7
1998	0.05	1.911	1.856	170.989	10.9
1999	0.05	1.519	1.524	146.265	10.4
2000	0.05	1.681	1.799	170.053	10.6
2001	0.05	2.159	2.167	175.115	12.4
2002	0.05	1.937	1.933	151.301	12.8
2003	0.05	1.510	1.522	121.735	12.5
2004	0.05	1.809	1.810	145.638	12.4
2005	0.05	1.596	1.602	128.965	12.4
2006	0.05	0.853	0.872	71.847	12.1
2007	0.05	0.788	0.797	65.674	12.1
2008	0.05	0.946	0.939	77.697	12.1
2009	0.05	0.592	0.595	52.852	11.3
2010	0.01	0.388	0.389	36.835	10.6
2011	0.01	0.239	0.240	22.395	10.7
2012	0.01	0.395	0.395	36.310	10.9
2013	0.01	0.390	0.390	33.671	11.6
2014	0.01	0.376	0.377	30.253	12.5
2015	0.01	0.289	0.290	21.863	13.3
2016	0.01	0.511	0.510	39.376	13.0
2017	0.01	0.316	0.315	26.027	12.1
2018	0.01	0.323	0.322	28.374	11.3
2019	0.01	0.353	0.353	29.944	11.8

Table 11. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Longline fleet in weight (B, million pounds gutted weight) and number (1,000s of fish) for Gulf of Mexico Gag Grouper. The mean body weight (MW, gutted pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1979	0.05	0.001	0.001	0.045	25.4
1980	0.05	0.096	0.096	3.962	24.3
1981	0.05	0.423	0.423	18.410	23.0
1982	0.05	0.886	0.887	41.263	21.5
1983	0.05	0.608	0.609	29.960	20.3
1984	0.05	0.416	0.417	21.415	19.5
1985	0.05	0.370	0.371	19.659	18.9
1986	0.05	0.513	0.515	27.462	18.8
1987	0.05	0.649	0.652	34.487	18.9
1988	0.05	0.393	0.394	20.619	19.1
1989	0.05	0.418	0.419	21.596	19.4
1990	0.05	0.622	0.627	31.658	19.8
1991	0.05	0.502	0.505	25.049	20.2
1992	0.05	0.580	0.585	29.062	20.1
1993	0.05	0.457	0.483	24.602	19.6
1994	0.05	0.338	0.354	18.532	19.1
1995	0.05	0.373	0.377	20.024	18.8
1996	0.05	0.377	0.385	21.366	18.0
1997	0.05	0.396	0.401	23.910	16.8
1998	0.05	0.549	0.538	33.276	16.2
1999	0.05	0.519	0.520	32.828	15.8
2000	0.05	0.545	0.568	36.467	15.6
2001	0.05	0.913	0.869	54.168	16.0
2002	0.05	0.986	0.928	56.685	16.4
2003	0.05	1.053	0.989	60.191	16.4
2004	0.05	1.042	0.981	59.929	16.4
2005	0.05	0.832	0.784	47.903	16.4
2006	0.05	0.508	0.493	30.567	16.1
2007	0.05	0.458	0.435	27.325	15.9

Table 11 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Longline fleet in weight (B, million pounds gutted weight) and number (1,000s of fish) for Gulf of Mexico Gag Grouper. The mean body weight (MW, gutted pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers .

Year	Input B SE	Input B	Exp B	Exp N	MW
2008	0.05	0.364	0.350	21.849	16.0
2009	0.05	0.149	0.140	9.053	15.5
2010	0.01	0.108	0.109	7.548	14.5
2011	0.01	0.079	0.080	5.642	14.1
2012	0.01	0.128	0.128	8.893	14.4
2013	0.01	0.186	0.186	12.140	15.3
2014	0.01	0.210	0.210	12.952	16.2
2015	0.01	0.253	0.253	14.776	17.1
2016	0.01	0.400	0.399	22.728	17.6
2017	0.01	0.176	0.176	10.163	17.3
2018	0.01	0.170	0.170	10.230	16.7
2019	0.01	0.179	0.179	11.049	16.2

Table 12. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat fleet in numbers (N, 1,000s of fish) and weight (B, million pounds gutted weight) for Gulf of Mexico Gag Grouper. The mean body weight (MW, gutted pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1963	0.05	23.007	23.009	0.177	7.7
1964	0.20	23.705	23.751	0.186	7.8
1965	0.20	24.403	24.457	0.201	8.2
1966	0.20	25.150	25.214	0.215	8.5
1967	0.20	25.898	25.971	0.227	8.7
1968	0.20	26.645	26.728	0.234	8.8
1969	0.20	27.393	27.484	0.238	8.7
1970	0.20	28.140	28.240	0.240	8.5
1971	0.20	30.751	30.871	0.256	8.3
1972	0.20	33.361	33.502	0.268	8.0
1973	0.20	35.972	36.128	0.276	7.6
1974	0.20	38.583	38.746	0.278	7.2
1975	0.20	41.193	41.346	0.272	6.6
1976	0.20	41.360	41.474	0.252	6.1
1977	0.20	41.527	41.610	0.244	5.9
1978	0.20	41.694	41.764	0.246	5.9
1979	0.20	41.861	41.914	0.241	5.7
1980	0.20	42.028	42.066	0.237	5.6
1981	0.20	73.757	76.271	0.440	5.8
1982	0.20	66.110	62.667	0.353	5.6
1983	0.20	61.752	57.809	0.319	5.5
1984	0.20	43.780	39.990	0.228	5.7
1985	0.20	103.116	97.084	0.572	5.9
1986	0.20	42.495	32.798	0.194	5.9
1987	0.20	32.156	23.784	0.144	6.1
1988	0.20	26.336	23.051	0.150	6.5
1989	0.20	35.145	52.904	0.362	6.8
1990	0.20	19.097	24.536	0.210	8.6
1991	0.20	11.453	1.818	0.014	7.9

Table 12 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat fleet in numbers (N, 1,000s of fish) and weight (B, million pounds gutted weight) for Gulf of Mexico Gag Grouper. The mean body weight (MW, gutted pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1992	0.20	13.789	10.379	0.071	6.9
1993	0.20	19.335	15.448	0.113	7.3
1994	0.20	20.561	19.021	0.142	7.5
1995	0.20	17.816	20.307	0.138	6.8
1996	0.20	16.062	15.848	0.097	6.1
1997	0.20	15.623	13.553	0.088	6.5
1998	0.20	36.316	38.048	0.251	6.6
1999	0.20	32.117	44.990	0.282	6.3
2000	0.20	30.824	30.403	0.205	6.7
2001	0.20	14.494	15.124	0.124	8.2
2002	0.20	11.615	12.047	0.095	7.9
2003	0.20	16.381	20.810	0.159	7.7
2004	0.20	24.670	27.565	0.215	7.8
2005	0.20	16.784	20.598	0.157	7.6
2006	0.20	6.764	6.541	0.050	7.6
2007	0.20	11.141	11.794	0.091	7.7
2008	0.20	10.521	12.547	0.092	7.4
2009	0.20	9.483	13.609	0.092	6.8
2010	0.20	11.094	18.075	0.123	6.8
2011	0.20	5.099	5.637	0.041	7.4
2012	0.20	5.253	5.521	0.044	8.0
2013	0.20	5.276	7.806	0.063	8.1
2014	0.20	6.203	5.405	0.047	8.7
2015	0.20	3.626	3.200	0.028	8.8
2016	0.20	2.490	3.281	0.027	8.1
2017	0.20	2.932	2.276	0.021	9.2
2018	0.20	3.026	2.707	0.024	8.8
2019	0.20	2.650	2.732	0.023	8.5

Table 13. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter fleet in numbers (N, 1,000s of fish) and weight (B, million pounds gutted weight) for Gulf of Mexico Gag Grouper. The mean body weight (MW, gutted pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1963	0.05	97.585	97.631	0.806	8.3
1964	0.20	100.546	101.413	0.850	8.4
1965	0.20	103.507	104.527	0.912	8.7
1966	0.20	106.677	107.876	0.980	9.1
1967	0.20	109.847	111.235	1.035	9.3
1968	0.20	113.017	114.594	1.075	9.4
1969	0.20	116.187	117.944	1.098	9.3
1970	0.20	119.357	121.280	1.110	9.2
1971	0.20	130.431	132.775	1.188	8.9
1972	0.20	141.504	144.263	1.251	8.7
1973	0.20	152.577	155.688	1.295	8.3
1974	0.20	163.650	166.954	1.311	7.9
1975	0.20	174.723	177.894	1.289	7.2
1976	0.20	175.431	177.845	1.188	6.7
1977	0.20	176.139	177.887	1.140	6.4
1978	0.20	176.847	178.271	1.143	6.4
1979	0.20	177.555	178.623	1.125	6.3
1980	0.20	178.263	179.002	1.099	6.1
1981	0.20	117.237	125.533	0.784	6.2
1982	0.20	106.427	99.962	0.615	6.2
1983	0.20	99.849	93.957	0.564	6.0
1984	0.20	69.958	64.311	0.397	6.2
1985	0.20	164.180	152.039	0.967	6.4
1986	0.20	367.116	359.392	2.314	6.4
1987	0.20	106.620	101.597	0.665	6.5
1988	0.20	86.866	87.646	0.610	7.0
1989	0.20	74.357	86.225	0.631	7.3
1990	0.20	26.279	29.295	0.258	8.8
1991	0.20	35.080	27.844	0.227	8.2

Table 13 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter fleet in numbers (N, 1,000s of fish) and weight (B, million pounds gutted weight) for Gulf of Mexico Gag Grouper. The mean body weight (MW, gutted pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1992	0.20	156.110	138.933	0.989	7.1
1993	0.20	137.481	121.689	0.914	7.5
1994	0.20	66.607	67.407	0.520	7.7
1995	0.20	112.353	139.967	0.986	7.0
1996	0.20	199.052	233.928	1.476	6.3
1997	0.20	139.119	152.400	1.017	6.7
1998	0.20	199.321	280.683	1.917	6.8
1999	0.20	137.899	312.929	2.030	6.5
2000	0.20	127.608	148.207	1.029	6.9
2001	0.20	84.576	89.958	0.750	8.3
2002	0.20	114.051	132.847	1.071	8.1
2003	0.20	92.980	160.894	1.258	7.8
2004	0.20	134.341	211.764	1.683	7.9
2005	0.20	126.872	229.028	1.786	7.8
2006	0.20	70.445	87.567	0.682	7.8
2007	0.20	33.991	45.459	0.357	7.8
2008	0.20	89.110	108.326	0.815	7.5
2009	0.20	46.692	70.515	0.488	6.9
2010	0.20	60.233	103.293	0.717	6.9
2011	0.20	10.632	18.246	0.137	7.5
2012	0.20	46.754	27.090	0.221	8.2
2013	0.20	24.939	31.029	0.257	8.3
2014	0.20	12.425	11.453	0.101	8.8
2015	0.20	12.977	10.743	0.097	9.0
2016	0.20	17.624	23.616	0.196	8.3
2017	0.20	25.424	24.782	0.229	9.2
2018	0.20	19.823	21.394	0.191	8.9
2019	0.20	28.537	25.713	0.222	8.6

Table 14. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private + Shore fleet in numbers (N, 1,000s of fish) and weight (B, million pounds gutted weight) for Gulf of Mexico Gag Grouper. The mean body weight (MW, gutted pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1963	0.05	374.170	374.701	1.771	4.7
1964	0.20	385.523	395.863	1.968	5.0
1965	0.20	396.876	409.007	2.129	5.2
1966	0.20	409.032	422.987	2.235	5.3
1967	0.20	421.187	436.845	2.275	5.2
1968	0.20	433.343	450.490	2.268	5.0
1969	0.20	445.498	463.850	2.238	4.8
1970	0.20	457.653	476.852	2.202	4.6
1971	0.20	500.111	522.313	2.309	4.4
1972	0.20	542.569	566.770	2.385	4.2
1973	0.20	585.027	609.304	2.420	4.0
1974	0.20	627.485	649.015	2.410	3.7
1975	0.20	669.943	685.911	2.382	3.5
1976	0.20	672.658	681.591	2.316	3.4
1977	0.20	675.373	679.996	2.387	3.5
1978	0.20	678.088	680.617	2.481	3.6
1979	0.20	680.802	680.676	2.419	3.6
1980	0.20	683.517	682.869	2.554	3.7
1981	0.38	330.039	318.318	1.234	3.9
1982	0.25	849.967	472.657	1.755	3.7
1983	0.50	428.677	376.633	1.467	3.9
1984	0.38	254.301	90.787	0.369	4.1
1985	0.53	602.137	288.458	1.215	4.2
1986	0.43	429.977	400.952	1.678	4.2
1987	0.43	401.543	328.727	1.472	4.5
1988	0.38	423.866	283.964	1.342	4.7
1989	0.32	353.138	261.803	1.218	4.7
1990	0.32	224.742	95.619	0.706	7.4
1991	0.25	258.847	200.935	1.340	6.7

Table 14 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private + Shore fleet in numbers (N, 1,000s of fish) and weight (B, million pounds gutted weight) for Gulf of Mexico Gag Grouper. The mean body weight (MW, gutted pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1992	0.20	216.166	225.322	1.354	6.0
1993	0.24	338.057	271.442	1.764	6.5
1994	0.23	200.029	208.434	1.390	6.7
1995	0.26	401.331	408.721	2.470	6.0
1996	0.19	236.847	212.046	1.188	5.6
1997	0.21	335.630	378.317	2.289	6.1
1998	0.17	459.605	664.823	4.086	6.1
1999	0.14	548.611	619.417	3.640	5.9
2000	0.15	586.751	406.270	2.578	6.3
2001	0.16	442.486	387.831	2.989	7.7
2002	0.18	520.785	443.521	3.275	7.4
2003	0.15	388.017	503.364	3.620	7.2
2004	0.17	608.989	682.053	4.994	7.3
2005	0.21	533.962	503.717	3.618	7.2
2006	0.25	285.535	248.268	1.791	7.2
2007	0.17	236.240	267.248	1.943	7.3
2008	0.18	379.698	459.336	3.198	7.0
2009	0.17	196.587	358.938	2.333	6.5
2010	0.19	251.765	374.612	2.469	6.6
2011	0.25	133.382	213.985	1.521	7.1
2012	0.24	101.646	156.057	1.196	7.7
2013	0.20	186.230	227.379	1.739	7.6
2014	0.24	132.567	129.195	1.043	8.1
2015	0.26	111.003	65.264	0.526	8.1
2016	0.28	82.266	83.969	0.622	7.4
2017	0.25	106.941	101.310	0.849	8.4
2018	0.23	121.852	124.409	1.019	8.2
2019	0.31	97.999	152.030	1.225	8.1

Table 15. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Commercial Vertical Line + Other fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds gutted weight) for Gulf of Mexico Gag Grouper. Dead discards in numbers (discard mortality rate = 0.25), dead discards in biomass, and mean weight (MW, gutted pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1963			2.499	0.625	6.096	1.523	2.4
1964			2.721	0.680	7.176	1.795	2.6
1965			2.589	0.647	6.989	1.742	2.7
1966			2.014	0.504	5.280	1.318	2.6
1967			1.520	0.380	3.849	0.961	2.5
1968			1.602	0.401	3.953	0.988	2.5
1969			1.925	0.481	4.647	1.162	2.4
1970			1.945	0.486	4.610	1.153	2.4
1971			2.094	0.523	4.870	1.217	2.3
1972			2.478	0.620	5.633	1.409	2.3
1973			2.099	0.525	4.630	1.157	2.2
1974			2.819	0.705	6.021	1.506	2.1
1975			4.417	1.104	9.127	2.282	2.1
1976			4.319	1.080	9.035	2.260	2.1
1977			3.888	0.972	8.488	2.121	2.2
1978			3.470	0.867	7.877	1.969	2.3
1979			6.614	1.654	13.748	3.437	2.1
1980			6.382	1.596	14.630	3.657	2.3
1981			6.357	1.589	15.110	3.777	2.4
1982			7.228	1.807	15.133	3.783	2.1
1983			5.495	1.374	12.952	3.236	2.4
1984			5.792	1.448	13.704	3.426	2.4
1985			6.862	1.716	16.566	4.142	2.4
1986			4.638	1.159	10.542	2.637	2.3
1987			2.722	0.681	7.088	1.773	2.6
1988			2.141	0.535	5.472	1.369	2.6
1989			2.766	0.691	7.271	1.817	2.6
1990			8.249	2.062	13.836	3.459	1.7
1991			10.715	2.679	23.598	5.900	2.2

Table 15 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Commercial Vertical Line + Other fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds gutted weight) for Gulf of Mexico Gag Grouper. Dead discards in numbers (discard mortality rate = 0.25), dead discards in biomass, and mean weight (MW, gutted pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1992			7.964	1.991	17.454	4.363	2.2
1993	0.22	17.085	10.515	2.629	21.493	5.373	2.0
1994	0.22	16.824	16.397	4.099	28.702	7.176	1.8
1995	0.22	18.991	23.582	5.896	49.132	12.282	2.1
1996	0.22	21.238	18.395	4.599	40.433	10.108	2.2
1997	0.22	22.344	19.103	4.775	35.278	8.821	1.8
1998	0.22	33.497	35.263	8.816	75.286	18.823	2.1
1999	0.22	28.141	19.853	4.963	45.517	11.380	2.3
2000	0.22	84.100	19.777	4.944	37.882	9.469	1.9
2001	0.22	100.510	65.290	16.322	211.639	52.906	3.2
2002	0.22	92.724	69.578	17.394	240.310	60.078	3.5
2003	0.22	79.853	55.505	13.877	193.570	48.391	3.5
2004	0.22	85.584	63.366	15.841	219.507	54.877	3.5
2005	0.22	79.540	58.240	14.560	208.621	52.157	3.6
2006	0.22	46.882	32.749	8.187	112.449	28.111	3.4
2007	0.22	34.193	35.756	8.939	113.220	28.305	3.2
2008	0.22	32.203	60.888	15.222	189.280	47.320	3.1
2009	0.22	37.010	49.164	12.291	167.556	41.888	3.4
2010	0.25	34.423	24.615	6.154	91.417	22.855	3.7
2011	0.25	28.390	11.291	2.823	47.298	11.826	4.2
2012	0.16	10.016	9.157	2.289	39.183	9.795	4.3
2013	0.16	9.958	6.776	1.694	32.690	8.173	4.8
2014	0.16	10.341	6.250	1.563	28.911	7.227	4.6
2015	0.16	8.009	6.067	1.517	25.942	6.486	4.3
2016	0.16	9.503	13.627	3.407	53.517	13.380	3.9
2017	0.16	7.887	10.807	2.702	38.733	9.683	3.6
2018	0.16	6.716	12.604	3.151	44.476	11.120	3.5
2019	0.25	20.621	20.060	5.015	83.368	20.842	4.2

Table 16. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Commercial Longline fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds gutted weight) for Gulf of Mexico Gag Grouper. Dead discards in numbers (discard mortality rate = 0.25), dead discards in biomass, and mean weight (MW, gutted pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1979			0.000	0.000	0.001	0.000	3.4
1980			0.024	0.006	0.087	0.022	3.5
1981			0.111	0.028	0.414	0.104	3.7
1982			0.281	0.070	0.977	0.245	3.5
1983			0.205	0.051	0.743	0.185	3.6
1984			0.139	0.035	0.525	0.132	3.8
1985			0.117	0.029	0.456	0.115	3.9
1986			0.158	0.040	0.602	0.150	3.8
1987			0.174	0.044	0.710	0.179	4.1
1988			0.088	0.022	0.379	0.095	4.3
1989			0.079	0.020	0.353	0.088	4.5
1990			0.229	0.057	0.467	0.117	2.0
1991			0.319	0.080	0.774	0.194	2.4
1992			0.281	0.070	0.703	0.176	2.5
1993	0.24	0.588	0.229	0.057	0.540	0.137	2.4
1994	0.24	0.673	0.271	0.068	0.556	0.139	2.1
1995	0.24	0.660	0.482	0.121	1.113	0.280	2.3
1996	0.24	0.809	0.457	0.114	1.113	0.278	2.4
1997	0.24	0.779	0.475	0.119	1.014	0.254	2.1
1998	0.24	0.807	0.824	0.206	1.933	0.483	2.3
1999	0.24	0.819	0.586	0.146	1.468	0.366	2.5
2000	0.23	1.304	0.481	0.120	1.071	0.269	2.2
2001	0.23	1.586	2.917	0.729	11.292	2.822	3.9
2002	0.23	1.627	3.761	0.940	14.987	3.748	4.0
2003	0.23	1.727	4.164	1.041	16.967	4.242	4.1
2004	0.23	1.693	3.975	0.994	15.955	3.988	4.0
2005	0.23	1.457	3.409	0.852	14.013	3.503	4.1
2006	0.23	1.351	2.191	0.548	8.858	2.216	4.0
2007	0.23	0.764	2.163	0.541	8.270	2.068	3.8

Table 16 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Commercial Longline fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds gutted weight) for Gulf of Mexico Gag Grouper. Dead discards in numbers (discard mortality rate = 0.25), dead discards in biomass, and mean weight (MW, gutted pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
2008	0.23	0.878	2.447	0.612	9.079	2.269	3.7
2009	0.23	0.457	1.454	0.363	5.687	1.422	3.9
2010	0.16	4.252	1.043	0.261	4.364	1.091	4.2
2011	0.16	4.503	2.118	0.529	23.799	5.950	11.2
2012	0.24	2.017	2.704	0.676	35.199	8.800	13.0
2013	0.24	2.473	3.556	0.889	50.652	12.663	14.2
2014	0.24	3.012	3.736	0.934	56.986	14.248	15.3
2015	0.24	3.242	4.378	1.094	68.996	17.249	15.8
2016	0.24	3.642	6.978	1.744	109.475	27.370	15.7
2017	0.24	3.505	3.264	0.816	48.677	12.169	14.9
2018	0.24	3.086	3.413	0.853	47.585	11.896	13.9
2019	0.16	6.193	4.418	1.105	53.938	13.484	12.2

Table 17. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Headboat fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds gutted weight) for Gulf of Mexico Gag Grouper. Dead discards in numbers (discard mortality rate = 0.12), dead discards in biomass, and mean weight (MW, gutted pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1963			6.600	0.792	9.996	1.200	1.5
1964			5.572	0.669	9.112	1.093	1.6
1965			5.432	0.652	8.638	1.037	1.6
1966			5.878	0.705	9.036	1.084	1.5
1967			6.497	0.780	9.811	1.177	1.5
1968			7.162	0.859	10.699	1.285	1.5
1969			7.856	0.943	11.634	1.396	1.5
1970			8.583	1.030	12.608	1.512	1.5
1971			9.992	1.199	14.535	1.744	1.5
1972			11.700	1.404	16.790	2.015	1.4
1973			13.840	1.661	19.522	2.341	1.4
1974			16.449	1.974	22.796	2.736	1.4
1975			19.412	2.329	26.605	3.194	1.4
1976			19.255	2.311	27.051	3.245	1.4
1977			17.549	2.106	25.494	3.058	1.5
1978			16.255	1.951	23.708	2.844	1.5
1979			19.600	2.352	26.824	3.221	1.4
1980			15.558	1.867	23.942	2.873	1.5
1981	1.046	56.153	26.644	3.197	39.531	4.742	1.5
1982	1.004	9.132	28.507	3.421	38.817	4.658	1.4
1983	0.731	9.388	19.869	2.384	31.262	3.752	1.6
1984	0.833	3.887	13.745	1.649	20.393	2.447	1.5
1985	0.827	14.373	31.253	3.751	47.333	5.679	1.5
1986	0.198	9.728	11.892	1.427	17.286	2.074	1.5
1987	0.198	4.854	6.125	0.735	10.407	1.249	1.7
1988	0.198	5.637	6.243	0.749	9.548	1.146	1.5
1989	0.198	20.373	14.049	1.686	21.025	2.522	1.5
1990	0.198	47.962	37.839	4.541	52.067	6.248	1.4
1991	0.198	1.142	2.724	0.327	5.186	0.622	1.9

Table 17 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Headboat fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds gutted weight) for Gulf of Mexico Gag Grouper. Dead discards in numbers (discard mortality rate = 0.12), dead discards in biomass, and mean weight (MW, gutted pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1992	0.198	7.035	8.709	1.045	15.577	1.869	1.8
1993	0.198	12.530	14.703	1.764	23.880	2.866	1.6
1994	0.198	35.298	37.121	4.455	53.027	6.363	1.4
1995	0.198	45.146	40.560	4.867	71.306	8.557	1.8
1996	0.198	18.025	18.294	2.195	33.008	3.961	1.8
1997	0.198	17.505	19.676	2.361	29.457	3.535	1.5
1998	0.198	57.554	56.305	6.757	102.453	12.293	1.8
1999	0.198	50.491	38.044	4.565	73.202	8.783	1.9
2000	0.198	30.406	30.431	3.652	46.620	5.594	1.5
2001	0.198	33.250	31.815	3.818	62.914	7.550	2.0
2002	0.198	25.685	24.765	2.972	53.434	6.412	2.2
2003	0.198	49.603	40.123	4.815	81.913	9.830	2.0
2004	0.198	57.962	51.936	6.232	112.319	13.479	2.2
2005	0.198	42.711	35.825	4.299	77.833	9.340	2.2
2006	0.198	12.765	13.164	1.580	25.996	3.120	2.0
2007	0.198	35.028	33.775	4.053	62.647	7.518	1.9
2008	0.198	53.173	46.456	5.575	90.200	10.824	1.9
2009	0.198	52.392	38.801	4.656	86.183	10.342	2.2
2010	0.198	46.592	30.765	3.692	71.414	8.570	2.3
2011	0.198	45.679	42.401	5.088	152.468	18.296	3.6
2012	0.198	37.878	36.894	4.427	157.860	18.943	4.3
2013	0.198	34.756	25.201	3.024	99.288	11.915	3.9
2014	0.198	20.162	22.422	2.691	77.156	9.259	3.4
2015	0.198	15.967	17.494	2.099	55.637	6.676	3.2
2016	0.198	20.739	16.345	1.961	45.494	5.459	2.8
2017	0.198	16.555	20.141	2.417	55.835	6.700	2.8
2018	0.198	21.040	23.141	2.777	67.206	8.065	2.9
2019	0.198	18.297	17.898	2.148	59.608	7.153	3.3

Table 18. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Charter fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds gutted weight) for Gulf of Mexico Gag Grouper. Dead discards in numbers (discard mortality rate = 0.12), dead discards in biomass, and mean weight (MW, gutted pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1963			21.047	2.526	34.908	4.189	1.7
1964			18.003	2.161	32.421	3.889	1.8
1965			17.195	2.063	30.388	3.646	1.8
1966			18.407	2.208	31.416	3.770	1.7
1967			20.342	2.441	34.024	4.081	1.7
1968			22.525	2.703	37.225	4.467	1.7
1969			24.846	2.982	40.677	4.881	1.6
1970			27.283	3.274	44.289	5.313	1.6
1971			31.910	3.829	51.308	6.158	1.6
1972			37.500	4.500	59.509	7.141	1.6
1973			44.525	5.343	69.470	8.336	1.6
1974			53.152	6.379	81.498	9.780	1.5
1975			63.525	7.623	95.751	11.490	1.5
1976			63.830	7.660	98.216	11.786	1.5
1977			58.269	6.992	92.773	11.133	1.6
1978			52.592	6.311	85.592	10.271	1.6
1979			64.087	7.690	95.473	11.457	1.5
1980			51.811	6.217	87.215	10.465	1.7
1981	0.844	89.783	32.847	3.942	54.838	6.581	1.7
1982	0.808	14.601	34.661	4.159	51.297	6.155	1.5
1983	0.617	15.011	25.121	3.014	43.451	5.214	1.7
1984	0.764	6.215	16.807	2.017	27.518	3.303	1.6
1985	0.562	22.980	36.900	4.428	62.016	7.443	1.7
1986	0.421	91.324	99.556	11.947	157.189	18.872	1.6
1987	0.367	17.620	20.292	2.435	37.948	4.555	1.9
1988	0.547	20.296	17.800	2.136	30.060	3.607	1.7
1989	0.514	46.217	15.751	1.890	28.027	3.362	1.8
1990	0.514	71.078	31.254	3.750	45.404	5.450	1.5
1991	0.744	3.502	31.786	3.814	63.310	7.597	2.0

Table 18 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Charter fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds gutted weight) for Gulf of Mexico Gag Grouper. Dead discards in numbers (discard mortality rate = 0.12), dead discards in biomass, and mean weight (MW, gutted pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1992	0.421	86.122	87.886	10.547	167.589	20.111	1.9
1993	0.489	97.098	81.792	9.815	145.598	17.472	1.8
1994	0.376	113.478	92.458	11.095	140.476	16.857	1.5
1995	0.284	308.655	211.682	25.402	391.675	47.000	1.9
1996	0.294	240.693	203.585	24.430	395.524	47.463	1.9
1997	0.275	168.734	159.908	19.189	254.413	30.530	1.6
1998	0.159	351.124	316.369	37.964	602.624	72.316	1.9
1999	0.090	233.276	202.370	24.285	414.641	49.756	2.0
2000	0.237	134.811	106.099	12.732	174.198	20.904	1.6
2001	0.376	201.966	138.962	16.676	293.865	35.263	2.1
2002	0.188	246.969	205.809	24.697	475.966	57.117	2.3
2003	0.129	296.289	232.206	27.864	509.545	61.145	2.2
2004	0.090	337.988	302.582	36.310	696.594	83.593	2.3
2005	0.090	339.608	301.234	36.148	703.953	84.474	2.3
2006	0.159	140.619	129.200	15.504	277.690	33.323	2.1
2007	0.188	113.324	94.324	11.319	189.648	22.756	2.0
2008	0.179	313.363	299.146	35.898	620.936	74.512	2.1
2009	0.256	267.022	157.089	18.851	369.153	44.297	2.3
2010	0.275	325.174	136.820	16.418	340.171	40.821	2.5
2011	0.149	190.736	148.833	17.860	625.487	75.058	4.2
2012	0.120	170.375	203.141	24.377	991.828	119.019	4.9
2013	0.322	234.277	168.350	20.202	851.202	102.144	5.1
2014	0.237	67.971	74.101	8.892	341.825	41.019	4.6
2015	0.256	72.623	88.446	10.614	370.373	44.445	4.2
2016	0.198	104.765	77.934	9.352	235.655	28.278	3.0
2017	0.294	145.159	145.309	17.437	438.250	52.589	3.0
2018	0.217	126.194	124.048	14.886	386.396	46.367	3.1
2019	0.246	99.177	117.681	14.122	415.586	49.871	3.5

Table 19. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private + Shore fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds gutted weight) for Gulf of Mexico Gag Grouper. Dead discards in numbers (discard mortality rate = 0.12), dead discards in biomass, and mean weight (MW, gutted pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1963			274	33	168	20	0.6
1964			272	33	156	19	0.6
1965			297	36	161	19	0.5
1966			333	40	175	21	0.5
1967			371	45	193	23	0.5
1968			410	49	211	25	0.5
1969			450	54	229	27	0.5
1970			490	59	246	30	0.5
1971			574	69	283	34	0.5
1972			678	81	326	39	0.5
1973			804	97	375	45	0.5
1974			951	114	431	52	0.5
1975			988	119	469	56	0.5
1976			875	105	444	53	0.5
1977			773	93	407	49	0.5
1978			976	117	424	51	0.4
1979			738	89	423	51	0.6
1980			668	80	364	44	0.5
1981	0.786	401	449	54	188	23	0.4
1982	0.345	197	475	57	284	34	0.6
1983	0.493	356	387	46	196	24	0.5
1984	0.086	83	86	10	47	6	0.5
1985	0.834	139	307	37	148	18	0.5
1986	0.469	361	286	34	197	24	0.7
1987	0.336	278	259	31	137	16	0.5
1988	0.340	194	197	24	120	14	0.6
1989	0.182	552	534	64	165	20	0.3
1990	0.325	362	458	55	411	49	0.9
1991	0.280	1,054	833	100	926	111	1.1

Table 19 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private + Shore fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds gutted weight) for Gulf of Mexico Gag Grouper. Dead discards in numbers (discard mortality rate = 0.12), dead discards in biomass, and mean weight (MW, gutted pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1992	0.199	831	644	77	577	69	0.9
1993	0.189	1,938	1,591	191	884	106	0.6
1994	0.132	1,548	1,458	175	1,151	138	0.8
1995	0.158	2,061	2,214	266	2,344	281	1.1
1996	0.123	1,037	1,119	134	783	94	0.7
1997	0.131	1,639	1,725	207	1,512	181	0.9
1998	0.141	2,270	2,275	273	2,786	334	1.2
1999	0.120	2,051	2,018	242	1,658	199	0.8
2000	0.108	1,359	1,537	184	1,180	142	0.8
2001	0.145	2,326	2,331	280	2,585	310	1.1
2002	0.119	2,902	2,862	343	3,054	366	1.1
2003	0.107	3,187	2,653	318	3,090	371	1.2
2004	0.118	4,113	3,435	412	4,198	504	1.2
2005	0.119	2,821	2,803	336	2,940	353	1.0
2006	0.134	1,753	1,954	235	1,662	199	0.9
2007	0.115	2,713	2,753	330	2,434	292	0.9
2008	0.123	4,442	4,466	536	5,212	625	1.2
2009	0.114	2,937	2,320	278	3,256	391	1.4
2010	0.117	2,315	2,032	244	2,175	261	1.1
2011	0.176	1,595	1,593	191	3,239	389	2.0
2012	0.146	1,140	1,215	146	2,378	285	2.0
2013	0.141	1,191	1,227	147	1,414	170	1.2
2014	0.148	1,026	943	113	1,010	121	1.1
2015	0.135	662	656	79	698	84	1.1
2016	0.229	1,103	802	96	725	87	0.9
2017	0.167	1,528	1,510	181	1,751	210	1.2
2018	0.181	1,036	1,341	161	2,041	245	1.5
2019	0.182	1,370	1,371	165	2,012	241	1.5

Table 20. Observed (Obs) versus predicted (Exp) standardized fishery-dependent catch-per-unit-effort (CPUE) indices for Gulf of Mexico Gag Grouper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs and further adjusted based on the Francis weighting method.

Yr	VL (Obs)	VL (Exp)	VL (SE)	LL (Obs)	LL (Exp)	LL (SE)	Hbt (Obs)	Hbt (Exp)	Hbt (SE)	Char Pri (Obs)	Char Pri (Exp)	Char Pri (SE)
1986							1.53	1.48	0.27	1.70	1.01	0.29
1987							1.59	1.36	0.27	0.36	0.88	0.39
1988							1.31	1.21	0.28	0.49	0.80	0.49
1989							1.15	1.05	0.28	0.32	0.68	0.41
1990	0.31	1.18	0.63	0.82	1.43	0.71	1.02	0.70	0.28	0.72	0.84	0.40
1991	0.31	1.11	0.56	0.64	1.37	0.63	0.75	0.74	0.30	0.71	0.90	0.41
1992	0.56	1.08	0.55	0.51	1.28	0.63	0.71	0.98	0.31	0.79	0.90	0.32
1993	0.65	1.03	0.52	0.67	1.16	0.57	0.72	0.90	0.30	1.00	0.86	0.31
1994	0.59	0.98	0.52	0.38	1.09	0.58	0.76	0.84	0.30	1.10	1.14	0.30
1995	0.78	0.94	0.52	0.48	1.03	0.58	0.80	0.95	0.30	1.58	1.34	0.28
1996	0.93	0.96	0.52	0.50	0.98	0.59	1.11	1.34	0.28	1.36	1.40	0.29
1997	0.91	1.10	0.51	0.64	1.02	0.56	1.15	1.50	0.27	1.23	1.74	0.27
1998	1.54	1.16	0.51	0.95	1.07	0.56	1.12	1.50	0.27	1.57	1.80	0.24
1999	1.07	1.18	0.51	0.85	1.07	0.57	1.31	1.73	0.27	1.24	1.59	0.24
2000	1.11	1.28	0.52	0.88	1.14	0.57	1.03	1.65	0.29	0.90	1.62	0.25
2001	1.59	1.25	0.52	1.64	1.22	0.56	0.66	1.14	0.31	1.08	1.71	0.25
2002	1.59	1.23	0.52	1.44	1.25	0.57	0.68	1.17	0.31	1.23	1.74	0.25
2003	1.56	1.24	0.52	1.71	1.25	0.56	0.97	1.28	0.30	1.77	1.83	0.24
2004	1.99	1.23	0.52	2.06	1.22	0.55	1.03	1.23	0.29	1.69	1.75	0.23
2005	1.87	0.80	0.52	2.26	0.80	0.55	1.27	0.85	0.27	1.86	1.08	0.23
2006	1.00	0.46	0.52	1.20	0.45	0.56	0.56	0.50	0.32	1.08	0.72	0.26
2007	0.65	0.43	0.53	0.91	0.42	0.57	0.61	0.46	0.32	1.12	0.83	0.26
2008	0.64	0.36	0.53	0.99	0.35	0.56	0.95	0.42	0.30	1.57	0.92	0.24

Table 20 Continued. Observed (Obs) versus predicted (Exp) standardized fishery-dependent catch-per-unit-effort (CPUE) indices for Gulf of Mexico Gag Grouper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs and further adjusted based on the Francis weighting method.

Yr	VL (Obs)	VL (Exp)	VL (SE)	LL (Obs)	LL (Exp)	LL (SE)	Hbt (Obs)	Hbt (Exp)	Hbt (SE)	Char Pri (Obs)	Char Pri (Exp)	Char Pri (SE)
2009	0.35	0.31	0.53	0.45	0.28	0.62	0.94	0.49	0.29	1.20	0.91	0.26
2010							1.25	0.62	0.29	1.19	0.83	0.27
2011										0.84	0.86	0.27
2012										0.77	0.78	0.27
2013										0.54	0.73	0.29
2014										0.45	0.48	0.28
2015										0.30	0.34	0.32
2016										0.45	0.39	0.31
2017										0.57	0.46	0.30
2018										0.66	0.49	0.30
2019										0.53	0.45	0.33

Table 21. Observed (Obs) versus predicted (Exp) standardized fishery-independent indices and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Gag Grouper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs and further adjusted based on the Francis weighting method.

Year	Age0 (Obs)	Age0 (Exp)	Age0 (SE)	SEAMAP Video (Obs)	SEAMAP Video (Exp)	SEAMAP Video (SE)	PC Video (Obs)	PC Video (Exp)	PC Video (SE)
1993				0.441	1.133	0.792			
1994	0.804	1.235	0.849	0.107	1.116	0.847			
1995	0.619	0.922	0.776	0.295	1.072	0.750			
1996	2.063	2.277	0.695	0.798	1.170	0.774			
1997	0.468	1.297	0.724	0.447	1.463	0.699			
1998	0.202	0.695	0.842						
1999	0.309	1.665	0.787						
2000	0.487	1.524	0.787						
2001	0.416	1.260	0.808						
2002	1.350	1.705	0.723	1.977	1.759	0.863			
2003	0.795	1.171	0.745						
2004	1.883	1.145	0.693	2.058	1.784	0.666			
2005	0.854	1.502	0.701	2.491	1.099	0.828			
2006	2.516	1.056	0.674	1.223	0.694	0.745	2.300	1.207	0.365
2007	2.287	1.139	0.673	1.676	0.655	0.818	1.610	1.456	0.418
2008	3.236	0.668	0.625	0.267	0.555	0.756	1.074	1.427	0.412
2009	0.873	0.471	0.682	0.796	0.553	0.666	1.650	1.196	0.344
2010	1.248	0.862	0.685	1.080	0.682	0.603	1.450	1.146	0.343
2011	0.088	0.214	0.783	1.462	0.849	0.582	1.075	1.069	0.370
2012	0.495	0.531	0.689	1.674	0.987	0.666	0.351	0.928	0.480
2013	0.805	0.769	0.686	1.484	1.051	0.786	0.642	1.028	0.522
2014	0.379	0.812	0.724	0.713	0.670	0.662	0.438	0.750	0.425
2015	0.756	0.415	0.693	1.136	0.399	0.807	0.288	0.550	0.536
2016	1.111	0.527	0.667	0.258	0.365	0.616	0.530	0.659	0.480
2017	1.078	0.478	0.677	0.384	0.360	0.645	0.686	0.743	0.434
2018	0.283	0.250	0.732	0.436	0.370	0.618	0.525	0.672	0.497
2019	0.595	0.356	0.689	0.798	0.389	1.233	1.383	0.584	0.413

Table 22. Summary of correlated parameters with correlation coefficients > 0.7 parameters for Gulf of Mexico Gag Grouper from the SRFS Run.

Parameter 1	Parameter 2	Correlation
InitF_seas_1_flt_5Rec_PRIV_SH_5	InitF_seas_1_flt_1Com_VL_OTH_1	0.806
Main_RecrDev_2005	Main_RecrDev_2004	0.708
Main_RecrDev_2012	Main_RecrDev_2010	0.750
Main_RecrDev_2013	Main_RecrDev_2010	0.726
Main_RecrDev_2013	Main_RecrDev_2012	0.806
Main_RecrDev_2014	Main_RecrDev_2012	0.745
Main_RecrDev_2014	Main_RecrDev_2013	0.813
Size_95%width_Srv_SEAMAP_VIDEO_9(9)	Size_inflection_Srv_SEAMAP_VIDEO_9(9)	0.760
Size_DblN_ascend_se_Rec_CBT_4(4)	Size_DblN_peak_Rec_CBT_4(4)	0.764
Size_DblN_descend_se_Rec_CBT_4(4)	Size_DblN_peak_Rec_CBT_4(4)	-0.792
Size_DblN_descend_se_Rec_HBT_3(3)	Size_DblN_peak_Rec_HBT_3(3)	-0.756
Size_DblN_end_logit_Rec_CBT_4(4)	Size_DblN_descend_se_Rec_CBT_4(4)	-0.764
VonBert_K_Fem_GP_1	L_at_Amin_Fem_GP_1	-0.826
VonBert_K_Fem_GP_1	L_at_Amax_Fem_GP_1	-0.972

Table 23. Comparing R0 likelihood profile results between the SRFS Run (top panel) and SEDAR 72 (bottom panel). Values show the difference in likelihood units compared to the minimum log-likelihood across ln(R0) values. Runs within 2 likelihood units of the minimum are highlighted in grey. Bolded zeros in the first row of each panel correspond to the maximum likelihood estimate of ln(R0) for each base model run.

	ln(R0)																				
Likelihood Component	8.5	8.6	8.7	8.8	8.9	9	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10	10.1	10.2	10.3	10.4	10.5
SRFS run Total	78	45	27	14	6	1	**0**	2	6	14	24	37	54	68	83	99	116	133	150	172	185
Catch	5	6	8	7	5	4	3	1	1	0	0	1	0	0	1	1	2	3	4	11	5
Equil_catch	0	0	0	0	0	0	1	1	1	2	2	3	31	37	43	48	52	56	60	64	68
Survey	44	35	26	18	11	6	3	1	0	0	1	3	4	7	9	12	14	16	17	14	17
Discard	22	15	11	7	6	4	3	3	2	2	3	4	2	2	2	3	3	2	1	1	0
Length_comp	4	0	2	5	8	11	14	17	19	21	24	26	34	40	45	52	60	68	77	84	92
Age_comp	43	37	31	29	30	29	29	29	29	29	28	27	15	13	10	7	5	3	1	1	0
Recruitment	16	9	5	2	0	0	1	3	5	9	13	18	4	4	4	5	6	8	9	10	11
InitEQ_Regime	0	0	0	0	1	1	2	3	5	6	8	11	18	21	23	26	29	32	35	39	43
SEDAR 72 Total	364	297	246	182	130	84	52	28	12	3	0	**1**	6	13	23	34	52	60	74	89	105
Catch	16	12	17	12	6	4	2	1	1	1	1	1	0	0	0	0	11	1	2	3	5
Equil_catch	0	0	0	0	0	0	0	0	1	1	2	3	4	7	12	25	31	36	42	45	49
Survey	95	82	90	77	61	48	36	26	18	12	8	4	2	1	1	1	0	4	6	7	9
Discard	39	34	38	32	25	17	11	6	2	0	0	0	1	2	2	2	6	3	4	4	4
Length_comp	71	54	18	6	4	0	1	4	7	11	13	16	19	22	26	30	30	40	46	54	61
Age_comp	75	74	66	62	56	50	44	37	31	25	24	23	22	21	19	14	10	8	6	3	0
Recruitment	122	93	72	47	33	20	11	7	5	4	3	4	5	6	7	1	0	0	0	1	2
InitEQ_Regime	0	0	0	0	0	0	0	1	1	2	3	4	6	8	11	14	16	19	21	24	26

Table 24. Settings used for Gulf of Mexico Gag Grouper SRFS Run projections.

Parameter	Value	Comment
Relative F	Not used	Average relative fishing mortality (apical F) over terminal three years of model (Red Tide F excluded)
Selectivity	2019	Fleet specific selectivity estimated in the terminal year of the model
Retention	2019	Fleet specific retention estimated in the terminal year of the model
Recruitment	Beverton-Holt stock-recruitment relationship	Derived from the model estimated Beverton-Holt stock-recruitment relationship
Interim Landings (2020-2022)	77/91/109 mt (Comm. Vertical Line) 139.04/164.5/128.26 mt (Comm. Longline) 2.98/3.64/3.09 thousands of fish (Headboat) 37.61/80.38/48.84 thousands of fish (Charter) 130.81/90.33/106.41 thousands of fish (Private)	Landings provided for 2020-2021; For 2022, used 3-year average of landings (2019-2021)
Allocation Ratio	39:61	Commercial:Recreational
Red Tide in Interim Years	0.18	Red Tide F for 2021 obtained from the Ecosim model (medium red tide scenario)

Table 25. Settings used for Gulf of Mexico Gag Grouper SEDAR 72 projections.

Parameter	Value	Comment
Relative F	Not used	Average relative fishing mortality (apical F) over terminal three years of model (Red Tide F excluded)
Selectivity	2019	Fleet specific selectivity estimated in the terminal year of the model
Retention	2019	Fleet specific retention estimated in the terminal year of the model
Recruitment	Beverton-Holt stock-recruitment relationship	Derived from the model estimated Beverton-Holt stock-recruitment relationship
Interim Landings (2020-2022)	77/91/109 mt (Comm. Vertical Line) 139.04/164.5/128.26 mt (Comm. Longline) 2.98/3.64/3.09 thousands of fish (Headboat) 37.61/80.38/48.84 thousands of fish (Charter) 305.4/208.66/246.52 thousands of fish (Private)	Landings provided for 2020-2021; For 2022, used 3-year average of landings (2019-2021)
Allocation Ratio	39:61	Commercial:Recreational
Red Tide in Interim Years	0.15	Red Tide F for 2021 obtained from the Ecosim model (medium red tide scenario)

Table 26. Summary of Magnuson-Stevens Reauthorization Act benchmarks and reference points for the Gulf of Mexico Gag Grouper assessment. Spawning Stock Biomass (SSB) is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+).

Criteria	Definition	SRFS Run			SEDAR 72		
Base M	Target M for fully selected ages in the Lorenzen (2005) scaling	0.159	0.159	0.159	0.159	0.159	0.159
Steepness	Steepness of the Beverton-Holt stock-recruit relationship (fixed)	0.855	0.855	0.855	0.855	0.855	0.855
R0	Virgin Recruitment (1000s)	8902	8903	8903	13641	13641	13641
Generation Time	Fecundity-weighted mean age	7.9	7.9	7.9	7.9	7.9	7.9
SSB0	Virgin spawning stock biomass (mt)	67045	67052	67052	100891	100891	100891
	Mortality Rate Criteria						
Fmsy proxy	Fmsy proxy used	Fspr30	Fspr40	Fmax	Fspr30	Fspr40	Fmax
MFMT	Fmsy proxy	0.144	0.098	0.327	0.148	0.101	0.322
%SPR equivalent of Fmsy proxy	%SPR equivalent of FMSYproxy	30	40	13	30	40	13
Fcurrent	Geometric mean of the last 3 years of the assessment (F2017-2019), excluding red tide mortality	0.353	0.352	0.352	0.416	0.416	0.414
Fcurrent/MFMT	Current stock status based on MFMT	2.45	3.58	1.08	2.81	4.11	1.28
	Biomass Criteria						
SSBmsy proxy	Equilibrium SSB at FMSYproxy	18035	25040	6063	27140	37676	9753
MSST	0.5*SSBFMSYproxy	9018	12520	3032	13570	18838	4876
SSBcurrent	SSB2019	1709	1706	1706	2304	2304	2304
SSBcurrent/SSBFMSYproxy	Current stock status based on SSBFMSYproxy	0.09	0.07	0.28	0.08	0.06	0.24
SSBcurrent/MSST	Current stock status based on MSST	0.19	0.14	0.56	0.17	0.12	0.47
Yr rebuilt at F=0	First year rebuilt fishing at F=0 starting in 2023	2033	2035	2027	2033	2036	2029
SSBcurrent/SSB0	SSB ratio in 2019	0.03	0.03	0.03	0.02	0.02	0.02

Table 27. Time series of fishing mortality and SSB relative to associated biological reference points for the SRFS Run (F_{SPR30} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR30} = 0.144, SSB_{FSPR30} = 18,035 mt, and MSST = 9,017 mt which was calculated as 0.5*SSB_{FSPR30}. Red indicates overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1963	0.065	0.451	27,791	1.541	3.082	0.415
1964	0.075	0.521	27,618	1.531	3.063	0.412
1965	0.082	0.569	27,152	1.506	3.011	0.405
1966	0.084	0.583	26,390	1.463	2.927	0.394
1967	0.083	0.576	25,223	1.399	2.797	0.376
1968	0.091	0.632	23,758	1.317	2.635	0.354
1969	0.102	0.708	22,107	1.226	2.452	0.330
1970	0.108	0.750	20,307	1.126	2.252	0.303
1971	0.123	0.854	18,555	1.029	2.058	0.277
1972	0.142	0.986	16,767	0.930	1.859	0.250
1973	0.148	1.028	14,936	0.828	1.656	0.223
1974	0.169	1.174	13,361	0.741	1.482	0.199
1975	0.197	1.368	11,848	0.657	1.314	0.177
1976	0.198	1.375	10,420	0.578	1.156	0.155
1977	0.200	1.389	9,489	0.526	1.052	0.142
1978	0.206	1.431	8,964	0.497	0.994	0.134
1979	0.237	1.646	8,621	0.478	0.956	0.129
1980	0.264	1.833	8,050	0.446	0.893	0.120
1981	0.219	1.521	7,421	0.412	0.823	0.111
1982	0.257	1.785	7,271	0.403	0.806	0.108
1983	0.224	1.556	6,930	0.384	0.768	0.103
1984	0.138	0.958	6,840	0.379	0.759	0.102
1985	0.233	1.618	7,572	0.420	0.840	0.113
1986	0.284	1.972	7,536	0.418	0.836	0.112
1987	0.203	1.410	6,885	0.382	0.764	0.103
1988	0.173	1.201	6,857	0.380	0.760	0.102
1989	0.216	1.500	6,979	0.387	0.774	0.104

Table 27 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for the SRFS Run (F_{SPR30} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR30} = 0.144, SSB_{FSPR30} = 18,035 mt, and MSST = 9,017 mt which was calculated as 0.5*SSB_{FSPR30}. Red indicates overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1990	0.182	1.264	6,502	0.361	0.721	0.097
1991	0.212	1.472	6,068	0.336	0.673	0.091
1992	0.229	1.590	5,702	0.316	0.632	0.085
1993	0.281	1.952	5,893	0.327	0.654	0.088
1994	0.243	1.688	5,706	0.316	0.633	0.085
1995	0.355	2.465	5,483	0.304	0.608	0.082
1996	0.237	1.646	5,085	0.282	0.564	0.076
1997	0.241	1.674	6,214	0.345	0.689	0.093
1998	0.407	2.827	7,462	0.414	0.828	0.111
1999	0.330	2.292	6,926	0.384	0.768	0.103
2000	0.255	1.771	7,521	0.417	0.834	0.112
2001	0.307	2.132	8,482	0.470	0.941	0.127
2002	0.306	2.125	8,069	0.447	0.895	0.120
2003	0.302	2.097	8,067	0.447	0.895	0.120
2004	0.390	2.709	8,549	0.474	0.948	0.128
2005	0.96 (0.327)*	6.667 (2.271)*	7,869	0.436	0.873	0.117
2006	0.395	2.743	3,264	0.181	0.362	0.049
2007	0.408	2.834	3,079	0.171	0.342	0.046
2008	0.628	4.361	2,866	0.159	0.318	0.043
2009	0.440	3.056	2,213	0.123	0.245	0.033
2010	0.369	2.563	2,634	0.146	0.292	0.039
2011	0.221	1.535	3,290	0.182	0.365	0.049
2012	0.201	1.396	4,114	0.228	0.456	0.061
2013	0.208	1.445	4,561	0.253	0.506	0.068
2014	0.937 (0.15)*	6.507 (1.042)*	4,901	0.272	0.544	0.073
2015	0.254	1.764	1,958	0.109	0.217	0.029
2016	0.343	2.382	1,834	0.102	0.203	0.027

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 27 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for the SRFS Run (F_{SPR30} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR30} = 0.144, SSB_{FSPR30} = 18,035 mt, and MSST = 9,017 mt which was calculated as 0.5*SSB_{FSPR30}. Red indicates overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
2017	0.342	2.375	1,694	0.094	0.188	0.025
2018	0.446 (0.344)*	3.097 (2.389)*	1,726	0.096	0.191	0.026
2019	0.375	2.604	1,709	0.095	0.190	0.025

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 28. Time series of fishing mortality and SSB relative to associated biological reference points for SEDAR 72 (F_{SPR30} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR30} = 0.148, SSB_{FSPR30} = 27,139 mt, and MSST = 13,569 mt which was calculated as 0.5*SSB_{FSPR30}. Red indicates where overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1963	0.076	0.513	30,564	1.126	2.252	0.303
1964	0.086	0.580	30,904	1.139	2.277	0.306
1965	0.094	0.634	30,927	1.140	2.279	0.307
1966	0.098	0.661	30,545	1.125	2.251	0.303
1967	0.100	0.675	29,420	1.084	2.168	0.292
1968	0.109	0.736	27,710	1.021	2.042	0.275
1969	0.120	0.810	25,718	0.948	1.895	0.255
1970	0.128	0.864	23,548	0.868	1.735	0.233
1971	0.145	0.979	21,432	0.790	1.579	0.212
1972	0.166	1.120	19,257	0.710	1.419	0.191
1973	0.177	1.194	17,043	0.628	1.256	0.169
1974	0.199	1.343	15,124	0.557	1.115	0.150
1975	0.227	1.532	13,345	0.492	0.983	0.132
1976	0.230	1.552	11,762	0.433	0.867	0.117
1977	0.233	1.572	10,791	0.398	0.795	0.107
1978	0.240	1.620	10,290	0.379	0.758	0.102
1979	0.263	1.775	9,967	0.367	0.735	0.099
1980	0.289	1.950	9,446	0.348	0.696	0.094
1981	0.222	1.498	8,892	0.328	0.655	0.088
1982	0.319	2.153	9,145	0.337	0.674	0.091
1983	0.263	1.775	8,645	0.319	0.637	0.086
1984	0.169	1.140	8,584	0.316	0.633	0.085
1985	0.268	1.809	9,595	0.354	0.707	0.095
1986	0.291	1.964	9,566	0.352	0.705	0.095
1987	0.242	1.633	9,029	0.333	0.665	0.089
1988	0.220	1.485	8,985	0.331	0.662	0.089
1989	0.235	1.586	8,971	0.331	0.661	0.089

Table 28 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for SEDAR 72 (F_{SPR30} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR30} = 0.148, SSB_{FSPR30} = 27,139 mt, and MSST = 13,569 mt which was calculated as 0.5*SSB_{FSPR30}. Red indicates where overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1990	0.215	1.451	8,402	0.310	0.619	0.083
1991	0.261	1.761	7,716	0.284	0.569	0.076
1992	0.244	1.647	7,080	0.261	0.522	0.070
1993	0.297	2.004	7,508	0.277	0.553	0.074
1994	0.270	1.822	7,384	0.272	0.544	0.073
1995	0.417	2.814	7,110	0.262	0.524	0.070
1996	0.225	1.518	6,470	0.238	0.477	0.064
1997	0.272	1.836	8,477	0.312	0.625	0.084
1998	0.481	3.246	10,257	0.378	0.756	0.102
1999	0.367	2.477	9,069	0.334	0.668	0.090
2000	0.260	1.755	9,854	0.363	0.726	0.098
2001	0.338	2.281	11,433	0.421	0.843	0.113
2002	0.327	2.207	10,784	0.397	0.795	0.107
2003	0.352	2.375	10,955	0.404	0.807	0.109
2004	0.454	3.064	11,381	0.419	0.839	0.113
2005	0.934 (0.355)*	6.303 (2.396)*	9,997	0.368	0.737	0.099
2006	0.400	2.699	4,851	0.179	0.358	0.048
2007	0.416	2.807	4,774	0.176	0.352	0.047
2008	0.692	4.670	4,592	0.169	0.338	0.046
2009	0.524	3.536	3,363	0.124	0.248	0.033
2010	0.461	3.111	3,768	0.139	0.278	0.037
2011	0.300	2.025	4,341	0.160	0.320	0.043
2012	0.286	1.930	5,141	0.189	0.379	0.051
2013	0.447	3.017	5,307	0.196	0.391	0.053
2014	0.607 (0.32)*	4.096 (2.16)*	4,209	0.155	0.310	0.042
2015	0.292	1.971	2,781	0.102	0.205	0.028
2016	0.351	2.369	2,571	0.095	0.189	0.025

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 28 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for SEDAR 72 (F_{SPR30} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR30} = 0.148, SSB_{FSPR30} = 27,139 mt, and MSST = 13,569 mt which was calculated as 0.5*SSB_{FSPR30}. Red indicates where overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
2017	0.396	2.672	2,462	0.091	0.181	0.024
2018	0.495 (0.435)*	3.34 (2.936)*	2,426	0.089	0.179	0.024
2019	0.417	2.814	2,304	0.085	0.170	0.023

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 29. Time series of fishing mortality and SSB relative to associated biological reference points for the SRFS Run (F_{SPR40} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR40} = 0.144, SSB_{FSPR40} = 18,035 mt, and MSST = 9,017 mt which was calculated as 0.5*SSB_{FSPR40}. Red indicates overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1963	0.064	0.651	27,795	1.110	2.220	0.415
1964	0.074	0.753	27,622	1.103	2.206	0.412
1965	0.081	0.824	27,156	1.085	2.169	0.405
1966	0.083	0.845	26,394	1.054	2.108	0.394
1967	0.082	0.835	25,227	1.008	2.015	0.376
1968	0.089	0.906	23,762	0.949	1.898	0.354
1969	0.100	1.018	22,110	0.883	1.766	0.330
1970	0.107	1.089	20,310	0.811	1.622	0.303
1971	0.121	1.232	18,557	0.741	1.482	0.277
1972	0.140	1.425	16,769	0.670	1.339	0.250
1973	0.145	1.476	14,937	0.597	1.193	0.223
1974	0.166	1.690	13,362	0.534	1.067	0.199
1975	0.195	1.985	11,849	0.473	0.946	0.177
1976	0.196	1.995	10,421	0.416	0.832	0.155
1977	0.198	2.015	9,490	0.379	0.758	0.142
1978	0.204	2.076	8,965	0.358	0.716	0.134
1979	0.235	2.392	8,621	0.344	0.689	0.129
1980	0.261	2.657	8,050	0.322	0.643	0.120
1981	0.218	2.219	7,421	0.296	0.593	0.111
1982	0.255	2.595	7,271	0.290	0.581	0.108
1983	0.222	2.260	6,930	0.277	0.554	0.103
1984	0.137	1.394	6,840	0.273	0.546	0.102
1985	0.231	2.351	7,573	0.302	0.605	0.113
1986	0.282	2.870	7,536	0.301	0.602	0.112
1987	0.202	2.056	6,885	0.275	0.550	0.103
1988	0.172	1.751	6,857	0.274	0.548	0.102
1989	0.214	2.178	6,980	0.279	0.558	0.104

Table 29 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for the SRFS Run (F_{SPR40} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR40} = 0.144, SSB_{FSPR40} = 18,035 mt, and MSST = 9,017 mt which was calculated as 0.5*SSB_{FSPR40}. Red indicates overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1990	0.180	1.832	6,502	0.260	0.519	0.097
1991	0.209	2.127	6,068	0.242	0.485	0.091
1992	0.227	2.310	5,702	0.228	0.455	0.085
1993	0.279	2.840	5,893	0.235	0.471	0.088
1994	0.241	2.453	5,706	0.228	0.456	0.085
1995	0.352	3.583	5,483	0.219	0.438	0.082
1996	0.235	2.392	5,085	0.203	0.406	0.076
1997	0.240	2.443	6,214	0.248	0.496	0.093
1998	0.404	4.112	7,462	0.298	0.596	0.111
1999	0.329	3.349	6,927	0.277	0.553	0.103
2000	0.254	2.585	7,521	0.300	0.601	0.112
2001	0.305	3.104	8,482	0.339	0.678	0.127
2002	0.304	3.094	8,069	0.322	0.645	0.120
2003	0.301	3.064	8,067	0.322	0.644	0.120
2004	0.388	3.949	8,550	0.341	0.683	0.128
2005	0.955 (0.322)*	9.72 (3.277)*	7,869	0.314	0.629	0.117
2006	0.393	4.000	3,264	0.130	0.261	0.049
2007	0.406	4.132	3,079	0.123	0.246	0.046
2008	0.625	6.361	2,866	0.114	0.229	0.043
2009	0.438	4.458	2,213	0.088	0.177	0.033
2010	0.368	3.746	2,634	0.105	0.210	0.039
2011	0.221	2.249	3,290	0.131	0.263	0.049
2012	0.201	2.046	4,115	0.164	0.329	0.061
2013	0.207	2.107	4,562	0.182	0.364	0.068
2014	0.931 (0.143)*	9.476 (1.455)*	4,902	0.196	0.392	0.073
2015	0.252	2.565	1,959	0.078	0.156	0.029
2016	0.341	3.471	1,834	0.073	0.147	0.027

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 29 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for the SRFS Run (F_{SPR40} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR40} = 0.144, SSB_{FSPR40} = 18,035 mt, and MSST = 9,017 mt which was calculated as 0.5*SSB_{FSPR40}. Red indicates overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
2017	0.340	3.461	1,695	0.068	0.135	0.025
2018	0.446 (0.342)*	4.539 (3.481)*	1,727	0.069	0.138	0.026
2019	0.374	3.807	1,706	0.068	0.136	0.025

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 30. Time series of fishing mortality and SSB relative to associated biological reference points for SEDAR 72 (F_{SPR40} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR40} = 0.148, SSB_{FSPR40} = 27,139 mt, and MSST = 13,569 mt which was calculated as 0.5*SSB_{FSPR40}. Red indicates where overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1963	0.075	0.741	30,564	0.811	1.622	0.303
1964	0.085	0.840	30,904	0.820	1.641	0.306
1965	0.093	0.919	30,927	0.821	1.642	0.307
1966	0.097	0.959	30,545	0.811	1.621	0.303
1967	0.099	0.979	29,420	0.781	1.562	0.292
1968	0.107	1.058	27,710	0.735	1.471	0.275
1969	0.119	1.176	25,718	0.683	1.365	0.255
1970	0.126	1.246	23,548	0.625	1.250	0.233
1971	0.143	1.414	21,432	0.569	1.138	0.212
1972	0.164	1.621	19,257	0.511	1.022	0.191
1973	0.174	1.720	17,043	0.452	0.905	0.169
1974	0.197	1.947	15,124	0.401	0.803	0.150
1975	0.224	2.214	13,345	0.354	0.708	0.132
1976	0.227	2.244	11,762	0.312	0.624	0.117
1977	0.231	2.283	10,791	0.286	0.573	0.107
1978	0.238	2.353	10,290	0.273	0.546	0.102
1979	0.261	2.580	9,967	0.265	0.529	0.099
1980	0.287	2.837	9,446	0.251	0.501	0.094
1981	0.220	2.175	8,892	0.236	0.472	0.088
1982	0.317	3.134	9,145	0.243	0.485	0.091
1983	0.261	2.580	8,645	0.229	0.459	0.086
1984	0.168	1.661	8,584	0.228	0.456	0.085
1985	0.266	2.629	9,595	0.255	0.509	0.095
1986	0.289	2.857	9,566	0.254	0.508	0.095
1987	0.240	2.372	9,029	0.240	0.479	0.089
1988	0.218	2.155	8,985	0.238	0.477	0.089
1989	0.233	2.303	8,971	0.238	0.476	0.089

Table 30 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for SEDAR 72 (F_{SPR40} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR40} = 0.148, SSB_{FSPR40} = 27,139 mt, and MSST = 13,569 mt which was calculated as 0.5*SSB_{FSPR40}. Red indicates where overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1990	0.213	2.106	8,402	0.223	0.446	0.083
1991	0.259	2.560	7,716	0.205	0.410	0.076
1992	0.242	2.392	7,080	0.188	0.376	0.070
1993	0.295	2.916	7,508	0.199	0.399	0.074
1994	0.268	2.649	7,384	0.196	0.392	0.073
1995	0.414	4.092	7,110	0.189	0.377	0.070
1996	0.223	2.204	6,470	0.172	0.343	0.064
1997	0.271	2.679	8,477	0.225	0.450	0.084
1998	0.479	4.735	10,257	0.272	0.545	0.102
1999	0.366	3.618	9,069	0.241	0.481	0.090
2000	0.259	2.560	9,854	0.262	0.523	0.098
2001	0.337	3.331	11,433	0.303	0.607	0.113
2002	0.325	3.213	10,784	0.286	0.573	0.107
2003	0.351	3.470	10,955	0.291	0.582	0.109
2004	0.452	4.468	11,381	0.302	0.604	0.113
2005	0.93 (0.351)*	9.193 (3.47)*	9,997	0.265	0.531	0.099
2006	0.398	3.934	4,851	0.129	0.258	0.048
2007	0.414	4.092	4,774	0.127	0.253	0.047
2008	0.690	6.821	4,592	0.122	0.244	0.046
2009	0.522	5.160	3,363	0.089	0.179	0.033
2010	0.460	4.547	3,768	0.100	0.200	0.037
2011	0.300	2.966	4,341	0.115	0.230	0.043
2012	0.285	2.817	5,141	0.136	0.273	0.051
2013	0.445	4.399	5,307	0.141	0.282	0.053
2014	0.603 (0.316)*	5.961 (3.124)*	4,209	0.112	0.223	0.042
2015	0.290	2.867	2,781	0.074	0.148	0.028
2016	0.348	3.440	2,571	0.068	0.136	0.025

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 30 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for SEDAR 72 (F_{SPR40} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{SPR40} = 0.148, SSB_{FSPR40} = 27,139 mt, and MSST = 13,569 mt which was calculated as 0.5*SSB_{FSPR40}. Red indicates where overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
2017	0.394	3.895	2,462	0.065	0.131	0.024
2018	0.493 (0.433)*	4.873 (4.28)*	2,426	0.064	0.129	0.024
2019	0.415	4.102	2,304	0.061	0.122	0.023

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 31. Time series of fishing mortality and SSB relative to associated biological reference points for the SRFS Run (F_{MAX} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{MAX} = 0.327, SSB_{FMAX} = 6,062 mt, and MSST = 3,031 mt which was calculated as 0.5*SSB_{FMAX}. Red indicates overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1963	0.064	0.196	27,795	4.585	9.170	0.415
1964	0.074	0.226	27,622	4.556	9.113	0.412
1965	0.081	0.248	27,156	4.480	8.959	0.405
1966	0.083	0.254	26,394	4.354	8.708	0.394
1967	0.082	0.251	25,227	4.161	8.323	0.376
1968	0.089	0.272	23,762	3.920	7.839	0.354
1969	0.100	0.306	22,110	3.647	7.294	0.330
1970	0.107	0.327	20,310	3.350	6.700	0.303
1971	0.121	0.370	18,557	3.061	6.122	0.277
1972	0.140	0.428	16,769	2.766	5.532	0.250
1973	0.145	0.444	14,937	2.464	4.928	0.223
1974	0.166	0.508	13,362	2.204	4.408	0.199
1975	0.195	0.597	11,849	1.955	3.909	0.177
1976	0.196	0.600	10,421	1.719	3.438	0.155
1977	0.198	0.606	9,490	1.565	3.131	0.142
1978	0.204	0.624	8,965	1.479	2.958	0.134
1979	0.235	0.719	8,621	1.422	2.844	0.129
1980	0.261	0.799	8,050	1.328	2.656	0.120
1981	0.218	0.667	7,421	1.224	2.449	0.111
1982	0.255	0.780	7,271	1.199	2.399	0.108
1983	0.222	0.679	6,930	1.143	2.286	0.103
1984	0.137	0.419	6,840	1.128	2.257	0.102
1985	0.231	0.707	7,573	1.249	2.498	0.113
1986	0.282	0.863	7,536	1.243	2.486	0.112
1987	0.202	0.618	6,885	1.136	2.272	0.103
1988	0.172	0.526	6,857	1.131	2.262	0.102
1989	0.214	0.655	6,980	1.151	2.303	0.104

Table 31 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for the SRFS Run (F_{MAX} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{MAX} = 0.327, SSB_{FMAX} = 6,062 mt, and MSST = 3,031 mt which was calculated as 0.5*SSB_{FMAX}. Red indicates overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1990	0.180	0.551	6,502	1.073	2.145	0.097
1991	0.209	0.640	6,068	1.001	2.002	0.091
1992	0.227	0.695	5,702	0.941	1.881	0.085
1993	0.279	0.854	5,893	0.972	1.944	0.088
1994	0.241	0.737	5,706	0.941	1.883	0.085
1995	0.352	1.077	5,483	0.905	1.809	0.082
1996	0.235	0.719	5,085	0.839	1.678	0.076
1997	0.240	0.734	6,214	1.025	2.050	0.093
1998	0.404	1.236	7,462	1.231	2.462	0.111
1999	0.329	1.007	6,927	1.143	2.285	0.103
2000	0.254	0.777	7,521	1.241	2.481	0.112
2001	0.305	0.933	8,482	1.399	2.798	0.127
2002	0.304	0.930	8,069	1.331	2.662	0.120
2003	0.301	0.921	8,067	1.331	2.662	0.120
2004	0.388	1.187	8,550	1.410	2.821	0.128
2005	0.955 (0.322)*	2.922 (0.985)*	7,869	1.298	2.596	0.117
2006	0.393	1.203	3,264	0.538	1.077	0.049
2007	0.406	1.242	3,079	0.508	1.016	0.046
2008	0.625	1.913	2,866	0.473	0.946	0.043
2009	0.438	1.340	2,213	0.365	0.730	0.033
2010	0.368	1.126	2,634	0.435	0.869	0.039
2011	0.221	0.676	3,290	0.543	1.086	0.049
2012	0.201	0.615	4,115	0.679	1.358	0.061
2013	0.207	0.633	4,562	0.753	1.505	0.068
2014	0.931 (0.143)*	2.849 (0.438)*	4,902	0.809	1.617	0.073
2015	0.252	0.771	1,959	0.323	0.646	0.029
2016	0.341	1.043	1,834	0.303	0.605	0.027

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 31 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for the SRFS Run (F_{MAX} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{MAX} = 0.327, SSB_{FMAX} = 6,062 mt, and MSST = 3,031 mt which was calculated as 0.5*SSB_{FMAX}. Red indicates overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
2017	0.340	1.040	1,695	0.280	0.559	0.025
2018	0.446 (0.342)*	1.365 (1.047)*	1,727	0.285	0.570	0.026
2019	0.374	1.144	1,706	0.281	0.563	0.025

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 32. Time series of fishing mortality and SSB relative to associated biological reference points for SEDAR 72 (F_{MAX} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{MAX} = 0.322, SSB_{FMAX} = 9,752 mt, and MSST = 4,876 mt which was calculated as 0.5*SSB_{FMAX}. Red indicates where overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1963	0.075	0.233	30,564	3.134	6.268	0.303
1964	0.085	0.264	30,904	3.169	6.338	0.306
1965	0.093	0.289	30,927	3.171	6.342	0.307
1966	0.097	0.301	30,545	3.132	6.264	0.303
1967	0.099	0.307	29,420	3.017	6.033	0.292
1968	0.107	0.332	27,710	2.841	5.683	0.275
1969	0.119	0.369	25,718	2.637	5.274	0.255
1970	0.126	0.391	23,548	2.415	4.829	0.233
1971	0.143	0.444	21,432	2.198	4.395	0.212
1972	0.164	0.509	19,257	1.975	3.949	0.191
1973	0.174	0.540	17,043	1.748	3.495	0.169
1974	0.197	0.611	15,124	1.551	3.101	0.150
1975	0.224	0.695	13,345	1.368	2.737	0.132
1976	0.227	0.705	11,762	1.206	2.412	0.117
1977	0.231	0.717	10,791	1.107	2.213	0.107
1978	0.238	0.739	10,290	1.055	2.110	0.102
1979	0.261	0.810	9,967	1.022	2.044	0.099
1980	0.287	0.891	9,446	0.969	1.937	0.094
1981	0.220	0.683	8,892	0.912	1.824	0.088
1982	0.317	0.984	9,145	0.938	1.875	0.091
1983	0.261	0.810	8,645	0.887	1.773	0.086
1984	0.168	0.521	8,584	0.880	1.760	0.085
1985	0.266	0.826	9,595	0.984	1.968	0.095
1986	0.289	0.897	9,566	0.981	1.962	0.095
1987	0.240	0.745	9,029	0.926	1.852	0.089
1988	0.218	0.677	8,985	0.921	1.843	0.089
1989	0.233	0.723	8,971	0.920	1.840	0.089

Table 32 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for SEDAR 72 (F_{MAX} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{MAX} = 0.322, SSB_{FMAX} = 9,752 mt, and MSST = 4,876 mt which was calculated as 0.5*SSB_{FMAX}. Red indicates where overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
1990	0.213	0.661	8,402	0.862	1.723	0.083
1991	0.259	0.804	7,716	0.791	1.582	0.076
1992	0.242	0.751	7,080	0.726	1.452	0.070
1993	0.295	0.916	7,508	0.770	1.540	0.074
1994	0.268	0.832	7,384	0.757	1.514	0.073
1995	0.414	1.285	7,110	0.729	1.458	0.070
1996	0.223	0.692	6,470	0.663	1.327	0.064
1997	0.271	0.841	8,477	0.869	1.738	0.084
1998	0.479	1.487	10,257	1.052	2.104	0.102
1999	0.366	1.136	9,069	0.930	1.860	0.090
2000	0.259	0.804	9,854	1.010	2.021	0.098
2001	0.337	1.046	11,433	1.172	2.345	0.113
2002	0.325	1.009	10,784	1.106	2.212	0.107
2003	0.351	1.089	10,955	1.123	2.247	0.109
2004	0.452	1.403	11,381	1.167	2.334	0.113
2005	0.93 (0.351)*	2.886 (1.089)*	9,997	1.025	2.050	0.099
2006	0.398	1.235	4,851	0.497	0.995	0.048
2007	0.414	1.285	4,774	0.490	0.979	0.047
2008	0.690	2.141	4,592	0.471	0.942	0.046
2009	0.522	1.620	3,363	0.345	0.690	0.033
2010	0.460	1.428	3,768	0.386	0.773	0.037
2011	0.300	0.931	4,341	0.445	0.890	0.043
2012	0.285	0.885	5,141	0.527	1.054	0.051
2013	0.445	1.381	5,307	0.544	1.088	0.053
2014	0.603 (0.316)*	1.871 (0.981)*	4,209	0.432	0.863	0.042
2015	0.290	0.900	2,781	0.285	0.570	0.028
2016	0.348	1.080	2,571	0.264	0.527	0.025

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 32 Continued. Time series of fishing mortality and SSB relative to associated biological reference points for SEDAR 72 (F_{MAX} scenario). SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total biomass age 3+). Reference points include F_{MAX} = 0.322, SSB_{FMAX} = 9,752 mt, and MSST = 4,876 mt which was calculated as 0.5*SSB_{FMAX}. Red indicates where overfishing and/or overfished states.

Year	F	F/FMSYproxy	SSB	SSB/ SSBFMSY proxy	SSB/MSST	SSB/SSB0
2017	0.394	1.223	2,462	0.253	0.505	0.024
2018	0.493 (0.433)*	1.53 (1.344)*	2,426	0.249	0.498	0.024
2019	0.415	1.288	2,304	0.236	0.473	0.023

*The number in parenthesis represents the total exploitation rate excluding red tide mortality.

Table 33. Results of the OFL projections (fishing set at F_{SPR30}) for the Gulf of Mexico Gag Grouper SRFS Run. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and OFL is the overfishing limit in millions of pounds gutted weight. Reference points include F_{SPR30} = 0.144, SSB_{FSPR30} = 18,035 metric tons, and MSST = 9,017 metric tons which was calculated as 0.5*SSB_{FSPR30}.

Year	R	F	F/FMSYproxy	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	OFL
2023	2,843	0.144	1	1,307	0.072	0.145	0.020	0.614
2024	3,655	0.144	1	1,923	0.107	0.213	0.029	0.891
2025	4,452	0.144	1	2,728	0.151	0.303	0.041	1.170
2026	5,048	0.144	1	3,527	0.196	0.391	0.053	1.395
2027	5,468	0.144	1	4,240	0.235	0.470	0.063	1.651

Table 34. Results of the OFL projections (fishing set at F_{SPR30}) for Gulf of Mexico Gag Grouper SEDAR 72. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and OFL is the overfishing limit in millions of pounds gutted weight. Reference points include F_{SPR30} = 0.148, SSB_{FSPR30} = 27,139 metric tons, and MSST = 13,569 metric tons which was calculated as 0.5*SSB_{FSPR30}.

Year	R	F	F/FMSYproxy	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	OFL
2023	3,238	0.148	1	1,314	0.048	0.097	0.013	0.707
2024	4,610	0.148	1	2,138	0.079	0.158	0.021	1.098
2025	5,974	0.148	1	3,226	0.119	0.238	0.032	1.478
2026	6,956	0.148	1	4,263	0.157	0.314	0.042	1.744
2027	7,608	0.148	1	5,121	0.189	0.377	0.051	2.073

Table 35. Results of the OFL projections (fishing set at F_{SPR40}) for the Gulf of Mexico Gag Grouper SRFS Run. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and OFL is the overfishing limit in millions of pounds gutted weight. Reference points include F_{SPR40} = 0.144, SSB_{FSPR40} = 18,035 metric tons, and MSST = 9,017 metric tons which was calculated as 0.5*SSB_{FSPR40}.

Year	R	F	F/FMSYproxy	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	OFL
2023	2,833	0.098	1	1,301	0.052	0.104	0.019	0.419
2024	3,740	0.098	1	1,998	0.080	0.160	0.030	0.627
2025	4,613	0.098	1	2,924	0.117	0.234	0.044	0.844
2026	5,268	0.098	1	3,882	0.155	0.310	0.058	1.031
2027	5,735	0.098	1	4,779	0.191	0.382	0.071	1.249

Table 36. Results of the OFL projections (fishing set at F_{SPR40}) for Gulf of Mexico Gag Grouper SEDAR 72. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and OFL is the overfishing limit in millions of pounds gutted weight. Reference points include F_{SPR40} = 0.148, SSB_{FSPR40} = 27,139 metric tons, and MSST = 13,569 metric tons which was calculated as 0.5*SSB_{FSPR40}.

Year	R	F	F/FMSYproxy	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	OFL
2023	3,238	0.101	1	1,314	0.035	0.070	0.013	0.484
2024	4,740	0.101	1	2,228	0.059	0.118	0.022	0.774
2025	6,222	0.101	1	3,464	0.092	0.184	0.034	1.068
2026	7,304	0.101	1	4,700	0.125	0.250	0.047	1.292
2027	8,039	0.101	1	5,786	0.154	0.307	0.057	1.574

Table 37. Results of the OFL projections (fishing set at F_{MAX}) for Gulf of Mexico Gag Grouper SRFS Run. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and OFL is the overfishing limit in millions of pounds gutted weight. Reference points include F_{MAX} = 0.327, SSB_{FMAX} = 6,062 metric tons, and MSST = 3,031 metric tons which was calculated as 0.5*SSB_{FMAX}.

Year	R	F	F/FMSYproxy	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	OFL
2023	2,833	0.327	1	1,301	0.215	0.429	0.019	1.375
2024	3,256	0.327	1	1,600	0.264	0.528	0.024	1.747
2025	3,741	0.327	1	1,998	0.330	0.659	0.030	2.072
2026	4,086	0.327	1	2,328	0.384	0.768	0.035	2.256
2027	4,300	0.327	1	2,554	0.421	0.843	0.038	2.440

Table 38. Results of the OFL projections (fishing set at F_{MAX}) for Gulf of Mexico Gag Grouper SEDAR 72. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and OFL is the overfishing limit in millions of pounds gutted weight. Reference points include F_{MAX} = 0.322, SSB_{FMAX} = 9,752 metric tons, and MSST = 4,876 metric tons which was calculated as 0.5*SSB_{FMAX}.

Year	R	F	F/FMSYproxy	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	OFL
2023	3,238	0.322	1	1,314	0.135	0.269	0.013	1.519
2024	4,113	0.322	1	1,813	0.186	0.372	0.018	2.102
2025	5,033	0.322	1	2,440	0.250	0.500	0.024	2.581
2026	5,632	0.322	1	2,921	0.300	0.599	0.029	2.780
2027	5,956	0.322	1	3,209	0.329	0.658	0.032	3.027

Table 39. Results of projections at F = 0 for the Gulf of Mexico Gag Grouper SRFS Run (F_{SPR30} scenario). Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. Reference points include SSB_{FSPR30} = 18,035 metric tons and $MSST_{FSPR30}$ = 9,017 metric tons (0.5 * SSB_{FSPR30}). SSB ratio was calculated as annual SSB divided by SSB_0 (67,045 metric tons).

Year	R	F	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	Yield
2023	2,842	0	1,307	0.072	0.145	0.020	0
2024	3,655	0	2,182	0.121	0.242	0.033	0
2025	4,452	0	3,404	0.189	0.378	0.051	0
2026	5,047	0	4,778	0.265	0.530	0.071	0
2027	5,468	0	6,197	0.344	0.687	0.092	0
2028	5,821	0	7,813	0.433	0.866	0.117	0
2029	6,169	0	9,816	0.544	1.089	0.146	0
2030	6,489	0	12,178	0.675	1.351	0.182	0
2031	6,760	0	14,805	0.821	1.642	0.221	0
2032	6,982	0	17,611	0.976	1.953	0.263	0
2033	7,163	0	20,532	1.138	2.277	0.306	0

Table 40. Results of projections at F = 0 for Gulf of Mexico Gag Grouper SEDAR 72 (F_{SPR30} scenario). Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. Reference points include SSB_{FSPR30} = 27,139 metric tons and $MSST_{FSPR30}$ = 13,569 metric tons (0.5 * SSB_{FSPR30}). SSB ratio was calculated as annual SSB divided by SSB_0 (100,891 metric tons).

Year	R	F	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	Yield
2023	3,238	0	1,314	0.048	0.097	0.013	0
2024	4,610	0	2,425	0.089	0.179	0.024	0
2025	5,973	0	4,014	0.148	0.296	0.040	0
2026	6,956	0	5,760	0.212	0.425	0.057	0
2027	7,608	0	7,479	0.276	0.551	0.074	0
2028	8,168	0	9,454	0.348	0.697	0.094	0
2029	8,783	0	12,057	0.444	0.889	0.120	0
2030	9,378	0	15,268	0.563	1.125	0.151	0
2031	9,888	0	18,934	0.698	1.395	0.188	0
2032	10,305	0	22,923	0.845	1.689	0.227	0
2033	10,646	0	27,151	1.000	2.001	0.269	0

Table 41. Results of projections at F = 0 for the Gulf of Mexico Gag Grouper SRFS Run (F_{SPR40} scenario). Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. Reference points include SSB_{FSPR40} = 18,035 metric tons and $MSST_{FSPR40}$ = 9,017 metric tons (0.5 * SSB_{FSPR40}). SSB ratio was calculated as annual SSB divided by SSB_0 (67,045 metric tons).

Year	R	F	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	Yield
2023	2,833	0	1,301	0.052	0.104	0.019	0
2024	3,739	0	2,174	0.087	0.174	0.032	0
2025	4,613	0	3,393	0.136	0.271	0.051	0
2026	5,268	0	4,765	0.190	0.381	0.071	0
2027	5,735	0	6,180	0.247	0.494	0.092	0
2028	6,125	0	7,792	0.311	0.622	0.116	0
2029	6,497	0	9,792	0.391	0.782	0.146	0
2030	6,829	0	12,152	0.485	0.971	0.181	0
2031	7,106	0	14,777	0.590	1.180	0.220	0
2032	7,330	0	17,581	0.702	1.404	0.262	0
2033	7,511	0	20,502	0.819	1.638	0.306	0
2034	7,657	0	23,486	0.938	1.876	0.350	0
2035	7,777	0	26,484	1.058	2.115	0.395	0

Table 42. Results of projections at F = 0 for Gulf of Mexico Gag Grouper SEDAR 72 (F_{SPR40} scenario). Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. Reference points include SSB_{FSPR40} = 27,139 metric tons and $MSST_{FSPR40}$ = 13,569 metric tons (0.5 * SSB_{FSPR40}). SSB ratio was calculated as annual SSB divided by SSB_0 (100,891 metric tons).

Year	R	F	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	Yield
2023	3,238	0	1,314	0.035	0.070	0.013	0
2024	4,740	0	2,425	0.064	0.129	0.024	0
2025	6,221	0	4,014	0.107	0.213	0.040	0
2026	7,303	0	5,760	0.153	0.306	0.057	0
2027	8,038	0	7,479	0.199	0.397	0.074	0
2028	8,669	0	9,454	0.251	0.502	0.094	0
2029	9,328	0	12,057	0.320	0.640	0.120	0
2030	9,944	0	15,268	0.405	0.811	0.151	0
2031	10,463	0	18,934	0.503	1.005	0.188	0
2032	10,882	0	22,923	0.608	1.217	0.227	0
2033	11,220	0	27,151	0.721	1.441	0.269	0
2034	11,496	0	31,547	0.837	1.675	0.313	0
2035	11,721	0	36,031	0.956	1.913	0.357	0
2036	11,905	0	40,523	1.076	2.151	0.402	0

Table 43. Results of projections at F = 0 for the Gulf of Mexico Gag Grouper SRFS Run (F_{MAX} scenario). Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. Reference points include SSB_{FMAX} = 6,062 metric tons and $MSST_{FMAX}$ = 3,031 metric tons (0.5 * SSB_{FMAX}). SSB ratio was calculated as annual SSB divided by SSB_0 (67,052 metric tons).

Year	R	F	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	Yield
2023	2,833	0	1,301	0.215	0.429	0.019	0
2024	3,256	0	2,174	0.359	0.717	0.032	0
2025	3,740	0	3,393	0.560	1.120	0.051	0
2026	4,086	0	4,765	0.786	1.572	0.071	0
2027	4,299	0	6,180	1.020	2.039	0.092	0

Table 44. Results of projections at F = 0 for Gulf of Mexico Gag Grouper SEDAR 72 (F_{MAX} scenario). Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. Reference points include SSB_{FMAX} = 9,752 metric tons and $MSST_{FMAX}$ = 4,876 metric tons (0.5 * SSB_{FMAX}). SSB ratio was calculated as annual SSB divided by SSB_0 (100,891 metric tons).

Year	R	F	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	Yield
2023	3,238	0	1,314	0.135	0.269	0.013	0
2024	4,112	0	2,425	0.249	0.497	0.024	0
2025	5,032	0	4,014	0.412	0.823	0.040	0
2026	5,632	0	5,760	0.591	1.181	0.057	0
2027	5,955	0	7,479	0.767	1.534	0.074	0
2028	6,219	0	9,454	0.969	1.939	0.094	0
2029	6,603	0	12,057	1.236	2.473	0.120	0

Table 45. Results for rebuilding projections using Tmin + 1 generation time for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	2,899	0.340	3.46	1,695	0.07	0.14	-	0.03
2018	1,517	0.446	4.54	1,727	0.07	0.14	-	0.03
2019	2,158	0.374	3.81	1,706	0.07	0.14	-	0.03
2020	3,553	0.331	3.37	1,836	0.07	0.15	1.88	0.03
2021	3,758	0.389	3.96	2,014	0.08	0.16	2.07	0.03
2022	3,139	0.482	4.91	1,513	0.06	0.12	1.91	0.02
2023	**2,833**	**0.081**	**0.83**	**1,301**	**0.05**	**0.10**	**0.35**	**0.02**
2024	3,773	0.081	0.83	2,028	0.08	0.16	0.53	0.03
2025	4,674	0.081	0.83	3,001	0.12	0.24	0.71	0.04
2026	5,350	0.081	0.83	4,023	0.16	0.32	0.88	0.06
2027	5,833	0.081	0.83	4,997	0.20	0.40	1.08	0.07
2028	6,235	0.081	0.83	6,045	0.24	0.48	1.31	0.09
2029	6,615	0.081	0.83	7,319	0.29	0.58	1.58	0.11
2030	6,950	0.081	0.83	8,787	0.35	0.70	1.88	0.13
2031	7,227	0.081	0.83	10,361	0.41	0.83	2.18	0.15
2032	7,450	0.081	0.83	11,972	0.48	0.96	2.48	0.18
2033	7,629	0.081	0.83	13,578	0.54	1.08	2.78	0.20
2034	7,774	0.081	0.83	15,152	0.61	1.21	3.08	0.23
2035	7,892	0.081	0.83	16,668	0.67	1.33	3.35	0.25
2036	7,987	0.081	0.83	18,101	0.72	1.45	3.61	0.27
2037	8,065	0.081	0.83	19,432	0.78	1.55	3.85	0.29

Table 45 Continued. Results for rebuilding projections using Tmin + 1 generation time for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2038	8,129	0.081	0.83	20,652	0.82	1.65	4.06	0.31
2039	8,181	0.081	0.83	21,754	0.87	1.74	4.26	0.32
2040	8,224	0.081	0.83	22,739	0.91	1.82	4.43	0.34
2041	8,259	0.081	0.83	23,610	0.94	1.89	4.58	0.35
2042	8,288	0.081	0.83	24,375	0.97	1.95	4.72	0.36
2043	8,312	0.081	0.83	25,040	1.00	2.00	4.83	0.37

Table 46. Results for rebuilding projections using Tmin * 2 for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	2,899	0.340	3.46	1,695	0.07	0.14	-	0.03
2018	1,517	0.446	4.54	1,727	0.07	0.14	-	0.03
2019	2,158	0.374	3.81	1,706	0.07	0.14	-	0.03
2020	3,553	0.331	3.37	1,836	0.07	0.15	1.88	0.03
2021	3,758	0.389	3.96	2,014	0.08	0.16	2.07	0.03
2022	3,139	0.482	4.91	1,513	0.06	0.12	1.91	0.02
2023	**2,833**	**0.091**	**0.93**	**1,301**	**0.05**	**0.10**	**0.39**	**0.02**
2024	3,754	0.091	0.93	2,010	0.08	0.16	0.58	0.03
2025	4,640	0.091	0.93	2,957	0.12	0.24	0.79	0.04
2026	5,304	0.091	0.93	3,942	0.16	0.31	0.97	0.06
2027	5,777	0.091	0.93	4,873	0.19	0.39	1.18	0.07
2028	6,173	0.091	0.93	5,866	0.23	0.47	1.43	0.09
2029	6,549	0.091	0.93	7,073	0.28	0.56	1.72	0.11
2030	6,882	0.091	0.93	8,459	0.34	0.68	2.03	0.13
2031	7,159	0.091	0.93	9,941	0.40	0.79	2.35	0.15
2032	7,383	0.091	0.93	11,448	0.46	0.91	2.67	0.17
2033	7,563	0.091	0.93	12,946	0.52	1.03	2.98	0.19
2034	7,709	0.091	0.93	14,408	0.58	1.15	3.28	0.21
2035	7,828	0.091	0.93	15,810	0.63	1.26	3.57	0.24
2036	7,924	0.091	0.93	17,131	0.68	1.37	3.84	0.26
2037	8,003	0.091	0.93	18,353	0.73	1.47	4.08	0.27

Table 46 Continued. Results for rebuilding projections using Tmin * 2 for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2038	8,067	0.091	0.93	19,466	0.78	1.55	4.31	0.29
2039	8,120	0.091	0.93	20,468	0.82	1.63	4.5	0.31
2040	8,163	0.091	0.93	21,360	0.85	1.71	4.68	0.32
2041	8,198	0.091	0.93	22,144	0.88	1.77	4.83	0.33
2042	8,227	0.091	0.93	22,829	0.91	1.82	4.96	0.34
2043	8,251	0.091	0.93	23,421	0.94	1.87	5.08	0.35
2044	8,271	0.091	0.93	23,929	0.96	1.91	5.18	0.36
2045	8,287	0.091	0.93	24,363	0.97	1.95	5.26	0.36
2046	8,301	0.091	0.93	24,730	0.99	1.98	5.33	0.37
2047	8,312	0.091	0.93	25,040	1.00	2.00	5.39	0.37

Table 47. Results for rebuilding projections using 75%F_{SPR40} for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	2,899	0.340	3.46	1,695	0.07	0.14	-	0.03
2018	1,517	0.446	4.54	1,727	0.07	0.14	-	0.03
2019	2,158	0.374	3.81	1,706	0.07	0.14	-	0.03
2020	3,553	0.331	3.37	1,836	0.07	0.15	1.88	0.03
2021	3,758	0.389	3.96	2,014	0.08	0.16	2.07	0.03
2022	3,139	0.482	4.91	1,513	0.06	0.12	1.91	0.02
2023	**2,833**	**0.074**	**0.75**	**1,301**	**0.05**	**0.10**	**0.31**	**0.02**
2024	3,788	0.074	0.75	2,041	0.08	0.16	0.48	0.03
2025	4,702	0.074	0.75	3,037	0.12	0.24	0.65	0.05
2026	5,387	0.074	0.75	4,089	0.16	0.33	0.81	0.06
2027	5,877	0.074	0.75	5,100	0.20	0.41	0.99	0.08
2028	6,285	0.074	0.75	6,194	0.25	0.49	1.21	0.09
2029	6,667	0.074	0.75	7,525	0.30	0.60	1.47	0.11
2030	7,003	0.074	0.75	9,062	0.36	0.72	1.75	0.14
2031	7,280	0.074	0.75	10,715	0.43	0.86	2.03	0.16
2032	7,503	0.074	0.75	12,413	0.50	0.99	2.32	0.19
2033	7,682	0.074	0.75	14,113	0.56	1.13	2.61	0.21
2034	7,826	0.074	0.75	15,785	0.63	1.26	2.89	0.24
2035	7,942	0.074	0.75	17,400	0.69	1.39	3.15	0.26
2036	8,037	0.074	0.75	18,932	0.76	1.51	3.4	0.28
2037	8,114	0.074	0.75	20,360	0.81	1.63	3.63	0.30

Table 47 Continued. Results for rebuilding projections using 75%F_{SPR40} for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2038	8,177	0.074	0.75	21,674	0.87	1.73	3.84	0.32
2039	8,229	0.074	0.75	22,865	0.91	1.83	4.03	0.34
2040	8,271	0.074	0.75	23,935	0.96	1.91	4.2	0.36
2041	8,306	0.074	0.75	24,886	0.99	1.99	4.35	0.37
2042	8,335	0.074	0.75	25,724	1.03	2.05	4.48	0.38

Table 48. Results for rebuilding projections using Tmin + 1 generation time for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.340	-	34:66	-	-	-	-	-	-	-	-	-	-
2018	0.446	-	34:66	-	-	-	-	-	-	-	-	-	-
2019	0.374	-	37:63	-	-	-	-	-	-	-	-	-	-
2020	0.331	-	43:57	-	-	-	-	-	-	-	-	-	-
2021	0.389	-	43:57	-	-	-	-	-	-	-	-	-	-
2022	0.482	-	40:60	-	-	-	-	-	-	-	-	-	-
2023	**0.081**	**39:61**	**52:48**	**0.14**	**-73**	**0.04**	**22**	**0.21**	**-81**	**-81**	**0.47**	**69**	**93**
2024	0.081	39:61	53:47	0.21	-59	0.05	20	0.32	-71	-71	0.51	61	90
2025	0.081	39:61	52:48	0.28	-45	0.06	18	0.44	-61	-62	0.55	56	89
2026	0.081	39:61	48:52	0.34	-32	0.07	16	0.54	-52	-55	0.64	54	89
2027	0.081	39:61	45:55	0.42	-17	0.08	16	0.66	-42	-47	0.81	55	89
2028	0.081	39:61	43:57	0.51	1	0.1	16	0.8	-29	-35	0.99	55	89
2029	0.081	39:61	42:58	0.62	22	0.12	16	0.97	-14	-22	1.14	54	88
2030	0.081	39:61	41:59	0.73	45	0.13	15	1.14	2	-7	1.26	52	87
2031	0.081	39:61	40:60	0.85	68	0.15	15	1.33	18	7	1.37	51	86
2032	0.081	39:61	39:61	0.97	92	0.17	15	1.52	35	20	1.48	49	85
2033	0.081	39:61	38:62	1.09	115	0.19	15	1.7	51	33	1.6	48	84
2034	0.081	39:61	36:64	1.2	137	0.2	15	1.88	67	46	1.71	48	84
2035	0.081	39:61	35:65	1.31	159	0.22	14	2.04	82	58	1.81	47	84
2036	0.081	39:61	34:66	1.41	178	0.23	14	2.2	96	69	1.91	46	83
2037	0.081	39:61	33:67	1.5	197	0.25	14	2.35	109	79	2	46	83

Table 48 Continued. Results for rebuilding projections using Tmin + 1 generation time for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2038	0.081	39:61	32:68	1.59	213	0.26	14	2.48	121	88	2.08	46	83
2039	0.081	39:61	31:69	1.66	228	0.27	14	2.6	131	96	2.15	45	83
2040	0.081	39:61	31:69	1.73	242	0.28	14	2.7	141	104	2.22	45	83
2041	0.081	39:61	30:70	1.79	253	0.29	14	2.8	149	110	2.29	45	82
2042	0.081	39:61	30:70	1.84	264	0.3	14	2.88	156	115	2.34	45	82
2043	0.081	39:61	29:71	1.88	273	0.3	14	2.95	162	120	2.39	45	82

Table 49. Results for rebuilding projections using Tmin * 2 for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.340	-	34:66	-	-	-	-	-	-	-	-	-	-
2018	0.446	-	34:66	-	-	-	-	-	-	-	-	-	-
2019	0.374	-	37:63	-	-	-	-	-	-	-	-	-	-
2020	0.331	-	43:57	-	-	-	-	-	-	-	-	-	-
2021	0.389	-	43:57	-	-	-	-	-	-	-	-	-	-
2022	0.482	-	40:60	-	-	-	-	-	-	-	-	-	-
2023	**0.091**	**39:61**	**52:48**	**0.15**	**-70**	**0.04**	**22**	**0.24**	**-79**	**-79**	**0.53**	**69**	**93**
2024	0.091	39:61	53:47	0.23	-55	0.06	20	0.36	-68	-68	0.57	62	90
2025	0.091	39:61	52:48	0.31	-39	0.07	18	0.48	-57	-58	0.61	56	89
2026	0.091	39:61	49:51	0.38	-25	0.07	16	0.59	-47	-51	0.71	54	89
2027	0.091	39:61	45:55	0.46	-9	0.09	16	0.72	-36	-42	0.89	55	89
2028	0.091	39:61	43:57	0.56	10	0.11	16	0.87	-22	-29	1.09	56	89
2029	0.091	39:61	42:58	0.67	32	0.13	16	1.05	-7	-15	1.25	54	88
2030	0.091	39:61	42:58	0.79	56	0.15	16	1.24	10	0	1.38	53	87
2031	0.091	39:61	41:59	0.92	81	0.16	15	1.43	28	15	1.5	51	86
2032	0.091	39:61	39:61	1.04	106	0.18	15	1.63	45	29	1.62	50	85
2033	0.091	39:61	38:62	1.16	130	0.2	15	1.82	62	43	1.74	49	85
2034	0.091	39:61	37:63	1.28	153	0.22	15	2	78	57	1.86	48	84
2035	0.091	39:61	36:64	1.39	175	0.24	14	2.18	94	69	1.97	47	84
2036	0.091	39:61	35:65	1.5	196	0.25	14	2.34	109	81	2.07	47	84
2037	0.091	39:61	34:66	1.59	215	0.26	14	2.49	122	91	2.17	47	83

Table 49 Continued. Results for rebuilding projections using Tmin * 2 for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2038	0.091	39:61	33:67	1.68	232	0.28	14	2.63	134	101	2.25	46	83
2039	0.091	39:61	32:68	1.76	247	0.29	14	2.75	145	109	2.33	46	83
2040	0.091	39:61	31:69	1.82	261	0.3	14	2.85	154	116	2.4	46	83
2041	0.091	39:61	31:69	1.88	273	0.31	14	2.95	162	123	2.47	46	83
2042	0.091	39:61	30:70	1.94	283	0.31	14	3.03	170	128	2.53	45	83
2043	0.091	39:61	30:70	1.98	292	0.32	14	3.1	176	133	2.58	45	83
2044	0.091	39:61	29:71	2.02	299	0.33	14	3.16	181	137	2.62	45	83
2045	0.091	39:61	29:71	2.05	306	0.33	14	3.21	186	141	2.66	45	83
2046	0.091	39:61	29:71	2.08	311	0.34	14	3.25	190	144	2.69	45	83
2047	0.091	39:61	29:71	2.1	316	0.34	14	3.29	193	146	2.72	45	83

Table 50. Results for rebuilding projections using 75%F_{SPR40} for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.340	-	34:66	-	-	-	-	-	-	-	-	-	-
2018	0.446	-	34:66	-	-	-	-	-	-	-	-	-	-
2019	0.374	-	37:63	-	-	-	-	-	-	-	-	-	-
2020	0.331	-	43:57	-	-	-	-	-	-	-	-	-	-
2021	0.389	-	43:57	-	-	-	-	-	-	-	-	-	-
2022	0.482	-	40:60	-	-	-	-	-	-	-	-	-	-
2023	**0.074**	**39:61**	**52:48**	**0.12**	**-76**	**0.03**	**22**	**0.19**	**-83**	**-83**	**0.42**	**69**	**93**
2024	0.074	39:61	53:47	0.19	-63	0.05	20	0.29	-74	-74	0.46	61	90
2025	0.074	39:61	51:49	0.25	-50	0.05	18	0.4	-65	-66	0.5	56	89
2026	0.074	39:61	48:52	0.32	-38	0.06	16	0.49	-56	-59	0.58	54	89
2027	0.074	39:61	45:55	0.39	-24	0.07	16	0.6	-46	-51	0.74	55	89
2028	0.074	39:61	43:57	0.47	-6	0.09	16	0.74	-34	-40	0.91	55	88
2029	0.074	39:61	42:58	0.57	13	0.11	16	0.9	-20	-27	1.04	54	88
2030	0.074	39:61	41:59	0.68	35	0.12	15	1.06	-5	-14	1.15	52	86
2031	0.074	39:61	40:60	0.79	57	0.14	15	1.24	10	-1	1.26	50	86
2032	0.074	39:61	39:61	0.91	79	0.16	15	1.42	26	12	1.37	49	85
2033	0.074	39:61	37:63	1.02	101	0.17	15	1.59	42	25	1.47	48	84
2034	0.074	39:61	36:64	1.13	123	0.19	14	1.76	57	37	1.58	47	84
2035	0.074	39:61	35:65	1.23	143	0.21	14	1.92	71	48	1.67	47	83
2036	0.074	39:61	34:66	1.33	162	0.22	14	2.08	85	59	1.76	46	83
2037	0.074	39:61	33:67	1.42	180	0.23	14	2.22	97	68	1.85	45	83

able 50 Continued. Results for rebuilding projections using 75%F_{SPR40} for Gulf of Mexico Gag Grouper SRFS Run F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2038	0.074	39:61	32:68	1.5	196	0.24	14	2.34	109	77	1.93	45	82
2039	0.074	39:61	31:69	1.57	211	0.26	14	2.46	119	85	2	45	82
2040	0.074	39:61	30:70	1.64	224	0.26	14	2.56	128	92	2.07	45	82
2041	0.074	39:61	29:71	1.7	236	0.27	14	2.65	136	98	2.13	45	82
2042	0.074	39:61	29:71	1.75	246	0.28	14	2.73	144	104	2.18	44	82

Table 51. Results for rebuilding projections using Tmin + 1 generation time for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,275	0.394	3.89	2,463	0.07	0.13	-	0.02
2018	2,216	0.493	4.87	2,427	0.06	0.13	-	0.02
2019	2,774	0.415	4.10	2,304	0.06	0.12	-	0.02
2020	5,056	0.427	4.22	2,458	0.07	0.13	3.34	0.02
2021	5,087	0.458	4.53	2,481	0.07	0.13	3.09	0.02
2022	4,148	0.660	6.53	1,835	0.05	0.10	3.14	0.02
2023	**3,238**	**0.083**	**0.83**	**1,314**	**0.03**	**0.07**	**0.4**	**0.01**
2024	4,789	0.083	0.83	2,262	0.06	0.12	0.65	0.02
2025	6,314	0.083	0.83	3,557	0.09	0.19	0.9	0.04
2026	7,433	0.083	0.83	4,874	0.13	0.26	1.1	0.05
2027	8,198	0.083	0.83	6,055	0.16	0.32	1.35	0.06
2028	8,853	0.083	0.83	7,335	0.19	0.39	1.68	0.07
2029	9,526	0.083	0.83	9,018	0.24	0.48	2.07	0.09
2030	10,147	0.083	0.83	11,061	0.29	0.59	2.5	0.11
2031	10,666	0.083	0.83	13,316	0.35	0.71	2.95	0.13
2032	11,084	0.083	0.83	15,666	0.42	0.83	3.42	0.16
2033	11,420	0.083	0.83	18,057	0.48	0.96	3.89	0.18
2034	11,692	0.083	0.83	20,454	0.54	1.09	4.36	0.20
2035	11,912	0.083	0.83	22,813	0.61	1.21	4.82	0.23
2036	12,092	0.083	0.83	25,087	0.67	1.33	5.25	0.25
2037	12,238	0.083	0.83	27,236	0.72	1.45	5.65	0.27

Table 51 Continued. Results for rebuilding projections using Tmin + 1 generation time for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2038	12,357	0.083	0.83	29,234	0.78	1.55	6.02	0.29
2039	12,454	0.083	0.83	31,064	0.82	1.65	6.36	0.31
2040	12,534	0.083	0.83	32,720	0.87	1.74	6.66	0.32
2041	12,599	0.083	0.83	34,203	0.91	1.82	6.93	0.34
2042	12,653	0.083	0.83	35,516	0.94	1.89	7.17	0.35
2043	12,698	0.083	0.83	36,670	0.97	1.95	7.38	0.36
2044	12,735	0.083	0.83	37,676	1.00	2.00	7.56	0.37

Table 52. Results for rebuilding projections using Tmin * 2 for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,275	0.394	3.89	2,463	0.07	0.13	-	0.02
2018	2,216	0.493	4.87	2,427	0.06	0.13	-	0.02
2019	2,774	0.415	4.10	2,304	0.06	0.12	-	0.02
2020	5,056	0.427	4.22	2,458	0.07	0.13	3.34	0.02
2021	5,087	0.458	4.53	2,481	0.07	0.13	3.09	0.02
2022	4,148	0.660	6.53	1,835	0.05	0.10	3.14	0.02
2023	**3,238**	**0.095**	**0.94**	**1,314**	**0.03**	**0.07**	**0.45**	**0.01**
2024	4,758	0.095	0.94	2,240	0.06	0.12	0.73	0.02
2025	6,255	0.095	0.94	3,497	0.09	0.19	1.01	0.03
2026	7,350	0.095	0.94	4,762	0.13	0.25	1.22	0.05
2027	8,096	0.095	0.94	5,881	0.16	0.31	1.5	0.06
2028	8,736	0.095	0.94	7,084	0.19	0.38	1.85	0.07
2029	9,400	0.095	0.94	8,667	0.23	0.46	2.27	0.09
2030	10,018	0.095	0.94	10,586	0.28	0.56	2.73	0.10
2031	10,537	0.095	0.94	12,694	0.34	0.67	3.22	0.13
2032	10,956	0.095	0.94	14,879	0.39	0.79	3.71	0.15
2033	11,293	0.095	0.94	17,091	0.45	0.91	4.21	0.17
2034	11,568	0.095	0.94	19,300	0.51	1.02	4.71	0.19
2035	11,791	0.095	0.94	21,467	0.57	1.14	5.18	0.21
2036	11,973	0.095	0.94	23,547	0.62	1.25	5.63	0.23
2037	12,122	0.095	0.94	25,505	0.68	1.35	6.05	0.25

Table 52 Continued. Results for rebuilding projections using Tmin * 2 for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2038	12,243	0.095	0.94	27,317	0.73	1.45	6.43	0.27
2039	12,342	0.095	0.94	28,970	0.77	1.54	6.78	0.29
2040	12,423	0.095	0.94	30,458	0.81	1.62	7.09	0.30
2041	12,489	0.095	0.94	31,782	0.84	1.69	7.37	0.32
2042	12,544	0.095	0.94	32,950	0.87	1.75	7.61	0.33
2043	12,589	0.095	0.94	33,970	0.90	1.80	7.82	0.34
2044	12,626	0.095	0.94	34,854	0.93	1.85	8	0.35
2045	12,657	0.095	0.94	35,614	0.95	1.89	8.16	0.35
2046	12,682	0.095	0.94	36,264	0.96	1.93	8.29	0.36
2047	12,703	0.095	0.94	36,816	0.98	1.95	8.4	0.36
2048	12,721	0.095	0.94	37,282	0.99	1.98	8.5	0.37
2049	12,735	0.095	0.94	37,675	1.00	2.00	8.58	0.37
2050	12,746	0.101	1.00	38,003	1.01	2.02	9.22	0.38

Table 53. Results for rebuilding projections using 75%F_{SPR40} for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,275	0.394	3.89	2,463	0.07	0.13	-	0.02
2018	2,216	0.493	4.87	2,427	0.06	0.13	-	0.02
2019	2,774	0.415	4.10	2,304	0.06	0.12	-	0.02
2020	5,056	0.427	4.22	2,458	0.07	0.13	3.34	0.02
2021	5,087	0.458	4.53	2,481	0.07	0.13	3.09	0.02
2022	4,148	0.660	6.53	1,835	0.05	0.10	3.14	0.02
2023	**3,238**	**0.076**	**0.75**	**1,314**	**0.03**	**0.07**	**0.36**	**0.01**
2024	4,809	0.076	0.75	2,277	0.06	0.12	0.59	0.02
2025	6,354	0.076	0.75	3,597	0.10	0.19	0.83	0.04
2026	7,488	0.076	0.75	4,950	0.13	0.26	1.01	0.05
2027	8,265	0.076	0.75	6,174	0.16	0.33	1.25	0.06
2028	8,931	0.076	0.75	7,508	0.20	0.40	1.55	0.07
2029	9,610	0.076	0.75	9,261	0.25	0.49	1.92	0.09
2030	10,232	0.076	0.75	11,392	0.30	0.60	2.33	0.11
2031	10,752	0.076	0.75	13,749	0.36	0.73	2.76	0.14
2032	11,168	0.076	0.75	16,216	0.43	0.86	3.21	0.16
2033	11,502	0.076	0.75	18,735	0.50	0.99	3.66	0.19
2034	11,772	0.076	0.75	21,267	0.56	1.13	4.11	0.21
2035	11,991	0.076	0.75	23,766	0.63	1.26	4.54	0.24
2036	12,168	0.076	0.75	26,180	0.69	1.39	4.95	0.26
2037	12,313	0.076	0.75	28,469	0.76	1.51	5.34	0.28

Table 53 Continued. Results for rebuilding projections using 75%F_{SPR40} for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{Fspr40} = 27,139 metric tons and $MSST_{Fspr40}$ = 13,569 metric tons (0.5 * SSB_{Fspr40}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2038	12,430	0.076	0.75	30,604	0.81	1.62	5.7	0.30
2039	12,526	0.076	0.75	32,566	0.86	1.73	6.03	0.32
2040	12,605	0.076	0.75	34,348	0.91	1.82	6.32	0.34
2041	12,670	0.076	0.75	35,949	0.95	1.91	6.59	0.36
2042	12,724	0.076	0.75	37,374	0.99	1.98	6.82	0.37
2043	12,768	0.076	0.75	38,631	1.03	2.05	7.03	0.38

Table 54. Results for rebuilding projections using Tmin + 1 generation time for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.394	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.493	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.415	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.427	-	34:66	-	-	-	-	-	-	-	-	-	-
2021	0.458	-	39:61	-	-	-	-	-	-	-	-	-	-
2022	0.660	-	34:66	-	-	-	-	-	-	-	-	-	-
2023	**0.083**	**39:61**	**61:39**	**0.16**	**-69**	**0.05**	**24**	**0.24**	**-78**	**-89**	**0.58**	**70**	**93**
2024	0.083	39:61	63:37	0.25	-50	0.07	21	0.39	-65	-83	0.61	61	90
2025	0.083	39:61	61:39	0.35	-31	0.07	17	0.55	-51	-77	0.62	53	89
2026	0.083	39:61	57:43	0.43	-15	0.08	16	0.67	-40	-74	0.7	51	89
2027	0.083	39:61	54:46	0.53	4	0.1	16	0.82	-27	-69	0.92	53	89
2028	0.083	39:61	51:49	0.65	29	0.12	16	1.02	-9	-62	1.18	54	89
2029	0.083	39:61	50:50	0.81	59	0.15	16	1.26	12	-52	1.38	52	88
2030	0.083	39:61	50:50	0.97	93	0.18	15	1.52	36	-42	1.53	50	87
2031	0.083	39:61	49:51	1.15	128	0.2	15	1.8	60	-32	1.67	48	86
2032	0.083	39:61	48:52	1.33	164	0.23	15	2.09	86	-23	1.81	46	85
2033	0.083	39:61	46:54	1.52	200	0.26	15	2.38	112	-13	1.95	45	84
2034	0.083	39:61	45:55	1.7	236	0.29	14	2.66	137	-4	2.08	44	84
2035	0.083	39:61	44:56	1.88	271	0.31	14	2.94	162	5	2.21	43	83
2036	0.083	39:61	43:57	2.05	305	0.34	14	3.2	185	14	2.32	42	82
2037	0.083	39:61	42:58	2.2	336	0.36	14	3.45	207	22	2.43	41	82

Table 54 Continued. Results for rebuilding projections using Tmin + 1 generation time for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2038	0.083	39:61	40:60	2.35	364	0.38	14	3.67	227	29	2.53	41	82
2039	0.083	39:61	39:61	2.48	390	0.4	14	3.88	245	35	2.63	40	81
2040	0.083	39:61	39:61	2.6	414	0.42	14	4.06	262	41	2.71	40	81
2041	0.083	39:61	38:62	2.7	435	0.43	14	4.23	276	46	2.79	40	81
2042	0.083	39:61	37:63	2.8	453	0.45	14	4.37	289	51	2.87	40	81
2043	0.083	39:61	36:64	2.88	469	0.46	14	4.5	301	55	2.93	39	81
2044	0.083	39:61	36:64	2.95	483	0.47	14	4.61	311	58	2.99	39	81

Table 55. Results for rebuilding projections using Tmin * 2 for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.394	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.493	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.415	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.427	-	34:66	-	-	-	-	-	-	-	-	-	-
2021	0.458	-	39:61	-	-	-	-	-	-	-	-	-	-
2022	0.660	-	34:66	-	-	-	-	-	-	-	-	-	-
2023	**0.095**	**39:61**	**61:39**	**0.18**	**-65**	**0.06**	**24**	**0.28**	**-75**	**-88**	**0.66**	**71**	**93**
2024	0.095	39:61	63:37	0.28	-44	0.07	21	0.44	-60	-81	0.69	61	90
2025	0.095	39:61	61:39	0.39	-22	0.08	18	0.62	-45	-75	0.71	54	89
2026	0.095	39:61	58:42	0.48	-6	0.09	16	0.75	-33	-71	0.8	52	89
2027	0.095	39:61	54:46	0.58	15	0.11	16	0.91	-19	-66	1.04	53	90
2028	0.095	39:61	52:48	0.72	42	0.14	16	1.13	0	-58	1.32	54	89
2029	0.095	39:61	51:49	0.88	75	0.17	16	1.38	23	-47	1.54	53	88
2030	0.095	39:61	50:50	1.07	111	0.2	16	1.67	48	-37	1.71	51	87
2031	0.095	39:61	49:51	1.25	148	0.22	15	1.96	75	-26	1.86	49	86
2032	0.095	39:61	48:52	1.45	186	0.25	15	2.27	102	-16	2.01	47	85
2033	0.095	39:61	47:53	1.64	225	0.28	15	2.57	129	-5	2.16	46	85
2034	0.095	39:61	46:54	1.84	263	0.31	14	2.87	156	5	2.31	45	84
2035	0.095	39:61	45:55	2.02	300	0.34	14	3.16	181	14	2.45	44	83
2036	0.095	39:61	43:57	2.2	334	0.36	14	3.44	206	23	2.57	43	83
2037	0.095	39:61	42:58	2.36	367	0.39	14	3.69	229	31	2.69	42	82

Table 55 Continued. Results for rebuilding projections using Tmin * 2 for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2038	0.095	39:61	41:59	2.51	396	0.41	14	3.93	250	39	2.79	42	82
2039	0.095	39:61	40:60	2.65	423	0.43	14	4.14	268	46	2.89	41	82
2040	0.095	39:61	40:60	2.77	447	0.45	14	4.33	285	52	2.98	41	82
2041	0.095	39:61	39:61	2.87	468	0.46	14	4.49	300	57	3.07	41	81
2042	0.095	39:61	38:62	2.97	487	0.48	14	4.64	313	61	3.14	40	81
2043	0.095	39:61	37:63	3.05	503	0.49	14	4.77	325	65	3.21	40	81
2044	0.095	39:61	37:63	3.12	517	0.5	14	4.88	335	69	3.27	40	81
2045	0.095	39:61	37:63	3.18	529	0.51	14	4.98	343	72	3.32	40	81
2046	0.095	39:61	36:64	3.23	539	0.51	14	5.06	350	74	3.37	40	81
2047	0.095	39:61	36:64	3.28	548	0.52	14	5.12	356	77	3.41	40	81
2048	0.095	39:61	35:65	3.31	555	0.53	14	5.18	362	78	3.44	40	81
2049	0.095	39:61	35:65	3.34	561	0.53	14	5.23	366	80	3.47	40	81
2050	0.101	39:61	35:65	3.6	611	0.57	14	5.62	401	93	3.74	40	81

Table 56. Results for rebuilding projections using 75%F_{SPR40} for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.394	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.493	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.415	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.427	-	34:66	-	-	-	-	-	-	-	-	-	-
2021	0.458	-	39:61	-	-	-	-	-	-	-	-	-	-
2022	0.660	-	34:66	-	-	-	-	-	-	-	-	-	-
2023	**0.076**	**39:61**	**61:39**	**0.14**	**-72**	**0.04**	**24**	**0.22**	**-80**	**-90**	**0.53**	**70**	**93**
2024	0.076	39:61	63:37	0.23	-54	0.06	21	0.36	-68	-85	0.55	60	90
2025	0.076	39:61	61:39	0.32	-36	0.07	17	0.5	-55	-79	0.57	53	89
2026	0.076	39:61	57:43	0.39	-22	0.07	16	0.62	-45	-76	0.64	51	89
2027	0.076	39:61	53:47	0.49	-4	0.09	16	0.76	-32	-72	0.85	53	89
2028	0.076	39:61	51:49	0.61	20	0.11	16	0.95	-16	-65	1.08	53	89
2029	0.076	39:61	50:50	0.75	48	0.14	16	1.17	4	-56	1.27	52	88
2030	0.076	39:61	49:51	0.91	80	0.16	15	1.42	27	-46	1.41	50	87
2031	0.076	39:61	48:52	1.08	113	0.19	15	1.68	50	-37	1.54	48	86
2032	0.076	39:61	47:53	1.25	147	0.22	15	1.96	74	-28	1.67	46	85
2033	0.076	39:61	46:54	1.43	182	0.24	14	2.23	99	-19	1.8	45	84
2034	0.076	39:61	45:55	1.6	217	0.27	14	2.5	123	-10	1.92	43	83
2035	0.076	39:61	43:57	1.77	250	0.29	14	2.77	147	-1	2.04	42	83
2036	0.076	39:61	42:58	1.93	282	0.32	14	3.02	169	7	2.15	42	82
2037	0.076	39:61	41:59	2.08	312	0.34	14	3.26	190	15	2.25	41	82

Table 56 Continued. Results for rebuilding projections using 75%F_{SPR40} for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR40} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2038	0.076	39:61	40:60	2.22	340	0.36	14	3.48	210	21	2.35	40	81
2039	0.076	39:61	39:61	2.35	365	0.38	14	3.68	228	28	2.44	40	81
2040	0.076	39:61	38:62	2.47	388	0.39	14	3.86	244	33	2.52	40	81
2041	0.076	39:61	37:63	2.57	408	0.41	14	4.02	258	38	2.6	39	81
2042	0.076	39:61	36:64	2.66	426	0.42	14	4.16	271	43	2.67	39	81
2043	0.076	39:61	36:64	2.74	442	0.43	14	4.29	282	47	2.73	39	81

Table 57. Results for projections using a 10 year rebuilding time frame for Gulf of Mexico Gag Grouper SRFS Run F_{MAX} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{FMAX} = 6,062 metric tons and $MSST_{FMAX}$ = 3,031 metric tons (0.5 * SSB_{FMAX}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	2,899	0.340	1.04	1,695	0.28	0.56	-	0.03
2018	1,517	0.446	1.37	1,727	0.28	0.57	-	0.03
2019	2,158	0.374	1.14	1,706	0.28	0.56	-	0.03
2020	3,553	0.331	1.01	1,836	0.30	0.61	1.88	0.03
2021	3,758	0.389	1.19	2,014	0.33	0.66	2.07	0.03
2022	3,139	0.482	1.48	1,513	0.25	0.50	1.91	0.02
2023	**2,833**	**0.245**	**0.75**	**1,301**	**0.21**	**0.43**	**1.04**	**0.02**
2024	3,435	0.245	0.75	1,740	0.29	0.57	1.4	0.03
2025	4,061	0.245	0.75	2,302	0.38	0.76	1.74	0.03
2026	4,520	0.245	0.75	2,809	0.46	0.93	1.97	0.04
2027	4,828	0.245	0.75	3,207	0.53	1.06	2.22	0.05
2028	5,086	0.245	0.75	3,585	0.59	1.18	2.52	0.05
2029	5,363	0.245	0.75	4,047	0.67	1.34	2.85	0.06
2030	5,636	0.245	0.75	4,571	0.75	1.51	3.2	0.07
2031	5,876	0.245	0.75	5,099	0.84	1.68	3.52	0.08
2032	6,076	0.245	0.75	5,599	0.92	1.85	3.83	0.08
2033	6,243	0.245	0.75	6,067	1.00	2.00	4.12	0.09

Table 58. Results for projections using a time frame that is halfway between Tmin and 10 years for Gulf of Mexico Gag Grouper SRFS Run F_{MAX} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{FMAX} = 6,062 metric tons and $MSST_{FMAX}$ = 3,031 metric tons (0.5 * SSB_{FMAX}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	2,899	0.340	1.04	1,695	0.28	0.56	-	0.03
2018	1,517	0.446	1.37	1,727	0.28	0.57	-	0.03
2019	2,158	0.374	1.14	1,706	0.28	0.56	-	0.03
2020	3,553	0.331	1.01	1,836	0.30	0.61	1.88	0.03
2021	3,758	0.389	1.19	2,014	0.33	0.66	2.07	0.03
2022	3,139	0.482	1.48	1,513	0.25	0.50	1.91	0.02
2023	**2,833**	**0.175**	**0.53**	**1,301**	**0.21**	**0.43**	**0.74**	**0.02**
2024	3,584	0.175	0.53	1,863	0.31	0.61	1.05	0.03
2025	4,331	0.175	0.53	2,589	0.43	0.85	1.36	0.04
2026	4,887	0.175	0.53	3,290	0.54	1.09	1.6	0.05
2027	5,275	0.175	0.53	3,893	0.64	1.28	1.86	0.06
2028	5,601	0.175	0.53	4,499	0.74	1.48	2.18	0.07
2029	5,932	0.175	0.53	5,232	0.86	1.73	2.53	0.08
2030	6,241	0.175	0.53	6,063	1.00	2.00	2.91	0.09

Table 59. Results for projections using a 10 year rebuilding time frame for Gulf of Mexico Gag Grouper SRFS Run F_{MAX} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.340	-	34:66	-	-	-	-	-	-	-	-	-	-
2018	0.446	-	34:66	-	-	-	-	-	-	-	-	-	-
2019	0.374	-	37:63	-	-	-	-	-	-	-	-	-	-
2020	0.331	-	43:57	-	-	-	-	-	-	-	-	-	-
2021	0.389	-	43:57	-	-	-	-	-	-	-	-	-	-
2022	0.482	-	40:60	-	-	-	-	-	-	-	-	-	-
2023	**0.245**	**39:61**	**52:48**	**0.4**	**-20**	**0.12**	**23**	**0.63**	**-44**	**-43**	**1.49**	**70**	**93**
2024	0.245	39:61	55:45	0.55	8	0.15	22	0.85	-24	-22	1.55	64	91
2025	0.245	39:61	55:45	0.68	34	0.17	20	1.06	-6	-6	1.59	60	90
2026	0.245	39:61	53:47	0.77	52	0.17	18	1.2	7	4	1.71	59	90
2027	0.245	39:61	50:50	0.86	71	0.19	18	1.35	20	15	2.02	60	90
2028	0.245	39:61	49:51	0.98	94	0.22	18	1.53	37	31	2.34	60	90
2029	0.245	39:61	49:51	1.11	120	0.25	18	1.74	55	49	2.57	60	90
2030	0.245	39:61	49:51	1.25	147	0.27	18	1.95	74	67	2.74	58	89
2031	0.245	39:61	48:52	1.37	172	0.29	17	2.15	91	83	2.91	58	89
2032	0.245	39:61	48:52	1.49	196	0.31	17	2.34	108	97	3.08	57	89
2033	0.245	39:61	47:53	1.61	218	0.33	17	2.52	124	112	3.26	56	88

Table 60. Results for projections using a time frame that is halfway between Tmin and 10 years for Gulf of Mexico Gag Grouper SRFS Run F_{MAX} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.340	-	34:66	-	-	-	-	-	-	-	-	-	-
2018	0.446	-	34:66	-	-	-	-	-	-	-	-	-	-
2019	0.374	-	37:63	-	-	-	-	-	-	-	-	-	-
2020	0.331	-	43:57	-	-	-	-	-	-	-	-	-	-
2021	0.389	-	43:57	-	-	-	-	-	-	-	-	-	-
2022	0.482	-	40:60	-	-	-	-	-	-	-	-	-	-
2023	**0.175**	**39:61**	**52:48**	**0.29**	**-43**	**0.08**	**22**	**0.45**	**-60**	**-60**	**1.04**	**70**	**93**
2024	0.175	39:61	54:46	0.41	-19	0.11	21	0.64	-43	-42	1.1	63	91
2025	0.175	39:61	53:47	0.53	5	0.12	19	0.83	-26	-27	1.15	58	89
2026	0.175	39:61	51:49	0.62	23	0.13	17	0.97	-13	-18	1.28	57	90
2027	0.175	39:61	48:52	0.73	43	0.15	17	1.13	1	-6	1.56	58	90
2028	0.175	39:61	46:54	0.85	68	0.18	17	1.33	18	10	1.85	58	90
2029	0.175	39:61	46:54	0.99	95	0.2	17	1.55	38	29	2.08	57	89
2030	0.175	39:61	45:55	1.13	124	0.23	17	1.77	58	48	2.25	56	88

Table 61. Results for rebuilding projections using a 10 year rebuilding time frame for Gulf of Mexico Gag Grouper SEDAR 72 F_{MAX} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{FMAX} = 9,752 metric tons and $MSST_{FMAX}$ = 4,876 metric tons (0.5 * SSB_{FMAX}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,275	0.394	1.22	2,463	0.25	0.51	-	0.02
2018	2,216	0.493	1.53	2,427	0.25	0.50	-	0.02
2019	2,774	0.415	1.29	2,304	0.24	0.47	-	0.02
2020	5,056	0.427	1.32	2,458	0.25	0.50	3.34	0.02
2021	5,087	0.458	1.42	2,481	0.25	0.51	3.09	0.02
2022	4,148	0.660	2.05	1,835	0.19	0.38	3.14	0.02
2023	**3,238**	**0.211**	**0.66**	**1,314**	**0.13**	**0.27**	**1**	**0.01**
2024	4,433	0.211	0.66	2,018	0.21	0.41	1.5	0.02
2025	5,636	0.211	0.66	2,924	0.30	0.60	1.95	0.03
2026	6,481	0.211	0.66	3,729	0.38	0.76	2.22	0.04
2027	7,016	0.211	0.66	4,335	0.44	0.89	2.56	0.04
2028	7,474	0.211	0.66	4,930	0.51	1.01	3.01	0.05
2029	8,015	0.211	0.66	5,747	0.59	1.18	3.54	0.06
2030	8,565	0.211	0.66	6,735	0.69	1.38	4.11	0.07
2031	9,046	0.211	0.66	7,772	0.80	1.59	4.66	0.08
2032	9,443	0.211	0.66	8,783	0.90	1.80	5.2	0.09
2033	9,772	0.211	0.66	9,760	1.00	2.00	5.73	0.10

Table 62. Results for rebuilding projections using a time frame that is halfway between Tmin and 10 years for Gulf of Mexico Gag Grouper SEDAR 72 F_{MAX} scenario. Recruitment (R) is in 1000s of age-0 fish, SSB is in metric tons, F is a harvest rate (total biomass killed / total biomass age 3+), and retained yield in millions of pounds gutted weight. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{FMAX} = 9,752 metric tons and $MSST_{FMAX}$ = 4,876 metric tons (0.5 * SSB_{FMAX}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,275	0.394	1.22	2,463	0.25	0.51	-	0.02
2018	2,216	0.493	1.53	2,427	0.25	0.50	-	0.02
2019	2,774	0.415	1.29	2,304	0.24	0.47	-	0.02
2020	5,056	0.427	1.32	2,458	0.25	0.50	3.34	0.02
2021	5,087	0.458	1.42	2,481	0.25	0.51	3.09	0.02
2022	4,148	0.660	2.05	1,835	0.19	0.38	3.14	0.02
2023	**3,238**	**0.157**	**0.49**	**1,314**	**0.13**	**0.27**	**0.75**	**0.01**
2024	4,585	0.157	0.49	2,120	0.22	0.43	1.16	0.02
2025	5,925	0.157	0.49	3,181	0.33	0.65	1.55	0.03
2026	6,887	0.157	0.49	4,182	0.43	0.86	1.82	0.04
2027	7,522	0.157	0.49	4,999	0.51	1.03	2.16	0.05
2028	8,069	0.157	0.49	5,836	0.60	1.20	2.59	0.06
2029	8,674	0.157	0.49	6,955	0.71	1.43	3.11	0.07
2030	9,263	0.157	0.49	8,306	0.85	1.70	3.67	0.08
2031	9,770	0.157	0.49	9,754	1.00	2.00	4.23	0.10

Table 63. Results for rebuilding projections using a 10 year rebuilding time frame for Gulf of Mexico Gag Grouper SEDAR 72 F_{MAX} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.394	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.493	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.415	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.427	-	34:66	-	-	-	-	-	-	-	-	-	-
2021	0.458	-	39:61	-	-	-	-	-	-	-	-	-	-
2022	0.660	-	34:66	-	-	-	-	-	-	-	-	-	-
2023	**0.211**	**39:61**	**62:38**	**0.39**	**-23**	**0.13**	**25**	**0.61**	**-45**	**-73**	**1.53**	**71**	**93**
2024	0.211	39:61	64:36	0.58	15	0.17	22	0.91	-19	-60	1.56	63	91
2025	0.211	39:61	63:37	0.76	50	0.18	19	1.19	6	-50	1.55	57	90
2026	0.211	39:61	60:40	0.87	72	0.18	17	1.36	21	-45	1.66	55	90
2027	0.211	39:61	57:43	1	98	0.21	17	1.56	39	-39	2.08	57	91
2028	0.211	39:61	56:44	1.17	132	0.25	17	1.84	63	-28	2.55	58	90
2029	0.211	39:61	56:44	1.38	173	0.29	17	2.16	93	-14	2.88	57	90
2030	0.211	39:61	56:44	1.6	217	0.33	17	2.5	123	0	3.11	55	89
2031	0.211	39:61	55:45	1.82	259	0.36	17	2.84	153	12	3.32	54	88
2032	0.211	39:61	55:45	2.03	301	0.4	16	3.17	182	24	3.56	53	88
2033	0.211	39:61	54:46	2.23	342	0.43	16	3.5	211	36	3.8	52	87

Table 64. Results for rebuilding projections using a time frame that is halfway between Tmin and 10 years for Gulf of Mexico Gag Grouper SEDAR 72 F_{MAX} scenario. F is a harvest rate (total biomass killed / total biomass age 3+), while relative F is measured in terms of apical Fs. The $F_{rebuild}$ is shown starting in 2023. Commercial (com) and recreational (rec) retained yield and discard (disc; live+dead) amounts are in millions of pounds gutted weight. Percent change in yield relative to the 2017-2019 average observed yield is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector. Percent contribution of discards (%Disc) to the total catch is shown in terms of biomass for the commercial sector and both biomass and numbers for the recreational sector.

Year	F	Allocation (com: rec)	Relative F (com: rec)	Com Yield	%Change Com Yield	Com Disc	Com %Disc	Rec Yield	%Change Rec Yield (bio)	%Change Rec Yield (num)	Rec Disc	Rec %Disc (bio)	Rec %Disc (num)
2017	0.394	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.493	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.415	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.427	-	34:66	-	-	-	-	-	-	-	-	-	-
2021	0.458	-	39:61	-	-	-	-	-	-	-	-	-	-
2022	0.660	-	34:66	-	-	-	-	-	-	-	-	-	-
2023	**0.157**	**39:61**	**62:38**	**0.29**	**-42**	**0.09**	**24**	**0.46**	**-59**	**-80**	**1.12**	**71**	**93**
2024	0.157	39:61	64:36	0.45	-11	0.12	22	0.71	-37	-69	1.15	62	90
2025	0.157	39:61	62:38	0.61	20	0.14	18	0.95	-16	-61	1.16	55	89
2026	0.157	39:61	59:41	0.71	41	0.14	17	1.11	-1	-56	1.28	53	90
2027	0.157	39:61	56:44	0.84	66	0.17	16	1.32	17	-50	1.63	55	90
2028	0.157	39:61	54:46	1.01	100	0.2	17	1.58	41	-39	2.03	56	90
2029	0.157	39:61	53:47	1.21	140	0.24	17	1.9	69	-26	2.33	55	89
2030	0.157	39:61	53:47	1.43	183	0.28	16	2.24	99	-13	2.55	53	88
2031	0.157	39:61	53:47	1.65	227	0.31	16	2.58	130	0	2.74	51	87

Figures

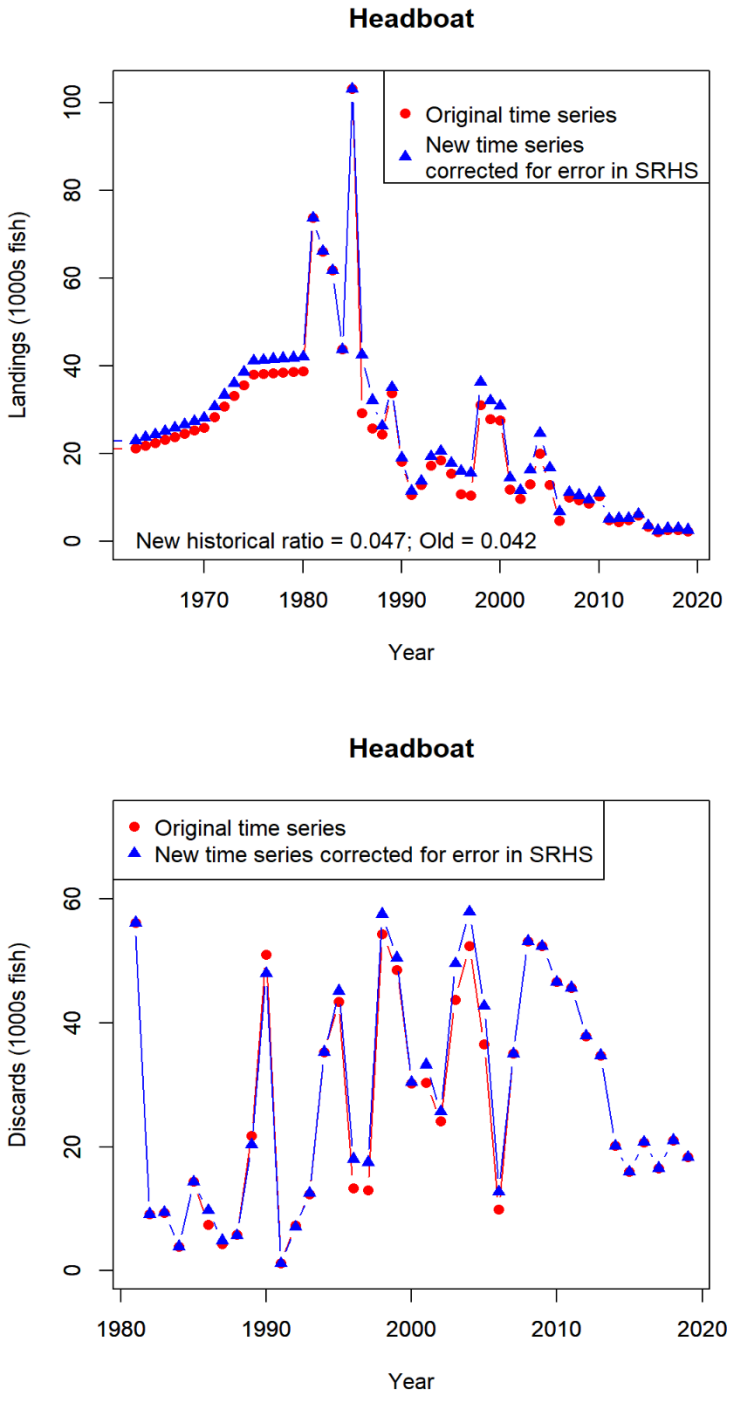


Figure 1. Original vs. corrected time series of landings and discards for the Recreational Headboat fleet used in the SRFS Run.

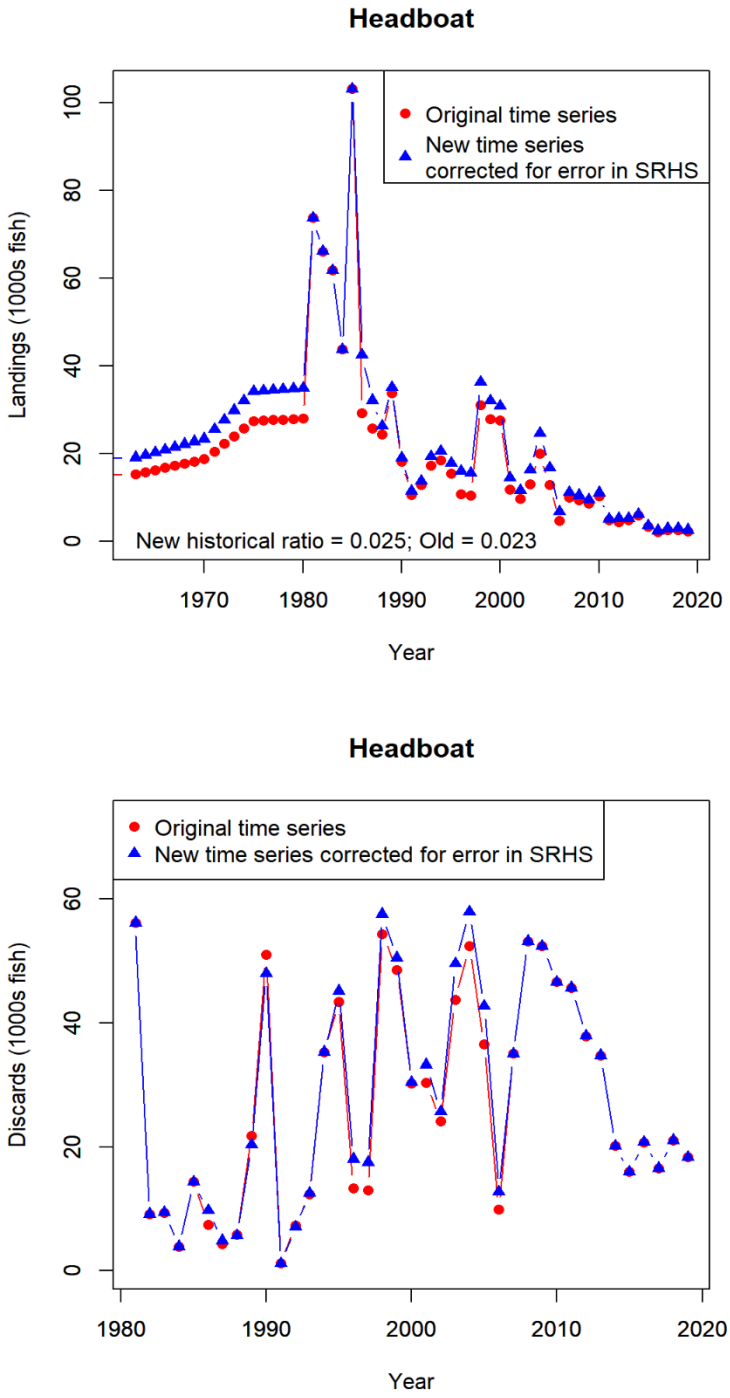


Figure 2. Original vs. corrected time series of landings and discards for the Recreational Headboat fleet used in the SEDAR 72 base run.

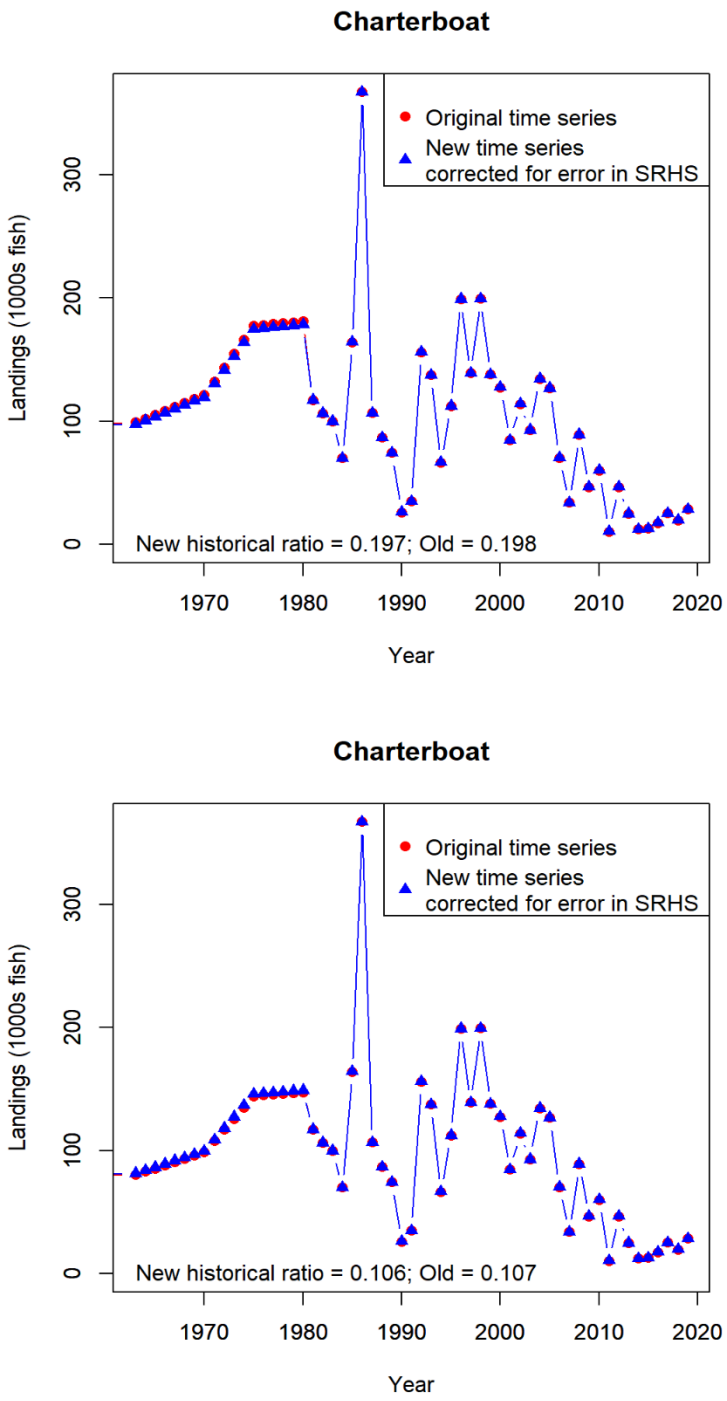


Figure 3. Original vs. corrected time series of landings for the Recreational Charter fleet used in the SRFS Run (top panel) and the SEDAR 72 base run (bottom panel).

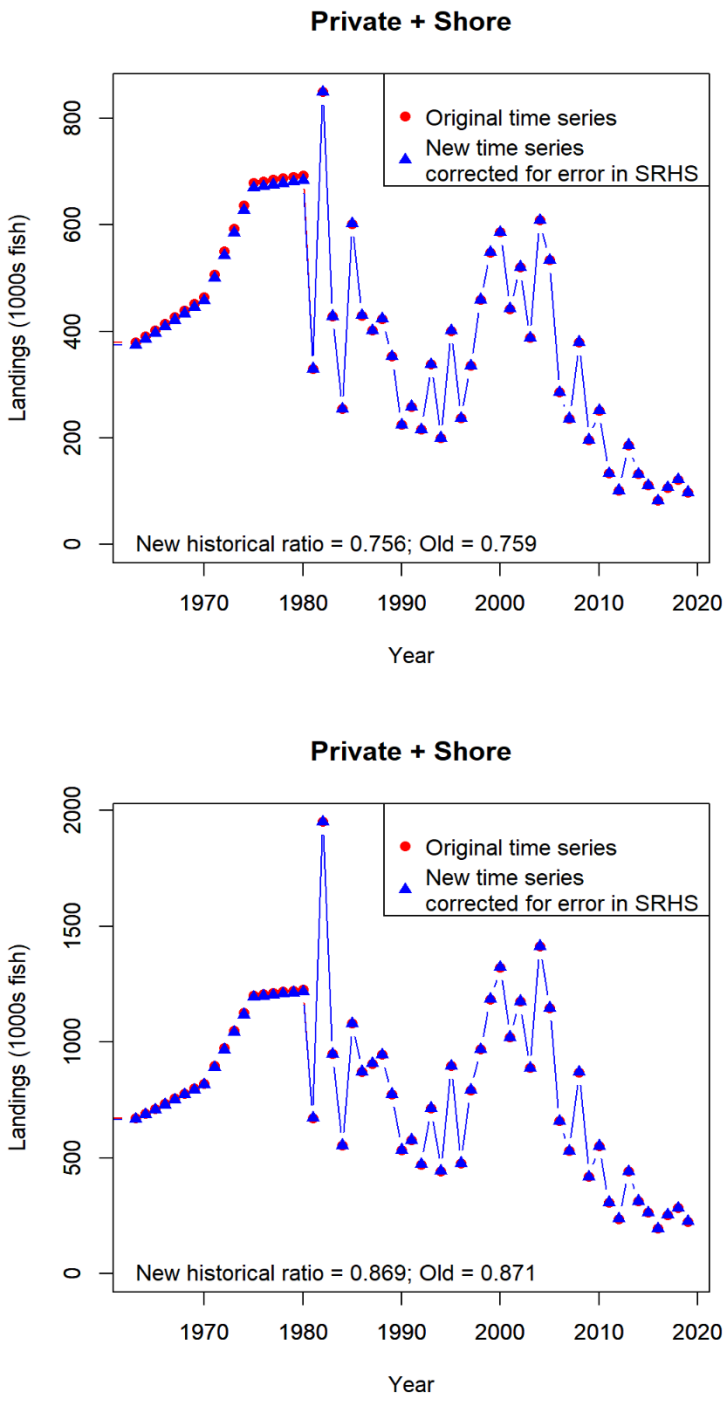


Figure 4. Original vs. corrected time series of landings for the Recreational Private + Shore fleet used in the SRFS Run (top panel) and the SEDAR 72 base run (bottom panel).

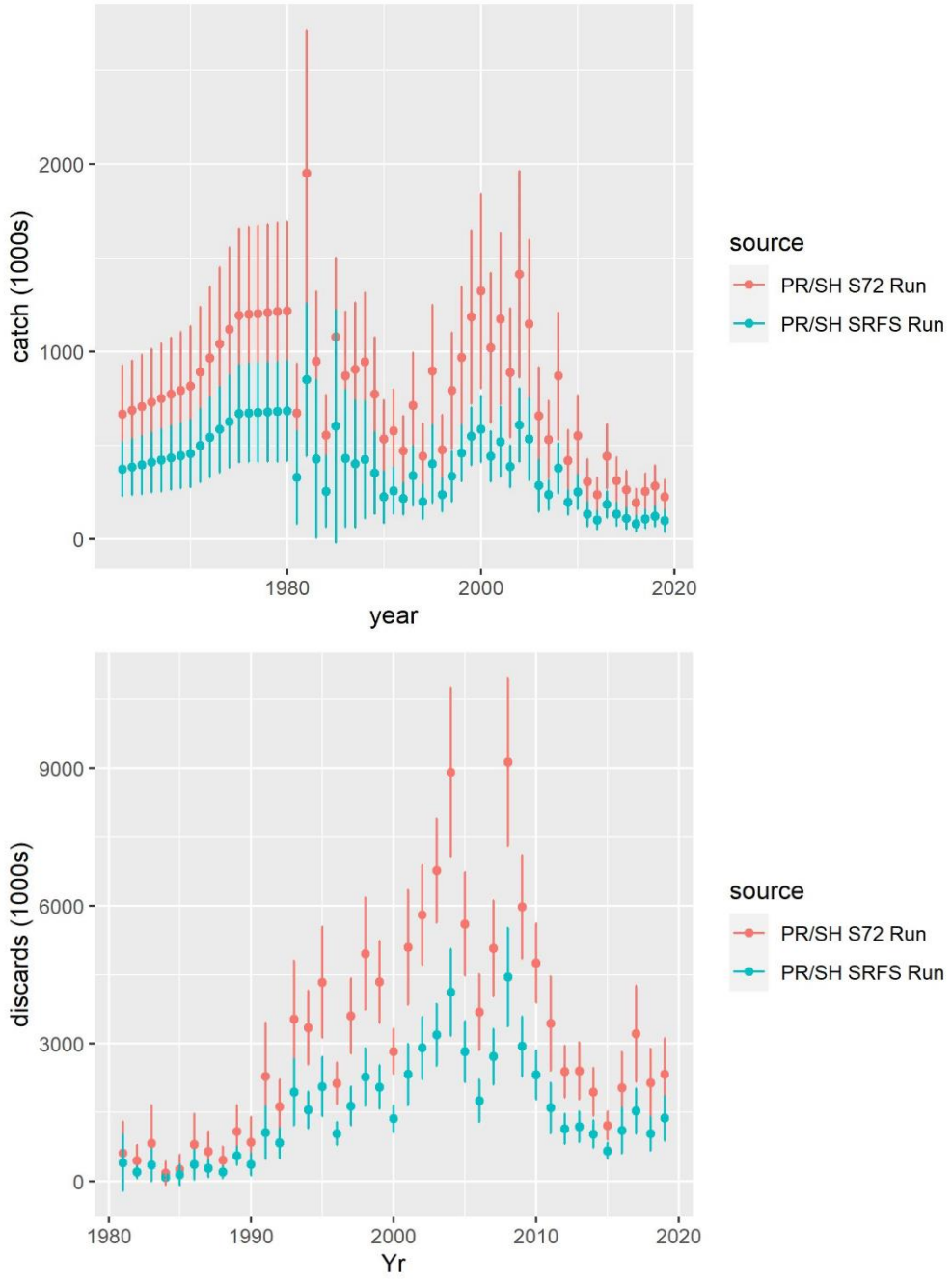


Figure 5. Time series of the Recreational Private + Shore fleet landings and discards in thousands of fish, and associated uncertainty, from the SRFS Run vs. the SEDAR 72 base run.

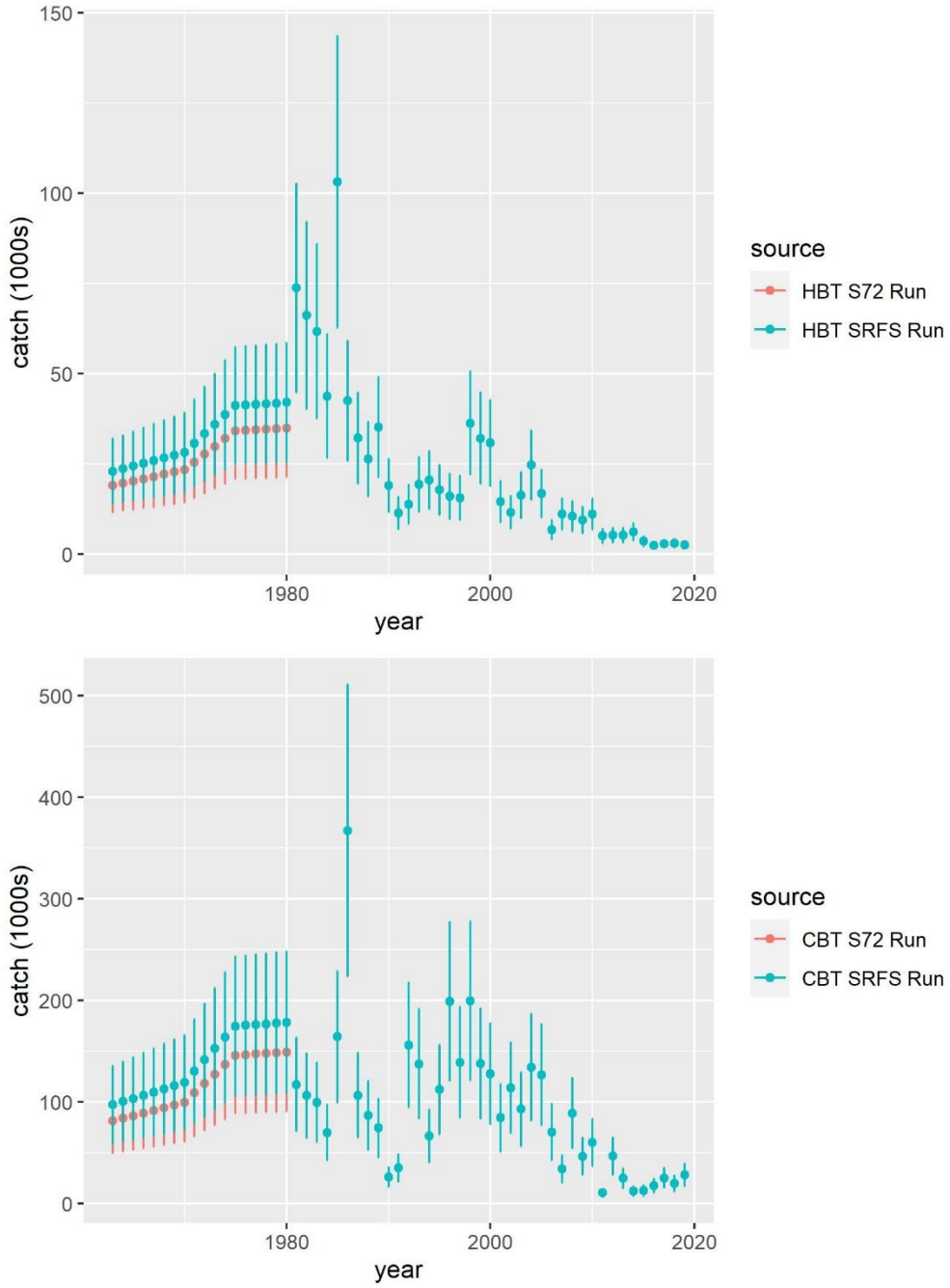
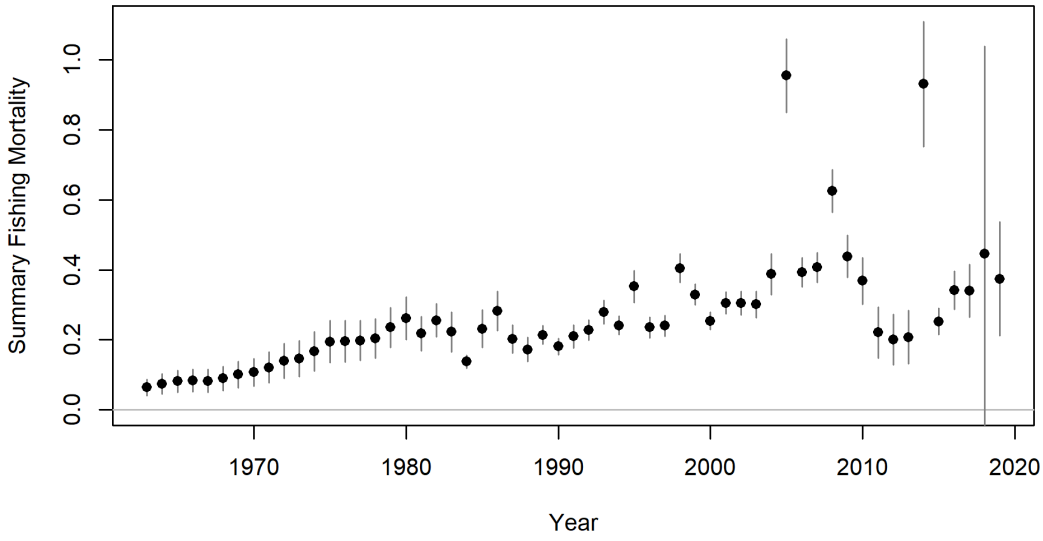


Figure 6. Time series of the Recreational Headboat and Recreational Charter fleet landings in thousands of fish, and associated uncertainty, from the SRFS Run vs. the SEDAR 72 base run.

SRFS Run



SEDAR 33U

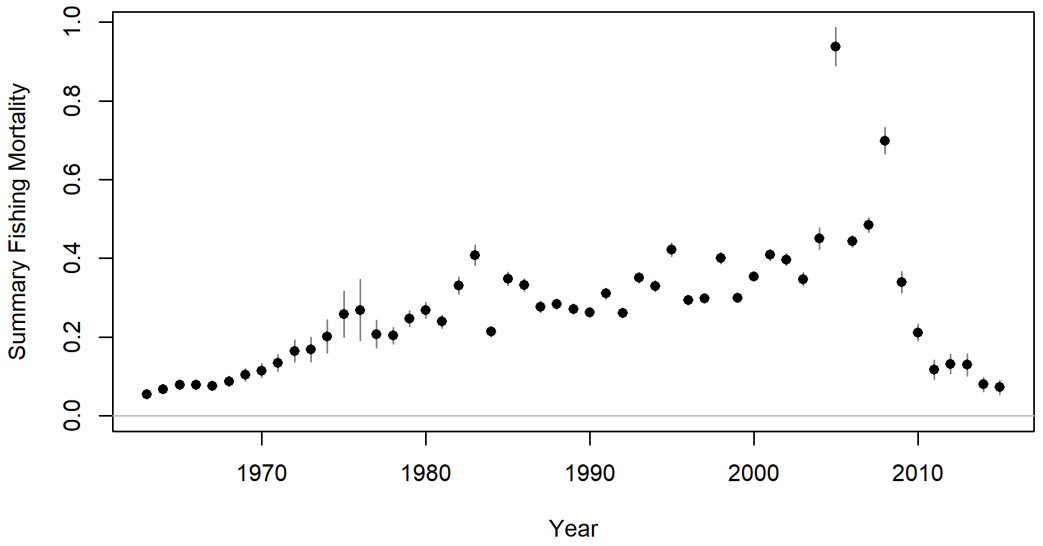
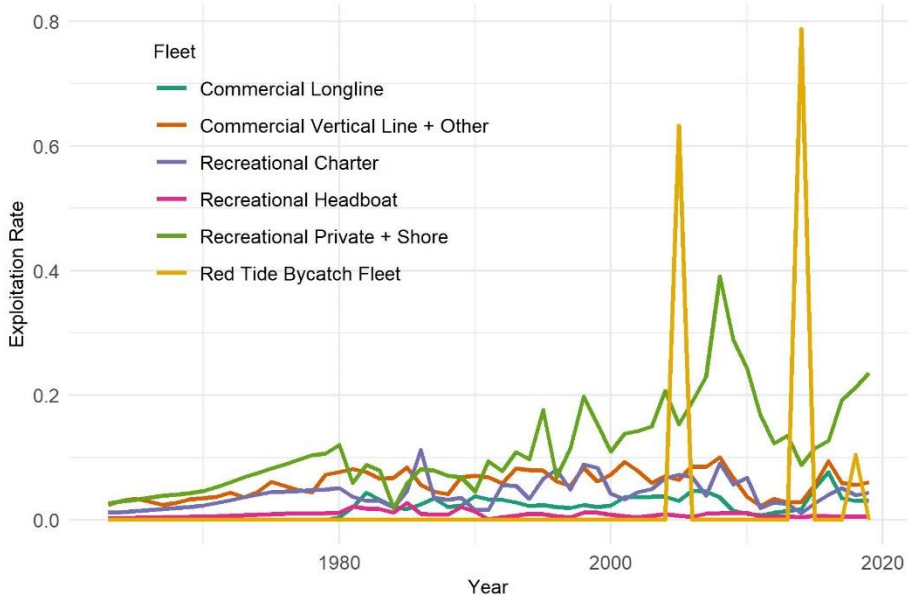


Figure 7. Annual exploitation rate estimates (total biomass killed / total biomass age 3+) for Gulf of Mexico Gag Grouper (red tide F included).

SRFS Run



SEDAR 33U

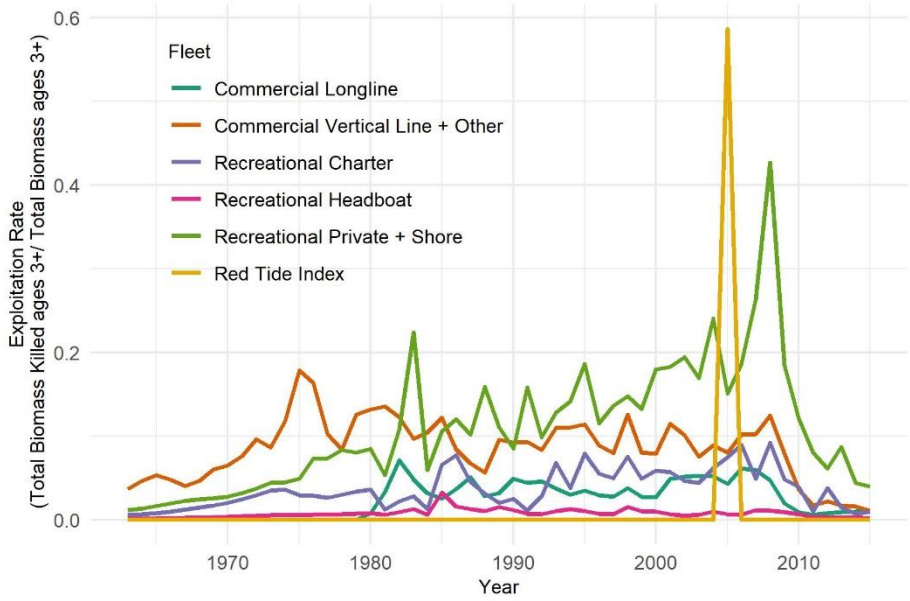


Figure 8. Annual exploitation rate (total biomass killed / total biomass age 3+) by fleet for Gulf of Mexico Gag Grouper.

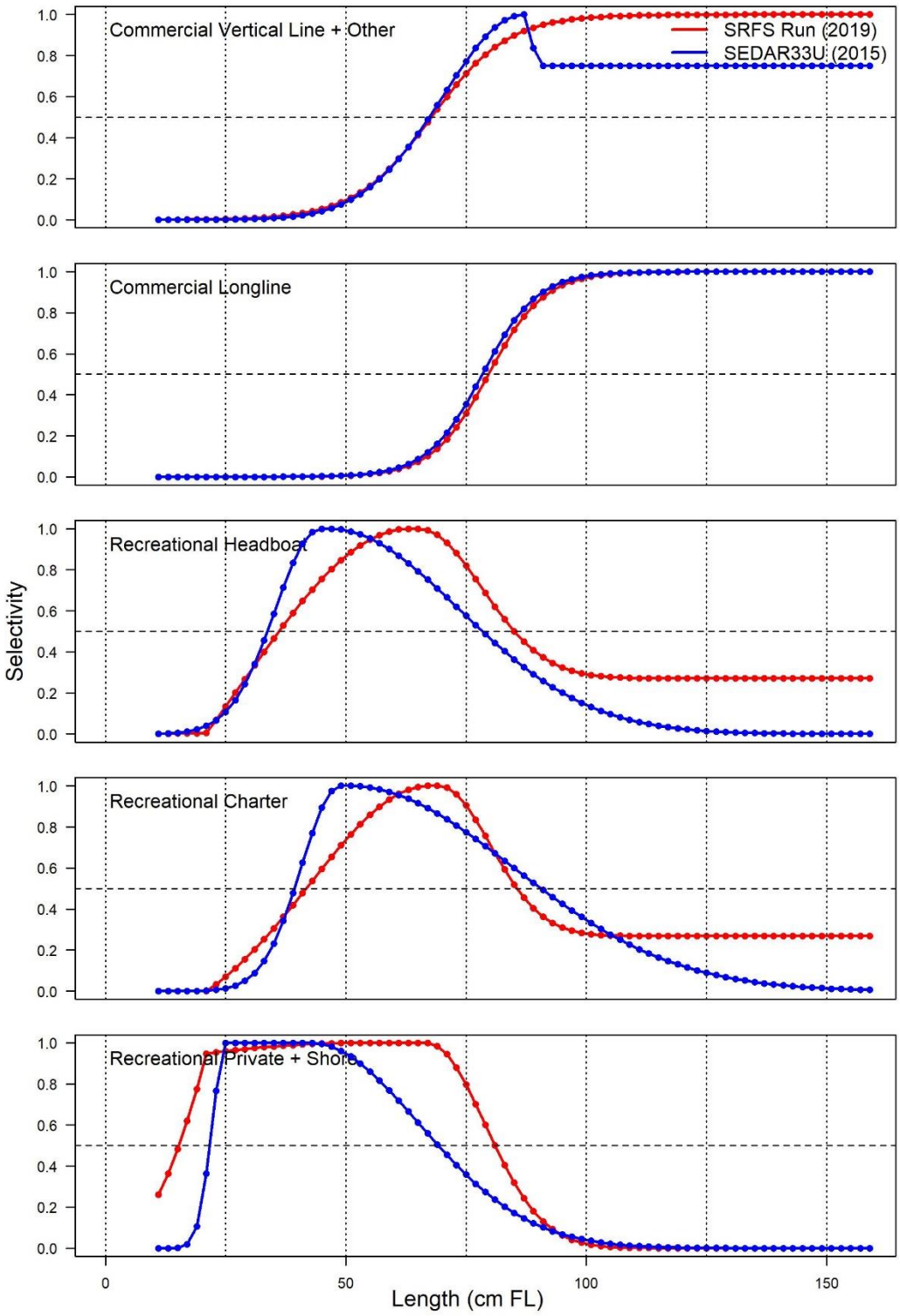
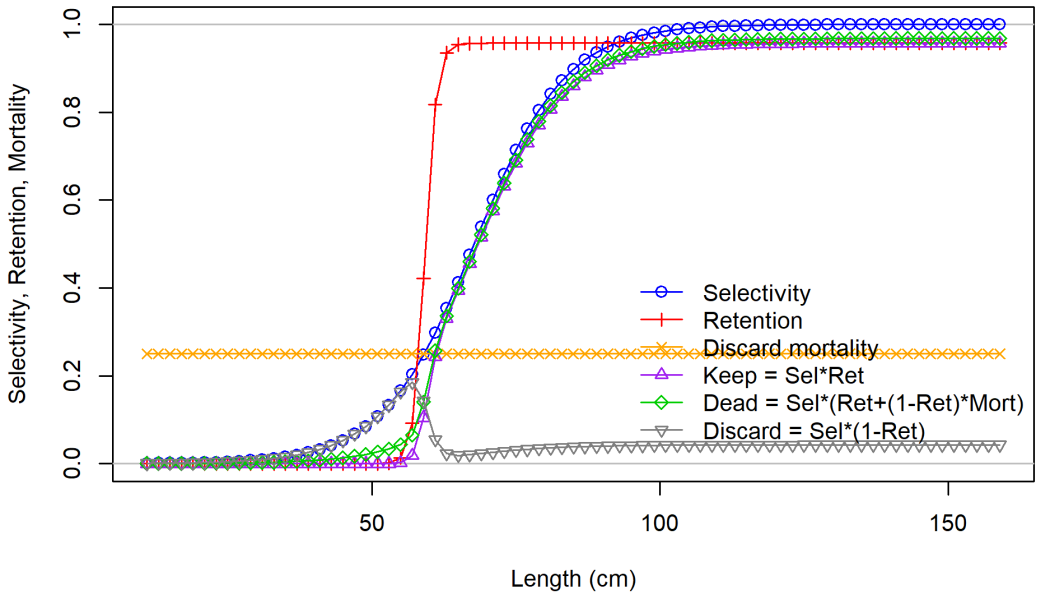


Figure 9. Length-based selectivity for each fleet for Gulf of Mexico Gag Grouper in the terminal year of the assessment (given in parentheses). Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify lengths in 25 cm FL intervals.

SRFS Run



SEDAR 33U

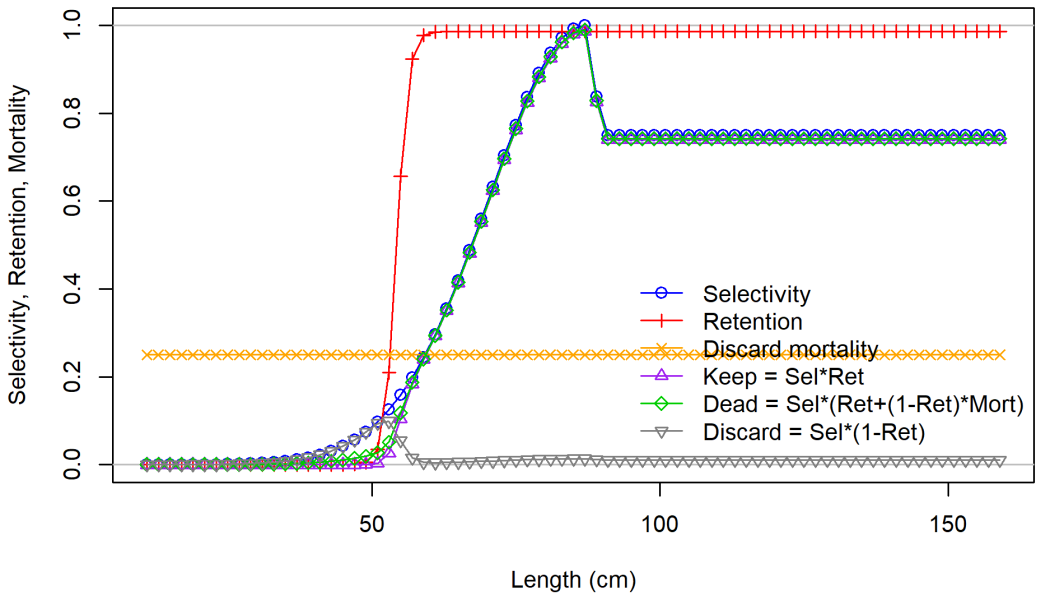
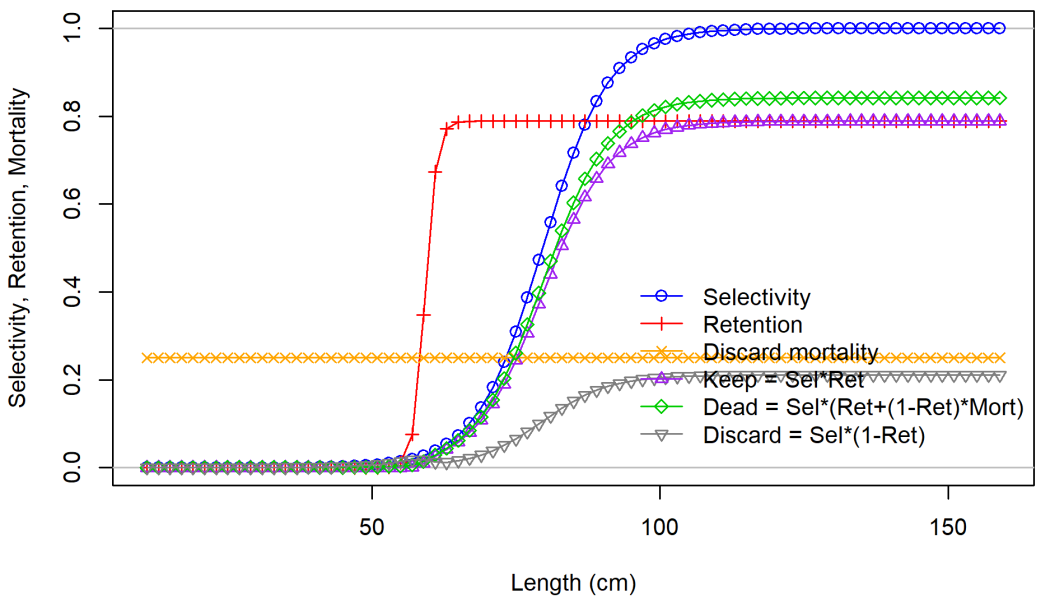


Figure 10. Length-based selectivity for the Commercial Vertical Line + Other fishery. Selectivity (blue line) is constant over the entire assessment time period (1963 - 2019). Retention (red line) is shown for the most recent time period. Discard mortality (orange line) is constant at 0.25.

SRFS Run



SEDAR 33U

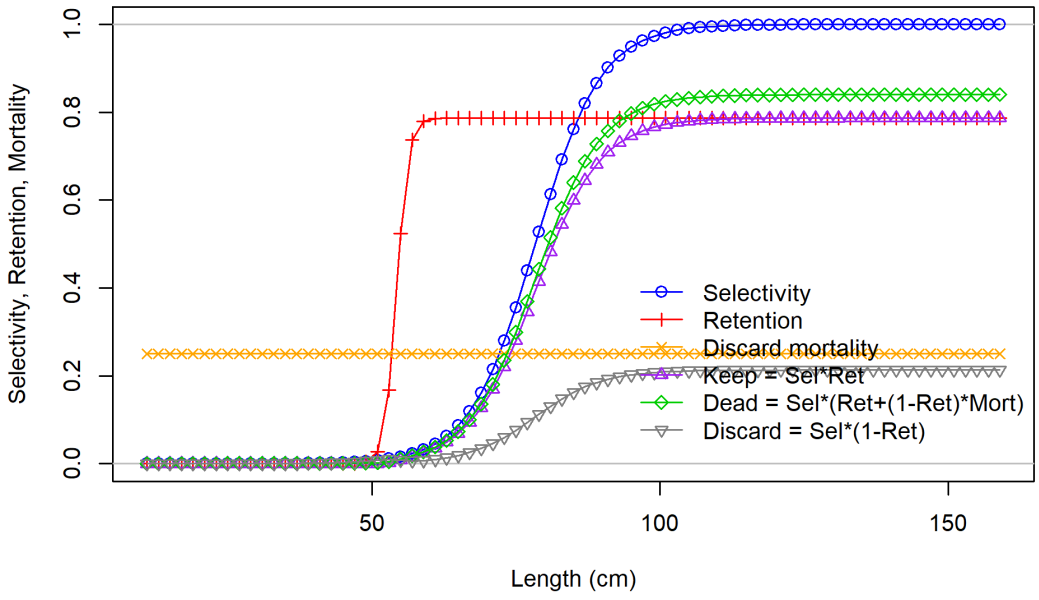
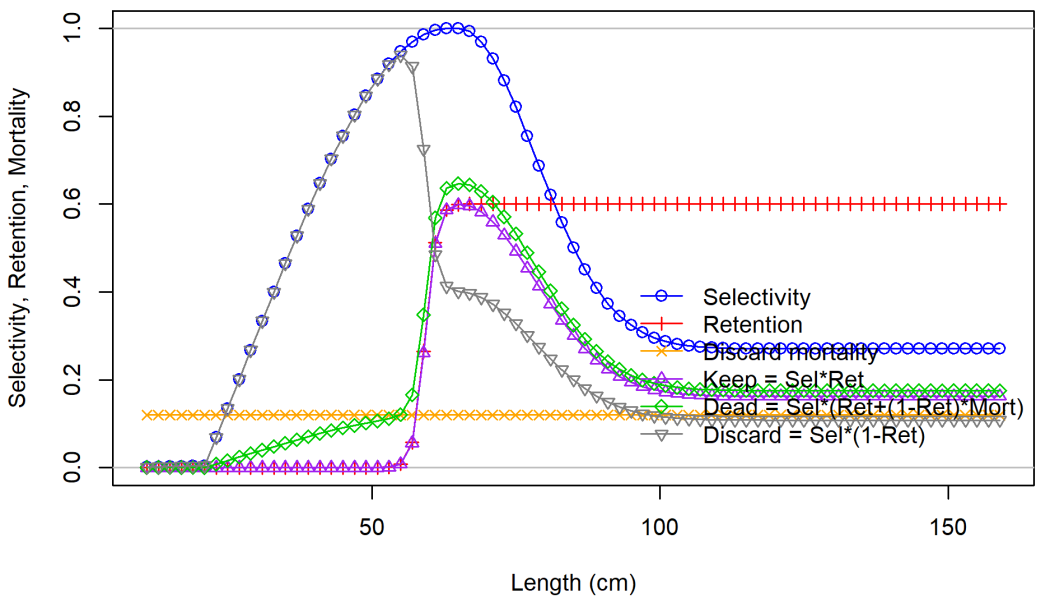


Figure 11. Length-based selectivity for the Commercial Longline fishery. Selectivity (blue line) is constant over the entire assessment time period (1963 - 2019). Retention (red line) is shown for the most recent time period. Discard mortality (orange line) is constant at 0.25.

SRFS Run



SEDAR 33U

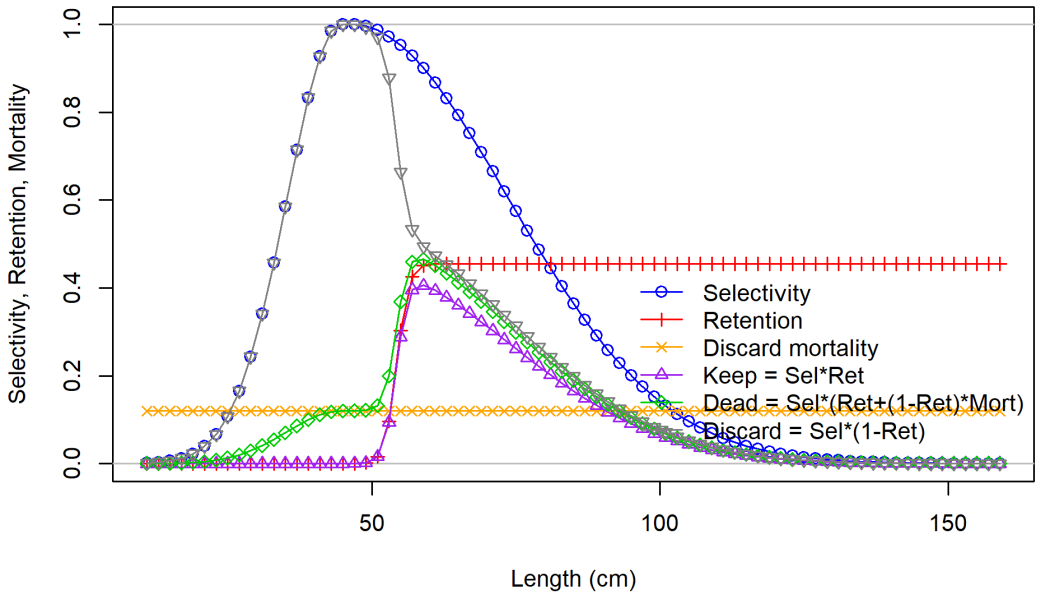
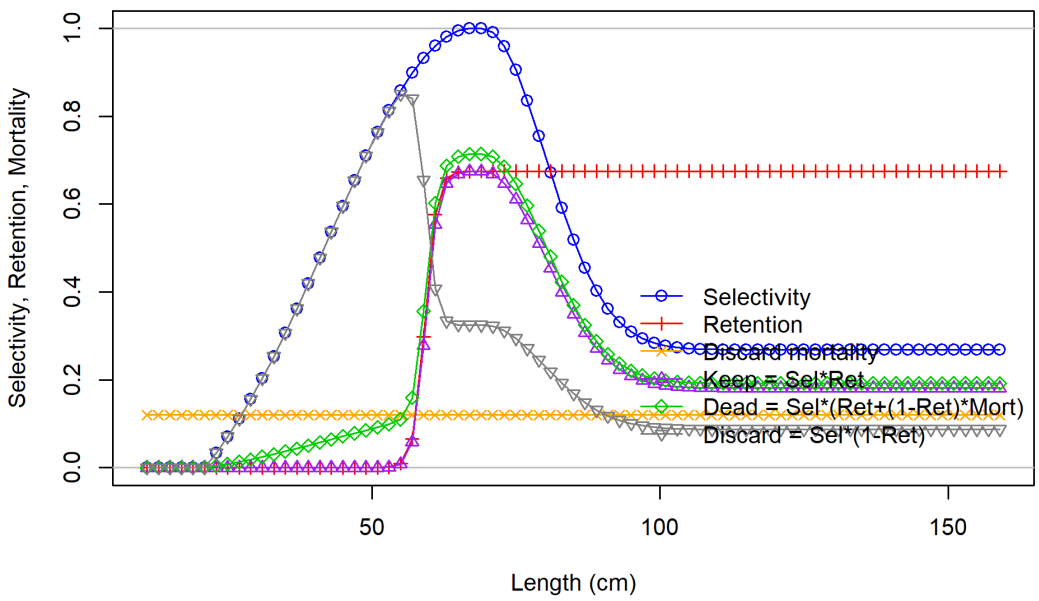


Figure 12. Length-based selectivity for the Recreational Headboat fishery. Selectivity (blue line) is constant over the entire assessment time period (1963 - 2019). Retention (red line) is shown for the most recent time period. Discard mortality (orange line) is constant at 0.12.

SRFS Run



SEDAR 33U

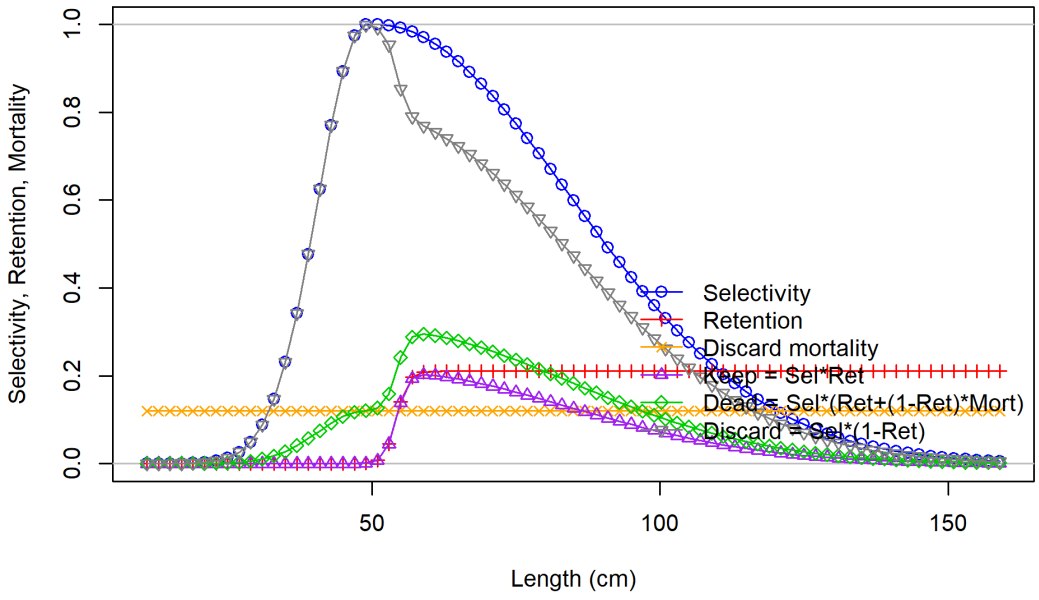
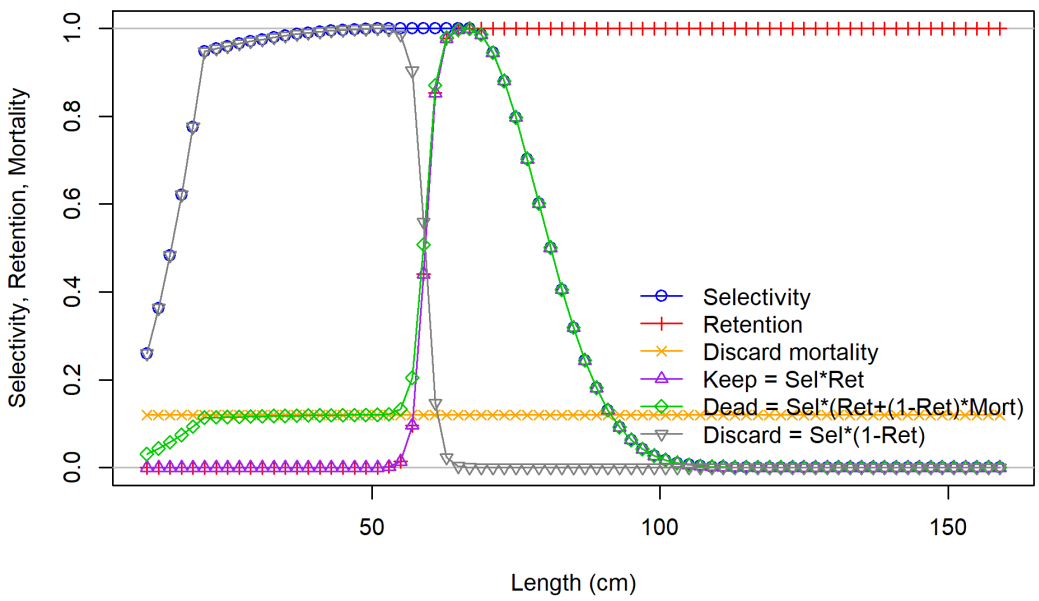


Figure 13. Length-based selectivity for the Recreational Charter fishery. Selectivity (blue line) is constant over the entire assessment time period (1963 - 2019). Retention (red line) is shown for the most recent time period. Discard mortality (orange line) is constant at 0.12.

SRFS Run



SEDAR 33U

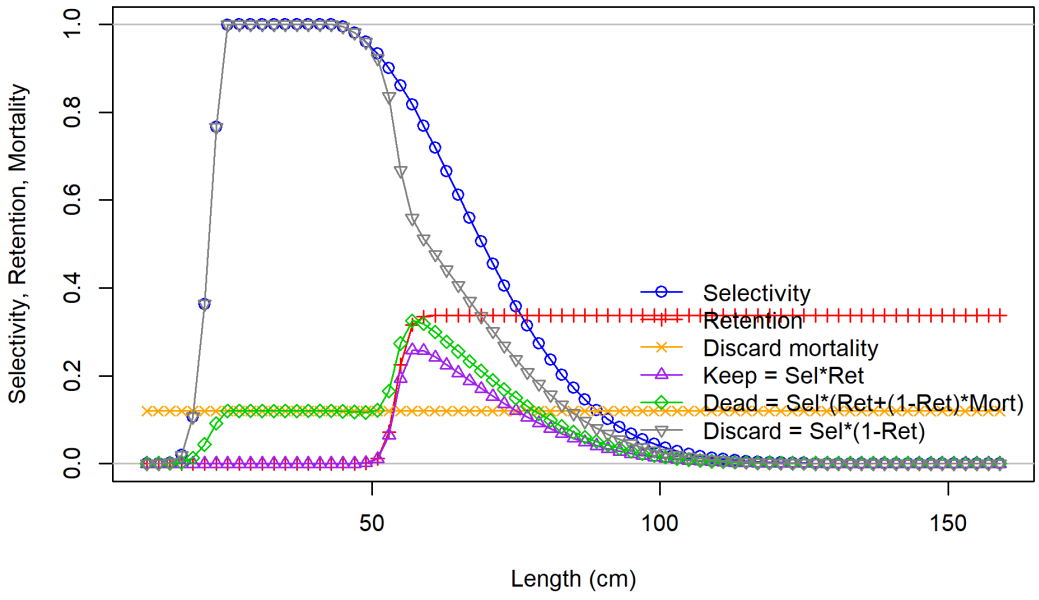


Figure 14. Length-based selectivity for the Recreational Private + Shore fishery. Selectivity (blue line) is constant over the entire assessment time period (1963 - 2019). Retention (red line) is shown for the most recent time period. Discard mortality (orange line) is constant at 0.12.

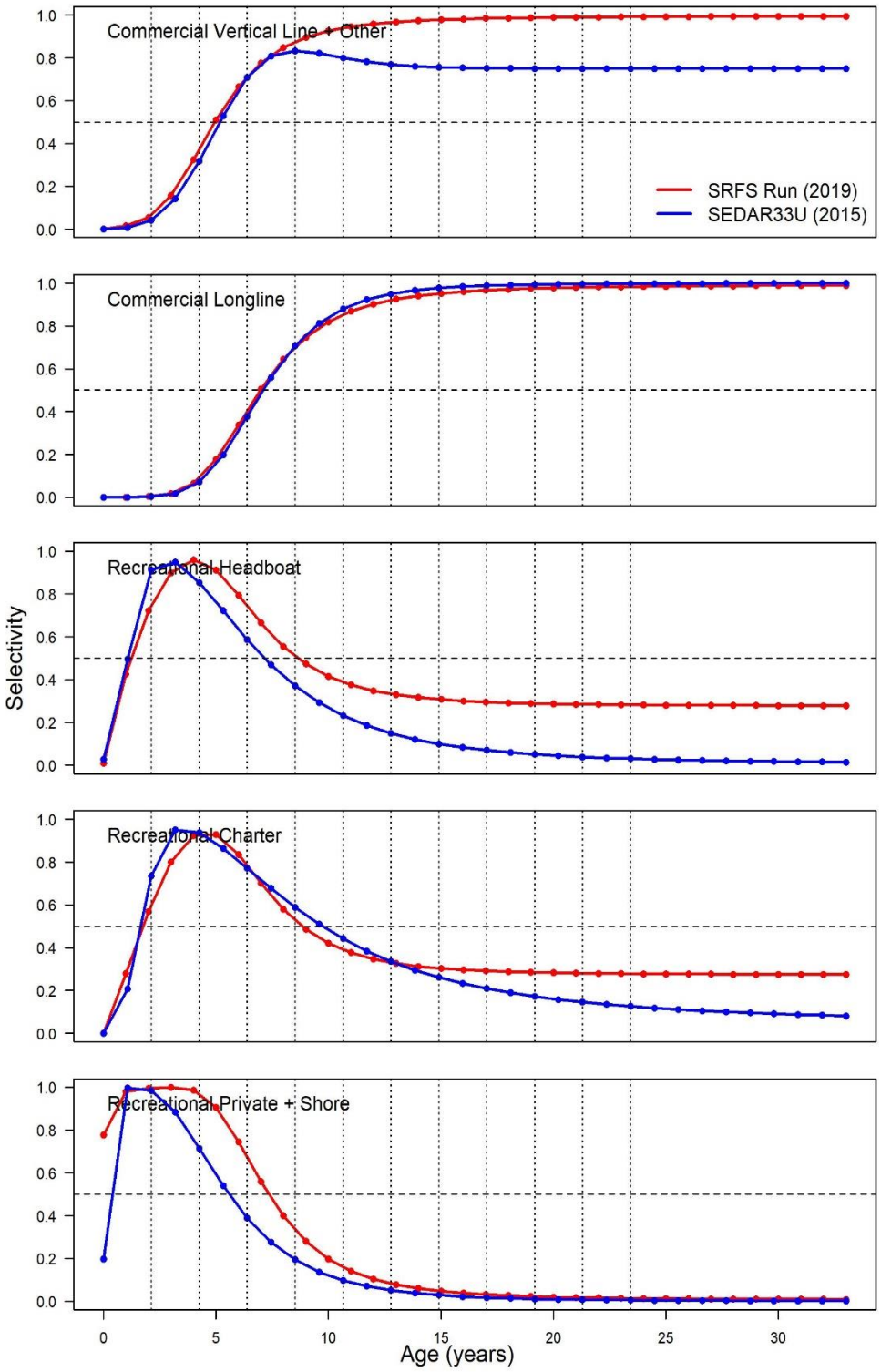


Figure 15. Derived age-based selectivity for each fleet for Gulf of Mexico Gag Grouper in the terminal year of the assessment (given in parentheses). Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify ages in two-year intervals.

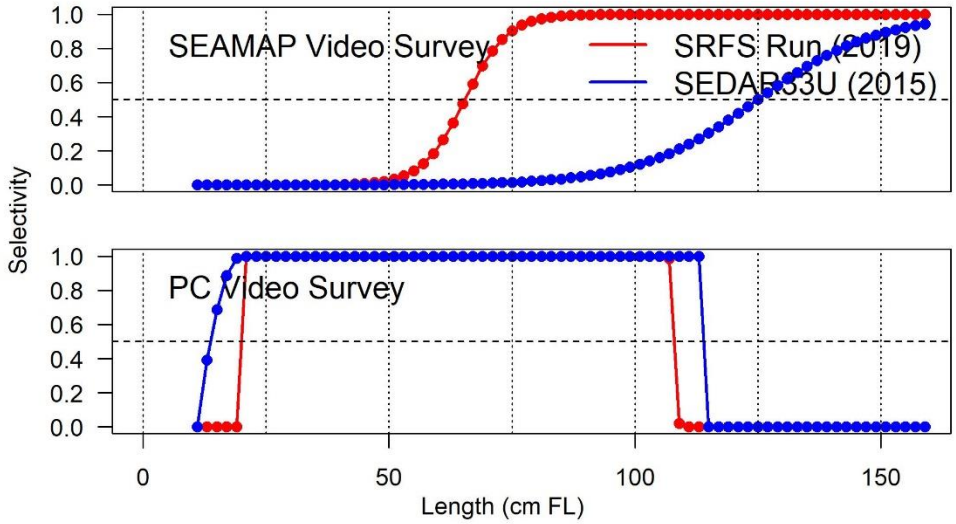


Figure 16. Length-based selectivity for each survey for Gulf of Mexico Gag Grouper in the terminal year of the assessment (given in parentheses). Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify lengths in 25 cm FL intervals.

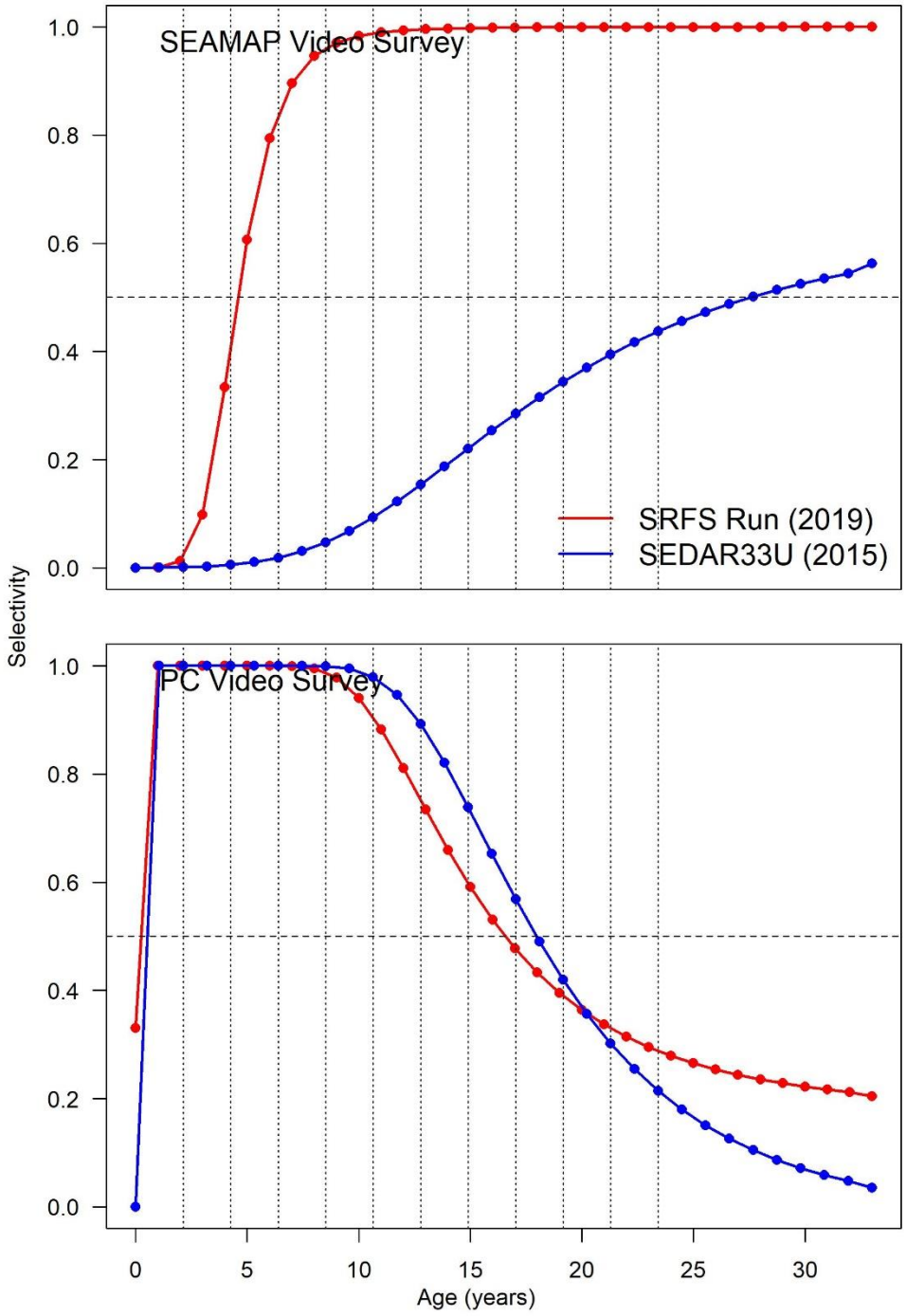


Figure 17. Derived age-based selectivity for each survey for Gulf of Mexico Gag Grouper in the terminal year of the assessment (given in parentheses). Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify ages in two-year intervals.

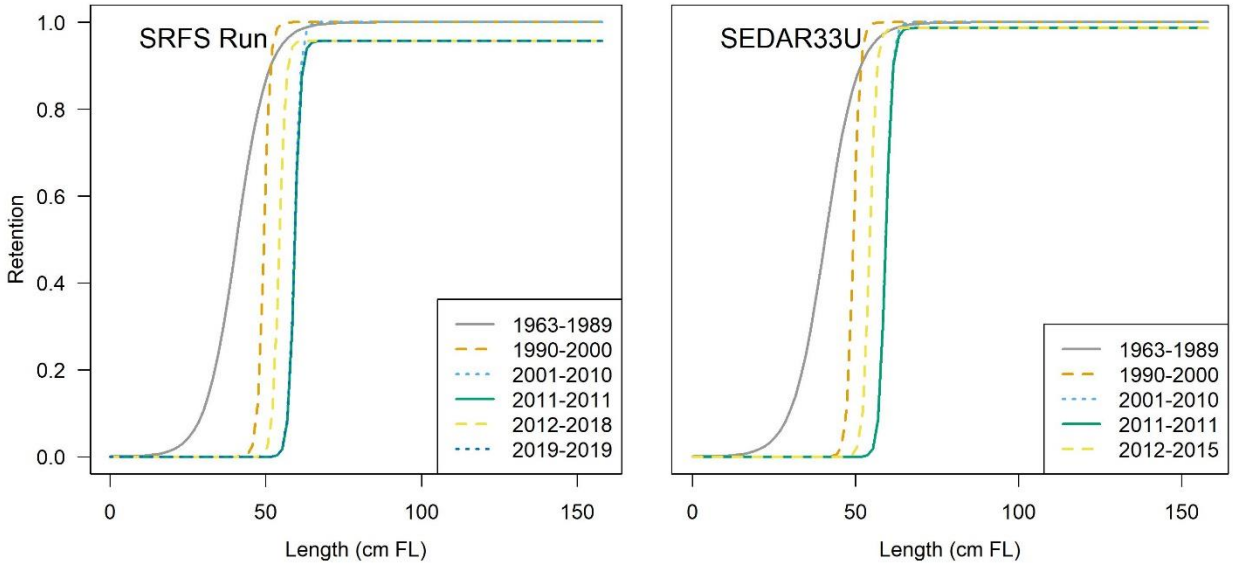


Figure 18. Time-varying retention functions for the Commercial Vertical Line + Other fishery for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U.

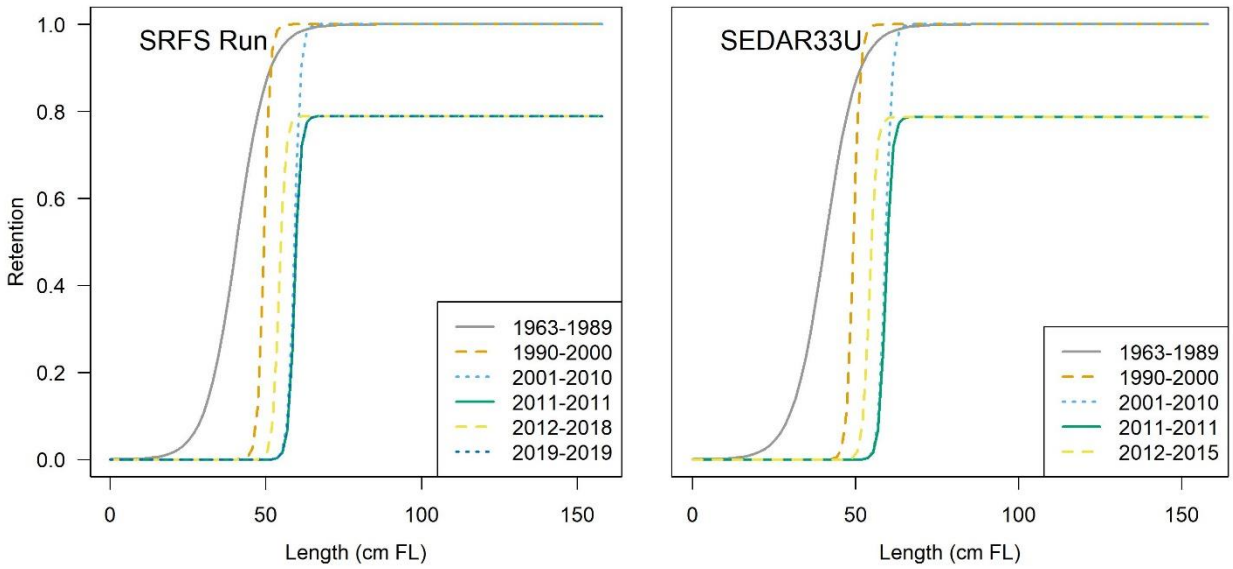


Figure 19. Time-varying retention functions for the Commercial Longline fishery for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U.

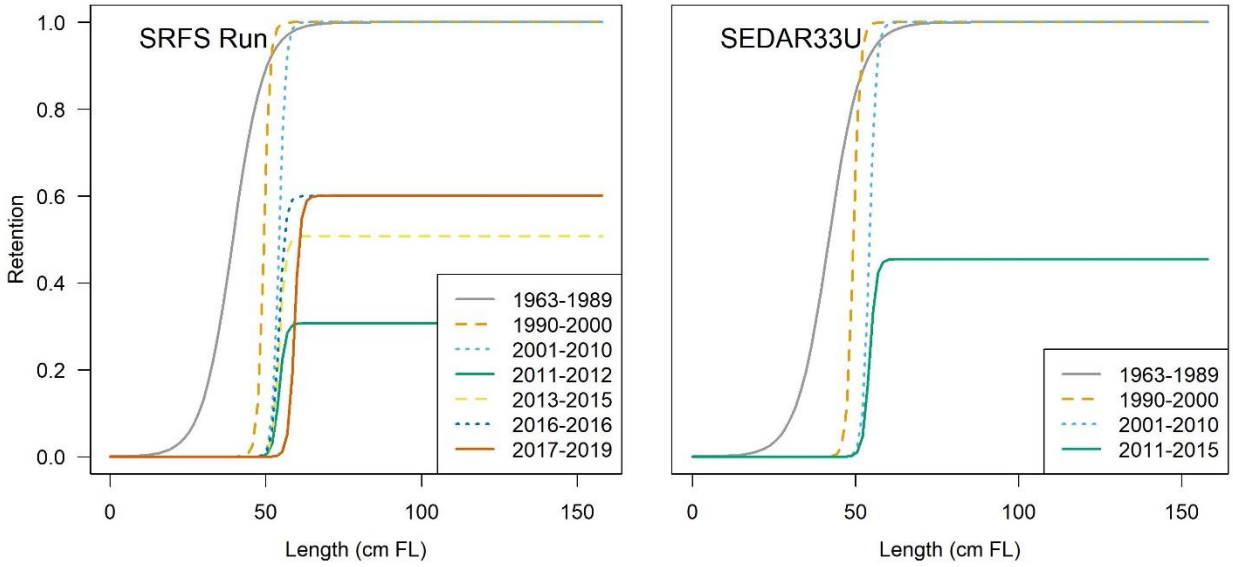


Figure 20. Time-varying retention functions for the Recreational Headboat fishery for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U.

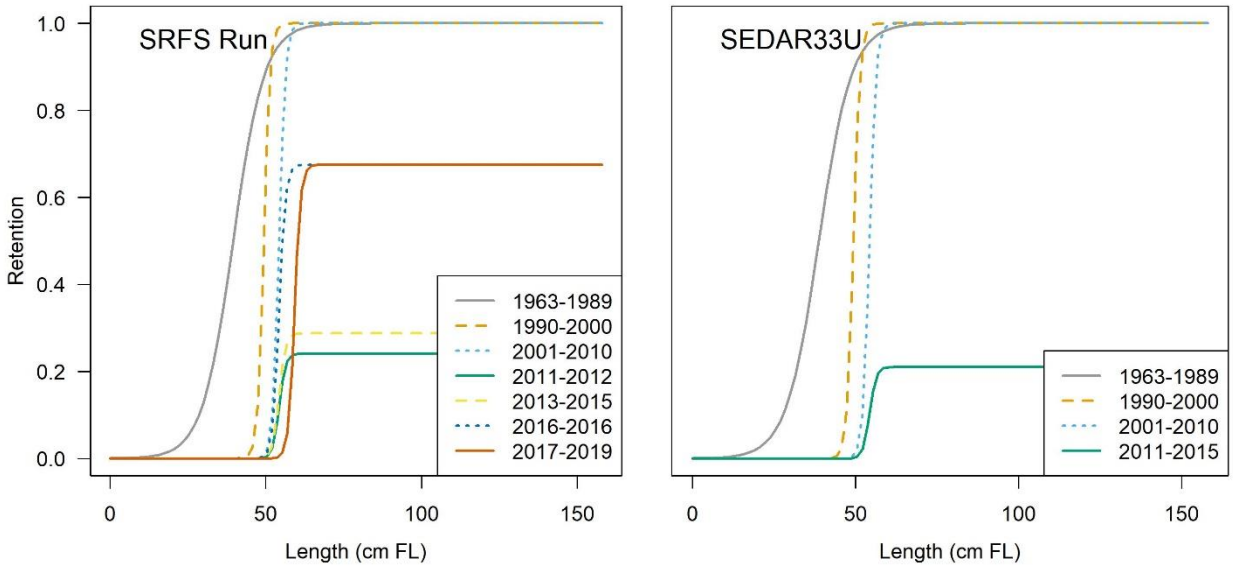


Figure 21. Time-varying retention functions for the Recreational Charter fishery for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U.

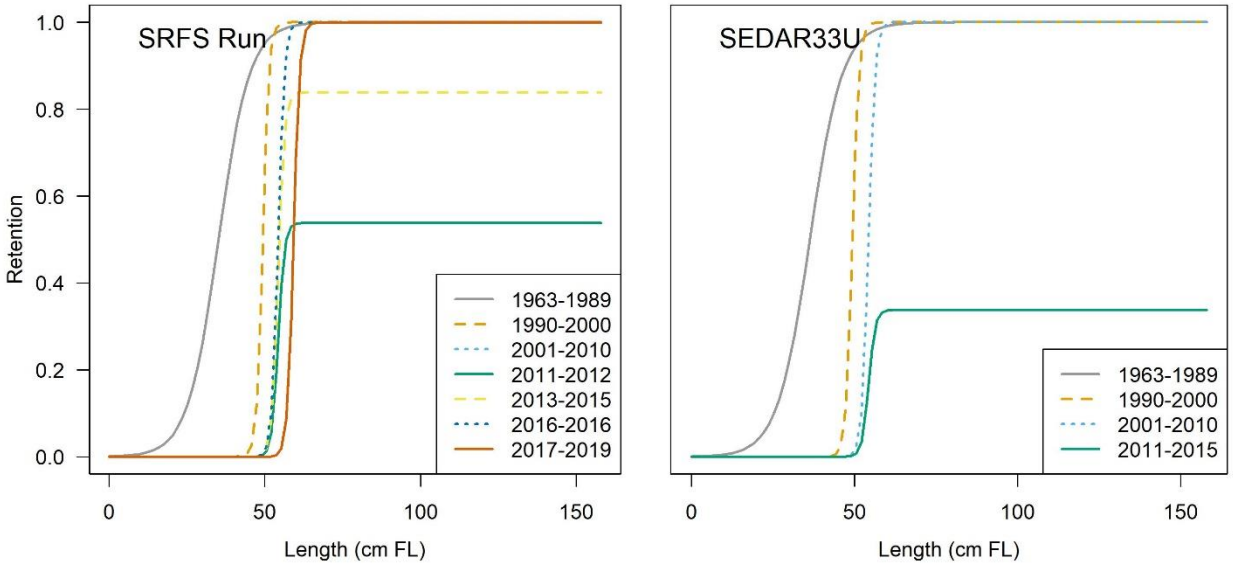
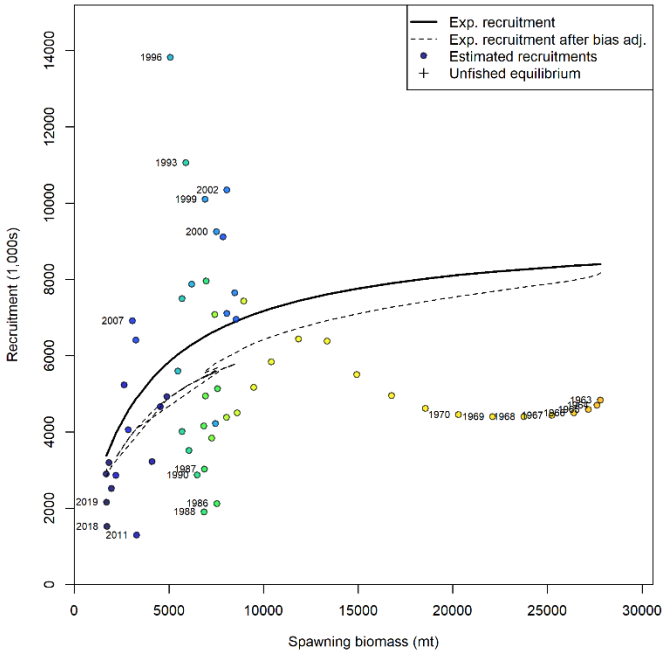


Figure 22. Time-varying retention functions for the Recreational Private + Shore fishery for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U.

SRFS Run



SEDAR 33U

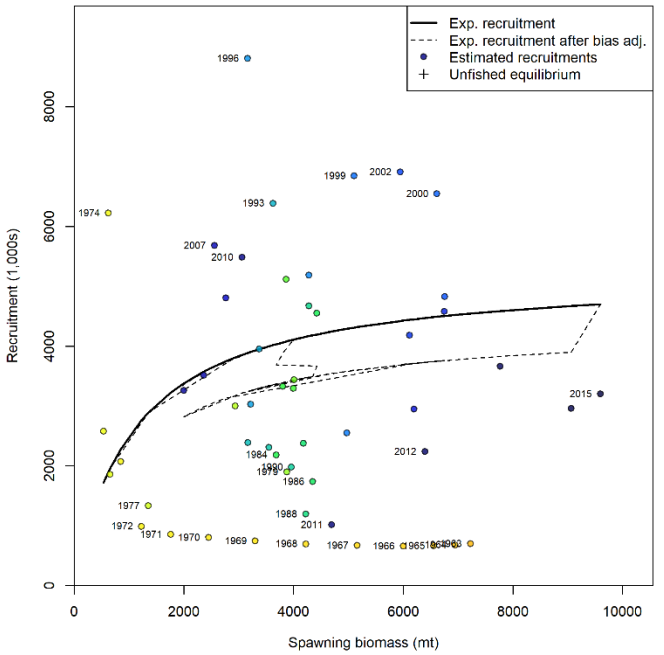
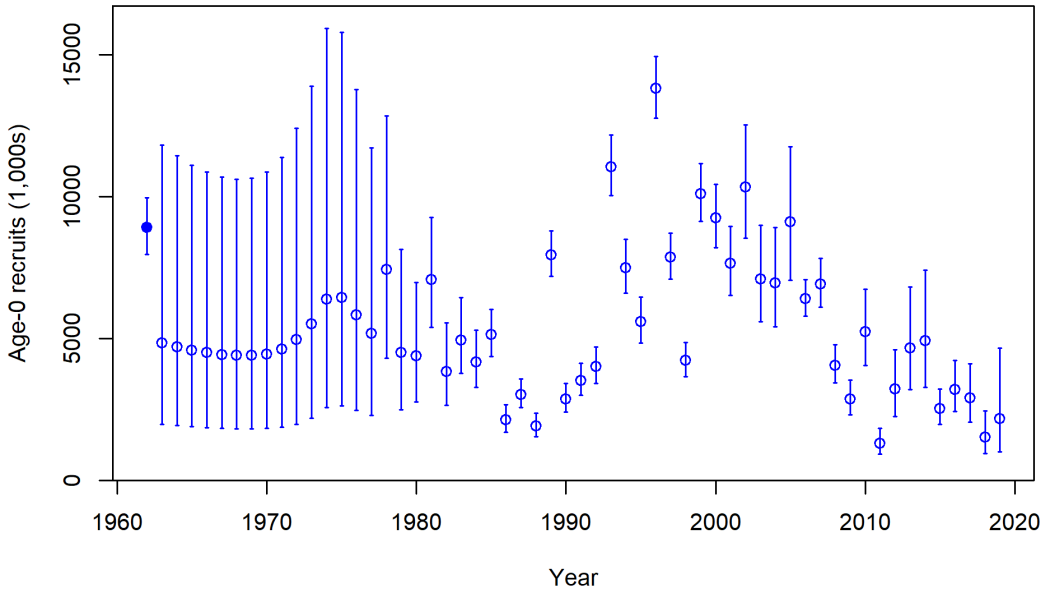


Figure 23. Predicted stock-recruitment relationship for Gulf of Mexico Gag Grouper (steepness and SigmaR were fixed at 0.855 and 0.6, respectively). Plotted are predicted annual recruitments from Stock Synthesis (circles), expected recruitment from the stock-recruit relationship (black line), and bias adjusted recruitment from the stock-recruit relationship (dashed line).

SRFS Run



SEDAR 33U

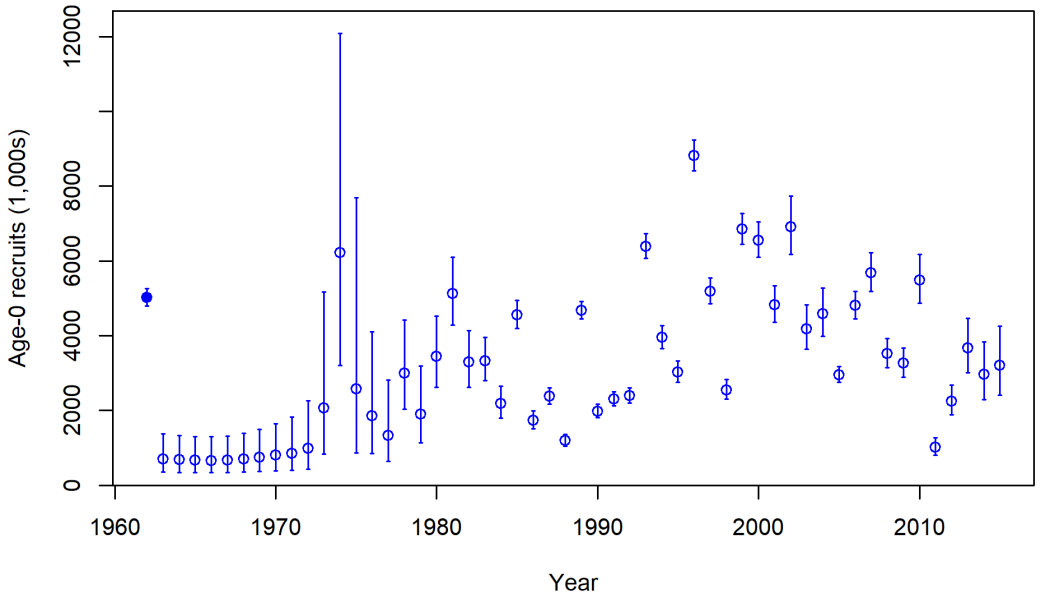
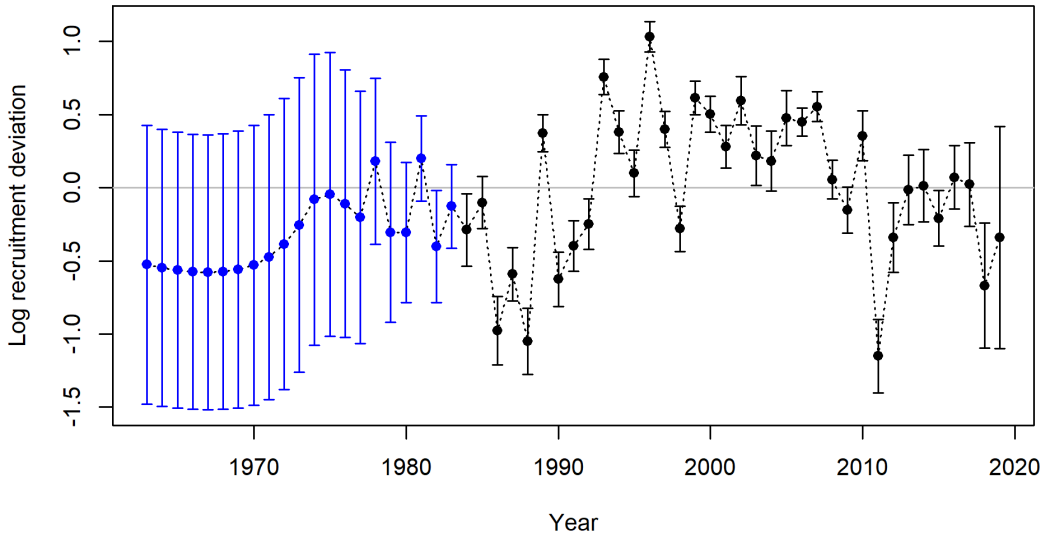


Figure 24. Estimated Age-0 recruitment with 95% confidence intervals for Gulf of Mexico Gag Grouper (steepness and SigmaR were fixed at 0.855 and 0.6, respectively).

SRFS Run



SEDAR 33U

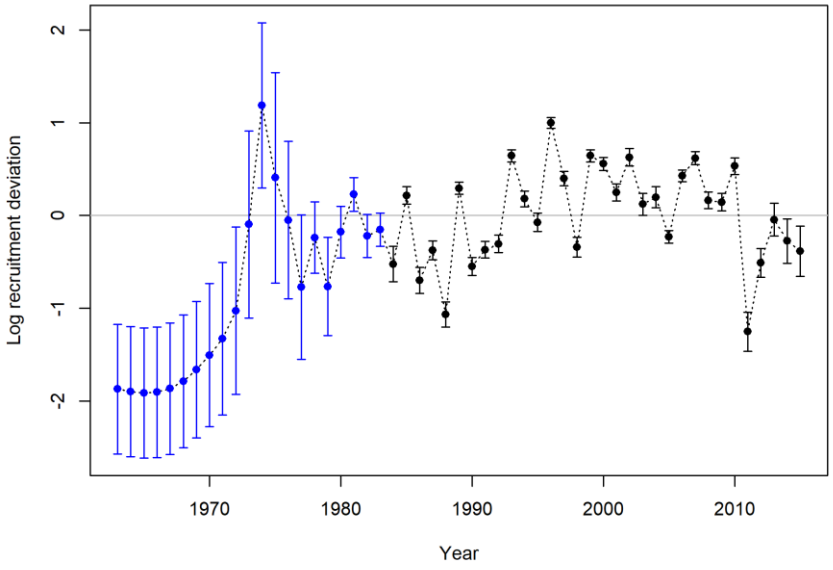
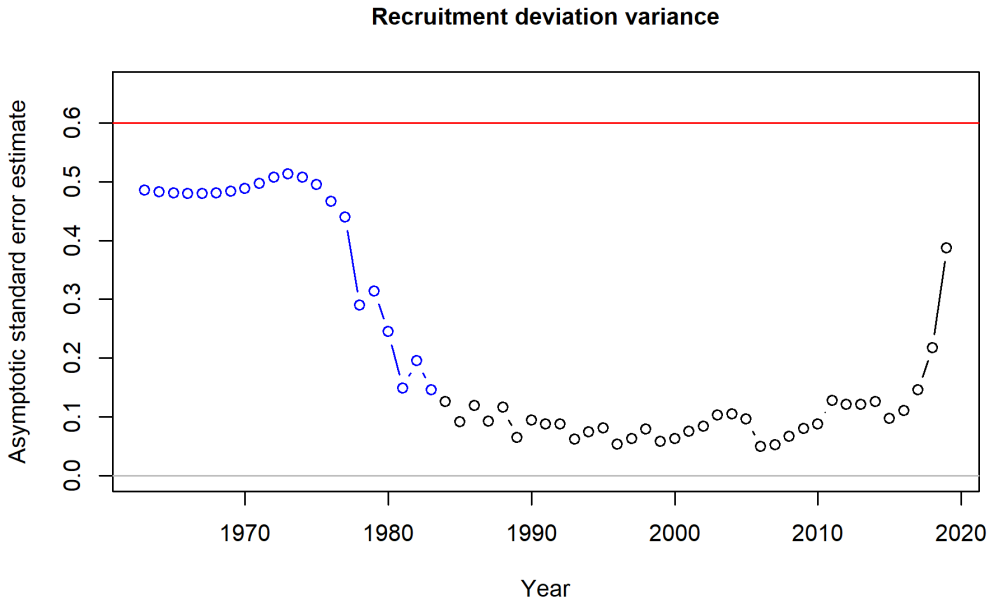


Figure 25. Estimated log recruitment deviations for Gulf of Mexico Gag Grouper (steepness and SigmaR were fixed at 0.855 and 0.6, respectively).

SRFS Run



SEDAR 33U

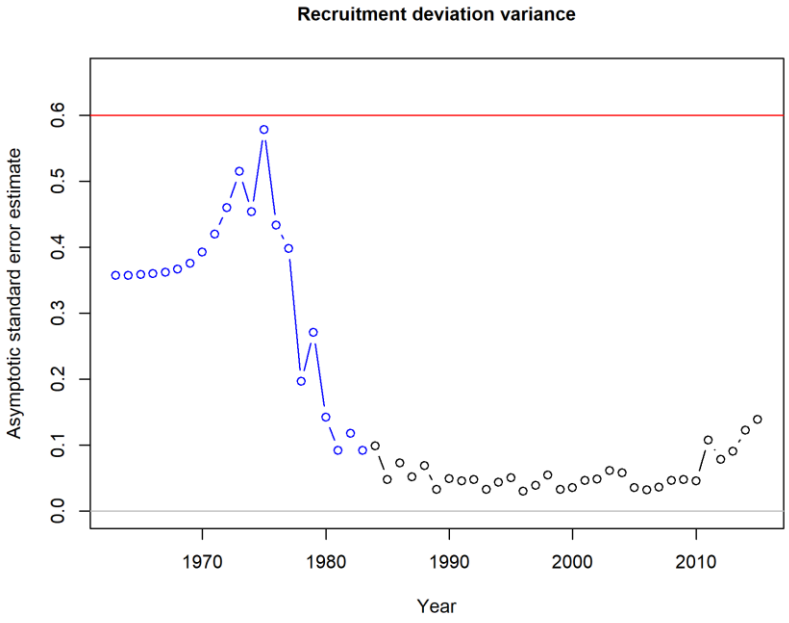


Figure 26. Asymptotic standard errors for recruitment deviations for Gulf of Mexico Gag Grouper. The red line represents the fixed value of 0.6 used in the SRFS Run and SEDAR 33U.

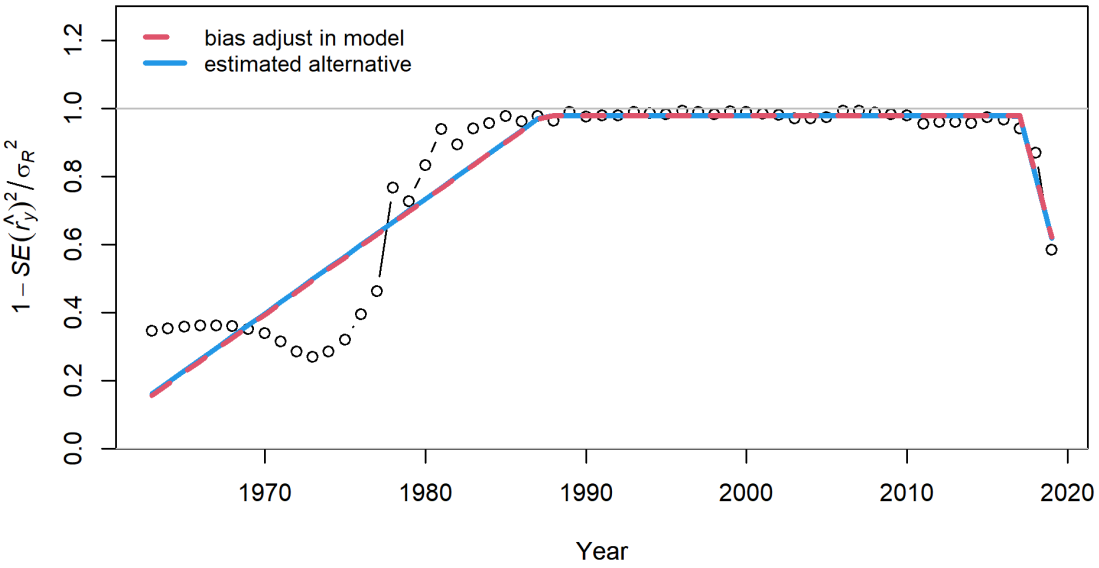


Figure 27. Points are transformed variances. Red line shows current settings for bias adjustment specified for the SRFS Run, which coincides with the least squares estimate of alternative bias adjustment relationship for recruitment deviations (dashed orange line). For more information, see Methot and Taylor (2011).

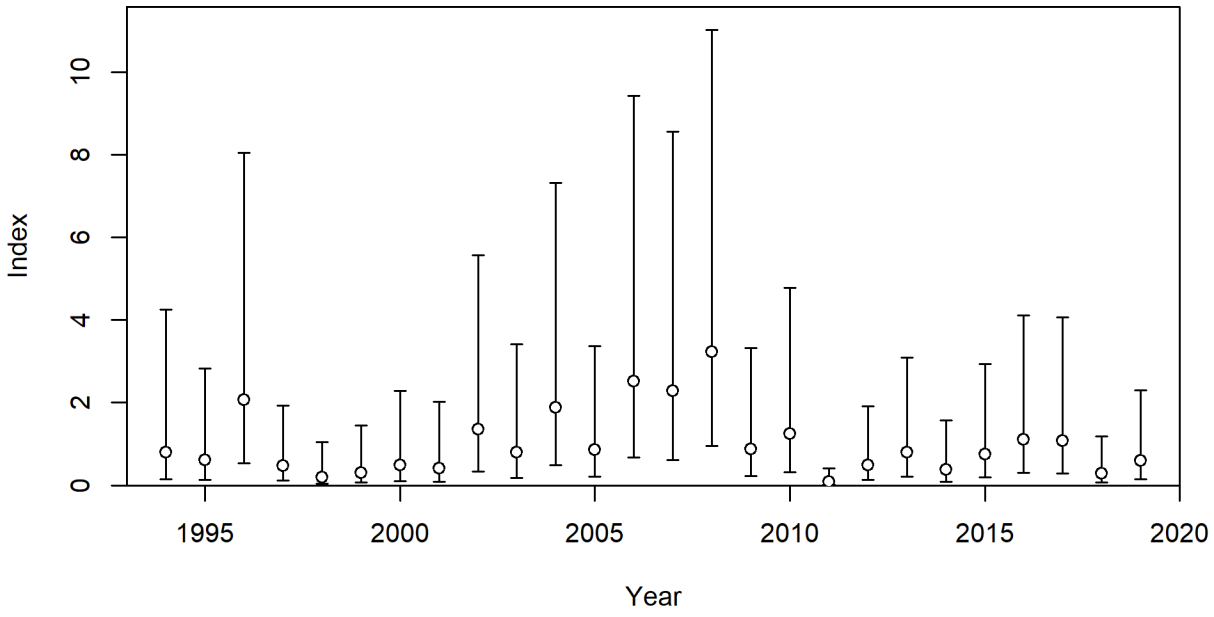


Figure 28. Standardized index of relative abundance and associated 95% uncertainty interval around index values based on the model assumption of lognormal error for Gulf of Mexico Gag Grouper from the Age-0 Survey. The uncertainty displayed includes the additional SE parameter estimated as part of the data weighting process.

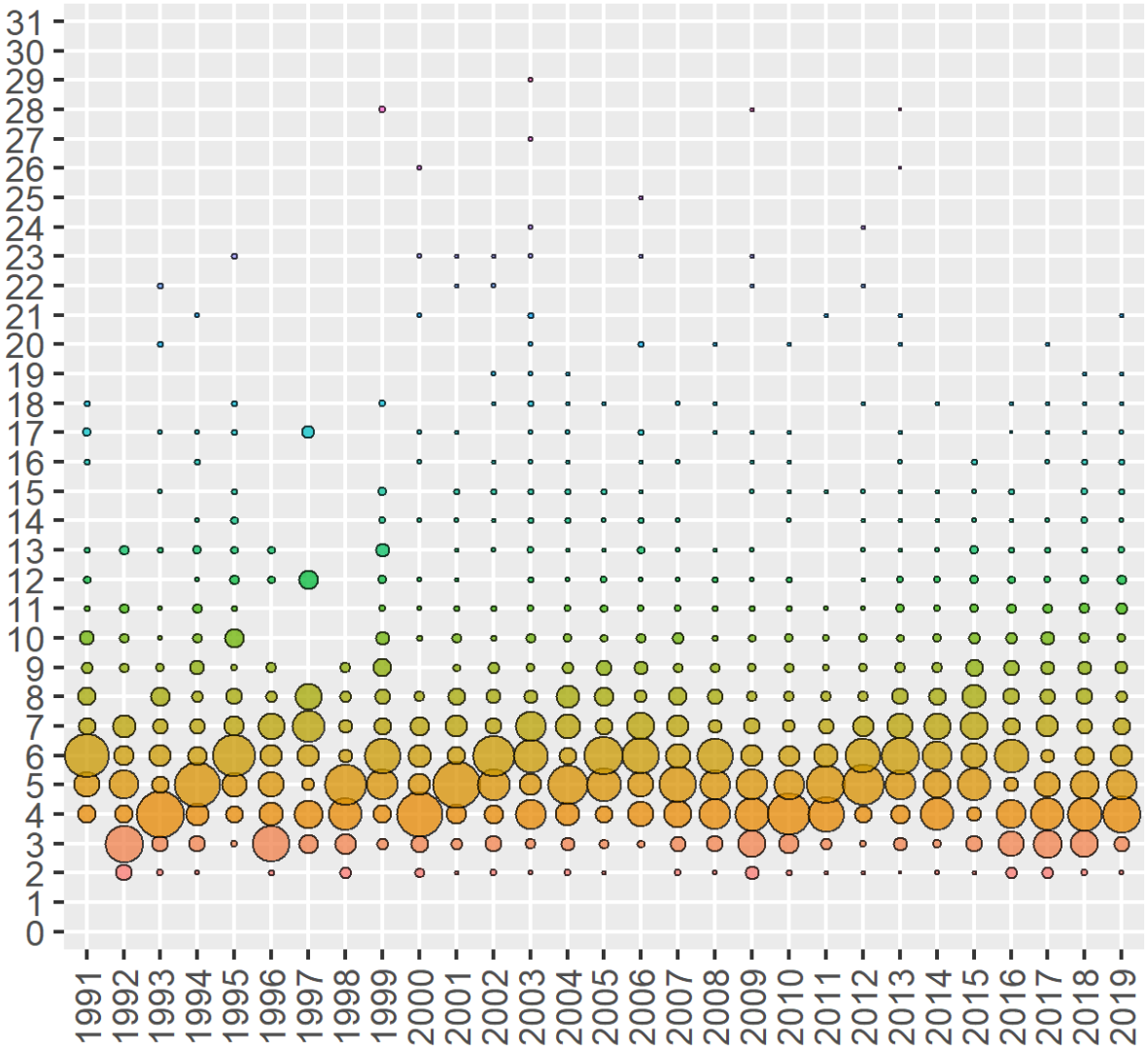


Figure 29. Observed relative age proportions in each year for Gulf of Mexico Gag Grouper in the Commercial Vertical Line + Other fishery. Cohort progressions are evident.

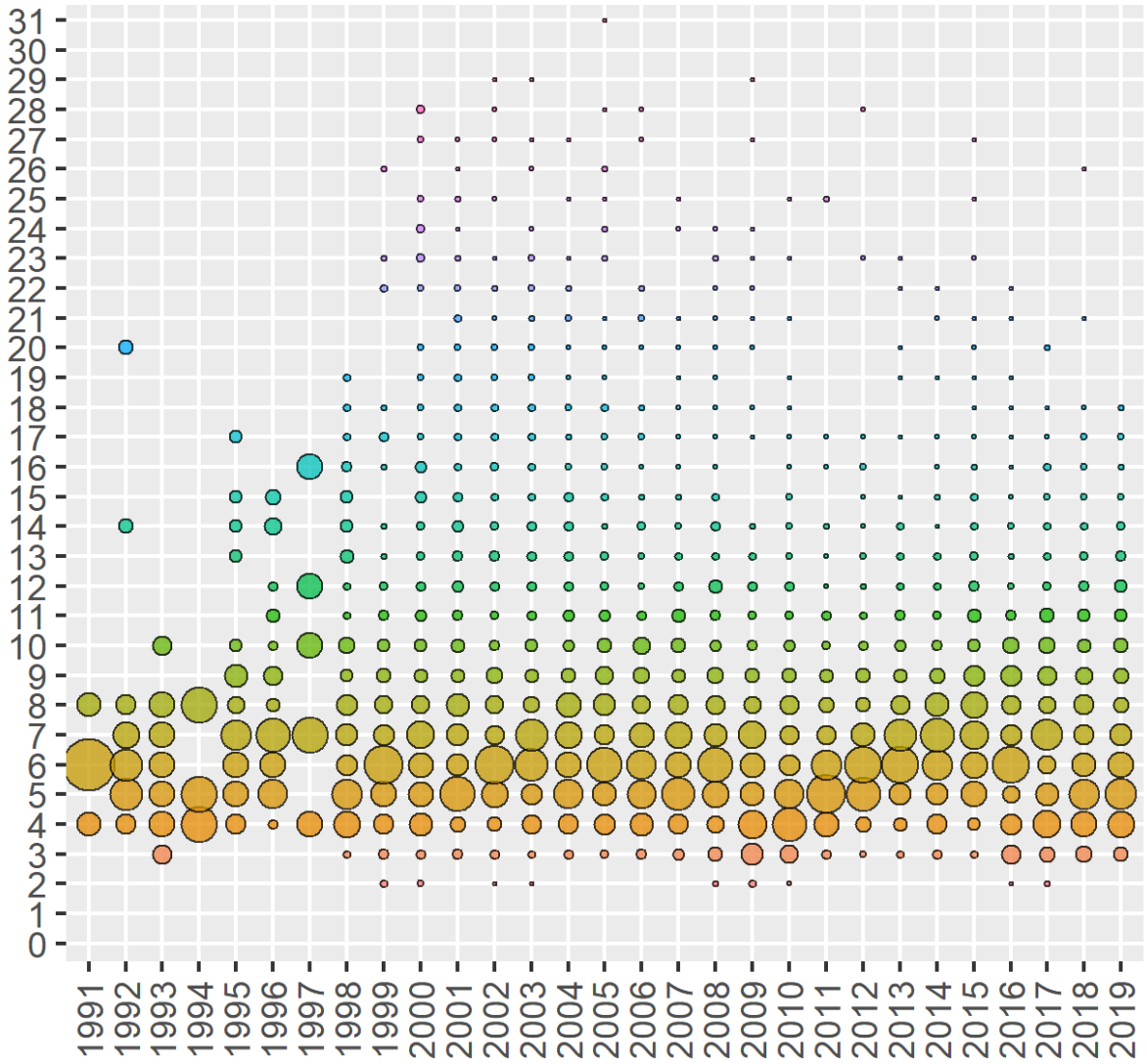


Figure 30. Observed relative age proportions in each year for Gulf of Mexico Gag Grouper in the Commercial Longline fishery. Cohort progressions are evident.

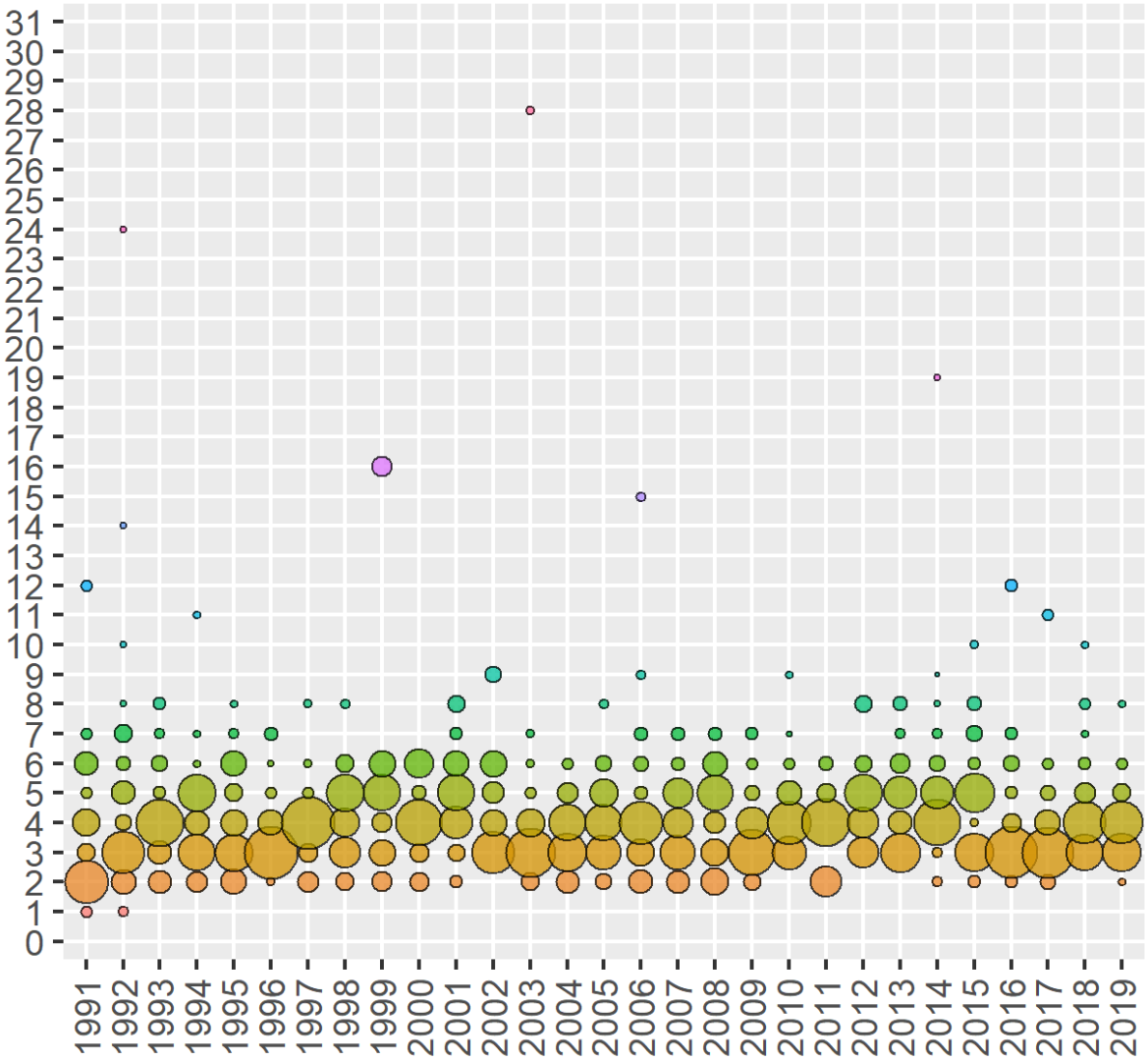


Figure 31. Observed relative age proportions in each year for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Cohort progressions are evident.

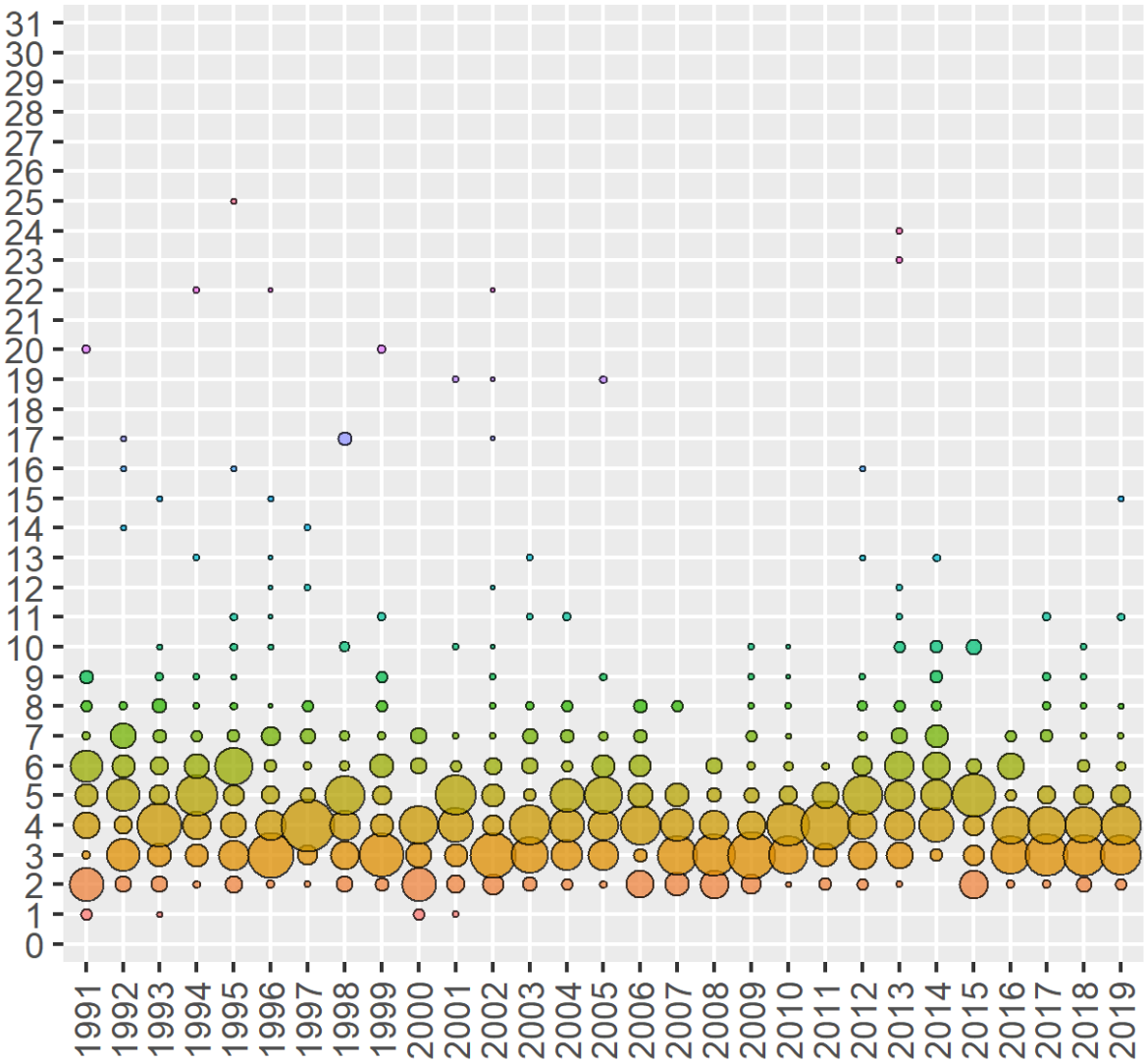


Figure 32. Observed relative age proportions in each year for Gulf of Mexico Gag Grouper in the Recreational Charter fishery. Cohort progressions are evident.

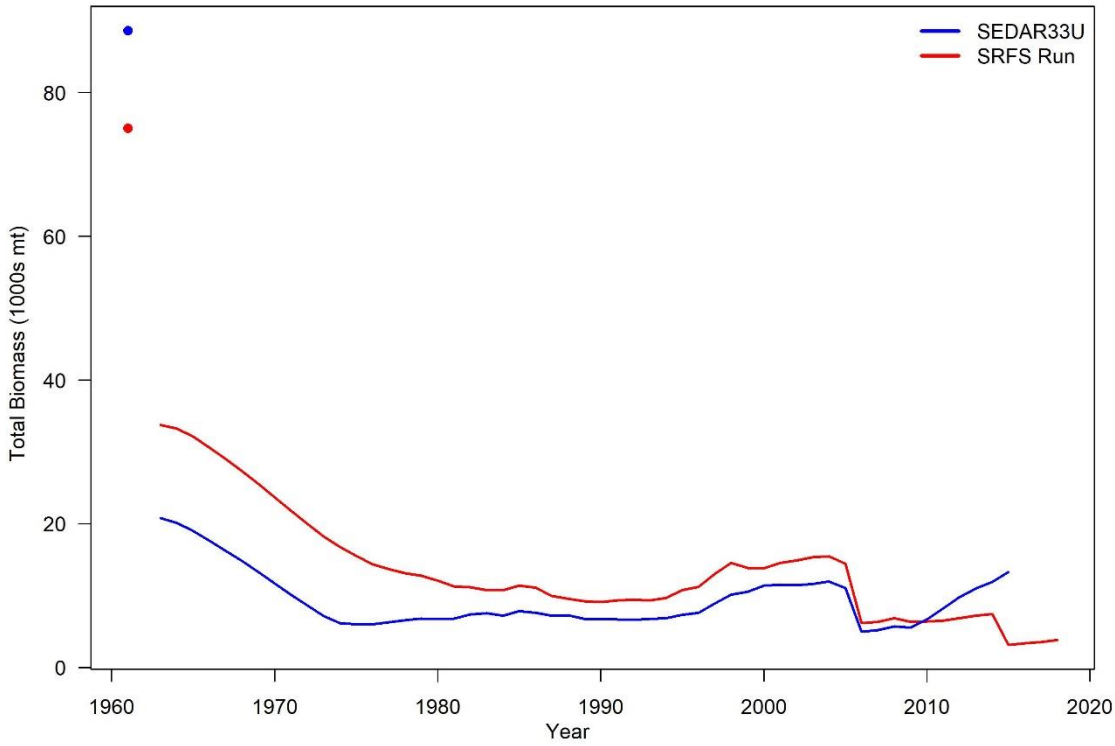


Figure 33. Estimate of total biomass (in 1000s of metric tons) for Gulf of Mexico Gag Grouper.

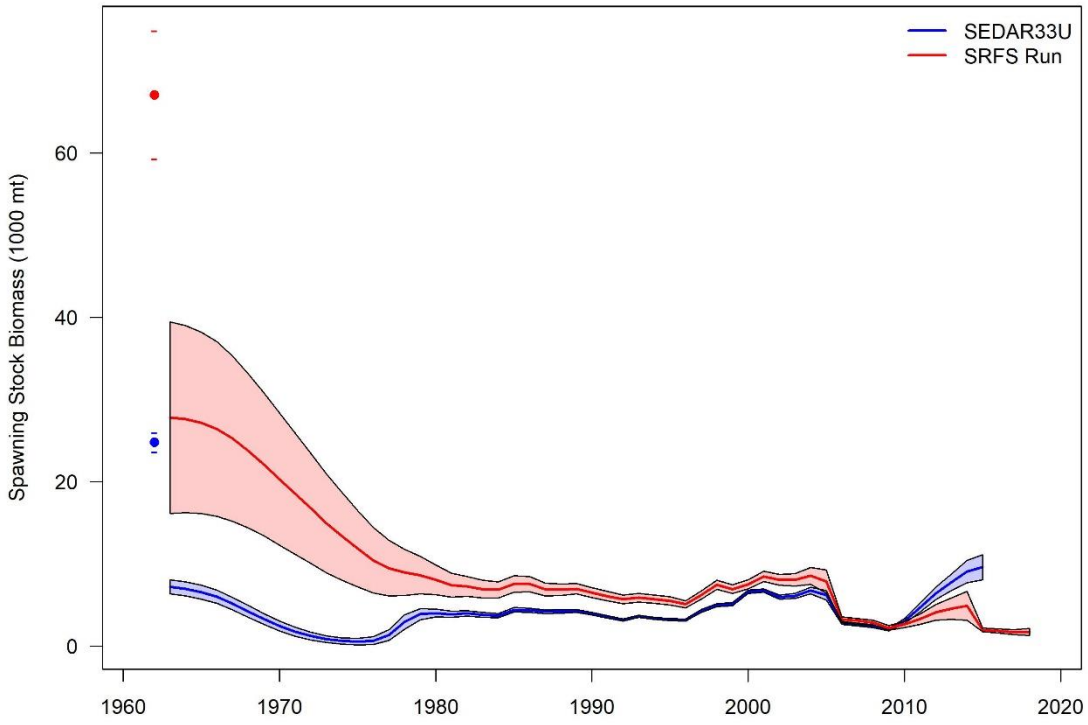


Figure 34. Estimate of spawning stock biomass (in 1000s of metric tons) and associated 95% confidence intervals for Gulf of Mexico Gag Grouper.

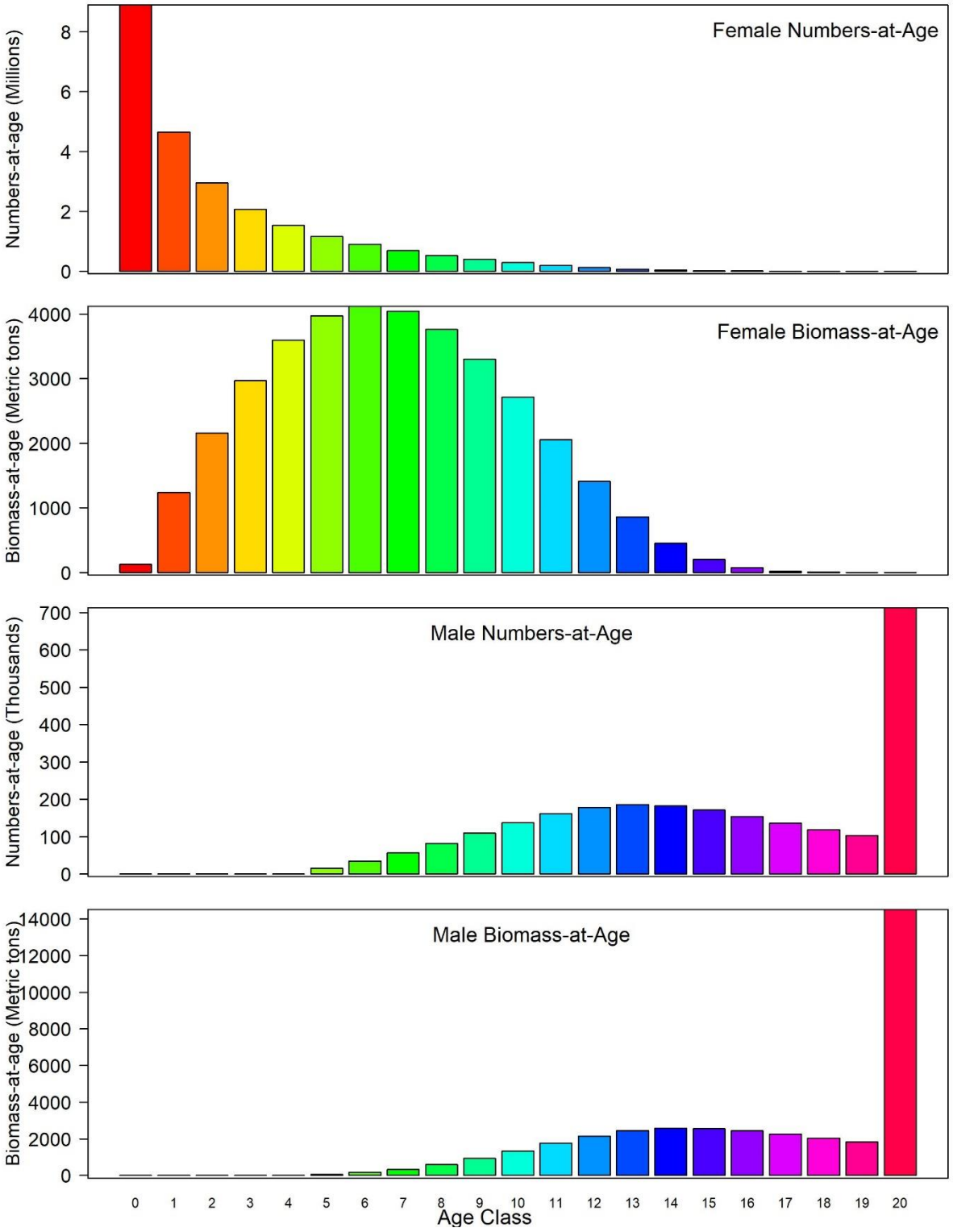
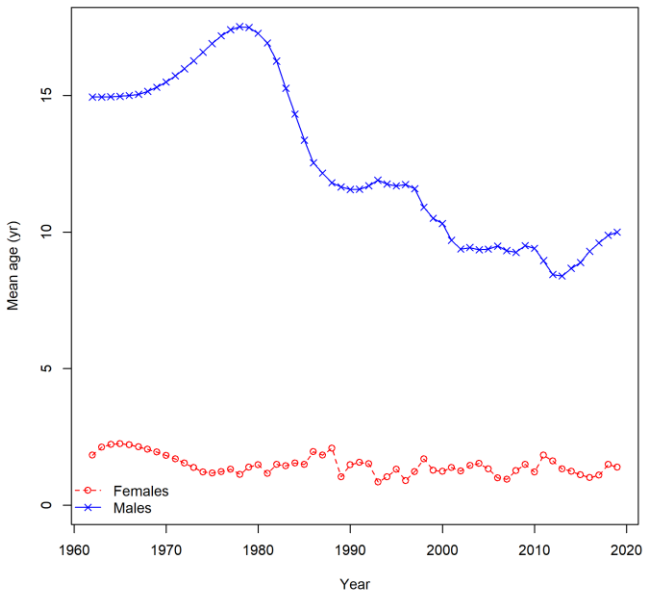


Figure 35. Expected numbers-at-age and biomass-at-age for female and male Gag Grouper in the Gulf of Mexico at virgin stock conditions.

SRFS Run



SEDAR 33U

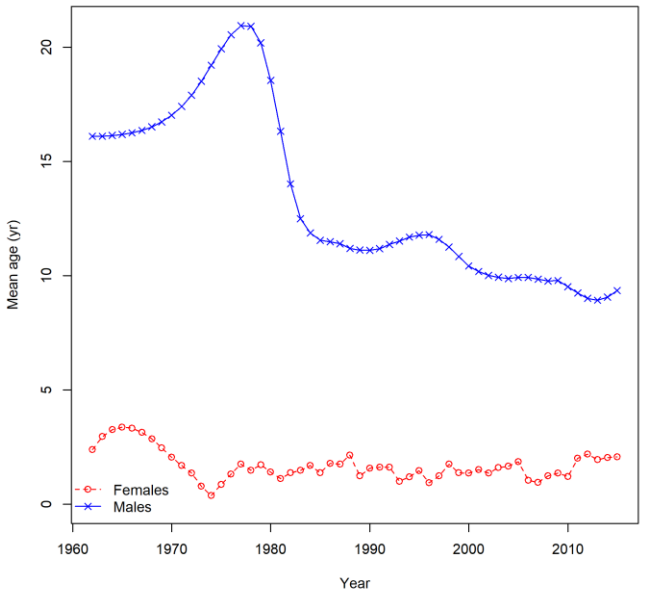


Figure 36. Predicted beginning of year mean age in the population by sex for Gulf of Mexico Gag Grouper.

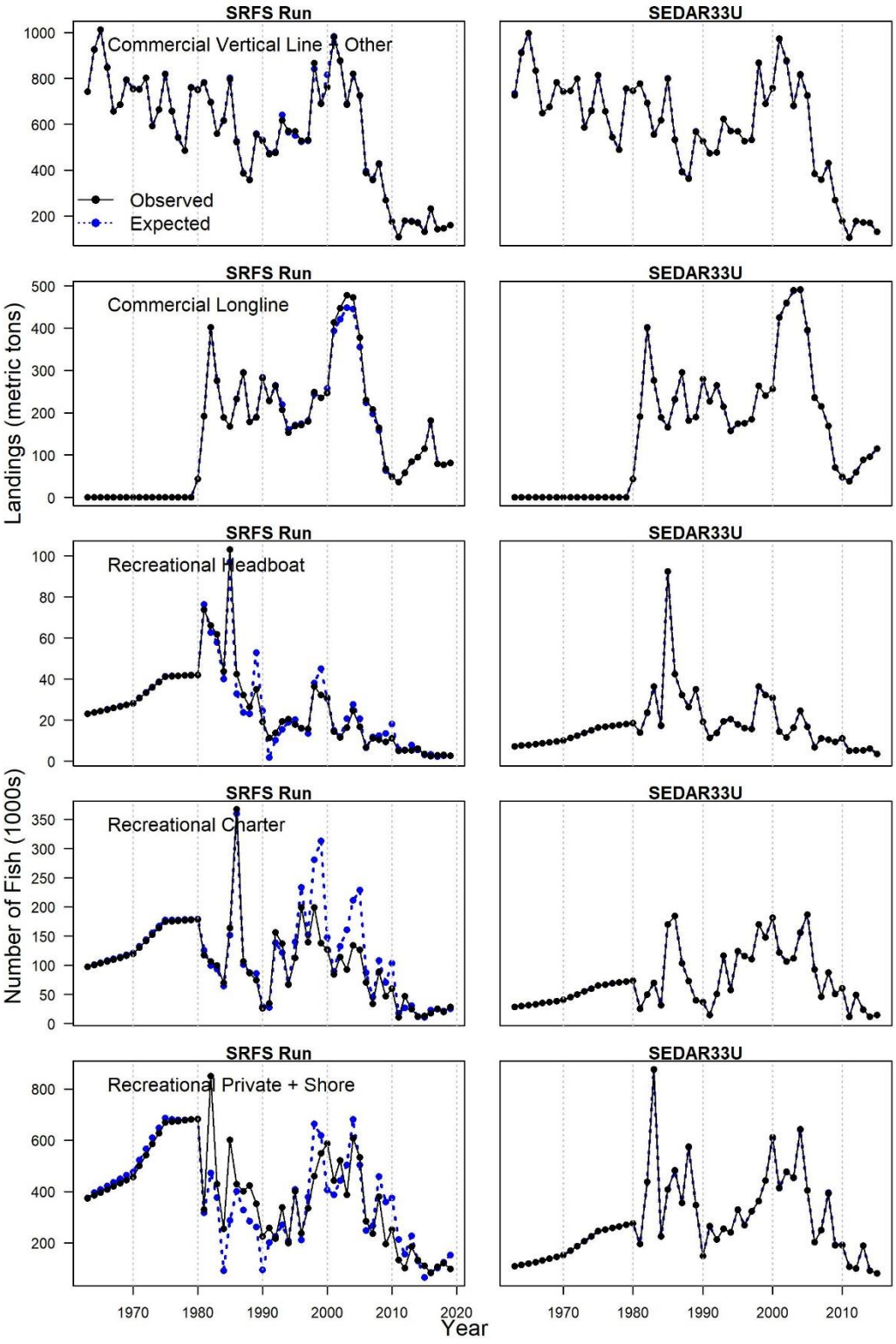


Figure 37. Gulf of Mexico Gag Grouper observed and expected landings by fishery for the SRFS Run (left panels) and SEDAR 33U (right panels). Commercial and recreational landings are in metric tons and numbers of fish, respectively. Dashed vertical lines identify ten-year intervals.

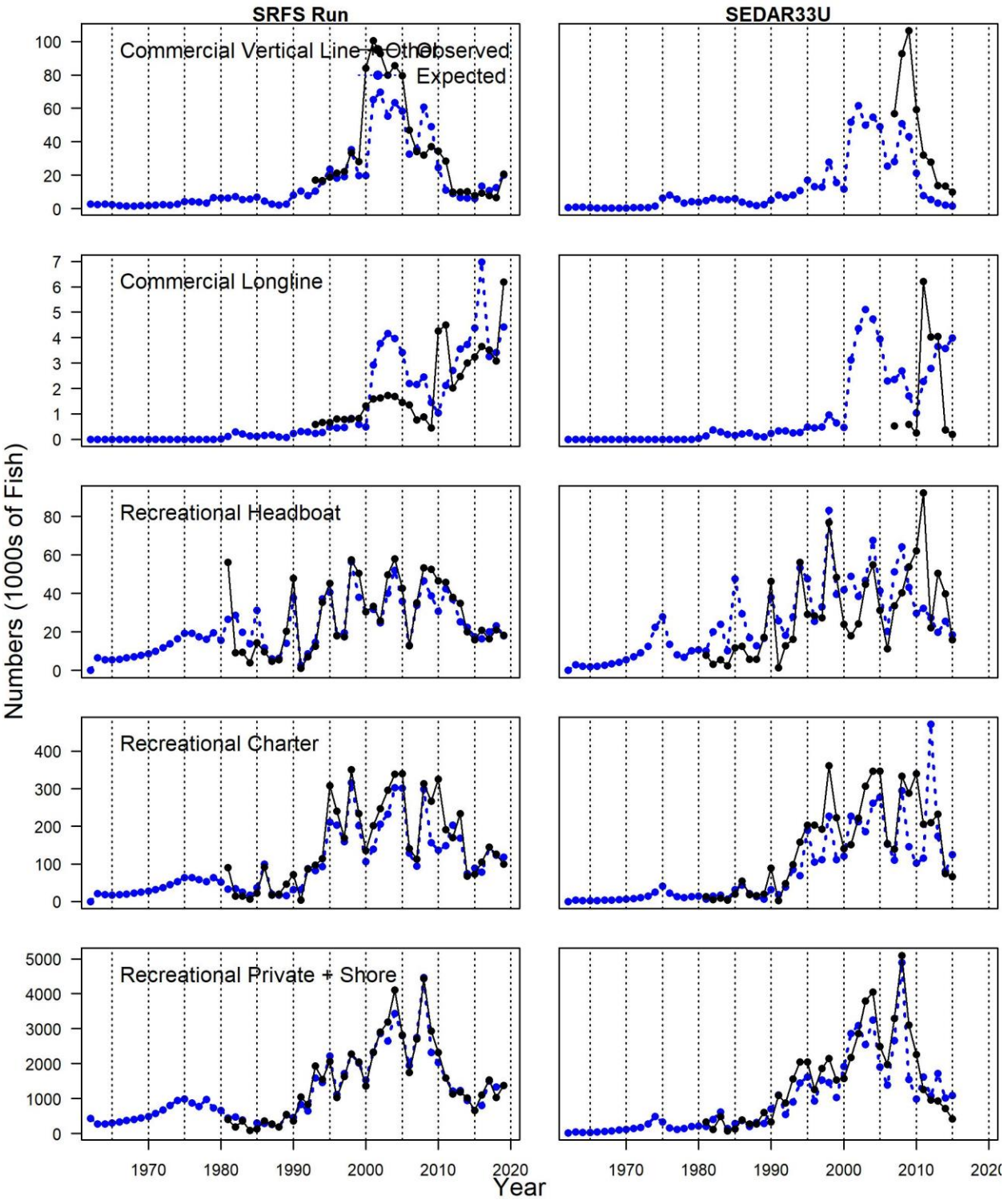


Figure 38. Gulf of Mexico Gag Grouper observed and expected discards by fishery for the SRFS Run (left panels) and SEDAR 33U (right panels). Commercial and recreational discards are in numbers of fish, respectively. Dashed vertical lines identify five-year intervals.

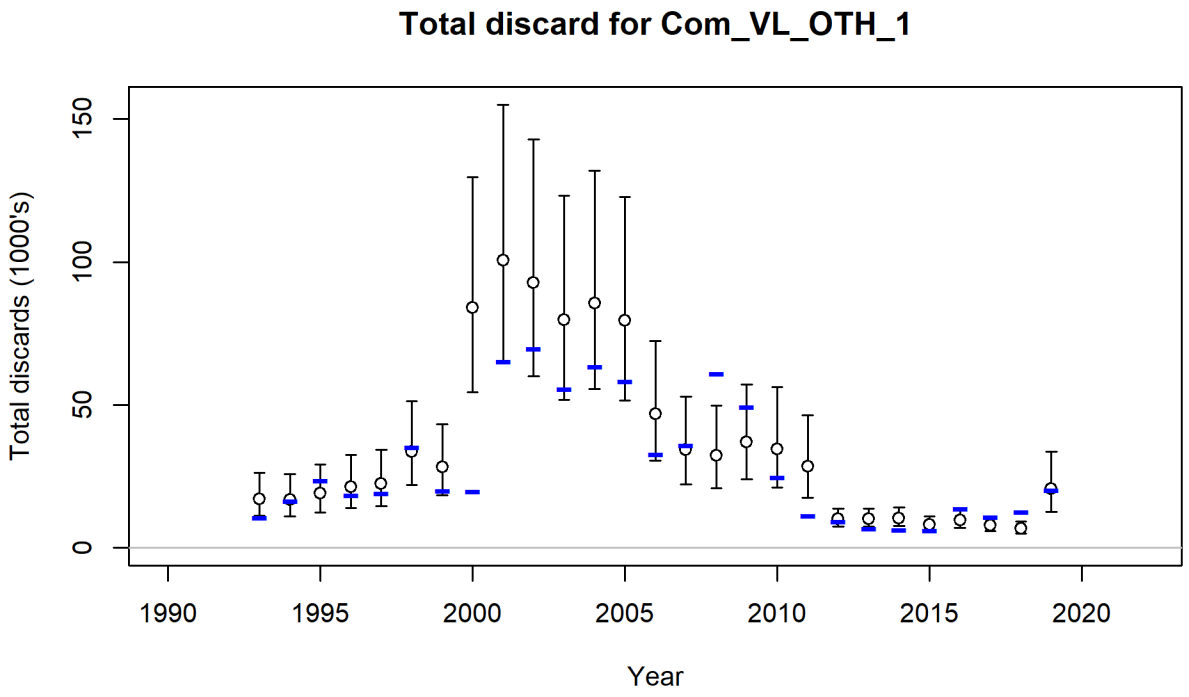


Figure 39. Input (dots with 95% confidence intervals) and expected (blue lines) discards by the Commercial Vertical Line + Other for Gulf of Mexico Gag Grouper. Discards are in numbers of fish (1,000s) and reflect released fish (i.e., before discard mortality has been applied).

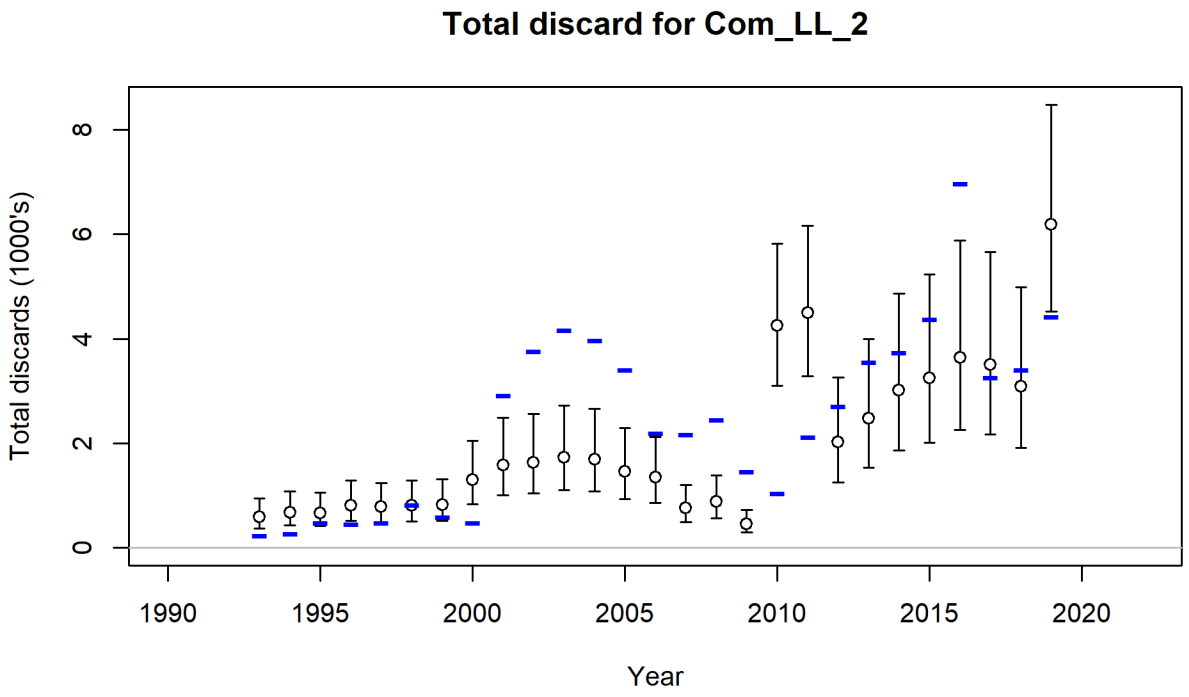


Figure 40. Input (dots with 95% confidence intervals) and expected (blue lines) discards by the Commercial Longline for Gulf of Mexico Gag Grouper. Discards are in numbers of fish (1,000s) and reflect released fish (i.e., before discard mortality has been applied).

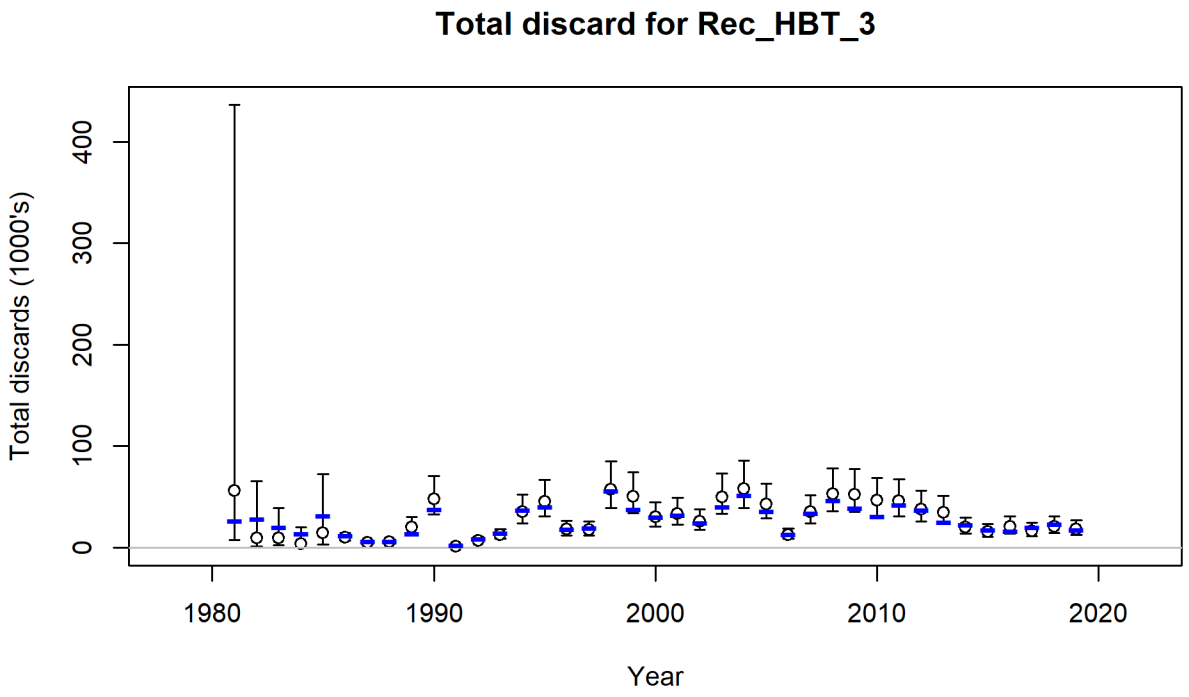


Figure 41. Input (dots with 95% confidence intervals) and expected (blue lines) discards by the Recreational Headboat for Gulf of Mexico Gag Grouper. Discards are in numbers of fish (1,000s) and reflect released fish (i.e., before discard mortality has been applied).

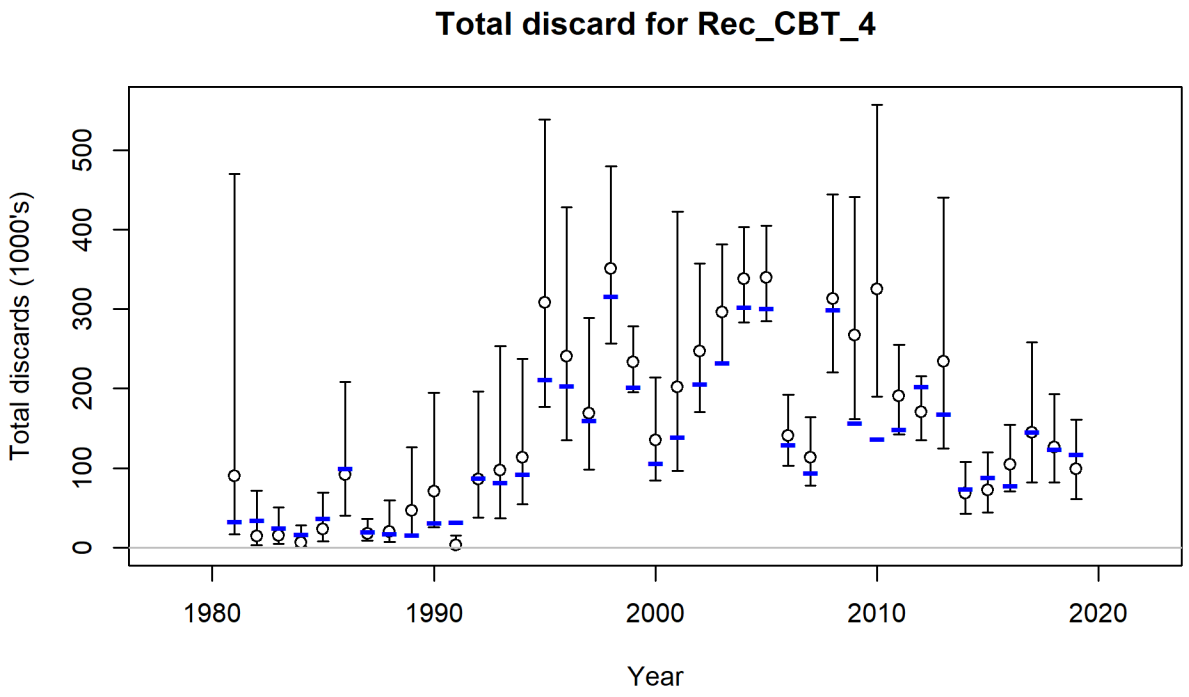


Figure 42. Input (dots with 95% confidence intervals) and expected (blue lines) discards by the Recreational Charter for Gulf of Mexico Gag Grouper. Discards are in numbers of fish (1,000s) and reflect released fish (i.e., before discard mortality has been applied).

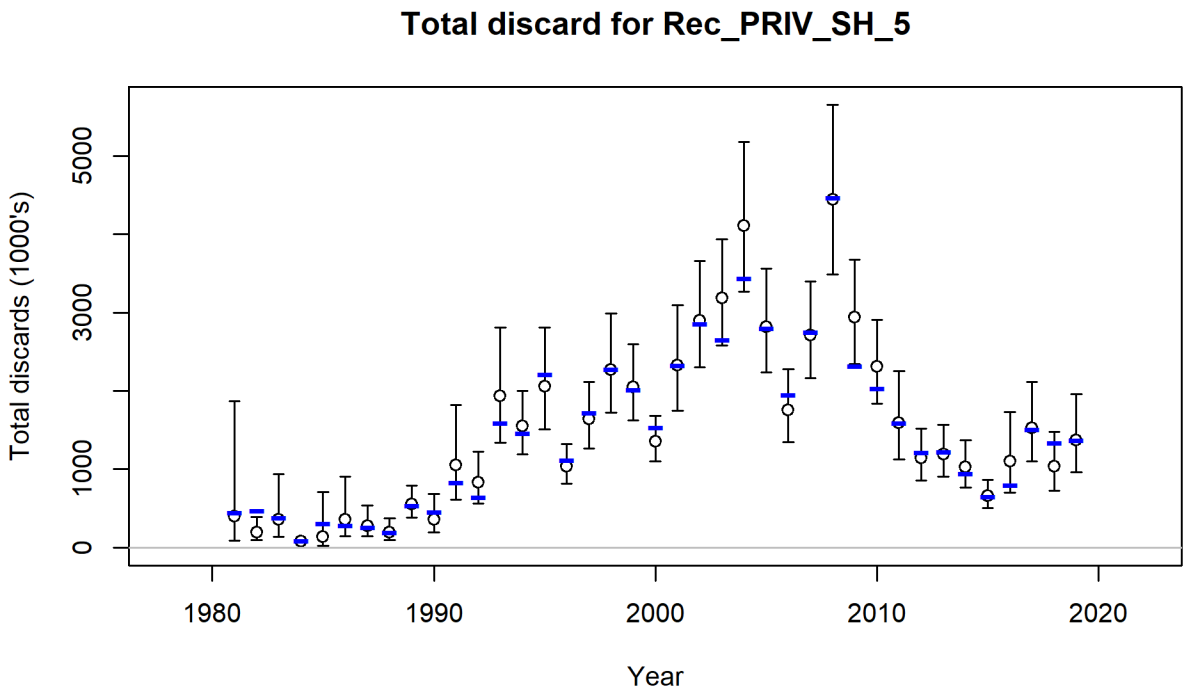


Figure 43. Input (dots with 95% confidence intervals) and expected (blue lines) discards by the Recreational Private + Shore for Gulf of Mexico Gag Grouper. Discards are in numbers of fish (1,000s) and reflect released fish (i.e., before discard mortality has been applied).

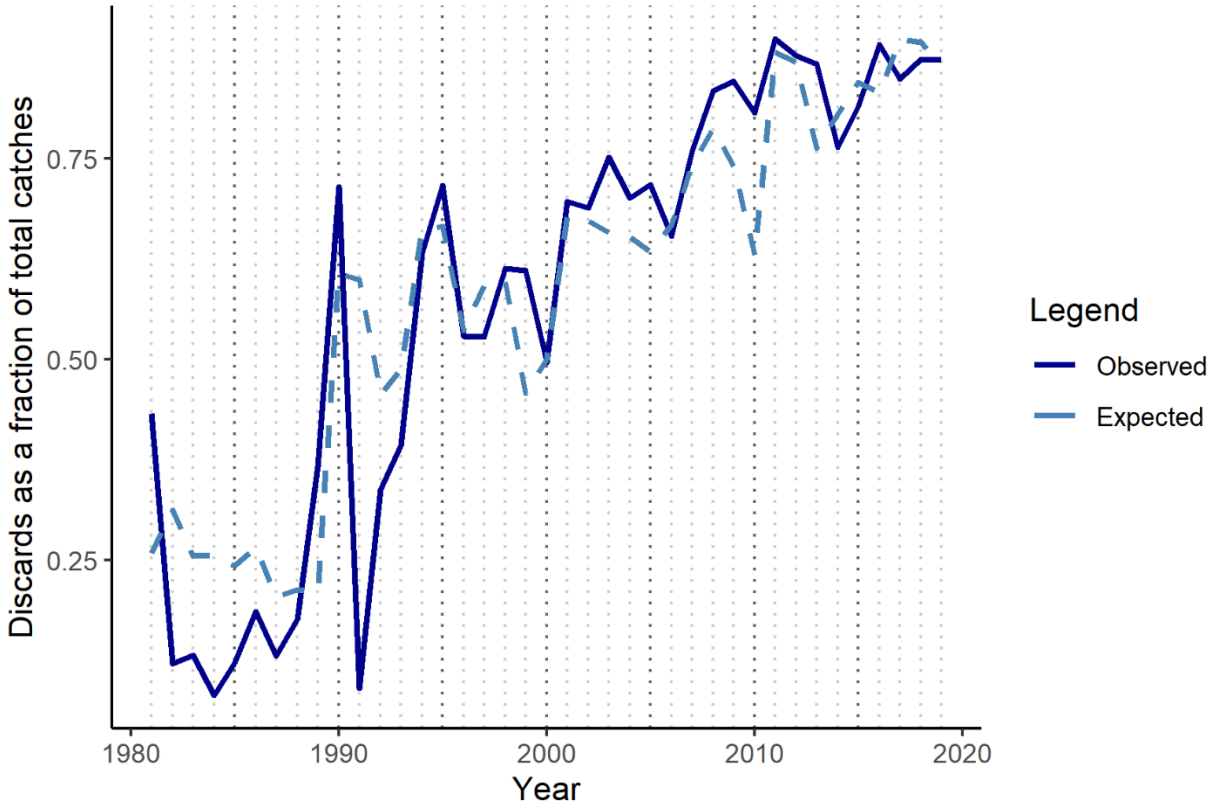


Figure 44. Observed and expected discard rates by the Recreational Headboat for Gulf of Mexico Gag Grouper.

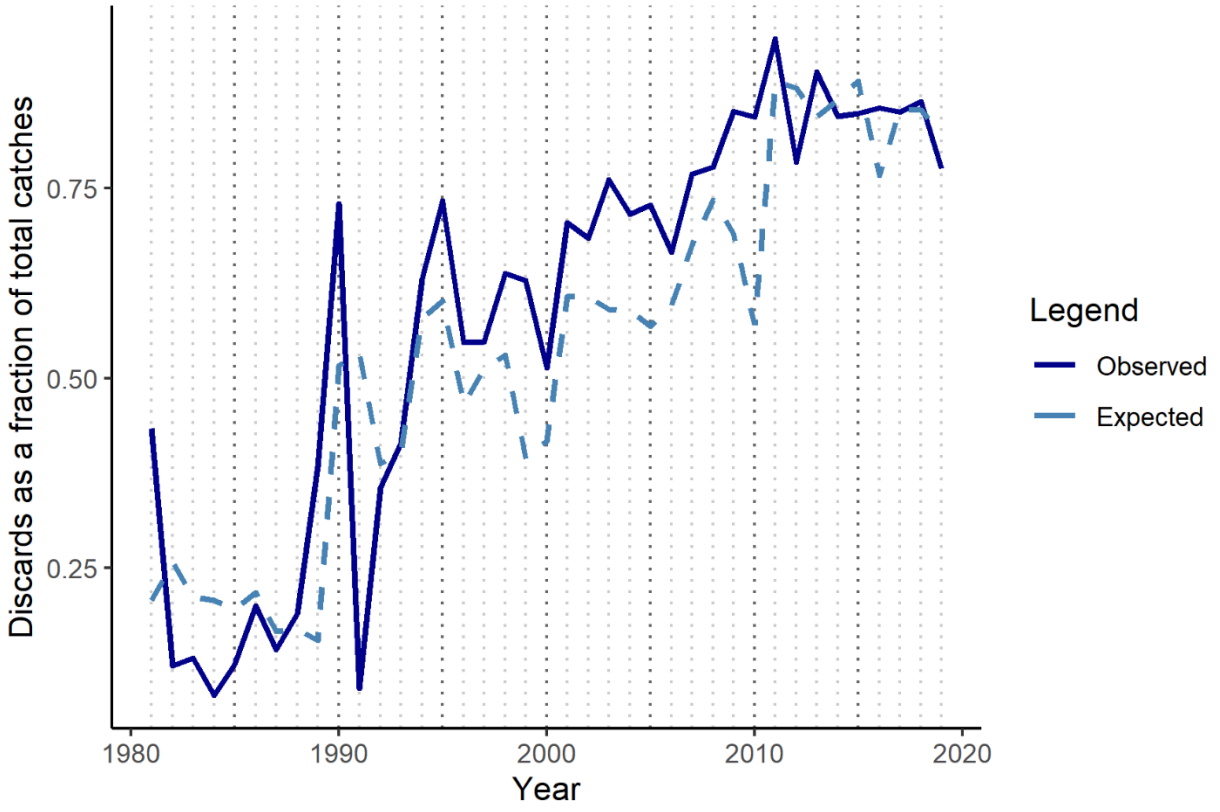


Figure 45. Observed and expected discard rates by the Recreational Charter for Gulf of Mexico Gag Grouper.

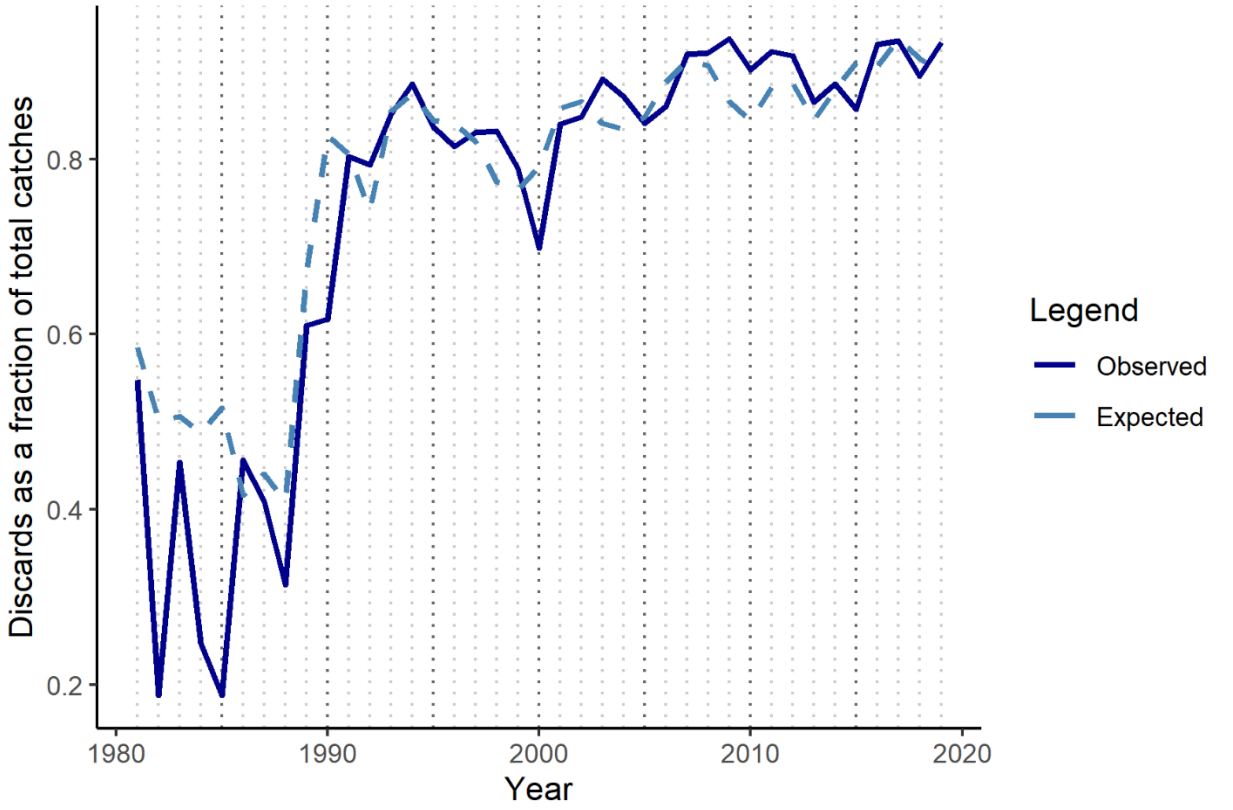


Figure 46. Observed and expected discard rates by the Recreational Private + Shore for Gulf of Mexico Gag Grouper.

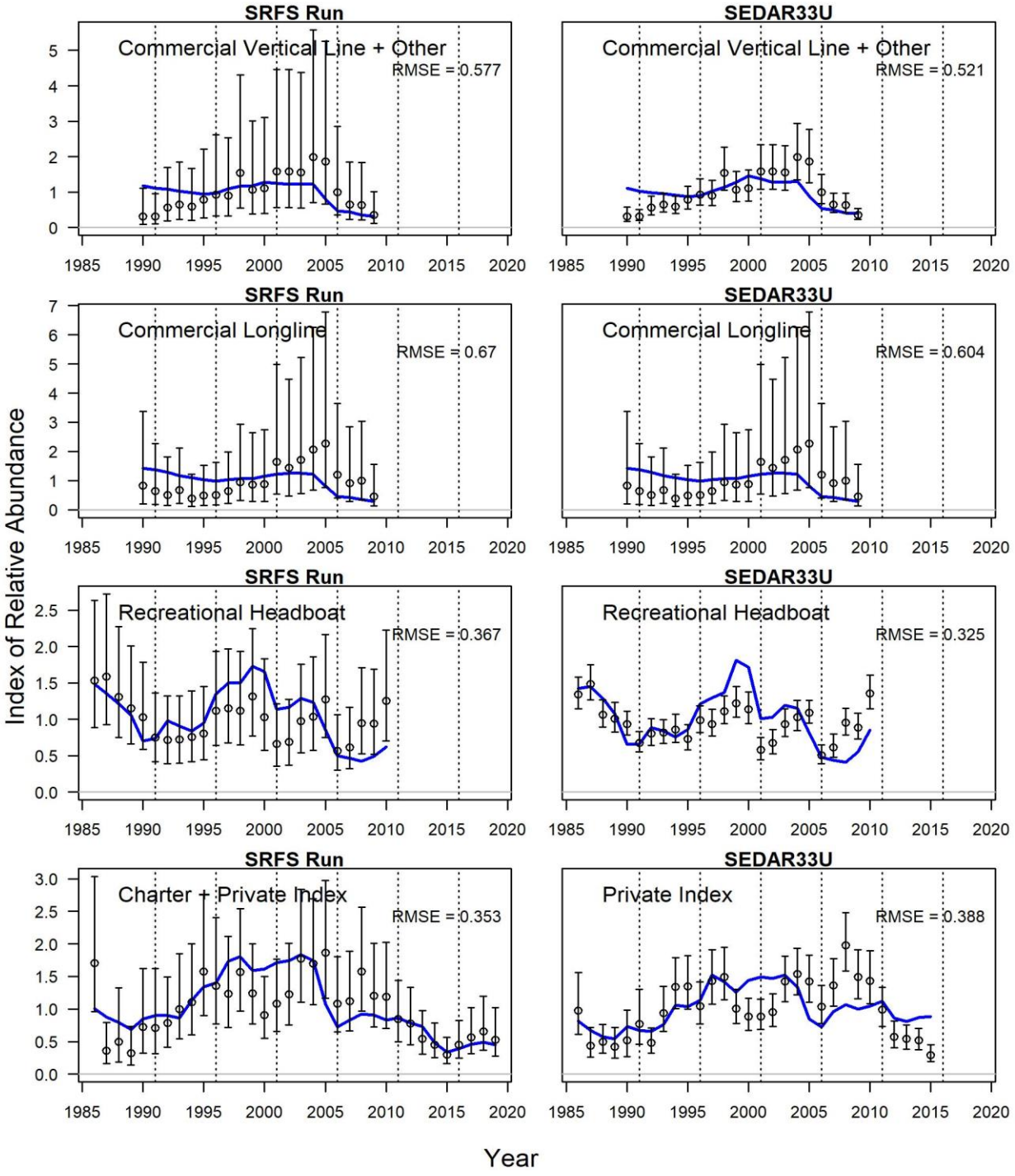


Figure 47. Gulf of Mexico Gag Grouper observed and expected indices for the SRFS Run (left panels) and SEDAR 33U (right panels). Dashed vertical lines identify five-year intervals. The root mean squared error (RMSE) is also provided.

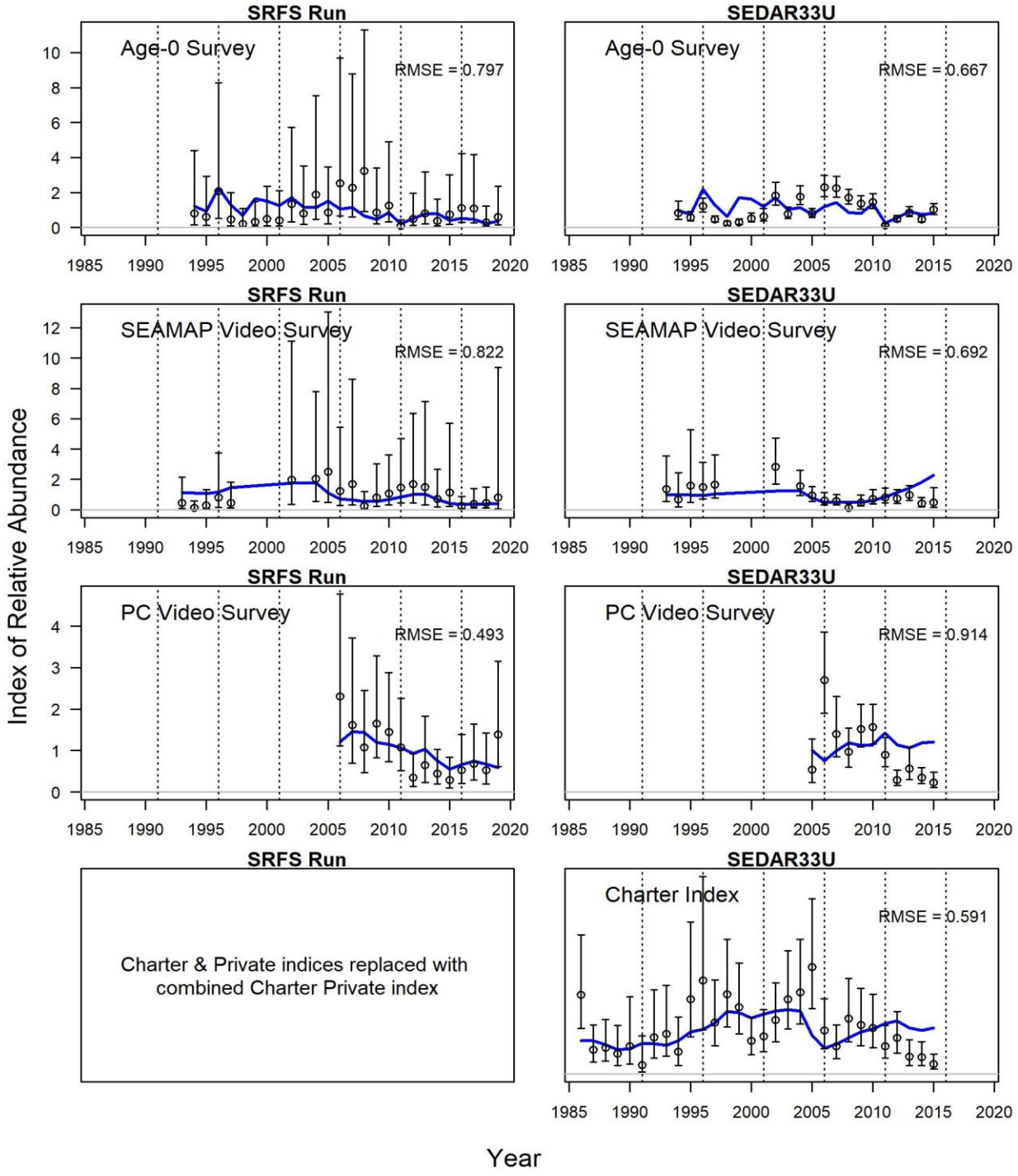


Figure 47 Continued. Gulf of Mexico Gag Grouper observed and expected indices for the SRFS Run (left panels) and SEDAR 33U (right panels). Dashed vertical lines identify five-year intervals. The root mean squared error (RMSE) is also provided.

SRFS Run

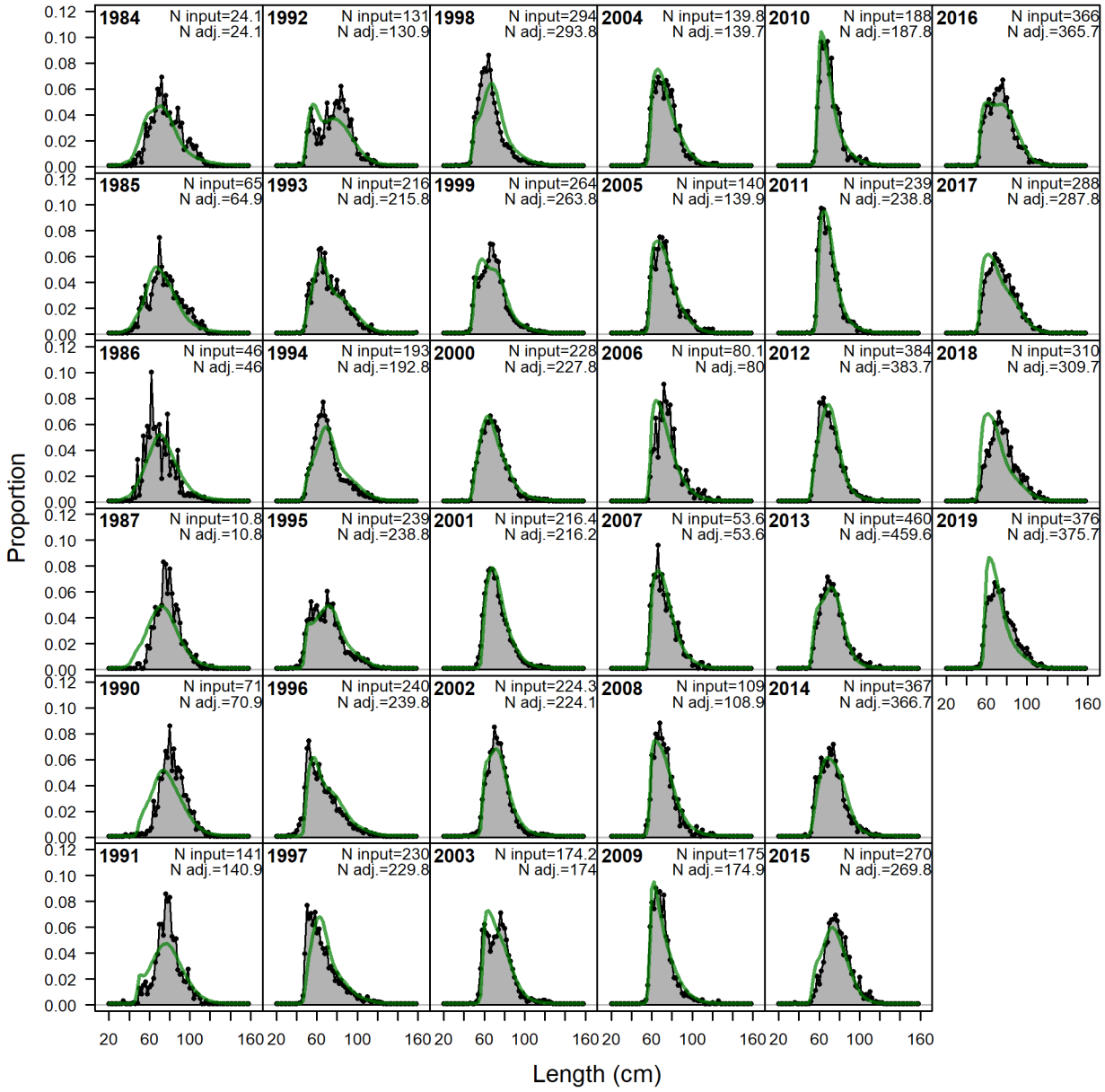


Figure 48. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Vertical Line + Other fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

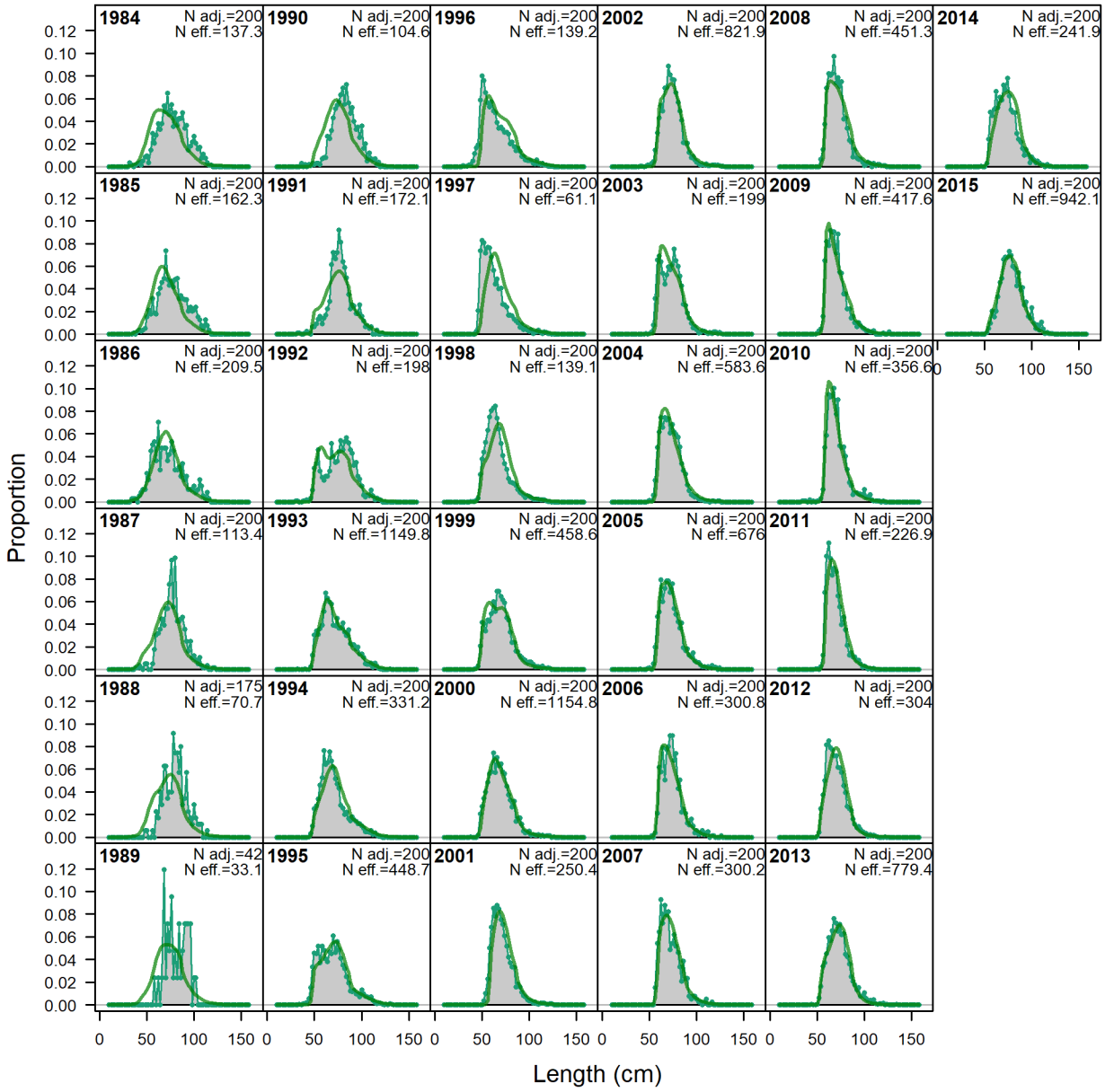


Figure 48 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Vertical Line + Other fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

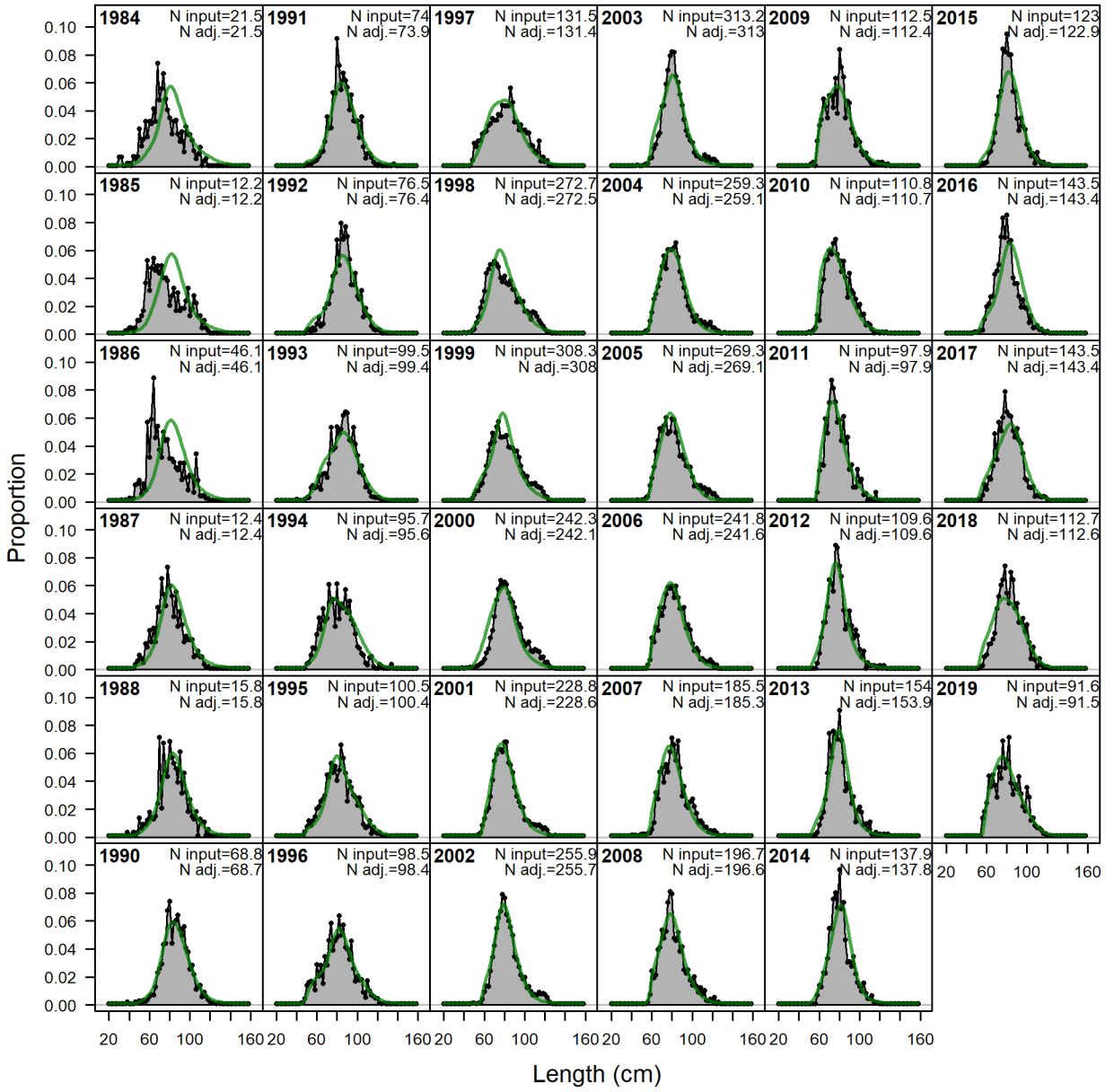


Figure 49. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Longline fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

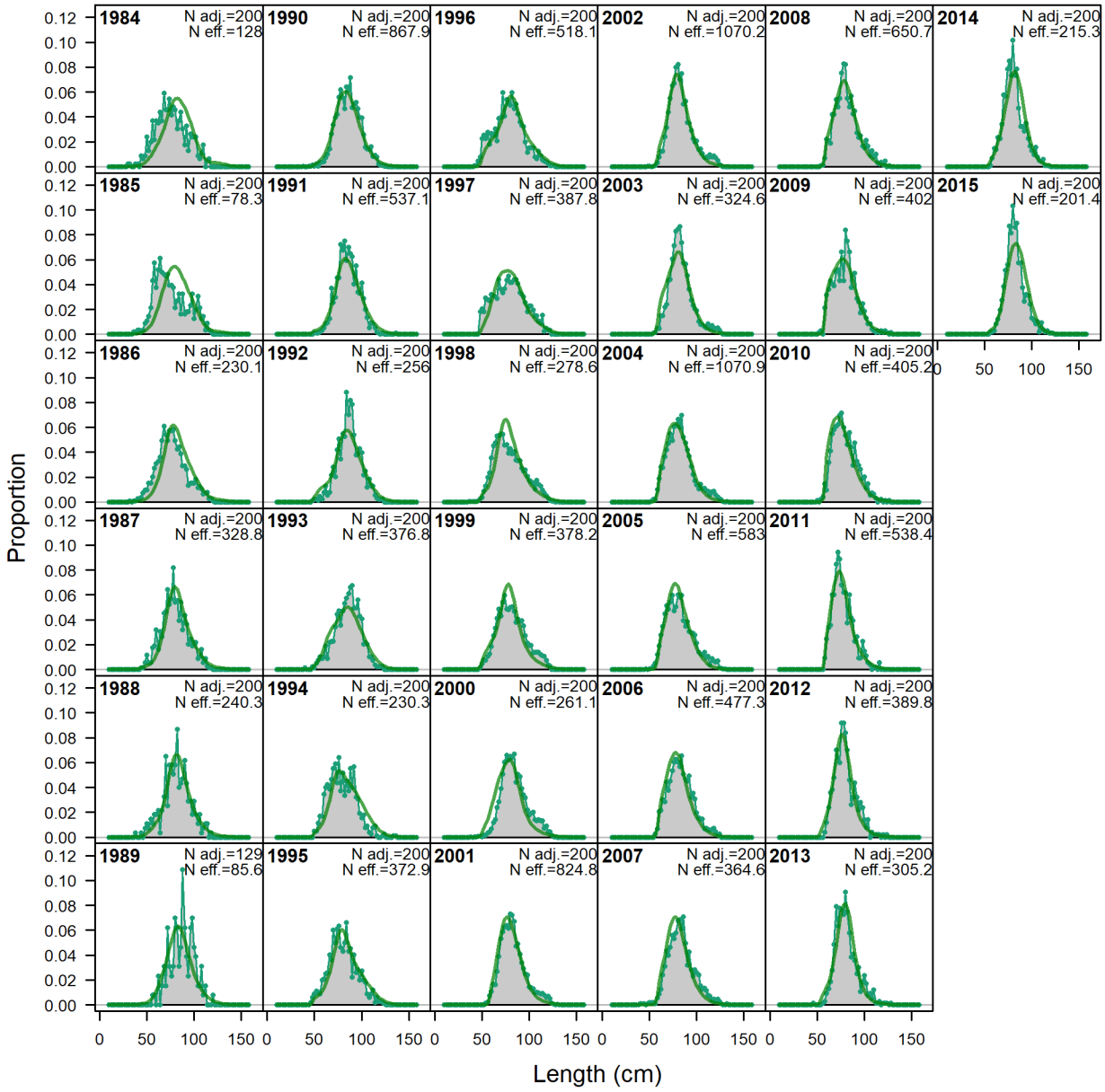


Figure 49 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Longline fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

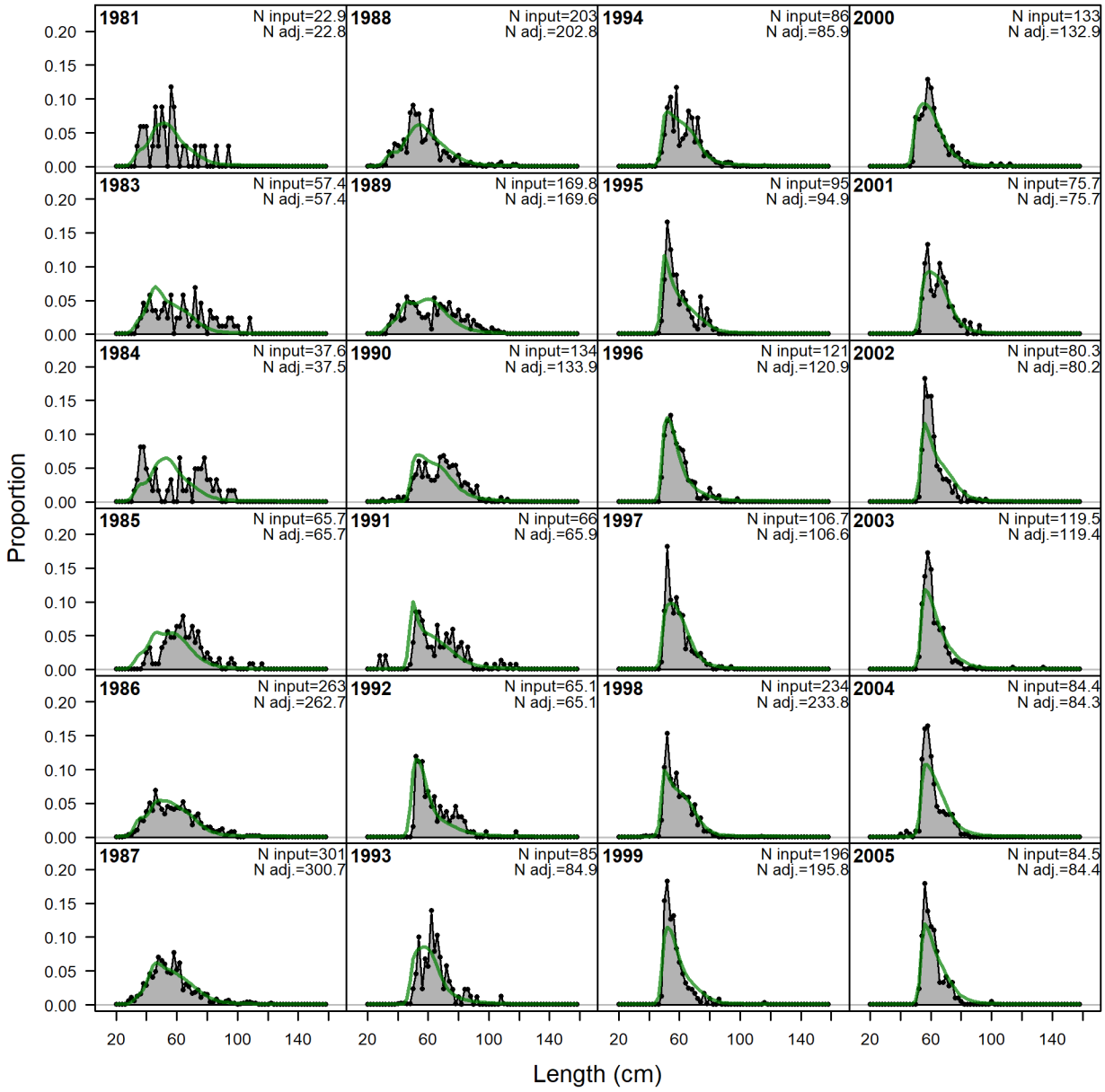


Figure 50. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

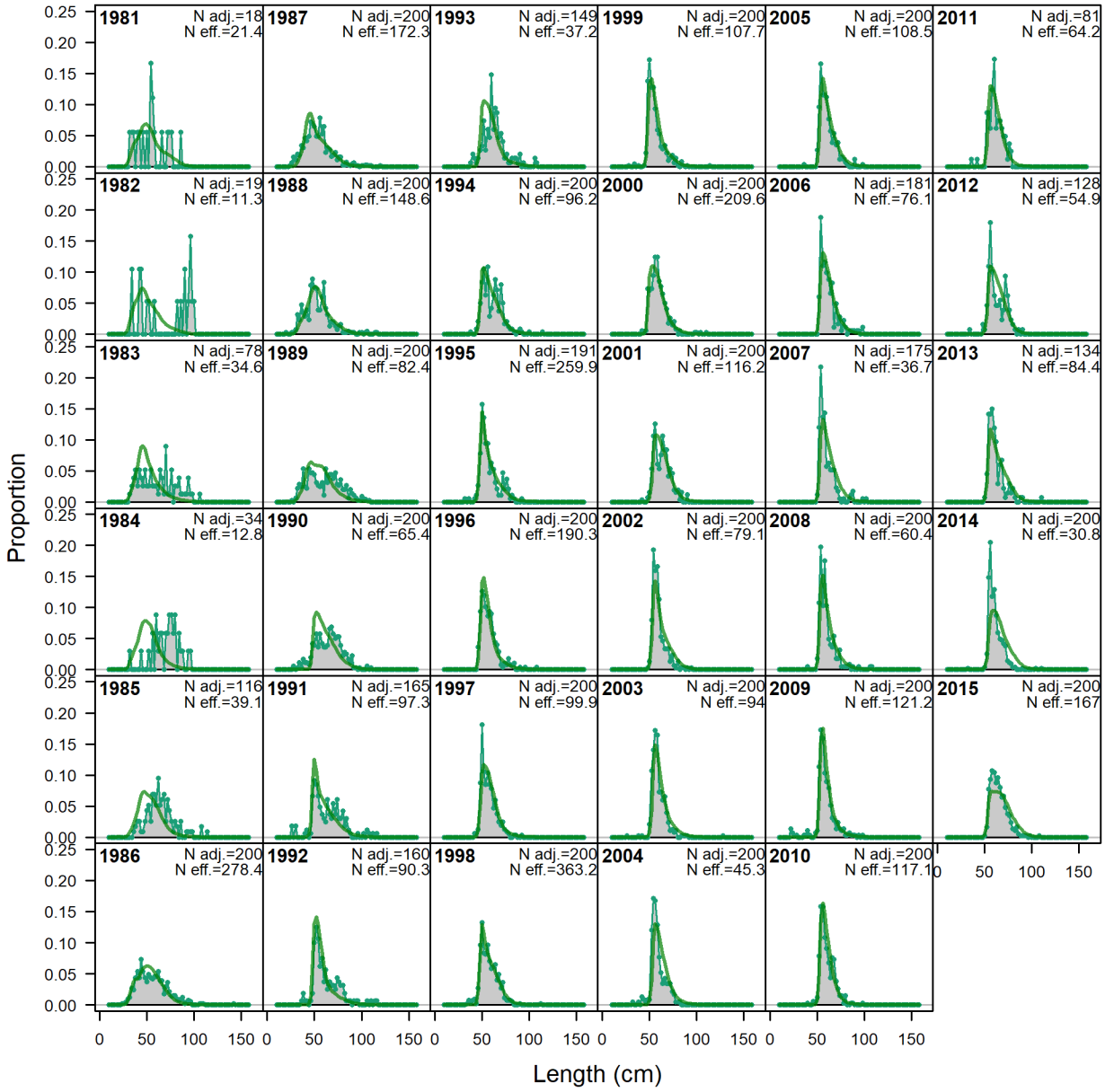


Figure 50 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

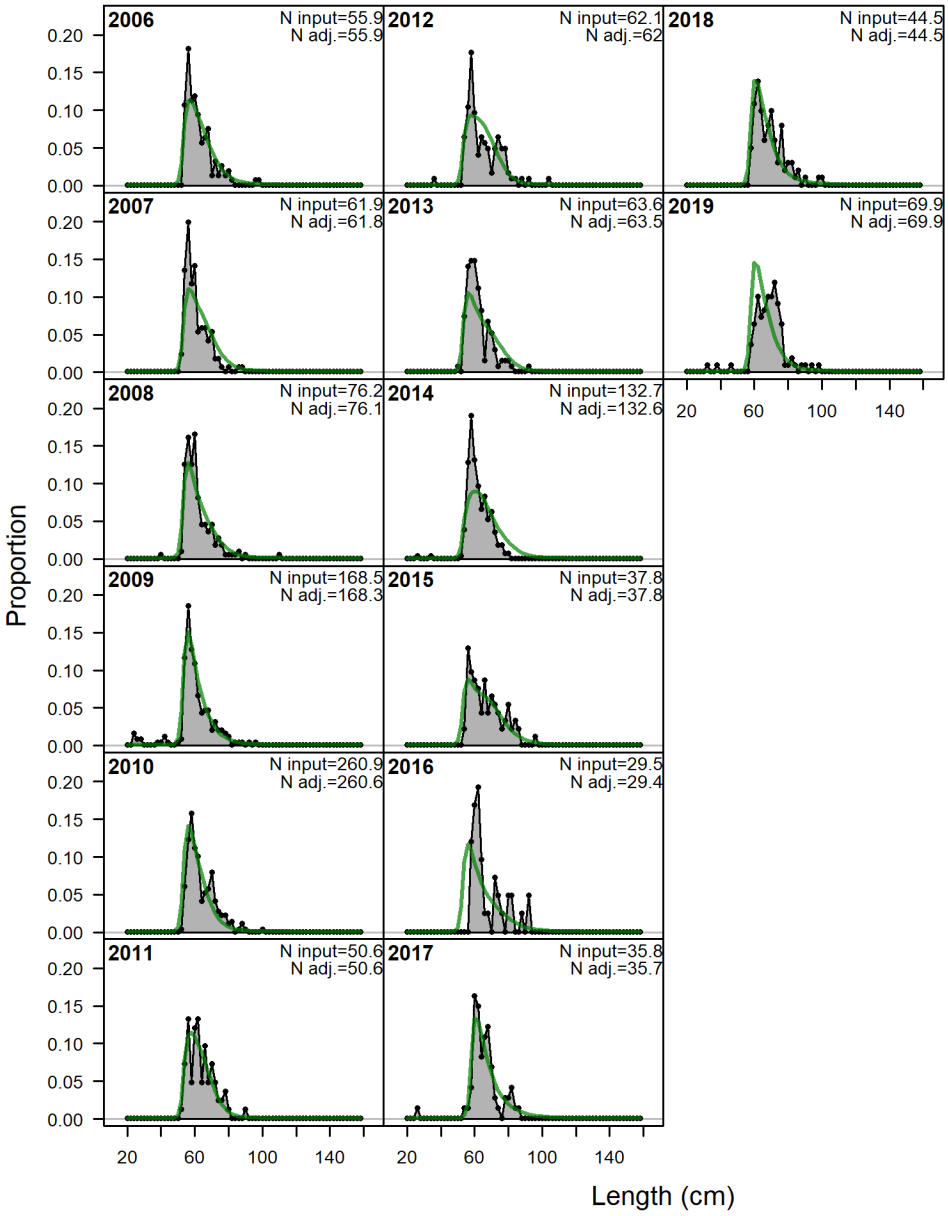


Figure 50 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

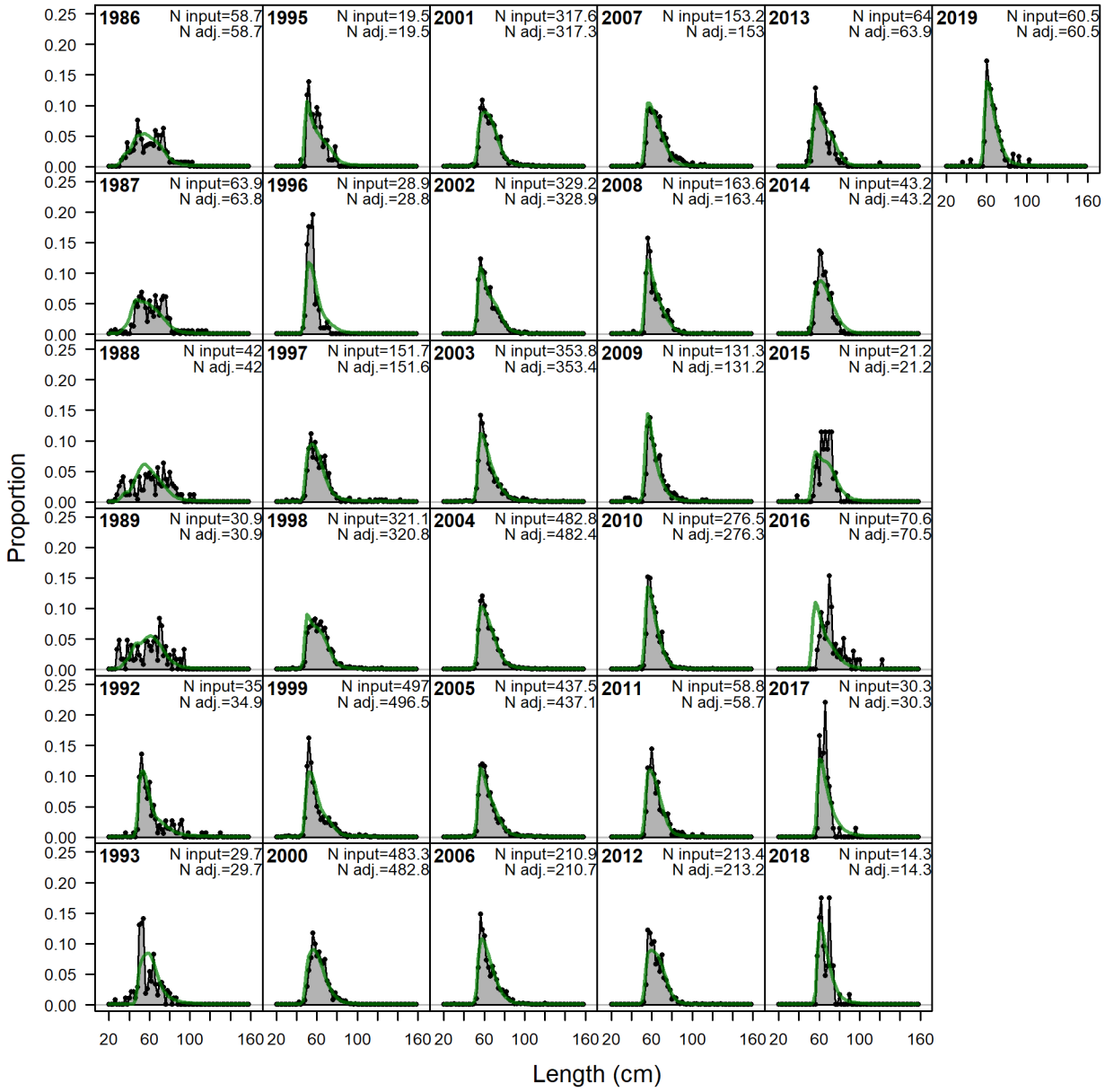


Figure 51. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Charter fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

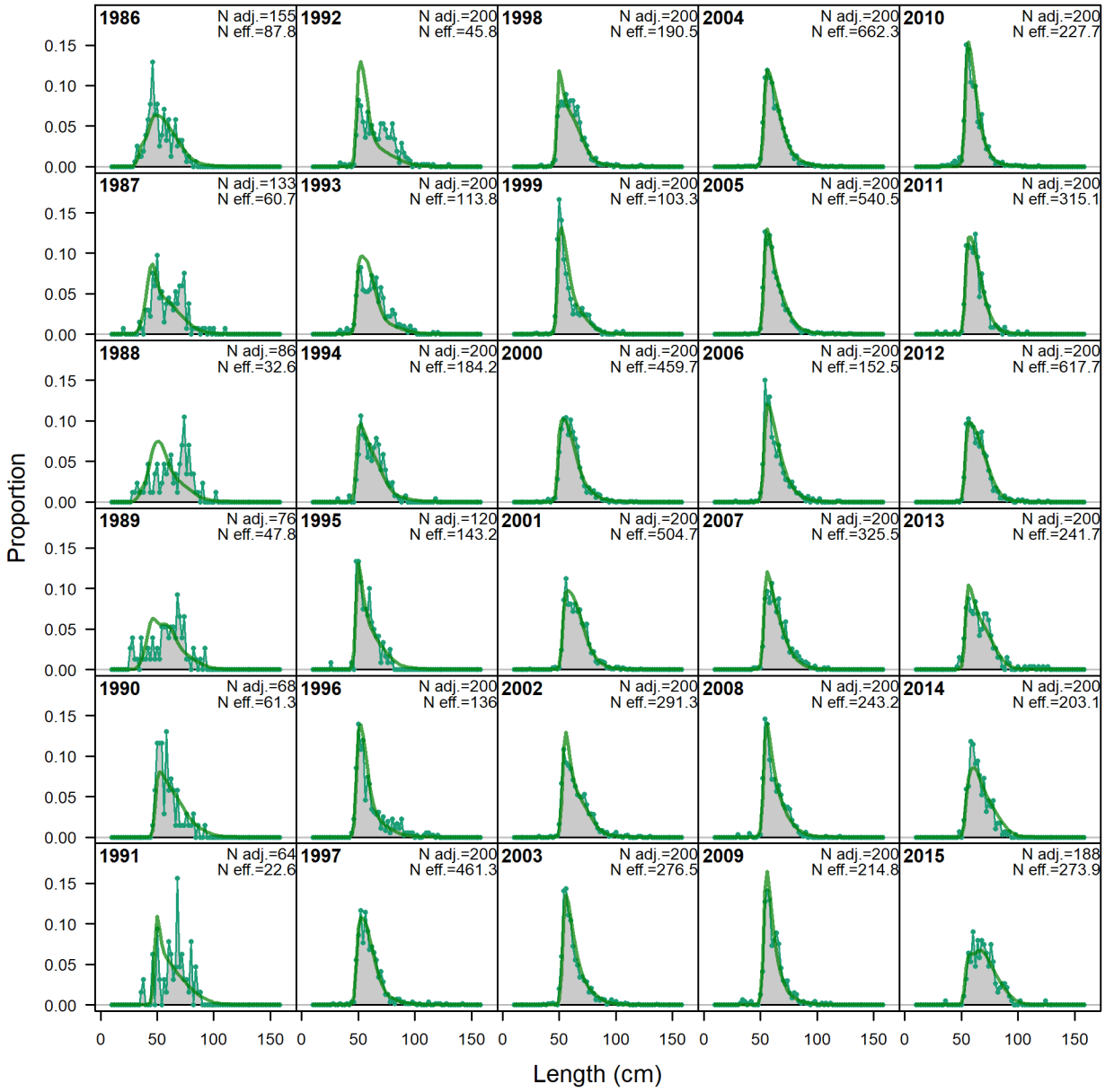


Figure 51 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Charter fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

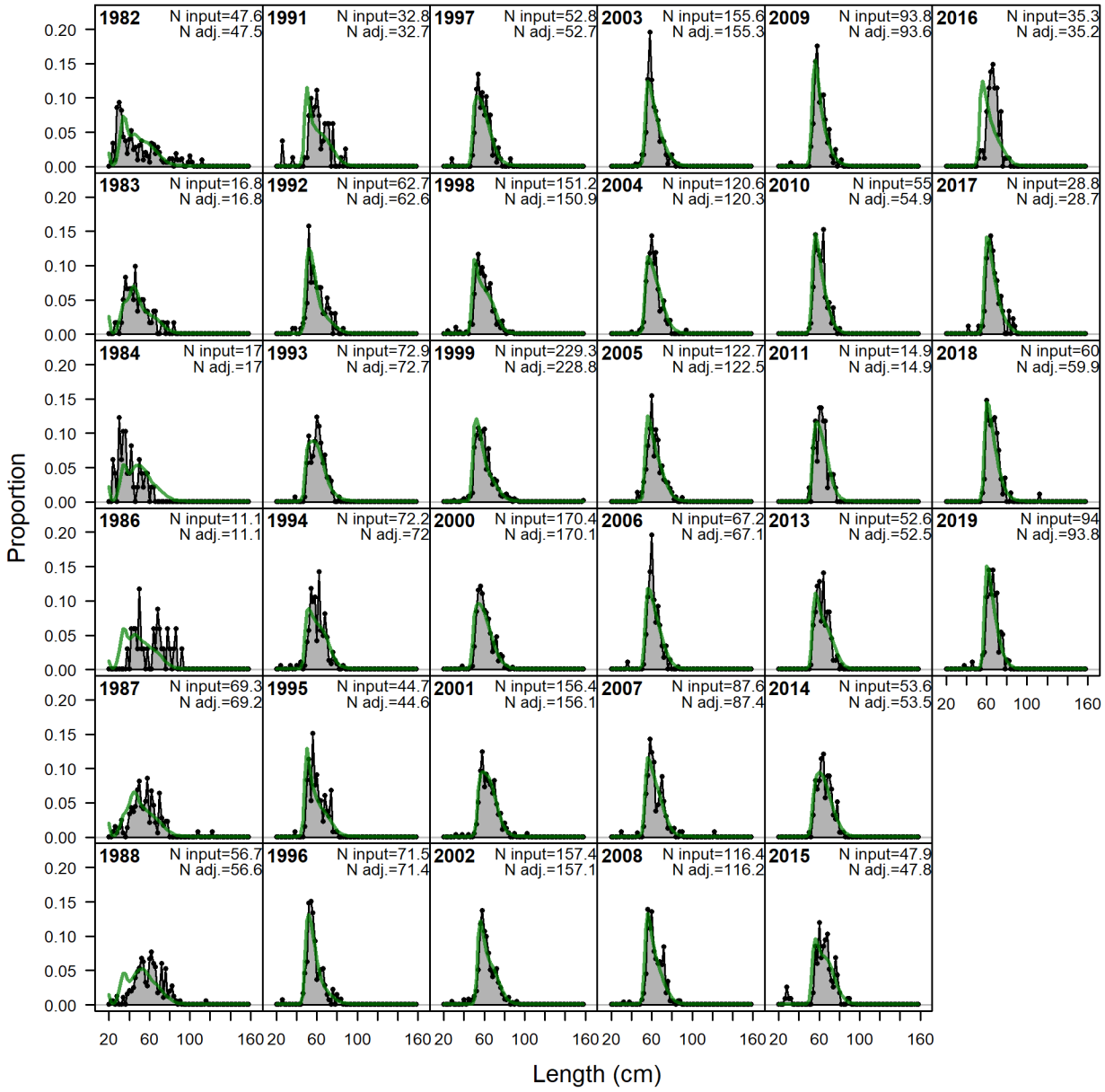


Figure 52. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Private + Shore fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

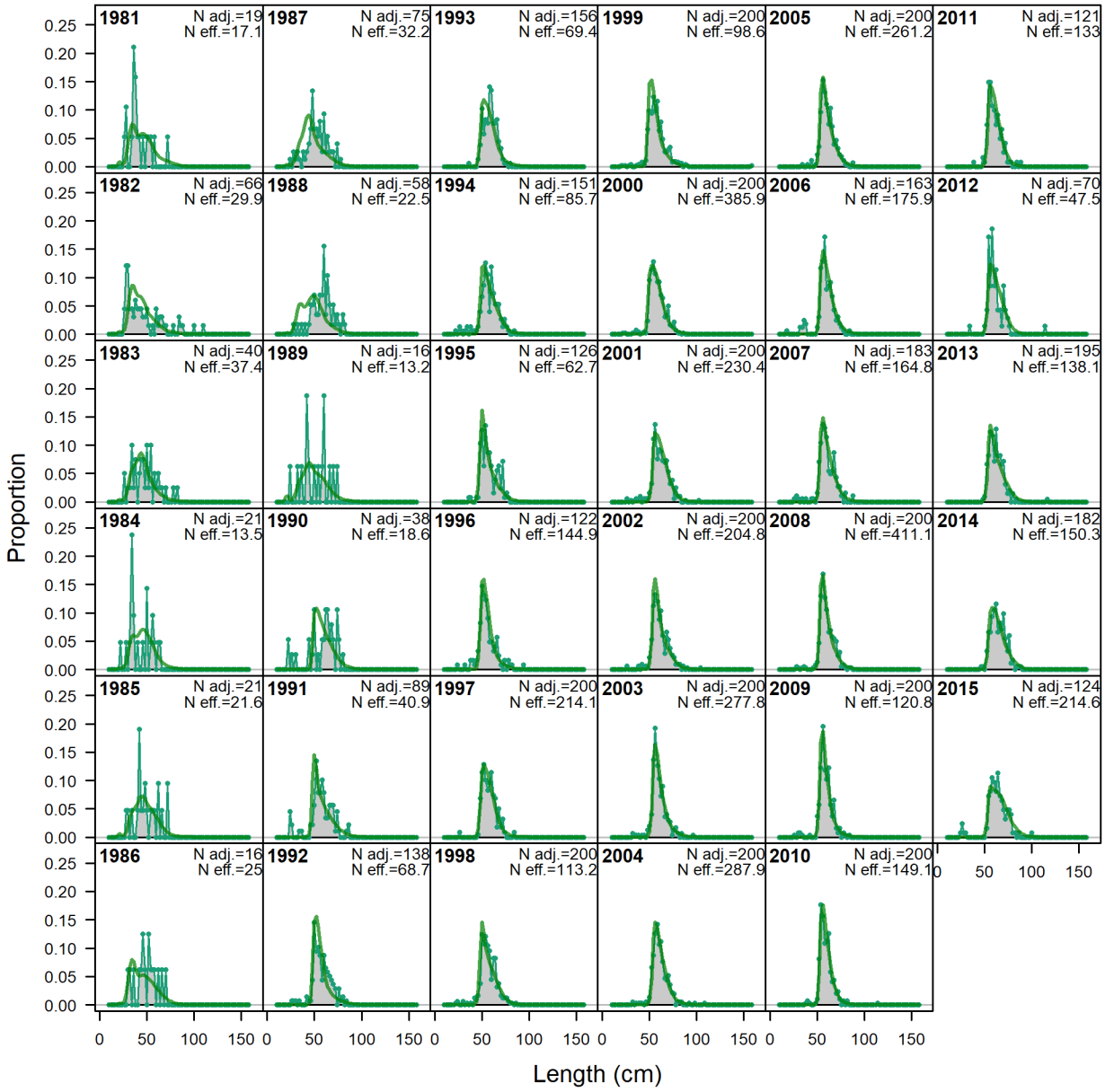


Figure 52 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Private + Shore fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

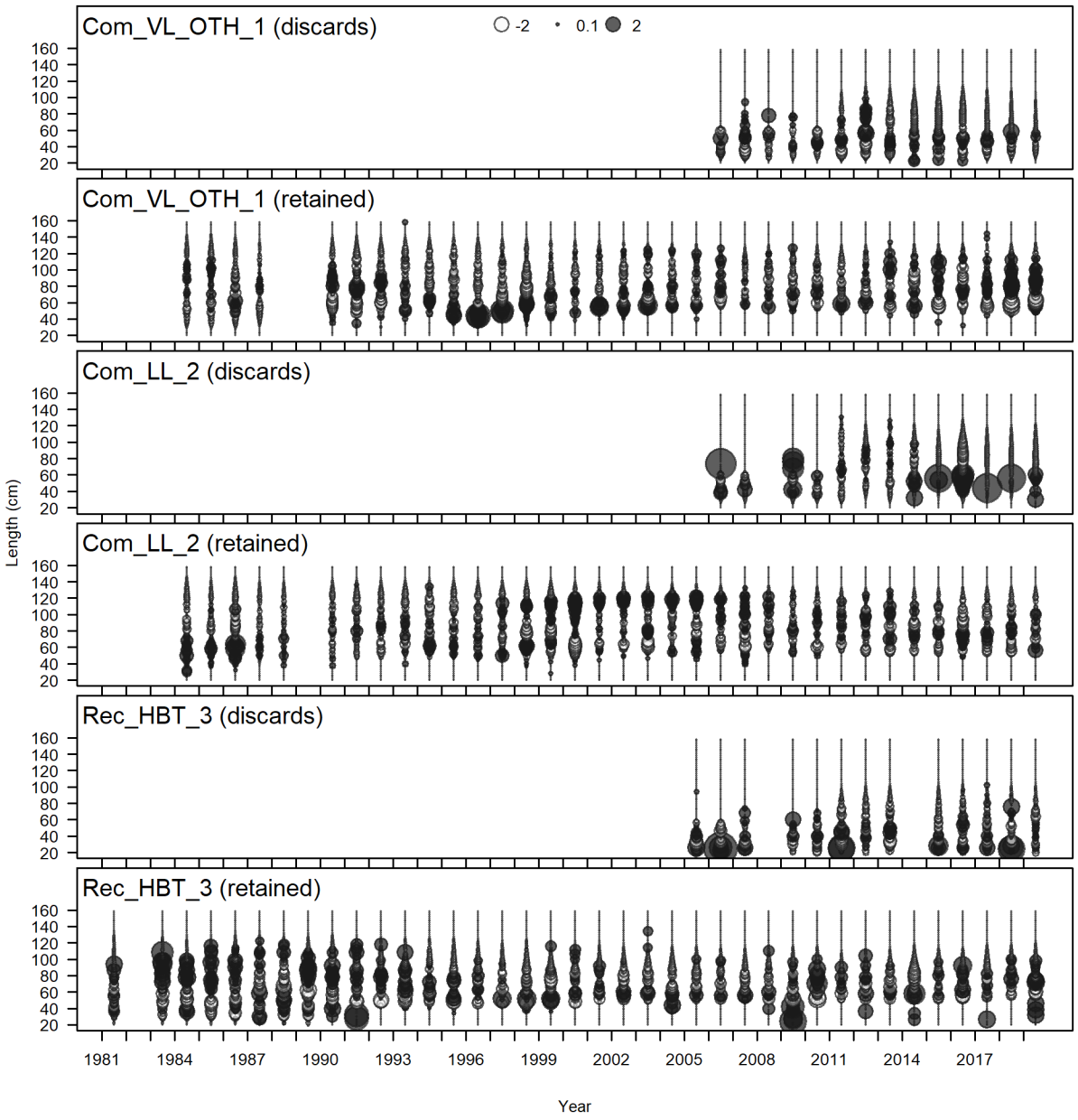


Figure 53. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Gag Grouper for the SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

SEDAR 33U

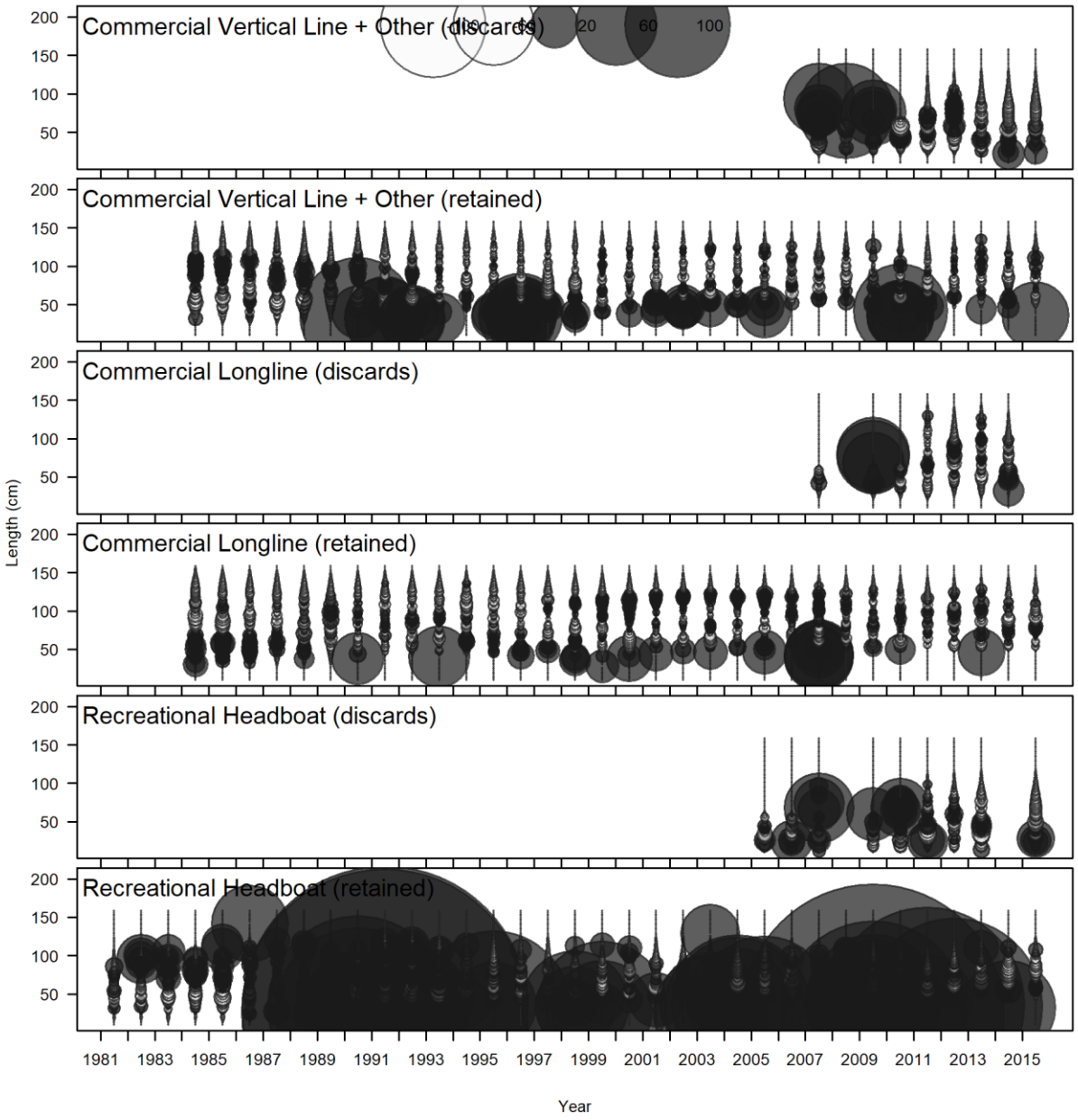


Figure 53 Continued. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Gag Grouper for the SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

SRFS Run

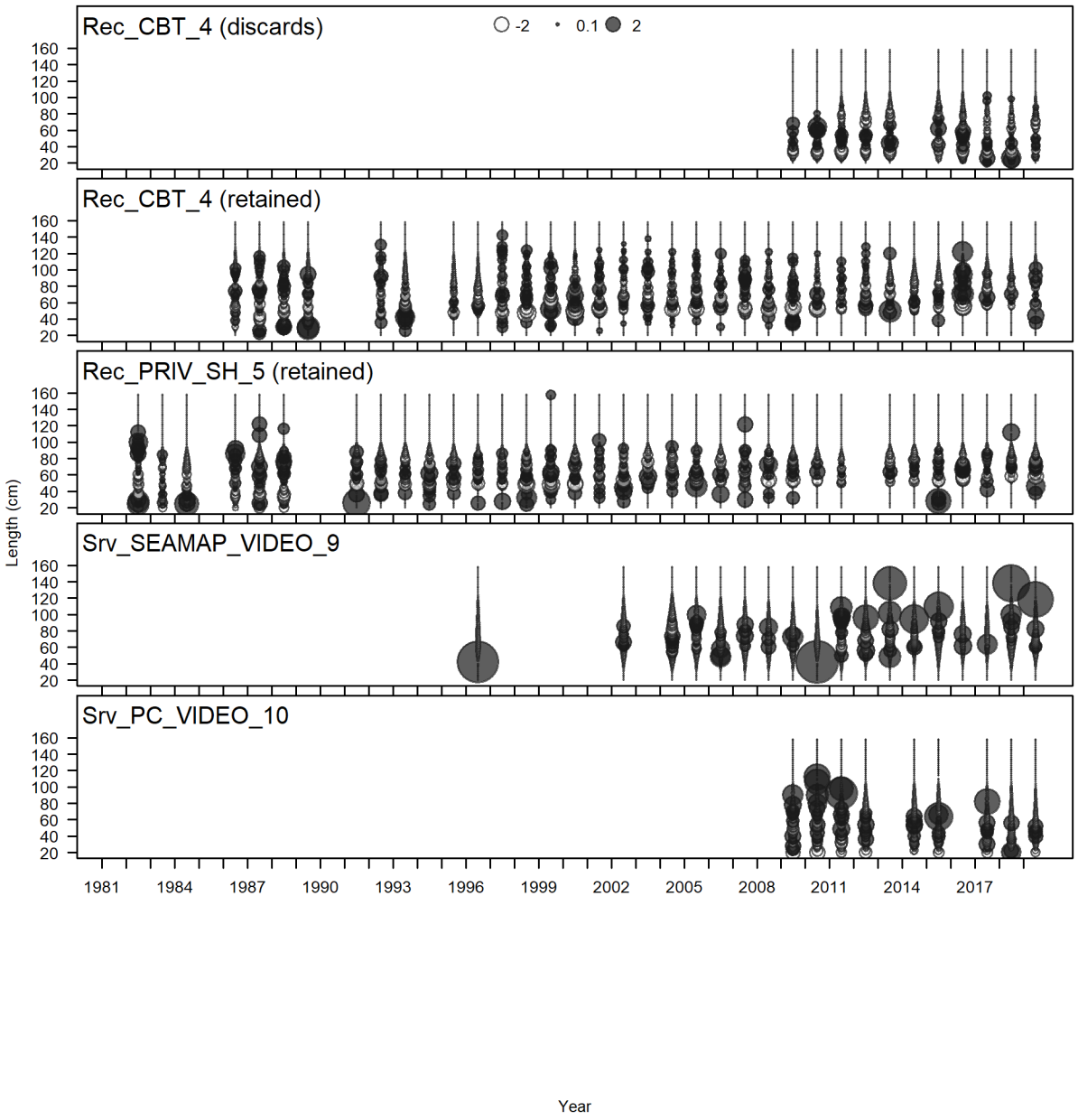


Figure 53 Continued. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Gag Grouper for the SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

SEDAR 33U

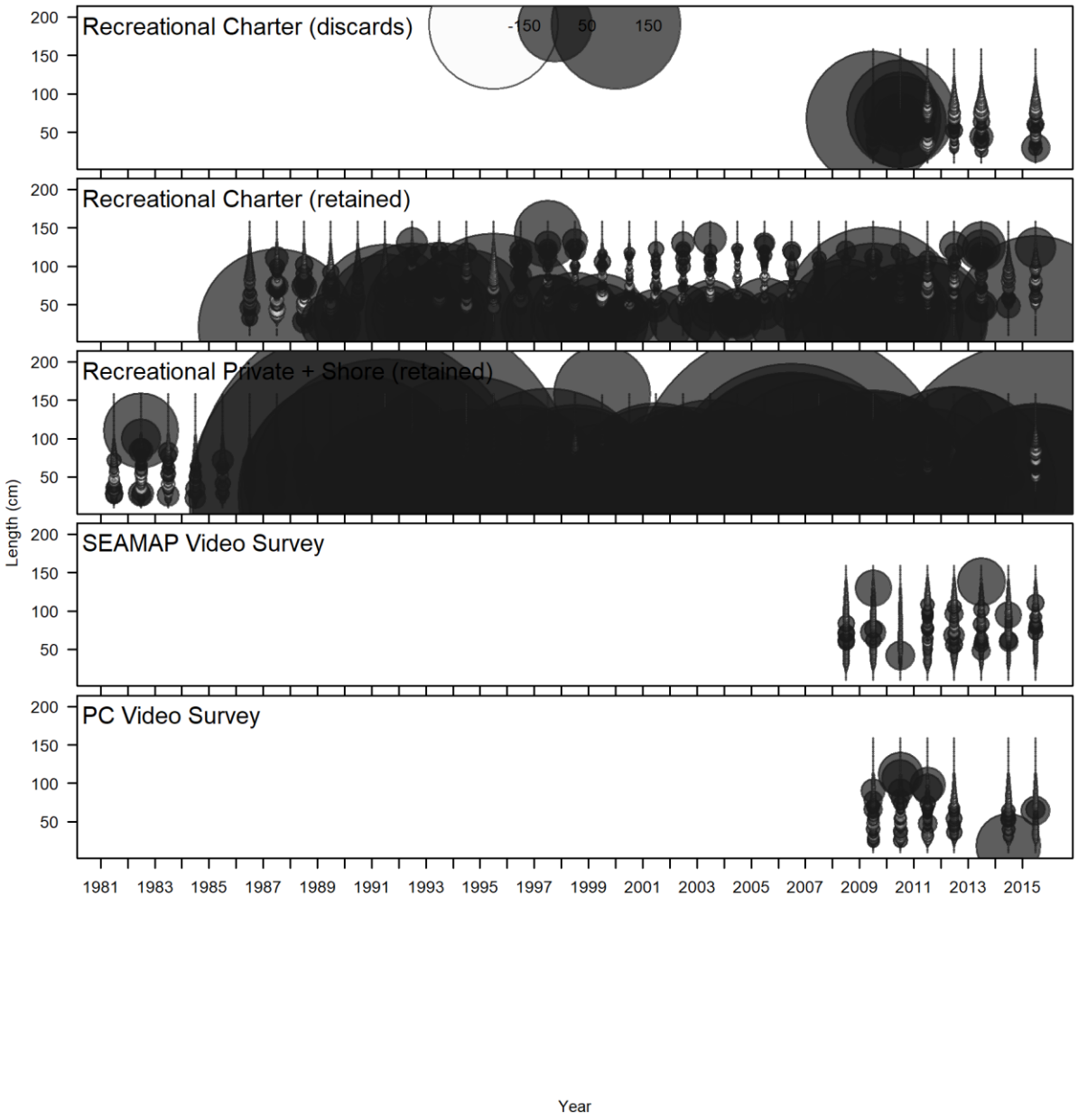


Figure 53 Continued. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Gag Grouper for the SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

SRFS Run

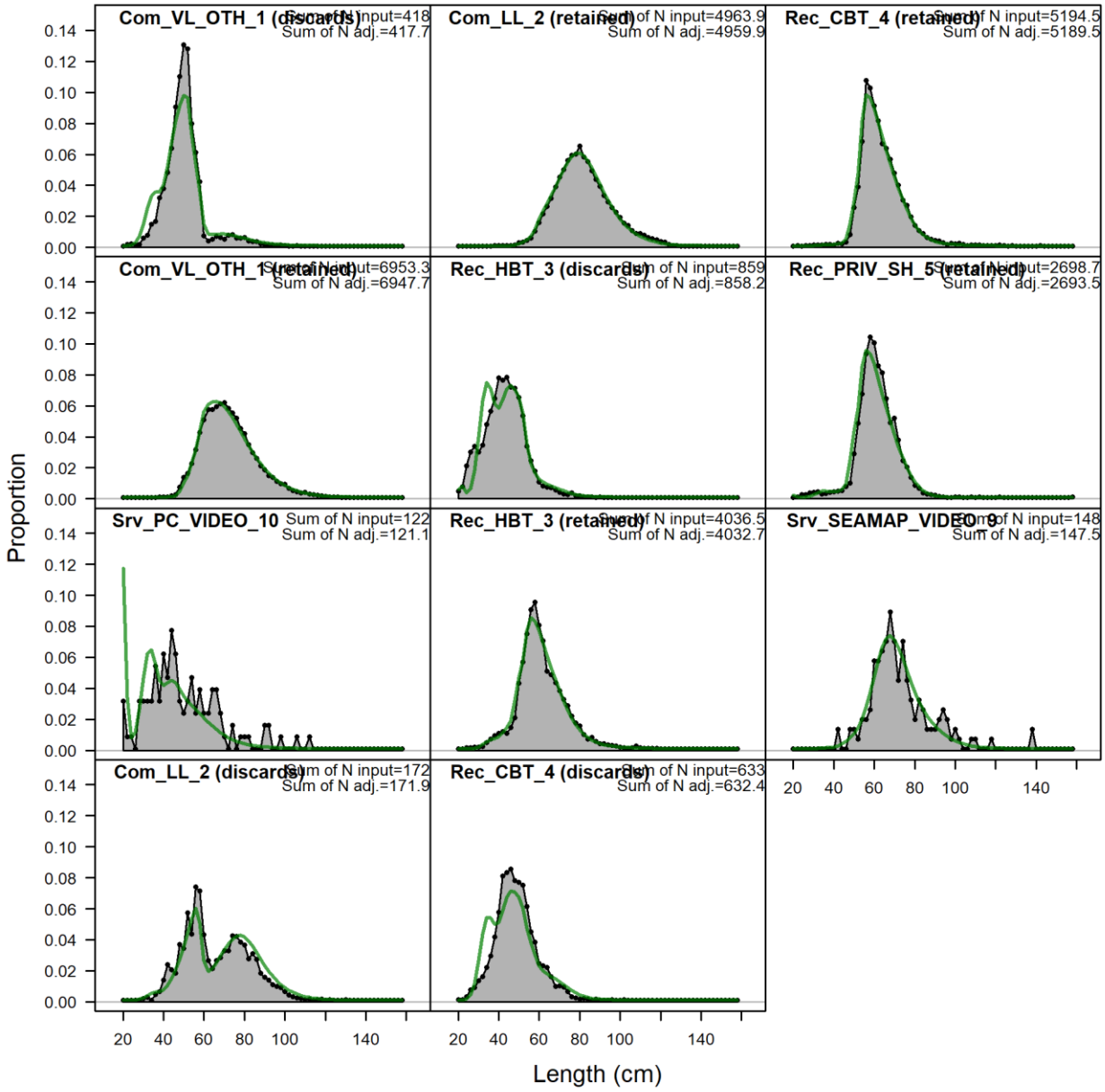


Figure 54. Model fits to the length composition of discarded or retained catch aggregated across years within a given fleet for Gulf of Mexico Gag Grouper. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'Sum of N input' is the total input sample size and 'Sum of N adj.' is the total sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'Sum of N adj.' is the input sample size and 'Sum of N eff.' can be ignored as it was not used.

SEDAR 33U

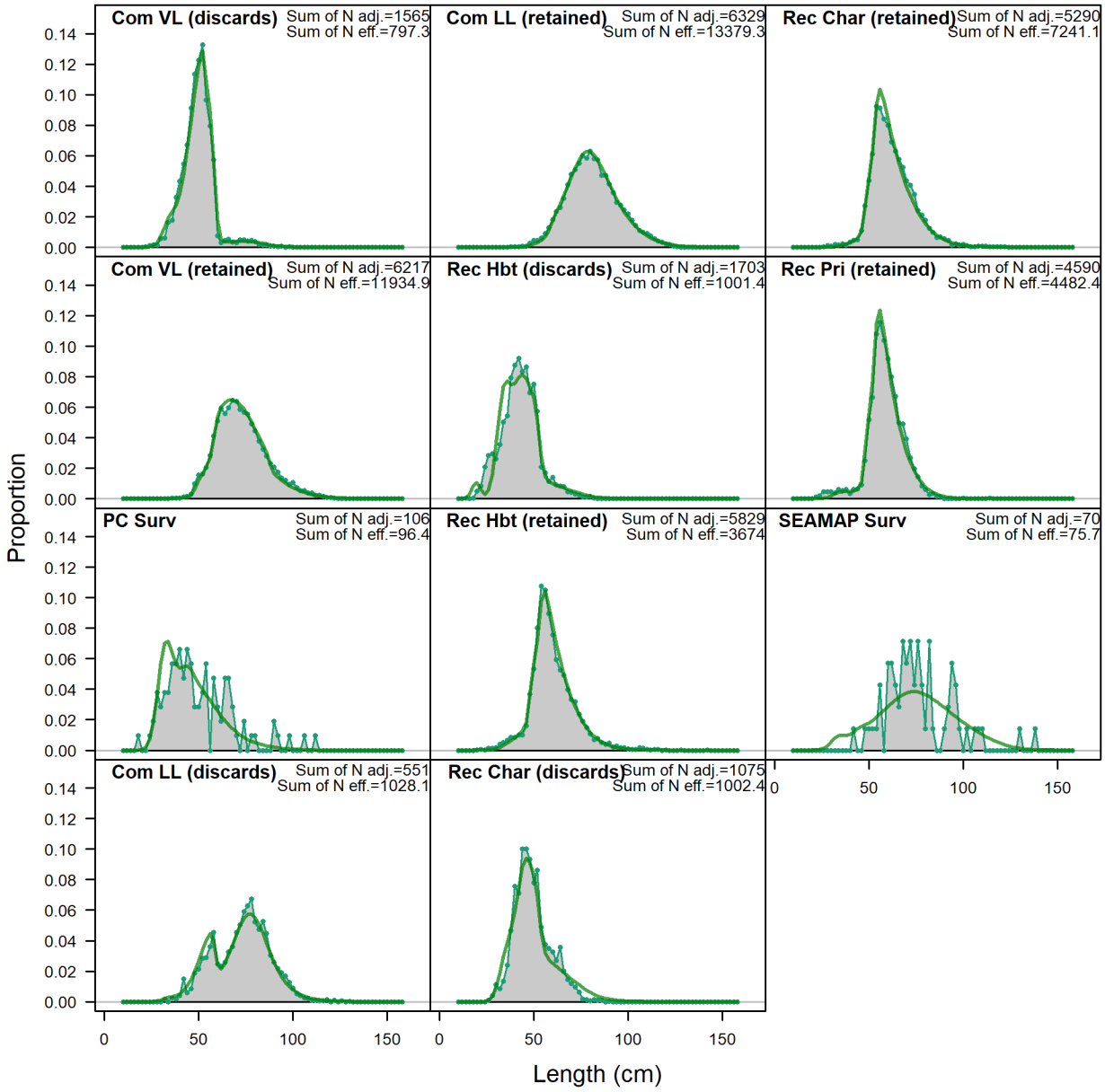


Figure 54 Continued. Model fits to the length composition of discarded or retained catch aggregated across years within a given fleet for Gulf of Mexico Gag Grouper. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'Sum of N input' is the total input sample size and 'Sum of N adj.' is the total sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'Sum of N adj.' is the input sample size and 'Sum of N eff.' can be ignored as it was not used.

SRFS Run

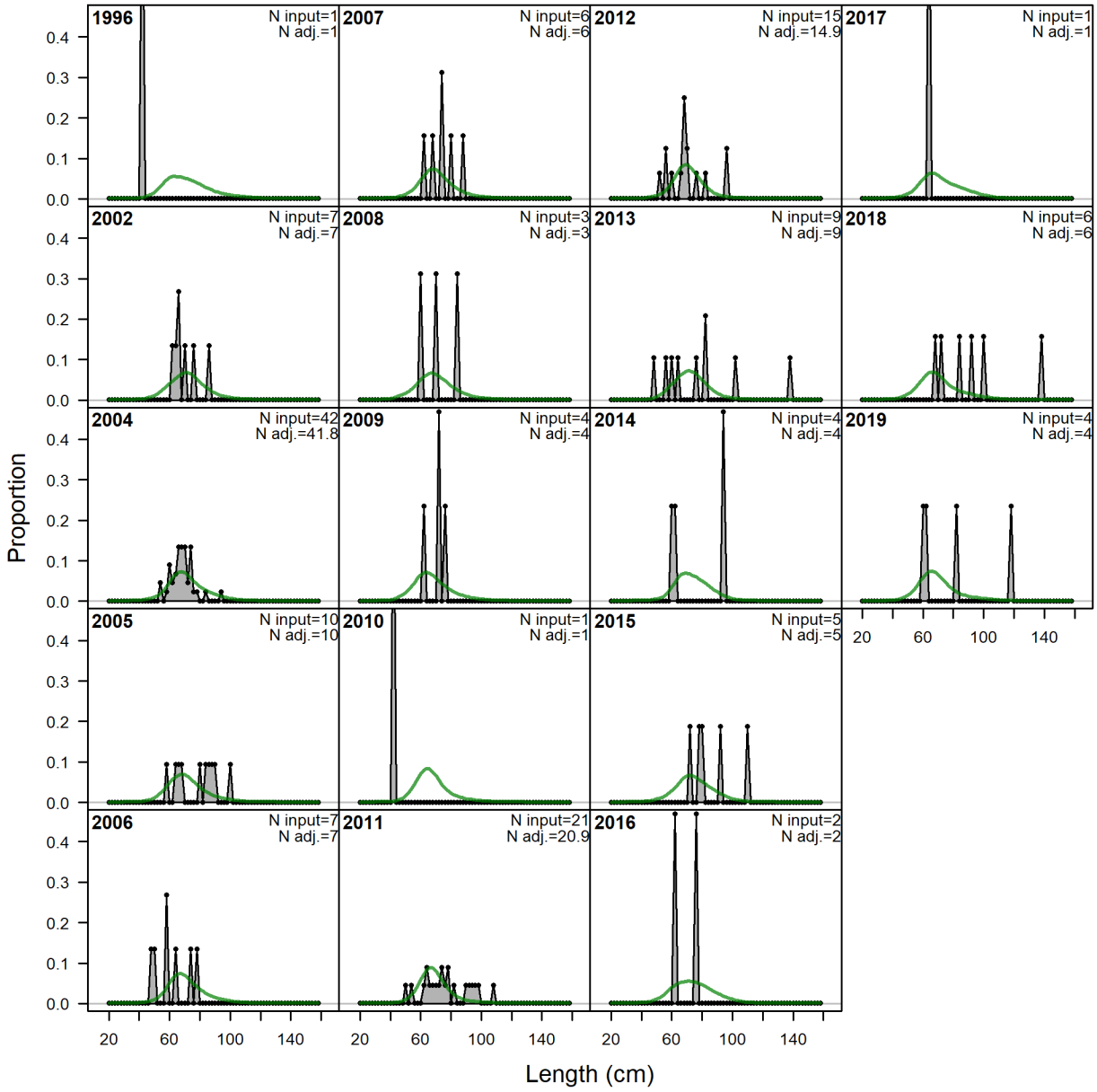


Figure 55. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the SEAMAP Video Survey fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

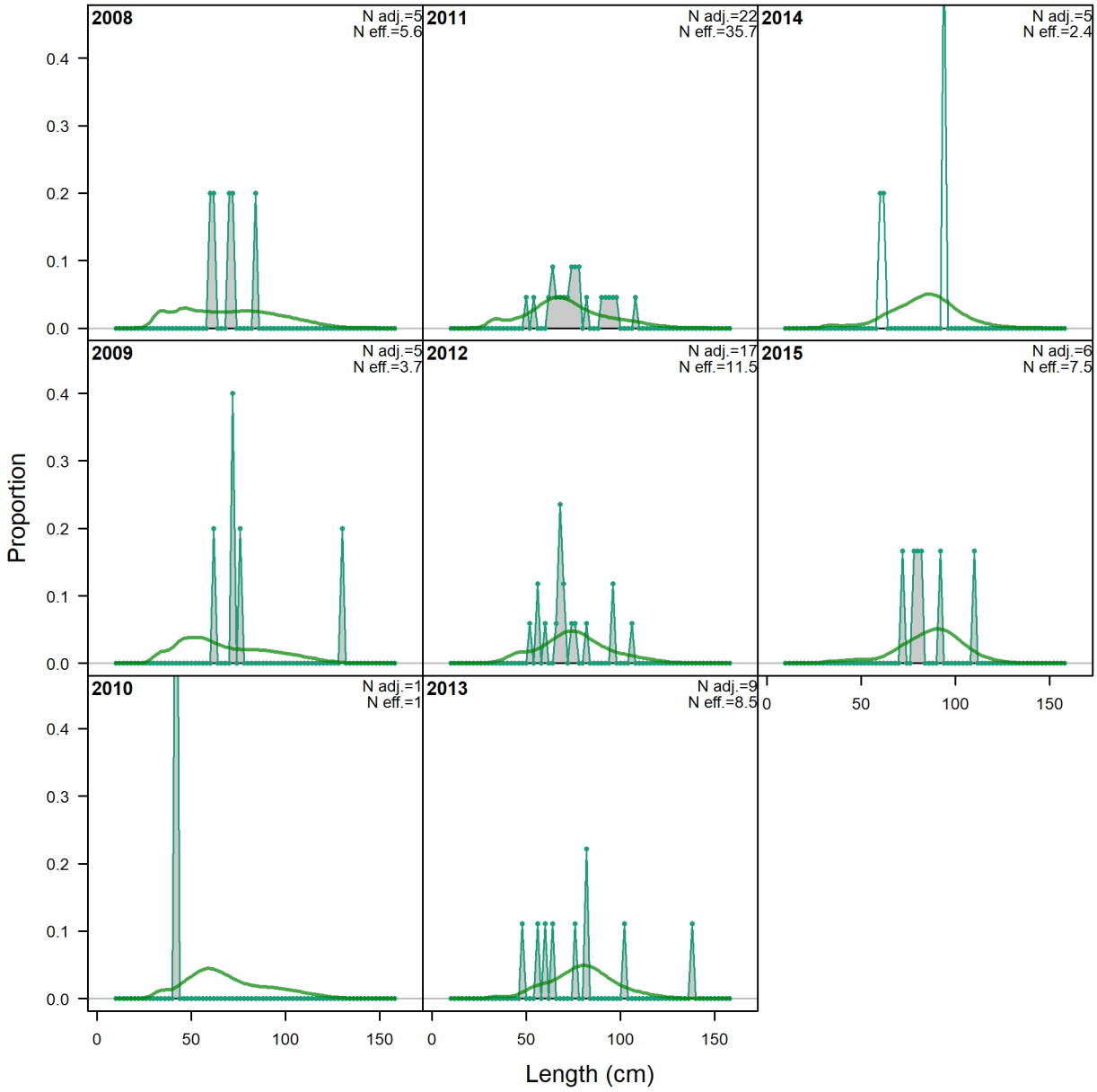


Figure 55 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the SEAMAP Video Survey fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

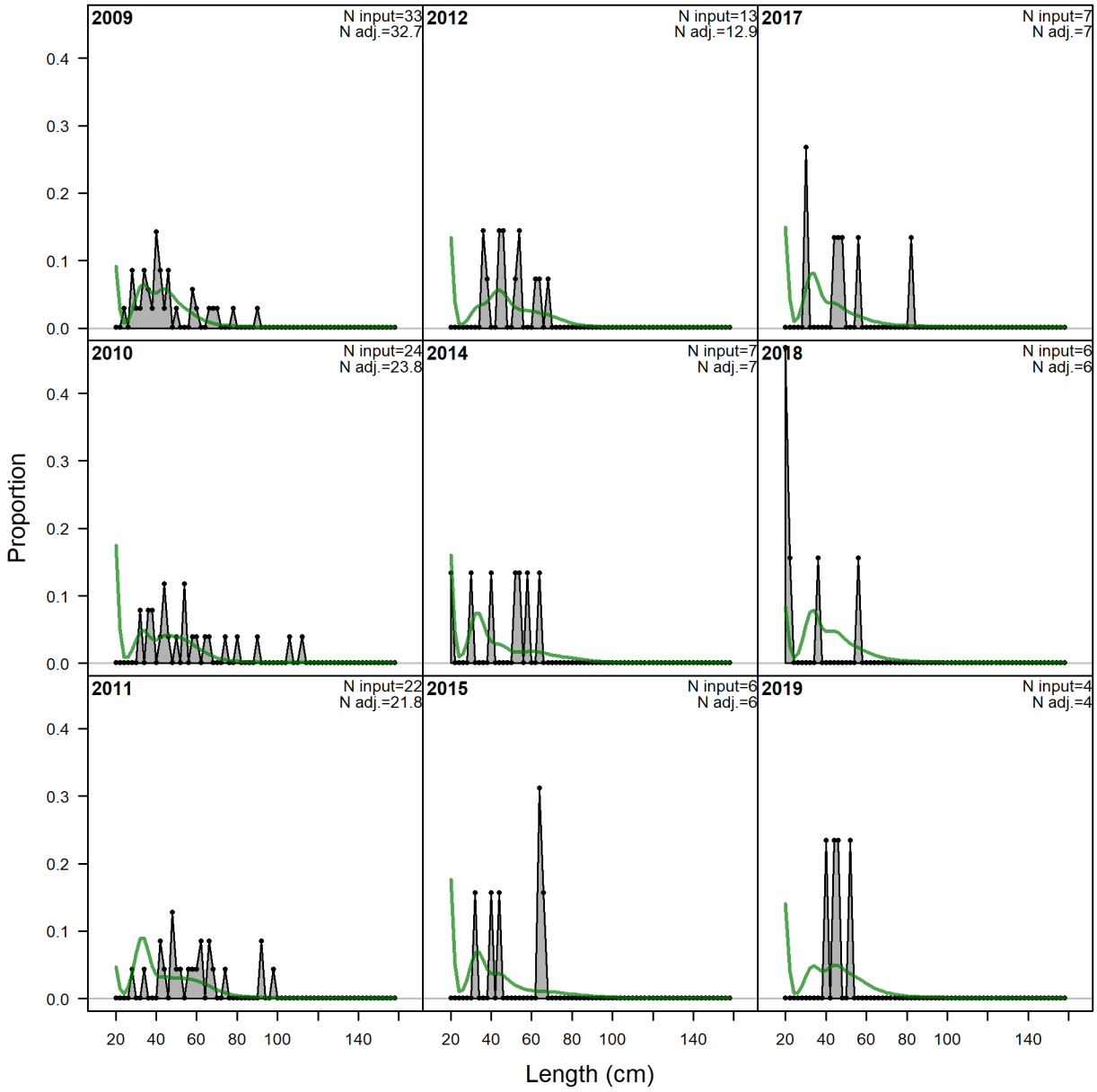


Figure 56. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the PC Video Survey fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

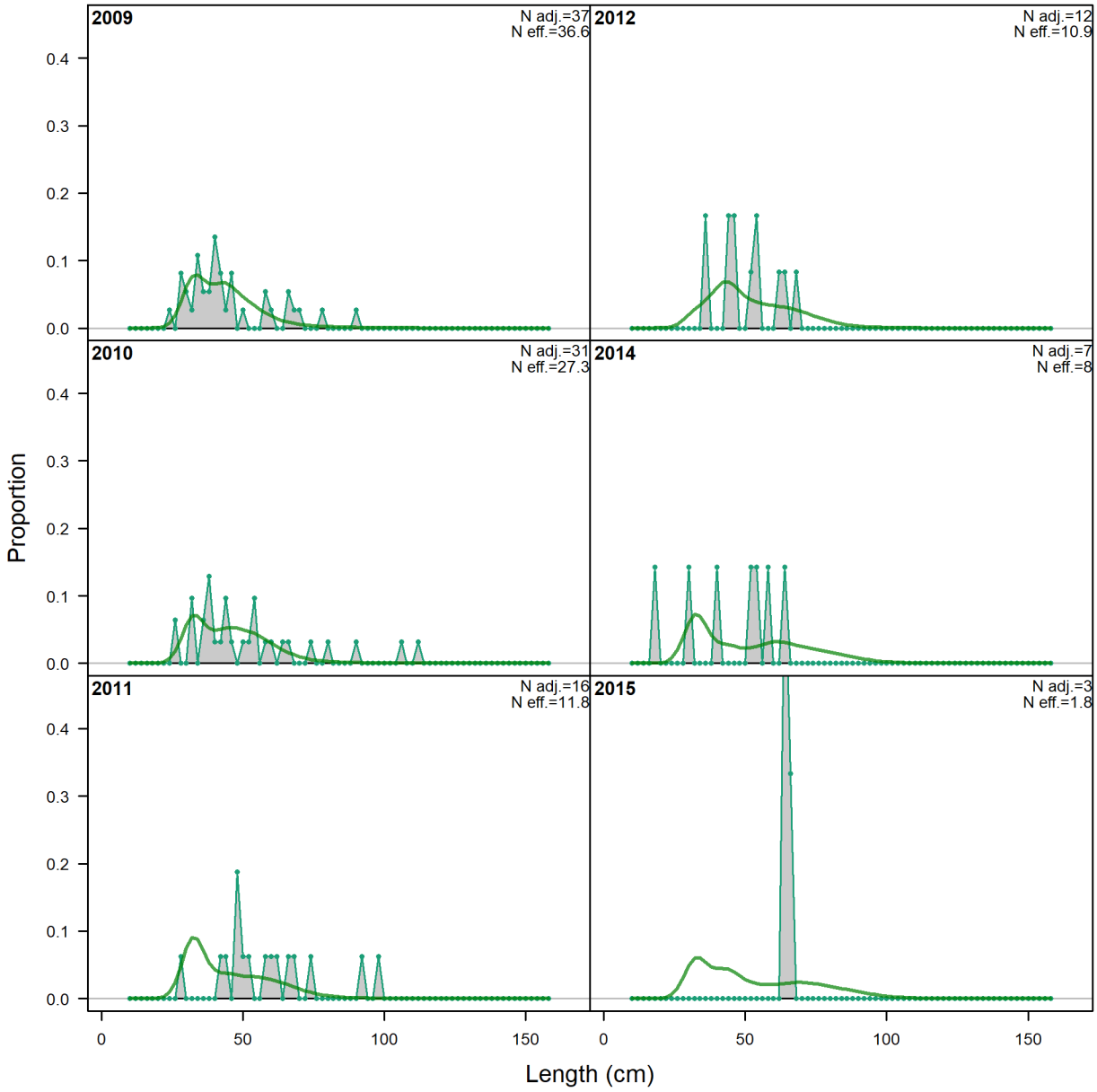


Figure 56 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the PC Video Survey fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

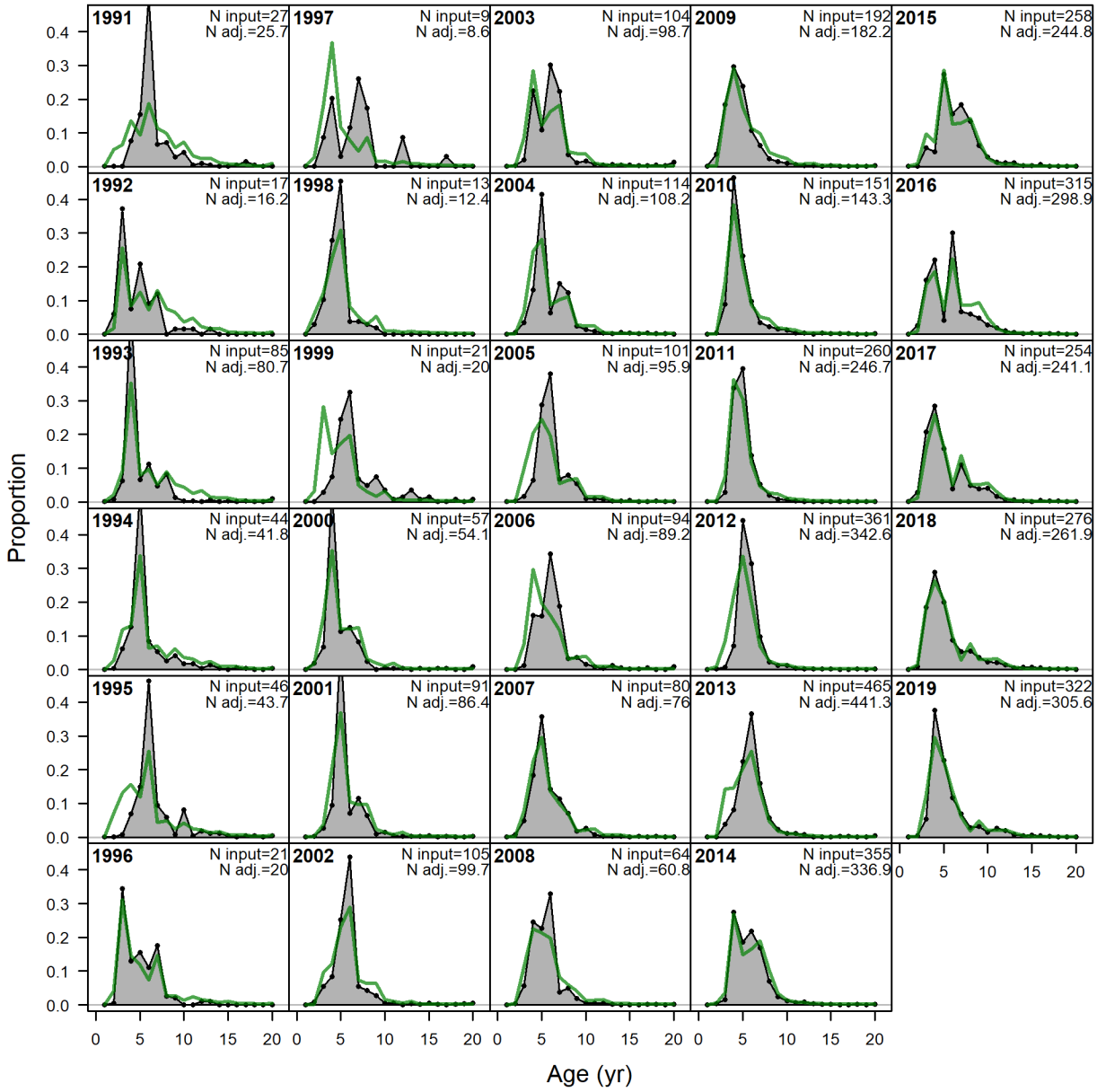


Figure 57. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Vertical Line + Other fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

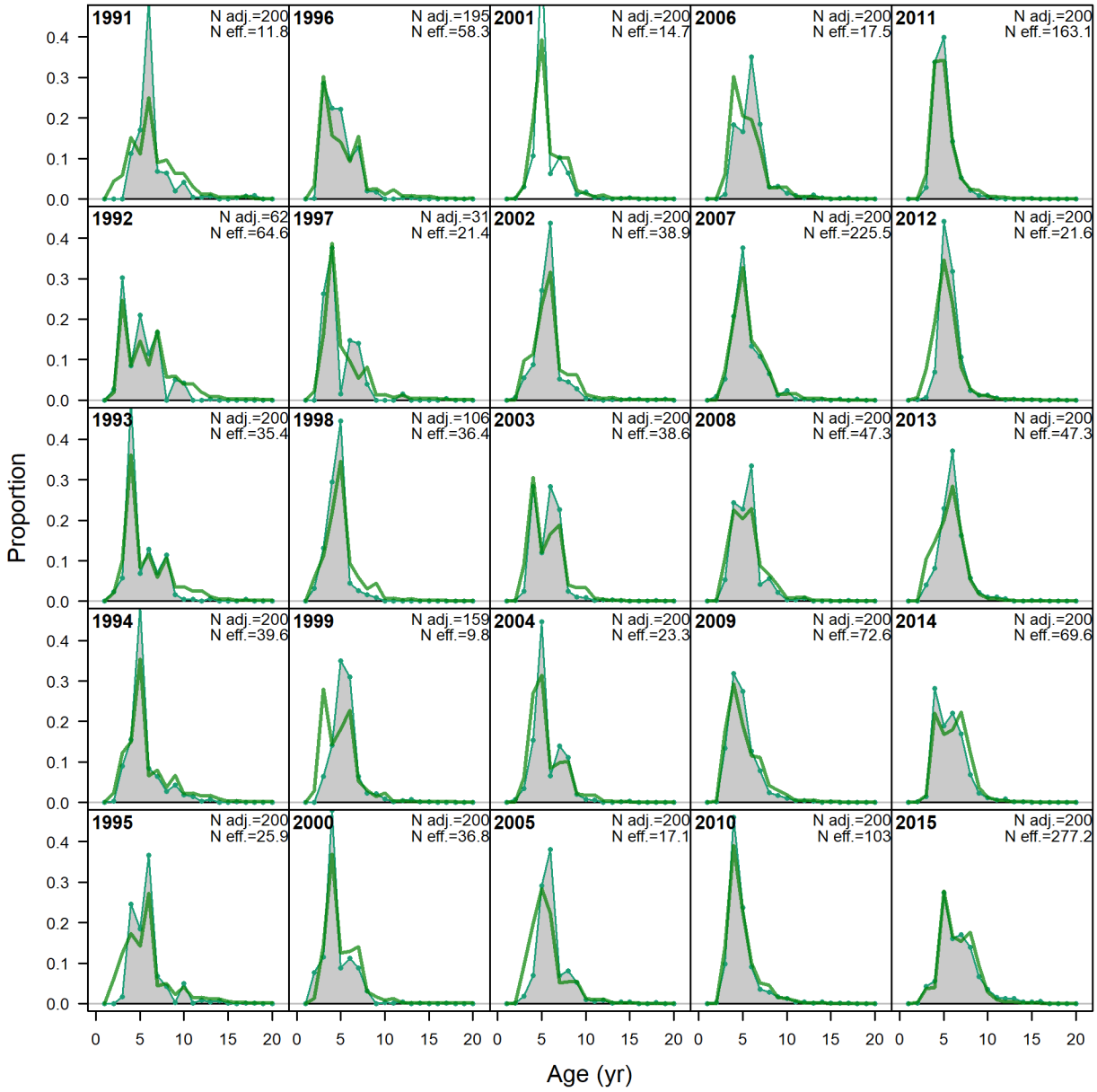


Figure 57 Continued. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Vertical Line + Other fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

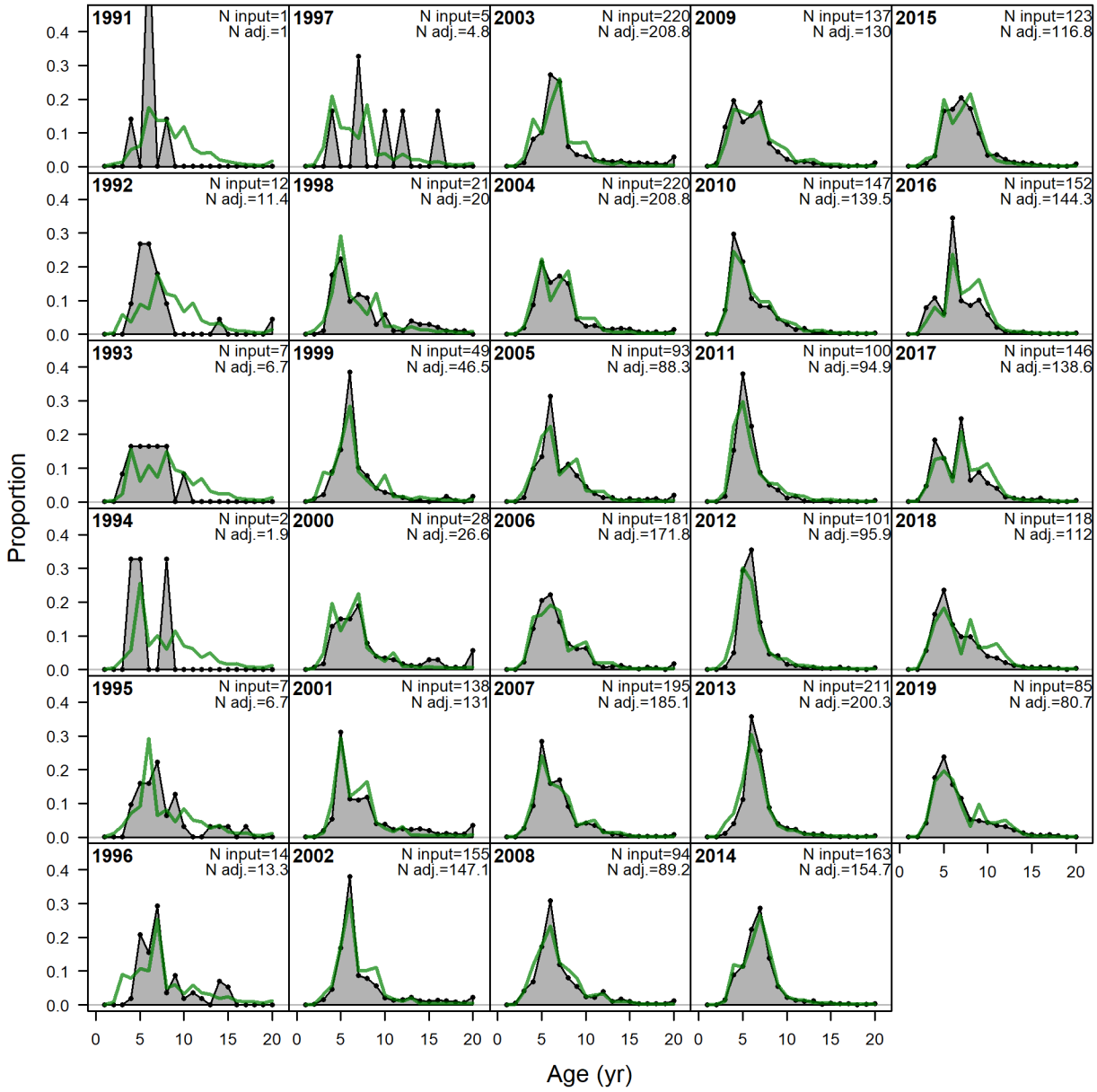


Figure 58. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Longline fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

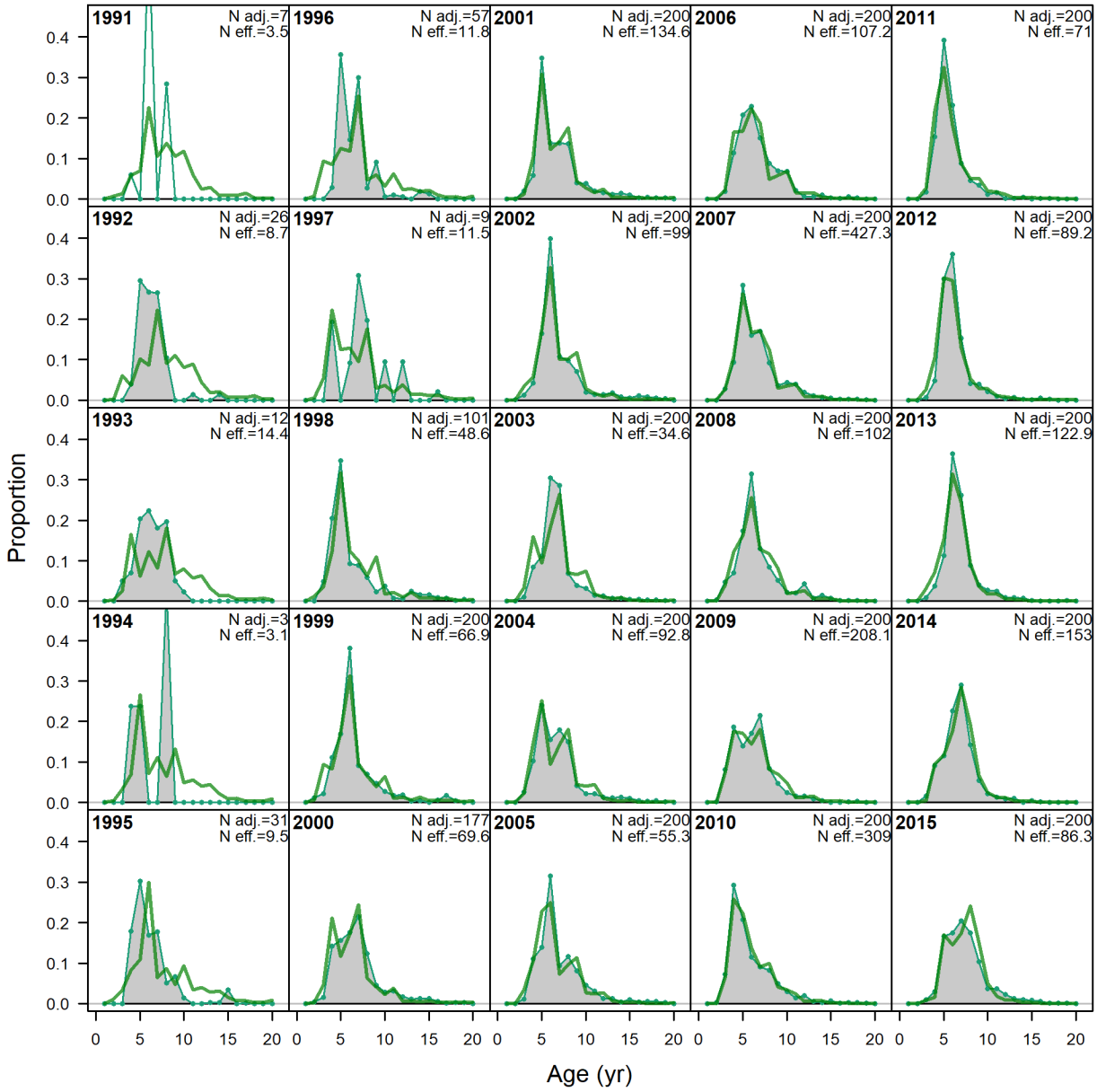


Figure 58 Continued. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Longline fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

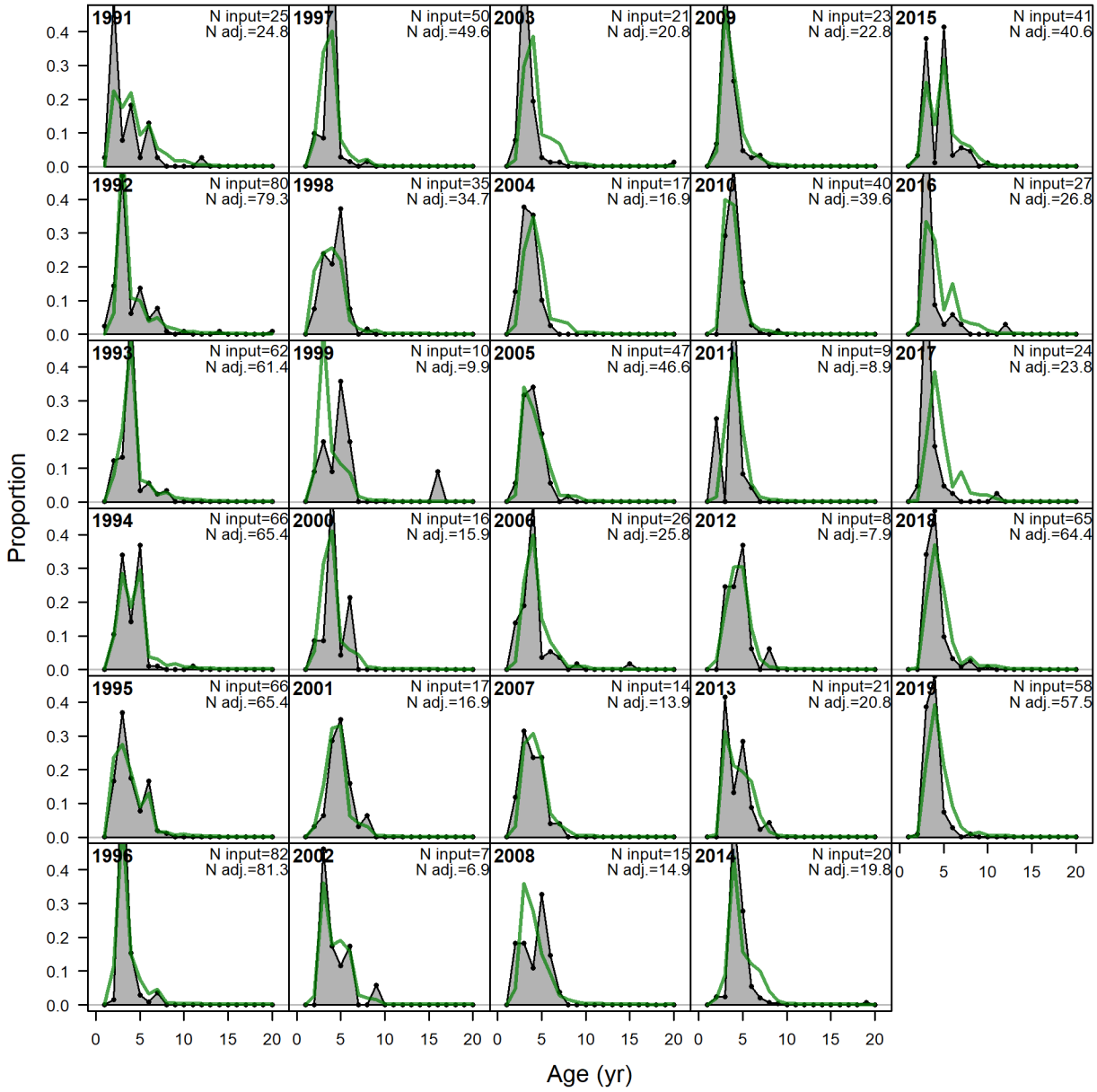


Figure 59. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

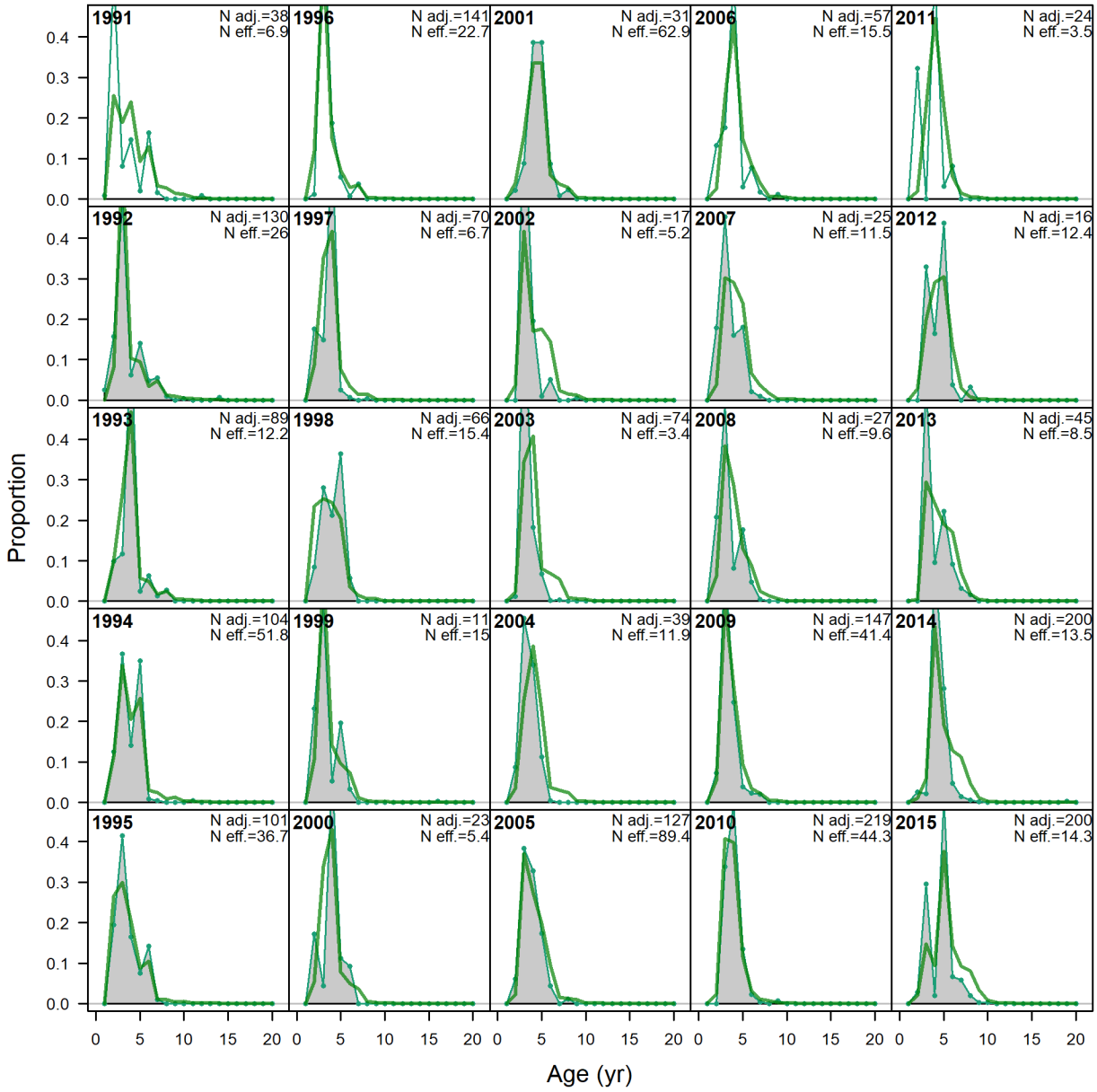


Figure 59 Continued. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

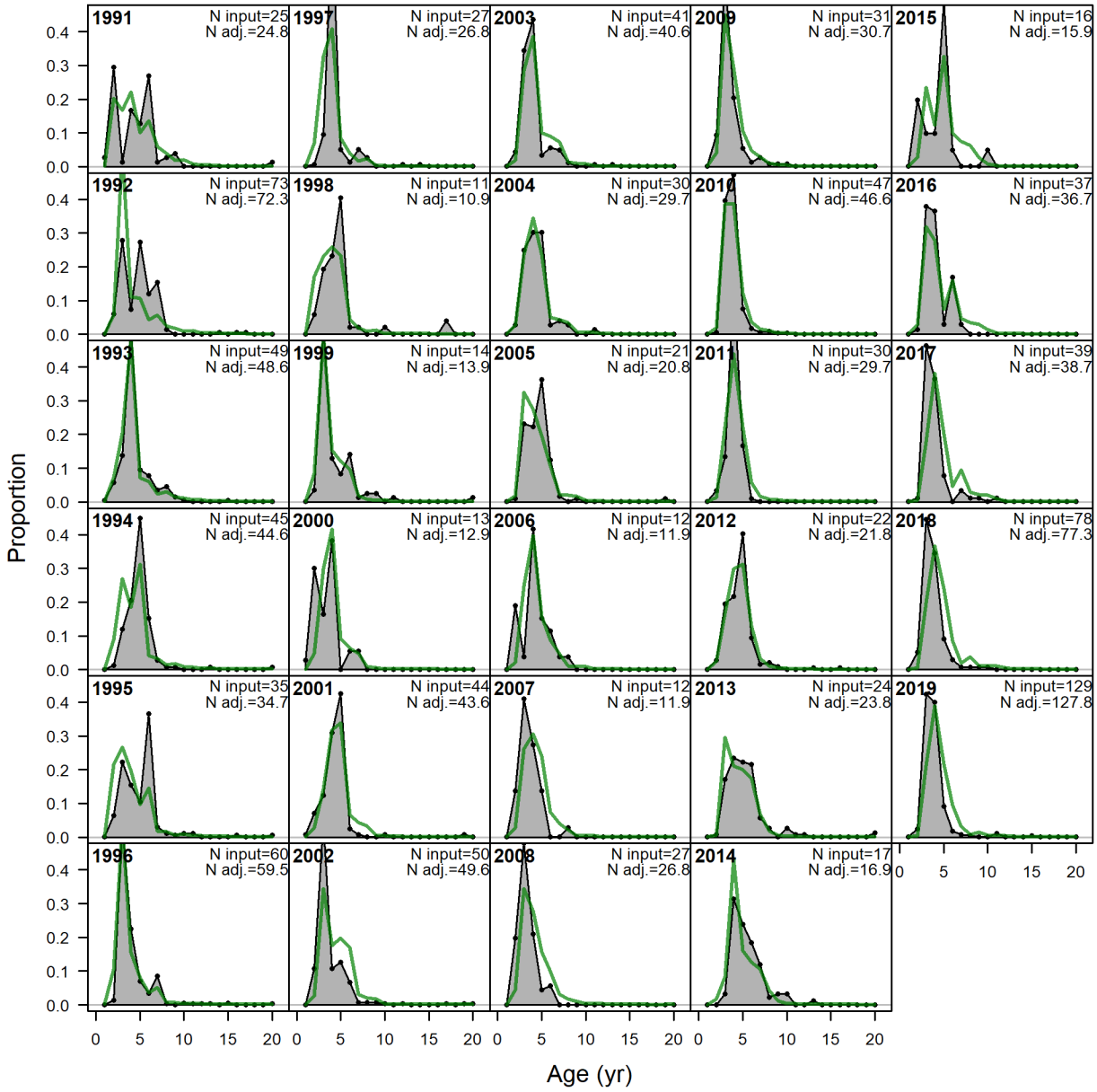


Figure 60. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Charter fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

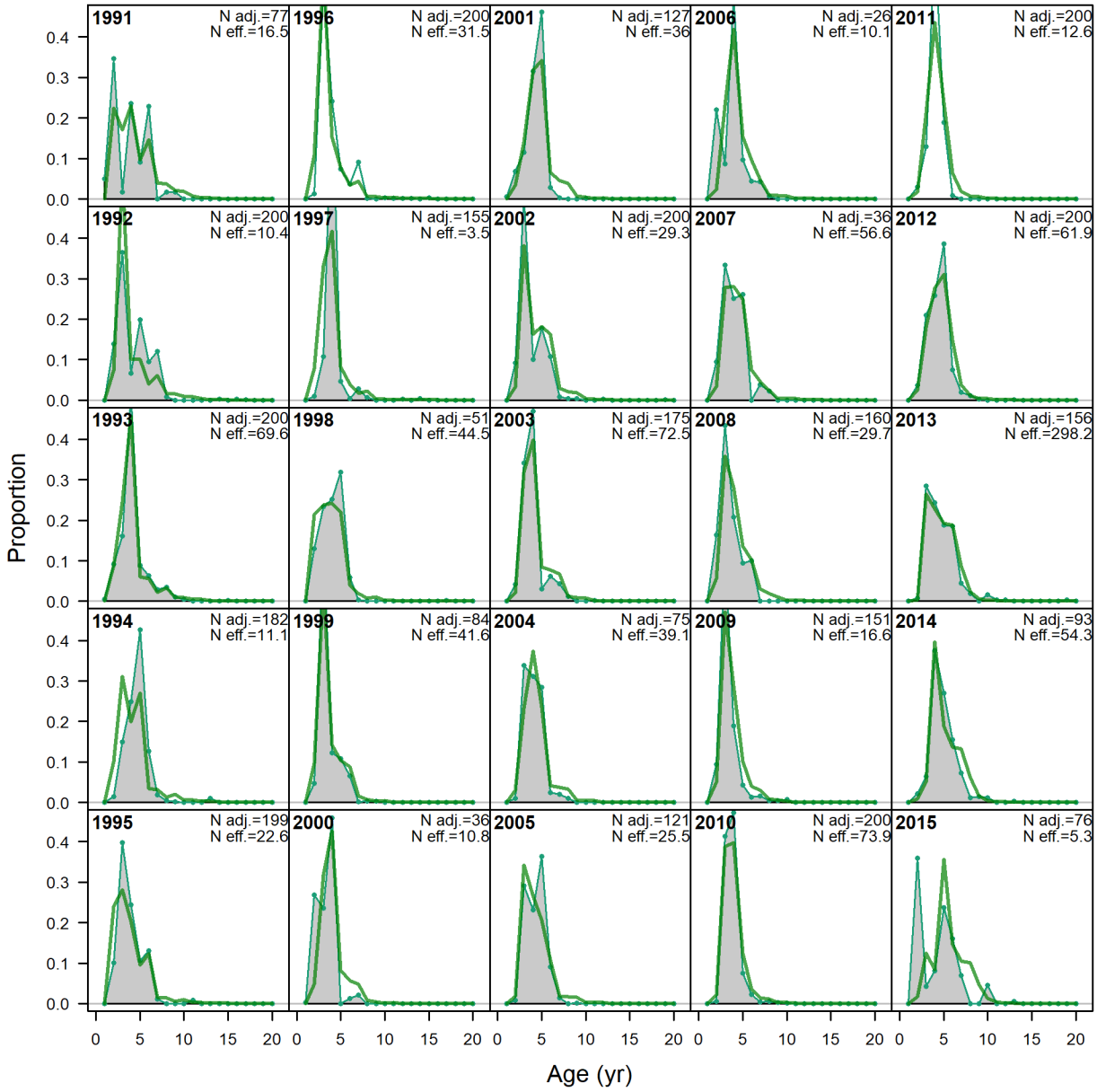


Figure 60 Continued. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Charter fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

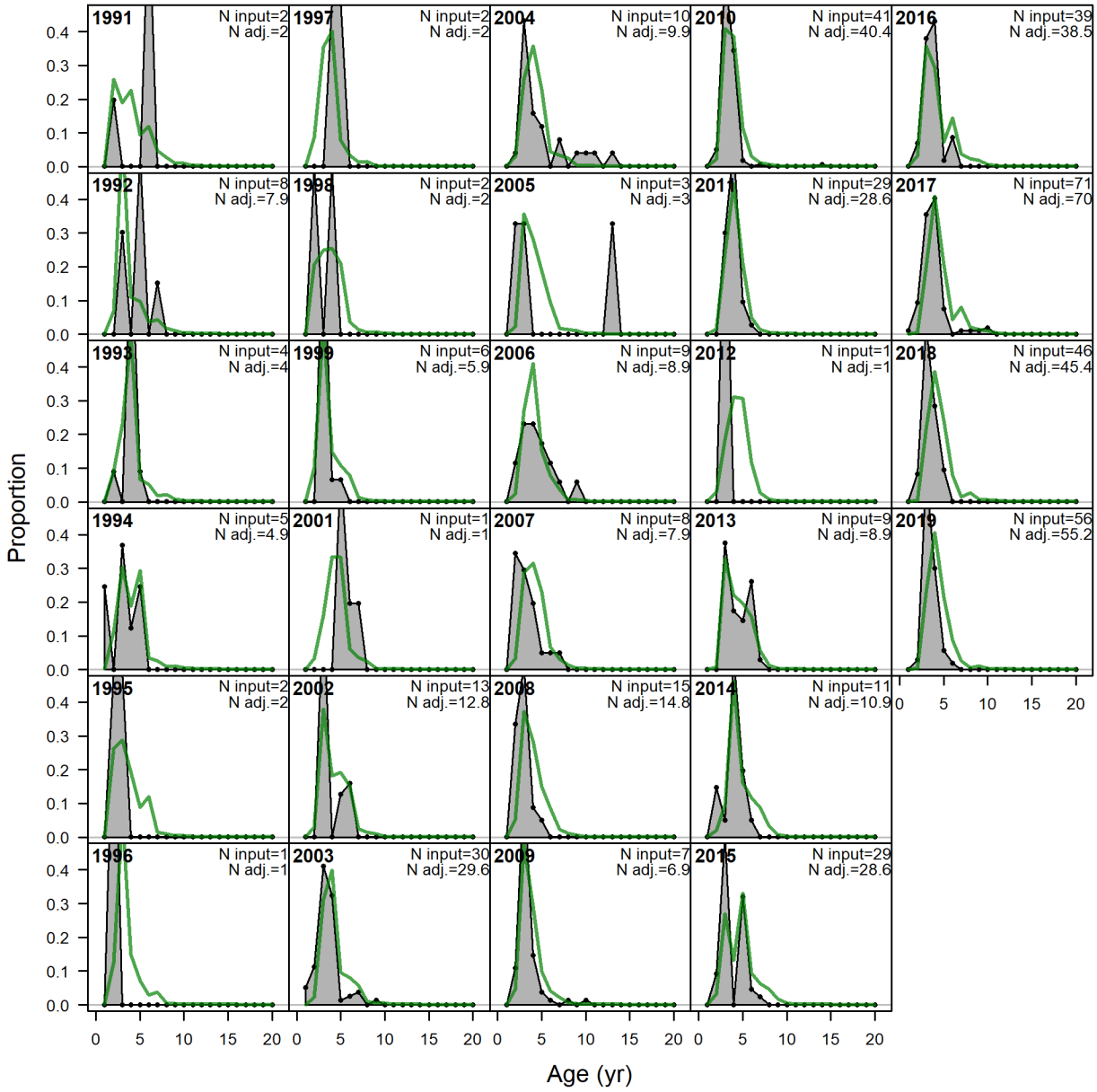


Figure 61. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Private + Shore fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SEDAR 33U

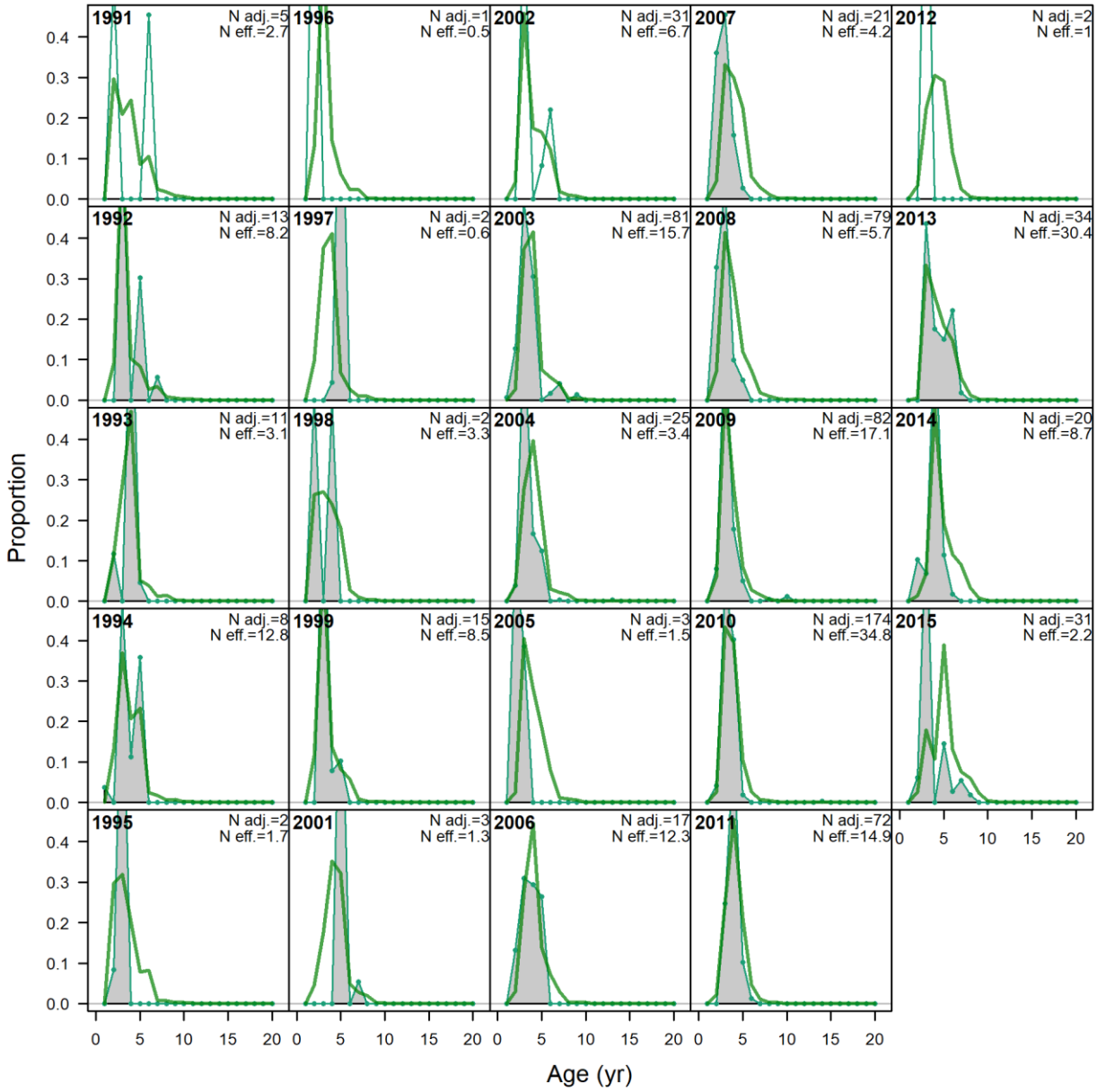


Figure 61 Continued. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Private + Shore fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'N input' is the input sample size and 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'N adj.' is the input sample size and 'N eff.' can be ignored as it was not used.

SRFS Run

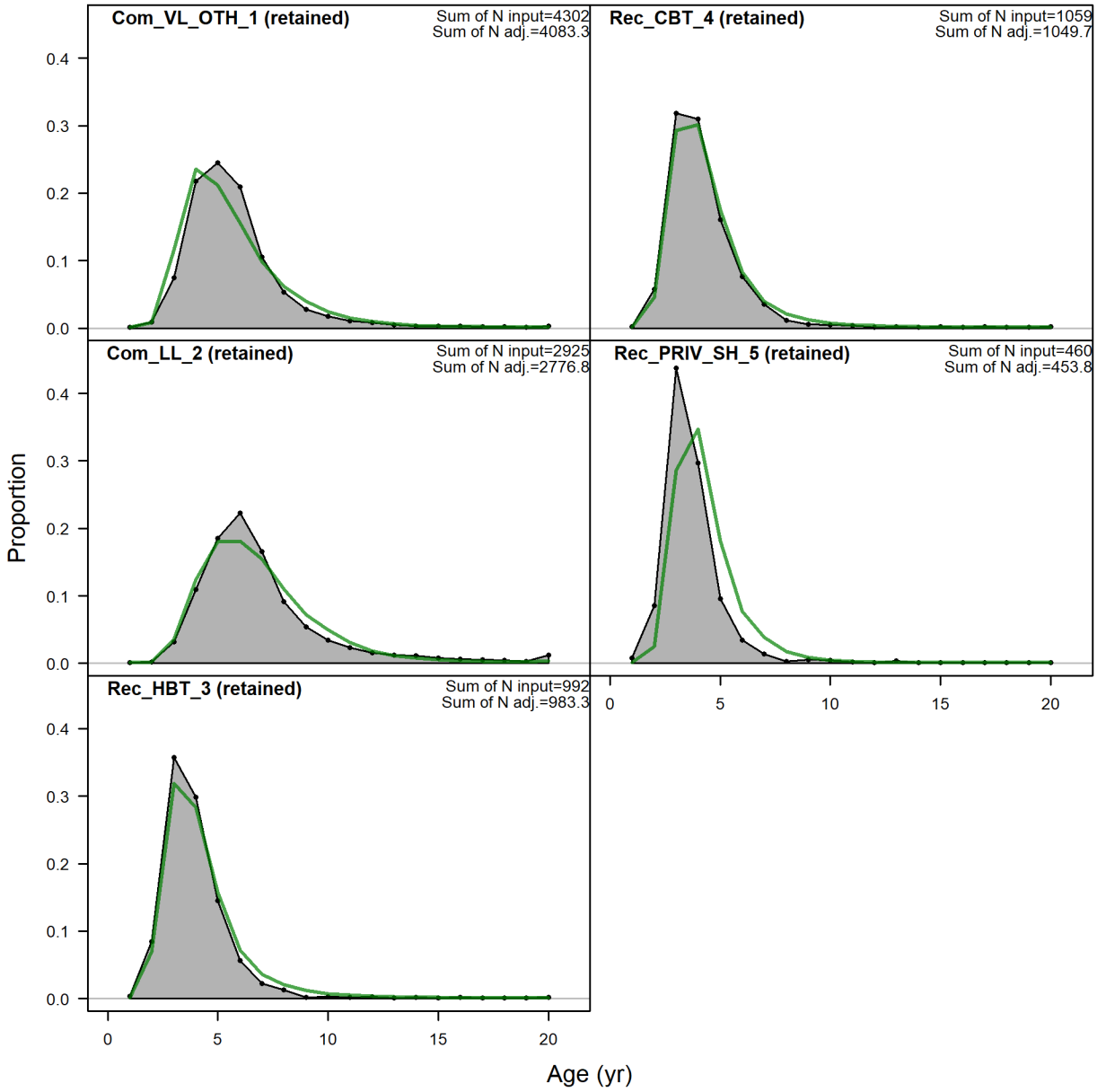


Figure 62. Model fits to the age composition of retained catch aggregated across years within a given fleet for Gulf of Mexico Gag Grouper. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'Sum of N input' is the total input sample size and 'Sum of N adj.' is the total sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'Sum of N adj.' is the input sample size and 'Sum of N eff.' can be ignored as it was not used.

SEDAR 33U

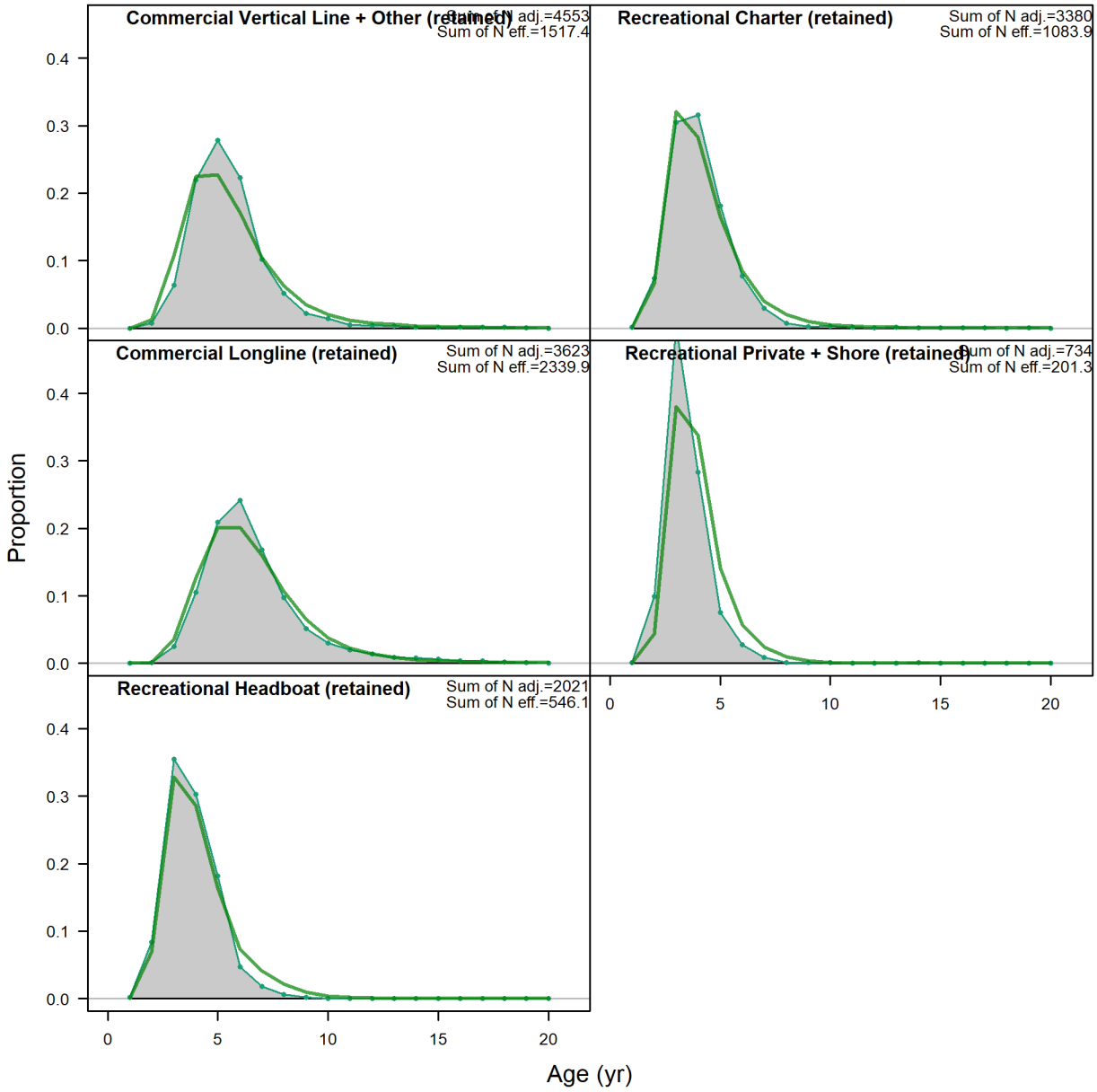


Figure 62 Continued. Model fits to the age composition of retained catch aggregated across years within a given fleet for Gulf of Mexico Gag Grouper. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For the SRFS Run, 'Sum of N input' is the total input sample size and 'Sum of N adj.' is the total sample size after adjustment by the Dirichlet-Multinomial parameter. For the SEDAR33 Update, 'Sum of N adj.' is the input sample size and 'Sum of N eff.' can be ignored as it was not used.

SRFS Run

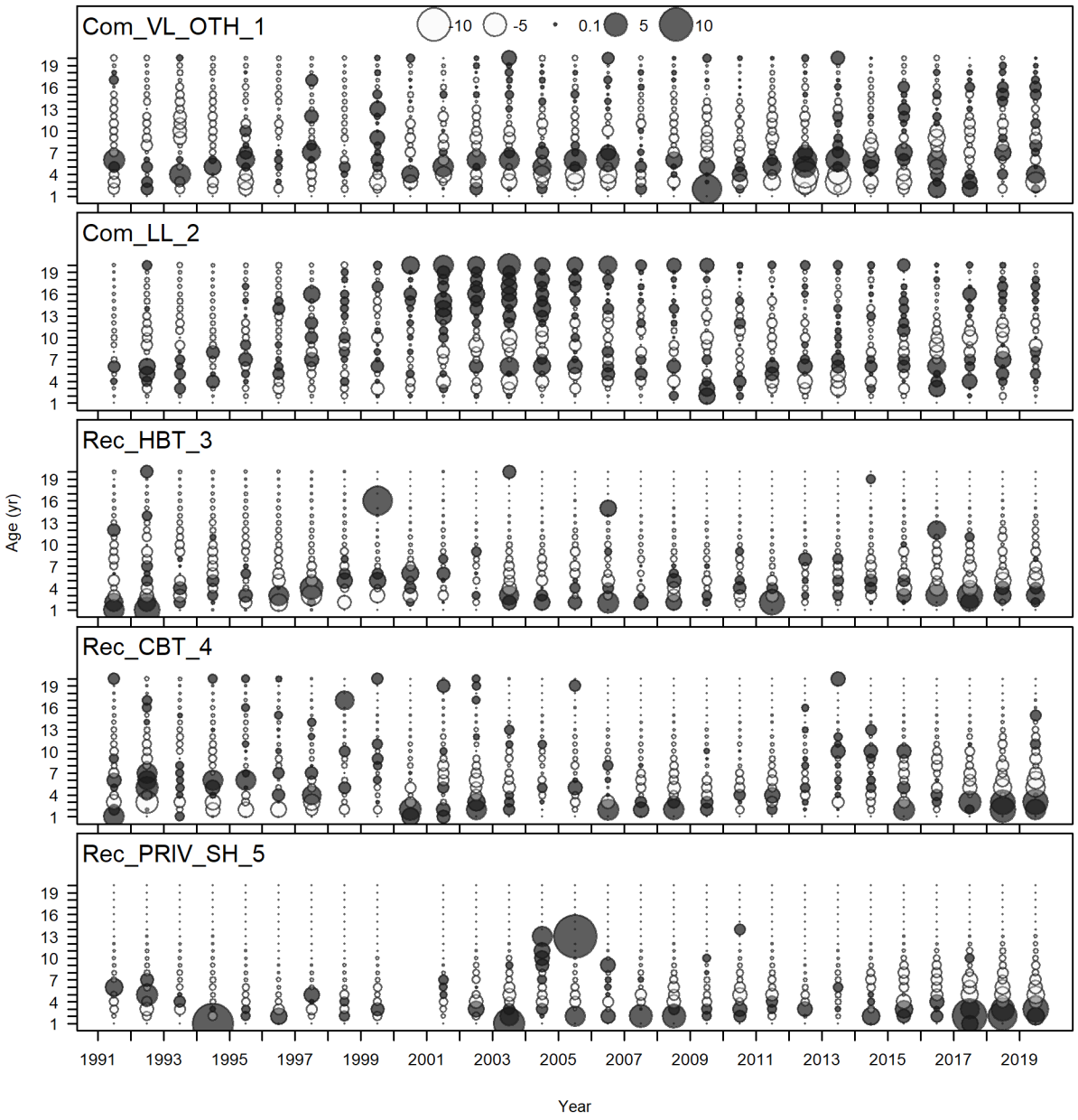


Figure 63. Pearson residuals for retained age composition data by year compared across fleets for Gulf of Mexico Gag Grouper For the SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

SEDAR 33U

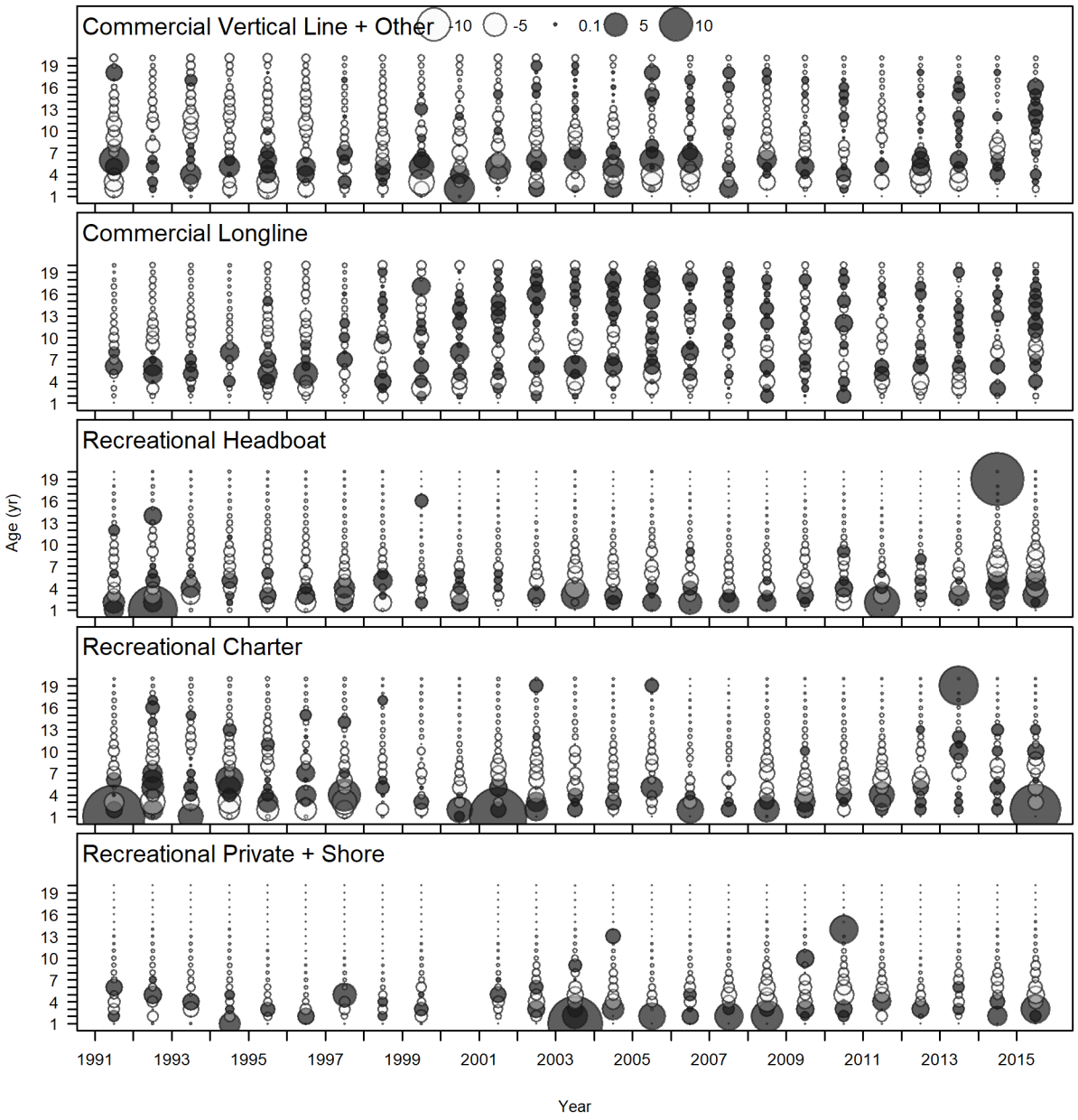


Figure 63 Continued. Pearson residuals for retained age composition data by year compared across fleets for Gulf of Mexico Gag Grouper for the SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

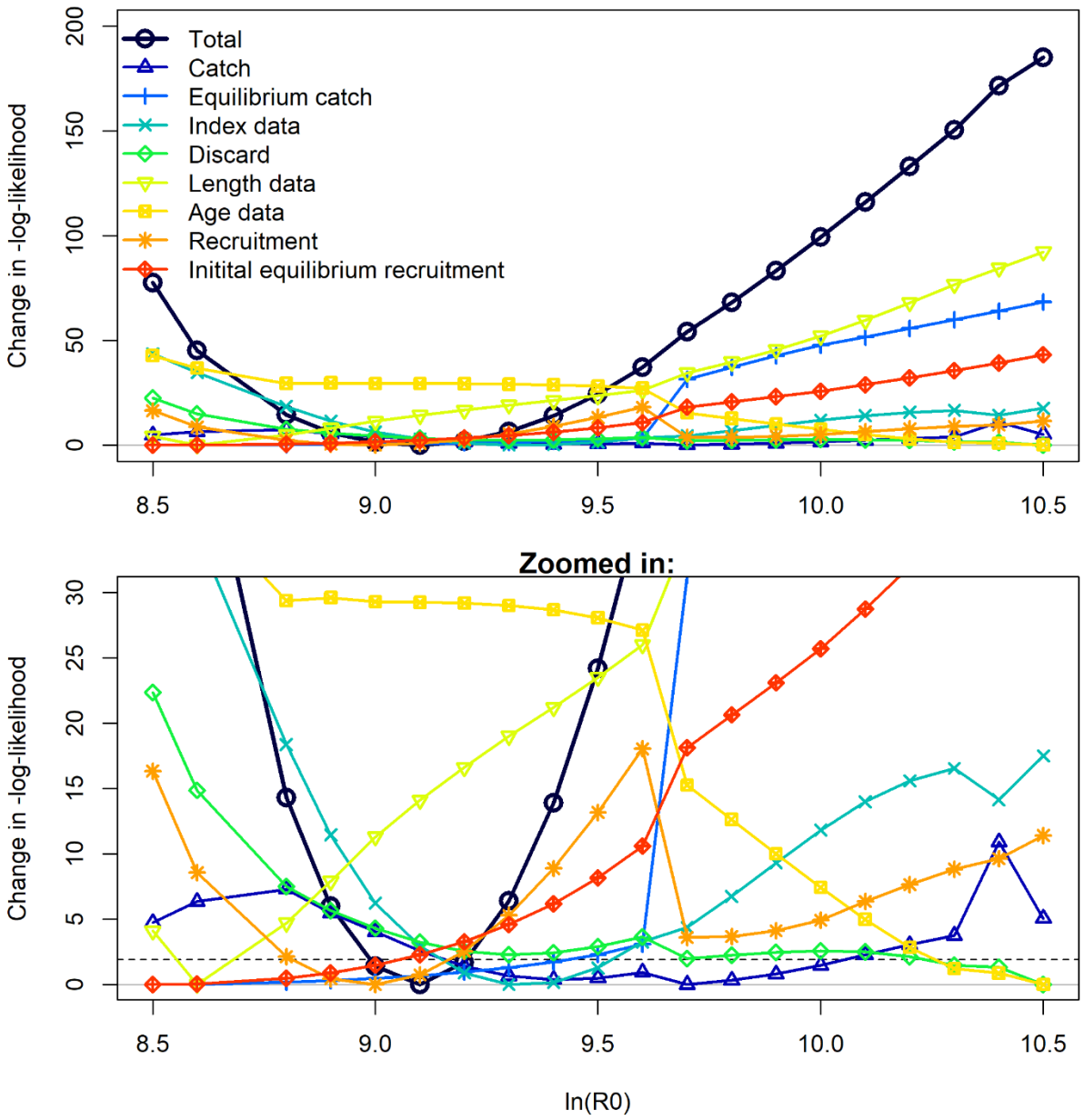


Figure 64. The profile likelihood for the natural log of the unfished recruitment parameter of the Beverton – Holt stock-recruit function for Gulf of Mexico Gag Grouper. Each line represents the change in negative log-likelihood value for each of the data sources fit in the model across the range of fixed steepness values tested in the profile diagnostic run. The MLE for the SRFS Run was 9.094. The bottom panel shows a close up of the top panel to better detect significant differences between runs.

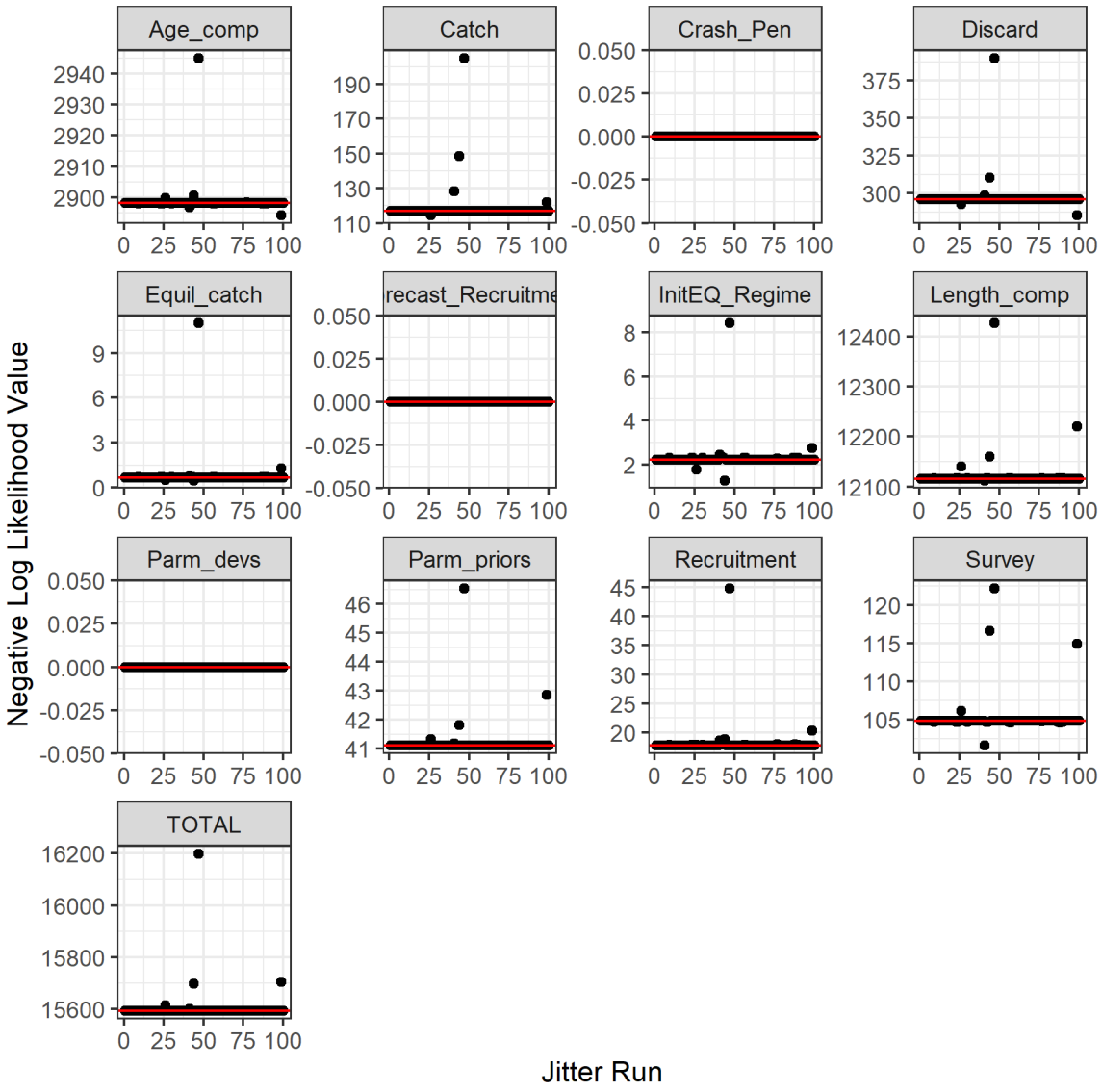


Figure 65. Results of the jitter analysis for various likelihood components for the Gulf of Mexico Gag Grouper SRFS Run. Each panel gives the results of 100 model runs where the starting parameter values for each run were randomly changed ('jittered') by 10% from the base model best fit values. The Base Run value for each panel is indicated by a red line.

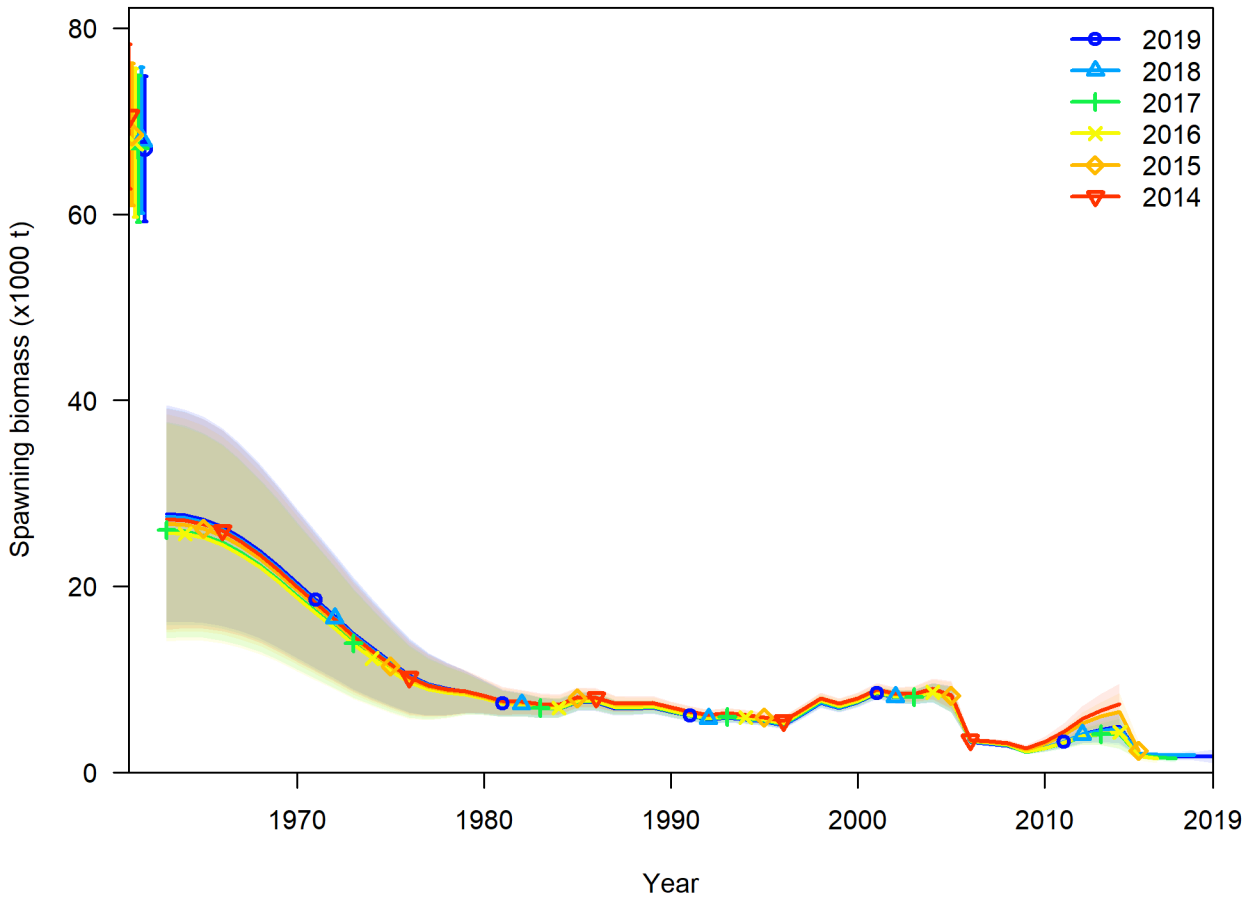


Figure 66. Results of a five year retrospective analysis for spawning biomass (metric tons) for the Gulf of Mexico Gag Grouper SRFS Run. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities. Mohn's rho= 0.09 – Mohn's rho between -0.15 and +0.20 is within the acceptable range, see Hurtado-Ferro et al., 2015.

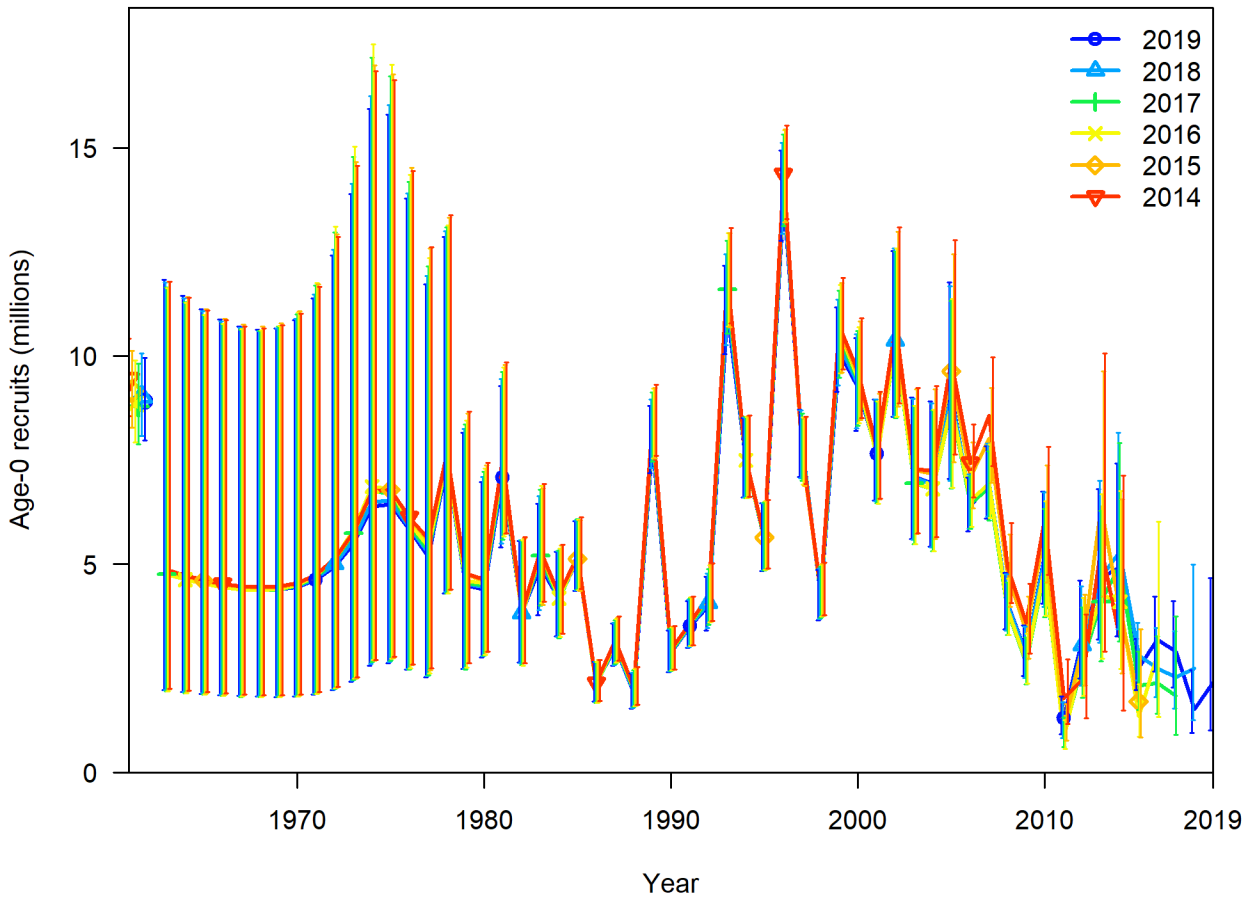


Figure 67. Results of a five year retrospective analysis for recruitment (millions of fish) for the Gulf of Mexico Gag Grouper SRFS Run. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities. Mohn's rho= -0.1 – Mohn's rho between -0.15 and +0.20 is within the acceptable range, see Hurtado-Ferro et al., 2015.

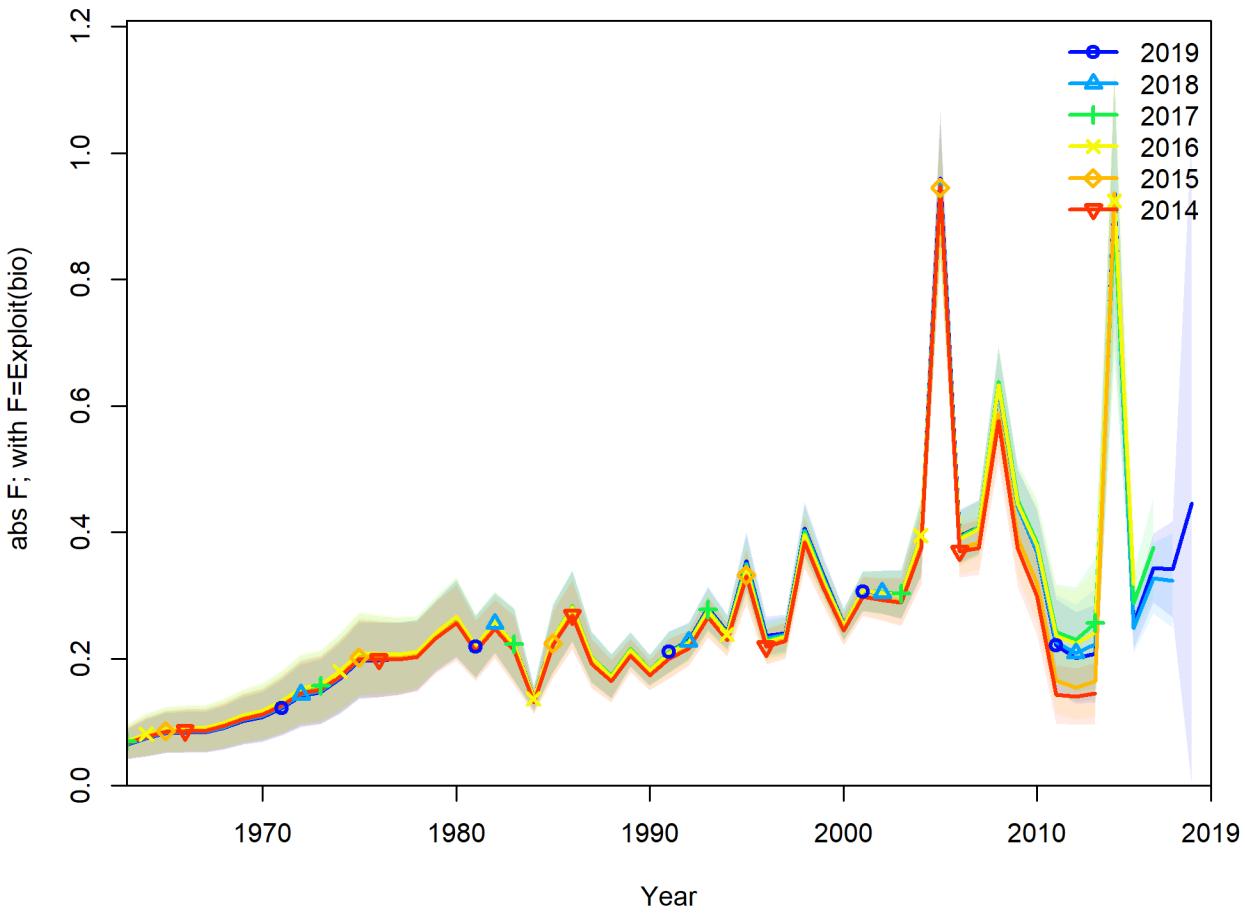


Figure 68. Results of a five year retrospective analysis for spawning biomass fishing mortality (total biomass killed / total biomass age 3+; bottom panel) for the Gulf of Mexico Gag Grouper SRFS Run. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities. Mohn's rho= -0.01 – Mohn's rho between -0.15 and +0.20 is within the acceptable range, see Hurtado-Ferro et al., 2015.

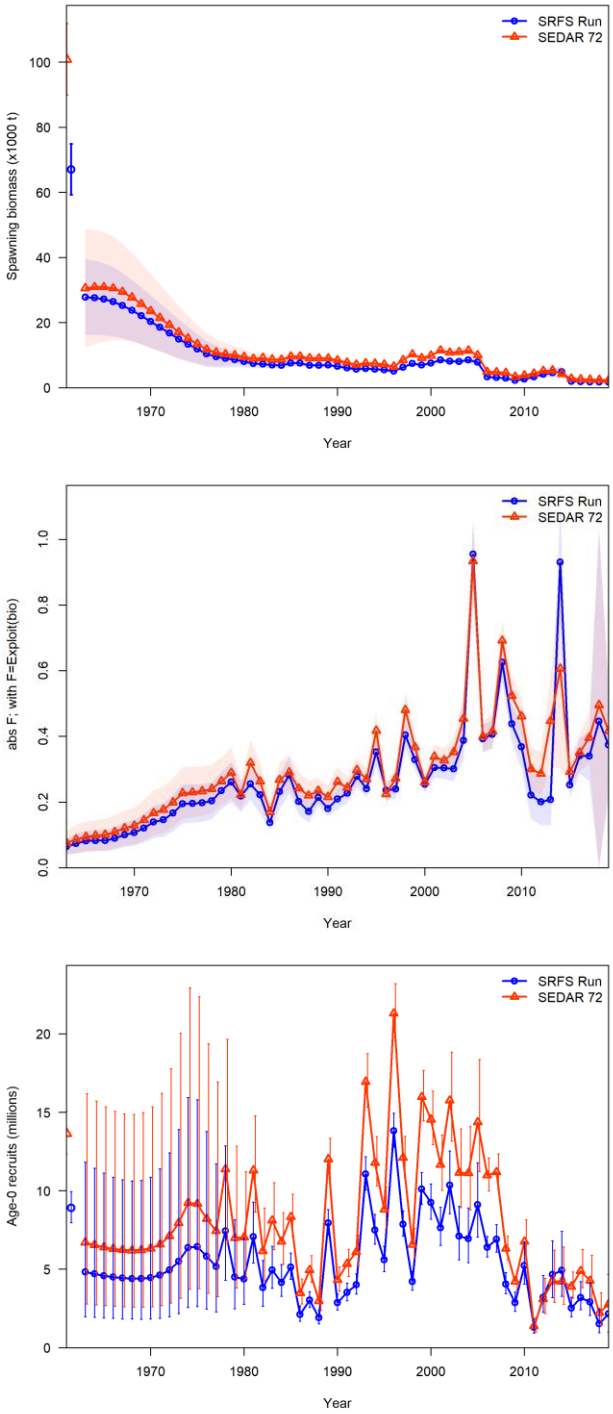


Figure 69. Differences in SSB estimates (top panel), annual exploitation rates (total biomass killed / total biomass age 3+) (middle panel) and annual recruitment (bottom panel), and associated uncertainty between the SEDAR 72 base run and the SRFS Run.

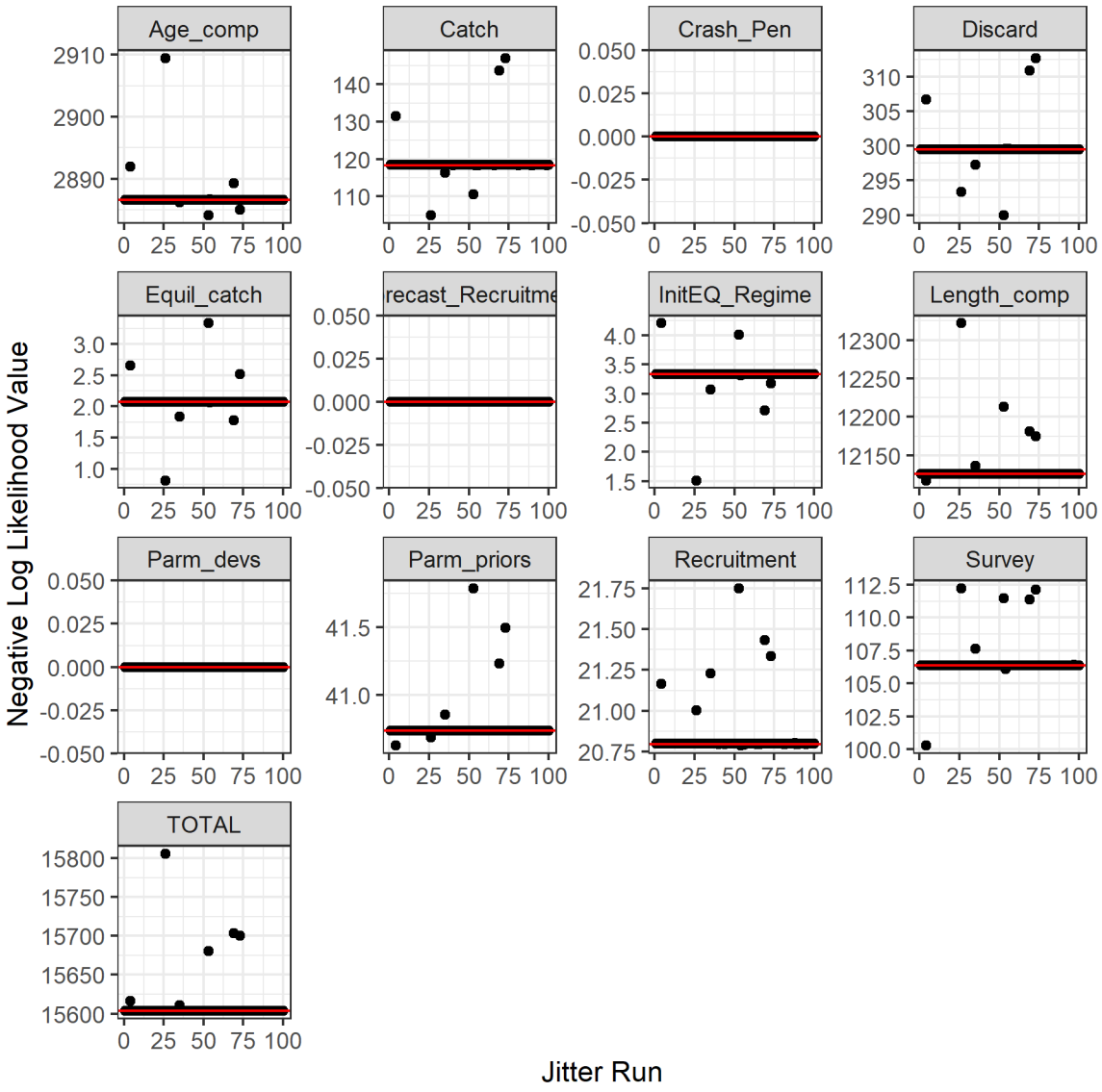


Figure 70. Results of the jitter analysis for various likelihood components for the Gulf of Mexico Gag Grouper for SEDAR 72 model. Each panel gives the results of 100 model runs where the starting parameter values for each run were randomly changed ('jittered') by 10% from the base model best fit values. The Base Run value for each panel is indicated by a red line.

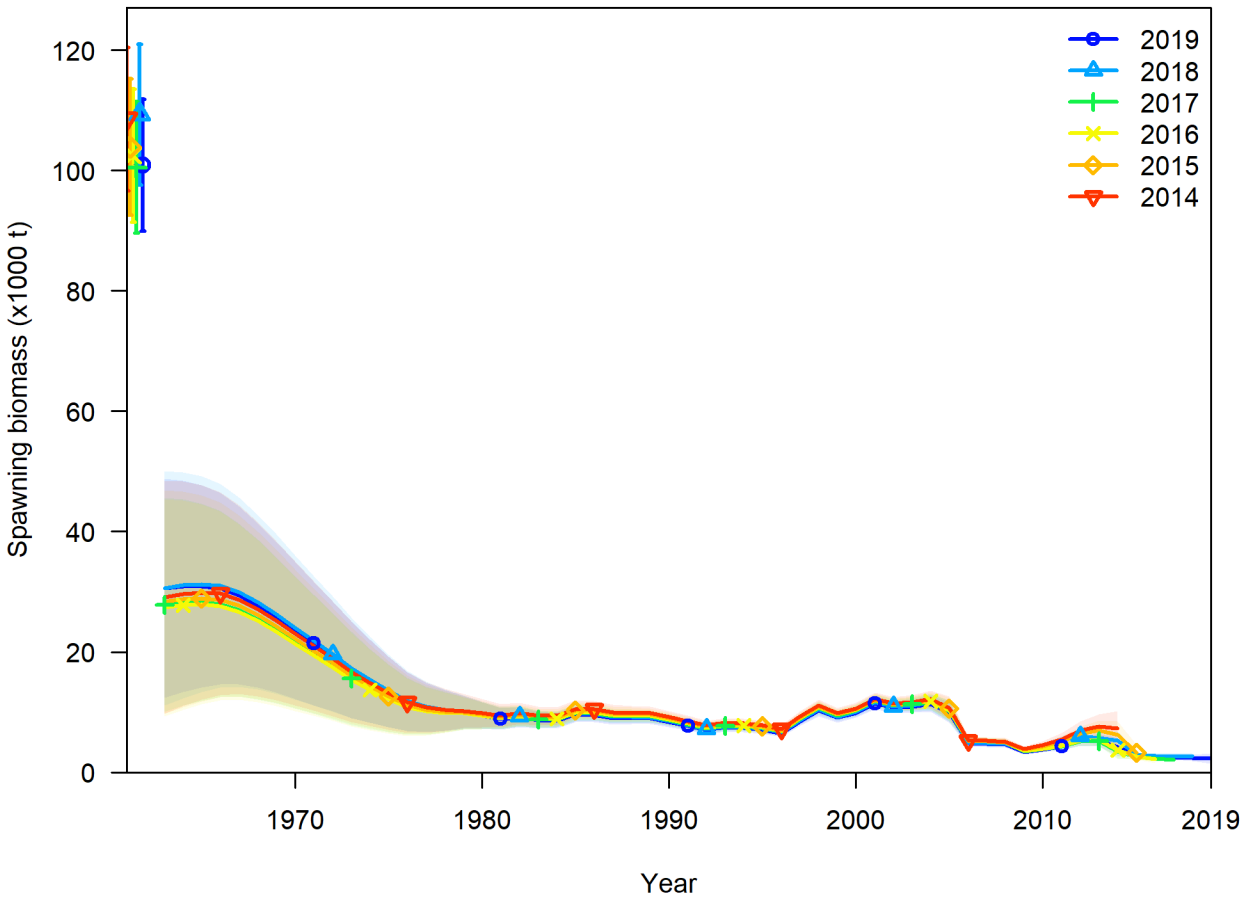


Figure 71. Results of a five year retrospective analysis for spawning biomass (metric tons) for the Gulf of Mexico Gag Grouper SEDAR 72 model. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities. Mohn's rho= 0.15 – Mohn's rho between -0.15 and +0.20 is within the acceptable range, see Hurtado-Ferro et al., 2015.

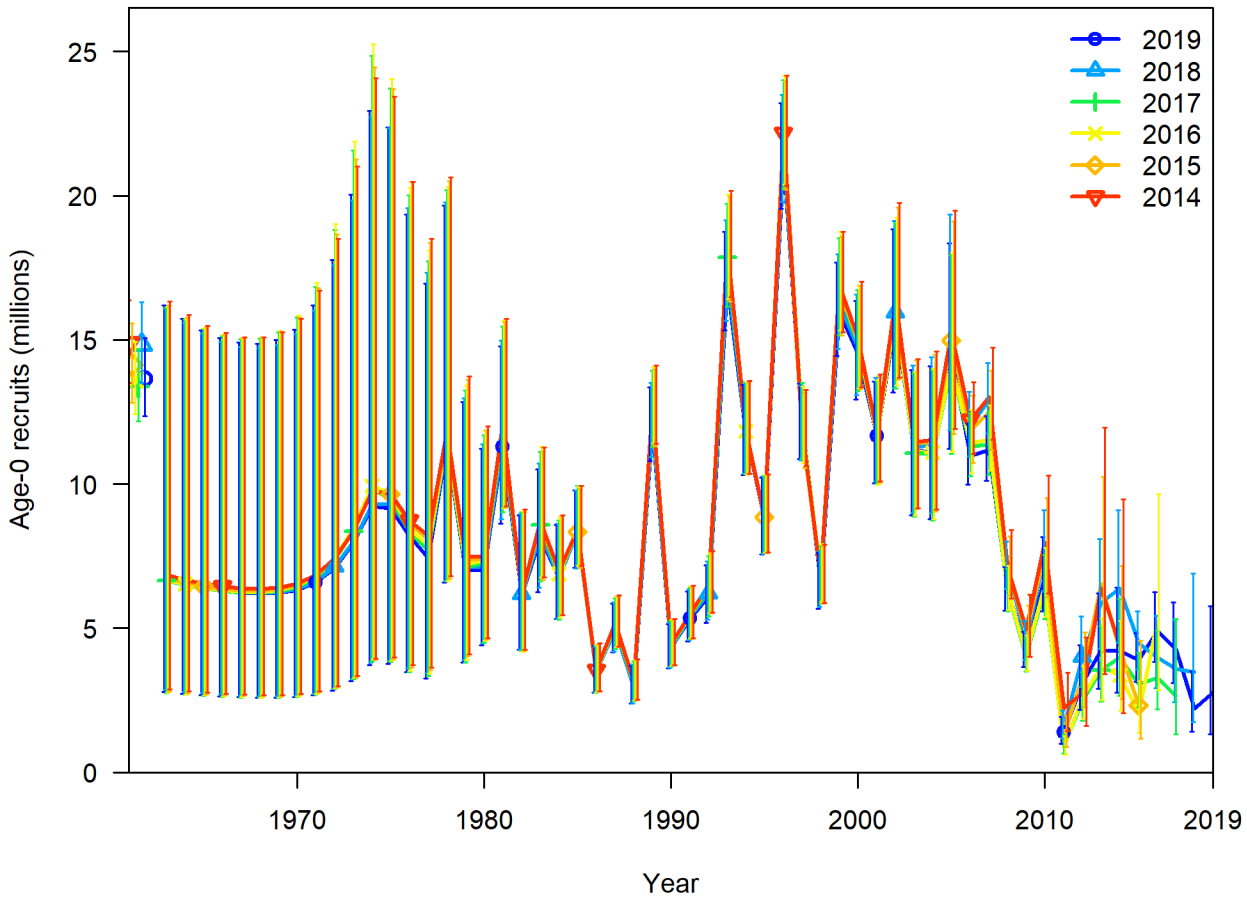


Figure 72. Results of a five year retrospective analysis for recruitment (millions of fish) for the Gulf of Mexico Gag Grouper SEDAR 72 model. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities. Mohn's rho= -0.02 – Mohn's rho between -0.15 and +0.20 is within the acceptable range, see Hurtado-Ferro et al., 2015.

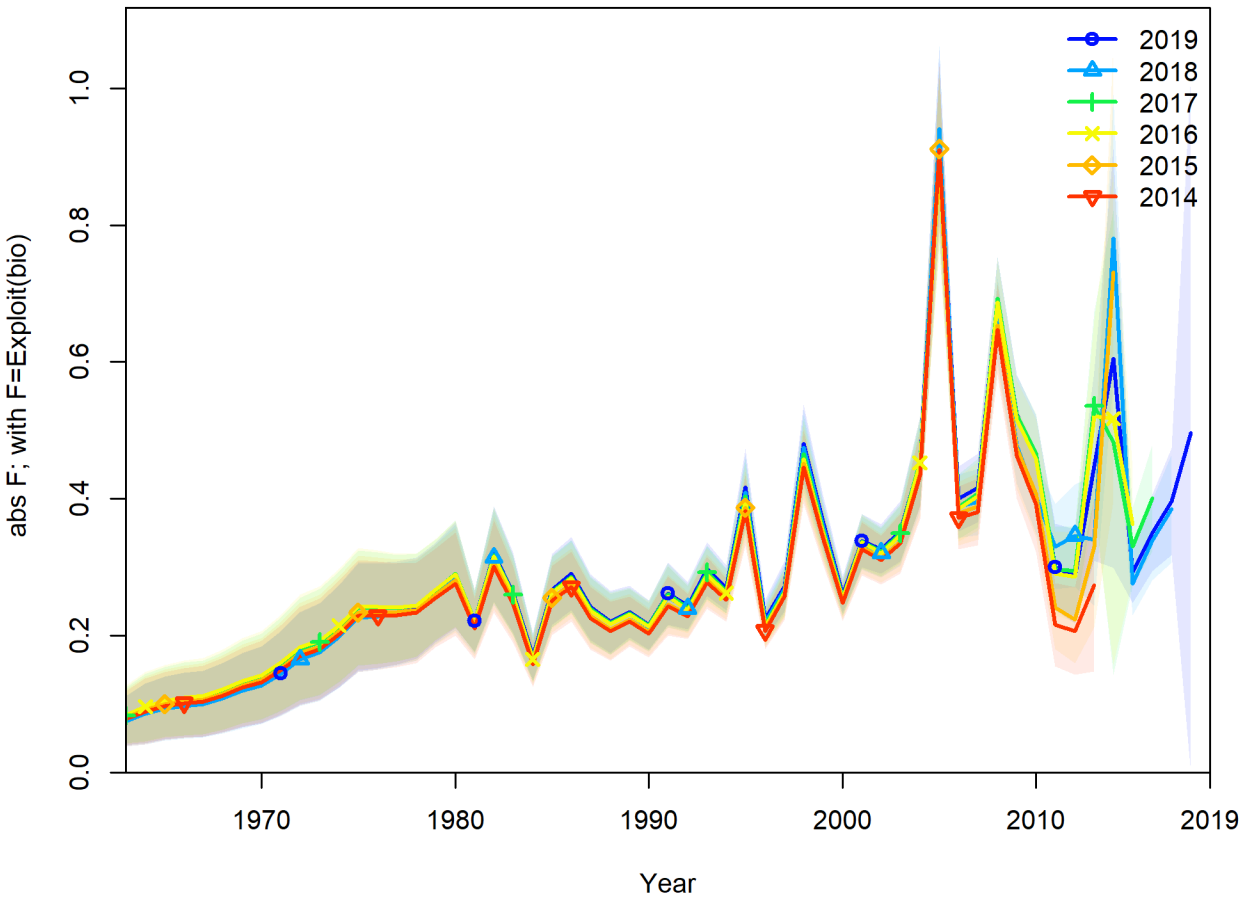


Figure 73. Results of a five year retrospective analysis for spawning biomass fishing mortality (total biomass killed / total biomass age 3+; bottom panel) for the Gulf of Mexico Gag Grouper for SEDAR 72 model. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities. Mohn's rho= 0.12 – Mohn's rho between -0.15 and +0.20 is within the acceptable range, see Hurtado-Ferro et al., 2015.

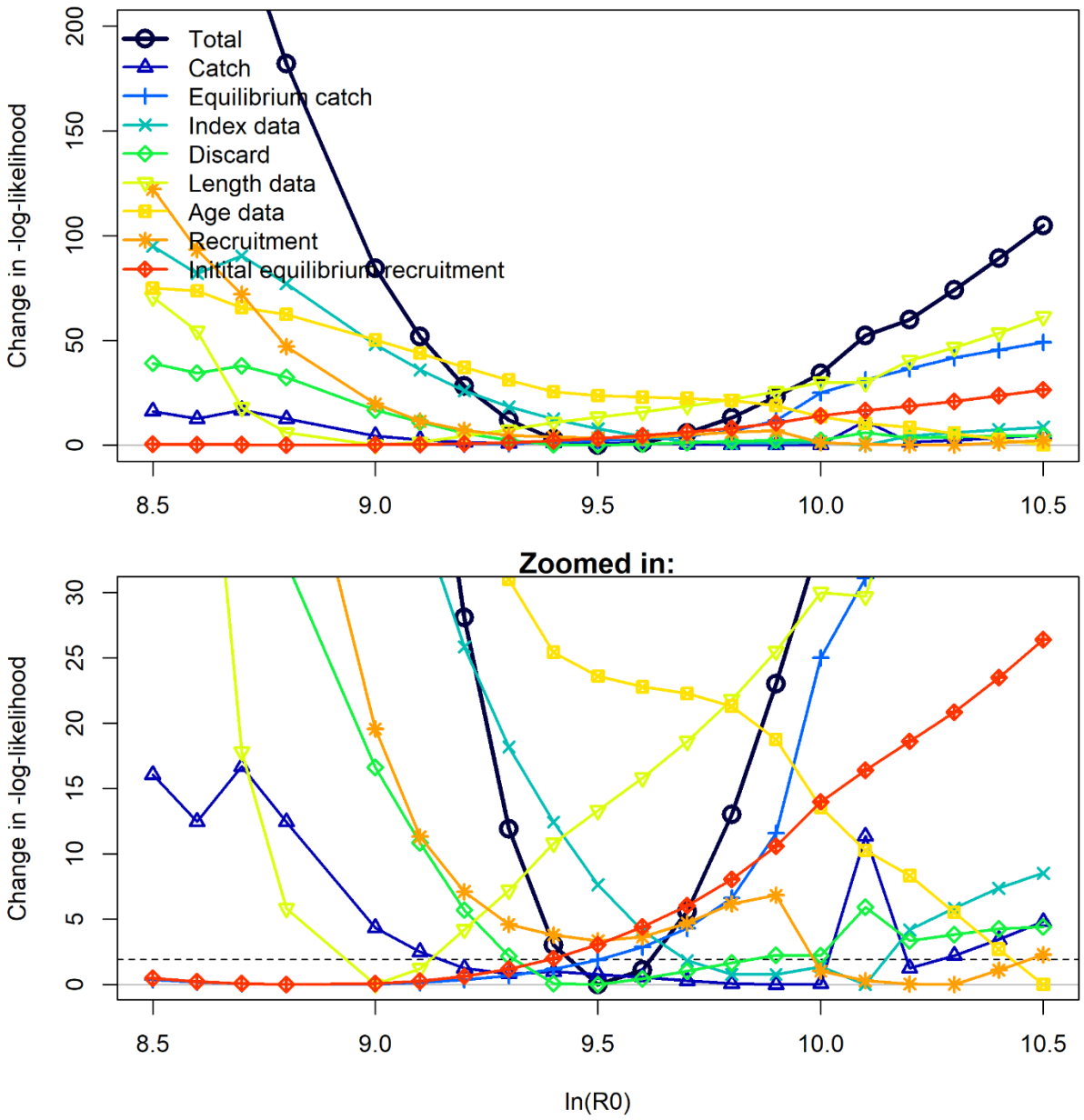


Figure 74. The profile likelihood for the natural log of the unfished recruitment parameter of the Beverton – Holt stock-recruit function for Gulf of Mexico Gag Grouper for SEDAR 72 model. Each line represents the change in negative log-likelihood value for each of the data sources fit in the model across the range of fixed steepness values tested in the profile diagnostic run. The MLE for the base model was 9.521. The bottom panel shows a close up of the top panel to better detect significant differences between runs.

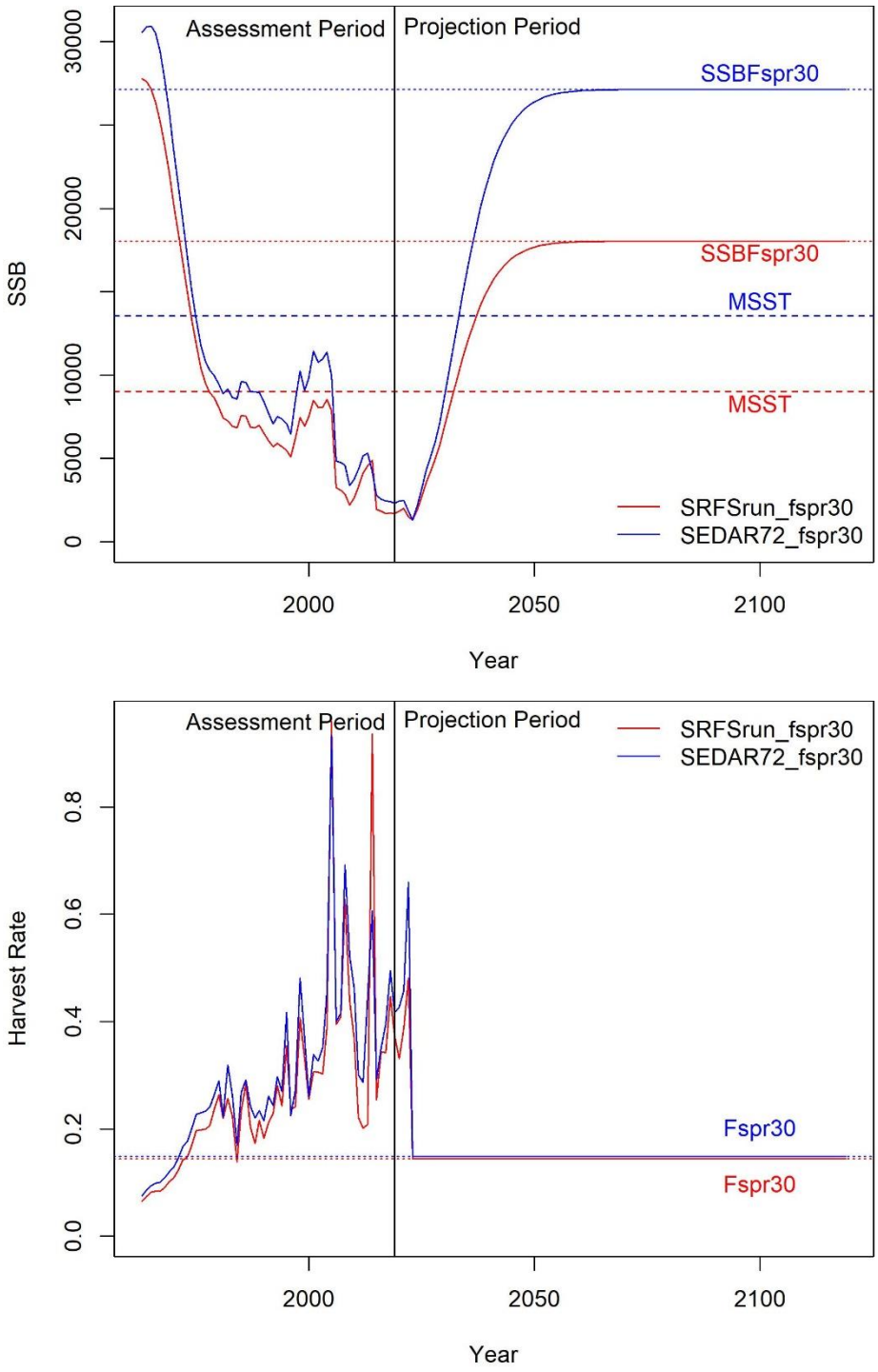


Figure 75. Time series of SSB and harvest rate (total biomass killed / total biomass age 3+) for the SRFS Run and the SEDAR 72 base run with respect to status determination criteria for the Gulf of Mexico Gag Grouper assessment.

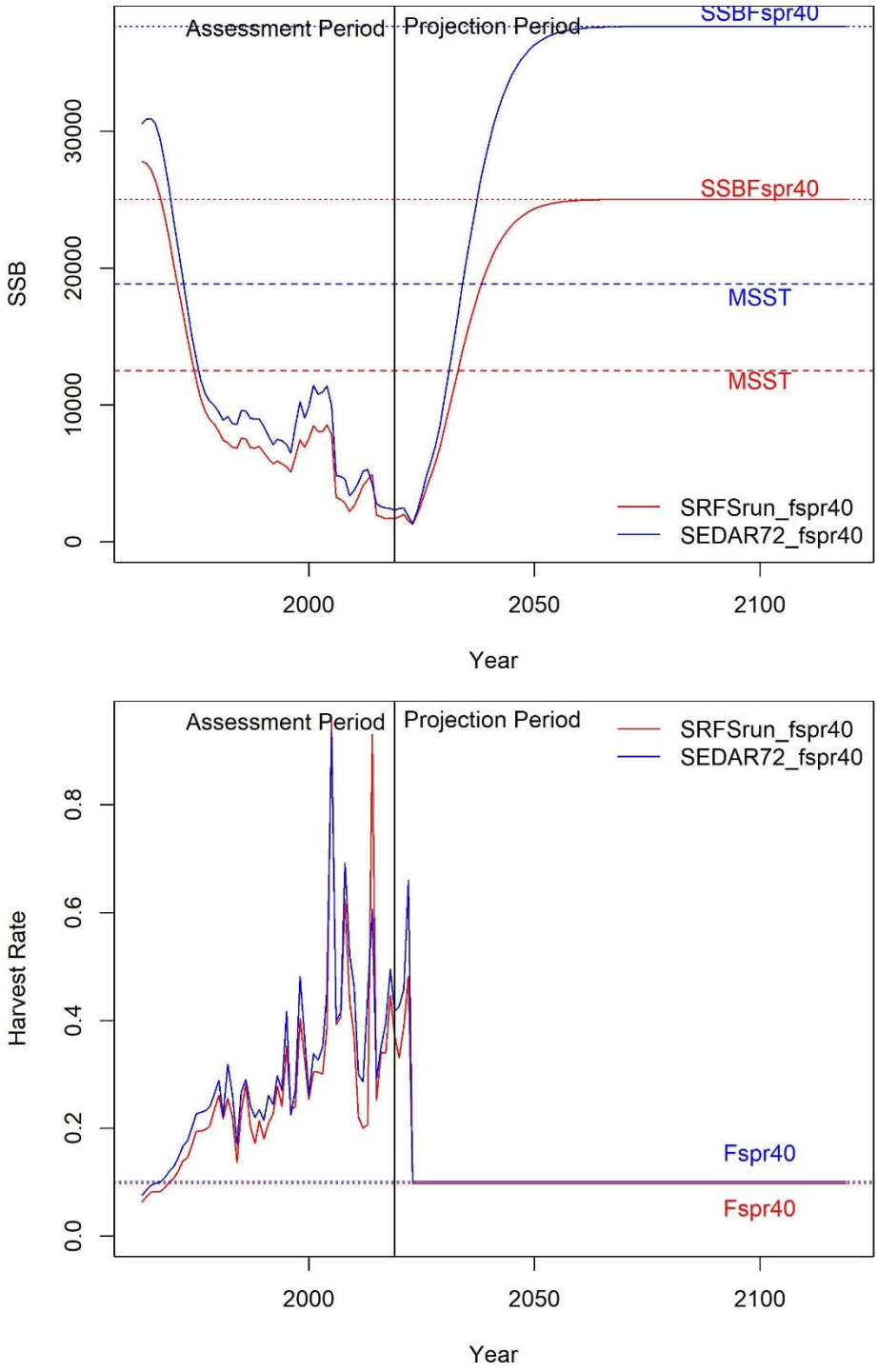


Figure 76. Time series of SSB and harvest rate (total biomass killed / total biomass age 3+) for the SRFS Run and the SEDAR 72 base run with respect to status determination criteria for the Gulf of Mexico Gag Grouper assessment.

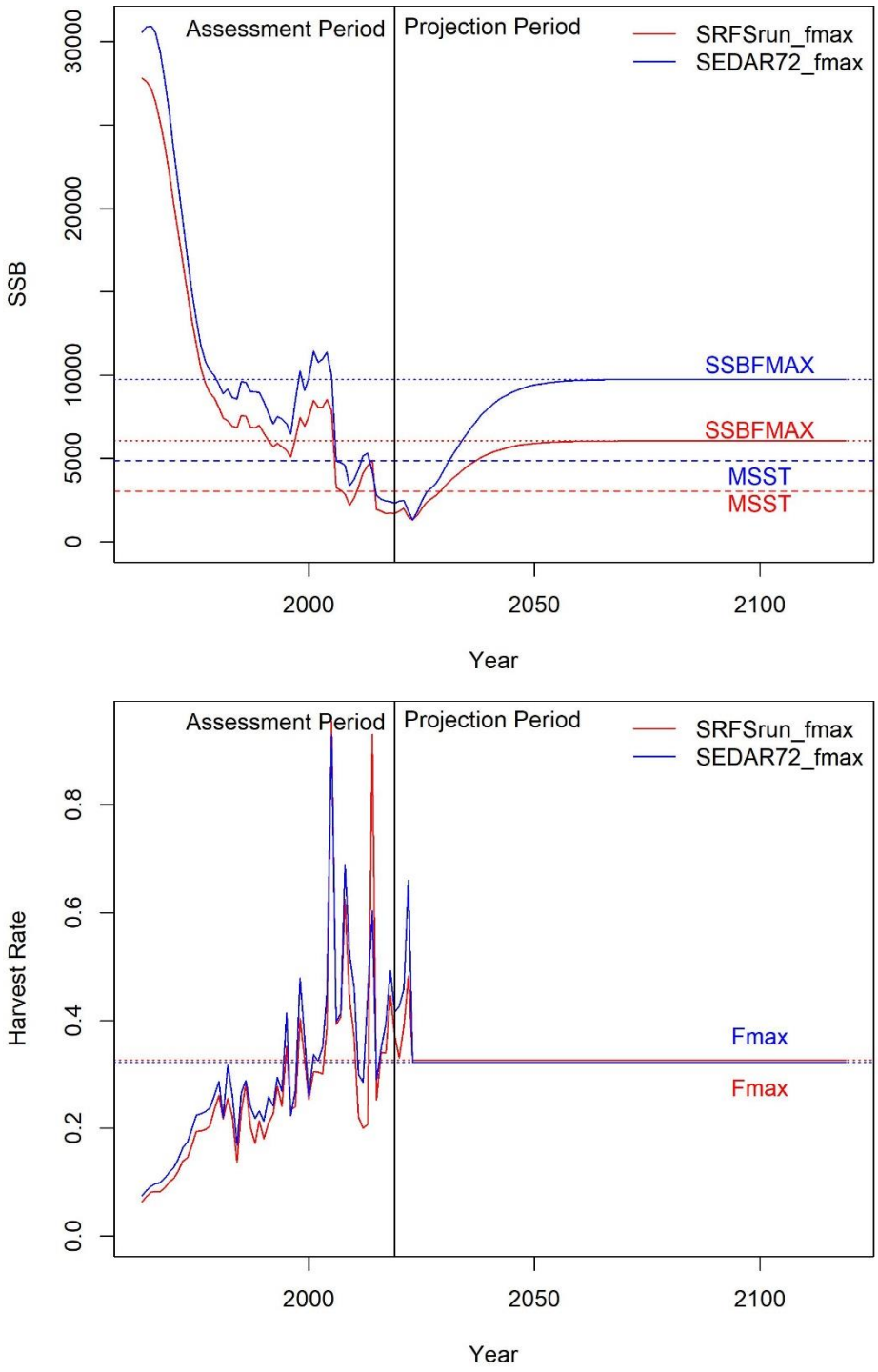


Figure 77. Time series of SSB and harvest rate (total biomass killed / total biomass age 3+) for the SRFS Run and the SEDAR 72 base run with respect to status determination criteria for the Gulf of Mexico Gag Grouper assessment.

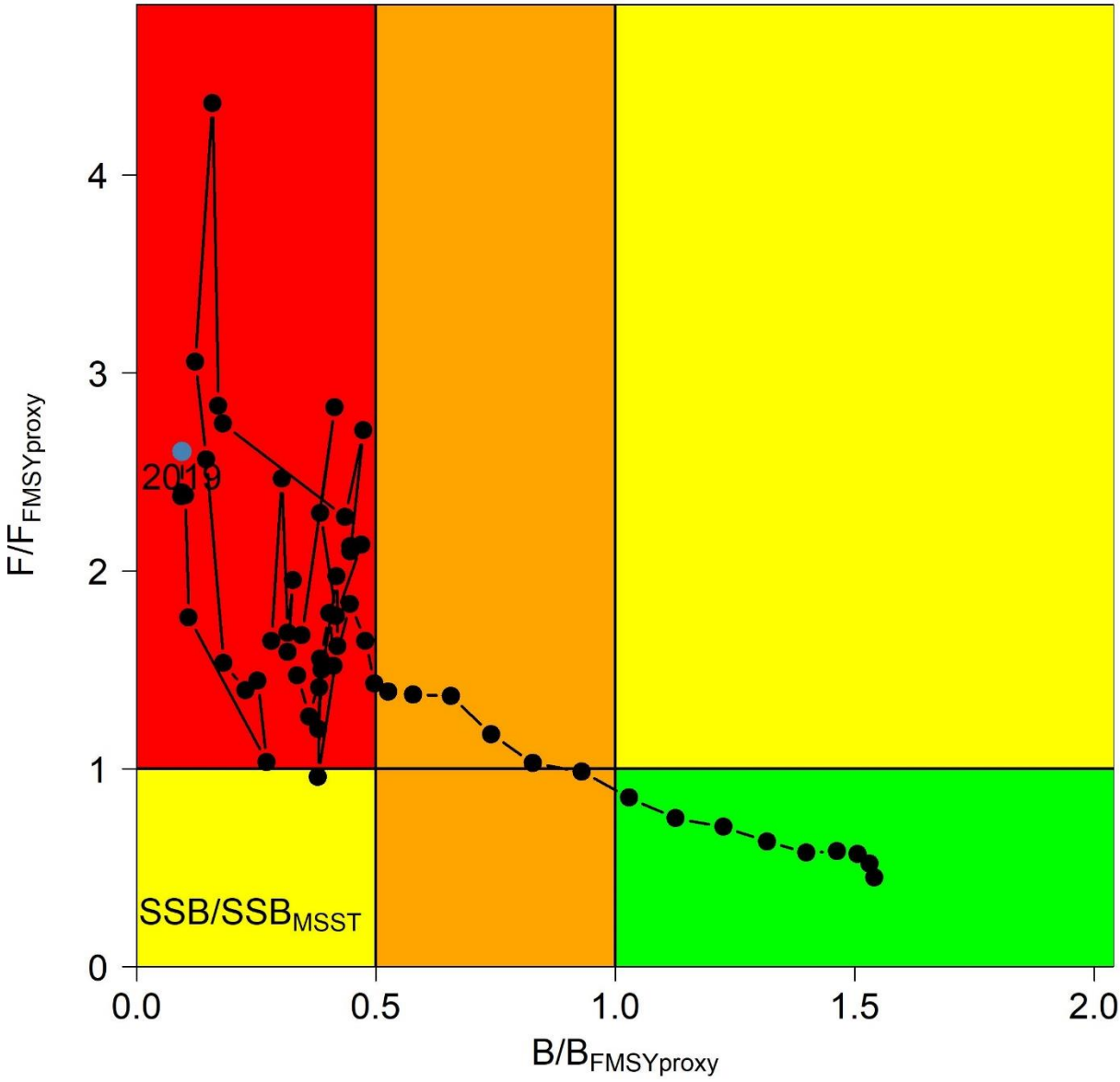


Figure 78. Kobe plot illustrating the trajectory of stock status for the SRFS Run. The orange coloring indicates regions where the stock is below the biomass target but above the biomass threshold (MSST = 0.5 x $SSB_{FMSYproxy}$). The 2019 terminal year stock status is indicated by the gray dot. Annual exploitation rates used to calculate $F/F_{MSYproxy}$ exclude red tide mortality. ***$F_{MSYproxy}$ defined as F_{SPR30}.***

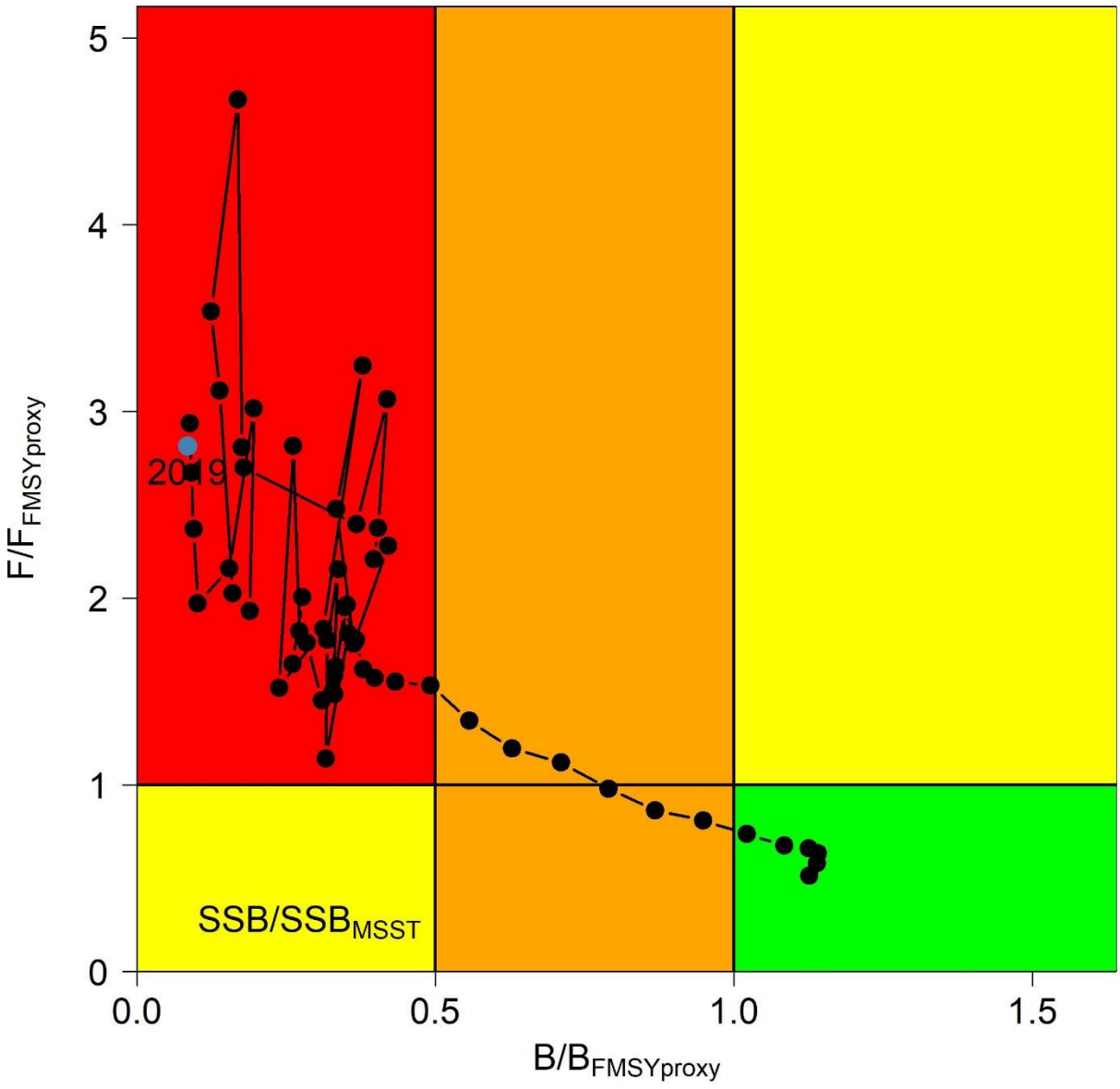


Figure 79. Kobe plot illustrating the trajectory of stock status for SEDAR 72. The orange coloring indicates regions where the stock is below the biomass target but above the biomass threshold (MSST = 0.5 x $SSB_{FMSYproxy}$). The 2019 terminal year stock status is indicated by the gray dot. Annual exploitation rates used to calculate $F/F_{MSYproxy}$ exclude red tide mortality. ***$F_{MSYproxy}$ defined as F_{SPR30}.***

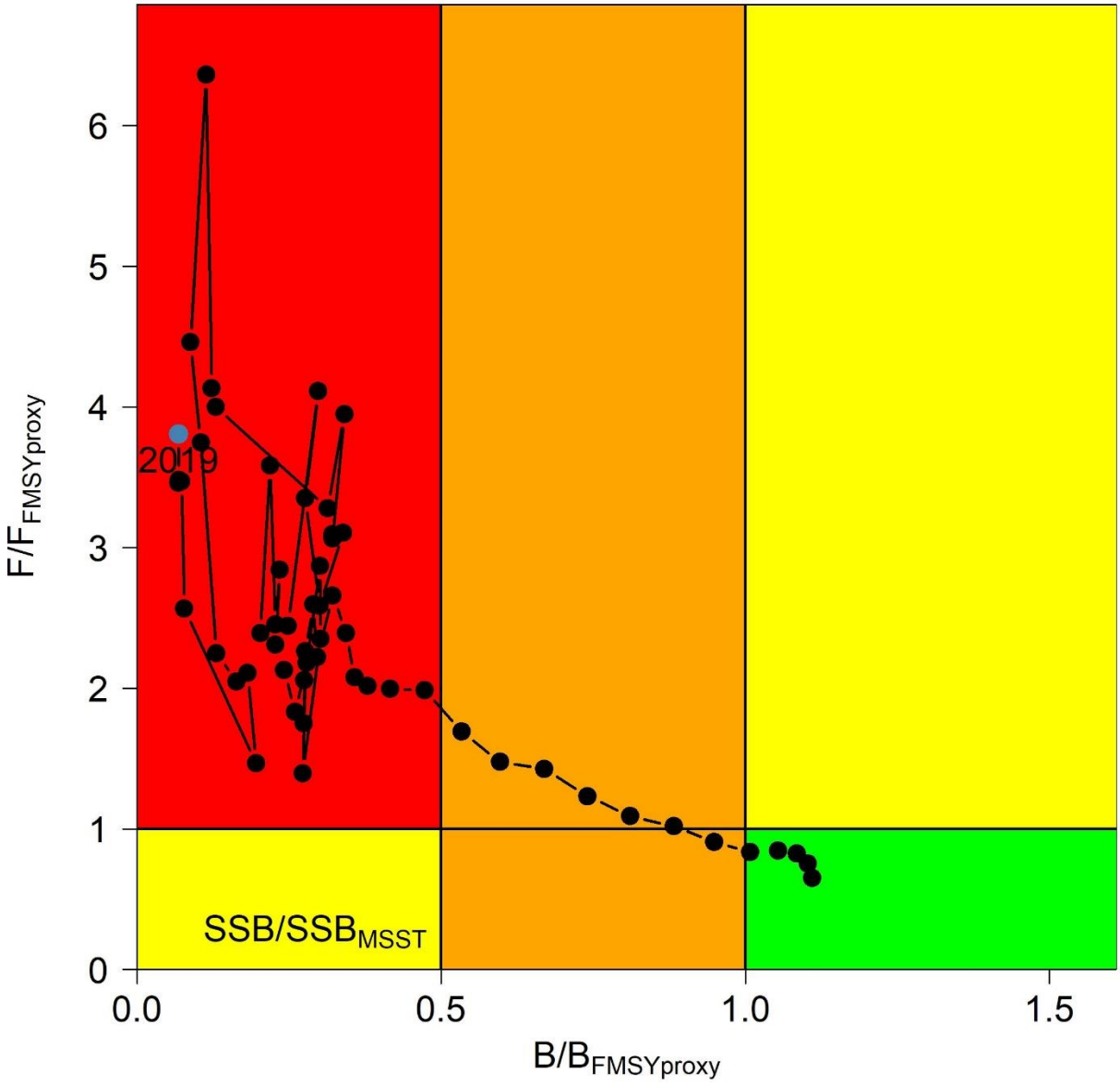


Figure 80. Kobe plot illustrating the trajectory of stock status for the SRFS Run. The orange coloring indicates regions where the stock is below the biomass target but above the biomass threshold (MSST = 0.5 x $SSB_{FMSYproxy}$). The 2019 terminal year stock status is indicated by the gray dot. Annual exploitation rates used to calculate $F/F_{MSYproxy}$ exclude red tide mortality. ***$F_{MSYproxy}$ defined as F_{SPR40}.***

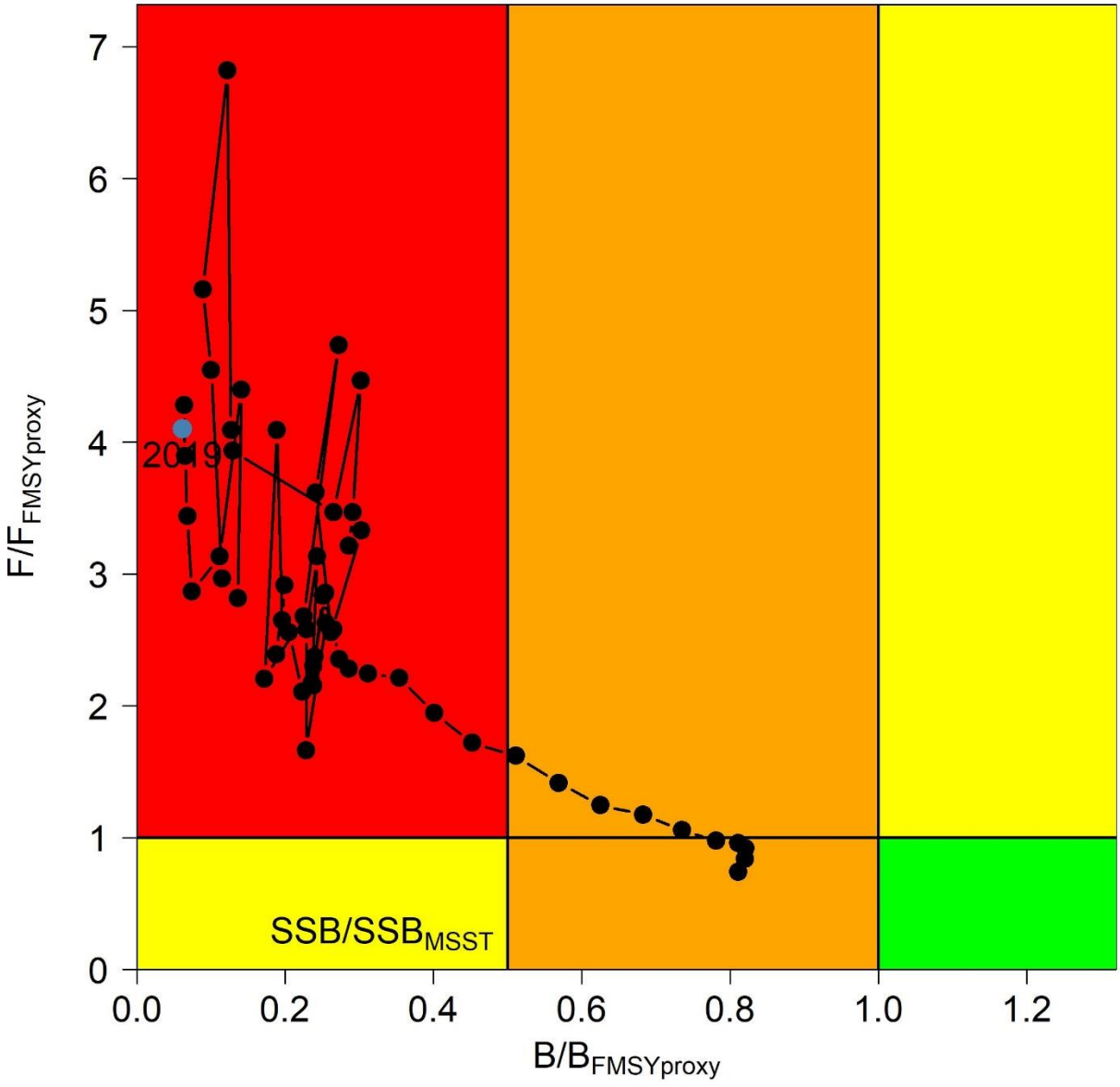


Figure 81. Kobe plot illustrating the trajectory of stock status for SEDAR 72. The orange coloring indicates regions where the stock is below the biomass target but above the biomass threshold (MSST = 0.5 x $SSB_{FMSYproxy}$). The 2019 terminal year stock status is indicated by the gray dot. Annual exploitation rates used to calculate F/F_{MAX} exclude red tide mortality. ***$F_{MSYproxy}$ defined as F_{SPR40}.***

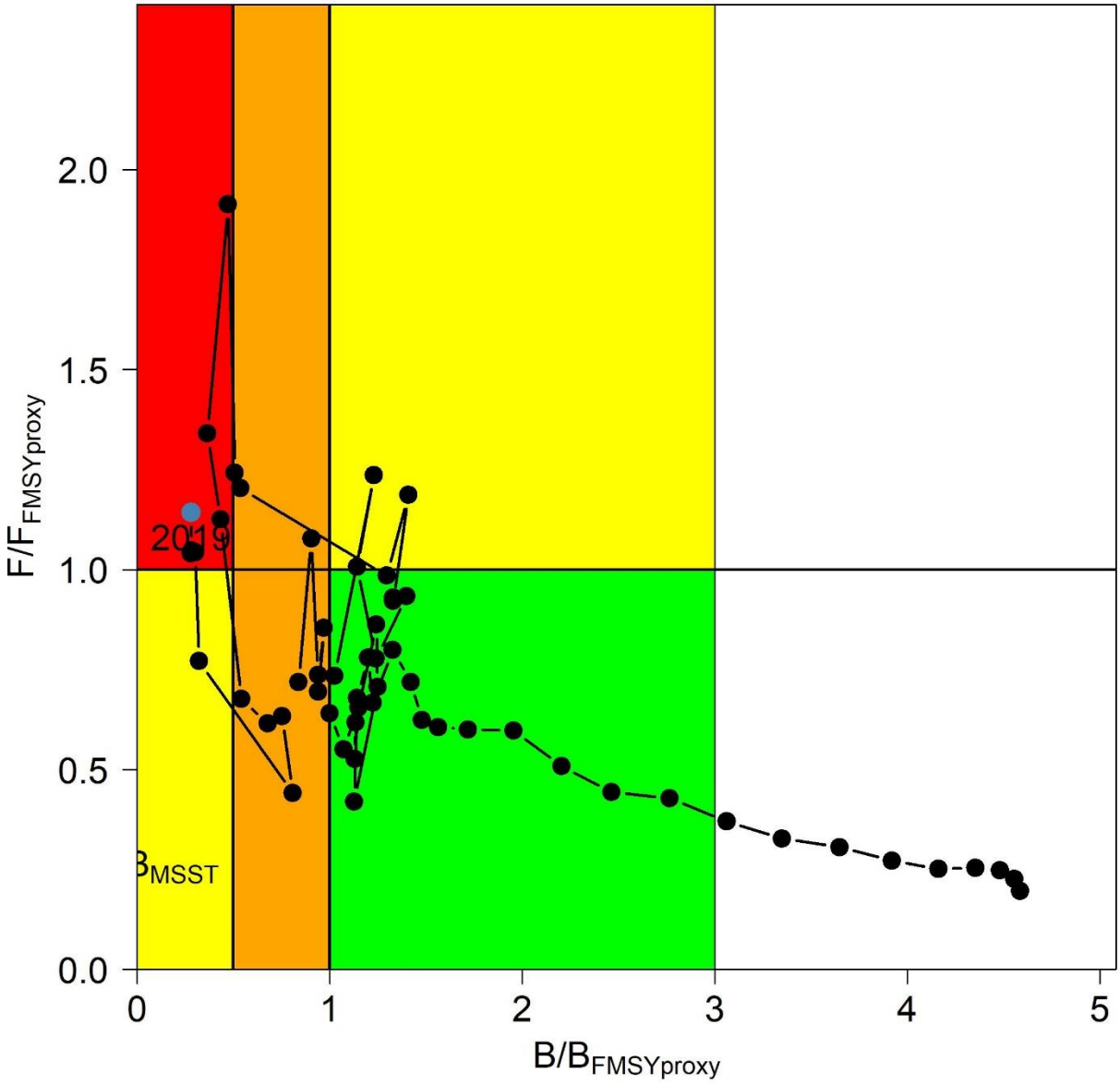


Figure 82. Kobe plot illustrating the trajectory of stock status for the SRFS Run. The orange coloring indicates regions where the stock is below the biomass target but above the biomass threshold (MSST = 0.5 x $SSB_{FMSYproxy}$). The 2019 terminal year stock status is indicated by the gray dot. Annual exploitation rates used to calculate $F/F_{MSYproxy}$ exclude red tide mortality. ***$F_{MSYproxy}$ defined as F_{MAX}.***

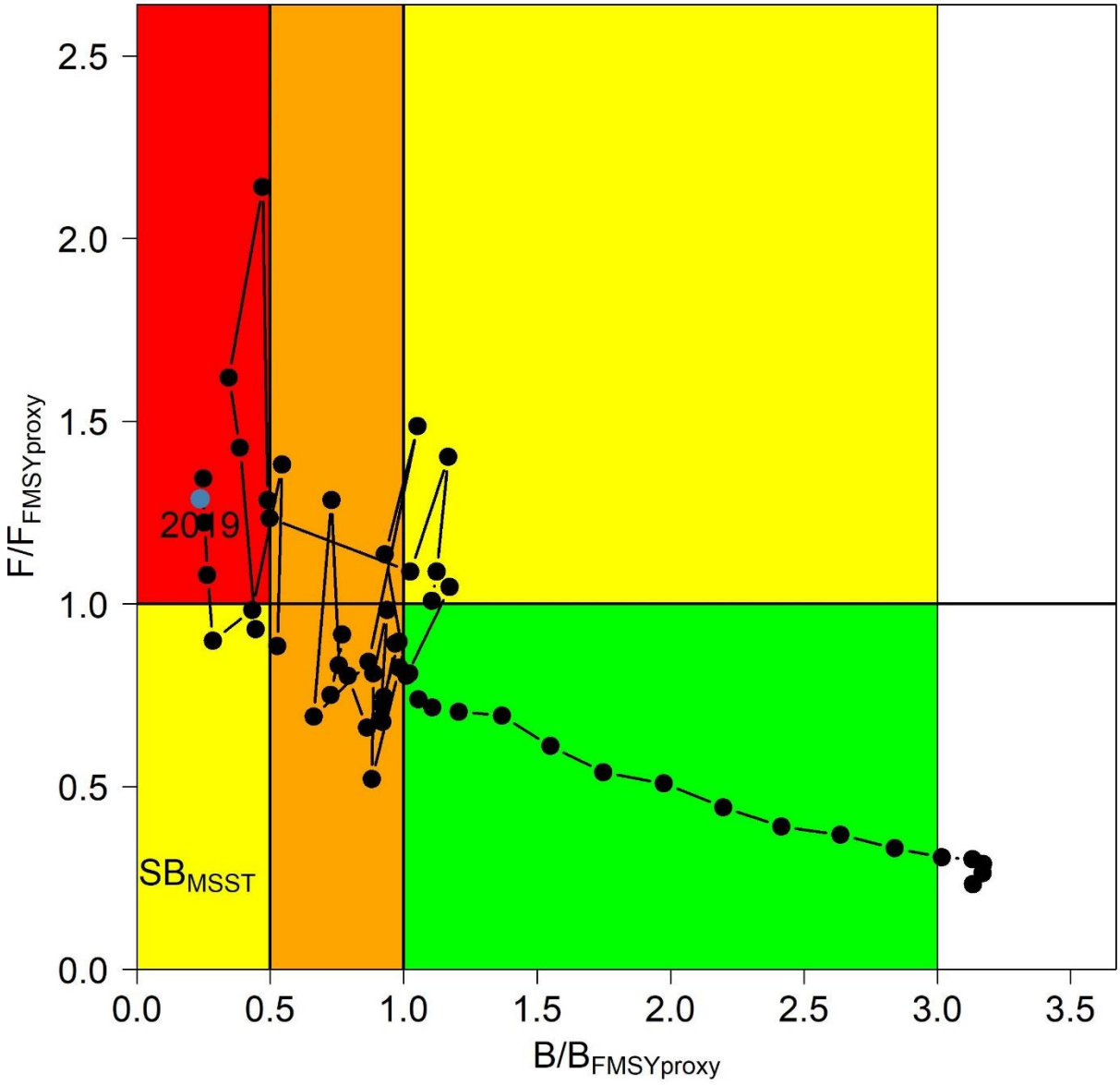


Figure 83. Kobe plot illustrating the trajectory of stock status for SEDAR 72. The orange coloring indicates regions where the stock is below the biomass target but above the biomass threshold (MSST = 0.5 x $SSB_{FMSYproxy}$). The 2019 terminal year stock status is indicated by the gray dot. Annual exploitation rates used to calculate F/F_{MAX} exclude red tide mortality. ***$F_{MSYproxy}$ defined as F_{MAX}.***