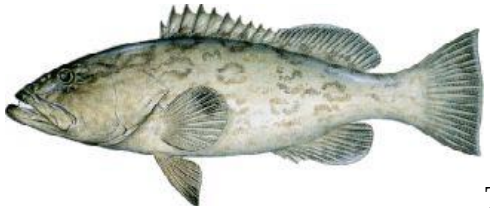

Tab B, No. 4(c)

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

Gulf Branch
Sustainable Fisheries Division
NOAA Fisheries - Southeast Fisheries Science Center

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Contents

1. Introduction

1.1. Council 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 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.

The intent of this report is therefore to detail any changes made to the formerly approved SEDAR 72 base model, 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), and generate new management benchmarks, stock status estimates and projections for Gulf of Mexico Gag Grouper. This alternative model run, from here on out, will be referred to as the SRFS Run.

1.2. 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 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.

2. Data Review and Update

A detailed review of the data sources used in the SEDAR 72 Operational Assessment are presented in *SEDAR (2021)*. The only modification made here concern the Private mode time series of catches and discards, and the time series of historical recreational catches (1963-1980).

2.1. 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 1**). 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, 2021), 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**).

2.2. 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 4.2% Headboat, 19.8% Charterboat, and 75.9% Private + Shore (compared with 2%, 10.5%, and 87.5%, 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 1 and 2**.

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 375 active parameters, 8 exhibited CVs above 1 and were poorly estimated,

including 4 recruitment deviations, 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 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 3**. Since 1963, the exploitation rate for the stock has averaged around 0.244, and ranged between 0.066 in 1963 to 0.63 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 0.378, which is slightly above the time series mean (0.244).

Table 7 and **Figure 4** 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 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 0.061, 0.031, 0.005, 0.044 and 0.237, 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 5**. 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 6-10** 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 11** 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 2. 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.

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 12**. The derived age-based selectivity functions are shown in **Figure 13**. The estimated selectivity of the SEAMAP survey from SRFS Run is considerably different than that of SEDAR 33U. SRFS Run shows 50% selection at age 5 instead of 27 in SEDAR 33U. Maximum (full) selectivity occurred at around 9 in 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 SRFS Run are similar due to the constraints imposed on the selectivity parameters in 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 14-18**. 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 14 and 15**) 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 to gradually higher values for each consecutive block (**Figures 16 and 17**), 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 for the first two block (most restrictive fishing seasons). The asymptote for the 2016-2019 block was estimated around 1 with very high variance, likely due to the lack of data on size composition of the discards to inform its height (**Figure 18, 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 19**. Estimated annual recruitment of age-0 fish (1000s) from 1963-2019 including recruitment deviations and variance are shown in **Table 8** and **Figures 20-22**. Virgin recruitment in log-space (Ln(R_0)) was estimated at 9.075 (**Table 5**), which equates to 8.74 million age-0 Gag Grouper. The estimated (and applied) recruitment bias adjustment ramp is shown in **Figure 23**.

During the main recruitment period (1984-2019), estimated recruitment averaged 5.39 million Gag Grouper and was lowest in 2011 at 1.26 million Gag Grouper and highest in 1996 at 13.65 million Gag Grouper (**Figure 20**). 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 24**) and the age composition of the Commercial Vertical Line + Other, Commercial Longline, Recreational Headboat and Recreational Charter fleets (**Figures 25-28**).

CVs for recruitment deviations during the main recruitment period averaged 0.103 between 2017 and 2016, and ranged from 0.04 in 1996 to 0.213 in 2014 (**Figure 22**). For the last two years of the assessment (2018, 2019), recruitment deviations were largely informed by the age-0 index, as age-0 and 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 1.466 million Gag Grouper (CV=0.246) and 2.094 million Gag Grouper (CV=0.403), 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 13,213 metric tons, and ranged from 3,125 metric tons in 2015 to 32,946 metric tons in 1963 (**Figure 29**). Exploitable biomass and numbers, which were comprised of Gag Grouper age-3 or older, averaged 11,225 metric tons and 2,807,161 Gag Grouper, respectively. Exploitable biomass was lowest in 2015 at 2,392 metric tons and peaked in 1963 at 30,202 metric tons, whereas exploitable numbers ranged from 696,558 Gag Grouper in 2015 to 5,697,968 Gag Grouper in 1963 (**Table 8**). SSB averaged 9,196 metric tons, and ranged from 1,675 metric tons in 2017 to 27,074 metric tons in 1963 (**Figure 30**). 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 9.1% and ranged from 0.9% in 2010 to 27.4% 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 31**. 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 31**). Predicted numbers at age and mean age over the entire time series for both SEDAR 33U and SRFS Run is shown in **Figure 32**.

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 33**). 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 33**). 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. A lot of the differences coincided with the model being better able to fit to the discard data (see **Figure 34**). In general, there was a closer fit to the landings data in SEDAR 33U compared with 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 34**. 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 35-36**). 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 37-39**). The model was able to fit discard observations very well throughout the time series for the Recreational Private + Shore fleet (**Figure 39**). For Recreational Headboat and Recreational

Charter fleets (**Figures 37 and 38**), the model was able to fit discard observations relatively well except in 2009-2010 the model expected Recreational Charter discards 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 40 and 41**). 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 and another, smaller, increase in 2000 and 2017 corresponding to the increase in the minimum size limit from 20 to 22 to 24 inches TL (**Figure 42**). 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 43**.

The model fit best to the Charter + Private Index and Recreational Headboat (root mean squared error [RMSE] = 0.353 and 0.369, respectively; with variance adjustment recommended of 0.111 and 0.107, respectively). Both indices had similar trends (**Figure 43**), with the index generally decreasing from 1985-1990, staying relatively flat from 1990-1995, then increasing to the late 1990s and generally decreasing from 1999 to 2010 in the case of the truncated Headboat CPUE index, and even further to 2015 in the case of the Charter + Private CPUE index. 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 (0.315 for VL and 0.281 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 43**).

Of the two video indices, the model fit better to the PC Video Survey (RMSE= 0.49) than to the SEAMAP Video Survey (RMSE= 0.824) (**Figure 43**). The fits to the fishery-independent indices were much improved between SEDAR 33U and SRFS Run, particularly in the last 5 years of the time series.

The age-0 survey had the highest suggested variance adjustment (0.526), likely to counter the very small values of the index, where input CVs made uncertainty appear unrealistically small (**Figure 43**). The RMSE for that index was 0.799.

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 SRFS Run compared to the fits from SEDAR 33U (**Figure 43**).

3.7.4. Length Compositions

Model fits to the retained and discarded length composition data are provided in **Figures 44-49**. 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 SRFS Run (**Figure 50**), but unlike the SEDAR 33U, no strong residual pattern in the tails was evident and residuals were generally smaller across fleets (**Figure 49**). The fit to the SEAMAP Video Survey length compositions was improved with the inclusion of additional samples (**Figure 51**). 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 52**).

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 44 and 45**), 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 46**). Residual patterns were more randomly distributed for the Recreational Charter (**Figure 47**). The length composition of the Recreational Private + Shore fleet showed individuals being retained below the size limit and consistent increase in mean length of the retained catch across the time series (**Figure 48**).

3.7.5. Age Compositions

Model fits to the age composition data are provided in **Figures 53-59**. Generally, the fits to the age composition were similar between SEDAR 33U and 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 57**).

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 (2005, 2014, 2018) (**Figure 4**). Red tide mortality (apical F) was estimated at 0.74, 0.88, and 0.07, respectively. This corresponds to removals of 7.67, 4.48, 0.26, 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 parametrized 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 9.075 (CV = 0.006) (**Figure 60**; **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 86% of runs, with no runs demonstrating a lower negative log-likelihood solution (**Figure 61**). For the 14 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 62-64**). 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 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 65**). One major difference between the two runs however is the estimates of virgin conditions. SRFS Run estimates a much smaller initial population size (SSB_0=65929 mt; R_0=8.7 million fish) compared to SEDAR 72 (SSB_0=106178 mt; R_0=14.3 million fish) (**Figure 65**). Nonetheless, current levels of depletions estimated by each model are similar: 2.56% of SSB_0 for the SRFS Run run vs. 2.16 % 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 65**), 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 = 0.77) compared with SEDAR 72 (0.25).

4.3. Diagnostics

Both models performed equally well in terms of the jitters (**Figures 61 and 66**) and retrospective analysis diagnostics (**Figures 62-64 and 67-69**). However, SEDAR 72 showed better diagnostics in the R0 profile (**Table 23**, **Figures 60 and 70**) compared with SRFS Run. The age and length data components showed a much higher level of disagreement in 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_{SPR30} and F_{MAX} key fishing mortality scenarios: F_0 and F_{OFL}. Where applicable, rebuilding projections are also presented. 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 the 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 ($SSB >= SSB_{FMSYproxy}$) in the absence of fishing mortality, 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 : $F_{RedTide2005} * 0.241 = 0.632 * 0.241 = 0.152$)

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

Following the Terms of Reference, benchmarks and reference points were calculated in two ways: 1. assuming an $F_{MSYproxy}$ equal to F_{SPR30}, 2. assuming an $F_{MSYproxy}$ equal to F_{MAX}.

5.4.1. Biological Reference Points

The following status determination criteria (SDCs) 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 0.143 for the SRFS Run and 0.148 for SEDAR 72 (**Table 26**). The resulting SSB_{FSPR30} was 17735 metric tons for SRFS Run and 28562 for SEDAR 72. The minimum stock size threshold (MSST) was 8867 metric tons and 14281 metric tons, respectively (**Figure 71**).

The harvest rate that results in SSB_{FMAX} over the long-term (100 years) was 0.327 for SRFS Run and 0.33 for SEDAR 72 (**Table 26**). The resulting SSB_{FMAX} was 5911 metric tons for SRFS Run and 9849 for SEDAR 72. The minimum stock size threshold (MSST) was 2955 metric tons and 4924 metric tons, respectively (**Figure 72**).

5.4.2. Stock Status

Benchmarks and reference points for the two model specifications (SRFS Run and SEDAR 72) are shown in **Table 26**. Detailed time series are presented in **Tables 27-30**.

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 71 and 72**), with the stock being more severely depleted in the $F_{MSYproxy} = F_{SPR30}$ scenarios.

For the SRFS Run F_{SPR30} scenario, in 2019 SSB was only 10% of the biomass level needed to support MSY (vs. 8% under the SEDAR 33U model run). From 2017 to 2019 the estimated stock harvest rate, using the geometric mean, was 0.356 (vs. 0.414 for SEDAR 72), which was equivalent to 248% of F_{SPR30} (vs. 280% for SEDAR 72) (**Table 26**, **Figure 71**).

For the SRFS Run F_{MAX} scenario, in 2019 SSB was only 29% of the biomass level needed to support MSY (vs. 23% under the SEDAR 33U model run). From 2017 to 2019 the estimated stock harvest rate, using the geometric mean, was 0.356 (vs. 0.414 for SEDAR 72), which was equivalent to 109% of F_{MAX} (vs. 126% for SEDAR 72) (**Table 26**, **Figure 72**).

The Kobe plot for the SRFS Run F_{SPR30} scenario (**Figure 73**) indicates that over the time horizon of the assessment (i.e., 1963 - 2019), the stock has experienced overfishing for 47 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 74**) 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_{MAX} scenario (**Figure 75**) 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 SRFS Run assessment. The Kobe plot for the SEDAR 72 scenario (**Figure 76**) indicates that over the time horizon of the assessment (i.e., 1963 - 2019), the stock has experienced overfishing for 18 of the 57 assessment years and has experienced overfishing consistently since 2016, including the terminal (2019) year of the SRFS Run 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 (52 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 2005 (2014 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 (2015 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 71 and 72**) often following large red tide events.

5.4.3. Overfishing Limits, F0 projections and Frebuild scenarios

OFL projection results for the SRFS Run are provided in **Tables 31 and 32** (**Tables 33 and 34** for SEDAR 72). 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 F0 projections for the F_{SPR30} scenario show the stock rebuilding in 2033 in the SRFS Run and 2034 in the SEDAR 72 scenario (**Tables 35 and 36**). The F0 projections for the F_{MAX} scenario show the stock rebuilding in 2027 in the SRFS Run and 2029 in the SEDAR 72 scenario (**Tables 37 and 38**).

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 F_{SPR30} scenario $T_{min} = 10$ years, as such, $F_{rebuild} = 0$ so no additional rebuilding options are presented beyond F=0 projections.

The rebuilding options for SRFS Run under the F_{MAX} scenario are presented in **Tables 39 and 40**. Details regarding the impact of retained yield and discards is shows in **Tables 41 and 42**.

The rebuilding options for SEDAR 72 under the F_{SPR30} scenario are presented in **Tables 43-45**. Details regarding the impact of retained yield and discards is shows in **Tables 46-48**.

The rebuilding options for SEDAR 72 under the F_{MAX} scenario are presented in **Tables 49 and 50**. Details regarding the impact of retained yield and discards is shows in **Tables 51 and 52**.

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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	99,069	21,211			379,415
1964	102,075	21,855			390,928
1965	105,081	22,498			402,441
1966	108,299	23,187			414,766
1967	111,518	23,876			427,092
1968	114,736	24,565			439,418
1969	117,955	25,255			451,744
1970	121,173	25,944			464,070
1971	132,415	28,350			507,123
1972	143,656	30,757			550,176
1973	154,898	33,164			593,229
1974	166,139	35,571			636,283
1975	177,381	37,978			679,336
1976	178,100	38,132			682,089
1977	178,819	38,286			684,841
1978	179,537	38,440			687,594
1979	180,256	38,594			690,347
1980	180,975	38,747			693,100
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	29,289	320,720	109,257	429,977
1987	106,620	25,801	366,673	34,870	401,543
1988	86,865	24,467	378,249	45,618	423,866
1989	74,357	33,840	305,923	47,215	353,138
1990	26,279	18,280	224,510	232	224,742
1991	35,079	10,714	230,749	28,098	258,847
1992	156,110	12,960	185,454	30,712	216,166
1993	137,481	17,229	272,856	65,200	338,057
1994	66,607	18,495	176,343	23,686	200,029
1995	112,353	15,465	359,098	42,233	401,331
1996	199,052	10,720	174,145	62,702	236,847
1997	139,119	10,494	331,393	4,238	335,630
1998	199,321	31,098	369,254	90,351	459,605
1999	137,899	27,845	461,781	86,829	548,611
2000	127,608	27,625	533,963	52,788	586,751
2001	84,576	11,875	419,619	22,866	442,486
2002	114,051	9,796	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	13,012	362,593	25,423	388,017
2004	134,341	20,063	583,521	25,468	608,989
2005	126,872	12,932	445,103	88,860	533,962
2006	70,445	4,728	271,208	14,327	285,535
2007	33,991	10,029	213,576	22,665	236,240
2008	89,110	9,414	355,829	23,870	379,698
2009	46,692	8,600	161,018	35,569	196,587
2010	60,233	10,340	217,547	34,217	251,765
2011	10,632	4,921	126,462	6,920	133,382
2012	46,754	4,362	98,223	3,424	101,646
2013	24,939	4,889	185,441	788	186,230
2014	12,425	5,976	131,229	1,338	132,567
2015	12,977	3,416	110,900	103	111,003
2016	17,623	2,109	81,612	655	82,266
2017	25,424	2,659	106,763	178	106,941
2018	19,823	2,657	117,749	4,103	121,852
2019	28,537	2,366	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	7,385	326,765	33,937	360,702
1987	17,620	4,304	278,064	0	278,064
1988	20,296	5,814	194,228	0	194,228
1989	46,217	21,810	392,943	158,704	551,647
1990	71,078	51,036	362,306	0	362,306
1991	3,502	1,187	922,993	130,939	1,053,932
1992	86,121	7,347	591,085	240,379	831,464
1993	97,098	12,369	1,194,732	742,999	1,937,731
1994	113,478	35,261	1,348,670	198,943	1,547,613
1995	308,655	43,452	1,706,575	354,185	2,060,760
1996	240,693	13,292	821,802	215,666	1,037,469
1997	168,734	12,984	1,468,975	170,011	1,638,986
1998	351,124	54,357	2,014,714	255,662	2,270,377
1999	233,276	48,522	1,719,038	331,877	2,050,916
2000	134,811	30,277	1,102,353	256,812	1,359,165
2001	201,966	30,345	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	24,157	2,173,640	728,071	2,901,711
2003	296,289	43,680	2,684,510	502,524	3,187,033
2004	337,988	52,364	3,602,436	510,158	4,112,594
2005	339,608	36,512	2,089,756	730,972	2,820,729
2006	140,619	9,848	1,445,373	307,616	1,752,989
2007	113,324	35,003	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	28.34	(10,40)	0.502	0.018	Sym_Beta(0.8)	3
L_at_Amax_Fem_GP_1	120.26	(80,160)	2.35	0.020	Sym_Beta(0.8)	3
VonBert_K_Fem_GP_1	0.126	(0.05,0.3)	0.006	0.044	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)	9.08	(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	-0.195	(-5,5)	0.086	-		1
Early_RecrDev_1963	-0.511	(-5,5)	0.488	-		6
Early_RecrDev_1964	-0.531	(-5,5)	0.485	-		6
Early_RecrDev_1965	-0.546	(-5,5)	0.483	-		6
Early_RecrDev_1966	-0.556	(-5,5)	0.482	-		6
Early_RecrDev_1967	-0.558	(-5,5)	0.482	-		6
Early_RecrDev_1968	-0.552	(-5,5)	0.484	-		6
Early_RecrDev_1969	-0.537	(-5,5)	0.487	-		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_1970	-0.506	(-5,5)	0.492	-		6
Early_RecrDev_1971	-0.451	(-5,5)	0.501	-		6
Early_RecrDev_1972	-0.357	(-5,5)	0.512	-		6
Early_RecrDev_1973	-0.225	(-5,5)	0.518	-		6
Early_RecrDev_1974	-0.05	(-5,5)	0.513	-		6
Early_RecrDev_1975	-0.016	(-5,5)	0.5	-		6
Early_RecrDev_1976	-0.086	(-5,5)	0.471	-		6
Early_RecrDev_1977	-0.183	(-5,5)	0.443	-		6
Early_RecrDev_1978	0.202	(-5,5)	0.29	1.440		6
Early_RecrDev_1979	-0.292	(-5,5)	0.315	-		6
Early_RecrDev_1980	-0.294	(-5,5)	0.246	-		6
Early_RecrDev_1981	0.211	(-5,5)	0.149	0.704		6
Early_RecrDev_1982	-0.4	(-5,5)	0.197	-		6
Early_RecrDev_1983	-0.118	(-5,5)	0.146	-		6
Main_RecrDev_1984	-0.29	(-5,5)	0.127	-		3
Main_RecrDev_1985	-0.096	(-5,5)	0.091	-		3
Main_RecrDev_1986	-0.974	(-5,5)	0.119	-		3
Main_RecrDev_1987	-0.588	(-5,5)	0.092	-		3
Main_RecrDev_1988	-1.04	(-5,5)	0.116	-		3
Main_RecrDev_1989	0.382	(-5,5)	0.065	0.169		3
Main_RecrDev_1990	-0.622	(-5,5)	0.095	-		3
Main_RecrDev_1991	-0.394	(-5,5)	0.088	-		3
Main_RecrDev_1992	-0.243	(-5,5)	0.088	-		3
Main_RecrDev_1993	0.764	(-5,5)	0.061	0.080		3
Main_RecrDev_1994	0.385	(-5,5)	0.074	0.192		3
Main_RecrDev_1995	0.106	(-5,5)	0.081	0.766		3
Main_RecrDev_1996	1.04	(-5,5)	0.053	0.051		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_1997	0.406	(-5,5)	0.063	0.154		3
Main_RecrDev_1998	-0.274	(-5,5)	0.079	-		3
Main_RecrDev_1999	0.621	(-5,5)	0.058	0.094		3
Main_RecrDev_2000	0.508	(-5,5)	0.063	0.124		3
Main_RecrDev_2001	0.284	(-5,5)	0.075	0.264		3
Main_RecrDev_2002	0.601	(-5,5)	0.084	0.139		3
Main_RecrDev_2003	0.228	(-5,5)	0.103	0.452		3
Main_RecrDev_2004	0.187	(-5,5)	0.104	0.557		3
Main_RecrDev_2005	0.478	(-5,5)	0.096	0.201		3
Main_RecrDev_2006	0.452	(-5,5)	0.049	0.109		3
Main_RecrDev_2007	0.557	(-5,5)	0.052	0.094		3
Main_RecrDev_2008	0.058	(-5,5)	0.066	1.140		3
Main_RecrDev_2009	-0.156	(-5,5)	0.079	-		3
Main_RecrDev_2010	0.347	(-5,5)	0.088	0.253		3
Main_RecrDev_2011	-1.16	(-5,5)	0.129	-		3
Main_RecrDev_2012	-0.359	(-5,5)	0.123	-		3
Main_RecrDev_2013	-0.03	(-5,5)	0.122	-		3
Main_RecrDev_2014	-0.001	(-5,5)	0.126	-		3
Main_RecrDev_2015	-0.206	(-5,5)	0.097	-		3
Main_RecrDev_2016	0.071	(-5,5)	0.11	1.560		3
Main_RecrDev_2017	0.011	(-5,5)	0.146	12.96		3
Main_RecrDev_2018	-0.686	(-5,5)	0.216	-		3
Main_RecrDev_2019	-0.354	(-5,5)	0.382	-		3
InitF_seas_1_flt_1Com_VL_OTH_1	0.036	(0,1)	0.009	0.240		1
InitF_seas_1_flt_5Rec_PRIV_SH_5	0.072	(0,1)	0.021	0.289		1
F_fleet_1_YR_1963_s_1	0.032	(0,2.9)	0.008	0.235		1
F_fleet_1_YR_1964_s_1	0.041	(0,2.9)	0.009	0.232		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_1965_s_1	0.045	(0,2.9)	0.01	0.230		1
F_fleet_1_YR_1966_s_1	0.039	(0,2.9)	0.009	0.228		1
F_fleet_1_YR_1967_s_1	0.032	(0,2.9)	0.007	0.225		1
F_fleet_1_YR_1968_s_1	0.035	(0,2.9)	0.008	0.222		1
F_fleet_1_YR_1969_s_1	0.043	(0,2.9)	0.01	0.221		1
F_fleet_1_YR_1970_s_1	0.045	(0,2.9)	0.01	0.221		1
F_fleet_1_YR_1971_s_1	0.049	(0,2.9)	0.011	0.221		1
F_fleet_1_YR_1972_s_1	0.058	(0,2.9)	0.013	0.222		1
F_fleet_1_YR_1973_s_1	0.048	(0,2.9)	0.011	0.222		1
F_fleet_1_YR_1974_s_1	0.061	(0,2.9)	0.013	0.219		1
F_fleet_1_YR_1975_s_1	0.085	(0,2.9)	0.018	0.216		1
F_fleet_1_YR_1976_s_1	0.078	(0,2.9)	0.016	0.208		1
F_fleet_1_YR_1977_s_1	0.07	(0,2.9)	0.013	0.192		1
F_fleet_1_YR_1978_s_1	0.067	(0,2.9)	0.012	0.171		1
F_fleet_1_YR_1979_s_1	0.113	(0,2.9)	0.017	0.151		1
F_fleet_1_YR_1980_s_1	0.122	(0,2.9)	0.016	0.135		1
F_fleet_1_YR_1981_s_1	0.137	(0,2.9)	0.017	0.122		1
F_fleet_1_YR_1982_s_1	0.13	(0,2.9)	0.015	0.113		1
F_fleet_1_YR_1983_s_1	0.108	(0,2.9)	0.012	0.107		1
F_fleet_1_YR_1984_s_1	0.116	(0,2.9)	0.012	0.101		1
F_fleet_1_YR_1985_s_1	0.145	(0,2.9)	0.014	0.095		1
F_fleet_1_YR_1986_s_1	0.098	(0,2.9)	0.009	0.091		1
F_fleet_1_YR_1987_s_1	0.075	(0,2.9)	0.007	0.088		1
F_fleet_1_YR_1988_s_1	0.068	(0,2.9)	0.006	0.084		1
F_fleet_1_YR_1989_s_1	0.108	(0,2.9)	0.009	0.081		1
F_fleet_1_YR_1990_s_1	0.109	(0,2.9)	0.009	0.081		1
F_fleet_1_YR_1991_s_1	0.102	(0,2.9)	0.008	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_1992_s_1	0.107	(0,2.9)	0.009	0.080		1
F_fleet_1_YR_1993_s_1	0.15	(0,2.9)	0.012	0.078		1
F_fleet_1_YR_1994_s_1	0.139	(0,2.9)	0.011	0.078		1
F_fleet_1_YR_1995_s_1	0.142	(0,2.9)	0.011	0.077		1
F_fleet_1_YR_1996_s_1	0.131	(0,2.9)	0.01	0.077		1
F_fleet_1_YR_1997_s_1	0.115	(0,2.9)	0.009	0.076		1
F_fleet_1_YR_1998_s_1	0.174	(0,2.9)	0.013	0.074		1
F_fleet_1_YR_1999_s_1	0.14	(0,2.9)	0.01	0.074		1
F_fleet_1_YR_2000_s_1	0.154	(0,2.9)	0.011	0.074		1
F_fleet_1_YR_2001_s_1	0.189	(0,2.9)	0.014	0.074		1
F_fleet_1_YR_2002_s_1	0.172	(0,2.9)	0.013	0.077		1
F_fleet_1_YR_2003_s_1	0.134	(0,2.9)	0.011	0.084		1
F_fleet_1_YR_2004_s_1	0.161	(0,2.9)	0.016	0.098		1
F_fleet_1_YR_2005_s_1	0.218	(0,2.9)	0.019	0.089		1
F_fleet_1_YR_2006_s_1	0.206	(0,2.9)	0.015	0.075		1
F_fleet_1_YR_2007_s_1	0.201	(0,2.9)	0.016	0.080		1
F_fleet_1_YR_2008_s_1	0.288	(0,2.9)	0.025	0.088		1
F_fleet_1_YR_2009_s_1	0.21	(0,2.9)	0.022	0.105		1
F_fleet_1_YR_2010_s_1	0.115	(0,2.9)	0.013	0.110		1
F_fleet_1_YR_2011_s_1	0.056	(0,2.9)	0.007	0.128		1
F_fleet_1_YR_2012_s_1	0.07	(0,2.9)	0.01	0.149		1
F_fleet_1_YR_2013_s_1	0.06	(0,2.9)	0.011	0.179		1
F_fleet_1_YR_2014_s_1	0.079	(0,2.9)	0.011	0.135		1
F_fleet_1_YR_2015_s_1	0.101	(0,2.9)	0.008	0.076		1
F_fleet_1_YR_2016_s_1	0.194	(0,2.9)	0.018	0.093		1
F_fleet_1_YR_2017_s_1	0.13	(0,2.9)	0.016	0.122		1
F_fleet_1_YR_2018_s_1	0.138	(0,2.9)	0.018	0.130		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_2019_s_1	0.167	(0,2.9)	0.045	0.270		1
F_fleet_2_YR_1979_s_1	9.98e-05	(0,2.9)	1.91e	0.191		1
F_fleet_2_YR_1980_s_1	0.009	(0,2.9)	0.002	0.174		1
F_fleet_2_YR_1981_s_1	0.046	(0,2.9)	0.007	0.157		1
F_fleet_2_YR_1982_s_1	0.108	(0,2.9)	0.016	0.144		1
F_fleet_2_YR_1983_s_1	0.079	(0,2.9)	0.01	0.132		1
F_fleet_2_YR_1984_s_1	0.054	(0,2.9)	0.006	0.119		1
F_fleet_2_YR_1985_s_1	0.047	(0,2.9)	0.005	0.110		1
F_fleet_2_YR_1986_s_1	0.066	(0,2.9)	0.007	0.103		1
F_fleet_2_YR_1987_s_1	0.085	(0,2.9)	0.008	0.097		1
F_fleet_2_YR_1988_s_1	0.05	(0,2.9)	0.005	0.092		1
F_fleet_2_YR_1989_s_1	0.053	(0,2.9)	0.005	0.088		1
F_fleet_2_YR_1990_s_1	0.081	(0,2.9)	0.007	0.086		1
F_fleet_2_YR_1991_s_1	0.068	(0,2.9)	0.006	0.085		1
F_fleet_2_YR_1992_s_1	0.084	(0,2.9)	0.007	0.084		1
F_fleet_2_YR_1993_s_1	0.077	(0,2.9)	0.006	0.084		1
F_fleet_2_YR_1994_s_1	0.06	(0,2.9)	0.005	0.085		1
F_fleet_2_YR_1995_s_1	0.067	(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	0.072	(0,2.9)	0.006	0.083		1
F_fleet_2_YR_1998_s_1	0.093	(0,2.9)	0.008	0.082		1
F_fleet_2_YR_1999_s_1	0.089	(0,2.9)	0.007	0.082		1
F_fleet_2_YR_2000_s_1	0.092	(0,2.9)	0.007	0.081		1
F_fleet_2_YR_2001_s_1	0.131	(0,2.9)	0.011	0.082		1
F_fleet_2_YR_2002_s_1	0.137	(0,2.9)	0.011	0.084		1
F_fleet_2_YR_2003_s_1	0.146	(0,2.9)	0.013	0.089		1
F_fleet_2_YR_2004_s_1	0.148	(0,2.9)	0.015	0.103		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_2005_s_1	0.181	(0,2.9)	0.017	0.094		1
F_fleet_2_YR_2006_s_1	0.202	(0,2.9)	0.016	0.081		1
F_fleet_2_YR_2007_s_1	0.193	(0,2.9)	0.017	0.086		1
F_fleet_2_YR_2008_s_1	0.187	(0,2.9)	0.018	0.095		1
F_fleet_2_YR_2009_s_1	0.093	(0,2.9)	0.01	0.112		1
F_fleet_2_YR_2010_s_1	0.067	(0,2.9)	0.008	0.118		1
F_fleet_2_YR_2011_s_1	0.047	(0,2.9)	0.006	0.136		1
F_fleet_2_YR_2012_s_1	0.054	(0,2.9)	0.008	0.154		1
F_fleet_2_YR_2013_s_1	0.062	(0,2.9)	0.011	0.182		1
F_fleet_2_YR_2014_s_1	0.088	(0,2.9)	0.012	0.138		1
F_fleet_2_YR_2015_s_1	0.166	(0,2.9)	0.013	0.080		1
F_fleet_2_YR_2016_s_1	0.285	(0,2.9)	0.028	0.097		1
F_fleet_2_YR_2017_s_1	0.144	(0,2.9)	0.018	0.126		1
F_fleet_2_YR_2018_s_1	0.157	(0,2.9)	0.021	0.135		1
F_fleet_2_YR_2019_s_1	0.184	(0,2.9)	0.05	0.274		1
F_fleet_3_YR_1963_s_1	0.004	(0,2.9)	6.08e	0.140		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	0.005	(0,2.9)	0.001	0.259		1
F_fleet_3_YR_1966_s_1	0.006	(0,2.9)	0.002	0.272		1
F_fleet_3_YR_1967_s_1	0.007	(0,2.9)	0.002	0.283		1
F_fleet_3_YR_1968_s_1	0.008	(0,2.9)	0.002	0.292		1
F_fleet_3_YR_1969_s_1	0.009	(0,2.9)	0.003	0.299		1
F_fleet_3_YR_1970_s_1	0.01	(0,2.9)	0.003	0.304		1
F_fleet_3_YR_1971_s_1	0.011	(0,2.9)	0.003	0.309		1
F_fleet_3_YR_1972_s_1	0.013	(0,2.9)	0.004	0.314		1
F_fleet_3_YR_1973_s_1	0.015	(0,2.9)	0.005	0.319		1
F_fleet_3_YR_1974_s_1	0.016	(0,2.9)	0.005	0.321		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_1975_s_1	0.016	(0,2.9)	0.005	0.316		1
F_fleet_3_YR_1976_s_1	0.016	(0,2.9)	0.005	0.302		1
F_fleet_3_YR_1977_s_1	0.015	(0,2.9)	0.004	0.282		1
F_fleet_3_YR_1978_s_1	0.015	(0,2.9)	0.004	0.263		1
F_fleet_3_YR_1979_s_1	0.015	(0,2.9)	0.004	0.247		1
F_fleet_3_YR_1980_s_1	0.015	(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	0.009	(0,2.9)	0.002	0.165		1
F_fleet_3_YR_1987_s_1	0.008	(0,2.9)	0.001	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	0.029	(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)	2.94e	0.200		1
F_fleet_3_YR_1992_s_1	0.006	(0,2.9)	9.69e	0.157		1
F_fleet_3_YR_1993_s_1	0.009	(0,2.9)	0.001	0.156		1
F_fleet_3_YR_1994_s_1	0.013	(0,2.9)	0.002	0.155		1
F_fleet_3_YR_1995_s_1	0.011	(0,2.9)	0.002	0.152		1
F_fleet_3_YR_1996_s_1	0.005	(0,2.9)	7.41e	0.153		1
F_fleet_3_YR_1997_s_1	0.004	(0,2.9)	5.75e	0.155		1
F_fleet_3_YR_1998_s_1	0.013	(0,2.9)	0.002	0.152		1
F_fleet_3_YR_1999_s_1	0.014	(0,2.9)	0.002	0.149		1
F_fleet_3_YR_2000_s_1	0.01	(0,2.9)	0.002	0.153		1
F_fleet_3_YR_2001_s_1	0.007	(0,2.9)	0.001	0.152		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_2002_s_1	0.005	(0,2.9)	8.37e	0.154		1
F_fleet_3_YR_2003_s_1	0.008	(0,2.9)	0.001	0.158		1
F_fleet_3_YR_2004_s_1	0.011	(0,2.9)	0.002	0.168		1
F_fleet_3_YR_2005_s_1	0.012	(0,2.9)	0.002	0.160		1
F_fleet_3_YR_2006_s_1	0.006	(0,2.9)	8.71e	0.154		1
F_fleet_3_YR_2007_s_1	0.014	(0,2.9)	0.002	0.154		1
F_fleet_3_YR_2008_s_1	0.016	(0,2.9)	0.003	0.154		1
F_fleet_3_YR_2009_s_1	0.016	(0,2.9)	0.002	0.157		1
F_fleet_3_YR_2010_s_1	0.017	(0,2.9)	0.003	0.164		1
F_fleet_3_YR_2011_s_1	0.017	(0,2.9)	0.003	0.195		1
F_fleet_3_YR_2012_s_1	0.016	(0,2.9)	0.003	0.209		1
F_fleet_3_YR_2013_s_1	0.013	(0,2.9)	0.003	0.221		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	0.017	(0,2.9)	0.003	0.172		1
F_fleet_3_YR_2016_s_1	0.013	(0,2.9)	0.002	0.175		1
F_fleet_3_YR_2017_s_1	0.013	(0,2.9)	0.003	0.192		1
F_fleet_3_YR_2018_s_1	0.014	(0,2.9)	0.003	0.194		1
F_fleet_3_YR_2019_s_1	0.013	(0,2.9)	0.004	0.284		1
F_fleet_4_YR_1963_s_1	0.022	(0,2.9)	0.003	0.146		1
F_fleet_4_YR_1964_s_1	0.024	(0,2.9)	0.006	0.257		1
F_fleet_4_YR_1965_s_1	0.027	(0,2.9)	0.007	0.261		1
F_fleet_4_YR_1966_s_1	0.031	(0,2.9)	0.008	0.272		1
F_fleet_4_YR_1967_s_1	0.035	(0,2.9)	0.01	0.284		1
F_fleet_4_YR_1968_s_1	0.04	(0,2.9)	0.012	0.294		1
F_fleet_4_YR_1969_s_1	0.045	(0,2.9)	0.014	0.302		1
F_fleet_4_YR_1970_s_1	0.05	(0,2.9)	0.015	0.308		1
F_fleet_4_YR_1971_s_1	0.059	(0,2.9)	0.018	0.313		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_1972_s_1	0.068	(0,2.9)	0.022	0.319		1
F_fleet_4_YR_1973_s_1	0.078	(0,2.9)	0.025	0.324		1
F_fleet_4_YR_1974_s_1	0.085	(0,2.9)	0.028	0.326		1
F_fleet_4_YR_1975_s_1	0.09	(0,2.9)	0.029	0.322		1
F_fleet_4_YR_1976_s_1	0.085	(0,2.9)	0.026	0.308		1
F_fleet_4_YR_1977_s_1	0.081	(0,2.9)	0.023	0.287		1
F_fleet_4_YR_1978_s_1	0.08	(0,2.9)	0.021	0.266		1
F_fleet_4_YR_1979_s_1	0.08	(0,2.9)	0.02	0.250		1
F_fleet_4_YR_1980_s_1	0.08	(0,2.9)	0.019	0.236		1
F_fleet_4_YR_1981_s_1	0.057	(0,2.9)	0.013	0.222		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	0.064	(0,2.9)	0.013	0.211		1
F_fleet_4_YR_1986_s_1	0.163	(0,2.9)	0.032	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	0.048	(0,2.9)	0.01	0.205		1
F_fleet_4_YR_1989_s_1	0.054	(0,2.9)	0.011	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	0.091	(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	0.112	(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
F_fleet_4_YR_1998_s_1	0.118	(0,2.9)	0.016	0.135		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_1999_s_1	0.116	(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	0.185		1
F_fleet_4_YR_2002_s_1	0.07	(0,2.9)	0.01	0.145		1
F_fleet_4_YR_2003_s_1	0.077	(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	0.166	(0,2.9)	0.018	0.110		1
F_fleet_4_YR_2006_s_1	0.108	(0,2.9)	0.015	0.136		1
F_fleet_4_YR_2007_s_1	0.061	(0,2.9)	0.009	0.150		1
F_fleet_4_YR_2008_s_1	0.158	(0,2.9)	0.023	0.148		1
F_fleet_4_YR_2009_s_1	0.09	(0,2.9)	0.016	0.173		1
F_fleet_4_YR_2010_s_1	0.104	(0,2.9)	0.019	0.181		1
F_fleet_4_YR_2011_s_1	0.071	(0,2.9)	0.012	0.167		1
F_fleet_4_YR_2012_s_1	0.108	(0,2.9)	0.019	0.173		1
F_fleet_4_YR_2013_s_1	0.1	(0,2.9)	0.027	0.267		1
F_fleet_4_YR_2014_s_1	0.06	(0,2.9)	0.013	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	0.094	(0,2.9)	0.016	0.169		1
F_fleet_4_YR_2017_s_1	0.133	(0,2.9)	0.028	0.209		1
F_fleet_4_YR_2018_s_1	0.106	(0,2.9)	0.021	0.198		1
F_fleet_4_YR_2019_s_1	0.115	(0,2.9)	0.035	0.300		1
F_fleet_5_YR_1963_s_1	0.06	(0,2.9)	0.008	0.132		1
F_fleet_5_YR_1964_s_1	0.069	(0,2.9)	0.018	0.260		1
F_fleet_5_YR_1965_s_1	0.079	(0,2.9)	0.022	0.274		1
F_fleet_5_YR_1966_s_1	0.091	(0,2.9)	0.026	0.288		1
F_fleet_5_YR_1967_s_1	0.103	(0,2.9)	0.031	0.299		1
F_fleet_5_YR_1968_s_1	0.116	(0,2.9)	0.035	0.307		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_1969_s_1	0.127	(0,2.9)	0.04	0.313		1
F_fleet_5_YR_1970_s_1	0.138	(0,2.9)	0.044	0.317		1
F_fleet_5_YR_1971_s_1	0.157	(0,2.9)	0.05	0.321		1
F_fleet_5_YR_1972_s_1	0.175	(0,2.9)	0.057	0.325		1
F_fleet_5_YR_1973_s_1	0.189	(0,2.9)	0.062	0.328		1
F_fleet_5_YR_1974_s_1	0.195	(0,2.9)	0.063	0.324		1
F_fleet_5_YR_1975_s_1	0.193	(0,2.9)	0.06	0.311		1
F_fleet_5_YR_1976_s_1	0.181	(0,2.9)	0.052	0.288		1
F_fleet_5_YR_1977_s_1	0.177	(0,2.9)	0.047	0.263		1
F_fleet_5_YR_1978_s_1	0.18	(0,2.9)	0.045	0.248		1
F_fleet_5_YR_1979_s_1	0.173	(0,2.9)	0.041	0.235		1
F_fleet_5_YR_1980_s_1	0.183	(0,2.9)	0.042	0.228		1
F_fleet_5_YR_1981_s_1	0.088	(0,2.9)	0.032	0.370		1
F_fleet_5_YR_1982_s_1	0.122	(0,2.9)	0.028	0.230		1
F_fleet_5_YR_1983_s_1	0.098	(0,2.9)	0.036	0.365		1
F_fleet_5_YR_1984_s_1	0.023	(0,2.9)	0.003	0.124		1
F_fleet_5_YR_1985_s_1	0.076	(0,2.9)	0.036	0.472		1
F_fleet_5_YR_1986_s_1	0.113	(0,2.9)	0.035	0.305		1
F_fleet_5_YR_1987_s_1	0.108	(0,2.9)	0.028	0.259		1
F_fleet_5_YR_1988_s_1	0.106	(0,2.9)	0.026	0.248		1
F_fleet_5_YR_1989_s_1	0.106	(0,2.9)	0.017	0.159		1
F_fleet_5_YR_1990_s_1	0.084	(0,2.9)	0.019	0.230		1
F_fleet_5_YR_1991_s_1	0.164	(0,2.9)	0.029	0.174		1
F_fleet_5_YR_1992_s_1	0.136	(0,2.9)	0.019	0.139		1
F_fleet_5_YR_1993_s_1	0.177	(0,2.9)	0.025	0.140		1
F_fleet_5_YR_1994_s_1	0.147	(0,2.9)	0.017	0.117		1
F_fleet_5_YR_1995_s_1	0.25	(0,2.9)	0.035	0.139		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_1996_s_1	0.089	(0,2.9)	0.01	0.112		1
F_fleet_5_YR_1997_s_1	0.146	(0,2.9)	0.017	0.117		1
F_fleet_5_YR_1998_s_1	0.257	(0,2.9)	0.029	0.113		1
F_fleet_5_YR_1999_s_1	0.205	(0,2.9)	0.02	0.097		1
F_fleet_5_YR_2000_s_1	0.143	(0,2.9)	0.014	0.097		1
F_fleet_5_YR_2001_s_1	0.207	(0,2.9)	0.023	0.110		1
F_fleet_5_YR_2002_s_1	0.229	(0,2.9)	0.025	0.111		1
F_fleet_5_YR_2003_s_1	0.236	(0,2.9)	0.026	0.110		1
F_fleet_5_YR_2004_s_1	0.335	(0,2.9)	0.042	0.125		1
F_fleet_5_YR_2005_s_1	0.356	(0,2.9)	0.045	0.126		1
F_fleet_5_YR_2006_s_1	0.297	(0,2.9)	0.036	0.123		1
F_fleet_5_YR_2007_s_1	0.348	(0,2.9)	0.036	0.102		1
F_fleet_5_YR_2008_s_1	0.649	(0,2.9)	0.065	0.099		1
F_fleet_5_YR_2009_s_1	0.434	(0,2.9)	0.047	0.107		1
F_fleet_5_YR_2010_s_1	0.356	(0,2.9)	0.047	0.132		1
F_fleet_5_YR_2011_s_1	0.361	(0,2.9)	0.073	0.201		1
F_fleet_5_YR_2012_s_1	0.276	(0,2.9)	0.06	0.217		1
F_fleet_5_YR_2013_s_1	0.25	(0,2.9)	0.056	0.226		1
F_fleet_5_YR_2014_s_1	0.236	(0,2.9)	0.041	0.175		1
F_fleet_5_YR_2015_s_1	0.223	(0,2.9)	0.033	0.147		1
F_fleet_5_YR_2016_s_1	0.226	(0,2.9)	0.04	0.179		1
F_fleet_5_YR_2017_s_1	0.385	(0,2.9)	0.068	0.176		1
F_fleet_5_YR_2018_s_1	0.434	(0,2.9)	0.087	0.199		1
F_fleet_5_YR_2019_s_1	0.472	(0,2.9)	0.142	0.300		1
F_fleet_6_YR_2005_s_1	0.741	(0,2.9)	0.121	0.164		1
F_fleet_6_YR_2014_s_1	0.881	(0,2.9)	0.201	0.228		1
F_fleet_6_YR_2018_s_1	0.07	(0,2.9)	0.245	3.490		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
LnQ_base_Com_VL_OTH_1(1)	-8.33	(-25,25)				Float
LnQ_base_Com_LL_2(2)	-7.81	(-25,25)				Float
LnQ_base_Rec_HBT_3(3)	-7.42	(-25,25)				Float
LnQ_base_Srv_CBT_PRIV_7(7)	-7.92	(-25,25)				Float
LnQ_base_Srv_AGE0_8(8)	-8.69	(-25,25)				Float
LnQ_base_Srv_SEAMAP_VIDEO_9(9)	-6.47	(-25,25)				Float
LnQ_base_Srv_PC_VIDEO_10(10)	-8.38	(-25,25)				Float
Size_inflection_Com_VL_OTH_1(1)	67.83	(20,125)	0.69	0.010		3
Size_95%width_Com_VL_OTH_1(1)	23.29	(0,50)	0.527	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)	79.66	(20,125)	0.471	0.006		3
Size_95%width_Com_LL_2(2)	17.03	(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)	63.11	(20,100)	1.85	0.029		3
Size_DblN_top_logit_Rec_HBT_3(3)	-9					Fixed
Size_DblN_ascend_se_Rec_HBT_3(3)	8.3	(-15,15)	0.722	0.087		4
Size_DblN_descend_se_Rec_HBT_3(3)	5.85	(-15,15)	0.343	0.059		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_start_logit_Rec_HBT_3(3)	-5.32	(-15,15)	0.562	-		3
Size_DblN_end_logit_Rec_HBT_3(3)	-0.987	(-15,15)	0.337	-		3
Retain_L_infl_Rec_HBT_3(3)	39.96	(10,85)	0.759	0.019		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)	67.46	(20,100)	1.53	0.023		3
Size_DblN_top_logit_Rec_CBT_4(4)	-9					Fixed
Size_DblN_ascend_se_Rec_CBT_4(4)	7.13	(-15,15)	0.197	0.028		4
Size_DblN_descend_se_Rec_CBT_4(4)	5.42	(-15,15)	0.413	0.076		4
Size_DblN_start_logit_Rec_CBT_4(4)	-15					Fixed
Size_DblN_end_logit_Rec_CBT_4(4)	-1	(-15,15)	0.354	-		3
Retain_L_infl_Rec_CBT_4(4)	39.59	(10,85)	1.56	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)	53.77	(20,100)	2.22	0.041		3
Size_DblN_top_logit_Rec_PRIV_SH_5(5)	-2					Fixed
Size_DblN_ascend_se_Rec_PRIV_SH_5(5)	14.57	(-15,15)	11.46	0.787		4
Size_DblN_descend_se_Rec_PRIV_SH_5(5)	5.53	(-15,15)	0.276	0.050		4
Size_DblN_start_logit_Rec_PRIV_SH_5(5)	-999					Fixed
Size_DblN_end_logit_Rec_PRIV_SH_5(5)	-999					Fixed
Retain_L_infl_Rec_PRIV_SH_5(5)	35.14	(10,85)	1.57	0.045		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
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)	65.43	(20,125)	1.9	0.029		3
Size_95%width_Srv_SEAMAP_VIDEO_9(9)	12.69	(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)	0.17	(-15,15)	8.44	49.66	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	2.93	(-5,20)	0.572	0.195	Normal(0,1.81	3
ln(DM_theta)_7	4.7	(-5,20)	0.714	0.152	Normal(0,1.81	3
ln(DM_theta)_8	4.25	(-5,20)	0.681	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
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_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	-0.938	(-10,10)	0.26	-		4
Retain_L_asymptote_logit_Rec_HBT_3(3)_B	-0.017	(-10,10)	0.27	-		4
Retain_L_asymptote_logit_Rec_HBT_3(3)_B	0.258	(-10,10)	0.247	0.958		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
Retain_L_asymptote_logit_Rec_CBT_4(4)_B	-0.906	(-10,10)	0.228	-		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	0.732	(-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	0.202	(-10,10)	0.456	2.250		4
Retain_L_asymptote_logit_Rec_PRIV_SH_5	1.79	(-10,10)	0.935	0.521		4
Retain_L_asymptote_logit_Rec_PRIV_SH_5	8.27	(-10,10)	34.08	4.120		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	0.066	0.055
1964	0.077	0.067
1965	0.084	0.078
1966	0.086	0.078
1967	0.086	0.076
1968	0.093	0.086
1969	0.104	0.104
1970	0.111	0.114
1971	0.125	0.133
1972	0.145	0.164
1973	0.150	0.168
1974	0.172	0.201
1975	0.201	0.258
1976	0.201	0.268
1977	0.203	0.207
1978	0.209	0.203
1979	0.240	0.247
1980	0.267	0.268
1981	0.221	0.239
1982	0.259	0.330
1983	0.225	0.408
1984	0.139	0.213
1985	0.234	0.348
1986	0.283	0.331
1987	0.202	0.276
1988	0.173	0.283
1989	0.215	0.271
1990	0.183	0.262
1991	0.212	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	0.230	0.261
1993	0.281	0.350
1994	0.243	0.329
1995	0.355	0.422
1996	0.235	0.294
1997	0.240	0.298
1998	0.407	0.401
1999	0.329	0.299
2000	0.255	0.353
2001	0.307	0.408
2002	0.306	0.397
2003	0.302	0.347
2004	0.390	0.451
2005	0.326	0.351
2006	0.394	0.443
2007	0.408	0.484
2008	0.630	0.698
2009	0.441	0.339
2010	0.370	0.211
2011	0.226	0.117
2012	0.207	0.131
2013	0.214	0.129
2014	0.154	0.079
2015	0.255	0.072
2016	0.344	
2017	0.343	
2018	0.348	
2019	0.378	

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	0.025	0.000	0.002	0.012	0.027	0	0.066
1964	0.031	0.000	0.003	0.013	0.030	0	0.077
1965	0.034	0.000	0.003	0.014	0.033	0	0.084
1966	0.030	0.000	0.003	0.016	0.036	0	0.086
1967	0.025	0.000	0.004	0.018	0.039	0	0.086
1968	0.028	0.000	0.004	0.020	0.042	0	0.093
1969	0.034	0.000	0.004	0.022	0.044	0	0.104
1970	0.035	0.000	0.005	0.024	0.047	0	0.111
1971	0.038	0.000	0.005	0.028	0.054	0	0.125
1972	0.045	0.000	0.006	0.032	0.061	0	0.145
1973	0.037	0.000	0.007	0.037	0.069	0	0.150
1974	0.046	0.000	0.008	0.041	0.077	0	0.172
1975	0.063	0.000	0.009	0.045	0.084	0	0.201
1976	0.056	0.000	0.009	0.046	0.091	0	0.201
1977	0.048	0.000	0.009	0.047	0.099	0	0.203
1978	0.045	0.000	0.009	0.048	0.106	0	0.209
1979	0.073	0.000	0.010	0.050	0.108	0	0.240
1980	0.078	0.004	0.010	0.052	0.123	0	0.267
1981	0.083	0.020	0.021	0.038	0.059	0	0.221
1982	0.077	0.044	0.018	0.031	0.088	0	0.259
1983	0.066	0.033	0.017	0.030	0.078	0	0.225
1984	0.068	0.021	0.011	0.020	0.018	0	0.139
1985	0.085	0.018	0.027	0.047	0.058	0	0.234
1986	0.057	0.025	0.007	0.113	0.082	0	0.283
1987	0.046	0.035	0.006	0.036	0.078	0	0.202
1988	0.042	0.021	0.007	0.032	0.070	0	0.173
1989	0.069	0.024	0.020	0.036	0.067	0	0.215
1990	0.071	0.038	0.013	0.016	0.045	0	0.183
1991	0.069	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	0.033	0.004	0.056	0.078	0.000	0.230
1993	0.084	0.029	0.006	0.055	0.107	0.000	0.281
1994	0.081	0.023	0.009	0.034	0.096	0.000	0.243
1995	0.080	0.024	0.008	0.067	0.175	0.000	0.355
1996	0.062	0.021	0.004	0.082	0.067	0.000	0.235
1997	0.055	0.019	0.003	0.049	0.114	0.000	0.240
1998	0.085	0.024	0.010	0.090	0.198	0.000	0.407
1999	0.062	0.021	0.010	0.084	0.152	0.000	0.329
2000	0.073	0.023	0.008	0.042	0.108	0.000	0.255
2001	0.094	0.037	0.005	0.033	0.138	0.000	0.307
2002	0.079	0.037	0.004	0.045	0.142	0.000	0.306
2003	0.060	0.038	0.005	0.050	0.149	0.000	0.302
2004	0.071	0.038	0.007	0.067	0.207	0.000	0.390
2005	0.065	0.031	0.005	0.073	0.153	0.634	0.960
2006	0.086	0.048	0.004	0.069	0.188	0.000	0.394
2007	0.086	0.045	0.009	0.039	0.229	0.000	0.408
2008	0.102	0.036	0.010	0.092	0.390	0.000	0.630
2009	0.069	0.015	0.010	0.057	0.290	0.000	0.441
2010	0.037	0.010	0.011	0.069	0.242	0.000	0.370
2011	0.023	0.008	0.005	0.019	0.172	0.000	0.226
2012	0.034	0.012	0.005	0.029	0.127	0.000	0.207
2013	0.029	0.014	0.005	0.026	0.139	0.000	0.214
2014	0.030	0.018	0.004	0.011	0.091	0.769	0.923
2015	0.056	0.051	0.006	0.027	0.115	0.000	0.255
2016	0.095	0.077	0.005	0.041	0.126	0.000	0.344
2017	0.060	0.035	0.005	0.052	0.192	0.000	0.343
2018	0.057	0.031	0.005	0.040	0.215	0.098	0.446
2019	0.061	0.031	0.005	0.044	0.237	0.000	0.378

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 = 65,929 metric tons for Gulf of Mexico Gag Grouper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
1963	32,946	30,201	27,074	5,698	4,807	0.41
1964	32,429	30,013	26,899	5,661	4,681	0.41
1965	31,360	29,522	26,430	5,578	4,573	0.40
1966	29,866	28,082	25,670	4,965	4,488	0.39
1967	28,260	26,523	24,522	4,479	4,429	0.37
1968	26,657	24,958	23,094	4,087	4,398	0.35
1969	24,932	23,260	21,488	3,743	4,405	0.33
1970	23,089	21,431	19,736	3,433	4,467	0.30
1971	21,331	19,669	18,035	3,168	4,636	0.27
1972	19,562	17,872	16,299	2,916	4,985	0.25
1973	17,812	16,043	14,522	2,679	5,549	0.22
1974	16,428	14,507	13,001	2,503	6,446	0.20
1975	15,253	13,095	11,543	2,395	6,478	0.17
1976	14,195	11,852	10,169	2,376	5,844	0.15
1977	13,503	11,239	9,286	2,530	5,161	0.14
1978	12,958	10,886	8,803	2,637	7,443	0.13
1979	12,656	10,460	8,491	2,584	4,474	0.13
1980	11,980	9,699	7,939	2,415	4,359	0.12
1981	11,152	9,493	7,316	2,668	7,017	0.11
1982	11,079	9,068	7,176	2,485	3,765	0.11
1983	10,644	8,478	6,843	2,335	4,892	0.10
1984	10,659	9,068	6,759	2,821	4,080	0.10
1985	11,288	9,486	7,484	2,724	5,071	0.11
1986	10,986	9,308	7,439	2,681	2,090	0.11
1987	9,867	8,402	6,804	2,314	2,978	0.10
1988	9,488	8,576	6,783	2,447	1,884	0.10
1989	9,144	8,096	6,906	1,995	7,878	0.10
1990	9,053	7,493	6,441	1,822	2,825	0.10
1991	9,225	6,911	6,006	1,595	3,471	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 = 65,929 metric tons for Gulf of Mexico Gag Grouper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
1992	9,344	8,137	5,640	2,713	3,954	0.09
1993	9,217	7,694	5,826	2,273	10,943	0.09
1994	9,614	7,063	5,644	2,049	7,411	0.09
1995	10,679	7,002	5,426	2,097	5,531	0.08
1996	11,138	8,460	5,035	3,394	13,655	0.08
1997	12,984	9,668	6,159	3,672	7,787	0.09
1998	14,429	10,055	7,403	3,426	4,171	0.11
1999	13,766	11,244	6,865	4,579	9,992	0.10
2000	13,672	11,198	7,454	4,140	9,132	0.11
2001	14,423	10,706	8,406	3,380	7,540	0.13
2002	14,778	11,454	7,991	4,126	10,225	0.12
2003	15,205	11,948	7,984	4,390	7,034	0.12
2004	15,333	11,905	8,459	4,174	6,854	0.13
2005	14,265	11,599	7,783	4,327	8,976	0.12
2006	6,133	4,726	3,230	1,718	6,315	0.05
2007	6,302	4,372	3,050	1,582	6,824	0.05
2008	6,810	4,394	2,837	1,710	3,996	0.04
2009	6,251	4,207	2,181	1,926	2,800	0.03
2010	6,325	5,011	2,590	2,307	5,088	0.04
2011	6,407	5,072	3,234	2,030	1,256	0.05
2012	6,701	5,343	4,022	1,833	3,097	0.06
2013	6,996	6,222	4,433	2,210	4,475	0.07
2014	7,179	5,785	4,729	1,649	4,725	0.07
2015	3,125	2,392	1,940	697	2,486	0.03
2016	3,344	2,504	1,814	820	3,147	0.03
2017	3,520	2,471	1,675	884	2,821	0.03
2018	3,780	2,664	1,705	1,027	1,466	0.03
2019	3,586	2,788	1,685	1,140	2,094	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	14,942	12,131	18,070	12,131	4,819.56	878.41	18.2
1964	14,816	12,082	17,931	12,082	4,787.11	874.30	18.3
1965	14,516	11,913	17,608	11,913	4,716.87	861.14	18.3
1966	14,010	11,659	16,423	11,659	4,123.37	841.20	20.4
1967	13,090	11,431	15,091	11,431	3,657.16	822.31	22.5
1968	11,868	11,226	13,731	11,226	3,284.70	801.92	24.4
1969	10,573	10,914	12,345	10,914	2,971.08	771.93	26.0
1970	9,293	10,443	10,988	10,443	2,703.45	729.72	27.0
1971	8,143	9,892	9,777	9,892	2,486.62	681.88	27.4
1972	7,075	9,223	8,648	9,223	2,289.26	626.44	27.4
1973	6,103	8,418	7,625	8,418	2,115.46	563.05	26.6
1974	5,336	7,664	6,842	7,664	1,998.55	504.84	25.3
1975	4,723	6,820	6,275	6,820	1,951.68	443.04	22.7
1976	4,289	5,880	5,971	5,880	1,997.85	378.03	18.9
1977	4,184	5,102	6,136	5,102	2,203.86	326.26	14.8
1978	4,340	4,463	6,423	4,463	2,351.49	285.70	12.1
1979	4,566	3,925	6,535	3,925	2,330.43	253.72	10.9
1980	4,614	3,325	6,374	3,325	2,196.03	219.27	10.0
1981	4,519	2,796	6,696	2,796	2,478.92	189.39	7.6
1982	4,871	2,304	6,764	2,304	2,322.24	163.01	7.0
1983	4,974	1,868	6,610	1,868	2,193.96	141.00	6.4
1984	5,110	1,648	7,419	1,648	2,688.55	132.21	4.9
1985	5,923	1,561	7,924	1,561	2,591.41	133.05	5.1
1986	5,979	1,459	7,848	1,459	2,549.80	131.37	5.2
1987	5,426	1,378	7,023	1,378	2,187.74	126.34	5.8
1988	5,390	1,393	7,182	1,393	2,317.50	129.82	5.6
1989	5,438	1,467	6,628	1,467	1,858.29	136.81	7.4
1990	4,966	1,474	6,018	1,474	1,684.52	137.21	8.1
1991	4,541	1,464	5,446	1,464	1,460.18	134.89	9.2

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	4,182	1,458	6,678	1,458	2,581.21	131.75	5.1
1993	4,453	1,373	6,320	1,373	2,151.65	121.04	5.6
1994	4,399	1,245	5,817	1,245	1,937.37	111.29	5.7
1995	4,254	1,172	5,829	1,172	1,991.17	105.58	5.3
1996	3,982	1,052	7,408	1,052	3,299.28	94.35	2.9
1997	5,183	975	8,692	975	3,583.28	88.86	2.5
1998	6,442	961	9,093	961	3,331.89	94.30	2.8
1999	6,002	862	10,381	862	4,490.06	88.55	2.0
2000	6,632	821	10,376	821	4,053.95	86.03	2.1
2001	7,558	848	9,858	848	3,284.88	95.47	2.9
2002	7,148	842	10,611	842	4,027.70	98.30	2.4
2003	7,151	832	11,115	832	4,293.74	95.95	2.2
2004	7,607	852	11,052	852	4,074.92	98.89	2.4
2005	6,967	815	10,783	815	4,233.27	94.01	2.2
2006	2,900	330	4,396	330	1,680.23	37.46	2.2
2007	2,755	295	4,076	295	1,547.29	34.28	2.2
2008	2,568	268	4,125	268	1,678.76	31.48	1.9
2009	1,985	196	4,011	196	1,903.92	22.20	1.2
2010	2,408	181	4,829	181	2,286.64	20.85	0.9
2011	3,037	197	4,875	197	2,006.13	24.15	1.2
2012	3,761	261	5,082	261	1,798.27	34.58	1.9
2013	4,088	345	5,876	345	2,164.46	46.00	2.1
2014	4,290	438	5,346	438	1,593.63	55.61	3.5
2015	1,716	224	2,168	224	669.12	27.44	4.1
2016	1,566	248	2,256	248	791.62	28.58	3.6
2017	1,449	225	2,246	225	859.02	24.83	2.9
2018	1,486	219	2,444	219	1,003.43	23.40	2.3
2019	1,492	193	2,595	193	1,119.85	20.37	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	87.235	18.8
1964	0.05	2.042	2.043	108.645	18.8
1965	0.05	2.232	2.235	117.725	19.0
1966	0.05	1.871	1.872	96.677	19.4
1967	0.05	1.446	1.447	72.641	19.9
1968	0.05	1.511	1.512	73.748	20.5
1969	0.05	1.749	1.751	83.334	21.0
1970	0.05	1.665	1.667	77.988	21.4
1971	0.05	1.659	1.661	76.883	21.6
1972	0.05	1.769	1.772	81.615	21.7
1973	0.05	1.306	1.307	60.328	21.7
1974	0.05	1.464	1.466	68.486	21.4
1975	0.05	1.804	1.808	87.156	20.7
1976	0.05	1.449	1.452	74.019	19.6
1977	0.05	1.197	1.198	65.496	18.3
1978	0.05	1.070	1.072	62.264	17.2
1979	0.05	1.676	1.679	102.664	16.4
1980	0.05	1.653	1.656	106.735	15.5
1981	0.05	1.722	1.725	117.793	14.6
1982	0.05	1.535	1.537	111.018	13.8
1983	0.05	1.231	1.234	93.313	13.2
1984	0.05	1.358	1.363	106.460	12.8
1985	0.05	1.757	1.769	139.304	12.7
1986	0.05	1.153	1.159	89.682	12.9
1987	0.05	0.850	0.854	64.819	13.2
1988	0.05	0.786	0.790	58.377	13.5
1989	0.05	1.225	1.234	87.526	14.1
1990	0.05	1.165	1.173	78.531	14.9
1991	0.05	1.037	1.045	69.743	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	77.048	13.7
1993	0.05	1.363	1.412	106.375	13.3
1994	0.05	1.258	1.247	94.245	13.2
1995	0.05	1.255	1.218	95.226	12.8
1996	0.05	1.164	1.154	102.746	11.2
1997	0.05	1.171	1.162	108.490	10.7
1998	0.05	1.911	1.855	170.994	10.8
1999	0.05	1.519	1.524	146.204	10.4
2000	0.05	1.681	1.798	169.942	10.6
2001	0.05	2.159	2.167	175.060	12.4
2002	0.05	1.937	1.932	151.286	12.8
2003	0.05	1.510	1.521	121.706	12.5
2004	0.05	1.809	1.810	145.584	12.4
2005	0.05	1.596	1.601	128.936	12.4
2006	0.05	0.853	0.873	71.885	12.1
2007	0.05	0.788	0.797	65.751	12.1
2008	0.05	0.946	0.940	77.781	12.1
2009	0.05	0.592	0.595	52.887	11.3
2010	0.01	0.388	0.389	36.856	10.5
2011	0.01	0.239	0.240	22.406	10.7
2012	0.01	0.395	0.395	36.325	10.9
2013	0.01	0.390	0.390	33.673	11.6
2014	0.01	0.376	0.377	30.251	12.5
2015	0.01	0.289	0.290	21.863	13.3
2016	0.01	0.511	0.510	39.379	13.0
2017	0.01	0.316	0.315	26.036	12.1
2018	0.01	0.323	0.322	28.379	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	25.3
1980	0.05	0.096	0.096	3.987	24.1
1981	0.05	0.423	0.423	18.515	22.8
1982	0.05	0.886	0.887	41.478	21.4
1983	0.05	0.608	0.609	30.100	20.2
1984	0.05	0.416	0.417	21.496	19.4
1985	0.05	0.370	0.371	19.712	18.8
1986	0.05	0.513	0.515	27.516	18.7
1987	0.05	0.649	0.652	34.539	18.9
1988	0.05	0.393	0.394	20.639	19.1
1989	0.05	0.418	0.419	21.609	19.4
1990	0.05	0.622	0.627	31.673	19.8
1991	0.05	0.502	0.506	25.052	20.2
1992	0.05	0.580	0.585	29.055	20.1
1993	0.05	0.457	0.483	24.593	19.7
1994	0.05	0.338	0.354	18.526	19.1
1995	0.05	0.373	0.377	20.026	18.8
1996	0.05	0.377	0.384	21.368	18.0
1997	0.05	0.396	0.401	23.906	16.8
1998	0.05	0.549	0.538	33.275	16.2
1999	0.05	0.519	0.520	32.824	15.8
2000	0.05	0.545	0.568	36.453	15.6
2001	0.05	0.913	0.868	54.150	16.0
2002	0.05	0.986	0.927	56.680	16.4
2003	0.05	1.053	0.988	60.180	16.4
2004	0.05	1.042	0.981	59.911	16.4
2005	0.05	0.832	0.784	47.891	16.4
2006	0.05	0.508	0.493	30.573	16.1
2007	0.05	0.458	0.436	27.349	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	21.868	16.0
2009	0.05	0.149	0.140	9.057	15.5
2010	0.01	0.108	0.109	7.551	14.5
2011	0.01	0.079	0.080	5.644	14.1
2012	0.01	0.128	0.128	8.894	14.4
2013	0.01	0.186	0.186	12.139	15.3
2014	0.01	0.210	0.210	12.948	16.2
2015	0.01	0.253	0.253	14.772	17.2
2016	0.01	0.400	0.399	22.725	17.6
2017	0.01	0.176	0.176	10.163	17.3
2018	0.01	0.170	0.170	10.227	16.7
2019	0.01	0.179	0.179	11.043	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	21.211	21.213	0.162	7.6
1964	0.20	21.855	21.893	0.171	7.8
1965	0.20	22.498	22.543	0.184	8.2
1966	0.20	23.187	23.240	0.197	8.5
1967	0.20	23.876	23.937	0.207	8.7
1968	0.20	24.566	24.634	0.214	8.7
1969	0.20	25.254	25.330	0.217	8.6
1970	0.20	25.944	26.025	0.219	8.4
1971	0.20	28.350	28.449	0.233	8.2
1972	0.20	30.757	30.872	0.244	7.9
1973	0.20	33.164	33.291	0.251	7.5
1974	0.20	35.571	35.702	0.252	7.1
1975	0.20	37.978	38.099	0.247	6.5
1976	0.20	38.132	38.221	0.229	6.0
1977	0.20	38.286	38.349	0.222	5.8
1978	0.20	38.440	38.492	0.225	5.8
1979	0.20	38.593	38.633	0.221	5.7
1980	0.20	38.747	38.775	0.217	5.6
1981	0.20	73.757	75.916	0.437	5.8
1982	0.20	66.110	62.361	0.350	5.6
1983	0.20	61.752	57.316	0.316	5.5
1984	0.20	43.780	39.705	0.226	5.7
1985	0.20	103.116	96.377	0.567	5.9
1986	0.20	29.289	22.494	0.133	5.9
1987	0.20	25.801	19.032	0.115	6.1
1988	0.20	24.467	21.419	0.139	6.5
1989	0.20	33.840	50.834	0.347	6.8
1990	0.20	18.280	23.936	0.205	8.6
1991	0.20	10.714	1.806	0.014	7.8

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	0.2	12.960	10.066	0.069	6.9
1993	0.2	17.229	14.116	0.103	7.3
1994	0.2	18.495	17.491	0.130	7.5
1995	0.2	15.465	18.163	0.123	6.8
1996	0.2	10.720	10.870	0.066	6.1
1997	0.2	10.494	9.288	0.060	6.5
1998	0.2	31.098	33.493	0.220	6.6
1999	0.2	27.845	40.216	0.252	6.3
2000	0.2	27.625	27.905	0.188	6.7
2001	0.2	11.875	12.791	0.105	8.2
2002	0.2	9.796	10.525	0.083	7.9
2003	0.2	13.012	17.021	0.130	7.7
2004	0.2	20.063	23.173	0.180	7.8
2005	0.2	12.932	16.373	0.125	7.6
2006	0.2	4.728	4.692	0.036	7.6
2007	0.2	10.029	10.917	0.084	7.7
2008	0.2	9.414	11.590	0.085	7.4
2009	0.2	8.600	12.698	0.086	6.8
2010	0.2	10.340	17.100	0.116	6.8
2011	0.2	4.921	5.157	0.038	7.3
2012	0.2	4.362	4.741	0.038	8.0
2013	0.2	4.889	7.278	0.059	8.1
2014	0.2	5.976	5.106	0.044	8.7
2015	0.2	3.416	2.995	0.026	8.8
2016	0.2	2.109	2.849	0.023	8.1
2017	0.2	2.659	2.044	0.019	9.2
2018	0.2	2.657	2.407	0.021	8.8
2019	0.2	2.366	2.459	0.021	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	99.069	99.116	0.815	8.2
1964	0.20	102.075	102.950	0.859	8.3
1965	0.20	105.081	106.108	0.921	8.7
1966	0.20	108.299	109.504	0.989	9.0
1967	0.20	111.518	112.909	1.044	9.2
1968	0.20	114.736	116.314	1.082	9.3
1969	0.20	117.955	119.708	1.105	9.2
1970	0.20	121.173	123.086	1.116	9.1
1971	0.20	132.415	134.741	1.193	8.9
1972	0.20	143.656	146.383	1.255	8.6
1973	0.20	154.898	157.958	1.298	8.2
1974	0.20	166.139	169.368	1.313	7.8
1975	0.20	177.381	180.446	1.291	7.2
1976	0.20	178.100	180.395	1.191	6.6
1977	0.20	178.819	180.443	1.145	6.3
1978	0.20	179.537	180.843	1.152	6.4
1979	0.20	180.256	181.207	1.136	6.3
1980	0.20	180.975	181.605	1.111	6.1
1981	0.20	117.237	125.464	0.782	6.2
1982	0.20	106.427	99.933	0.613	6.1
1983	0.20	99.849	93.983	0.564	6.0
1984	0.20	69.958	64.295	0.396	6.2
1985	0.20	164.180	151.986	0.967	6.4
1986	0.20	367.116	358.885	2.310	6.4
1987	0.20	106.620	101.531	0.664	6.5
1988	0.20	86.866	87.601	0.610	7.0
1989	0.20	74.357	86.148	0.631	7.3
1990	0.20	26.279	29.246	0.258	8.8
1991	0.20	35.080	27.824	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	0.2	156.110	138.551	0.986	7.1
1993	0.2	137.481	121.358	0.911	7.5
1994	0.2	66.607	67.256	0.518	7.7
1995	0.2	112.353	139.820	0.984	7.0
1996	0.2	199.052	233.571	1.473	6.3
1997	0.2	139.119	152.129	1.015	6.7
1998	0.2	199.321	280.993	1.918	6.8
1999	0.2	137.899	312.893	2.030	6.5
2000	0.2	127.608	147.907	1.027	6.9
2001	0.2	84.576	89.922	0.749	8.3
2002	0.2	114.051	132.788	1.071	8.1
2003	0.2	92.980	160.609	1.256	7.8
2004	0.2	134.341	211.324	1.679	7.9
2005	0.2	126.872	228.690	1.783	7.8
2006	0.2	70.445	87.745	0.683	7.8
2007	0.2	33.991	45.532	0.357	7.8
2008	0.2	89.110	108.386	0.815	7.5
2009	0.2	46.692	70.424	0.488	6.9
2010	0.2	60.233	103.164	0.716	6.9
2011	0.2	10.632	18.259	0.137	7.5
2012	0.2	46.754	27.159	0.222	8.2
2013	0.2	24.939	31.076	0.257	8.3
2014	0.2	12.425	11.452	0.101	8.8
2015	0.2	12.977	10.739	0.097	9.0
2016	0.2	17.624	23.583	0.196	8.3
2017	0.2	25.424	24.768	0.229	9.2
2018	0.2	19.823	21.431	0.191	8.9
2019	0.2	28.537	25.792	0.223	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	0.050000	379.415	379.948	1.778	4.7
1964	0.200000	390.928	401.280	1.975	4.9
1965	0.200000	402.441	414.557	2.133	5.1
1966	0.200000	414.766	428.669	2.235	5.2
1967	0.200000	427.092	442.647	2.272	5.1
1968	0.200000	439.418	456.400	2.262	5.0
1969	0.200000	451.744	469.854	2.230	4.7
1970	0.200000	464.070	482.935	2.193	4.5
1971	0.200000	507.123	528.819	2.299	4.3
1972	0.200000	550.176	573.648	2.374	4.1
1973	0.200000	593.229	616.511	2.408	3.9
1974	0.200000	636.283	656.556	2.398	3.7
1975	0.200000	679.336	693.872	2.374	3.4
1976	0.200000	682.089	689.697	2.317	3.4
1977	0.200000	684.841	688.242	2.398	3.5
1978	0.200000	687.594	688.952	2.495	3.6
1979	0.200000	690.347	689.145	2.435	3.5
1980	0.200000	693.100	691.519	2.576	3.7
1981	0.382749	330.039	315.723	1.217	3.9
1982	0.245153	849.967	469.376	1.734	3.7
1983	0.503027	428.677	370.220	1.438	3.9
1984	0.382483	254.301	88.816	0.359	4.0
1985	0.526935	602.137	283.930	1.192	4.2
1986	0.434219	429.977	395.899	1.651	4.2
1987	0.431957	401.543	321.829	1.438	4.5
1988	0.377222	423.866	279.196	1.315	4.7
1989	0.316419	353.138	254.242	1.173	4.6
1990	0.316198	224.742	94.046	0.694	7.4
1991	0.246862	258.847	197.960	1.318	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	0.200582	216.166	221.483	1.330	6.0
1993	0.237770	338.057	264.523	1.717	6.5
1994	0.231867	200.029	203.824	1.360	6.7
1995	0.262732	401.331	401.466	2.426	6.0
1996	0.194329	236.847	206.231	1.156	5.6
1997	0.206927	335.630	370.832	2.245	6.1
1998	0.165983	459.605	659.163	4.054	6.2
1999	0.144173	548.611	607.020	3.571	5.9
2000	0.154596	586.751	397.723	2.526	6.3
2001	0.155083	442.486	383.580	2.958	7.7
2002	0.184107	520.785	435.241	3.216	7.4
2003	0.150376	388.017	495.292	3.563	7.2
2004	0.166347	608.989	671.820	4.921	7.3
2005	0.208674	533.962	494.250	3.552	7.2
2006	0.249076	285.535	243.629	1.758	7.2
2007	0.171075	236.240	262.950	1.913	7.3
2008	0.181990	379.698	453.056	3.157	7.0
2009	0.171617	196.587	353.677	2.300	6.5
2010	0.188073	251.765	367.248	2.421	6.6
2011	0.249811	133.382	217.083	1.544	7.1
2012	0.243114	101.646	158.391	1.214	7.7
2013	0.196160	186.230	228.784	1.751	7.7
2014	0.237905	132.567	129.147	1.042	8.1
2015	0.260466	111.003	65.135	0.525	8.1
2016	0.279511	82.266	82.410	0.610	7.4
2017	0.247264	106.941	99.982	0.838	8.4
2018	0.234391	121.852	124.346	1.018	8.2
2019	0.309597	97.999	151.305	1.220	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			2.523	0.631	6.153	1.537	2.4
1964			2.753	0.688	7.249	1.812	2.6
1965			2.629	0.657	7.077	1.764	2.7
1966			2.052	0.513	5.364	1.340	2.6
1967			1.551	0.388	3.920	0.979	2.5
1968			1.638	0.409	4.032	1.008	2.5
1969			1.970	0.492	4.747	1.186	2.4
1970			1.993	0.498	4.716	1.179	2.4
1971			2.148	0.537	4.991	1.248	2.3
1972			2.547	0.637	5.778	1.444	2.3
1973			2.162	0.540	4.764	1.190	2.2
1974			2.908	0.727	6.206	1.552	2.1
1975			4.562	1.141	9.425	2.355	2.1
1976			4.452	1.113	9.321	2.330	2.1
1977			3.984	0.996	8.724	2.180	2.2
1978			3.533	0.883	8.045	2.011	2.3
1979			6.718	1.679	13.988	3.497	2.1
1980			6.448	1.612	14.813	3.704	2.3
1981			6.408	1.602	15.258	3.814	2.4
1982			7.281	1.820	15.276	3.821	2.1
1983			5.501	1.375	13.012	3.252	2.4
1984			5.799	1.450	13.739	3.435	2.4
1985			6.851	1.713	16.583	4.145	2.4
1986			4.636	1.159	10.556	2.639	2.3
1987			2.715	0.679	7.081	1.770	2.6
1988			2.135	0.534	5.467	1.367	2.6
1989			2.757	0.689	7.262	1.817	2.6
1990			8.285	2.071	13.920	3.479	1.7
1991			10.699	2.675	23.596	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			7.954	1.988	17.436	4.359	2.2
1993	0.218	17.085	10.514	2.629	21.515	5.379	2.0
1994	0.218	16.824	16.441	4.110	28.823	7.207	1.8
1995	0.218	18.991	23.565	5.891	49.143	12.286	2.1
1996	0.218	21.238	18.365	4.592	40.397	10.099	2.2
1997	0.218	22.344	19.121	4.780	35.360	8.841	1.8
1998	0.218	33.497	35.164	8.791	75.142	18.786	2.1
1999	0.218	28.141	19.797	4.949	45.415	11.354	2.3
2000	0.221	84.100	19.795	4.949	37.957	9.491	1.9
2001	0.221	100.510	65.293	16.323	211.802	52.937	3.2
2002	0.221	92.724	69.478	17.370	240.088	60.021	3.5
2003	0.221	79.853	55.439	13.859	193.363	48.341	3.5
2004	0.221	85.584	63.320	15.830	219.371	54.842	3.5
2005	0.221	79.540	58.220	14.555	208.579	52.146	3.6
2006	0.221	46.882	32.759	8.190	112.579	28.144	3.4
2007	0.221	34.193	35.723	8.931	113.198	28.301	3.2
2008	0.221	32.203	60.904	15.226	189.377	47.344	3.1
2009	0.221	37.010	49.251	12.313	167.906	41.976	3.4
2010	0.251	34.423	24.658	6.164	91.622	22.906	3.7
2011	0.251	28.390	11.300	2.825	47.366	11.841	4.2
2012	0.159	10.016	9.143	2.286	39.178	9.795	4.3
2013	0.159	9.958	6.767	1.692	32.677	8.170	4.8
2014	0.159	10.341	6.250	1.563	28.929	7.233	4.6
2015	0.159	8.009	6.070	1.518	25.959	6.488	4.3
2016	0.159	9.503	13.646	3.412	53.592	13.397	3.9
2017	0.159	7.887	10.818	2.704	38.790	9.698	3.6
2018	0.159	6.716	12.578	3.144	44.474	11.118	3.5
2019	0.251	20.621	19.980	4.995	83.227	20.807	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			0.025	0.006	0.088	0.022	3.5
1981			0.112	0.028	0.421	0.106	3.8
1982			0.284	0.071	0.990	0.247	3.5
1983			0.206	0.051	0.750	0.187	3.6
1984			0.139	0.035	0.527	0.130	3.8
1985			0.117	0.029	0.459	0.115	3.9
1986			0.158	0.040	0.600	0.150	3.8
1987			0.174	0.044	0.712	0.179	4.1
1988			0.088	0.022	0.381	0.095	4.3
1989			0.078	0.020	0.351	0.088	4.5
1990			0.230	0.058	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	0.238	0.588	0.229	0.057	0.540	0.134	2.4
1994	0.238	0.673	0.272	0.068	0.558	0.139	2.1
1995	0.238	0.660	0.482	0.120	1.113	0.278	2.3
1996	0.238	0.809	0.456	0.114	1.111	0.278	2.4
1997	0.238	0.779	0.475	0.119	1.016	0.256	2.1
1998	0.238	0.807	0.822	0.205	1.931	0.483	2.4
1999	0.238	0.819	0.583	0.146	1.466	0.366	2.5
2000	0.231	1.304	0.481	0.120	1.071	0.269	2.2
2001	0.231	1.586	2.917	0.729	11.296	2.824	3.9
2002	0.231	1.627	3.757	0.939	14.976	3.743	4.0
2003	0.231	1.727	4.158	1.040	16.943	4.235	4.1
2004	0.231	1.693	3.971	0.993	15.939	3.986	4.0
2005	0.231	1.457	3.408	0.852	14.006	3.501	4.1
2006	0.231	1.351	2.193	0.548	8.869	2.218	4.0
2007	0.231	0.764	2.163	0.541	8.272	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	0.231	0.878	2.447	0.612	9.079	2.269	3.7
2009	0.231	0.457	1.456	0.364	5.698	1.425	3.9
2010	0.161	4.252	1.046	0.261	4.377	1.094	4.2
2011	0.161	4.503	2.120	0.530	23.815	5.954	11.2
2012	0.245	2.017	2.704	0.676	35.214	8.803	13.0
2013	0.245	2.473	3.556	0.889	50.672	12.668	14.3
2014	0.245	3.012	3.737	0.934	57.012	14.254	15.3
2015	0.245	3.242	4.379	1.095	69.027	17.256	15.8
2016	0.245	3.642	6.981	1.745	109.526	27.381	15.7
2017	0.245	3.505	3.266	0.817	48.700	12.175	14.9
2018	0.245	3.086	3.412	0.853	47.605	11.901	14.0
2019	0.161	6.193	4.414	1.104	53.951	13.488	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			6.805	0.817	10.317	1.238	1.5
1964			5.770	0.692	9.424	1.131	1.6
1965			5.646	0.678	8.967	1.076	1.6
1966			6.113	0.734	9.392	1.127	1.5
1967			6.753	0.810	10.194	1.223	1.5
1968			7.438	0.893	11.111	1.333	1.5
1969			8.155	0.979	12.077	1.449	1.5
1970			8.907	1.069	13.083	1.570	1.5
1971			10.365	1.244	15.080	1.810	1.5
1972			12.133	1.456	17.412	2.088	1.4
1973			14.345	1.721	20.236	2.427	1.4
1974			17.028	2.043	23.603	2.831	1.4
1975			20.048	2.406	27.503	3.300	1.4
1976			19.798	2.376	27.871	3.344	1.4
1977			17.968	2.156	26.178	3.142	1.5
1978			16.632	1.996	24.304	2.917	1.5
1979			20.083	2.410	27.542	3.305	1.4
1980			15.915	1.910	24.546	2.945	1.5
1981	1.046	56.153	29.514	3.542	43.823	5.258	1.5
1982	1.004	9.132	31.498	3.780	43.017	5.161	1.4
1983	0.731	9.388	21.792	2.615	34.388	4.127	1.6
1984	0.833	3.887	15.169	1.820	22.536	2.705	1.5
1985	0.827	14.373	34.413	4.130	52.245	6.270	1.5
1986	0.198	7.385	9.063	1.087	13.200	1.584	1.5
1987	0.198	4.304	5.441	0.653	9.260	1.111	1.7
1988	0.198	5.814	6.440	0.773	9.872	1.185	1.5
1989	0.198	21.810	15.075	1.809	22.511	2.703	1.5
1990	0.198	51.036	39.621	4.755	54.107	6.493	1.4
1991	0.198	1.187	2.823	0.339	5.334	0.640	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	7.347	8.887	1.066	15.711	1.885	1.8
1993	0.198	12.369	14.256	1.711	22.851	2.742	1.6
1994	0.198	35.261	36.468	4.376	51.627	6.195	1.4
1995	0.198	43.452	38.059	4.567	66.291	7.955	1.7
1996	0.198	13.292	13.178	1.581	23.496	2.819	1.8
1997	0.198	12.984	14.348	1.722	21.278	2.553	1.5
1998	0.198	54.357	51.878	6.225	93.571	11.228	1.8
1999	0.198	48.522	35.581	4.270	67.735	8.128	1.9
2000	0.198	30.277	29.746	3.570	45.077	5.409	1.5
2001	0.198	30.345	28.327	3.399	55.342	6.641	2.0
2002	0.198	24.157	22.644	2.717	48.238	5.788	2.1
2003	0.198	43.680	34.527	4.143	69.481	8.338	2.0
2004	0.198	52.364	45.768	5.492	97.759	11.731	2.1
2005	0.198	36.512	29.862	3.583	64.010	7.681	2.1
2006	0.198	9.848	9.937	1.192	19.344	2.321	1.9
2007	0.198	35.003	32.980	3.958	60.308	7.237	1.8
2008	0.198	53.173	45.194	5.423	86.629	10.395	1.9
2009	0.198	52.392	37.824	4.539	83.102	9.972	2.2
2010	0.198	46.592	30.347	3.642	69.605	8.353	2.3
2011	0.198	45.679	44.306	5.317	157.747	18.930	3.6
2012	0.198	37.878	35.831	4.300	152.776	18.333	4.3
2013	0.198	34.756	25.047	3.006	97.324	11.679	3.9
2014	0.198	20.162	22.766	2.732	76.980	9.238	3.4
2015	0.198	15.967	17.592	2.111	55.017	6.602	3.1
2016	0.198	20.739	16.012	1.921	44.554	5.346	2.8
2017	0.198	16.555	20.291	2.435	55.959	6.715	2.8
2018	0.198	21.040	22.898	2.748	66.387	7.966	2.9
2019	0.198	18.297	17.772	2.133	59.305	7.117	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			21.573	2.588	35.858	4.303	1.7
1964			18.523	2.223	33.356	4.001	1.8
1965			17.758	2.131	31.381	3.765	1.8
1966			19.024	2.283	32.494	3.900	1.7
1967			21.017	2.522	35.192	4.222	1.7
1968			23.259	2.791	38.488	4.619	1.7
1969			25.645	3.078	42.047	5.046	1.6
1970			28.153	3.379	45.766	5.492	1.6
1971			32.914	3.950	53.003	6.360	1.6
1972			38.668	4.641	61.460	7.374	1.6
1973			45.888	5.507	71.721	8.607	1.6
1974			54.711	6.565	84.060	10.086	1.5
1975			65.267	7.832	98.613	11.834	1.5
1976			65.306	7.837	100.813	12.097	1.5
1977			59.343	7.121	94.863	11.385	1.6
1978			53.433	6.412	87.305	10.476	1.6
1979			65.281	7.834	97.557	11.707	1.5
1980			52.685	6.322	88.978	10.677	1.7
1981	0.844	89.783	32.945	3.954	55.162	6.618	1.7
1982	0.808	14.601	34.758	4.171	51.645	6.197	1.5
1983	0.617	15.011	25.090	3.011	43.594	5.232	1.7
1984	0.764	6.215	16.856	2.023	27.666	3.320	1.6
1985	0.562	22.980	36.906	4.429	62.281	7.474	1.7
1986	0.421	91.324	99.753	11.970	157.917	18.938	1.6
1987	0.367	17.620	20.314	2.438	38.094	4.572	1.9
1988	0.547	20.296	17.821	2.138	30.203	3.624	1.7
1989	0.514	46.217	15.778	1.893	28.144	3.377	1.8
1990	0.514	71.078	31.434	3.772	45.786	5.496	1.5
1991	0.744	3.502	31.723	3.807	63.266	7.591	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	87.794	10.535	167.498	20.100	1.9
1993	0.489	97.098	81.747	9.810	145.695	17.483	1.8
1994	0.376	113.478	92.714	11.126	141.164	16.940	1.5
1995	0.284	308.655	211.437	25.373	391.600	46.991	1.9
1996	0.294	240.693	203.410	24.410	395.465	47.454	1.9
1997	0.275	168.734	160.233	19.228	255.438	30.653	1.6
1998	0.159	351.124	316.342	37.961	603.036	72.364	1.9
1999	0.090	233.276	202.368	24.284	414.854	49.783	2.0
2000	0.237	134.811	106.362	12.763	174.897	20.988	1.6
2001	0.376	201.966	139.134	16.696	294.577	35.349	2.1
2002	0.188	246.969	205.749	24.690	476.182	57.142	2.3
2003	0.129	296.289	232.261	27.872	509.763	61.172	2.2
2004	0.090	337.988	302.635	36.316	696.867	83.623	2.3
2005	0.090	339.608	301.438	36.172	704.854	84.582	2.3
2006	0.159	140.619	129.465	15.536	278.626	33.435	2.2
2007	0.188	113.324	94.454	11.334	190.085	22.809	2.0
2008	0.179	313.363	299.905	35.989	622.902	74.748	2.1
2009	0.256	267.022	157.239	18.869	369.759	44.372	2.4
2010	0.275	325.174	136.784	16.414	340.411	40.849	2.5
2011	0.149	190.736	148.812	17.857	625.569	75.068	4.2
2012	0.120	170.375	203.153	24.378	992.818	119.138	4.9
2013	0.322	234.277	168.395	20.207	851.803	102.217	5.1
2014	0.237	67.971	74.092	8.891	341.687	41.002	4.6
2015	0.256	72.623	88.490	10.619	370.230	44.428	4.2
2016	0.198	104.765	78.004	9.360	235.719	28.287	3.0
2017	0.294	145.159	145.450	17.454	438.722	52.646	3.0
2018	0.217	126.194	123.983	14.878	387.001	46.440	3.1
2019	0.246	99.177	117.353	14.082	415.600	49.873	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			288	35	173	21	0.6
1964			287	34	161	19	0.6
1965			314	38	167	20	0.5
1966			352	42	182	22	0.5
1967			392	47	200	24	0.5
1968			433	52	218	26	0.5
1969			474	57	236	28	0.5
1970			516	62	254	31	0.5
1971			604	72	292	35	0.5
1972			714	86	336	40	0.5
1973			845	101	387	46	0.5
1974			998	120	444	53	0.4
1975			1,030	124	482	58	0.5
1976			908	109	454	54	0.5
1977			801	96	416	50	0.5
1978			1,019	122	435	52	0.4
1979			762	91	431	52	0.6
1980			694	83	372	45	0.5
1981	0.786	401	460	55	189	23	0.4
1982	0.345	197	479	57	283	34	0.6
1983	0.493	356	391	47	194	23	0.5
1984	0.086	83	86	10	46	6	0.5
1985	0.834	139	312	37	148	18	0.5
1986	0.469	361	287	34	196	23	0.7
1987	0.336	278	261	31	136	16	0.5
1988	0.340	194	199	24	119	14	0.6
1989	0.182	552	539	65	164	20	0.3
1990	0.325	362	461	55	411	49	0.9
1991	0.280	1,054	837	100	917	110	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	652	78	574	69	0.9
1993	0.189	1,938	1,614	194	880	106	0.5
1994	0.132	1,548	1,466	176	1,144	137	0.8
1995	0.158	2,061	2,220	266	2,320	278	1.0
1996	0.123	1,037	1,128	135	773	93	0.7
1997	0.131	1,639	1,736	208	1,504	180	0.9
1998	0.141	2,270	2,291	275	2,775	333	1.2
1999	0.120	2,051	2,044	245	1,643	197	0.8
2000	0.108	1,359	1,550	186	1,174	141	0.8
2001	0.145	2,326	2,353	282	2,573	309	1.1
2002	0.119	2,902	2,880	346	3,015	362	1.0
2003	0.107	3,187	2,673	321	3,064	368	1.1
2004	0.118	4,113	3,461	415	4,163	500	1.2
2005	0.119	2,821	2,823	339	2,909	349	1.0
2006	0.134	1,753	1,972	237	1,646	197	0.8
2007	0.115	2,713	2,780	334	2,415	290	0.9
2008	0.123	4,442	4,496	540	5,181	622	1.2
2009	0.114	2,937	2,328	279	3,229	388	1.4
2010	0.117	2,315	2,040	245	2,147	258	1.1
2011	0.176	1,595	1,588	191	3,186	382	2.0
2012	0.146	1,140	1,217	146	2,332	280	1.9
2013	0.141	1,191	1,229	148	1,358	163	1.1
2014	0.148	1,026	941	113	971	116	1.0
2015	0.135	662	656	79	674	81	1.0
2016	0.229	1,103	809	97	720	86	0.9
2017	0.167	1,528	1,516	182	1,738	209	1.1
2018	0.181	1,036	1,348	162	2,040	245	1.5
2019	0.182	1,370	1,378	165	1,995	239	1.4

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	1.35	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	0.62	0.82	1.43	0.70	1.02	0.70	0.28	0.72	0.85	0.40
1991	0.31	1.12	0.55	0.64	1.37	0.62	0.75	0.74	0.30	0.71	0.91	0.41
1992	0.56	1.08	0.54	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	0.91	0.30	1.00	0.87	0.30
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	0.51	0.48	1.04	0.57	0.80	0.95	0.30	1.58	1.34	0.28
1996	0.93	0.96	0.51	0.50	0.98	0.58	1.11	1.35	0.28	1.36	1.41	0.28
1997	0.91	1.10	0.51	0.64	1.02	0.56	1.15	1.50	0.27	1.23	1.75	0.27
1998	1.54	1.16	0.51	0.95	1.07	0.56	1.12	1.51	0.27	1.57	1.81	0.24
1999	1.07	1.19	0.51	0.85	1.07	0.56	1.31	1.73	0.27	1.24	1.60	0.24
2000	1.11	1.28	0.51	0.88	1.15	0.56	1.03	1.65	0.29	0.90	1.62	0.25
2001	1.59	1.25	0.51	1.64	1.23	0.55	0.66	1.14	0.31	1.08	1.72	0.25
2002	1.59	1.23	0.51	1.44	1.25	0.56	0.68	1.16	0.31	1.23	1.75	0.24
2003	1.56	1.24	0.51	1.71	1.25	0.55	0.97	1.28	0.30	1.77	1.84	0.23
2004	1.99	1.23	0.51	2.06	1.22	0.55	1.03	1.23	0.29	1.69	1.75	0.23
2005	1.87	0.80	0.51	2.26	0.80	0.54	1.27	0.85	0.27	1.86	1.08	0.23
2006	1.00	0.46	0.52	1.20	0.45	0.55	0.56	0.50	0.32	1.08	0.72	0.25
2007	0.65	0.43	0.52	0.91	0.42	0.56	0.61	0.46	0.32	1.12	0.83	0.26
2008	0.64	0.36	0.52	0.99	0.35	0.55	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	0.52	0.45	0.28	0.62	0.94	0.49	0.29	1.20	0.91	0.25
2010							1.25	0.62	0.29	1.19	0.83	0.26
2011										0.84	0.85	0.27
2012										0.77	0.77	0.27
2013										0.54	0.72	0.29
2014										0.45	0.48	0.28
2015										0.30	0.34	0.32
2016										0.45	0.39	0.30
2017										0.57	0.46	0.29
2018										0.66	0.49	0.30
2019										0.53	0.44	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	1.137	0.788			
1994	0.804	1.247	0.845	0.107	1.121	0.843			
1995	0.619	0.930	0.771	0.295	1.077	0.747			
1996	2.063	2.297	0.690	0.798	1.176	0.770			
1997	0.468	1.310	0.719	0.447	1.472	0.696			
1998	0.202	0.702	0.837						
1999	0.309	1.681	0.782						
2000	0.487	1.536	0.783						
2001	0.416	1.268	0.804						
2002	1.350	1.720	0.719	1.977	1.767	0.859			
2003	0.795	1.183	0.740						
2004	1.883	1.153	0.688	2.058	1.791	0.663			
2005	0.854	1.510	0.697	2.491	1.103	0.824			
2006	2.516	1.062	0.670	1.223	0.697	0.742	2.300	1.218	0.368
2007	2.287	1.148	0.669	1.676	0.658	0.814	1.610	1.467	0.421
2008	3.236	0.672	0.621	0.267	0.556	0.752	1.074	1.432	0.415
2009	0.873	0.471	0.678	0.796	0.552	0.662	1.650	1.196	0.347
2010	1.248	0.856	0.680	1.080	0.680	0.600	1.450	1.146	0.346
2011	0.088	0.211	0.778	1.462	0.844	0.578	1.075	1.058	0.373
2012	0.495	0.521	0.685	1.674	0.976	0.663	0.351	0.917	0.483
2013	0.805	0.753	0.681	1.484	1.032	0.782	0.642	1.011	0.525
2014	0.379	0.795	0.719	0.713	0.665	0.659	0.438	0.746	0.427
2015	0.756	0.418	0.688	1.136	0.401	0.804	0.288	0.556	0.539
2016	1.111	0.529	0.663	0.258	0.367	0.613	0.530	0.665	0.483
2017	1.078	0.475	0.673	0.384	0.361	0.641	0.686	0.745	0.437
2018	0.283	0.247	0.727	0.436	0.370	0.614	0.525	0.669	0.500
2019	0.595	0.352	0.685	0.798	0.388	1.230	1.383	0.581	0.416

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	0.809
Main_RecrDev_2005	Main_RecrDev_2004	0.705
Main_RecrDev_2012	Main_RecrDev_2010	0.752
Main_RecrDev_2013	Main_RecrDev_2010	0.726
Main_RecrDev_2013	Main_RecrDev_2012	0.810
Main_RecrDev_2014	Main_RecrDev_2012	0.749
Main_RecrDev_2014	Main_RecrDev_2013	0.815
Size_95%width_Srv_SEAMAP_VIDEO_9(9)	Size_inflection_Srv_SEAMAP_VIDEO_9(9)	0.761
Size_DblN_ascend_se_Rec_CBT_4(4)	Size_DblN_peak_Rec_CBT_4(4)	0.761
Size_DblN_descend_se_Rec_CBT_4(4)	Size_DblN_peak_Rec_CBT_4(4)	-0.791
Size_DblN_descend_se_Rec_HBT_3(3)	Size_DblN_peak_Rec_HBT_3(3)	-0.761
Size_DblN_descend_se_Rec_PRIV_SH_5(5)	Size_DblN_peak_Rec_PRIV_SH_5(5)	-0.913
Size_DblN_end_logit_Rec_CBT_4(4)	Size_DblN_descend_se_Rec_CBT_4(4)	-0.768
VonBert_K_Fem_GP_1	L_at_Amin_Fem_GP_1	-0.819
VonBert_K_Fem_GP_1	L_at_Amax_Fem_GP_1	-0.972

Table 23. Comparing R0 likelihood profile results between 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	80	42	24	12	5	2	**0**	2	7	13	22	34	46	59	72	85	99	114	130	146	162
Catch	17	5	6	6	5	3	2	1	0	0	0	1	2	0	0	1	1	2	2	3	3
Equil_catch	0	0	0	0	0	0	1	1	1	2	3	3	5	36	41	45	49	52	56	60	64
Survey	40	34	26	18	11	6	3	1	0	0	1	2	4	5	7	9	12	14	16	18	19
Discard	25	13	9	7	5	4	3	3	3	3	3	4	4	2	2	2	2	1	1	1	0
Length_comp	0	6	7	10	13	17	19	22	23	25	27	29	32	38	42	47	52	57	63	69	75
Age_comp	41	34	29	28	27	27	27	27	27	26	25	24	23	12	10	8	6	4	3	1	0
Recruitment	15	8	5	2	0	0	1	3	5	8	12	17	22	3	4	5	7	8	10	12	14
InitEQ_Regime	0	0	0	0	1	2	2	3	5	6	8	11	14	20	22	25	28	31	35	39	43
SEDAR 72 Total	357	308	238	175	122	80	49	27	12	4	0	**0**	2	7	13	21	29	39	49	60	81
Catch	16	24	17	12	7	4	2	0	0	0	1	2	3	3	4	4	4	4	4	4	20
Equil_catch	0	0	0	0	0	0	0	0	1	1	2	3	5	8	14	23	28	33	38	42	45
Survey	92	102	88	74	59	45	33	24	16	12	8	5	3	1	0	0	0	1	2	4	1
Discard	36	47	35	29	21	14	9	4	2	1	0	1	1	1	1	1	1	0	0	0	3
Length_comp	69	27	17	5	1	0	1	4	6	8	10	11	13	15	17	19	22	25	28	32	31
Age_comp	76	72	67	63	57	50	44	38	32	27	22	19	17	15	12	9	7	6	5	3	0
Recruitment	116	87	65	43	28	17	9	5	3	3	3	4	4	5	4	1	0	0	0	1	3
InitEQ_Regime	0	0	0	0	0	0	0	1	1	2	3	4	6	8	10	13	15	18	20	23	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) 2.61/3.47/2.82 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) 2.61/3.47/2.82 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		SEDAR72	
Base M	Target M for fully selected ages in the Lorenzen (2005) scaling	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
R0	Virgin Recruitment (1000s)	8736	8736	14319	14319
Generation Time	Fecundity-weighted mean age	7.9	7.9	7.9	7.9
SSB0	Virgin spawning stock biomass (mt)	65929	65929	106178	106178
	Mortality Rate Criteria				
Fmsy proxy	Fmsy proxy used	Fspr30	Fmax	Fspr30	Fmax
MFMT	Fmsy proxy	0.14	0.327	0.148	0.33
%SPR equivalent of Fmsy proxy	%SPR equivalent of FMSYproxy	30	13	30	13
Fcurrent	Geometric mean of the last 3 years of the assessment (F2017-2019), excluding red tide mortality	0.356	0.356	0.414	0.414
Fcurrent/MFMT	Current stock status based on MFMT	2.55	1.09	2.8	1.26
	Biomass Criteria				
SSBmsy proxy	Equilibrium SSB at FMSYproxy	17735	5910	28562	9850
MSST	0.5*SSBFMSYproxy	8868	2955	14281	4925
SSBcurrent	SSB2019	1686	1686	2296	2296
SSBcurrent/SSBFMSY proxy	Current stock status based on SSBFMSYproxy	0.1	0.29	0.08	0.23
SSBcurrent/MSST	Current stock status based on MSST	0.19	0.57	0.16	0.47
Yr rebuilt at F=0	First year rebuilt fishing at F=0 starting in 2023	2033	2027	2034	2029
SSBcurrent/SSB0	SSB ratio in 2019	0.03	0.03	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} = 0.143, SSB_{FSPR30} = 17,734 mt, and MSST = 8,867 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	0.066	0.460	27,074	1.527	3.053	0.411
1964	0.077	0.537	26,899	1.517	3.033	0.408
1965	0.084	0.586	26,430	1.490	2.981	0.401
1966	0.086	0.600	25,670	1.447	2.895	0.389
1967	0.086	0.600	24,522	1.383	2.765	0.372
1968	0.093	0.648	23,094	1.302	2.604	0.350
1969	0.104	0.725	21,488	1.212	2.423	0.326
1970	0.111	0.774	19,736	1.113	2.226	0.299
1971	0.125	0.872	18,035	1.017	2.034	0.274
1972	0.145	1.011	16,299	0.919	1.838	0.247
1973	0.150	1.046	14,522	0.819	1.638	0.220
1974	0.172	1.199	13,001	0.733	1.466	0.197
1975	0.201	1.402	11,543	0.651	1.302	0.175
1976	0.201	1.402	10,169	0.573	1.147	0.154
1977	0.203	1.415	9,286	0.524	1.047	0.141
1978	0.209	1.457	8,803	0.496	0.993	0.134
1979	0.240	1.673	8,491	0.479	0.958	0.129
1980	0.267	1.862	7,939	0.448	0.895	0.120
1981	0.221	1.541	7,316	0.413	0.825	0.111
1982	0.259	1.806	7,176	0.405	0.809	0.109
1983	0.225	1.569	6,843	0.386	0.772	0.104
1984	0.139	0.969	6,759	0.381	0.762	0.103
1985	0.234	1.632	7,484	0.422	0.844	0.114
1986	0.283	1.973	7,439	0.419	0.839	0.113
1987	0.202	1.408	6,804	0.384	0.767	0.103
1988	0.173	1.206	6,783	0.383	0.765	0.103
1989	0.215	1.499	6,906	0.389	0.779	0.105

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} = 0.143, SSB_{FSPR30} = 17,734 mt, and MSST = 8,867 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	0.183	1.276	6,441	0.363	0.726	0.098
1991	0.212	1.478	6,006	0.339	0.677	0.091
1992	0.230	1.604	5,640	0.318	0.636	0.086
1993	0.281	1.959	5,826	0.329	0.657	0.088
1994	0.243	1.694	5,644	0.318	0.637	0.086
1995	0.355	2.475	5,426	0.306	0.612	0.082
1996	0.235	1.639	5,035	0.284	0.568	0.076
1997	0.240	1.673	6,159	0.347	0.695	0.093
1998	0.407	2.838	7,403	0.417	0.835	0.112
1999	0.329	2.294	6,865	0.387	0.774	0.104
2000	0.255	1.778	7,454	0.420	0.841	0.113
2001	0.307	2.141	8,406	0.474	0.948	0.128
2002	0.306	2.134	7,991	0.451	0.901	0.121
2003	0.302	2.106	7,984	0.450	0.900	0.121
2004	0.390	2.719	8,459	0.477	0.954	0.128
2005	0.96 (0.326)*	6.694 (2.273)*	7,783	0.439	0.878	0.118
2006	0.394	2.747	3,230	0.182	0.364	0.049
2007	0.408	2.845	3,050	0.172	0.344	0.046
2008	0.630	4.393	2,837	0.160	0.320	0.043
2009	0.441	3.075	2,181	0.123	0.246	0.033
2010	0.370	2.580	2,590	0.146	0.292	0.039
2011	0.226	1.576	3,234	0.182	0.365	0.049
2012	0.207	1.443	4,022	0.227	0.454	0.061
2013	0.214	1.492	4,433	0.250	0.500	0.067
2014	0.923 (0.154)*	6.436 (1.074)*	4,729	0.267	0.533	0.072
2015	0.255	1.778	1,940	0.109	0.219	0.029
2016	0.344	2.399	1,814	0.102	0.205	0.028

*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} = 0.143, SSB_{FSPR30} = 17,734 mt, and MSST = 8,867 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	0.343	2.392	1.675	0.094	0.189	0.025
2018	0.446 (0.348)*	3.11 (2.427)*	1,705	0.096	0.192	0.026
2019	0.378	2.636	1,685	0.095	0.190	0.026

*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} = 28,562 mt, and MSST = 14,281 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	0.078	0.527	29.324	1.027	2.053	0.276
1964	0.089	0.601	29,824	1.044	2.088	0.281
1965	0.097	0.655	30,030	1.051	2.103	0.283
1966	0.101	0.682	29,829	1.044	2.089	0.281
1967	0.103	0.696	28,830	1.009	2.019	0.272
1968	0.111	0.750	27,196	0.952	1.904	0.256
1969	0.123	0.831	25,265	0.885	1.769	0.238
1970	0.131	0.885	23,150	0.811	1.621	0.218
1971	0.148	1.000	21,089	0.738	1.477	0.199
1972	0.169	1.142	18,966	0.664	1.328	0.179
1973	0.180	1.216	16,802	0.588	1.177	0.158
1974	0.202	1.365	14,928	0.523	1.045	0.141
1975	0.231	1.560	13,190	0.462	0.924	0.124
1976	0.233	1.574	11,644	0.408	0.815	0.110
1977	0.236	1.594	10,707	0.375	0.750	0.101
1978	0.242	1.635	10,239	0.358	0.717	0.096
1979	0.266	1.797	9,939	0.348	0.696	0.094
1980	0.291	1.966	9,431	0.330	0.660	0.089
1981	0.225	1.520	8,884	0.311	0.622	0.084
1982	0.326	2.202	9,136	0.320	0.640	0.086
1983	0.268	1.810	8,590	0.301	0.602	0.081
1984	0.171	1.155	8,513	0.298	0.596	0.080
1985	0.271	1.831	9,549	0.334	0.669	0.090
1986	0.293	1.979	9,540	0.334	0.668	0.090
1987	0.246	1.662	9,029	0.316	0.632	0.085
1988	0.225	1.520	8,979	0.314	0.629	0.085
1989	0.240	1.621	8,960	0.314	0.627	0.084

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} = 28,562 mt, and MSST = 14,281 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	0.217	1.466	8.377	0.293	0.587	0.079
1991	0.264	1.783	7,714	0.270	0.540	0.073
1992	0.246	1.662	7,100	0.249	0.497	0.067
1993	0.302	2.040	7,575	0.265	0.530	0.071
1994	0.275	1.858	7,465	0.261	0.523	0.070
1995	0.424	2.864	7,193	0.252	0.504	0.068
1996	0.226	1.527	6,550	0.229	0.459	0.062
1997	0.276	1.864	8,660	0.303	0.606	0.082
1998	0.487	3.290	10,500	0.368	0.735	0.099
1999	0.376	2.540	9,266	0.324	0.649	0.087
2000	0.266	1.797	10,031	0.351	0.702	0.094
2001	0.342	2.310	11,633	0.407	0.815	0.110
2002	0.330	2.229	10,977	0.384	0.769	0.103
2003	0.353	2.385	11,184	0.392	0.783	0.105
2004	0.453	3.060	11,694	0.409	0.819	0.110
2005	0.949 (0.353)*	6.411 (2.385)*	10,363	0.363	0.726	0.098
2006	0.406	2.743	4,979	0.174	0.349	0.047
2007	0.423	2.858	4,894	0.171	0.343	0.046
2008	0.696	4.702	4,686	0.164	0.328	0.044
2009	0.526	3.553	3,429	0.120	0.240	0.032
2010	0.471	3.182	3,865	0.135	0.271	0.036
2011	0.297	2.006	4,423	0.155	0.310	0.042
2012	0.285	1.925	5,290	0.185	0.370	0.050
2013	0.477	3.222	5,491	0.192	0.385	0.052
2014	0.583 (0.337)*	3.938 (2.277)*	4,161	0.146	0.291	0.039
2015	0.295	1.993	2,832	0.099	0.198	0.027
2016	0.347	2.344	2,622	0.092	0.184	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} = 28,562 mt, and MSST = 14,281 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	0.391	2.641	2.542	0.089	0.178	0.024
2018	0.562 (0.424)*	3.797 (2.864)*	2,540	0.089	0.178	0.024
2019	0.428	2.891	2,296	0.080	0.161	0.022

*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_{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} = 5,910 mt, and MSST = 2,955 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	0.066	0.202	27,074	4.581	9.161	0.411
1964	0.077	0.235	26,899	4.551	9.102	0.408
1965	0.084	0.257	26,430	4.472	8.943	0.401
1966	0.086	0.263	25,670	4.343	8.686	0.389
1967	0.086	0.263	24,522	4.149	8.298	0.372
1968	0.093	0.284	23,094	3.907	7.814	0.350
1969	0.104	0.318	21,488	3.636	7.271	0.326
1970	0.111	0.339	19,736	3.339	6.678	0.299
1971	0.125	0.382	18,035	3.051	6.103	0.274
1972	0.145	0.443	16,299	2.758	5.515	0.247
1973	0.150	0.458	14,522	2.457	4.914	0.220
1974	0.172	0.526	13,001	2.200	4.399	0.197
1975	0.201	0.614	11,543	1.953	3.906	0.175
1976	0.201	0.614	10,169	1.721	3.441	0.154
1977	0.203	0.620	9,286	1.571	3.142	0.141
1978	0.209	0.639	8,803	1.489	2.979	0.134
1979	0.240	0.733	8,491	1.437	2.873	0.129
1980	0.267	0.816	7,939	1.343	2.687	0.120
1981	0.221	0.675	7,316	1.238	2.476	0.111
1982	0.259	0.792	7,176	1.214	2.428	0.109
1983	0.225	0.688	6,843	1.158	2.316	0.104
1984	0.139	0.425	6,759	1.144	2.287	0.103
1985	0.234	0.715	7,484	1.266	2.533	0.114
1986	0.283	0.865	7,439	1.259	2.517	0.113
1987	0.202	0.617	6,804	1.151	2.303	0.103
1988	0.173	0.529	6,783	1.148	2.295	0.103
1989	0.215	0.657	6,906	1.168	2.337	0.105

Table 29 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} = 5,910 mt, and MSST = 2,955 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	0.183	0.559	6,441	1.090	2.180	0.098
1991	0.212	0.648	6,006	1.016	2.032	0.091
1992	0.230	0.703	5,640	0.954	1.909	0.086
1993	0.281	0.859	5,826	0.986	1.971	0.088
1994	0.243	0.743	5,644	0.955	1.910	0.086
1995	0.355	1.085	5,426	0.918	1.836	0.082
1996	0.235	0.718	5,035	0.852	1.704	0.076
1997	0.240	0.733	6,159	1.042	2.084	0.093
1998	0.407	1.244	7,403	1.253	2.505	0.112
1999	0.329	1.005	6,865	1.162	2.323	0.104
2000	0.255	0.779	7,454	1.261	2.522	0.113
2001	0.307	0.938	8,406	1.422	2.845	0.128
2002	0.306	0.935	7,991	1.352	2.704	0.121
2003	0.302	0.923	7,984	1.351	2.702	0.121
2004	0.390	1.192	8,459	1.431	2.863	0.128
2005	0.96 (0.326)*	2.934 (0.996)*	7,783	1.317	2.634	0.118
2006	0.394	1.204	3,230	0.547	1.093	0.049
2007	0.408	1.247	3,050	0.516	1.032	0.046
2008	0.630	1.925	2,837	0.480	0.960	0.043
2009	0.441	1.348	2,181	0.369	0.738	0.033
2010	0.370	1.131	2,590	0.438	0.876	0.039
2011	0.226	0.691	3,234	0.547	1.094	0.049
2012	0.207	0.633	4,022	0.681	1.361	0.061
2013	0.214	0.654	4,433	0.750	1.500	0.067
2014	0.923 (0.154)*	2.821 (0.471)*	4,729	0.800	1.600	0.072
2015	0.255	0.779	1,940	0.328	0.657	0.029
2016	0.344	1.051	1,814	0.307	0.614	0.028

*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_{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} = 5,910 mt, and MSST = 2,955 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	0.343	1.048	1,675	0.283	0.567	0.025
2018	0.446 (0.348)*	1.363 (1.064)*	1,705	0.289	0.577	0.026
2019	0.378	1.155	1,685	0.285	0.570	0.026

*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_{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} = 0.33, SSB_{FMAX} = 9,848 mt, and MSST = 4,924 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	0.078	0.236	29.324	2.977	5.955	0.276
1964	0.089	0.270	29,824	3.028	6.056	0.281
1965	0.097	0.294	30,030	3.049	6.098	0.283
1966	0.101	0.306	29,829	3.029	6.057	0.281
1967	0.103	0.312	28,830	2.927	5.855	0.272
1968	0.111	0.336	27,196	2.761	5.523	0.256
1969	0.123	0.373	25,265	2.565	5.130	0.238
1970	0.131	0.397	23,150	2.351	4.701	0.218
1971	0.148	0.449	21,089	2.141	4.283	0.199
1972	0.169	0.512	18,966	1.926	3.851	0.179
1973	0.180	0.546	16,802	1.706	3.412	0.158
1974	0.202	0.612	14,928	1.516	3.031	0.141
1975	0.231	0.700	13,190	1.339	2.679	0.124
1976	0.233	0.706	11,644	1.182	2.365	0.110
1977	0.236	0.715	10,707	1.087	2.174	0.101
1978	0.242	0.733	10,239	1.040	2.079	0.096
1979	0.266	0.806	9,939	1.009	2.018	0.094
1980	0.291	0.882	9,431	0.958	1.915	0.089
1981	0.225	0.682	8,884	0.902	1.804	0.084
1982	0.326	0.988	9,136	0.928	1.855	0.086
1983	0.268	0.812	8,590	0.872	1.744	0.081
1984	0.171	0.518	8,513	0.864	1.729	0.080
1985	0.271	0.821	9,549	0.970	1.939	0.090
1986	0.293	0.888	9,540	0.969	1.937	0.090
1987	0.246	0.746	9,029	0.917	1.834	0.085
1988	0.225	0.682	8,979	0.912	1.823	0.085
1989	0.240	0.727	8,960	0.910	1.820	0.084

Table 30 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} = 0.33, SSB_{FMAX} = 9,848 mt, and MSST = 4,924 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	0.217	0.658	8.377	0.851	1.701	0.079
1991	0.264	0.800	7,714	0.783	1.567	0.073
1992	0.246	0.746	7,100	0.721	1.442	0.067
1993	0.302	0.915	7,575	0.769	1.538	0.071
1994	0.275	0.833	7,465	0.758	1.516	0.070
1995	0.424	1.285	7,193	0.730	1.461	0.068
1996	0.226	0.685	6,550	0.665	1.330	0.062
1997	0.276	0.836	8,660	0.879	1.759	0.082
1998	0.487	1.476	10,500	1.066	2.132	0.099
1999	0.376	1.140	9,266	0.941	1.882	0.087
2000	0.266	0.806	10,031	1.019	2.037	0.094
2001	0.342	1.036	11,633	1.181	2.362	0.110
2002	0.330	1.000	10,977	1.115	2.229	0.103
2003	0.353	1.070	11,184	1.136	2.271	0.105
2004	0.453	1.373	11,694	1.187	2.375	0.110
2005	0.949 (0.353)*	2.876 (1.07)*	10,363	1.052	2.105	0.098
2006	0.406	1.230	4,979	0.506	1.011	0.047
2007	0.423	1.282	4,894	0.497	0.994	0.046
2008	0.696	2.109	4,686	0.476	0.952	0.044
2009	0.526	1.594	3,429	0.348	0.696	0.032
2010	0.471	1.427	3,865	0.393	0.785	0.036
2011	0.297	0.900	4,423	0.449	0.898	0.042
2012	0.285	0.864	5,290	0.537	1.074	0.050
2013	0.477	1.446	5,491	0.558	1.115	0.052
2014	0.583 (0.337)*	1.767 (1.021)*	4,161	0.422	0.845	0.039
2015	0.295	0.894	2,832	0.288	0.575	0.027
2016	0.347	1.052	2,622	0.266	0.533	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_{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} = 0.33, SSB_{FMAX} = 9,848 mt, and MSST = 4,924 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	0.391	1.185	2.542	0.258	0.516	0.024
2018	0.562 (0.424)*	1.703 (1.285)*	2,540	0.258	0.516	0.024
2019	0.428	1.297	2,296	0.233	0.466	0.022

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

Table 31. 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} = 0.143, SSB_{FSPR30} = 17,734 metric tons, and MSST = 8,867 metric tons which was calculated as 0.5*SSB_{FSPR30}.

Year	R	F	F/FMSYproxy	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	OFL
2023	2,691	0.143	1	1,221	0.069	0.138	0.019	0.578
2024	3,505	0.143	1	1,822	0.103	0.205	0.028	0.848
2025	4,304	0.143	1	2,607	0.147	0.294	0.040	1.116
2026	4,896	0.143	1	3,382	0.191	0.381	0.051	1.329
2027	5,309	0.143	1	4,064	0.229	0.458	0.062	1.573

Table 32. 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} = 5,910 metric tons, and MSST = 2,955 metric tons which was calculated as 0.5*SSB_{FMAX}.

Year	R	F	F/FMSYproxy	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	OFL
2023	2,691	0.327	1	1,221	0.207	0.413	0.019	1.304
2024	3,126	0.327	1	1,521	0.257	0.515	0.023	1.676
2025	3,615	0.327	1	1,916	0.324	0.648	0.029	1.994
2026	3,957	0.327	1	2,236	0.378	0.757	0.034	2.163
2027	4,162	0.327	1	2,449	0.414	0.829	0.037	2.338

Table 33. 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} = 28,562 metric tons, and MSST = 14,281 metric tons which was calculated as $0.5*SSB_{FSPR30}$.

Year	R	F	F/FMSYproxy	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	OFL
2023	3,316	0.148	1	1,339	0.047	0.094	0.013	0.724
2024	4,740	0.148	1	2,181	0.076	0.153	0.021	1.124
2025	6,160	0.148	1	3,293	0.115	0.231	0.031	1.512
2026	7,192	0.148	1	4,356	0.153	0.305	0.041	1.786
2027	7,880	0.148	1	5,237	0.183	0.367	0.049	2.127

Table 34. 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} = 0.33, SSB_{FMAX} = 9,848 metric tons, and MSST = 4,924 metric tons which was calculated as $0.5*SSB_{FMAX}$.

Year	R	F	F/FMSYproxy	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	OFL
2023	3,316	0.33	1	1,339	0.136	0.272	0.013	1.594
2024	4,197	0.33	1	1,834	0.186	0.373	0.017	2.191
2025	5,134	0.33	1	2,458	0.250	0.499	0.023	2.682
2026	5,746	0.33	1	2,934	0.298	0.596	0.028	2.882
2027	6,075	0.33	1	3,216	0.327	0.653	0.030	3.134

Table 35. 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} = 17,734 metric tons and $MSST_{FSPR30}$ = 8,867 metric tons (0.5 * SSB_{FSPR30}). SSB ratio was calculated as annual SSB divided by SSB_0 (65,929 metric tons).

Year	R	F	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	Yield
2023	2,690	0	1,221	0.069	0.138	0.019	0
2024	3,505	0	2,064	0.116	0.233	0.031	0
2025	4,304	0	3,246	0.183	0.366	0.049	0
2026	4,896	0	4,570	0.258	0.515	0.069	0
2027	5,309	0	5,926	0.334	0.668	0.090	0
2028	5,657	0	7,472	0.421	0.843	0.113	0
2029	6,005	0	9,403	0.530	1.060	0.143	0
2030	6,327	0	11,693	0.659	1.319	0.177	0
2031	6,600	0	14,248	0.803	1.607	0.216	0
2032	6,823	0	16,983	0.958	1.915	0.258	0
2033	7,005	0	19,838	1.119	2.237	0.301	0
2034	7,155	0	22,762	1.283	2.567	0.345	0
2035	7,279	0	25,704	1.449	2.899	0.390	0

Table 36. 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} = 28,562 metric tons and $MSST_{FSPR30}$ = 14,281 metric tons (0.5 * SSB_{FSPR30}). SSB ratio was calculated as annual SSB divided by SSB_0 (106,178 metric tons).

Year	R	F	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	Yield
2023	3,315	0	1,339	0.047	0.094	0.013	0
2024	4,739	0	2,475	0.087	0.173	0.023	0
2025	6,160	0	4,098	0.143	0.287	0.039	0
2026	7,191	0	5,882	0.206	0.412	0.055	0
2027	7,880	0	7,640	0.268	0.535	0.072	0
2028	8,474	0	9,666	0.338	0.677	0.091	0
2029	9,129	0	12,345	0.432	0.864	0.116	0
2030	9,764	0	15,660	0.548	1.097	0.147	0
2031	10,311	0	19,456	0.681	1.362	0.183	0
2032	10,759	0	23,597	0.826	1.652	0.222	0
2033	11,125	0	27,999	0.980	1.961	0.264	0
2034	11,430	0	32,587	1.141	2.282	0.307	0
2035	11,682	0	37,280	1.305	2.610	0.351	0

Table 37. 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} = 5,910 metric tons and $MSST_{FMAX}$ = 2,955 metric tons (0.5 * SSB_{FMAX}). SSB ratio was calculated as annual SSB divided by SSB_0 (65,929 metric tons).

Year	R	F	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	Yield
2023	2,690	0	1,221	0.207	0.413	0.019	0
2024	3,125	0	2,064	0.349	0.699	0.031	0
2025	3,615	0	3,246	0.549	1.099	0.049	0
2026	3,956	0	4,570	0.773	1.547	0.069	0
2027	4,162	0	5,926	1.003	2.005	0.090	0

Table 38. 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} = 9,848 metric tons and $MSST_{FMAX}$ = 4,924 metric tons (0.5 * SSB_{FMAX}). SSB ratio was calculated as annual SSB divided by SSB_0 (106,178 metric tons).

Year	R	F	SSB	SSB/SSBFMSYproxy	SSB/MSST	SSB/SSB0	Yield
2023	3,315	0	1,339	0.136	0.272	0.013	0
2024	4,197	0	2,475	0.251	0.503	0.023	0
2025	5,133	0	4,098	0.416	0.832	0.039	0
2026	5,746	0	5,882	0.597	1.195	0.055	0
2027	6,074	0	7,640	0.776	1.552	0.072	0
2028	6,342	0	9,666	0.981	1.963	0.091	0
2029	6,738	0	12,345	1.253	2.507	0.116	0

Table 39. 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} = 5,910 metric tons and $MSST_{FMAX}$ = 2,955 metric tons (0.5 * SSB_{FMAX}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	2,821	0.343	1.05	1,675	0.28	0.57	-	0.03
2018	1,466	0.446	1.36	1,706	0.29	0.58	-	0.03
2019	2,094	0.378	1.16	1,686	0.29	0.57	-	0.03
2020	3,487	0.337	1.03	1,806	0.31	0.61	1.88	0.03
2021	3,669	0.400	1.22	1,964	0.33	0.66	2.07	0.03
2022	3,031	0.503	1.54	1,452	0.25	0.49	1.9	0.02
2023	**2,691**	**0.244**	**0.75**	**1,221**	**0.21**	**0.41**	**0.98**	**0.02**
2024	3,302	0.244	0.75	1,656	0.28	0.56	1.34	0.03
2025	3,933	0.244	0.75	2,212	0.37	0.75	1.66	0.03
2026	4,390	0.244	0.75	2,707	0.46	0.92	1.88	0.04
2027	4,691	0.244	0.75	3,090	0.52	1.05	2.12	0.05
2028	4,944	0.244	0.75	3,453	0.58	1.17	2.41	0.05
2029	5,221	0.244	0.75	3,906	0.66	1.32	2.74	0.06
2030	5,496	0.244	0.75	4,423	0.75	1.50	3.08	0.07
2031	5,737	0.244	0.75	4,946	0.84	1.67	3.4	0.08
2032	5,938	0.244	0.75	5,442	0.92	1.84	3.7	0.08
2033	6,105	0.244	0.75	5,906	1.00	2.00	3.99	0.09
2034	6,248	0.327	1.00	6,346	1.07	2.15	5.7	0.10

Table 40. 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} = 5,910 metric tons and $MSST_{FMAX}$ = 2,955 metric tons (0.5 * SSB_{FMAX}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	2,821	0.343	1.05	1,675	0.28	0.57	-	0.03
2018	1,466	0.446	1.36	1,706	0.29	0.58	-	0.03
2019	2,094	0.378	1.16	1,686	0.29	0.57	-	0.03
2020	3,487	0.337	1.03	1,806	0.31	0.61	1.88	0.03
2021	3,669	0.400	1.22	1,964	0.33	0.66	2.07	0.03
2022	3,031	0.503	1.54	1,452	0.25	0.49	1.9	0.02
2023	**2,691**	**0.172**	**0.52**	**1,221**	**0.21**	**0.41**	**0.69**	**0.02**
2024	3,449	0.172	0.52	1,775	0.30	0.60	0.99	0.03
2025	4,202	0.172	0.52	2,492	0.42	0.84	1.29	0.04
2026	4,757	0.172	0.52	3,180	0.54	1.08	1.51	0.05
2027	5,140	0.172	0.52	3,767	0.64	1.27	1.76	0.06
2028	5,463	0.172	0.52	4,357	0.74	1.47	2.07	0.07
2029	5,793	0.172	0.52	5,080	0.86	1.72	2.42	0.08
2030	6,105	0.172	0.52	5,906	1.00	2.00	2.78	0.09
2031	6,372	0.327	1.00	6,764	1.14	2.29	5.96	0.10

Table 41. 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	0.343	-	34:66	-	-	-	-	-	-	-	-	-	-
2018	0.446	-	35:65	-	-	-	-	-	-	-	-	-	-
2019	0.378	-	37:63	-	-	-	-	-	-	-	-	-	-
2020	0.337	-	43:57	-	-	-	-	-	-	-	-	-	-
2021	0.400	-	43:57	-	-	-	-	-	-	-	-	-	-
2022	0.503	-	40:60	-	-	-	-	-	-	-	-	-	-
2023	**0.244**	**39:61**	**52:48**	**0.38**	**-25**	**0.11**	**23**	**0.6**	**-47**	**-46**	**1.44**	**71**	**93**
2024	0.244	39:61	55:45	0.52	3	0.15	22	0.82	-27	-26	1.49	65	91
2025	0.244	39:61	55:45	0.65	28	0.16	20	1.02	-10	-10	1.52	60	90
2026	0.244	39:61	53:47	0.73	45	0.16	18	1.15	2	-1	1.64	59	90
2027	0.244	39:61	51:49	0.83	63	0.18	18	1.29	15	10	1.95	60	91
2028	0.244	39:61	49:51	0.94	86	0.21	18	1.47	31	25	2.27	61	91
2029	0.244	39:61	49:51	1.07	111	0.24	18	1.67	49	43	2.5	60	90
2030	0.244	39:61	49:51	1.2	137	0.26	18	1.88	67	61	2.67	59	89
2031	0.244	39:61	49:51	1.33	162	0.28	18	2.07	85	76	2.83	58	89
2032	0.244	39:61	48:52	1.44	186	0.3	17	2.26	101	91	3	57	89
2033	0.244	39:61	47:53	1.56	208	0.32	17	2.43	117	105	3.18	57	89
2034	0.327	39:61	47:53	2.22	340	0.46	17	3.48	210	193	4.6	57	89

Table 42. 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	0.343	-	34:66	-	-	-	-	-	-	-	-	-	-
2018	0.446	-	35:65	-	-	-	-	-	-	-	-	-	-
2019	0.378	-	37:63	-	-	-	-	-	-	-	-	-	-
2020	0.337	-	43:57	-	-	-	-	-	-	-	-	-	-
2021	0.400	-	43:57	-	-	-	-	-	-	-	-	-	-
2022	0.503	-	40:60	-	-	-	-	-	-	-	-	-	-
2023	**0.172**	**39:61**	**52:48**	**0.27**	**-47**	**0.08**	**23**	**0.42**	**-62**	**-62**	**0.99**	**70**	**93**
2024	0.172	39:61	54:46	0.39	-23	0.1	21	0.61	-46	-45	1.05	63	91
2025	0.172	39:61	54:46	0.5	-1	0.12	19	0.79	-30	-31	1.09	58	90
2026	0.172	39:61	51:49	0.59	17	0.12	17	0.92	-18	-22	1.21	57	90
2027	0.172	39:61	48:52	0.69	36	0.14	17	1.08	-4	-11	1.49	58	90
2028	0.172	39:61	47:53	0.81	60	0.17	17	1.26	12	5	1.78	59	90
2029	0.172	39:61	46:54	0.94	86	0.19	17	1.47	31	24	2	58	89
2030	0.172	39:61	46:54	1.08	115	0.22	17	1.7	51	42	2.17	56	88
2031	0.327	39:61	45:55	2.33	360	0.46	17	3.64	224	203	4.68	56	89

Table 43. Results for rebuilding projections using Tmin + 1 generation time 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. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{FSPR30} = 28,562 metric tons and $MSST_{FSPR30}$ = 14,281 metric tons (0.5 * SSB_{FSPR30}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,533	0.391	2.64	2,542	0.09	0.18	-	0.02
2018	2,354	0.562	3.80	2,540	0.09	0.18	-	0.02
2019	2,819	0.428	2.89	2,296	0.08	0.16	-	0.02
2020	5,098	0.426	2.88	2,432	0.09	0.17	3.33	0.02
2021	5,160	0.455	3.07	2,477	0.09	0.17	3.09	0.02
2022	4,207	0.650	4.39	1,840	0.06	0.13	3.14	0.02
2023	**3,316**	**0.124**	**0.84**	**1,339**	**0.05**	**0.09**	**0.61**	**0.01**
2024	4,809	0.124	0.84	2,228	0.08	0.16	0.96	0.02
2025	6,293	0.124	0.84	3,416	0.12	0.24	1.31	0.03
2026	7,378	0.124	0.84	4,579	0.16	0.32	1.56	0.04
2027	8,112	0.124	0.84	5,573	0.20	0.39	1.88	0.05
2028	8,745	0.124	0.84	6,622	0.23	0.46	2.3	0.06
2029	9,425	0.124	0.84	8,015	0.28	0.56	2.79	0.08
2030	10,074	0.124	0.84	9,705	0.34	0.68	3.34	0.09
2031	10,627	0.124	0.84	11,547	0.40	0.81	3.9	0.11
2032	11,077	0.124	0.84	13,434	0.47	0.94	4.47	0.13
2033	11,444	0.124	0.84	15,328	0.54	1.07	5.04	0.14
2034	11,745	0.124	0.84	17,208	0.60	1.20	5.6	0.16
2035	11,993	0.124	0.84	19,045	0.67	1.33	6.14	0.18
2036	12,197	0.124	0.84	20,800	0.73	1.46	6.65	0.20
2037	12,364	0.124	0.84	22,443	0.79	1.57	7.12	0.21

Table 43 Continued. Results for rebuilding projections using Tmin + 1 generation time 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. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{FSPR30} = 28,562 metric tons and $MSST_{FSPR30}$ = 14,281 metric tons (0.5 * SSB_{FSPR30}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2038	12,500	0.124	0.84	23,952	0.84	1.68	7.54	0.23
2039	12,612	0.124	0.84	25,319	0.89	1.77	7.92	0.24
2040	12,703	0.124	0.84	26,540	0.93	1.86	8.26	0.25
2041	12,778	0.124	0.84	27,617	0.97	1.93	8.56	0.26
2042	12,840	0.124	0.84	28,558	1.00	2.00	8.82	0.27
2043	12,890	0.148	1.00	29,373	1.03	2.06	10.78	0.28

Table 44. Results for rebuilding projections using Tmin * 2 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. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{FSPR30} = 28,562 metric tons and $MSST_{FSPR30}$ = 14,281 metric tons (0.5 * SSB_{FSPR30}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,533	0.391	2.64	2,542	0.09	0.18	-	0.02
2018	2,354	0.562	3.80	2,540	0.09	0.18	-	0.02
2019	2,819	0.428	2.89	2,296	0.08	0.16	-	0.02
2020	5,098	0.426	2.88	2,432	0.09	0.17	3.33	0.02
2021	5,160	0.455	3.07	2,477	0.09	0.17	3.09	0.02
2022	4,207	0.650	4.39	1,840	0.06	0.13	3.14	0.02
2023	**3,316**	**0.135**	**0.91**	**1,339**	**0.05**	**0.09**	**0.66**	**0.01**
2024	4,777	0.135	0.91	2,207	0.08	0.15	1.03	0.02
2025	6,232	0.135	0.91	3,359	0.12	0.24	1.4	0.03
2026	7,292	0.135	0.91	4,475	0.16	0.31	1.67	0.04
2027	8,005	0.135	0.91	5,416	0.19	0.38	2	0.05
2028	8,621	0.135	0.91	6,400	0.22	0.45	2.43	0.06
2029	9,290	0.135	0.91	7,710	0.27	0.54	2.94	0.07
2030	9,932	0.135	0.91	9,300	0.33	0.65	3.5	0.09
2031	10,483	0.135	0.91	11,024	0.39	0.77	4.08	0.10
2032	10,932	0.135	0.91	12,781	0.45	0.89	4.66	0.12
2033	11,299	0.135	0.91	14,536	0.51	1.02	5.24	0.14
2034	11,602	0.135	0.91	16,274	0.57	1.14	5.81	0.15
2035	11,852	0.135	0.91	17,968	0.63	1.26	6.35	0.17
2036	12,059	0.135	0.91	19,584	0.69	1.37	6.86	0.18
2037	12,228	0.135	0.91	21,092	0.74	1.48	7.34	0.20

Table 44 Continued. Results for rebuilding projections using Tmin * 2 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. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{FSPR30} = 28,562 metric tons and $MSST_{FSPR30}$ = 14,281 metric tons (0.5 * SSB_{FSPR30}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2038	12,366	0.135	0.91	22,473	0.79	1.57	7.76	0.21
2039	12,480	0.135	0.91	23,721	0.83	1.66	8.15	0.22
2040	12,573	0.135	0.91	24,832	0.87	1.74	8.48	0.23
2041	12,649	0.135	0.91	25,810	0.90	1.81	8.78	0.24
2042	12,712	0.135	0.91	26,662	0.93	1.87	9.03	0.25
2043	12,763	0.135	0.91	27,397	0.96	1.92	9.25	0.26
2044	12,805	0.135	0.91	28,025	0.98	1.96	9.44	0.26
2045	12,840	0.135	0.91	28,559	1.00	2.00	9.6	0.27
2046	12,868	0.148	1.00	29,009	1.02	2.03	10.66	0.27

Table 45. Results for rebuilding projections using 75%F_{SPR30} 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. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{FSPR30} = 28,562 metric tons and $MSST_{FSPR30}$ = 14,281 metric tons (0.5 * SSB_{FSPR30}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,533	0.391	2.64	2,542	0.09	0.18	-	0.02
2018	2,354	0.562	3.80	2,540	0.09	0.18	-	0.02
2019	2,819	0.428	2.89	2,296	0.08	0.16	-	0.02
2020	5,098	0.426	2.88	2,432	0.09	0.17	3.33	0.02
2021	5,160	0.455	3.07	2,477	0.09	0.17	3.09	0.02
2022	4,207	0.650	4.39	1,840	0.06	0.13	3.14	0.02
2023	**3,316**	**0.111**	**0.75**	**1,339**	**0.05**	**0.09**	**0.54**	**0.01**
2024	4,846	0.111	0.75	2,254	0.08	0.16	0.86	0.02
2025	6,365	0.111	0.75	3,484	0.12	0.24	1.19	0.03
2026	7,479	0.111	0.75	4,704	0.16	0.33	1.43	0.04
2027	8,237	0.111	0.75	5,765	0.20	0.40	1.73	0.05
2028	8,891	0.111	0.75	6,895	0.24	0.48	2.13	0.06
2029	9,584	0.111	0.75	8,391	0.29	0.59	2.6	0.08
2030	10,239	0.111	0.75	10,209	0.36	0.71	3.12	0.10
2031	10,794	0.111	0.75	12,200	0.43	0.85	3.66	0.11
2032	11,244	0.111	0.75	14,253	0.50	1.00	4.21	0.13
2033	11,610	0.111	0.75	16,324	0.57	1.14	4.77	0.15
2034	11,909	0.111	0.75	18,388	0.64	1.29	5.31	0.17
2035	12,154	0.111	0.75	20,411	0.71	1.43	5.84	0.19
2036	12,355	0.111	0.75	22,350	0.78	1.56	6.34	0.21
2037	12,518	0.111	0.75	24,170	0.85	1.69	6.8	0.23

Table 45 Continued. Results for rebuilding projections using 75%F_{SPR30} 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. The $F_{rebuild}$ is shown starting in 2023. Reference points include SSB_{FSPR30} = 28,562 metric tons and $MSST_{FSPR30}$ = 14,281 metric tons (0.5 * SSB_{FSPR30}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2038	12,652	0.111	0.75	25,850	0.91	1.81	7.22	0.24
2039	12,762	0.111	0.75	27,376	0.96	1.92	7.6	0.26
2040	12,852	0.111	0.75	28,745	1.01	2.01	7.94	0.27

Table 46. Results for rebuilding projections using Tmin + 1 generation time for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR30} 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	0.391	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.562	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.428	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.426	-	36:64	-	-	-	-	-	-	-	-	-	-
2021	0.455	-	41:59	-	-	-	-	-	-	-	-	-	-
2022	0.650	-	35:65	-	-	-	-	-	-	-	-	-	-
2023	**0.124**	**39:61**	**63:37**	**0.24**	**-53**	**0.07**	**24**	**0.37**	**-84**	**-84**	**0.87**	**70**	**93**
2024	0.124	39:61	64:36	0.37	-26	0.1	21	0.58	-75	-75	0.9	61	90
2025	0.124	39:61	63:37	0.51	1	0.11	18	0.8	-66	-67	0.92	54	88
2026	0.124	39:61	59:41	0.61	20	0.12	16	0.95	-60	-63	1.02	52	88
2027	0.124	39:61	56:44	0.73	45	0.14	16	1.15	-52	-56	1.32	53	89
2028	0.124	39:61	53:47	0.9	77	0.17	16	1.4	-41	-47	1.67	54	89
2029	0.124	39:61	53:47	1.09	116	0.21	16	1.7	-28	-34	1.94	53	88
2030	0.124	39:61	52:48	1.3	157	0.24	16	2.04	-14	-21	2.14	51	87
2031	0.124	39:61	52:48	1.52	201	0.28	15	2.38	0	-9	2.32	49	86
2032	0.124	39:61	51:49	1.74	245	0.31	15	2.73	15	3	2.51	48	85
2033	0.124	39:61	50:50	1.97	289	0.34	15	3.08	30	15	2.7	47	84
2034	0.124	39:61	48:52	2.19	332	0.38	15	3.42	44	27	2.88	46	84
2035	0.124	39:61	47:53	2.4	374	0.41	15	3.75	58	38	3.04	45	83
2036	0.124	39:61	46:54	2.59	413	0.44	14	4.06	71	48	3.19	44	83
2037	0.124	39:61	45:55	2.78	449	0.46	14	4.34	83	58	3.33	43	82

Table 46 Continued. Results for rebuilding projections using Tmin + 1 generation time for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR30} 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	0.124	39:61	44:56	2.94	482	0.49	14	4.6	94	66	3.45	43	82
2039	0.124	39:61	43:57	3.09	511	0.51	14	4.83	104	74	3.57	42	82
2040	0.124	39:61	43:57	3.22	537	0.53	14	5.04	113	81	3.67	42	82
2041	0.124	39:61	42:58	3.34	560	0.55	14	5.22	120	87	3.76	42	81
2042	0.124	39:61	41:59	3.44	580	0.56	14	5.38	127	92	3.85	42	81
2043	0.148	39:61	41:59	4.2	731	0.68	14	6.57	177	134	4.72	42	81

Table 47. Results for rebuilding projections using Tmin * 2 for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR30} 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	0.391	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.562	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.428	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.426	-	36:64	-	-	-	-	-	-	-	-	-	-
2021	0.455	-	41:59	-	-	-	-	-	-	-	-	-	-
2022	0.650	-	35:65	-	-	-	-	-	-	-	-	-	-
2023	**0.135**	**39:61**	**63:37**	**0.26**	**-49**	**0.08**	**24**	**0.4**	**-83**	**-83**	**0.95**	**70**	**93**
2024	0.135	39:61	64:36	0.4	-20	0.11	21	0.63	-73	-73	0.98	61	90
2025	0.135	39:61	63:37	0.55	8	0.12	18	0.86	-64	-64	1	54	88
2026	0.135	39:61	59:41	0.65	29	0.13	16	1.02	-57	-60	1.1	52	88
2027	0.135	39:61	56:44	0.78	54	0.15	16	1.22	-49	-54	1.42	54	89
2028	0.135	39:61	54:46	0.95	87	0.19	16	1.48	-37	-43	1.79	55	89
2029	0.135	39:61	53:47	1.15	127	0.22	16	1.8	-24	-30	2.08	54	88
2030	0.135	39:61	53:47	1.37	170	0.26	16	2.14	-10	-17	2.29	52	87
2031	0.135	39:61	52:48	1.59	215	0.29	16	2.49	5	-4	2.47	50	86
2032	0.135	39:61	51:49	1.82	259	0.33	15	2.84	20	8	2.67	48	85
2033	0.135	39:61	50:50	2.04	304	0.36	15	3.2	35	20	2.87	47	85
2034	0.135	39:61	49:51	2.27	348	0.39	15	3.54	50	32	3.06	46	84
2035	0.135	39:61	48:52	2.48	390	0.43	15	3.88	64	44	3.23	45	84
2036	0.135	39:61	47:53	2.68	429	0.46	15	4.19	77	54	3.39	45	83
2037	0.135	39:61	46:54	2.86	466	0.48	14	4.47	89	64	3.53	44	83

Table 47 Continued. Results for rebuilding projections using Tmin * 2 for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR30} 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	0.135	39:61	45:55	3.03	499	0.51	14	4.74	100	73	3.66	44	82
2039	0.135	39:61	44:56	3.18	528	0.53	14	4.97	110	80	3.77	43	82
2040	0.135	39:61	44:56	3.31	554	0.55	14	5.17	118	87	3.88	43	82
2041	0.135	39:61	43:57	3.42	577	0.56	14	5.35	126	93	3.97	43	82
2042	0.135	39:61	42:58	3.52	597	0.58	14	5.51	133	98	4.06	42	82
2043	0.135	39:61	42:58	3.61	614	0.59	14	5.64	138	102	4.13	42	82
2044	0.135	39:61	41:59	3.68	628	0.6	14	5.76	143	106	4.2	42	82
2045	0.135	39:61	41:59	3.74	640	0.61	14	5.86	147	109	4.25	42	82
2046	0.148	39:61	41:59	4.16	722	0.68	14	6.5	174	132	4.73	42	82

Table 48. Results for rebuilding projections using 75%F_{SPR30} for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR30} 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	0.391	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.562	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.428	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.426	-	36:64	-	-	-	-	-	-	-	-	-	-
2021	0.455	-	41:59	-	-	-	-	-	-	-	-	-	-
2022	0.650	-	35:65	-	-	-	-	-	-	-	-	-	-
2023	**0.111**	**39:61**	**63:37**	**0.21**	**-58**	**0.07**	**24**	**0.33**	**-86**	**-86**	**0.78**	**70**	**93**
2024	0.111	39:61	64:36	0.34	-33	0.09	21	0.53	-78	-77	0.81	60	90
2025	0.111	39:61	62:38	0.46	-9	0.1	18	0.72	-69	-70	0.82	53	88
2026	0.111	39:61	59:41	0.56	10	0.11	16	0.87	-63	-66	0.91	51	88
2027	0.111	39:61	55:45	0.68	34	0.13	16	1.06	-55	-60	1.19	53	89
2028	0.111	39:61	53:47	0.83	64	0.16	16	1.3	-45	-51	1.52	54	89
2029	0.111	39:61	52:48	1.01	101	0.19	16	1.59	-33	-39	1.77	53	88
2030	0.111	39:61	52:48	1.22	141	0.23	16	1.9	-20	-27	1.96	51	86
2031	0.111	39:61	51:49	1.43	182	0.26	15	2.23	-6	-15	2.12	49	85
2032	0.111	39:61	50:50	1.64	225	0.29	15	2.57	8	-3	2.3	47	85
2033	0.111	39:61	49:51	1.86	268	0.32	15	2.91	23	8	2.48	46	84
2034	0.111	39:61	48:52	2.07	310	0.35	15	3.24	37	19	2.65	45	83
2035	0.111	39:61	46:54	2.28	350	0.38	14	3.56	50	30	2.8	44	83
2036	0.111	39:61	45:55	2.47	389	0.41	14	3.87	63	40	2.94	43	82
2037	0.111	39:61	44:56	2.65	424	0.44	14	4.15	75	50	3.07	43	82

Table 48 Continued. Results for rebuilding projections using 75%F_{SPR30} for Gulf of Mexico Gag Grouper SEDAR 72 F_{SPR30} 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	0.111	39:61	43:57	2.82	457	0.46	14	4.4	86	58	3.19	42	82
2039	0.111	39:61	42:58	2.96	486	0.48	14	4.63	96	66	3.3	42	81
2040	0.111	39:61	41:59	3.09	512	0.5	14	4.84	104	72	3.41	41	81

Table 49. 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} = 9,848 metric tons and $MSST_{FMAX}$ = 4,924 metric tons (0.5 * SSB_{FMAX}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,533	0.391	1.19	2,542	0.26	0.52	-	0.02
2018	2,354	0.562	1.70	2,540	0.26	0.52	-	0.02
2019	2,819	0.428	1.30	2,296	0.23	0.47	-	0.02
2020	5,098	0.426	1.29	2,432	0.25	0.49	3.33	0.02
2021	5,160	0.455	1.38	2,477	0.25	0.50	3.09	0.02
2022	4,207	0.650	1.97	1,840	0.19	0.37	3.14	0.02
2023	**3,316**	**0.216**	**0.66**	**1,339**	**0.14**	**0.27**	**1.05**	**0.01**
2024	4,540	0.216	0.66	2,049	0.21	0.42	1.56	0.02
2025	5,778	0.216	0.66	2,961	0.30	0.60	2.03	0.03
2026	6,654	0.216	0.66	3,769	0.38	0.77	2.31	0.04
2027	7,209	0.216	0.66	4,376	0.44	0.89	2.66	0.04
2028	7,685	0.216	0.66	4,971	0.50	1.01	3.13	0.05
2029	8,255	0.216	0.66	5,793	0.59	1.18	3.68	0.05
2030	8,837	0.216	0.66	6,791	0.69	1.38	4.27	0.06
2031	9,348	0.216	0.66	7,841	0.80	1.59	4.84	0.07
2032	9,772	0.216	0.66	8,865	0.90	1.80	5.41	0.08
2033	10,124	0.216	0.66	9,856	1.00	2.00	5.96	0.09

Table 50. 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} = 9,848 metric tons and $MSST_{FMAX}$ = 4,924 metric tons (0.5 * SSB_{FMAX}).

Year	R	F	F/ MFMT	SSB	SSB/ SSBFmsy	SSB/ MSST	Yield	SSB/ SSB0
2017	4,533	0.391	1.19	2,542	0.26	0.52	-	0.02
2018	2,354	0.562	1.70	2,540	0.26	0.52	-	0.02
2019	2,819	0.428	1.30	2,296	0.23	0.47	-	0.02
2020	5,098	0.426	1.29	2,432	0.25	0.49	3.33	0.02
2021	5,160	0.455	1.38	2,477	0.25	0.50	3.09	0.02
2022	4,207	0.650	1.97	1,840	0.19	0.37	3.14	0.02
2023	**3,316**	**0.162**	**0.49**	**1,339**	**0.14**	**0.27**	**0.79**	**0.01**
2024	4,698	0.162	0.49	2,154	0.22	0.44	1.22	0.02
2025	6,081	0.162	0.49	3,222	0.33	0.65	1.63	0.03
2026	7,081	0.162	0.49	4,229	0.43	0.86	1.91	0.04
2027	7,742	0.162	0.49	5,047	0.51	1.02	2.26	0.05
2028	8,313	0.162	0.49	5,886	0.60	1.20	2.71	0.06
2029	8,952	0.162	0.49	7,012	0.71	1.42	3.25	0.07
2030	9,578	0.162	0.49	8,377	0.85	1.70	3.84	0.08
2031	10,120	0.162	0.49	9,842	1.00	2.00	4.43	0.09
2032	10,564	0.330	1.00	11,316	1.15	2.30	10.17	0.11

Table 51. 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	0.391	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.562	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.428	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.426	-	36:64	-	-	-	-	-	-	-	-	-	-
2021	0.455	-	41:59	-	-	-	-	-	-	-	-	-	-
2022	0.650	-	35:65	-	-	-	-	-	-	-	-	-	-
2023	**0.216**	**39:61**	**63:37**	**0.41**	**-19**	**0.13**	**24**	**0.64**	**-73**	**-72**	**1.56**	**71**	**93**
2024	0.216	39:61	65:35	0.61	21	0.17	22	0.95	-60	-58	1.59	63	90
2025	0.216	39:61	64:36	0.79	57	0.19	19	1.24	-48	-48	1.58	56	89
2026	0.216	39:61	62:38	0.9	78	0.19	17	1.41	-40	-43	1.69	54	89
2027	0.216	39:61	58:42	1.04	105	0.21	17	1.62	-31	-36	2.11	56	90
2028	0.216	39:61	57:43	1.22	141	0.26	17	1.91	-19	-25	2.59	58	90
2029	0.216	39:61	57:43	1.44	184	0.3	17	2.25	-5	-10	2.94	57	89
2030	0.216	39:61	57:43	1.66	229	0.34	17	2.6	10	4	3.17	55	88
2031	0.216	39:61	56:44	1.89	273	0.38	17	2.95	25	17	3.39	53	88
2032	0.216	39:61	56:44	2.11	317	0.41	16	3.3	39	29	3.64	52	87
2033	0.216	39:61	55:45	2.33	360	0.45	16	3.64	54	42	3.89	52	87

Table 52. 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	0.391	-	26:74	-	-	-	-	-	-	-	-	-	-
2018	0.562	-	26:74	-	-	-	-	-	-	-	-	-	-
2019	0.428	-	31:69	-	-	-	-	-	-	-	-	-	-
2020	0.426	-	36:64	-	-	-	-	-	-	-	-	-	-
2021	0.455	-	41:59	-	-	-	-	-	-	-	-	-	-
2022	0.650	-	35:65	-	-	-	-	-	-	-	-	-	-
2023	**0.162**	**39:61**	**63:37**	**0.31**	**-39**	**0.1**	**24**	**0.48**	**-80**	**-79**	**1.15**	**70**	**93**
2024	0.162	39:61	64:36	0.48	-6	0.13	21	0.74	-69	-68	1.18	61	90
2025	0.162	39:61	63:37	0.64	26	0.14	18	0.99	-58	-59	1.19	55	89
2026	0.162	39:61	60:40	0.74	47	0.15	17	1.16	-51	-54	1.3	53	89
2027	0.162	39:61	57:43	0.88	74	0.17	16	1.38	-42	-47	1.66	55	89
2028	0.162	39:61	55:45	1.06	109	0.21	17	1.65	-30	-36	2.08	56	89
2029	0.162	39:61	54:46	1.27	151	0.25	17	1.98	-16	-22	2.4	55	88
2030	0.162	39:61	54:46	1.5	196	0.29	16	2.34	-1	-8	2.62	53	87
2031	0.162	39:61	54:46	1.73	242	0.33	16	2.7	14	5	2.82	51	87
2032	0.330	39:61	53:47	3.97	685	0.75	16	6.2	162	140	6.58	51	87

Figures

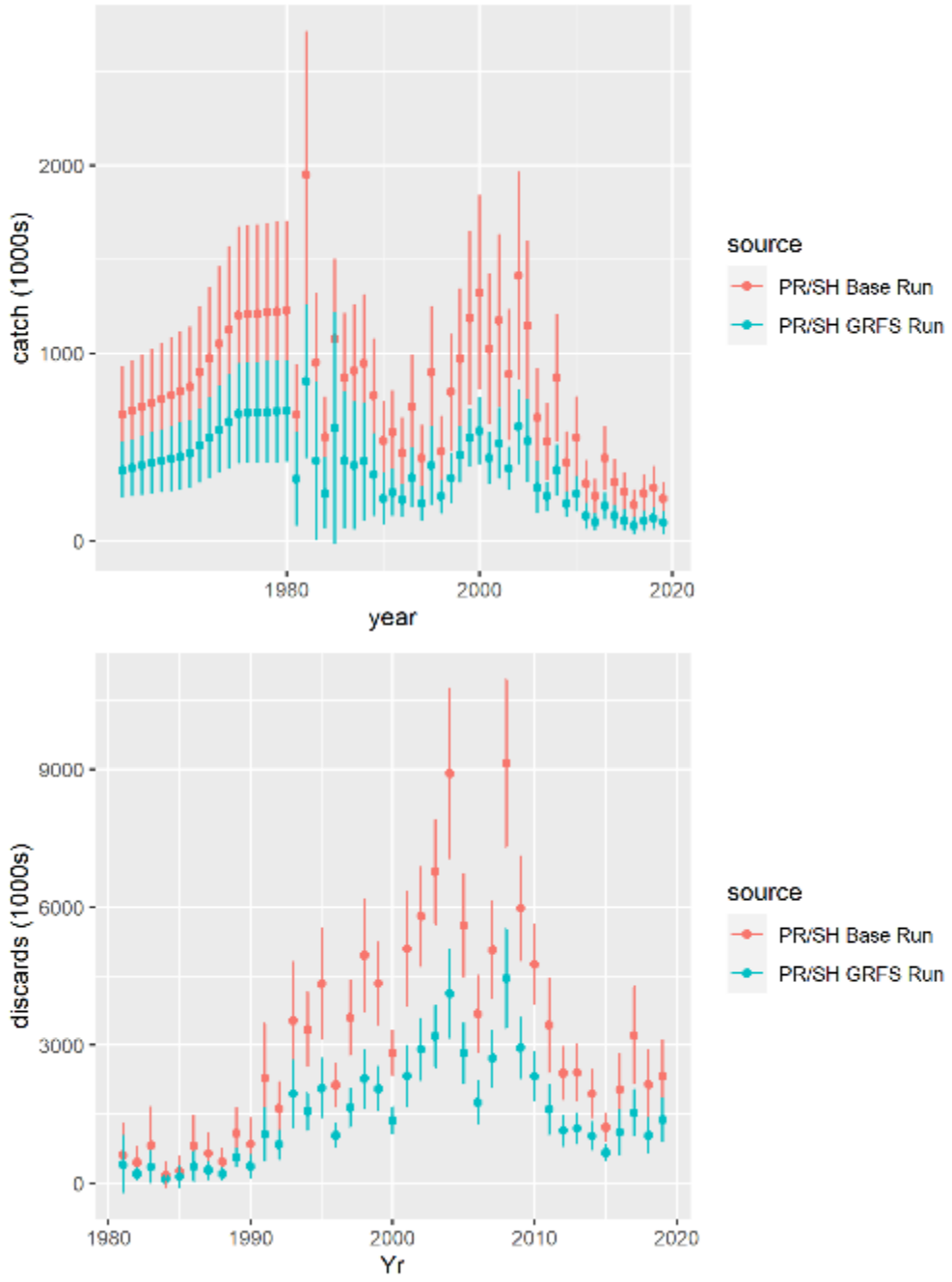


Figure 1. Time series of the Recreational Private + Shore fleet landings and discards in thousands of fish, and associated uncertainty, from the SRFS Run vs. the SEDAR 72 base run.

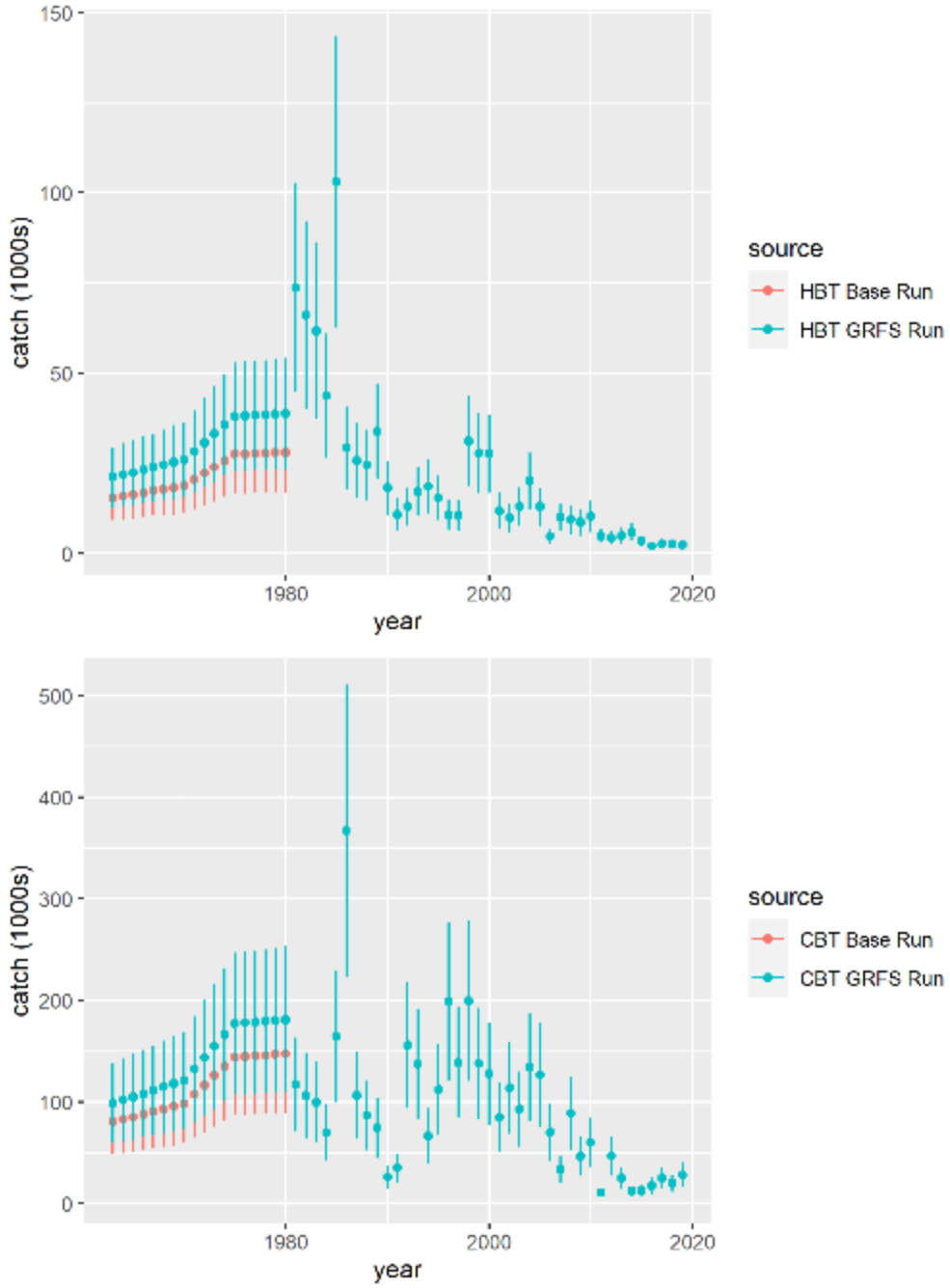
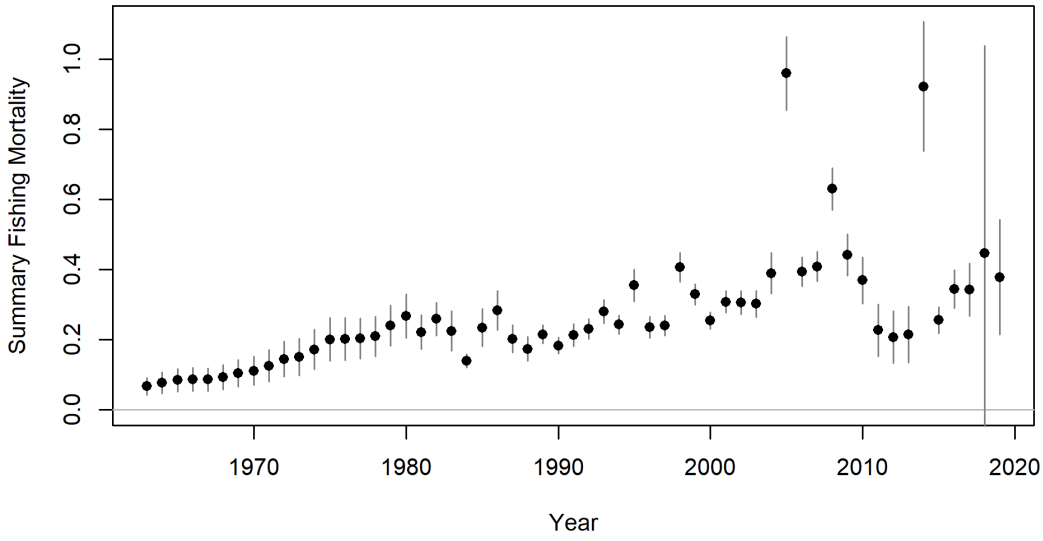


Figure 2. Time series of the Recreational Headboat and Recreational Charter fleet landings in thousands of fish, and associated uncertainty, from the SRFS Run vs. the SEDAR 72 base run.

SRFS Run



SEDAR 33U

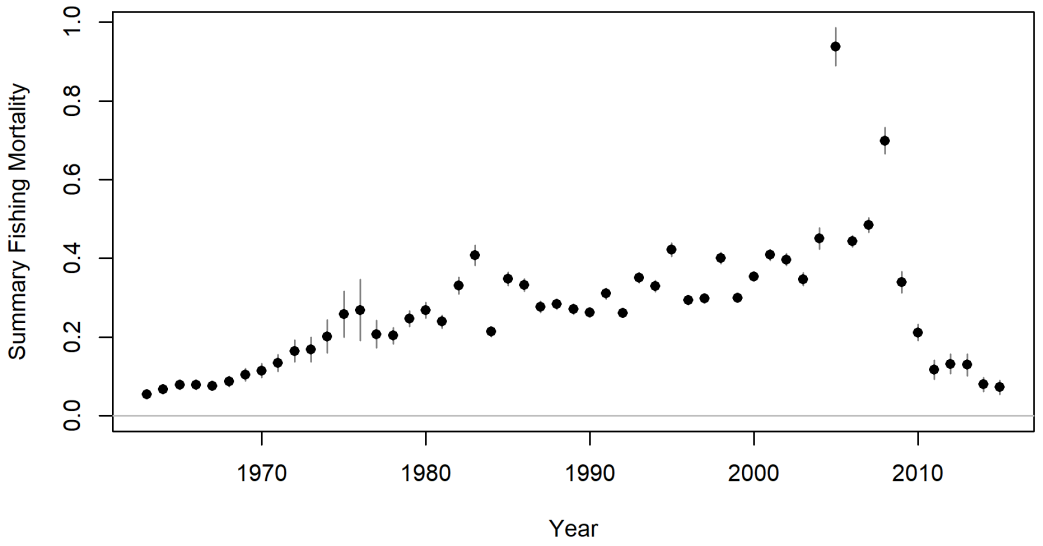
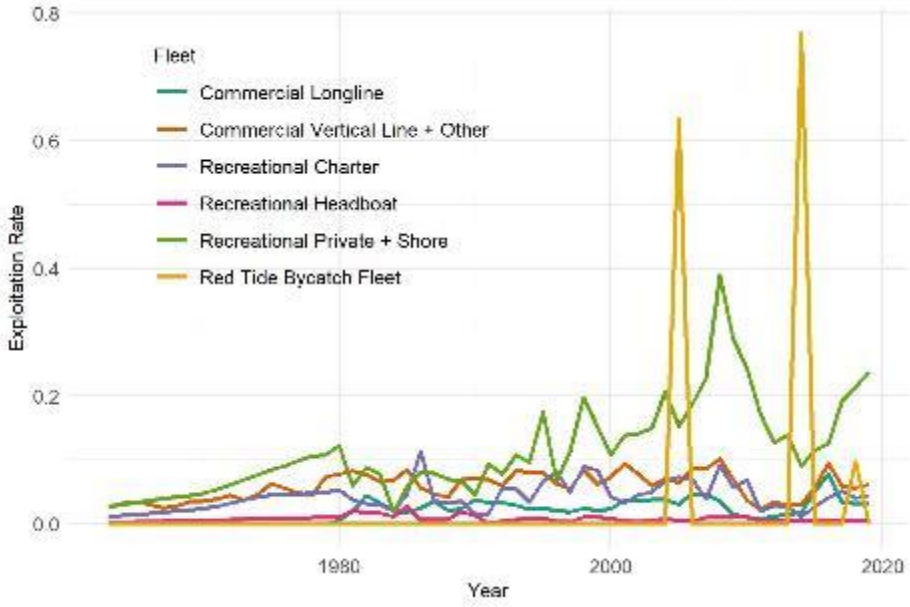


Figure 3. Annual exploitation rate estimates (total biomass killed / total biomass age 3+) for Gulf of Mexico Gag Grouper (red tide F included).

SRFS Run



SEDAR 33U

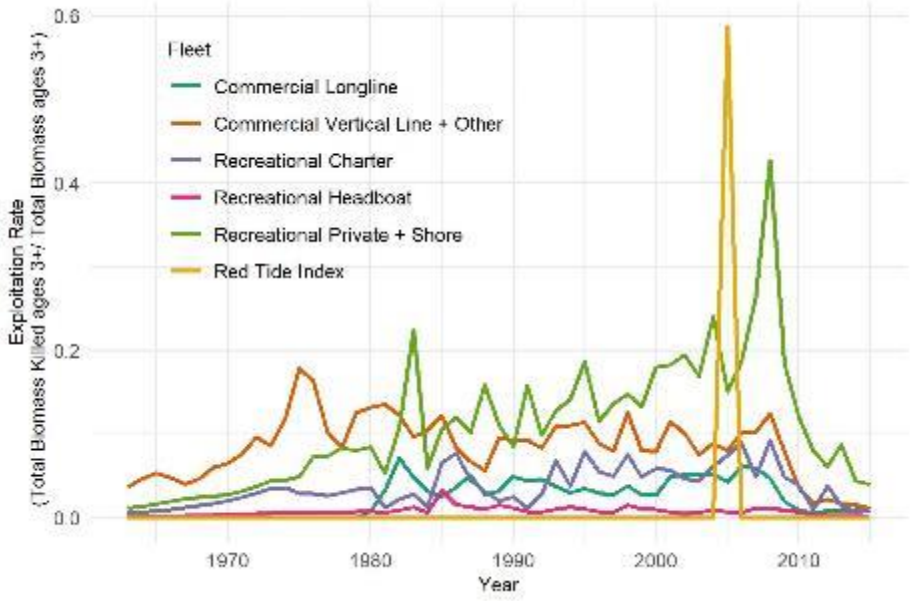


Figure 4. Annual exploitation rate (total biomass killed / total biomass age 3+) by fleet for Gulf of Mexico Gag Grouper.

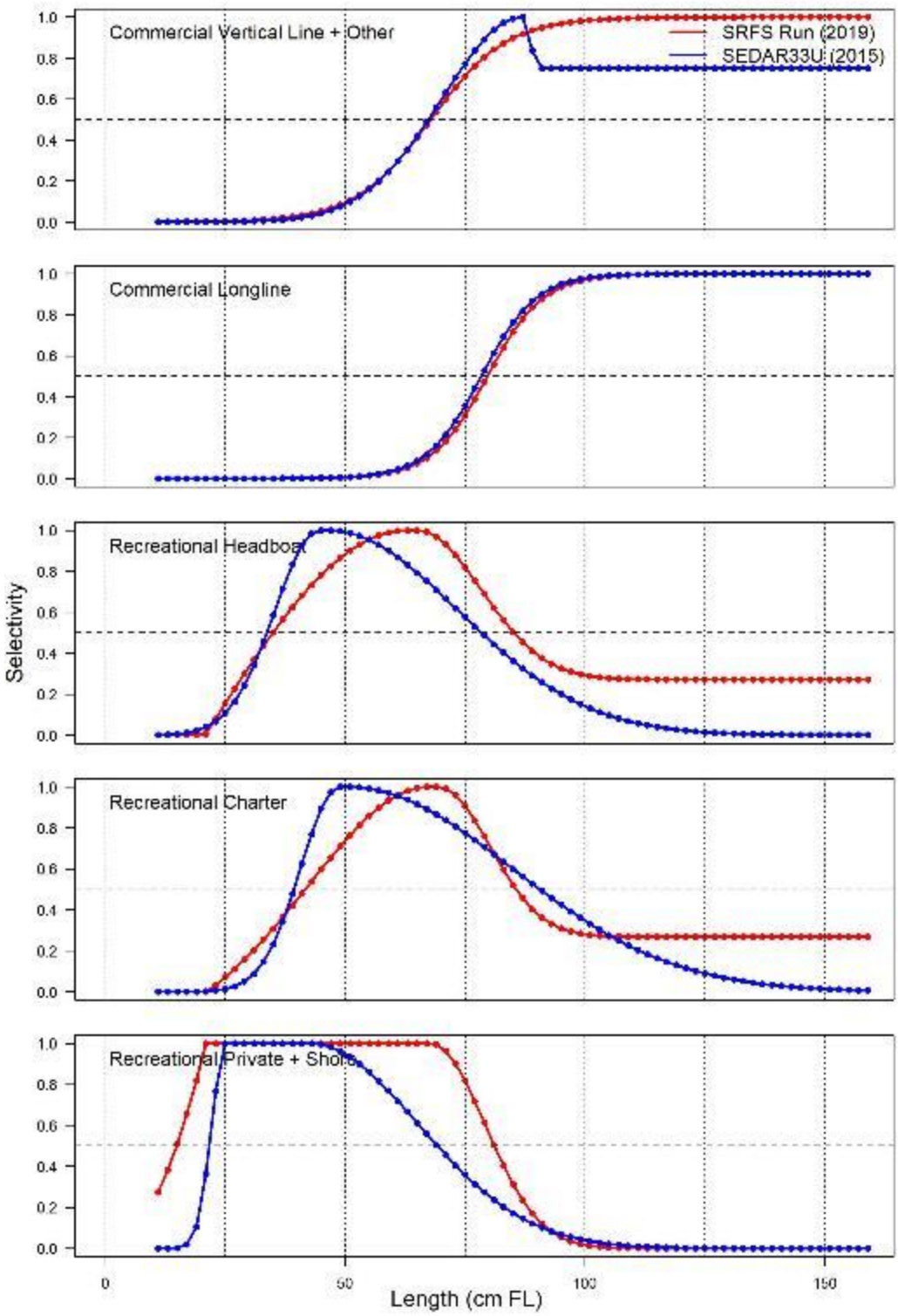
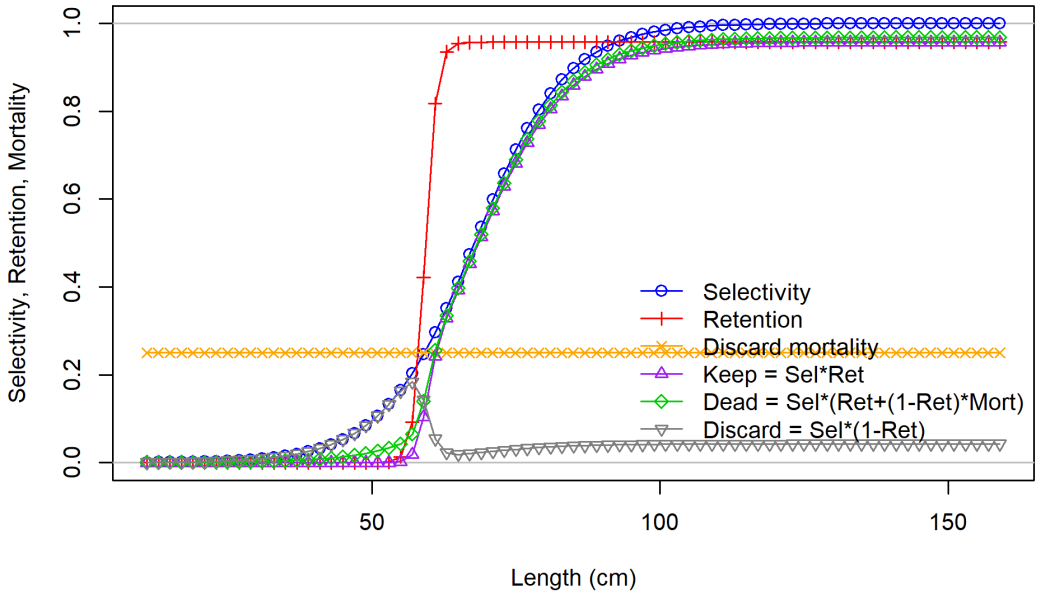


Figure 5. Length-based selectivity for each fleet for Gulf of Mexico Gag Grouper in the terminal year of the assessment (given in parentheses). Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify lengths in 25 cm FL intervals.

SRFS Run



SEDAR 33U

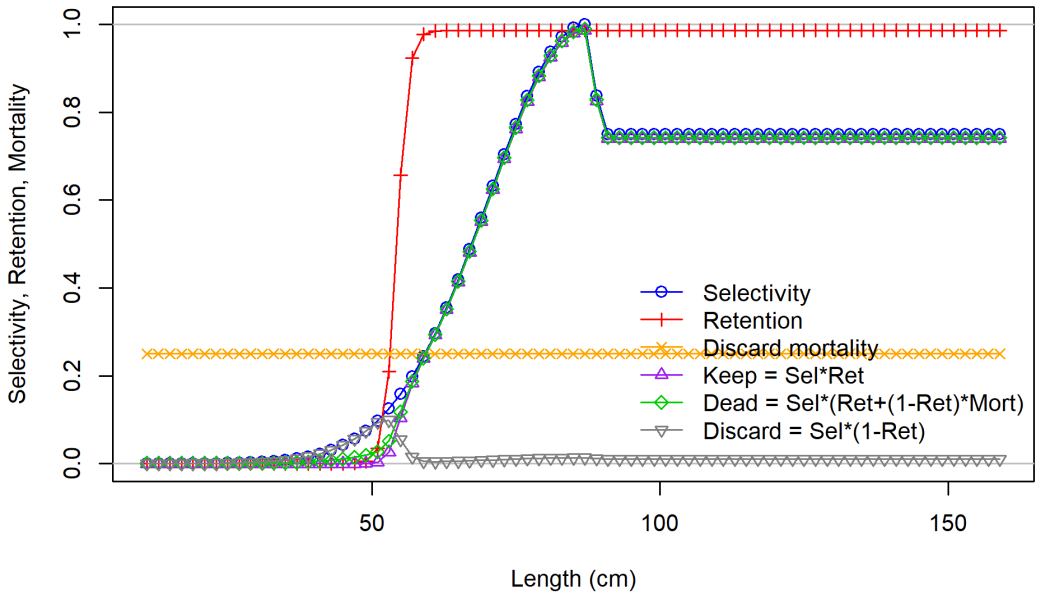
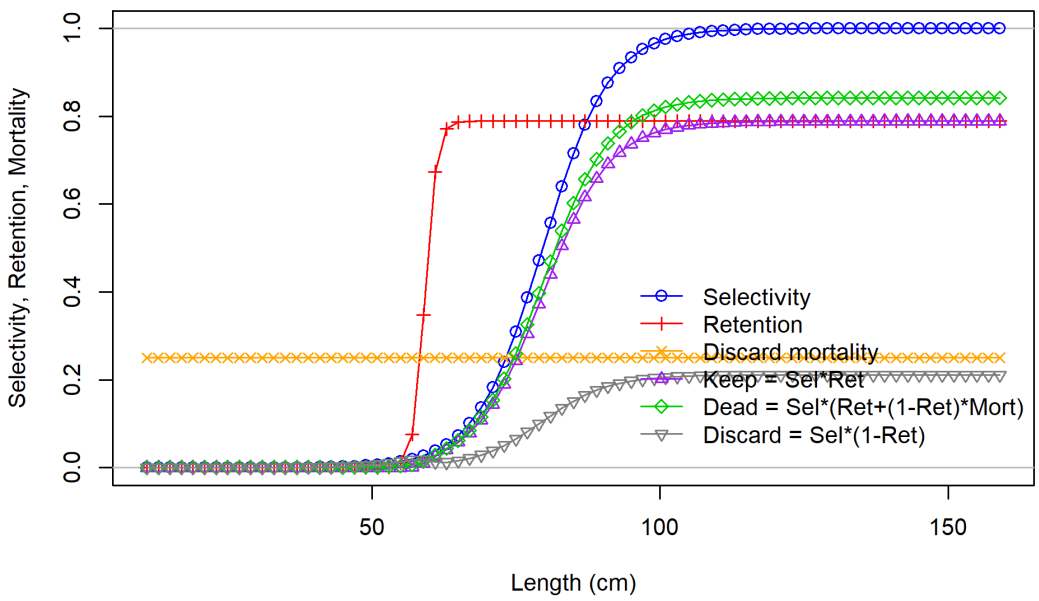


Figure 6. Length-based selectivity for the Commercial Vertical Line + Other fishery. Selectivity (blue line) is constant over the entire assessment time period (1963 - 2019). Retention (red line) is shown for the most recent time period. Discard mortality (orange line) is constant at 0.25.

SRFS Run



SEDAR 33U

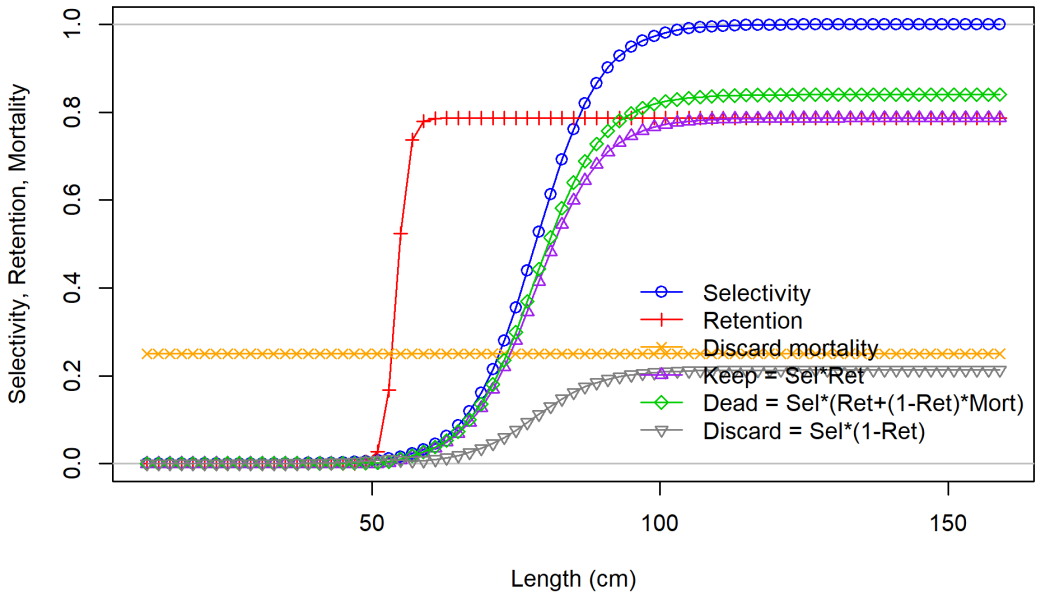
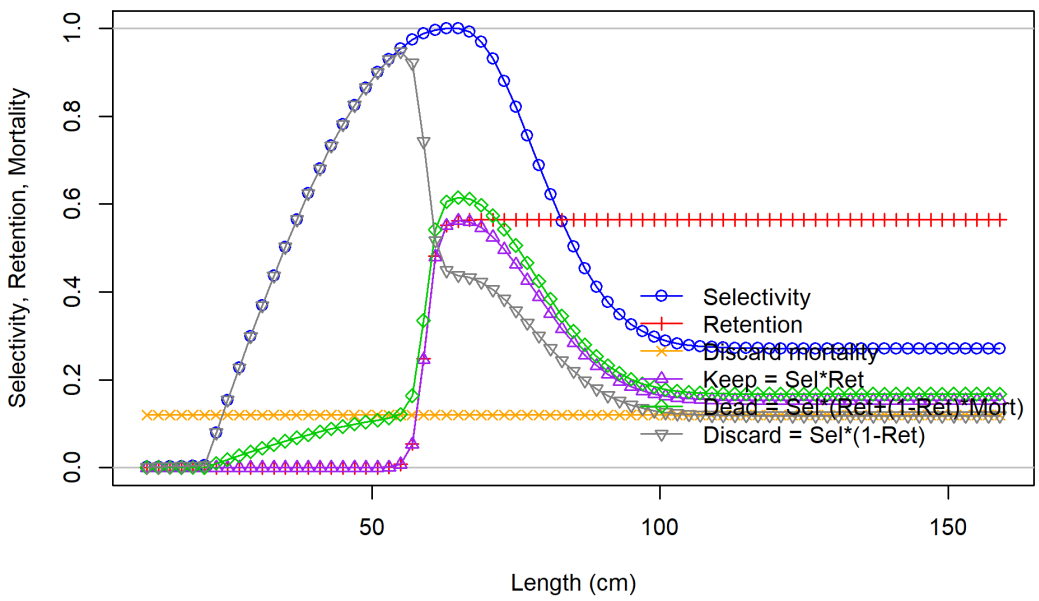


Figure 7. Length-based selectivity for the Commercial Longline fishery. Selectivity (blue line) is constant over the entire assessment time period (1963 - 2019). Retention (red line) is shown for the most recent time period. Discard mortality (orange line) is constant at 0.25.

SRFS Run



SEDAR 33U

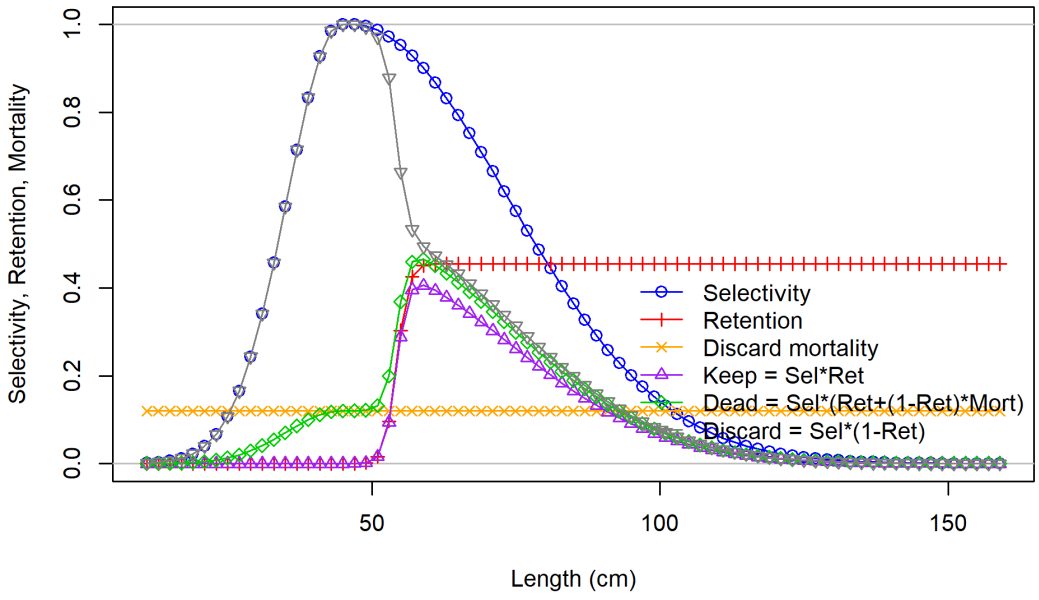
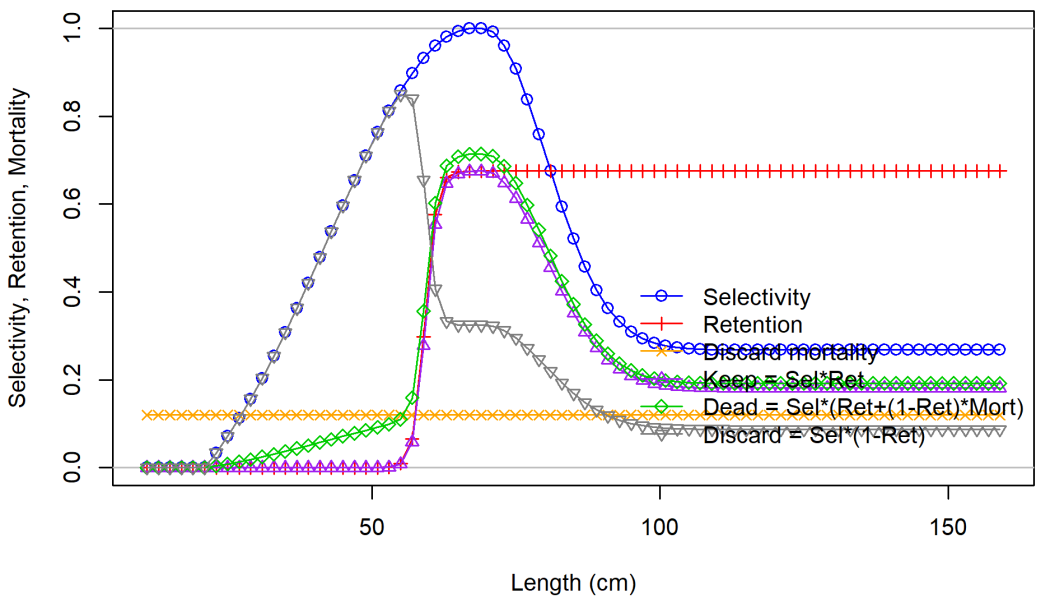


Figure 8. Length-based selectivity for the Recreational Headboat fishery. Selectivity (blue line) is constant over the entire assessment time period (1963 - 2019). Retention (red line) is shown for the most recent time period. Discard mortality (orange line) is constant at 0.12.

SRFS Run



SEDAR 33U

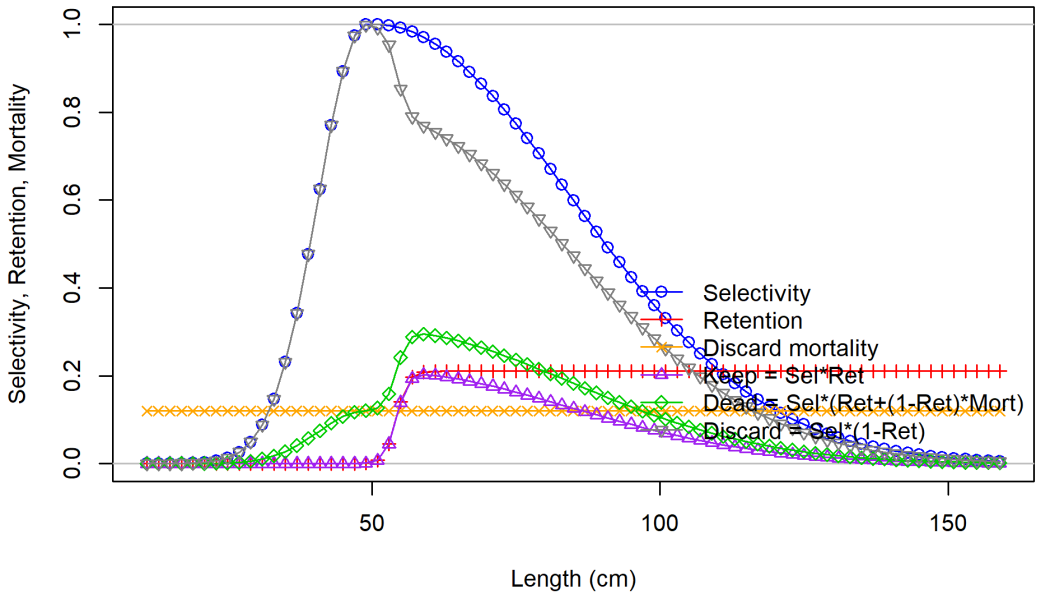
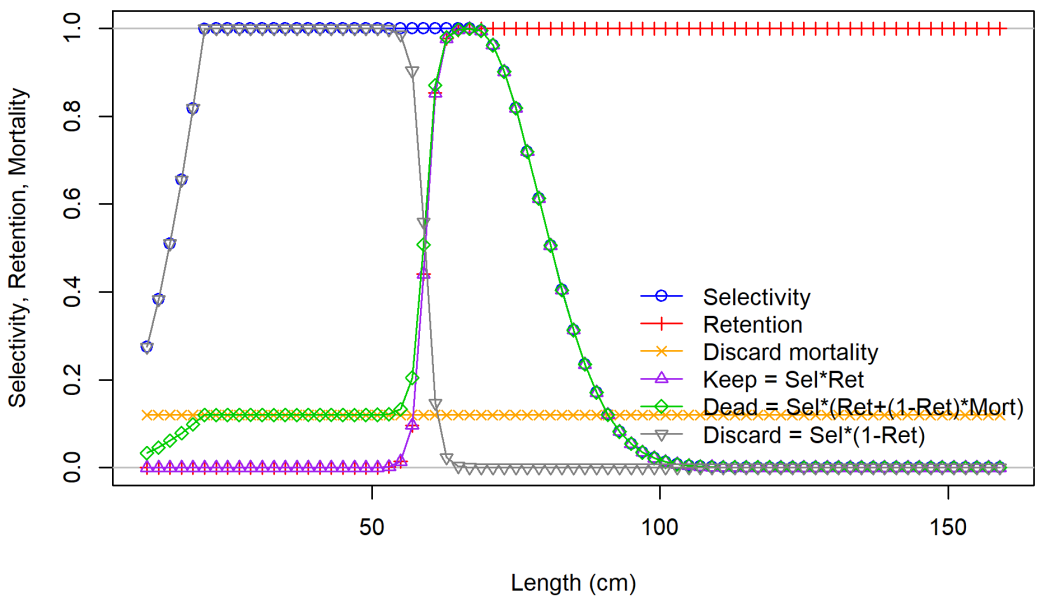


Figure 9. Length-based selectivity for the Recreational Charter fishery. Selectivity (blue line) is constant over the entire assessment time period (1963 - 2019). Retention (red line) is shown for the most recent time period. Discard mortality (orange line) is constant at 0.12.

SRFS Run



SEDAR 33U

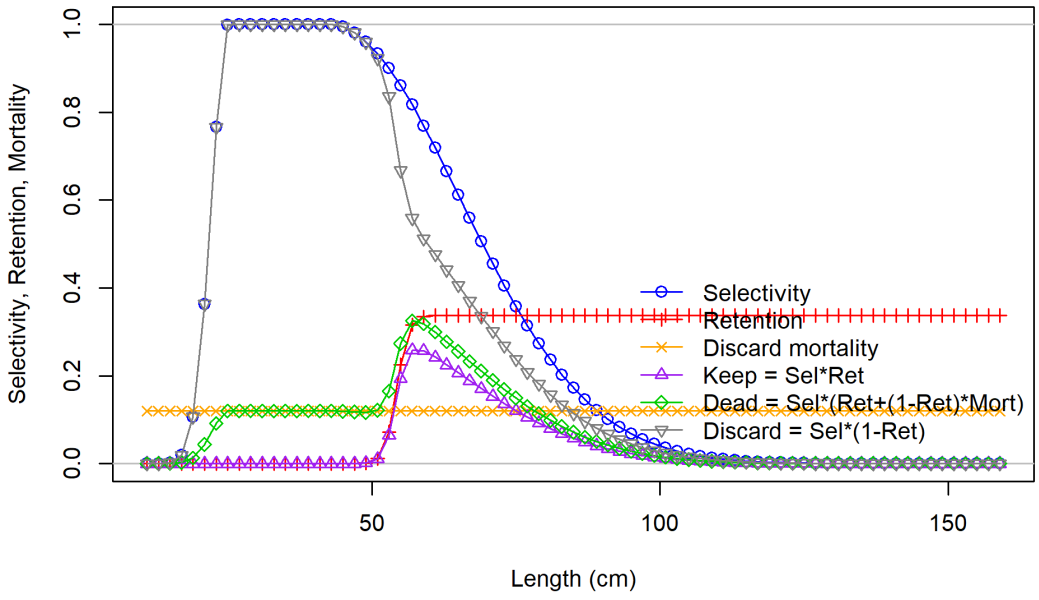


Figure 10. Length-based selectivity for the Recreational Private + Shore fishery. Selectivity (blue line) is constant over the entire assessment time period (1963 - 2019). Retention (red line) is shown for the most recent time period. Discard mortality (orange line) is constant at 0.12.

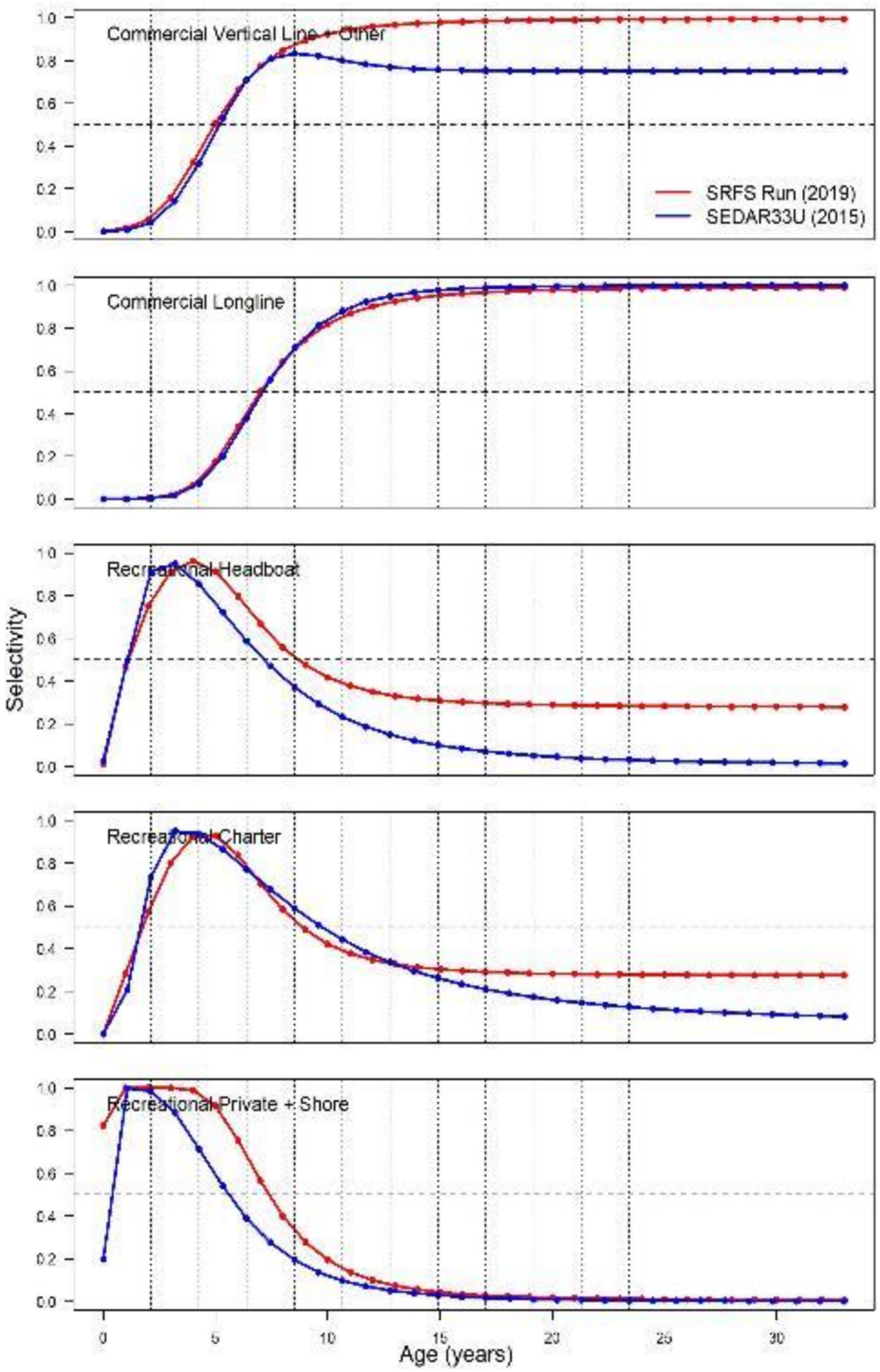


Figure 11. Derived age-based selectivity for each fleet for Gulf of Mexico Gag Grouper in the terminal year of the assessment (given in parentheses). Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify ages in 2 year intervals.

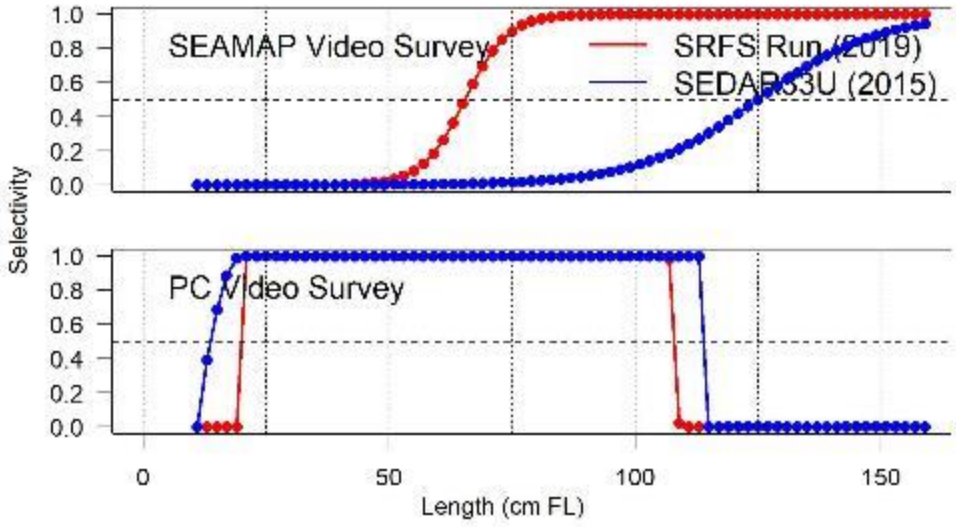


Figure 12. Length-based selectivity for each survey for Gulf of Mexico Gag Grouper in the terminal year of the assessment (given in parentheses). Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify lengths in 25 cm FL intervals.

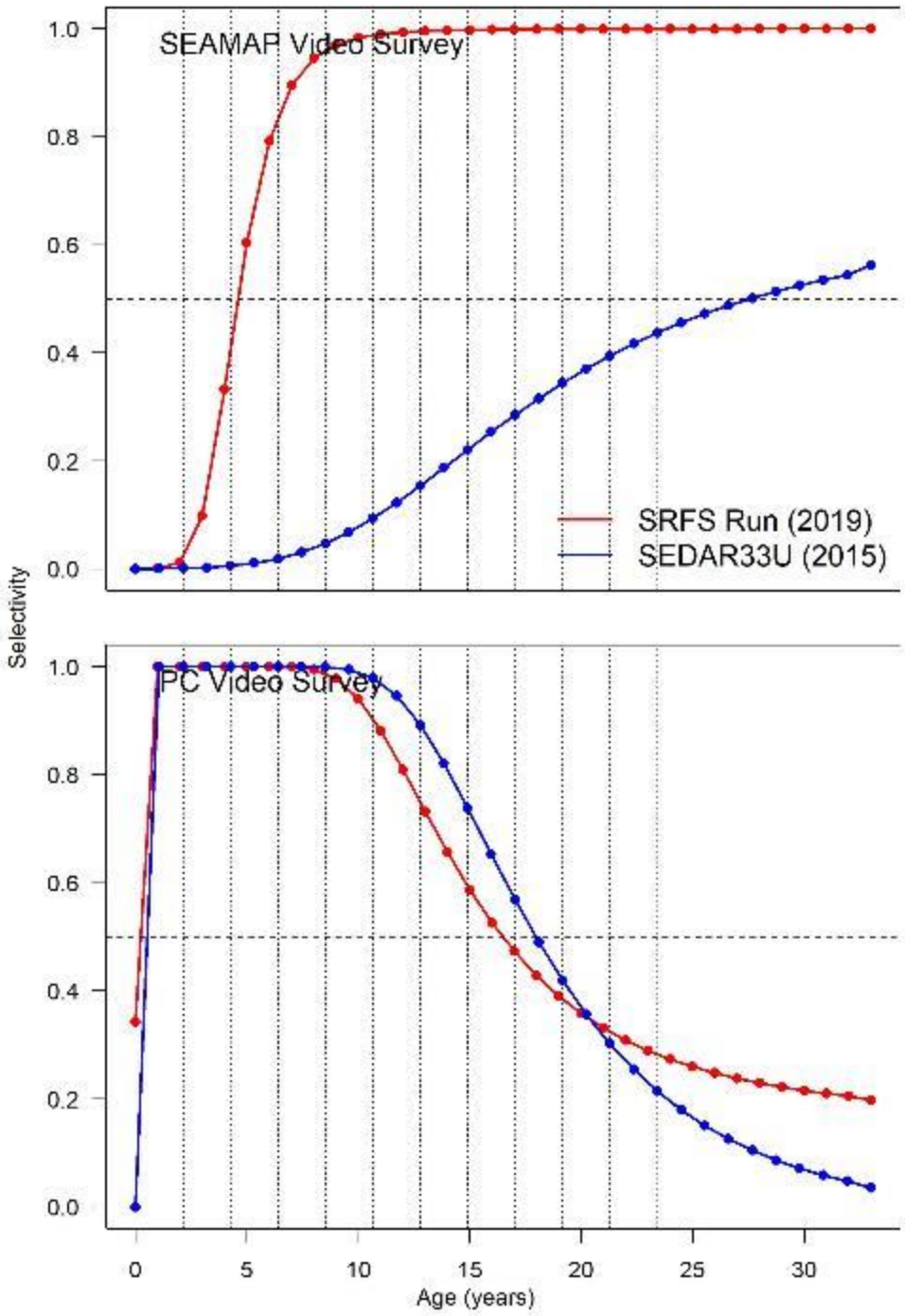


Figure 13. Derived age-based selectivity for each survey for Gulf of Mexico Gag Grouper in the terminal year of the assessment (given in parentheses). Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify ages in 2 year intervals.

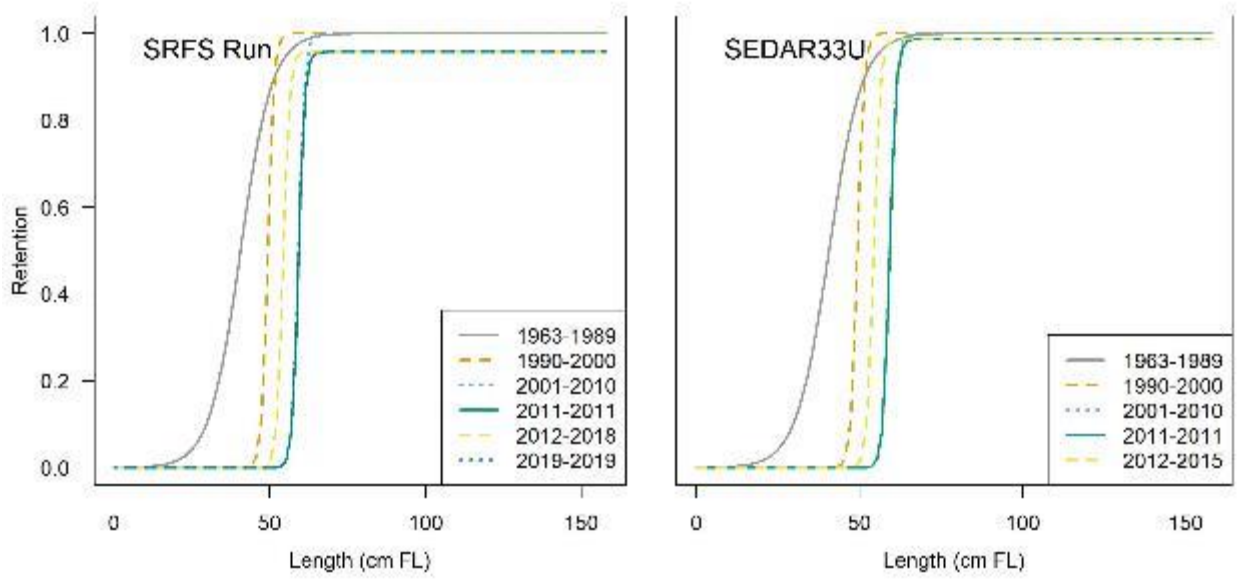


Figure 14. Time-varying retention functions for the Commercial Vertical Line + Other fishery for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U.

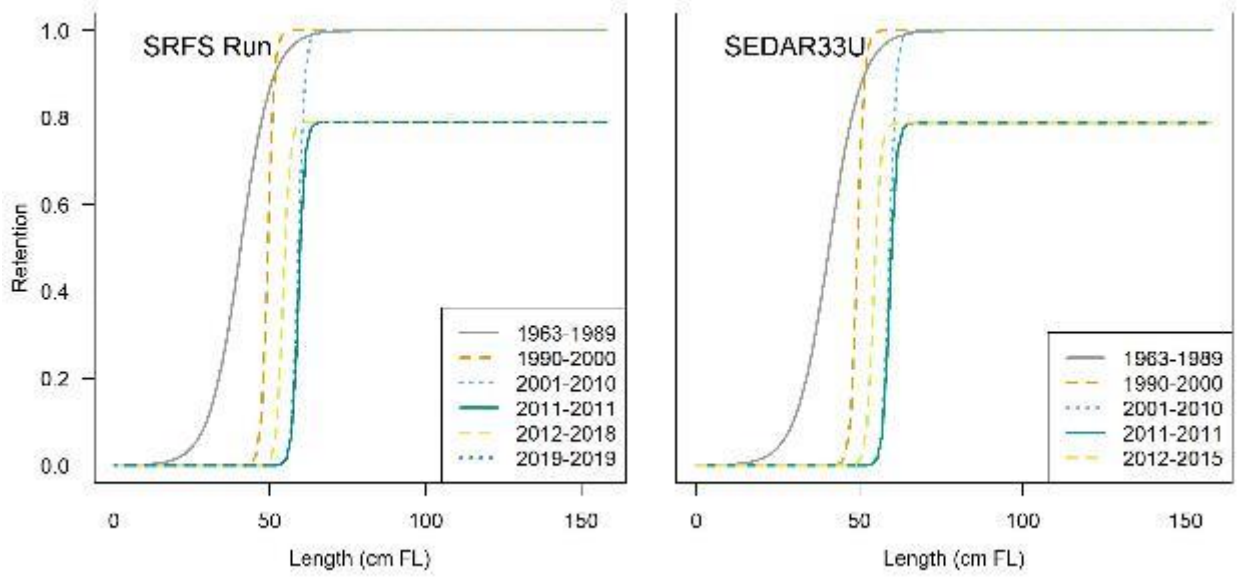


Figure 15. Time-varying retention functions for the Commercial Longline fishery for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U.

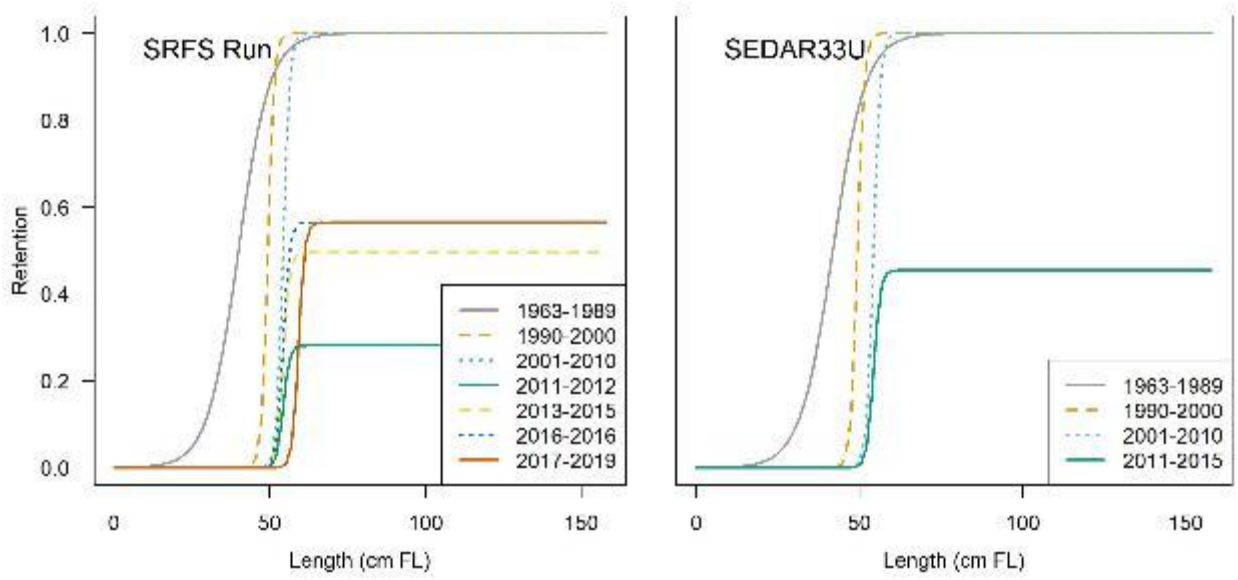


Figure 16. Time-varying retention functions for the Recreational Headboat fishery for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U.

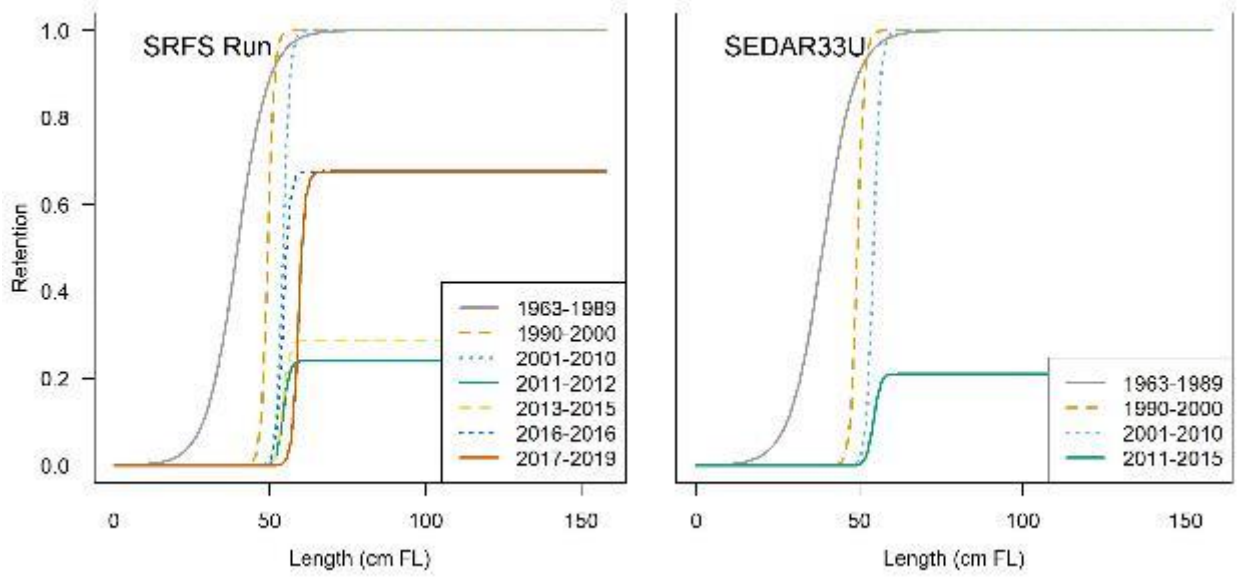


Figure 17. Time-varying retention functions for the Recreational Charter fishery for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U.

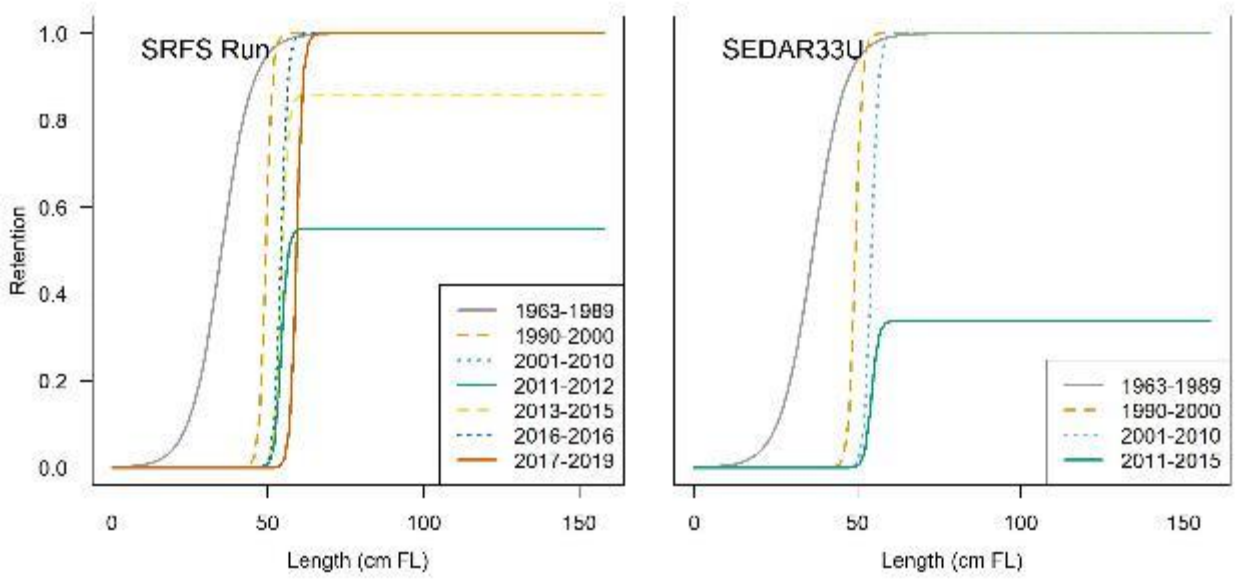
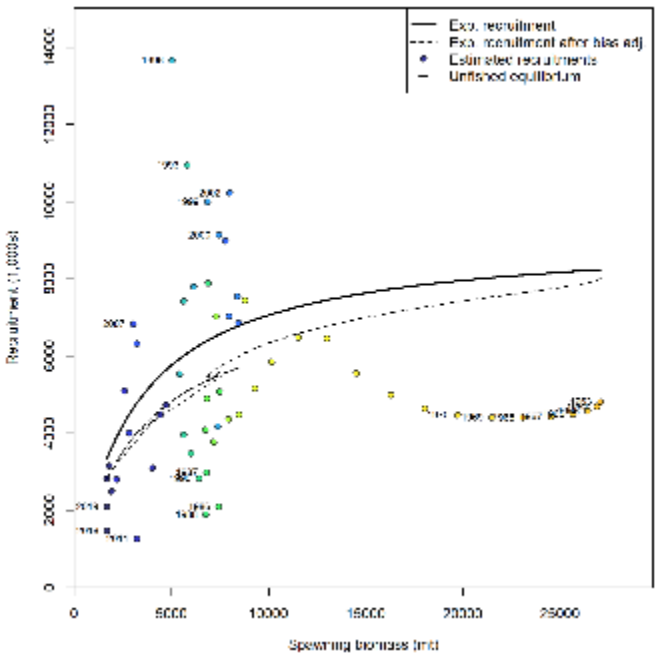


Figure 18. Time-varying retention functions for the Recreational Private + Shore fishery for Gulf of Mexico Gag Grouper from the SRFS Run and SEDAR 33U.

SRFS Run



SEDAR 33U

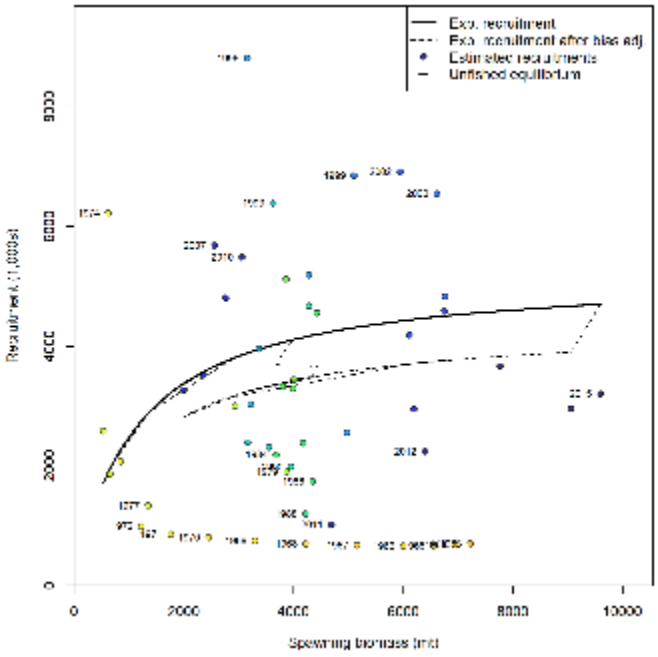
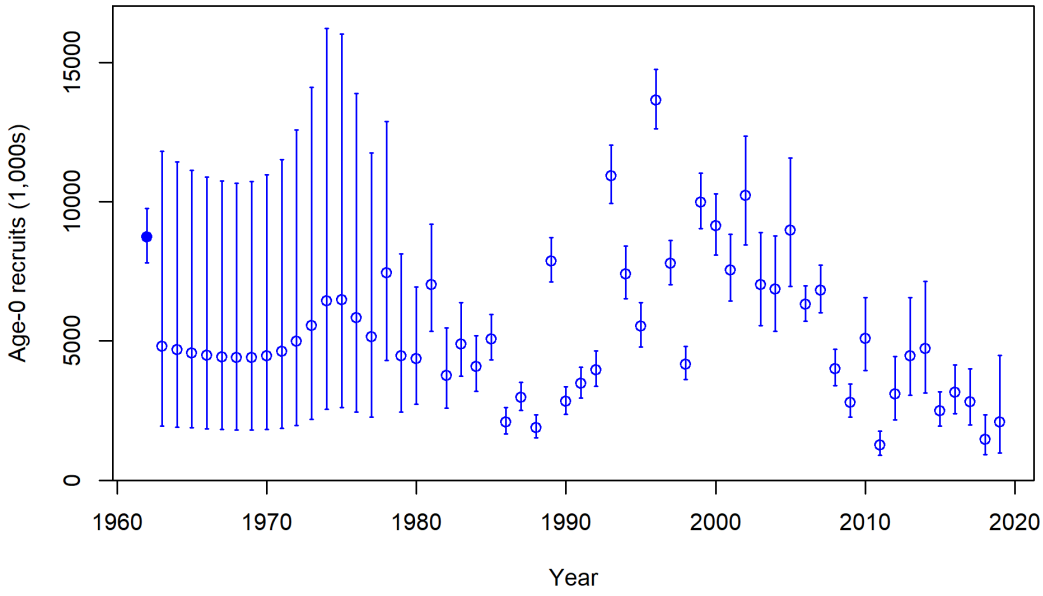


Figure 19. Predicted stock-recruitment relationship for Gulf of Mexico Gag Grouper (steepness and SigmaR were fixed at 0.855 and 0.6, respectively). Plotted are predicted annual recruitments from Stock Synthesis (circles), expected recruitment from the stock-recruit relationship (black line), and bias adjusted recruitment from the stock-recruit relationship (dashed line).

SRFS Run



SEDAR 33U

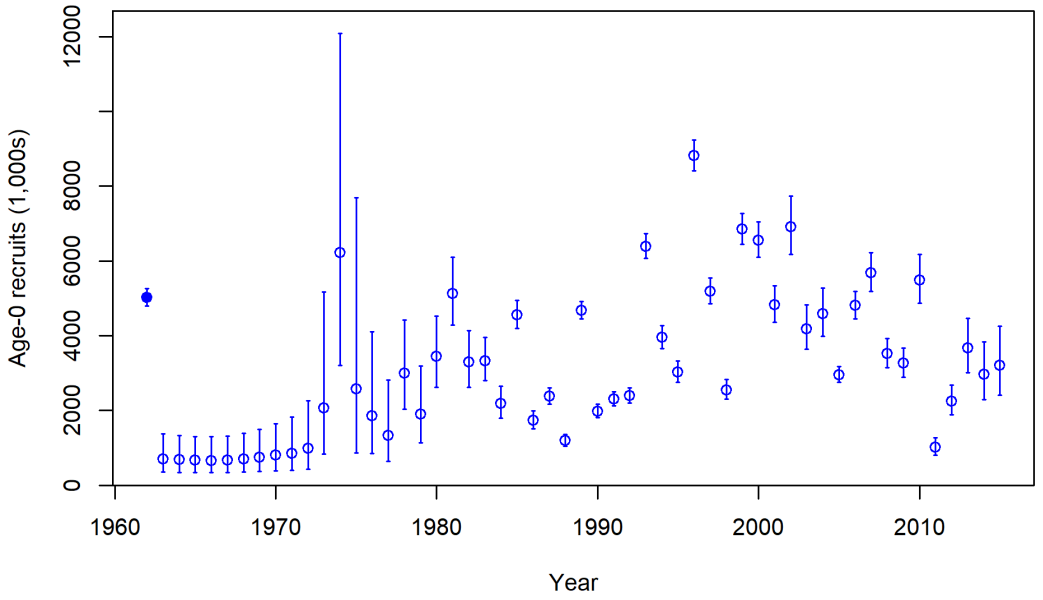
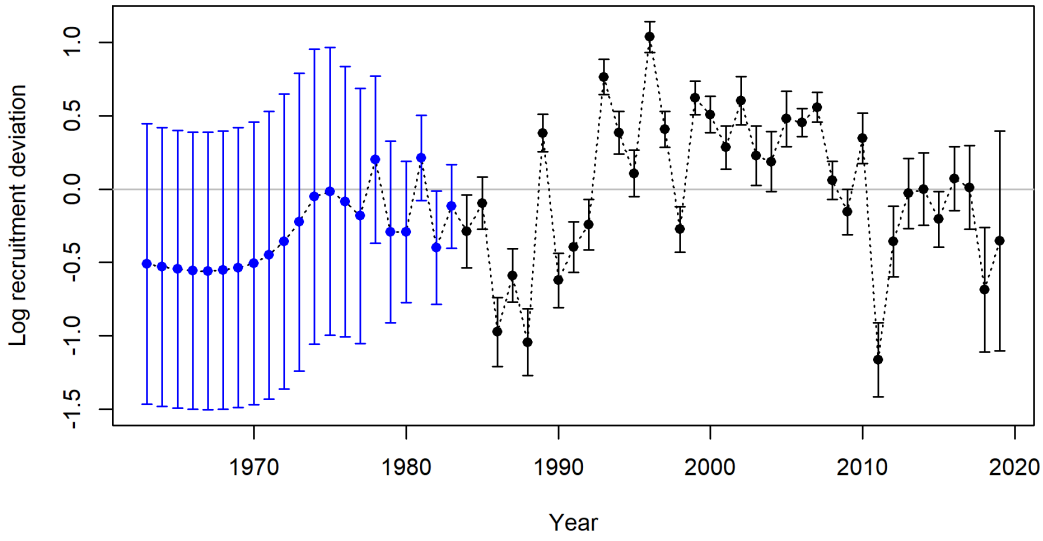


Figure 20. Estimated Age-0 recruitment with 95% confidence intervals for Gulf of Mexico Gag Grouper (steepness and SigmaR were fixed at 0.855 and 0.6, respectively).

SRFS Run



SEDAR 33U

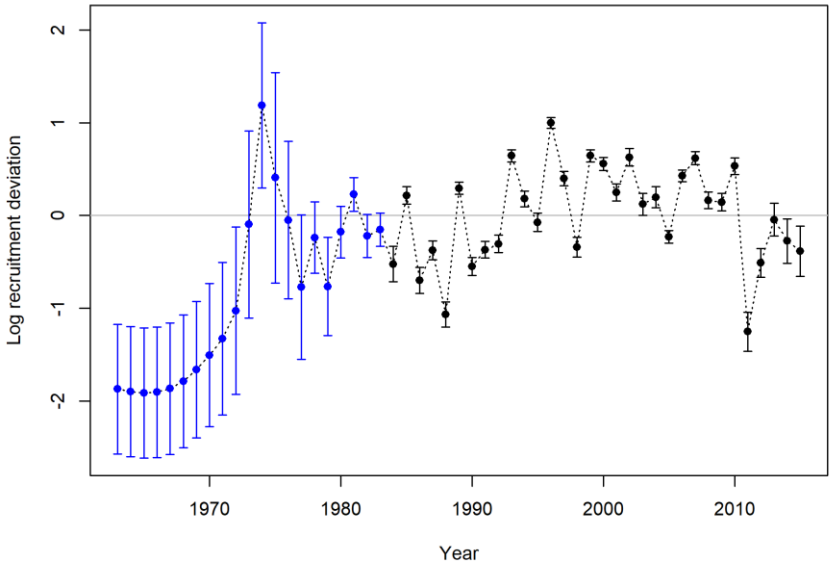
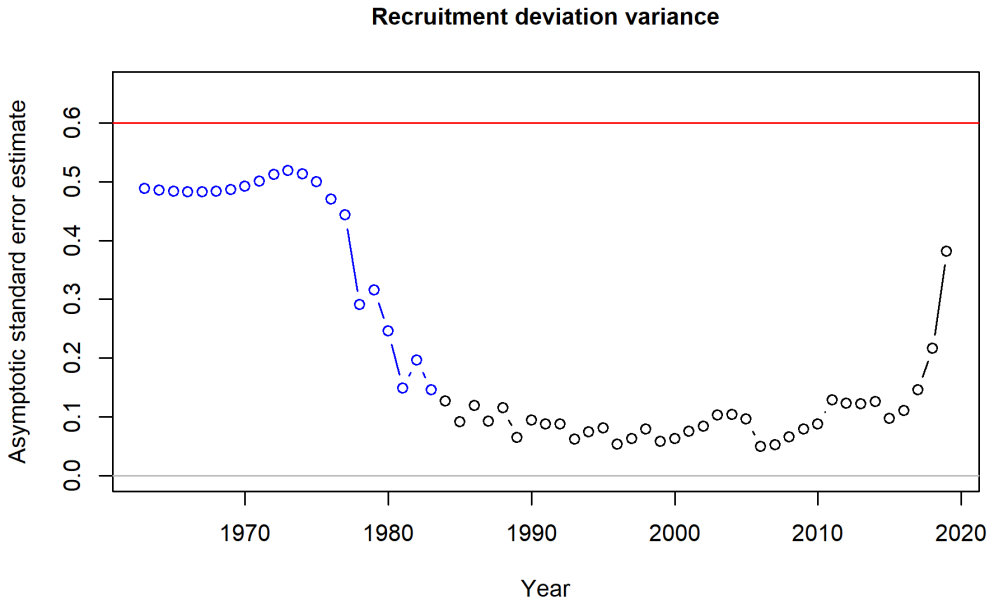


Figure 21. Estimated log recruitment deviations for Gulf of Mexico Gag Grouper (steepness and SigmaR were fixed at 0.855 and 0.6, respectively).

SRFS Run



SEDAR 33U

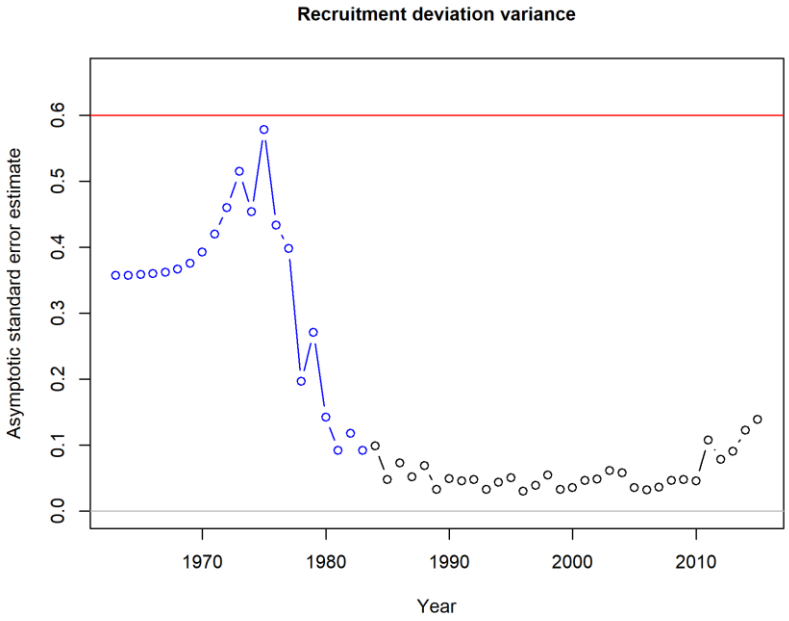


Figure 22. Asymptotic standard errors for recruitment deviations for Gulf of Mexico Gag Grouper. The red line represents the fixed value of 0.6 used in the SRFS Run and SEDAR 33U models.

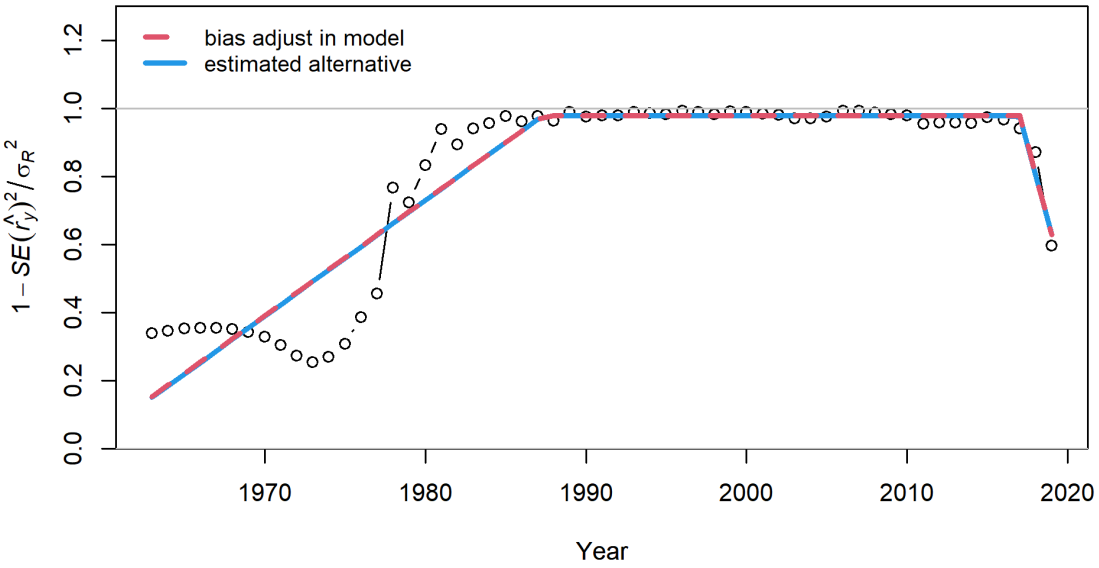


Figure 23. Points are transformed variances. Red line shows current settings for bias adjustment specified for the SRFS Run, which coincides with the least squares estimate of alternative bias adjustment relationship for recruitment deviations (dashed orange line). For more information, see Methot and Taylor 2011.

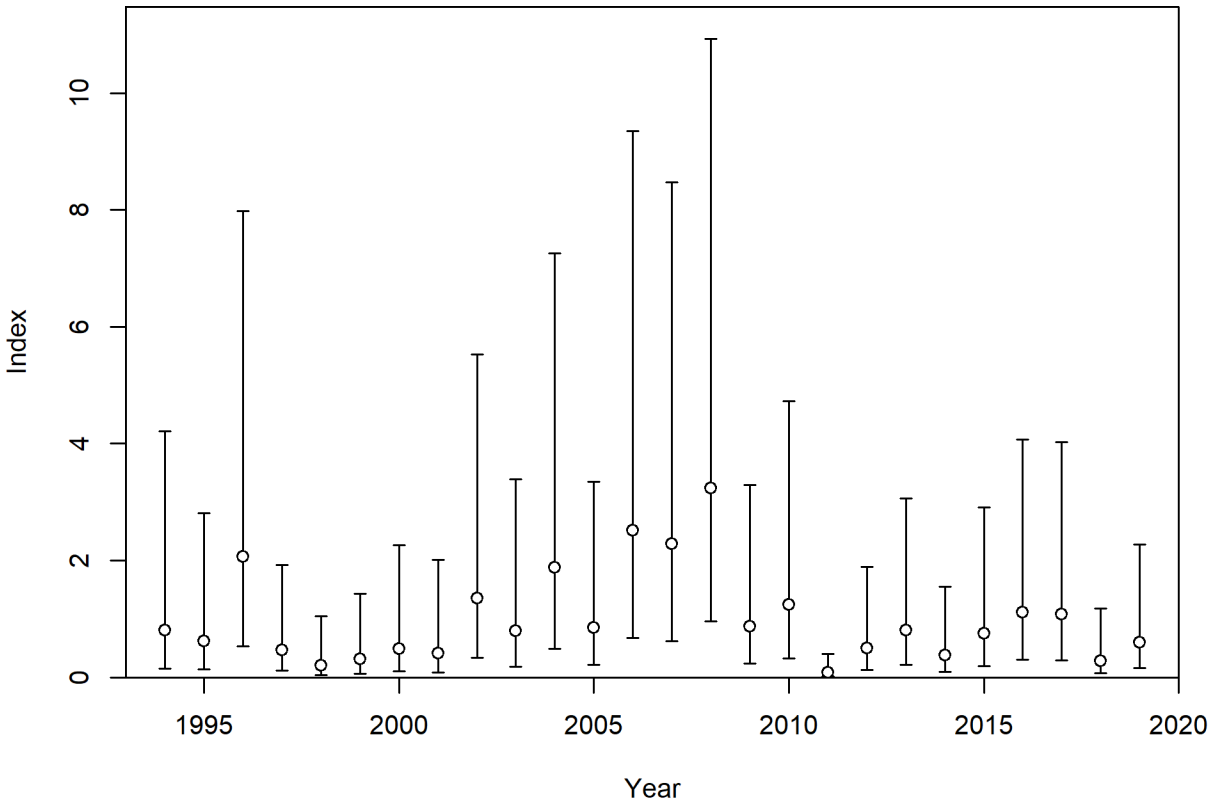


Figure 24. Standardized index of relative abundance and associated 95% uncertainty interval around index values based on the model assumption of lognormal error for Gulf of Mexico Gag Grouper from the Age-0 Survey. The uncertainty displayed includes the additional SE parameter estimated as part of the data weighting process.

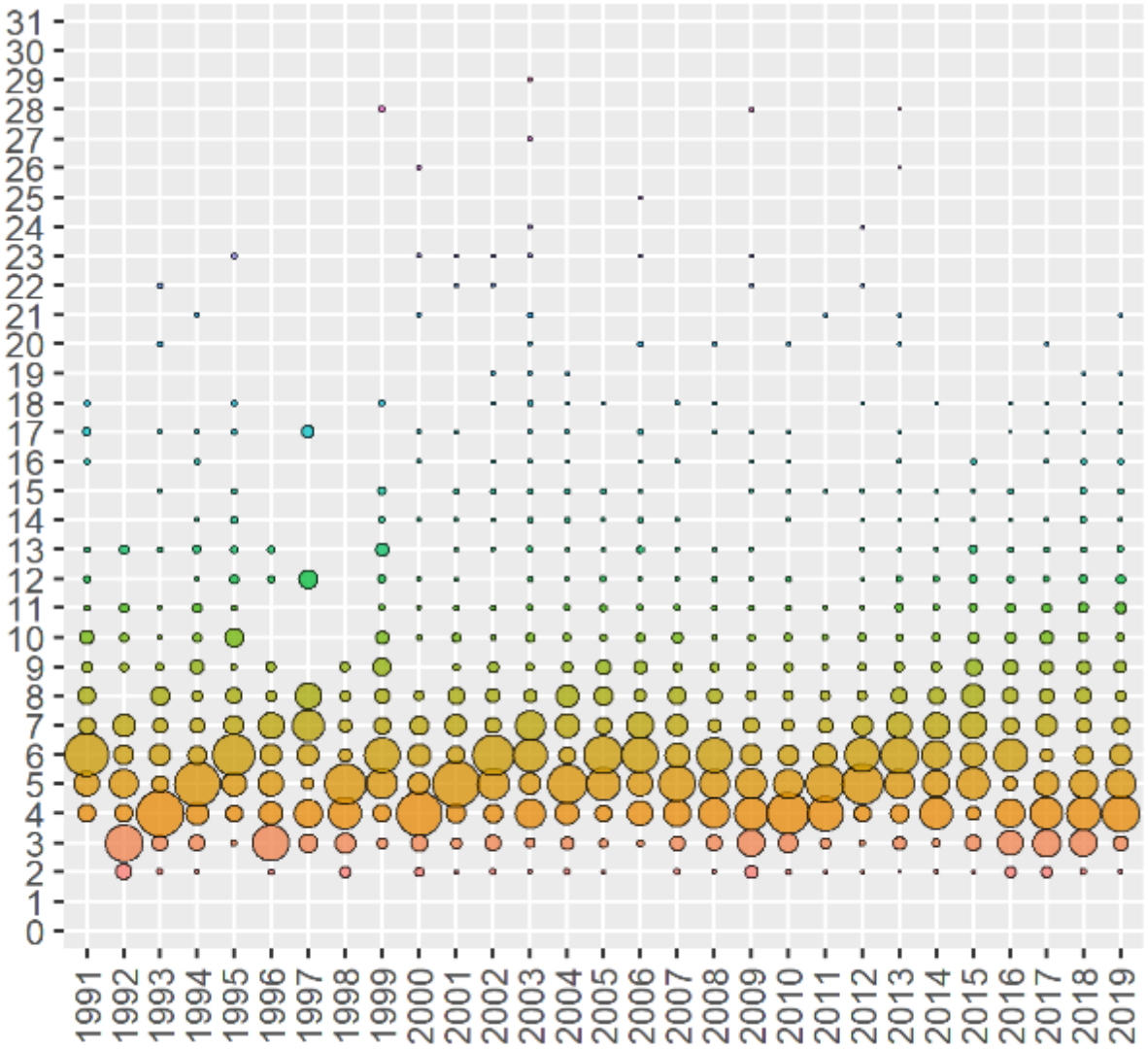


Figure 25. Observed relative age proportions in each year for Gulf of Mexico Gag Grouper in the Commercial Vertical Line + Other fishery. Cohort progressions are evident.

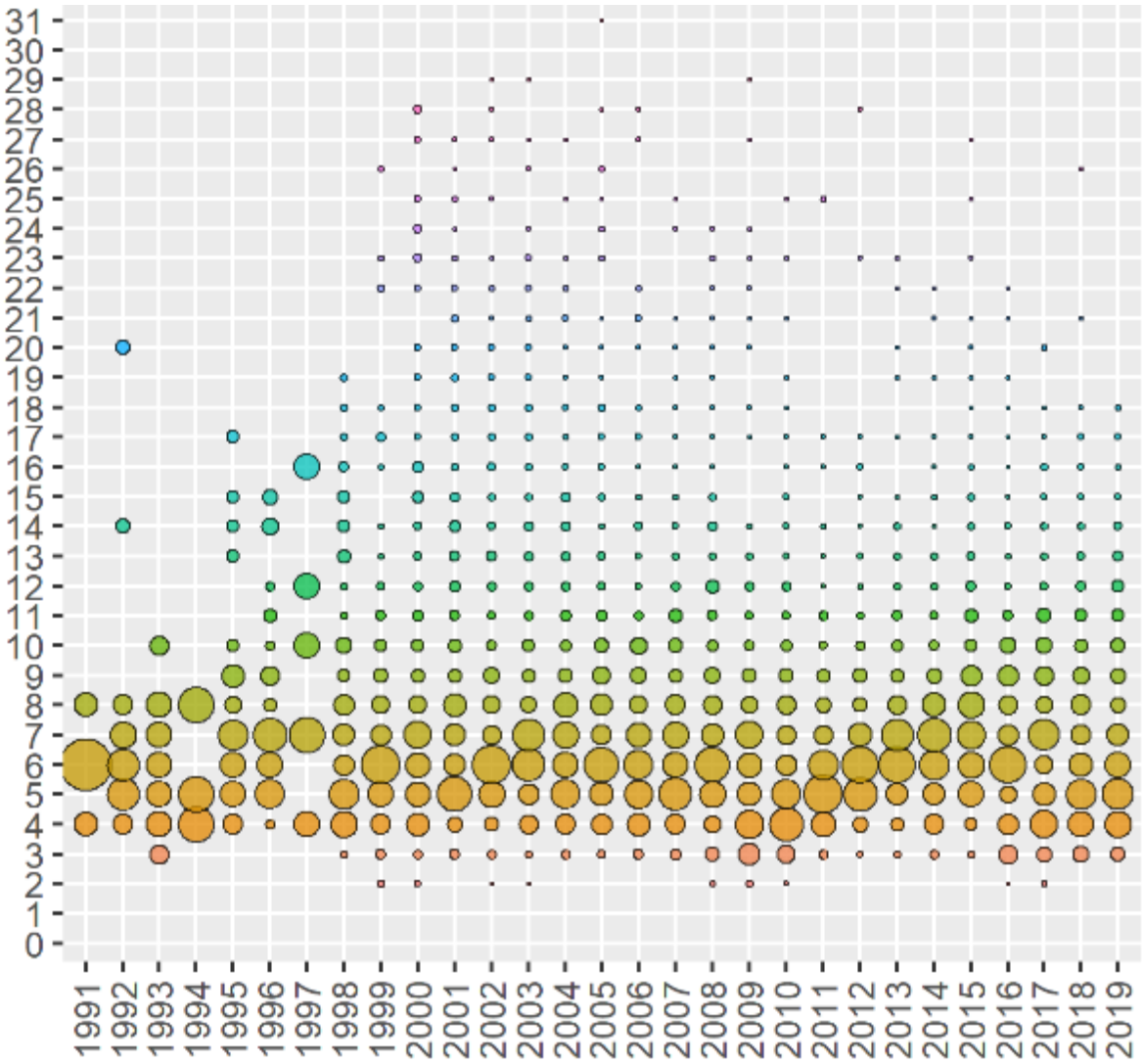


Figure 26. Observed relative age proportions in each year for Gulf of Mexico Gag Grouper in the Commercial Longline fishery. Cohort progressions are evident.

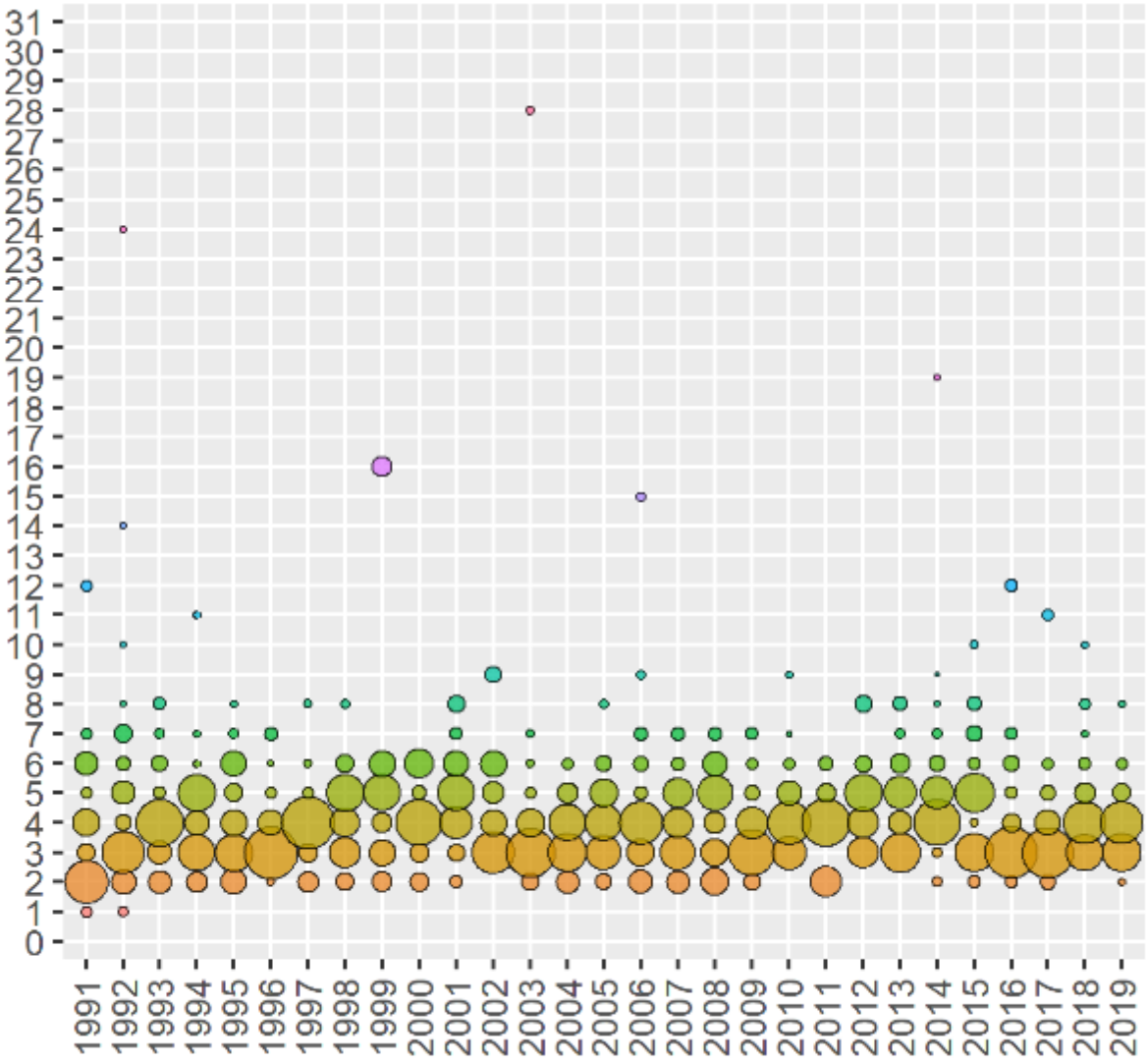


Figure 27. Observed relative age proportions in each year for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Cohort progressions are evident.

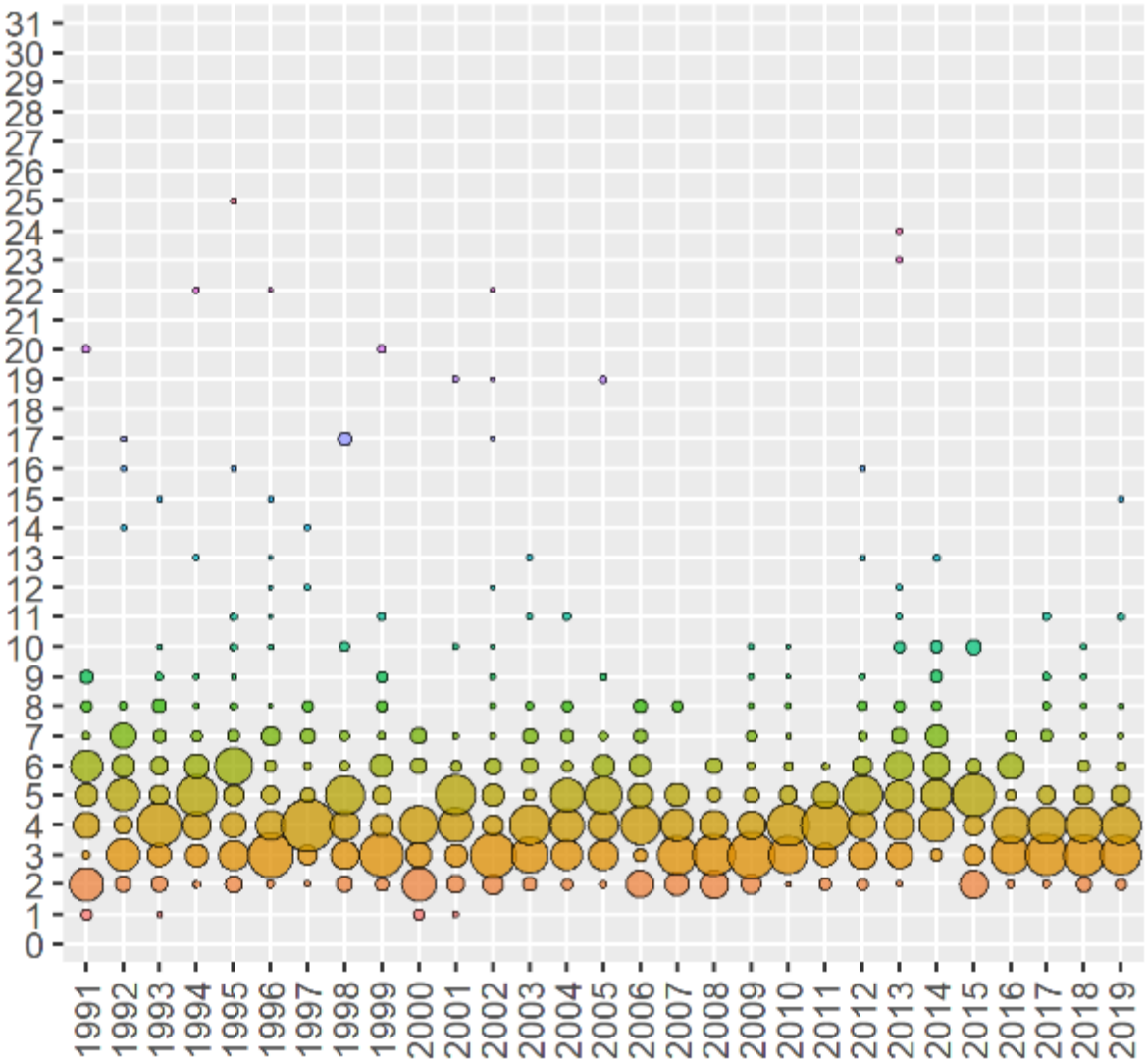


Figure 28. Observed relative age proportions in each year for Gulf of Mexico Gag Grouper in the Recreational Charter fishery. Cohort progressions are evident.

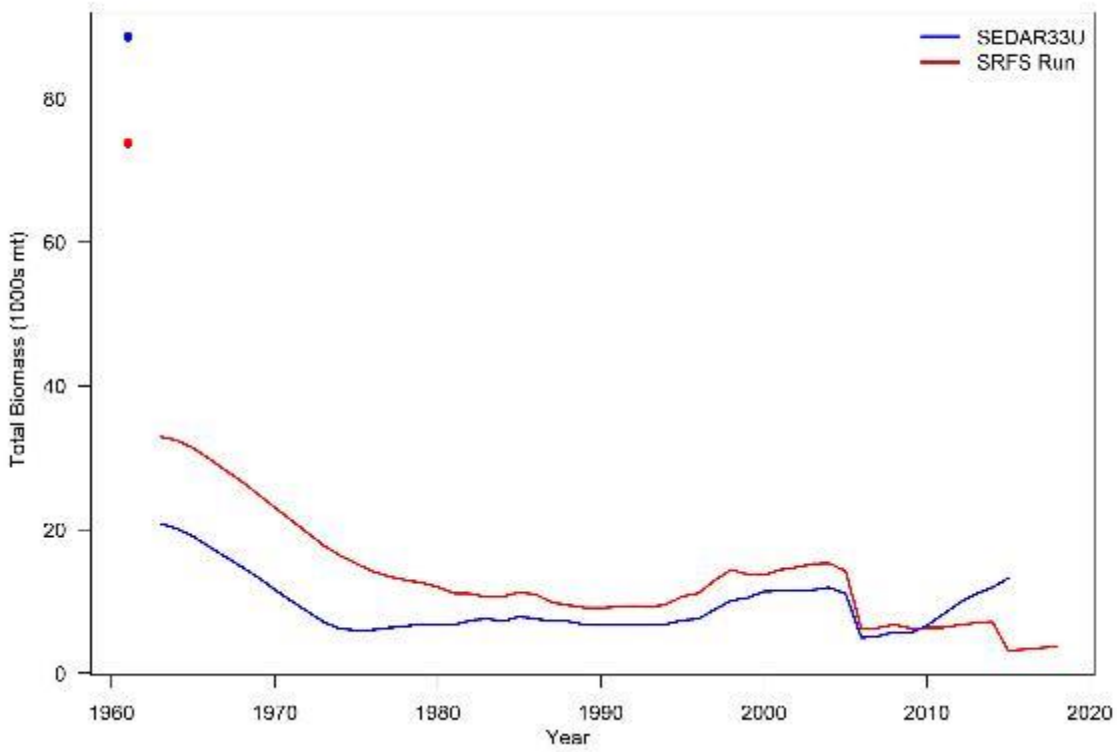


Figure 29. Estimate of total biomass (in 1000s of metric tons) for Gulf of Mexico Gag Grouper.

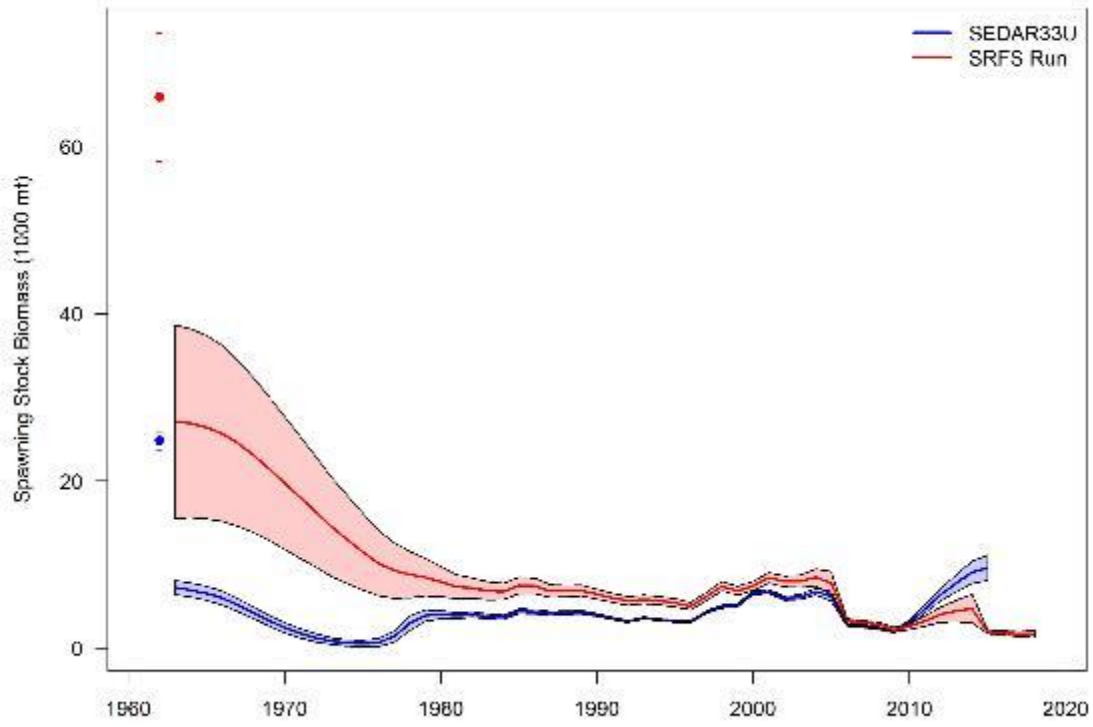


Figure 30. Estimate of spawning stock biomass (in 1000s of metric tons) and associated 95% confidence intervals for Gulf of Mexico Gag Grouper.

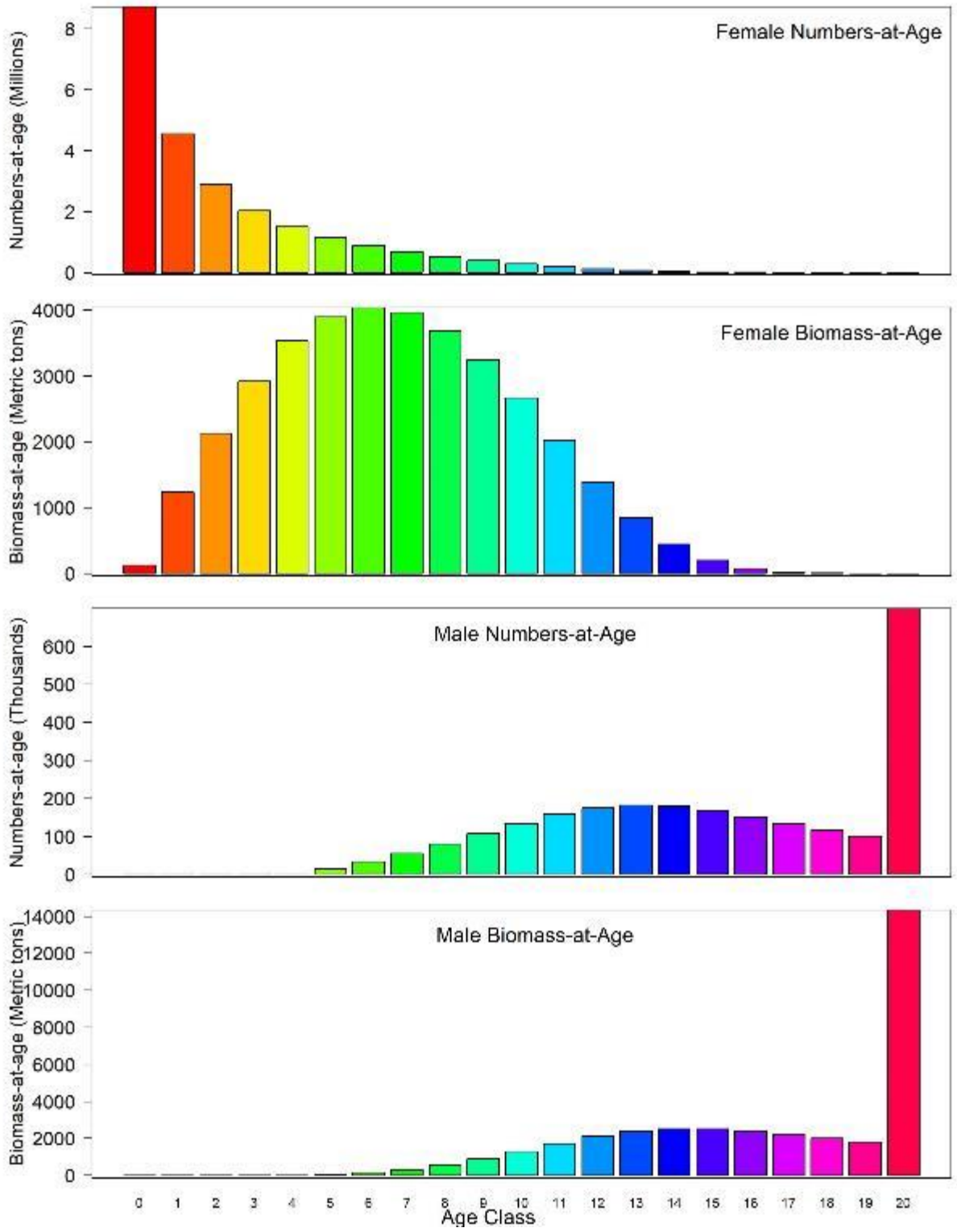
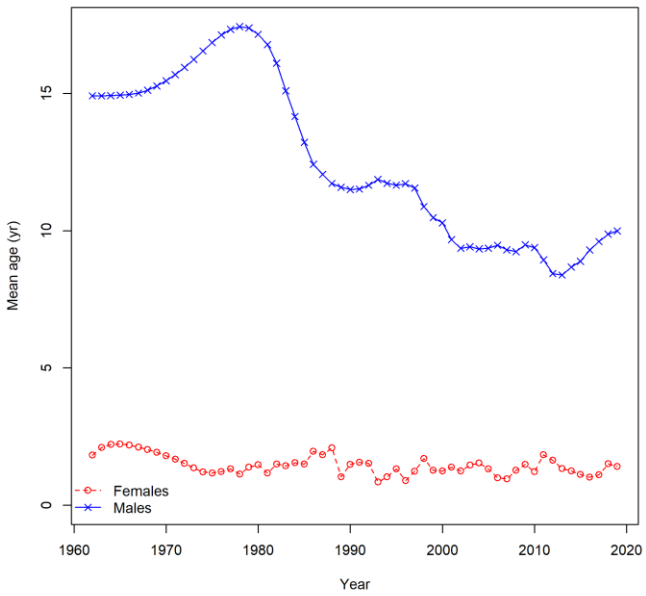


Figure 31. Expected numbers-at-age and biomass-at-age for female and male Gag Grouper in the Gulf of Mexico at virgin stock conditions.

SRFS Run



SEDAR 33U

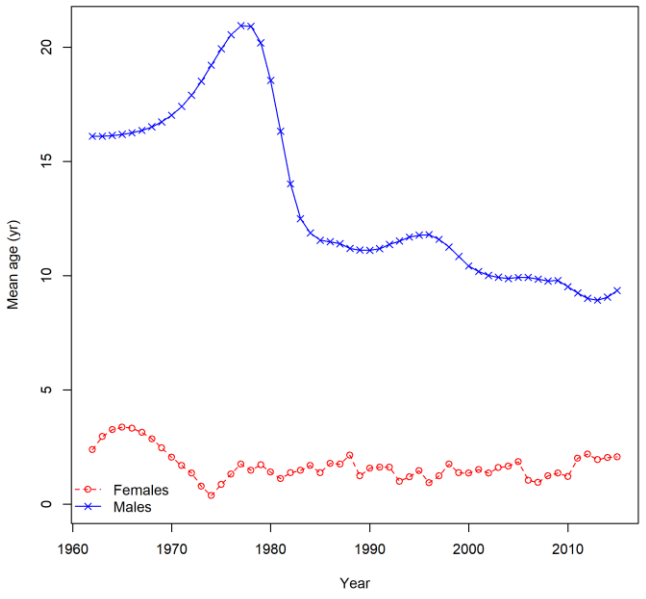


Figure 32. Predicted beginning of year mean age in the population by sex for Gulf of Mexico Gag Grouper.

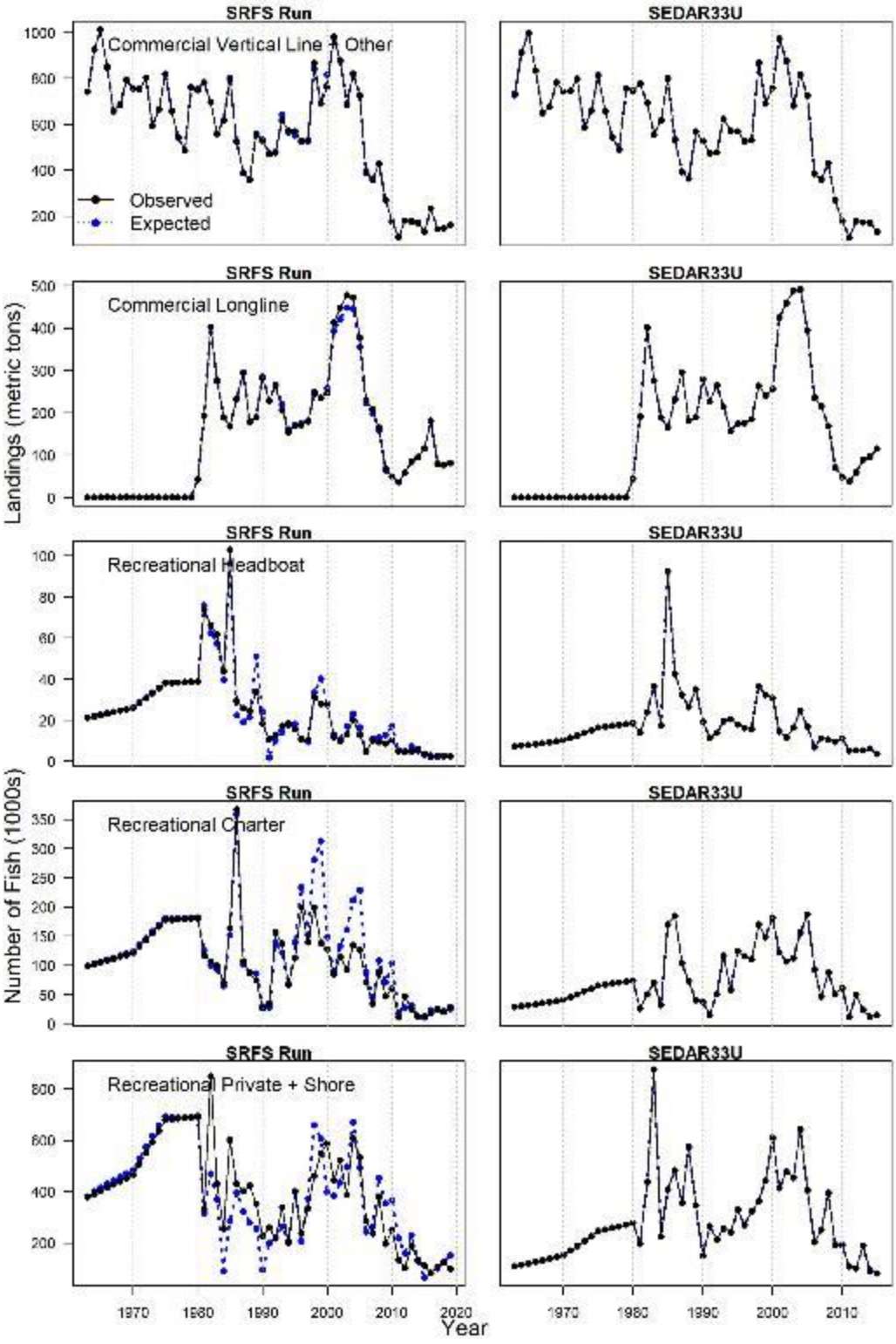


Figure 33. Gulf of Mexico Gag Grouper observed and expected landings by fishery for SRFS Run (left panels) and SEDAR 33U (right panels). Commercial and recreational landings are in metric tons and numbers of fish, respectively. Dashed vertical lines identify ten year intervals.

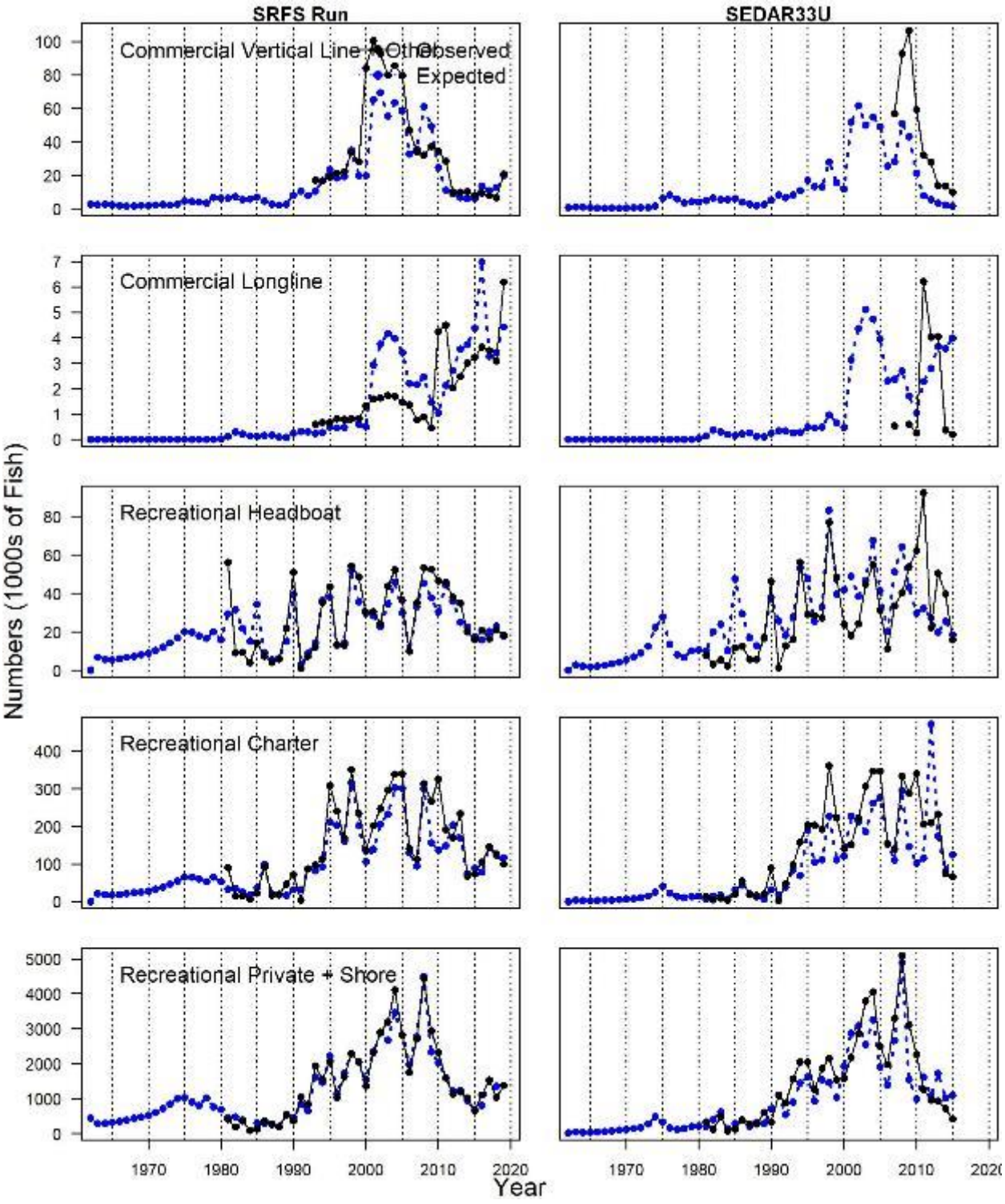


Figure 34. Gulf of Mexico Gag Grouper observed and expected discards by fishery for SRFS Run (left panels) and SEDAR 33U (right panels). Commercial and recreational discards are in numbers of fish, respectively. Dashed vertical lines identify five year intervals.

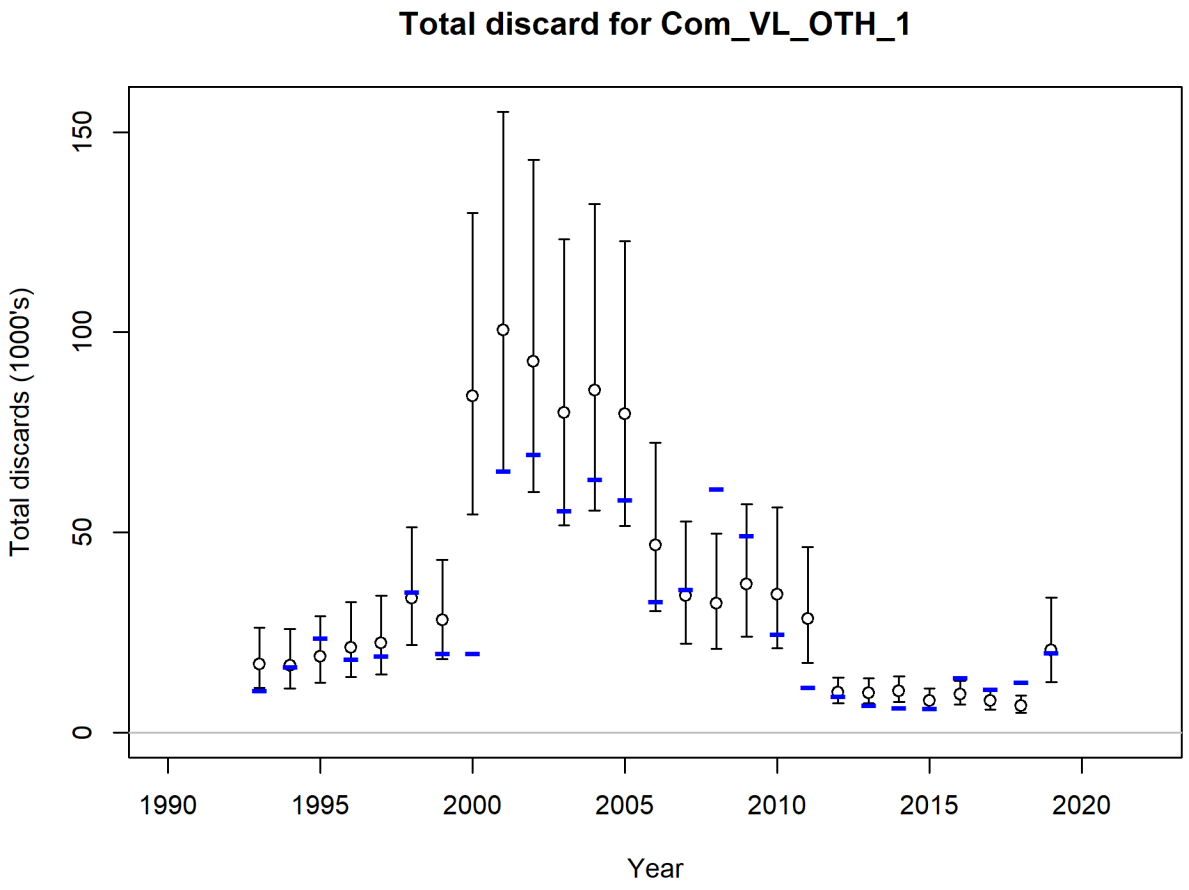


Figure 35. Input (dots with 95% confidence intervals) and expected (blue lines) discards by the Commercial Vertical Line + Other for Gulf of Mexico Gag Grouper. Discards are in numbers of fish (1,000s) and reflect released fish (i.e., before discard mortality has been applied).

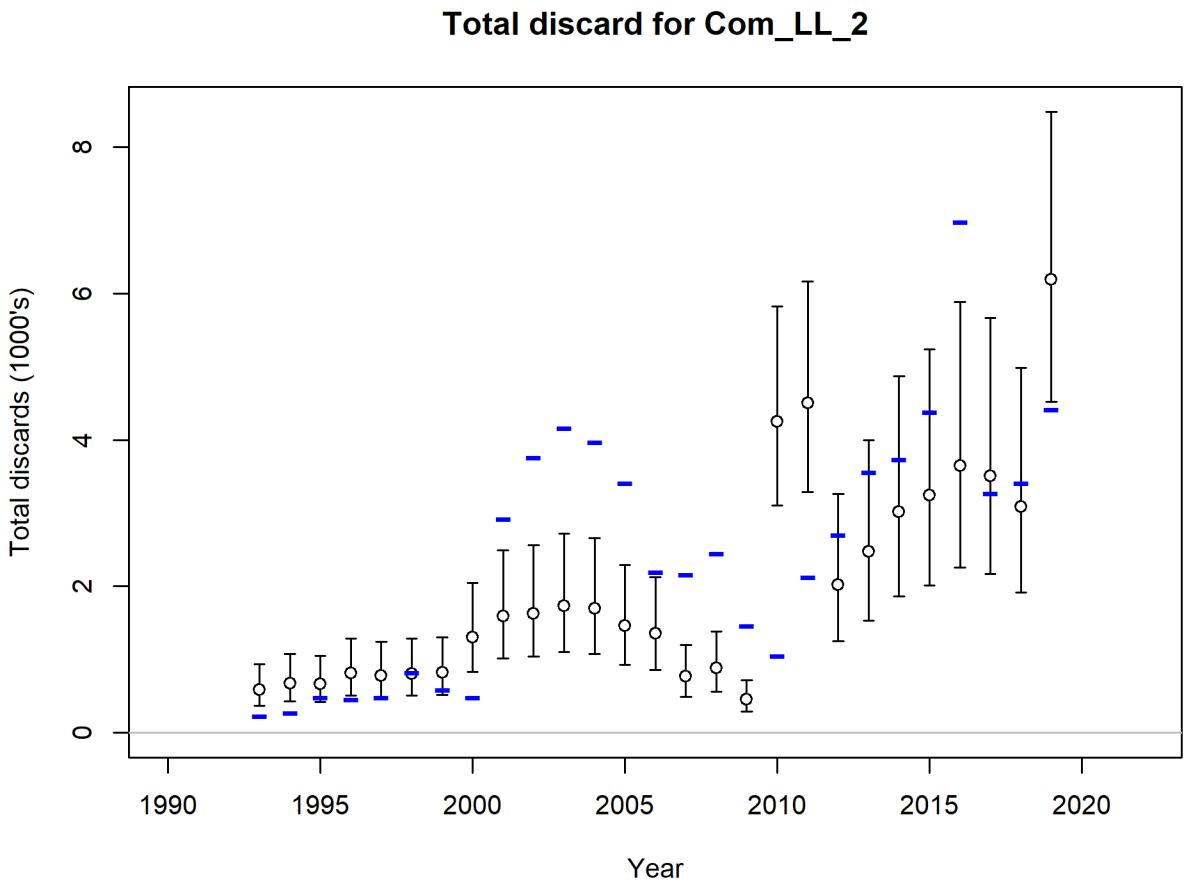


Figure 36. Input (dots with 95% confidence intervals) and expected (blue lines) discards by the Commercial Longline for Gulf of Mexico Gag Grouper. Discards are in numbers of fish (1,000s) and reflect released fish (i.e., before discard mortality has been applied).

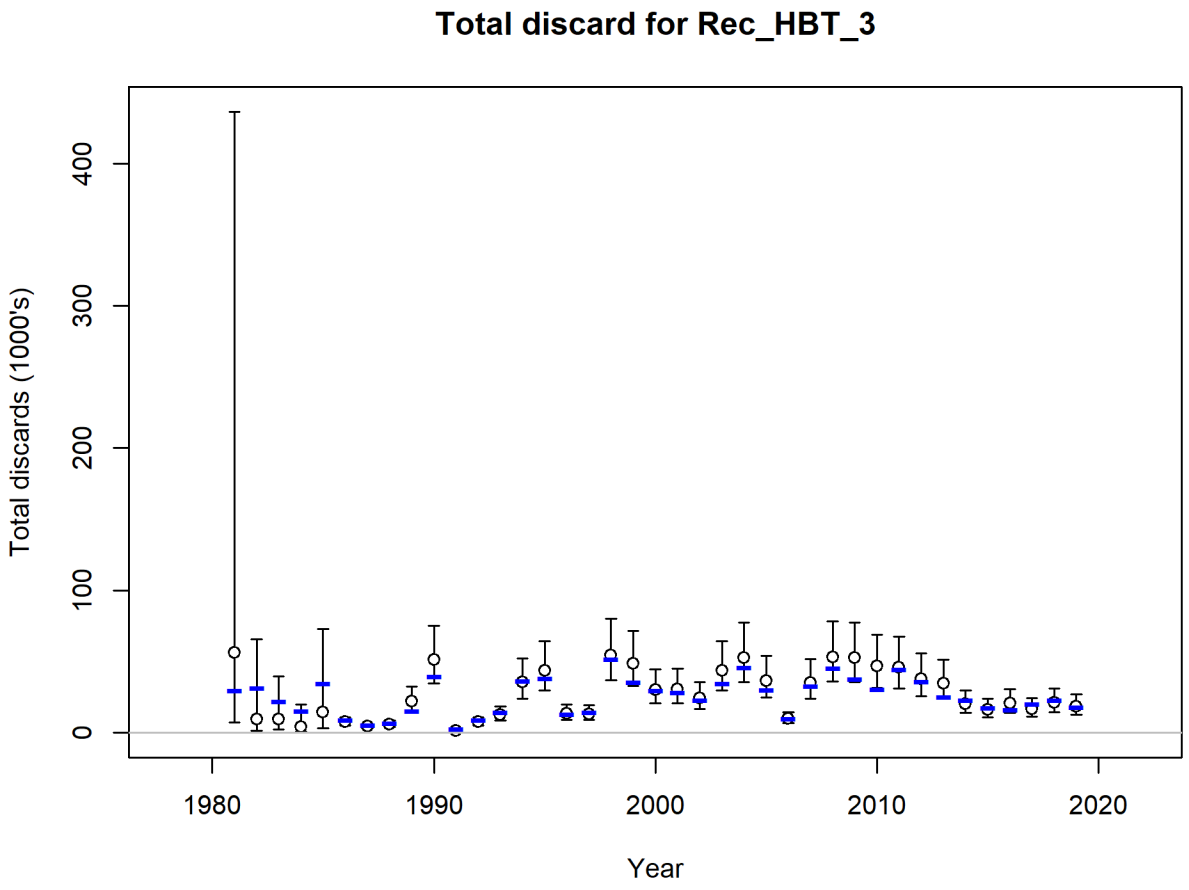


Figure 37. Input (dots with 95% confidence intervals) and expected (blue lines) discards by the Recreational Headboat for Gulf of Mexico Gag Grouper. Discards are in numbers of fish (1,000s) and reflect released fish (i.e., before discard mortality has been applied).

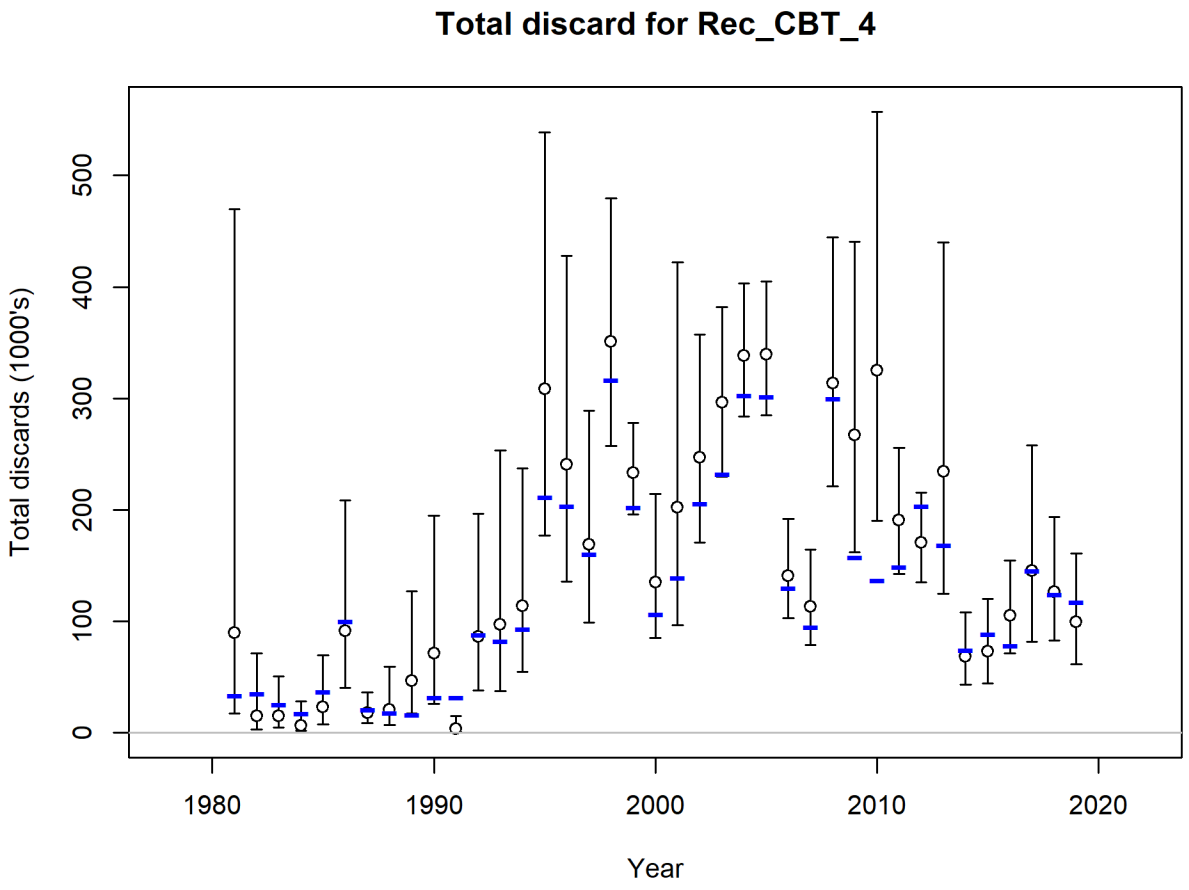


Figure 38. Input (dots with 95% confidence intervals) and expected (blue lines) discards by the Recreational Charter for Gulf of Mexico Gag Grouper. Discards are in numbers of fish (1,000s) and reflect released fish (i.e., before discard mortality has been applied).

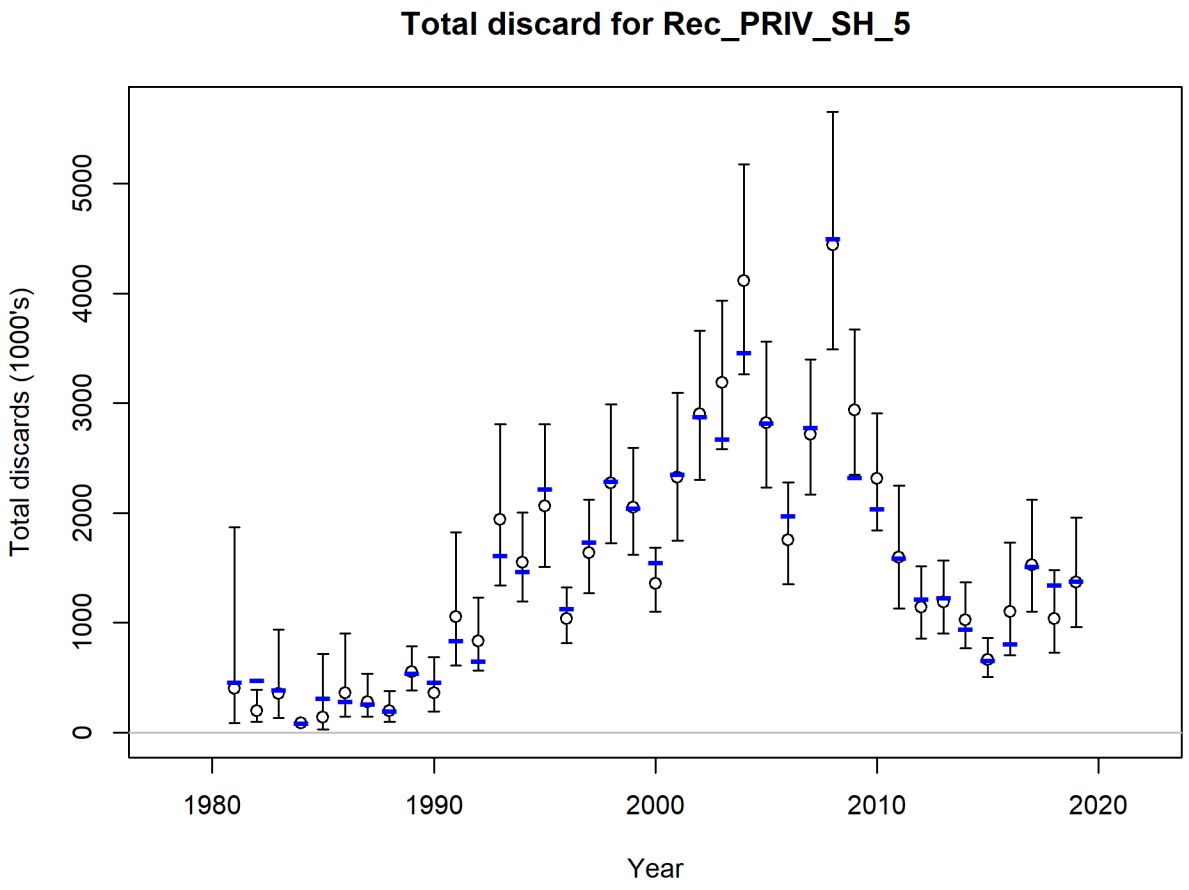


Figure 39. Input (dots with 95% confidence intervals) and expected (blue lines) discards by the Recreational Private + Shore for Gulf of Mexico Gag Grouper. Discards are in numbers of fish (1,000s) and reflect released fish (i.e., before discard mortality has been applied).

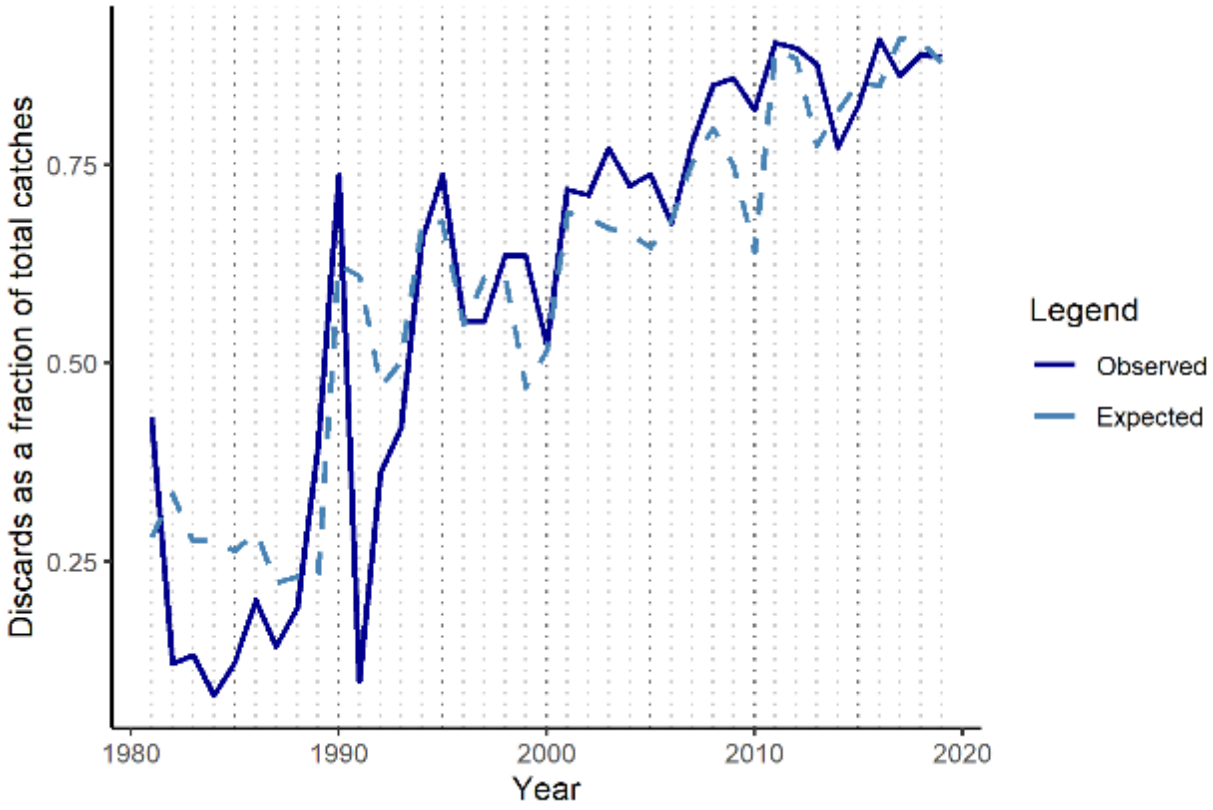


Figure 40. Observed and expected discard rates by the Recreational Headboat for Gulf of Mexico Gag Grouper.

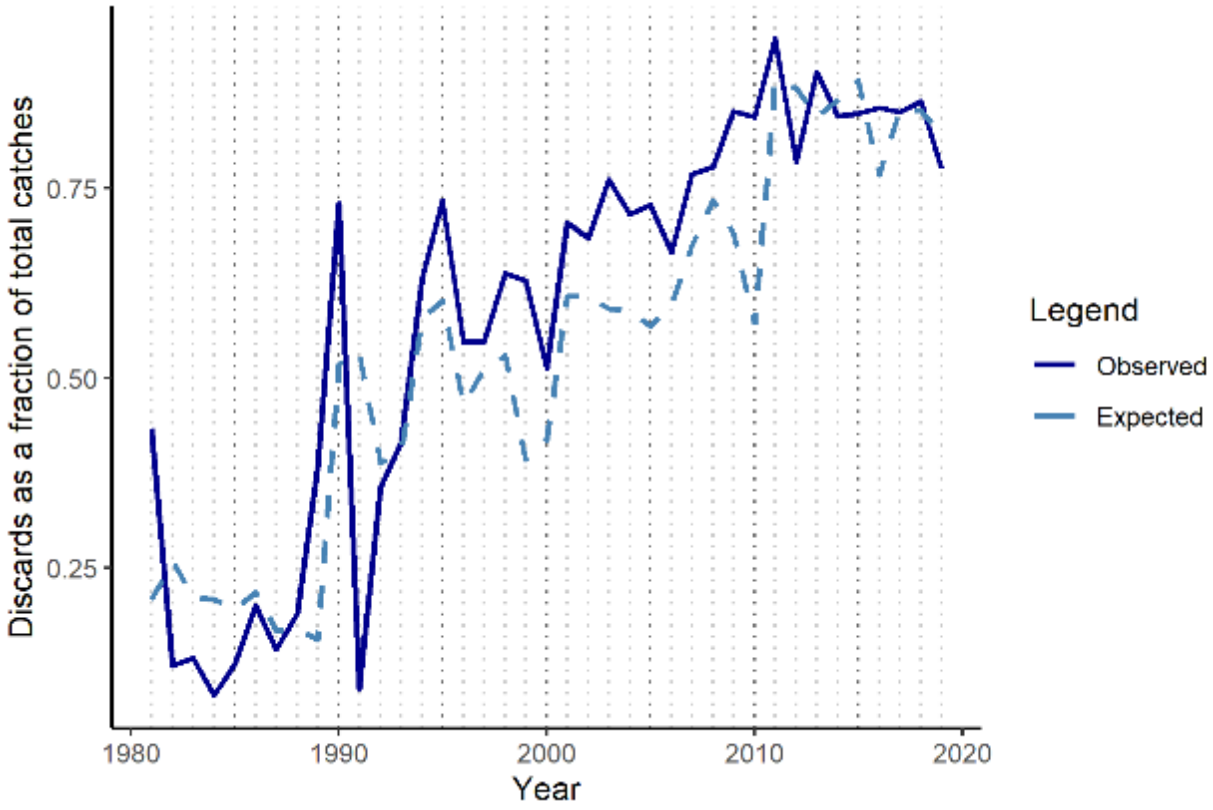


Figure 41. Observed and expected discard rates by the Recreational Charter for Gulf of Mexico Gag Grouper.

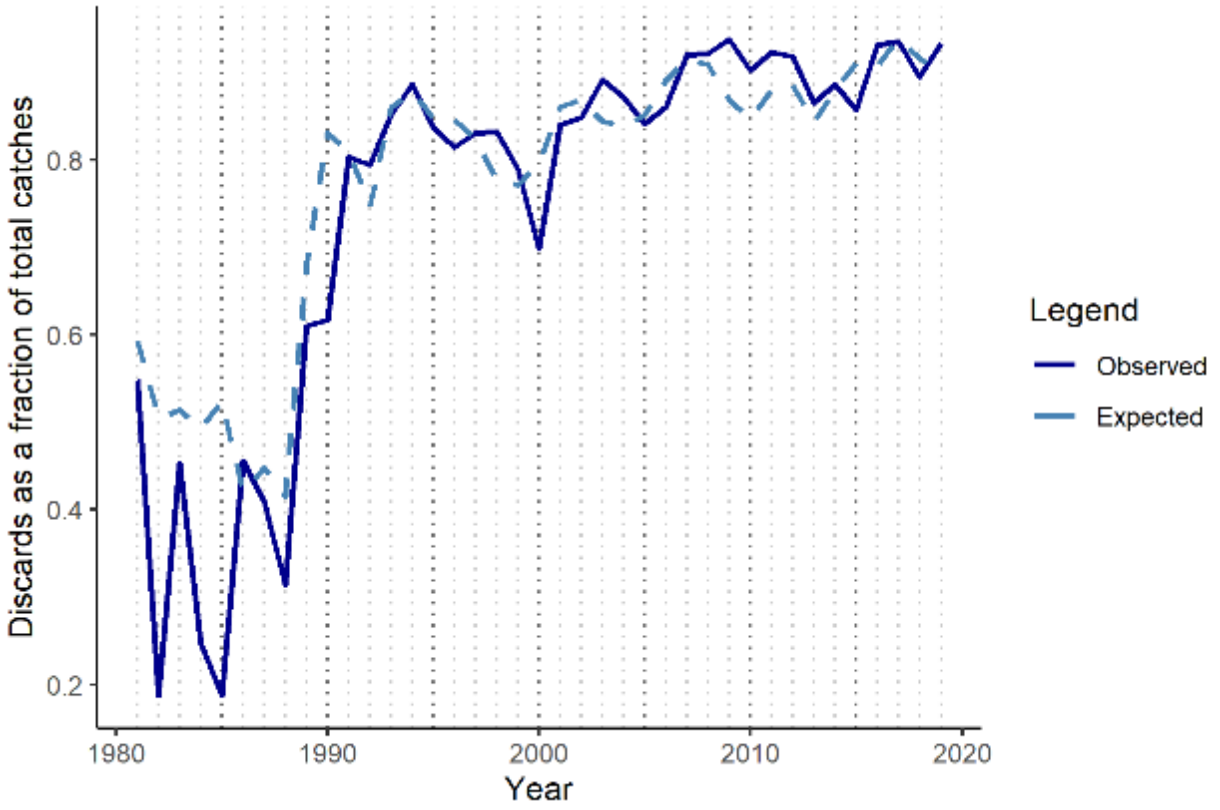


Figure 42. Observed and expected discard rates by the Recreational Charter for Gulf of Mexico Gag Grouper.

SRFS Run

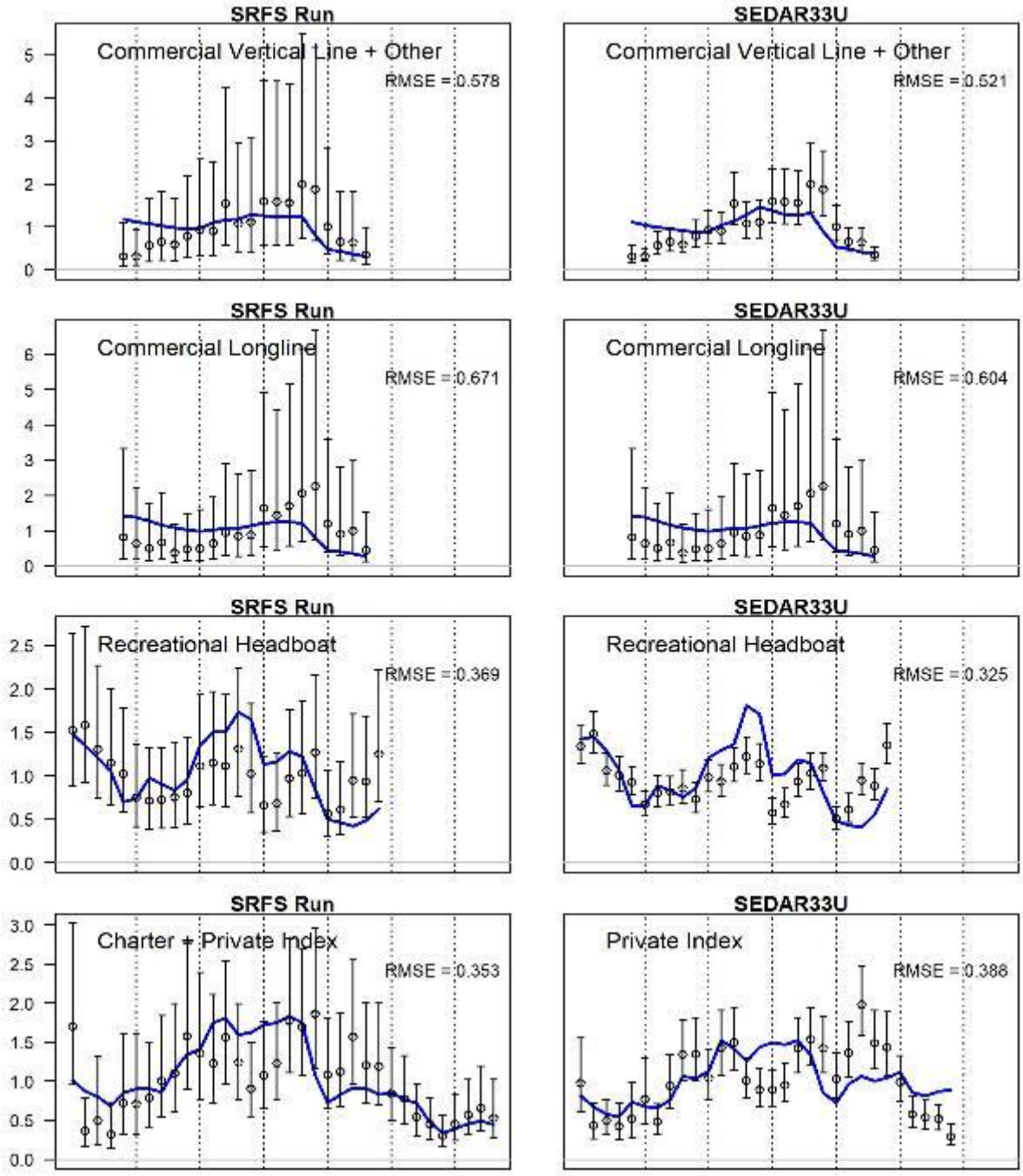


Figure 43. Gulf of Mexico Gag Grouper observed and expected indices for SRFS Run (left panels) and SEDAR 33U (right panels). Dashed vertical lines identify five year intervals. The root mean squared error (RMSE) is also provided.

SEDAR 33U

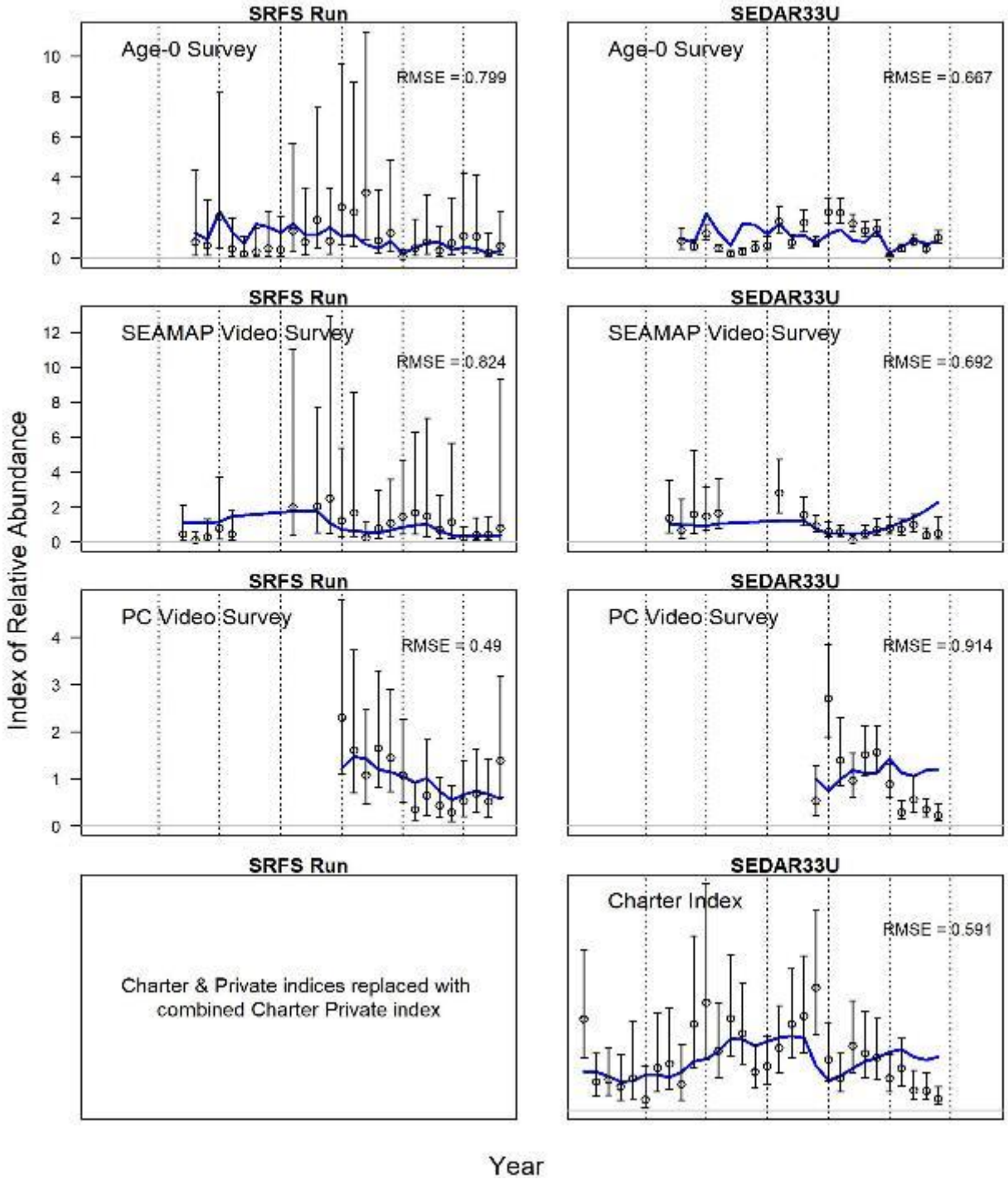


Figure 43 Continued. Gulf of Mexico Gag Grouper observed and expected indices for SRFS Run (left panels) and SEDAR 33U (right panels). Dashed vertical lines identify five year intervals. The root mean squared error (RMSE) is also provided.

SRFS Run

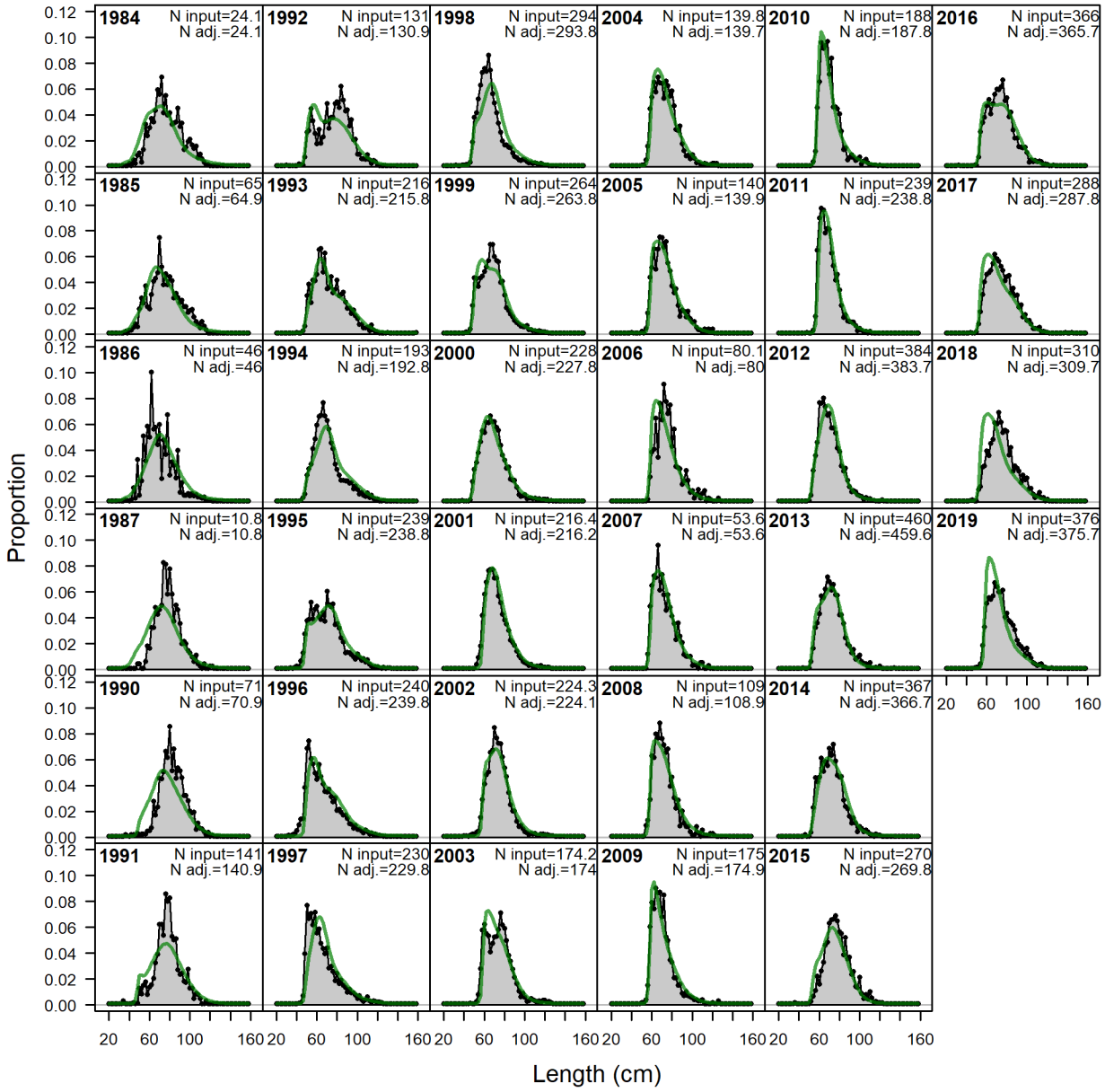


Figure 44. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Vertical Line + Other fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input 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

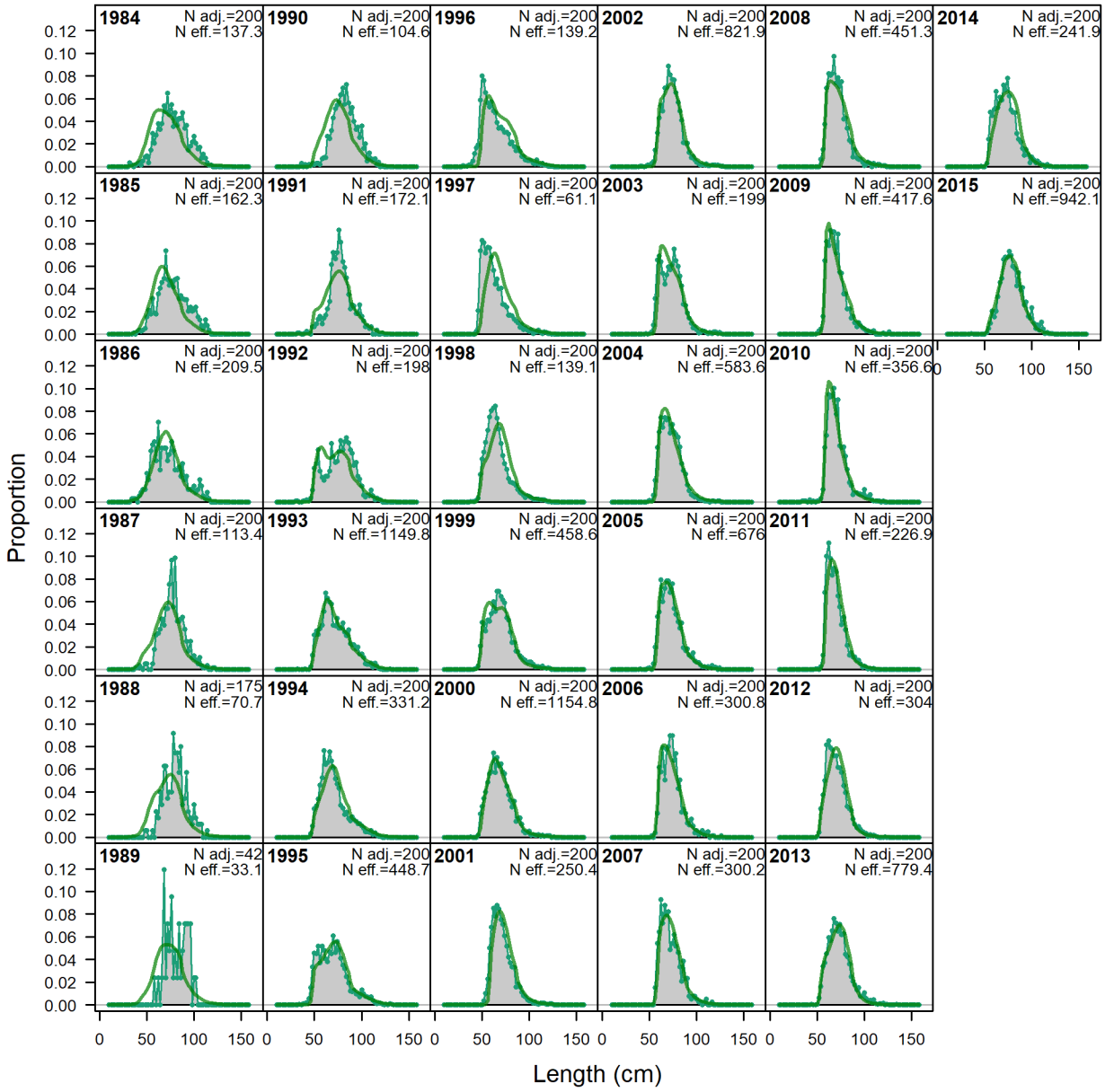


Figure 44 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Vertical Line + Other fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is 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

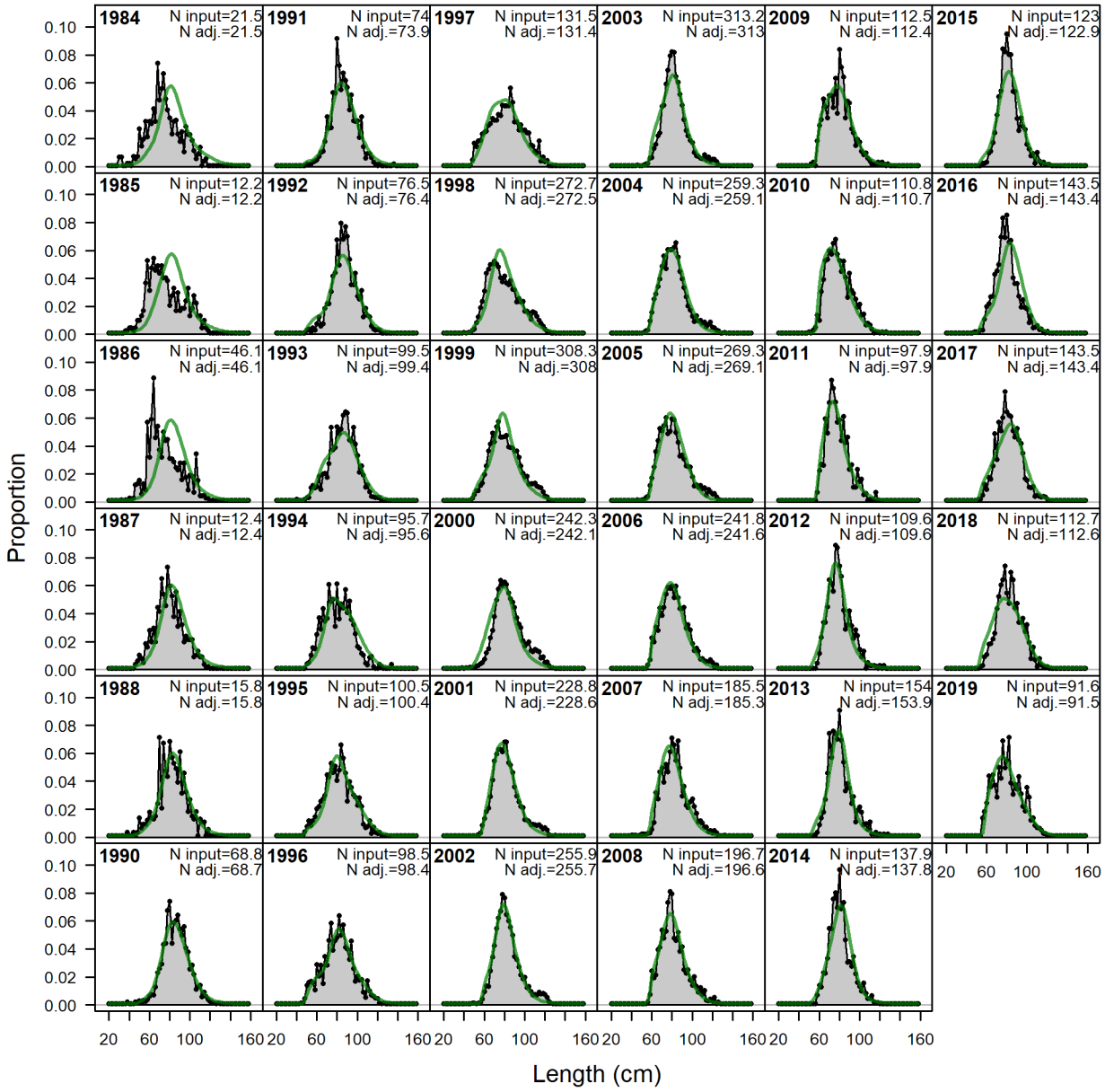


Figure 45. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Longline fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample size and '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

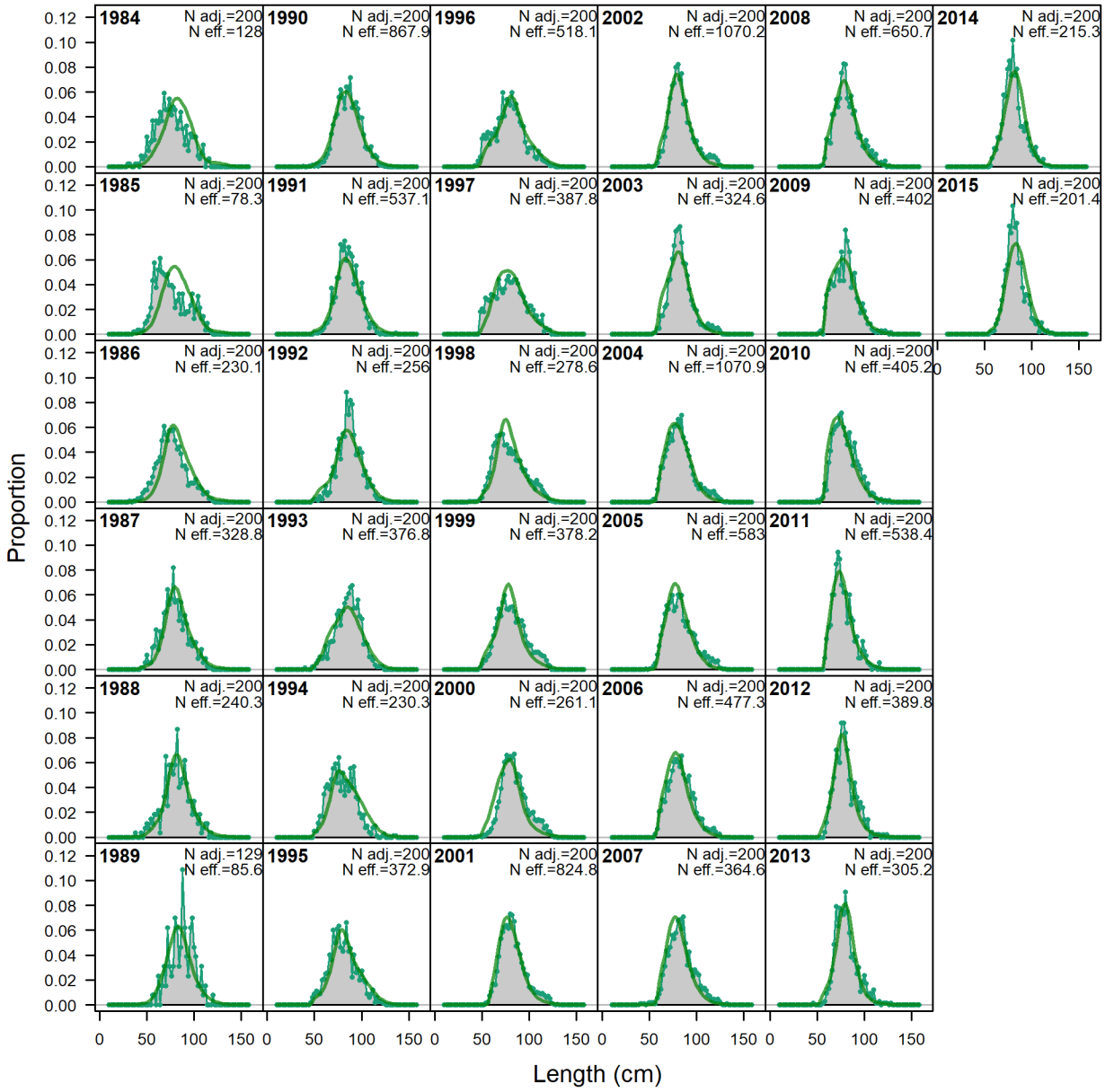


Figure 45 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Longline fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

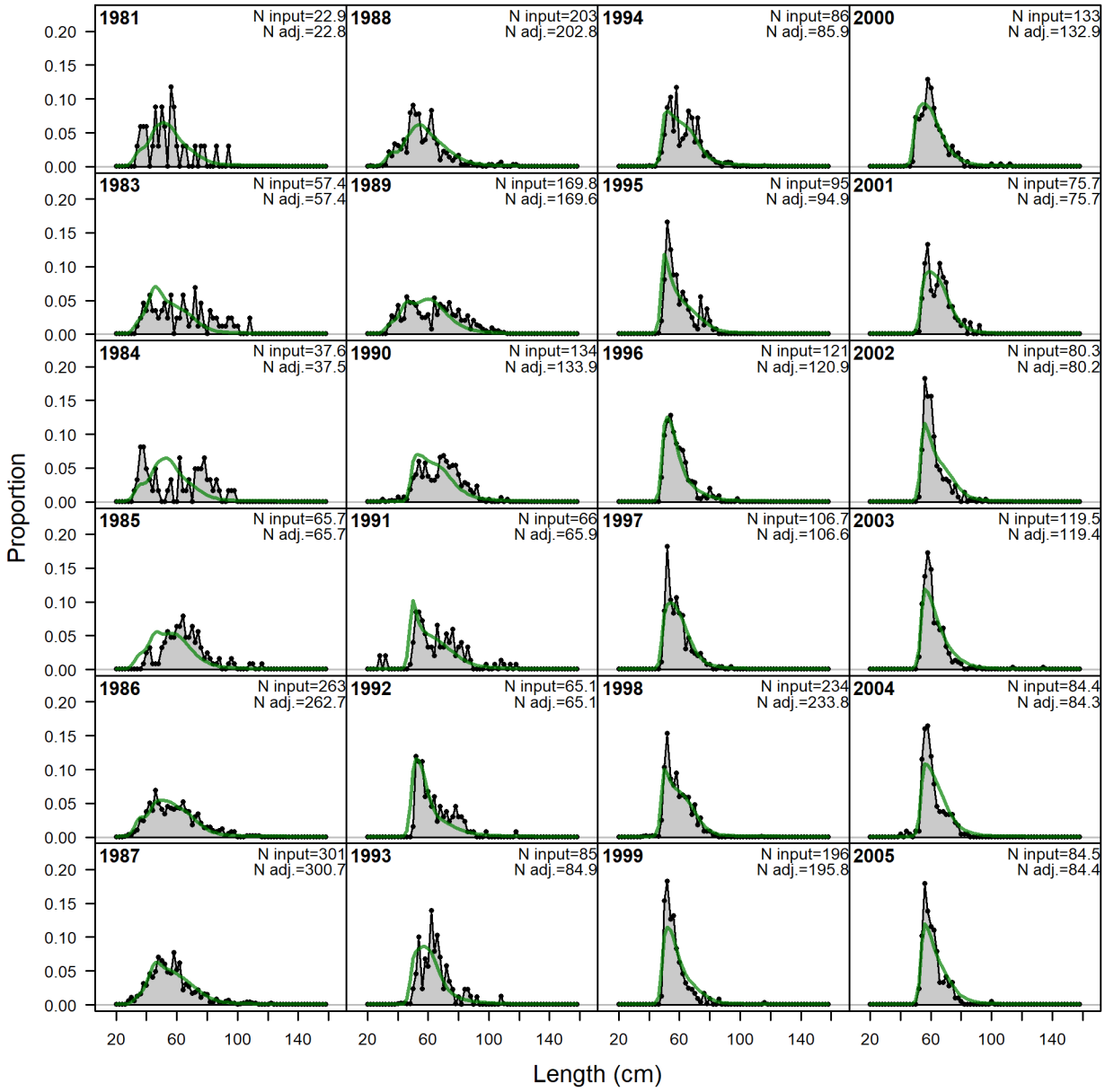


Figure 46. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample size 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

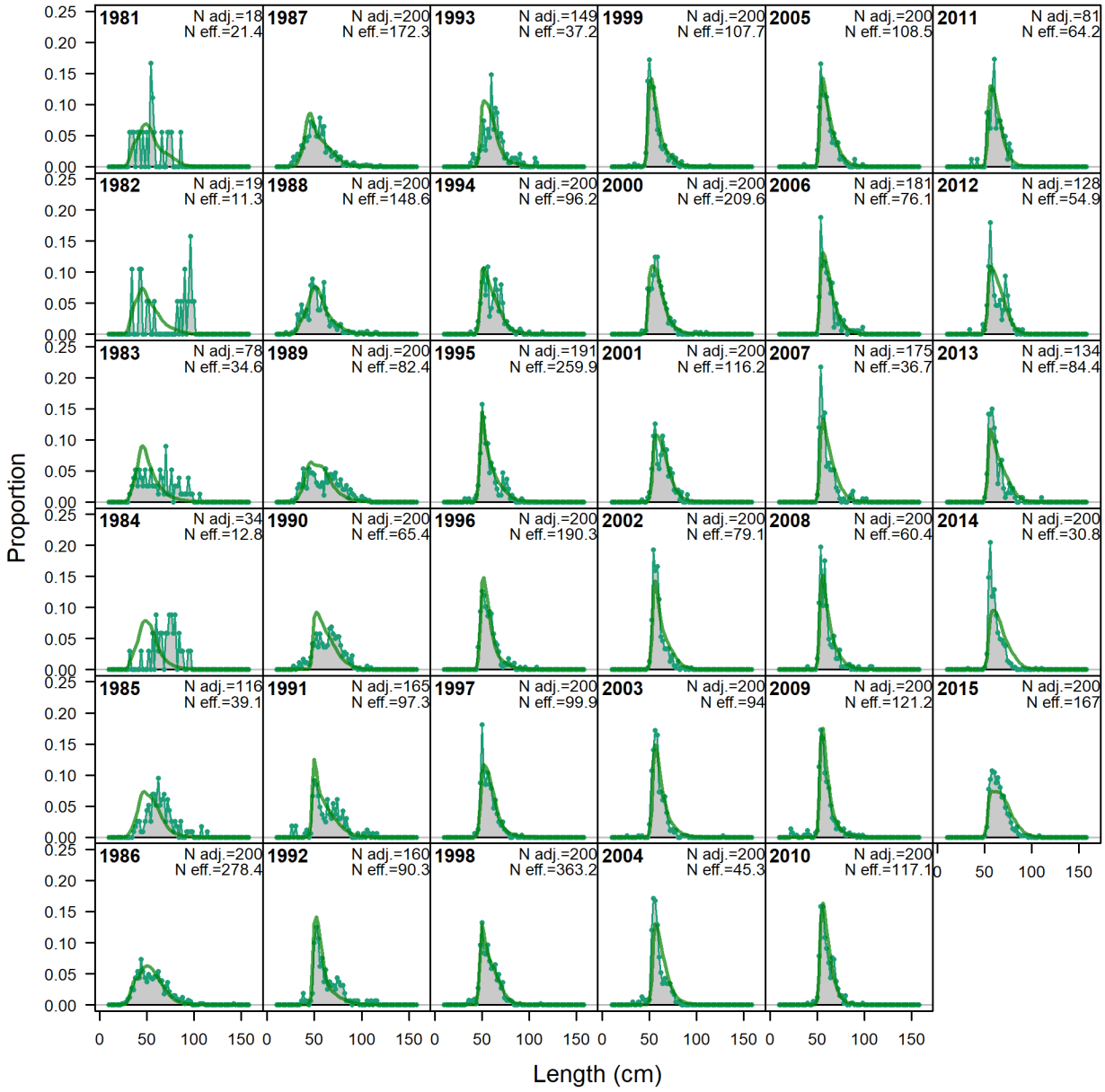


Figure 46 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

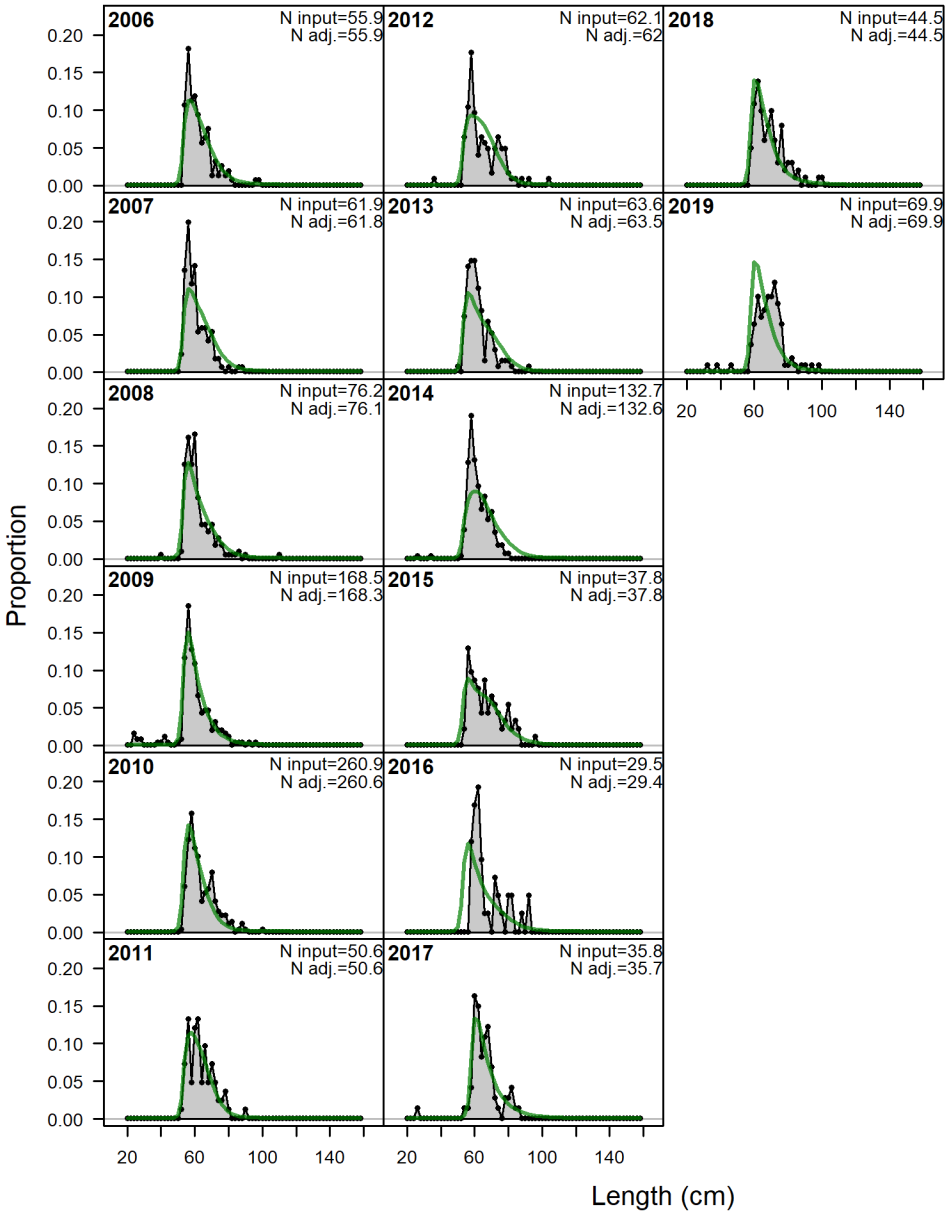


Figure 46 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

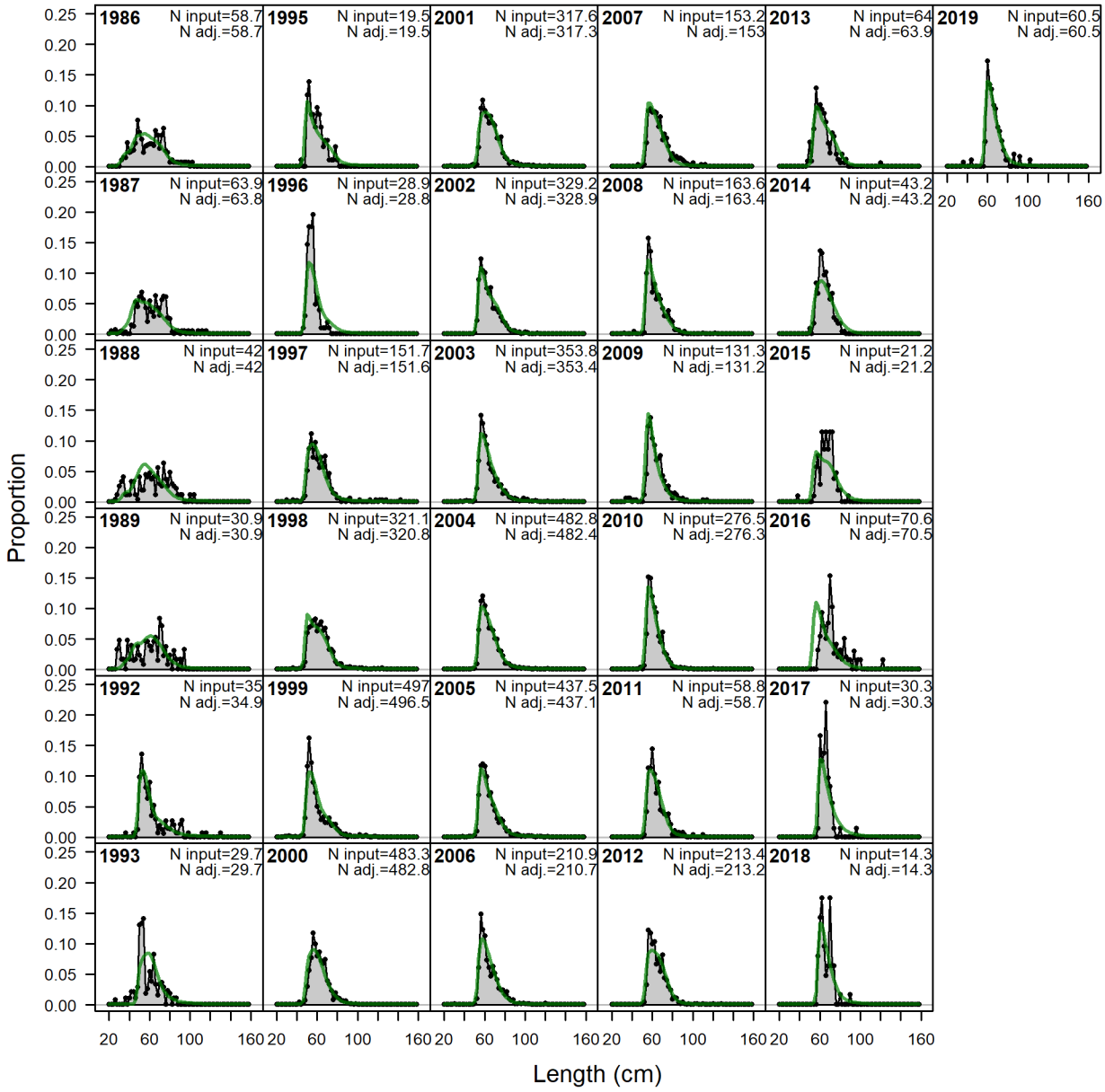


Figure 47. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Charter fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample size 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

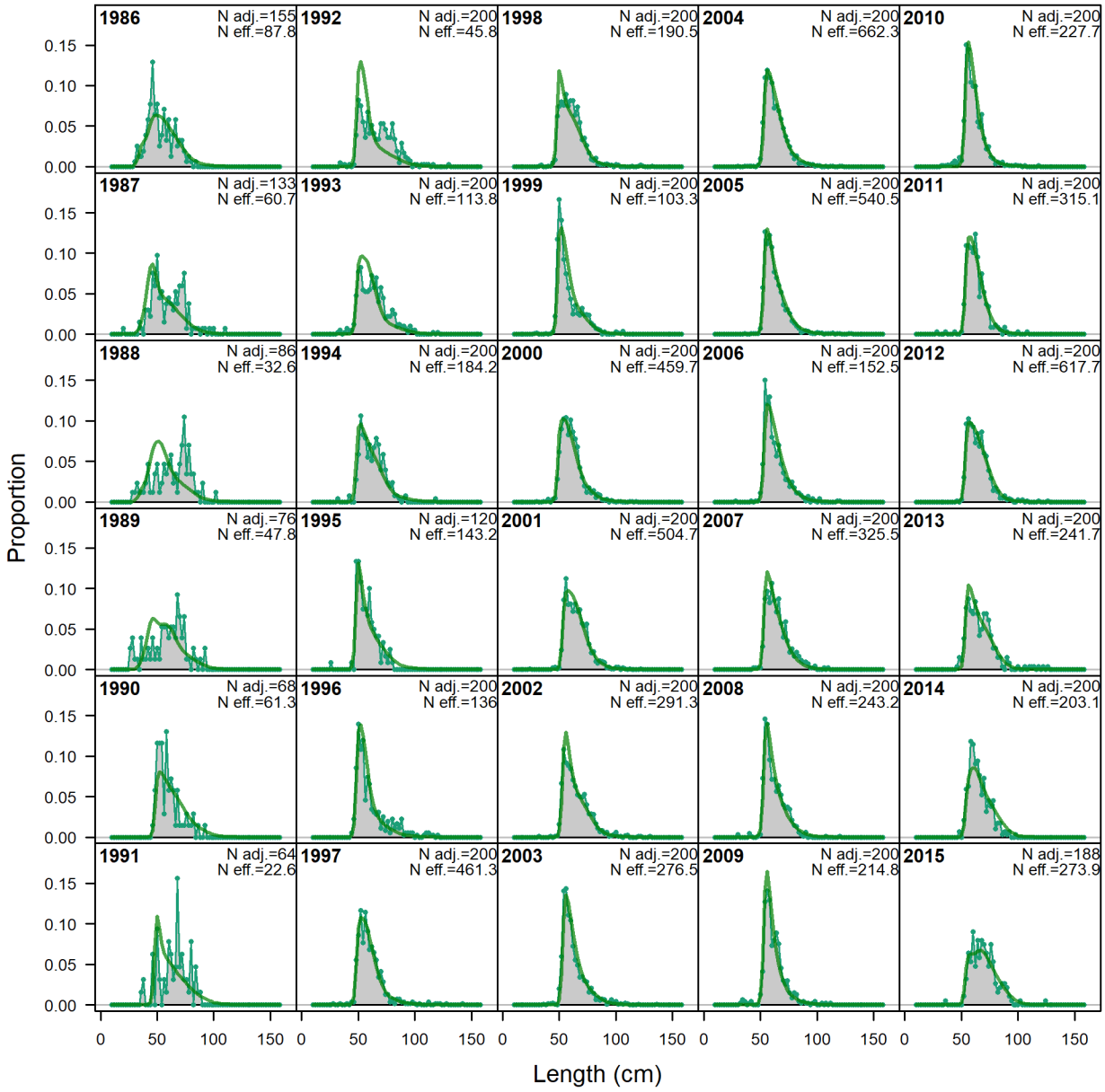


Figure 47 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Charter fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

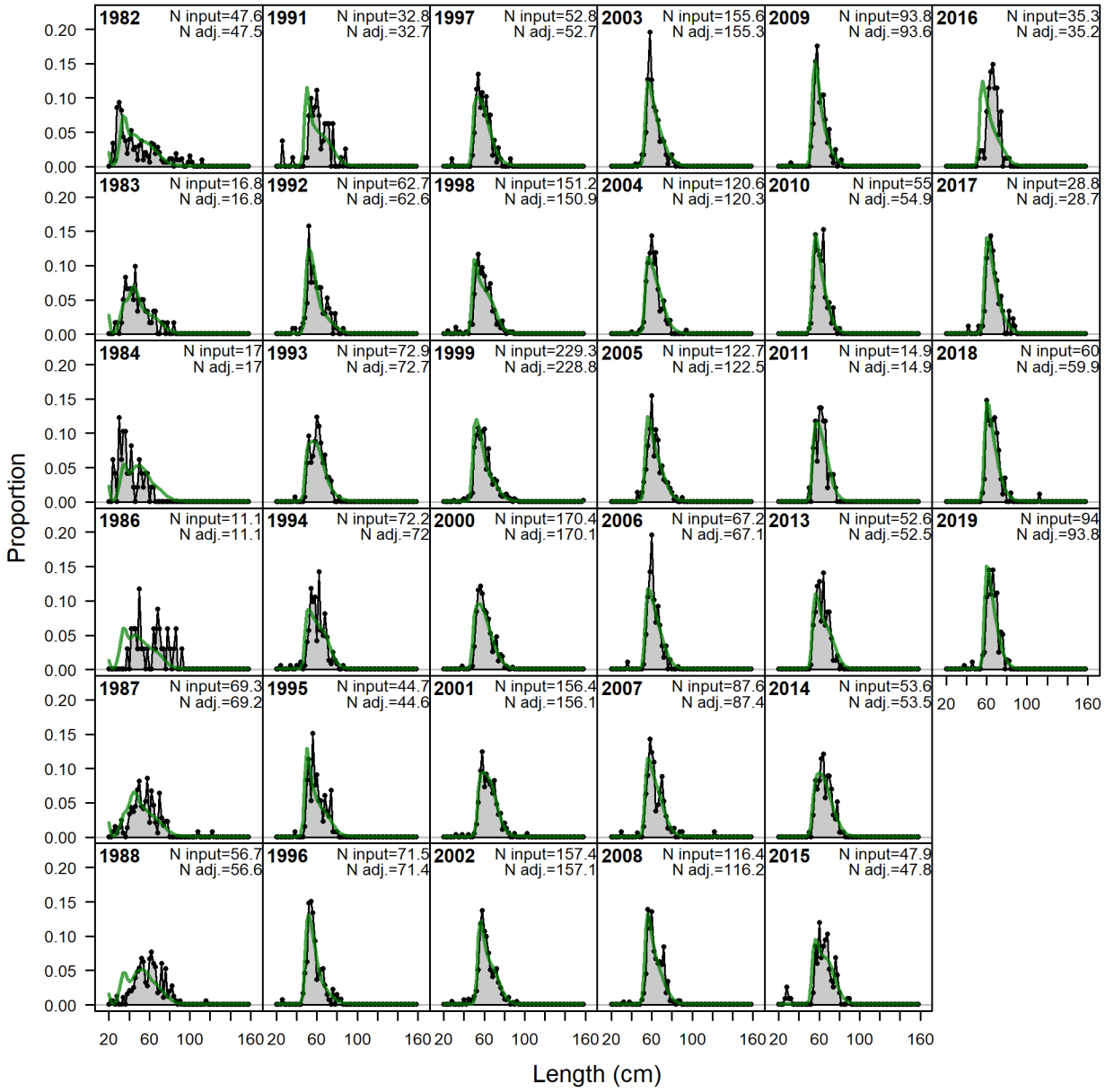


Figure 48. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Private + Shore fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

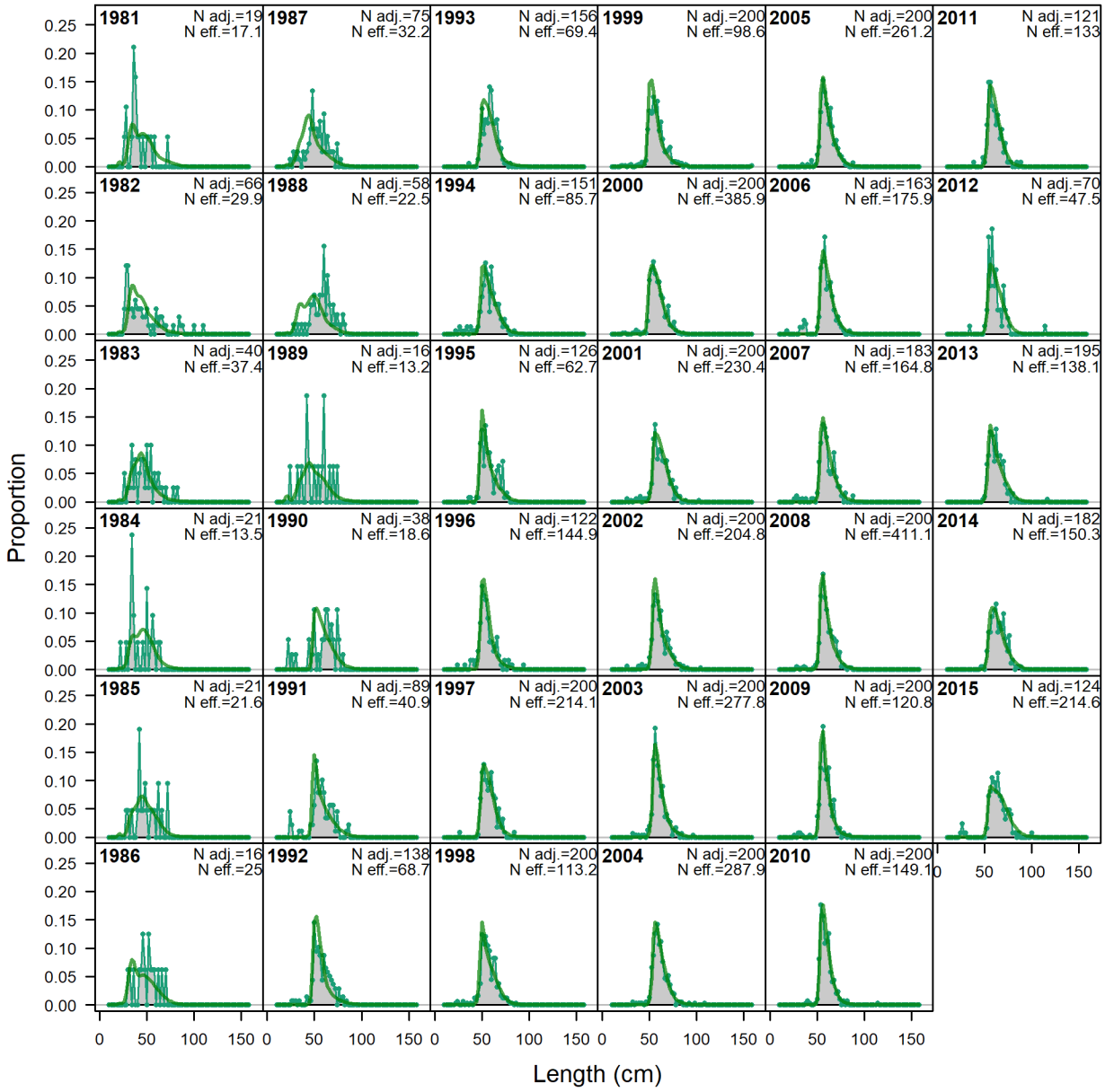


Figure 48 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Private + Shore fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the 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

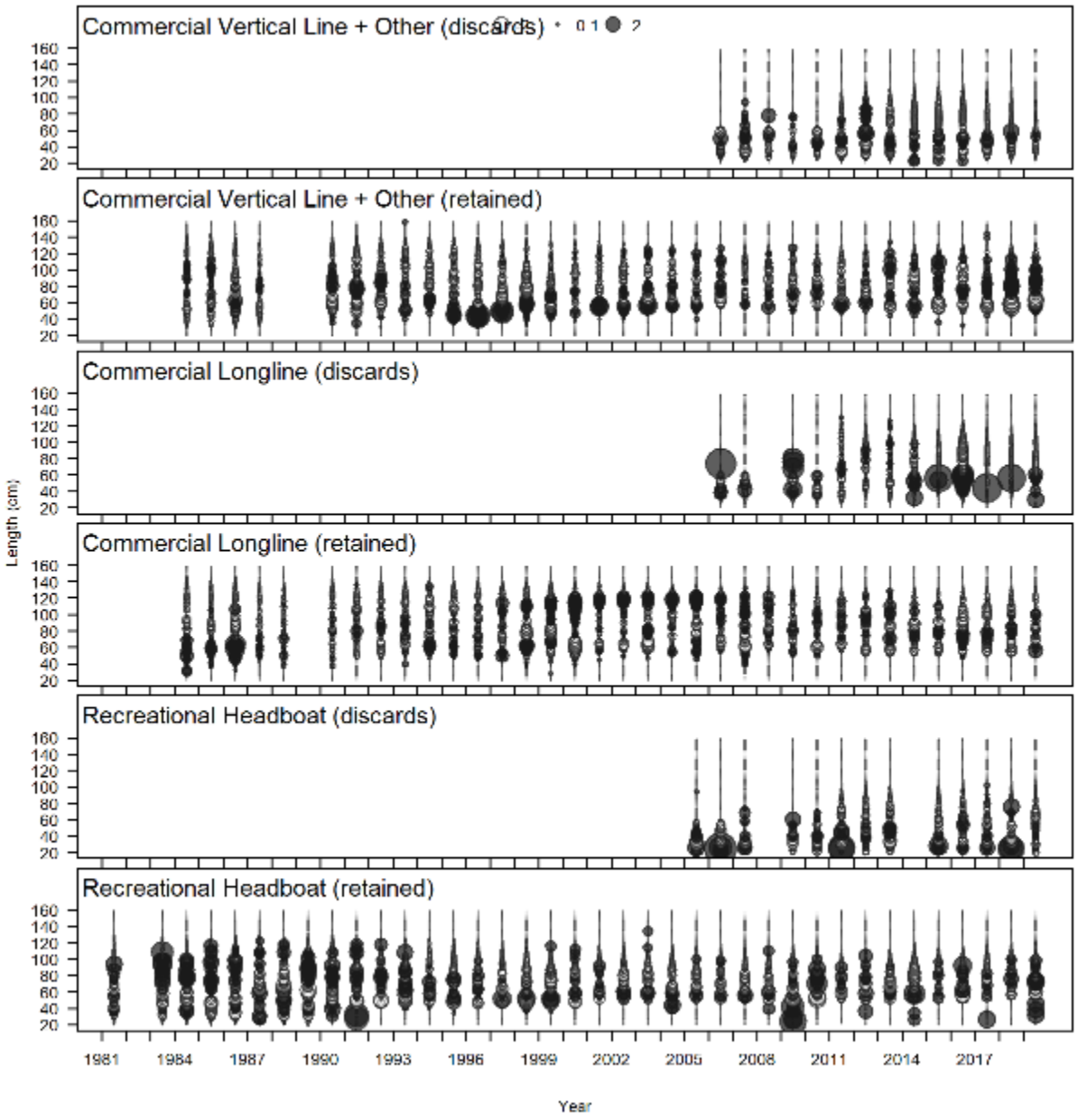


Figure 49. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Gag Grouper for SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

SEDAR 33U

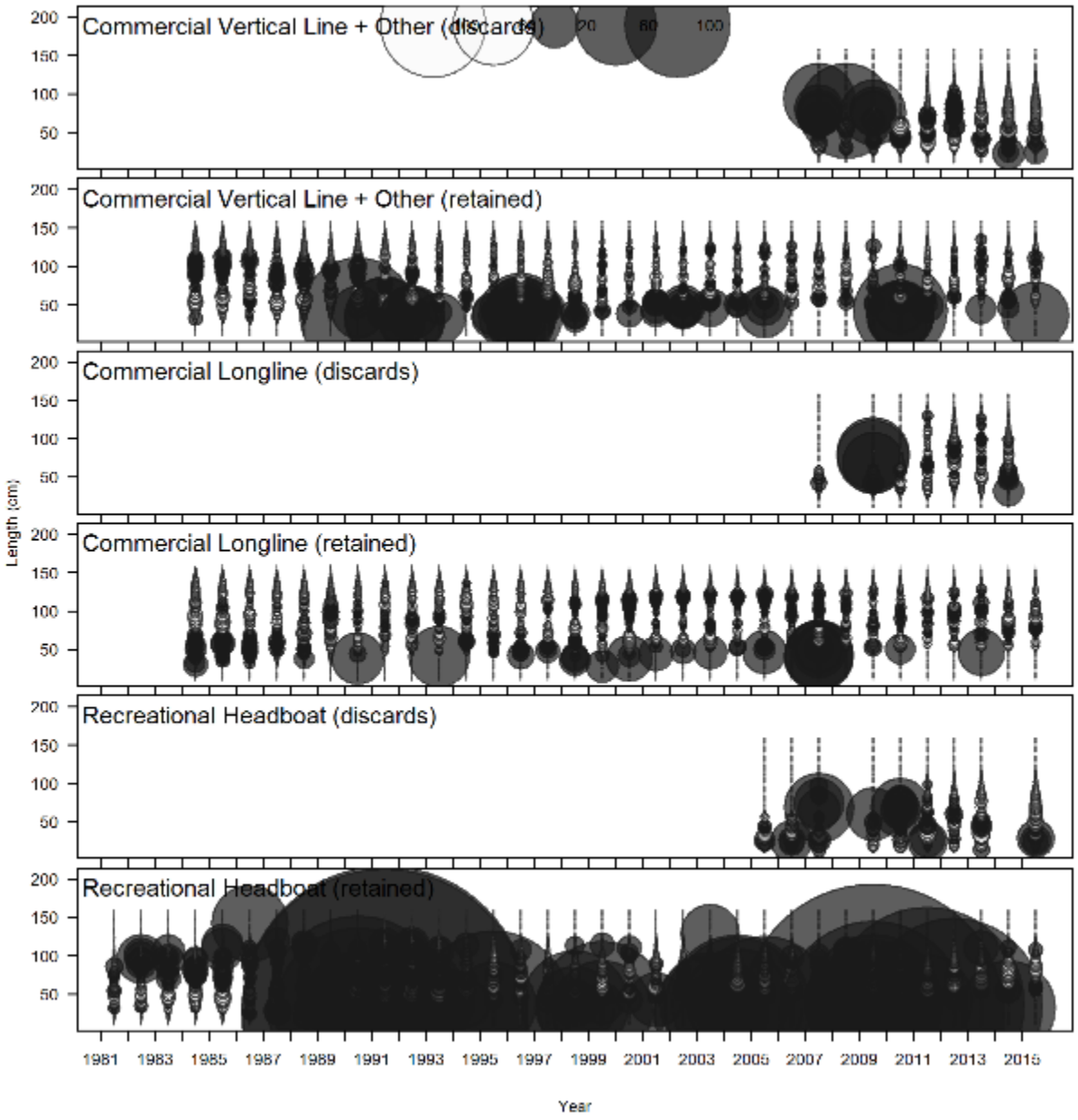


Figure 49 Continued. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Gag Grouper for SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

SRFS Run

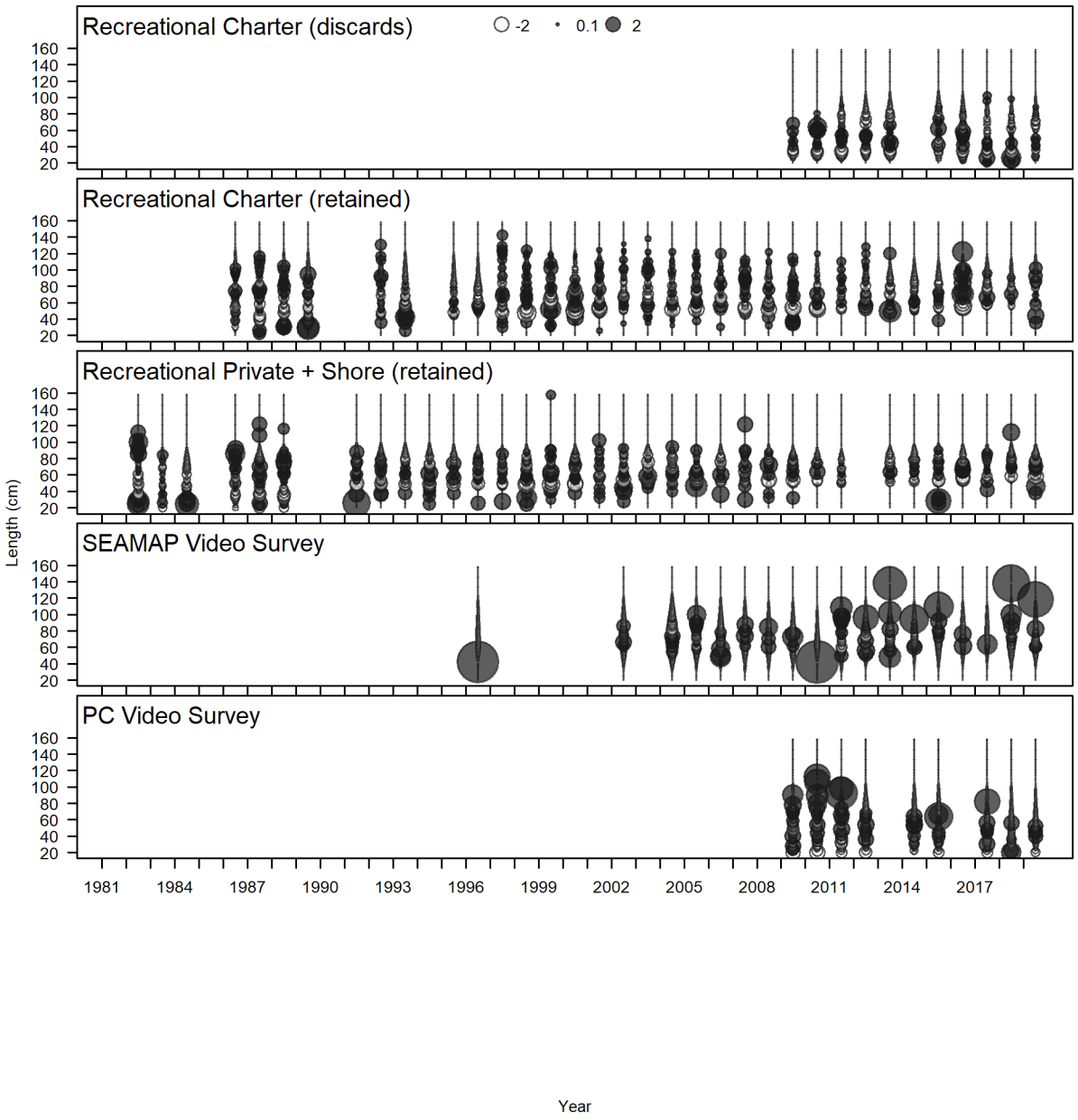


Figure 49 Continued. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Gag Grouper for SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

SEDAR 33U

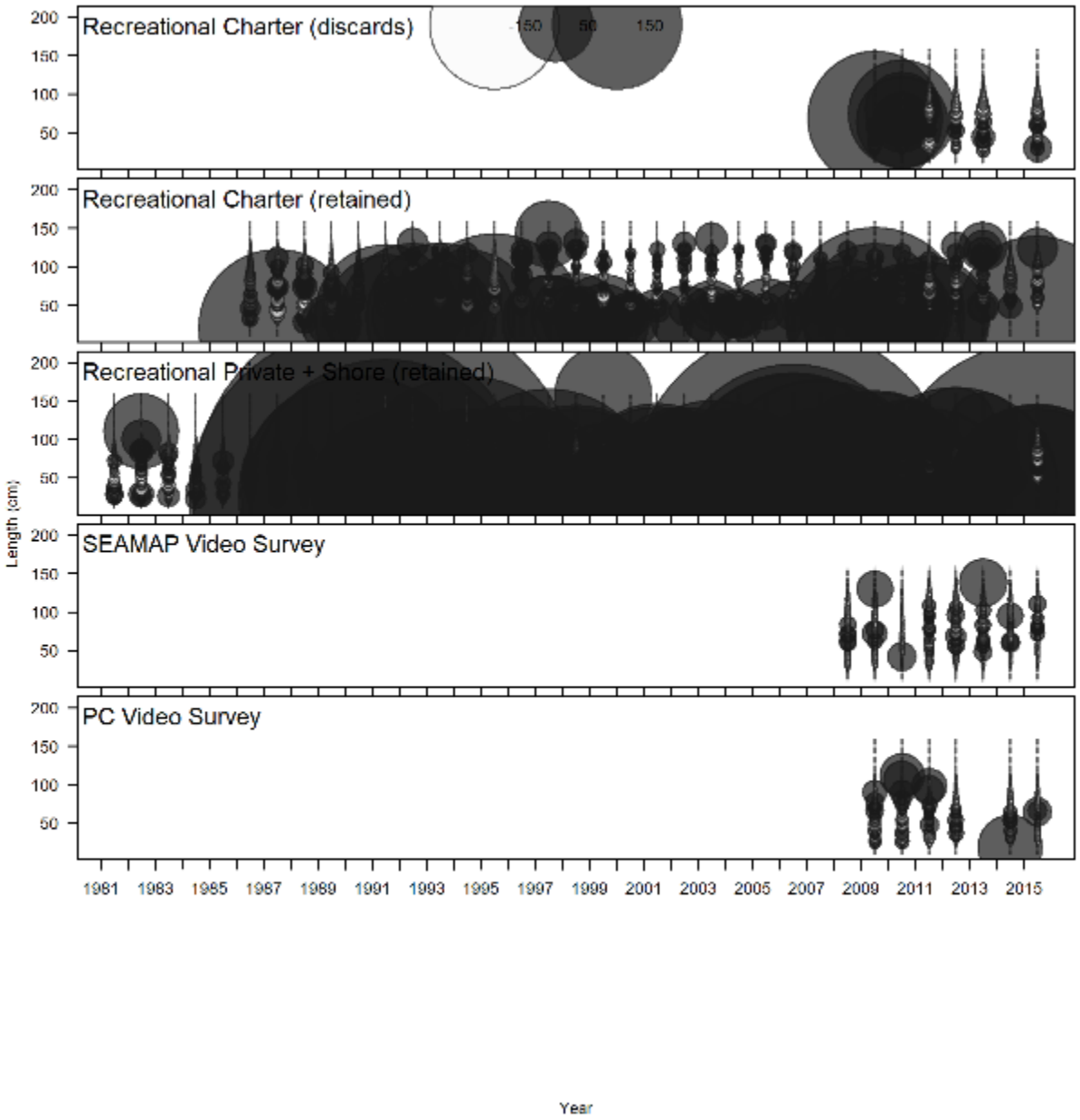


Figure 49 Continued. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Gag Grouper for SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

SRFS Run

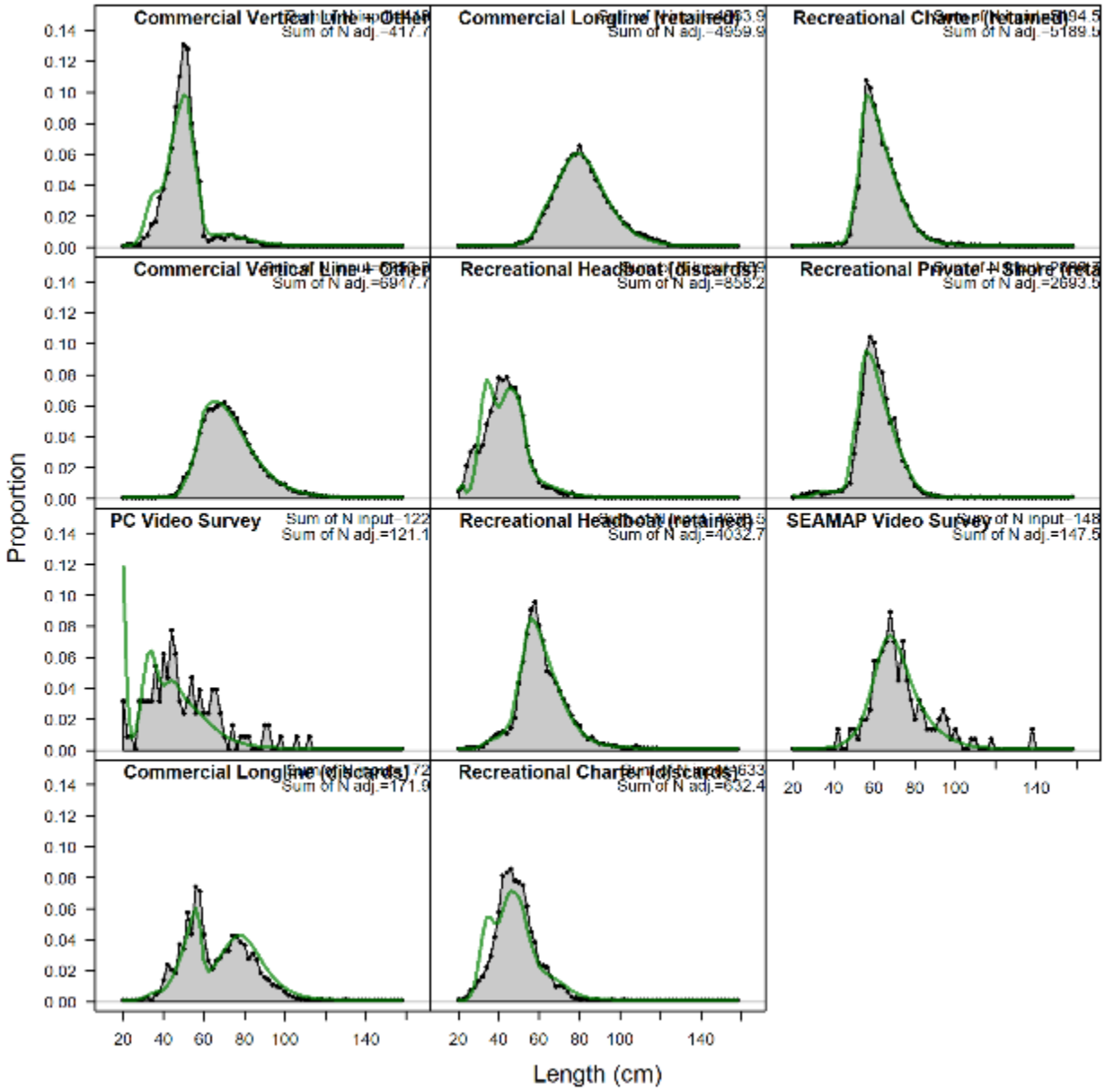


Figure 50. Model fits to the length composition of discarded or retained catch aggregated across years within a given fleet for Gulf of Mexico Gag Grouper. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'Sum of N input' 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

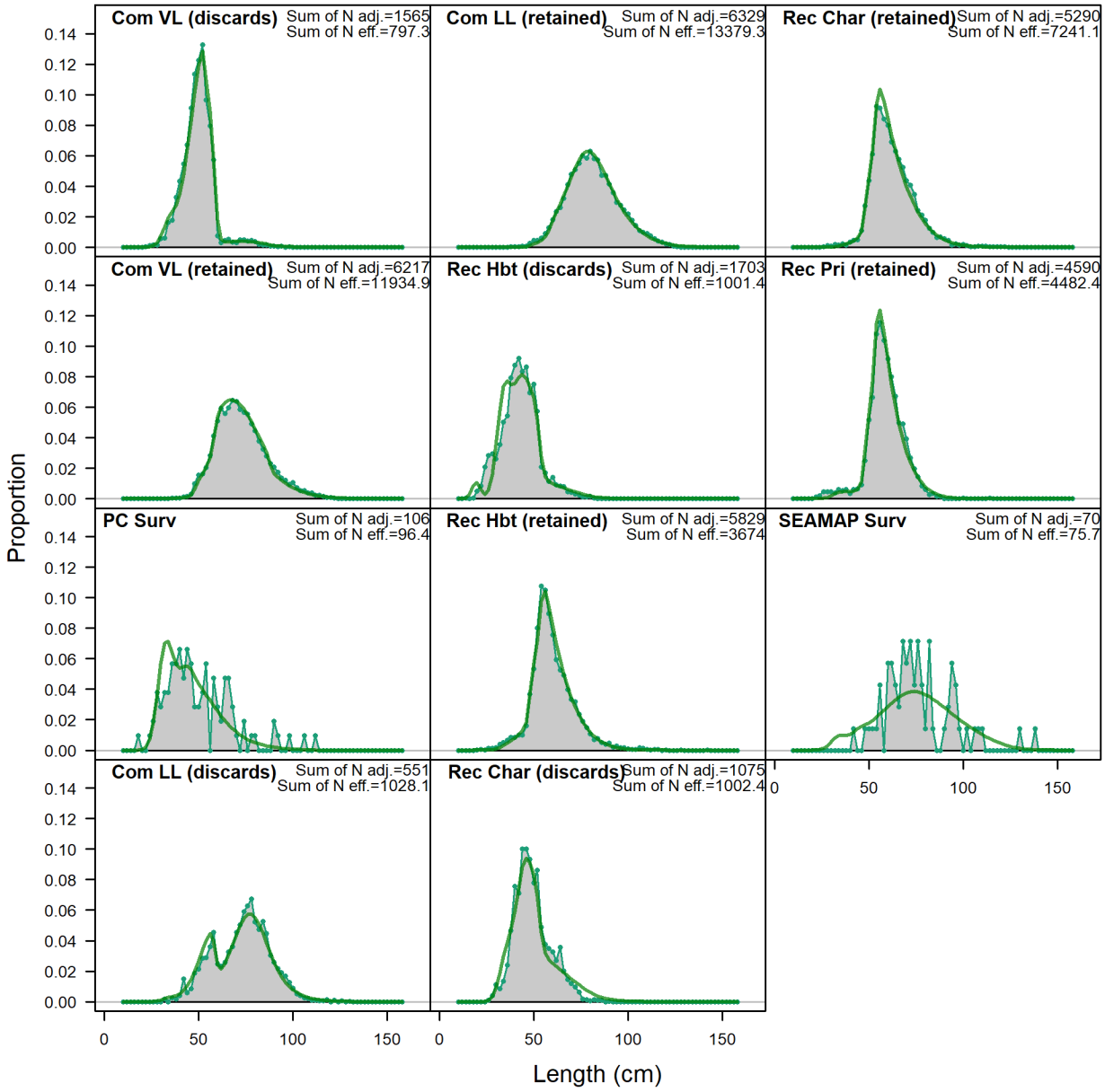


Figure 50 Continued. Model fits to the length composition of discarded or retained catch aggregated across years within a given fleet for Gulf of Mexico Gag Grouper. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'Sum 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

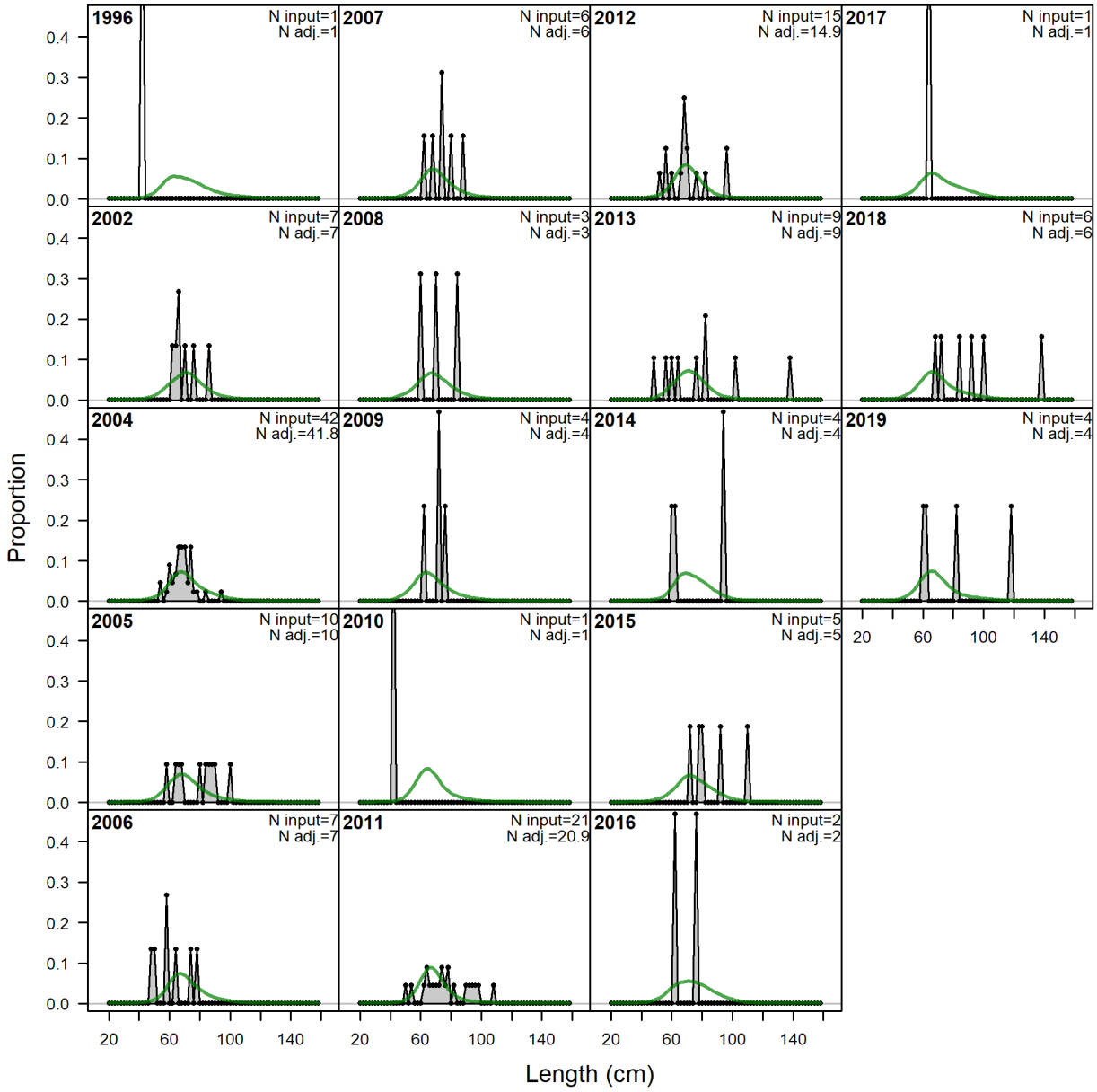


Figure 51. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the SEAMAP Video Survey fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample size and '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

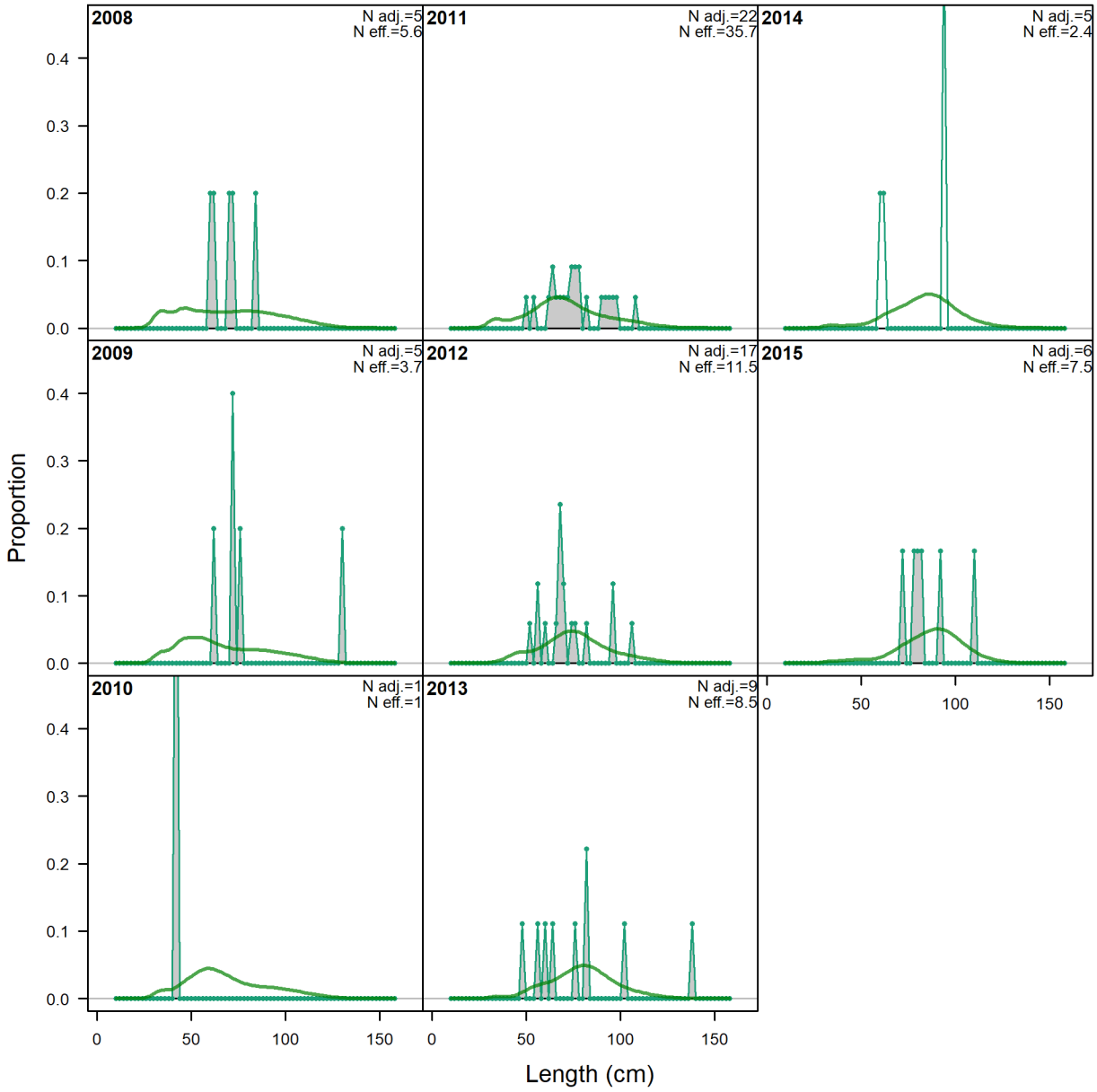


Figure 51 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the SEAMAP Video Survey fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

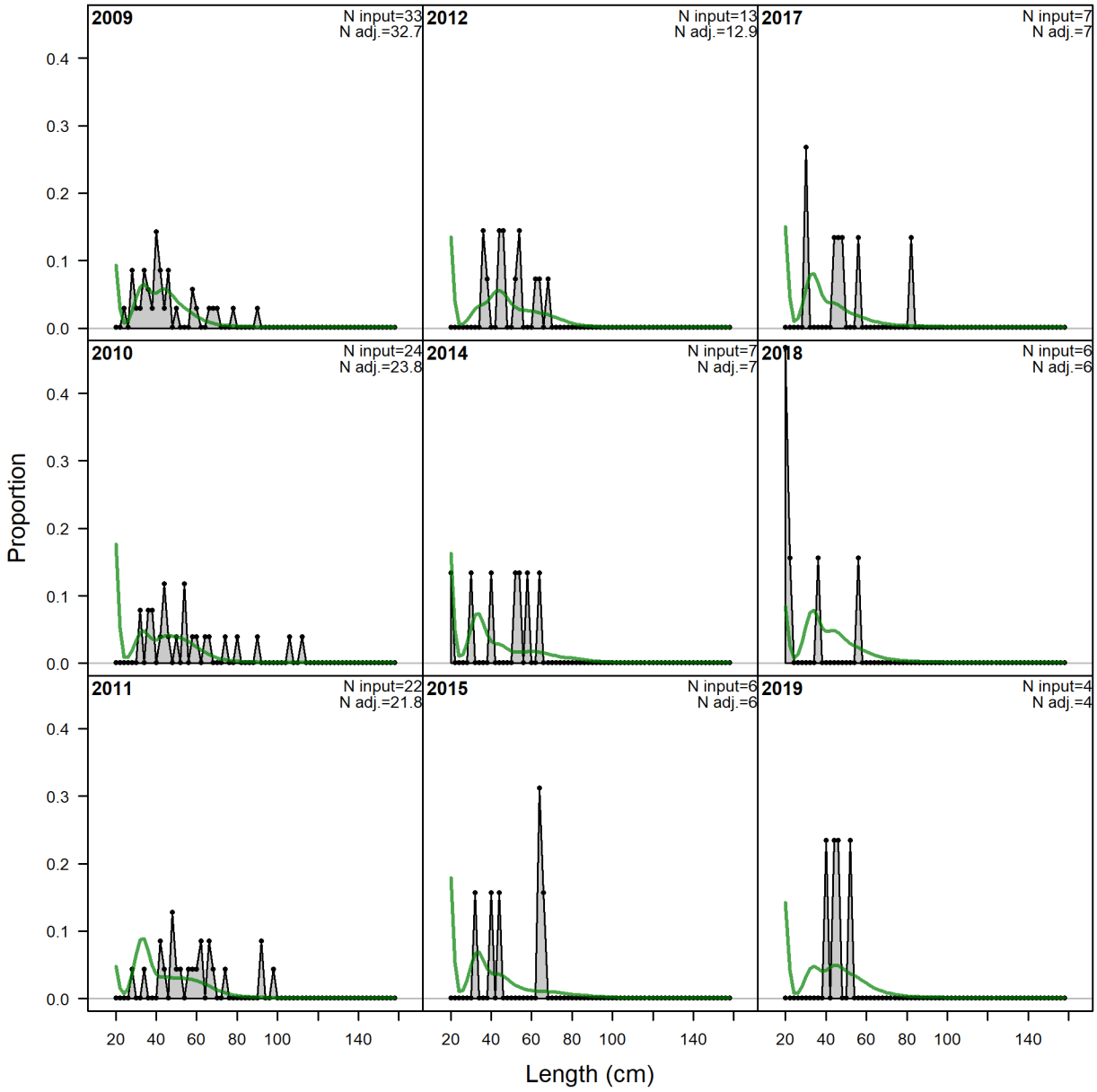


Figure 52. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the PC Video Survey fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample size and 'N 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

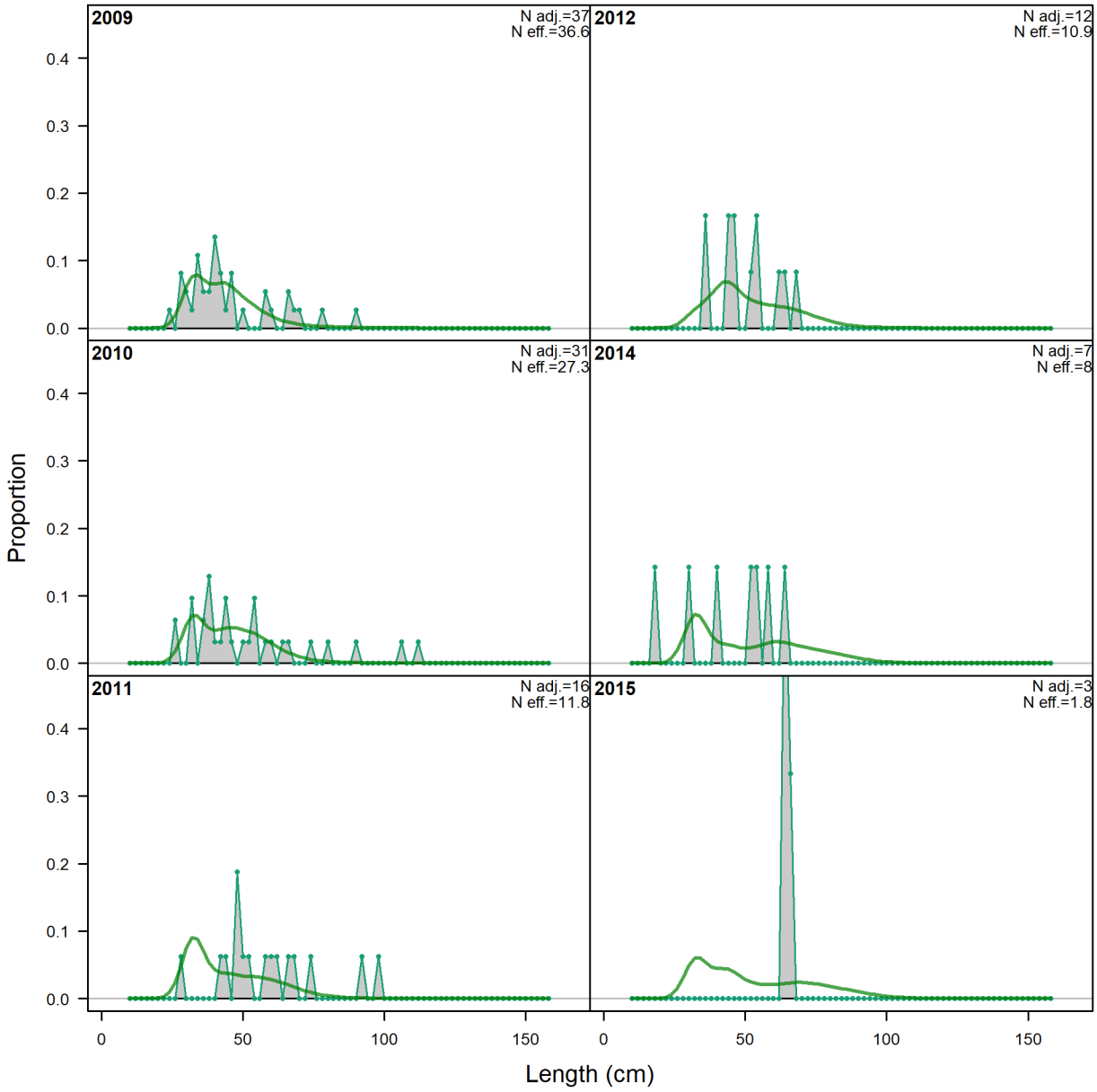


Figure 52 Continued. Observed and predicted length compositions (retained) for Gulf of Mexico Gag Grouper in the PC Video Survey fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

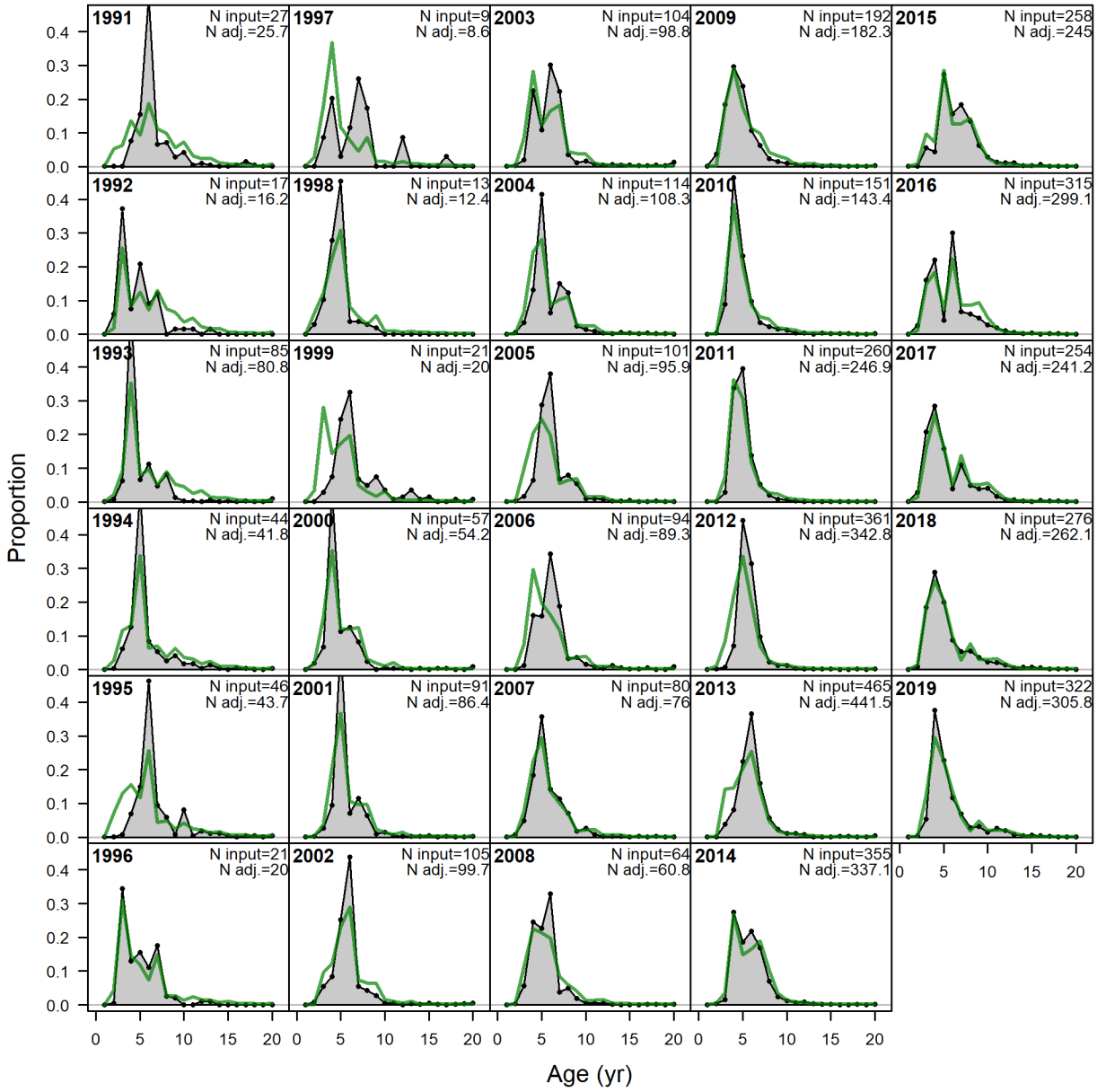


Figure 53. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Vertical Line + Other fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

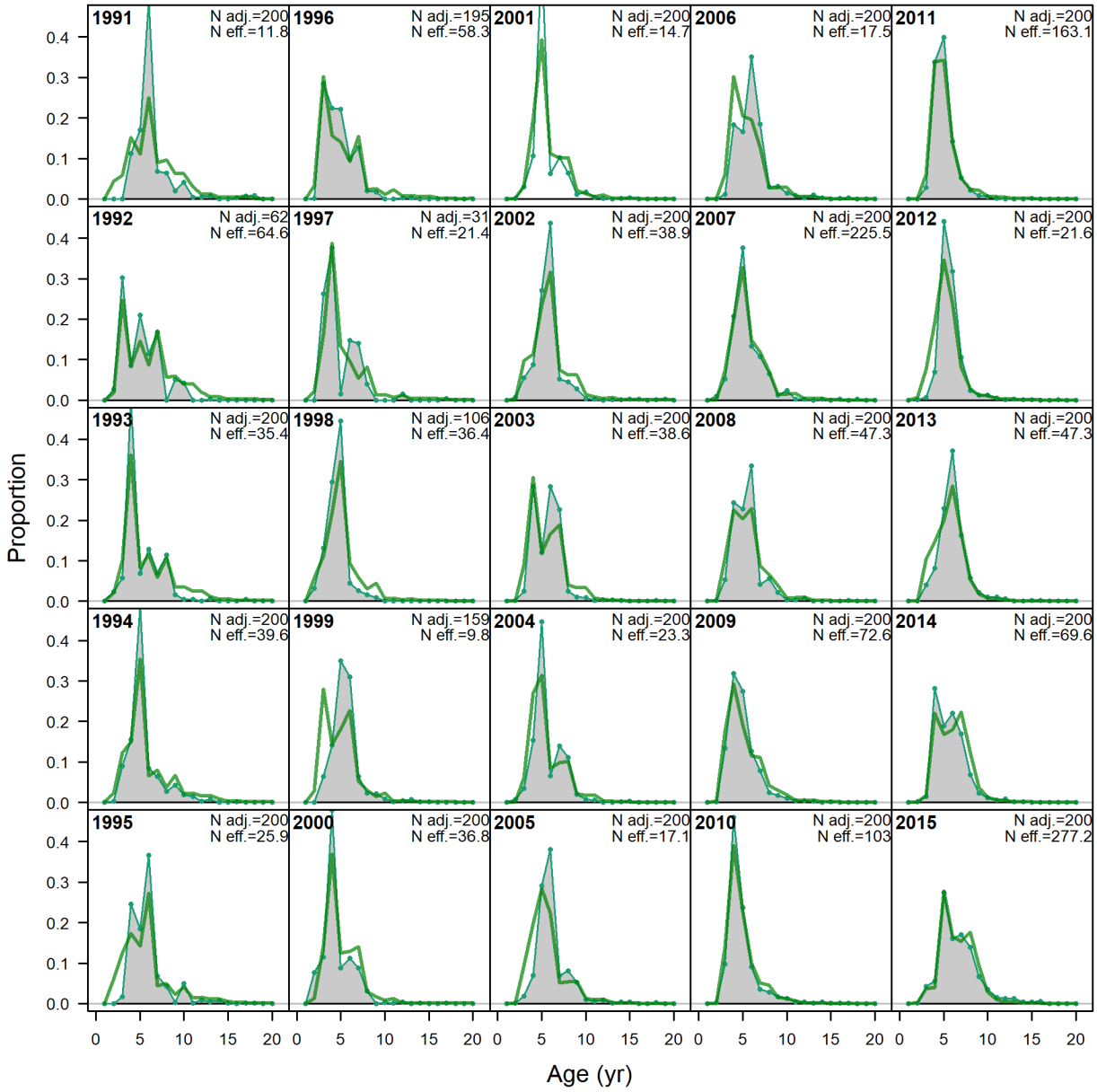


Figure 53 Continued. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Vertical Line + Other fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the 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

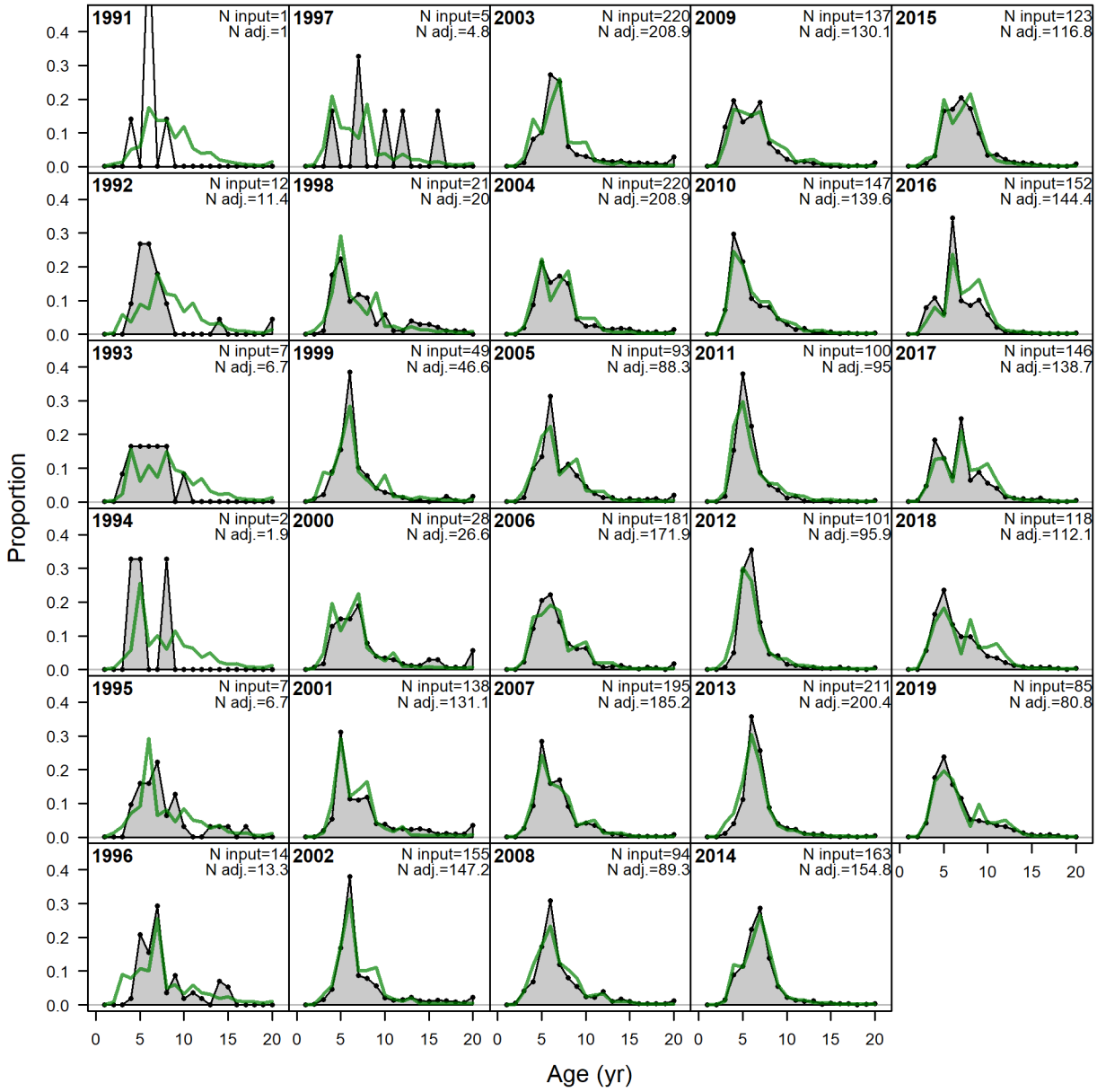


Figure 54. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Longline fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample size and '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

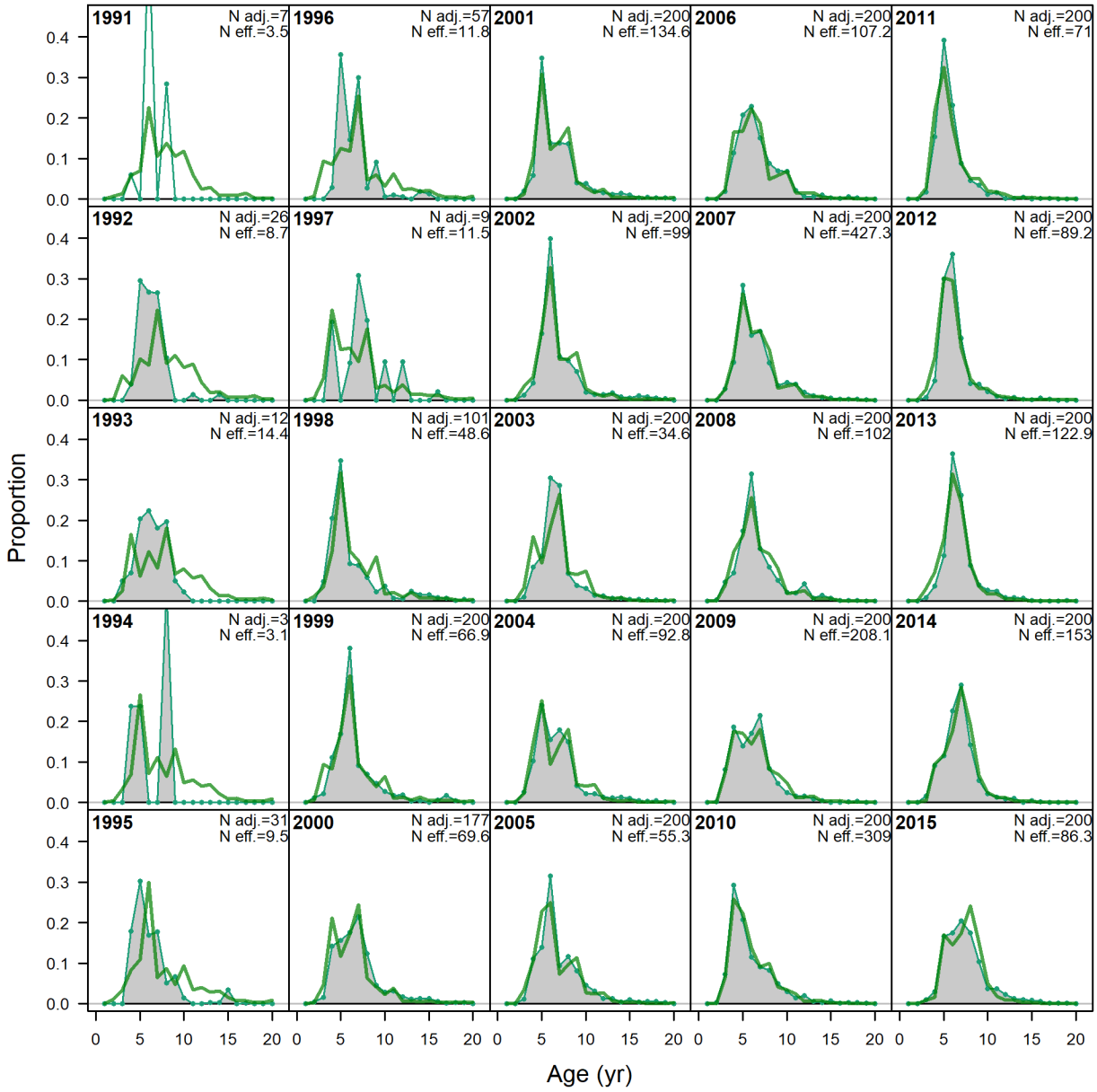


Figure 54 Continued. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Commercial Longline fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

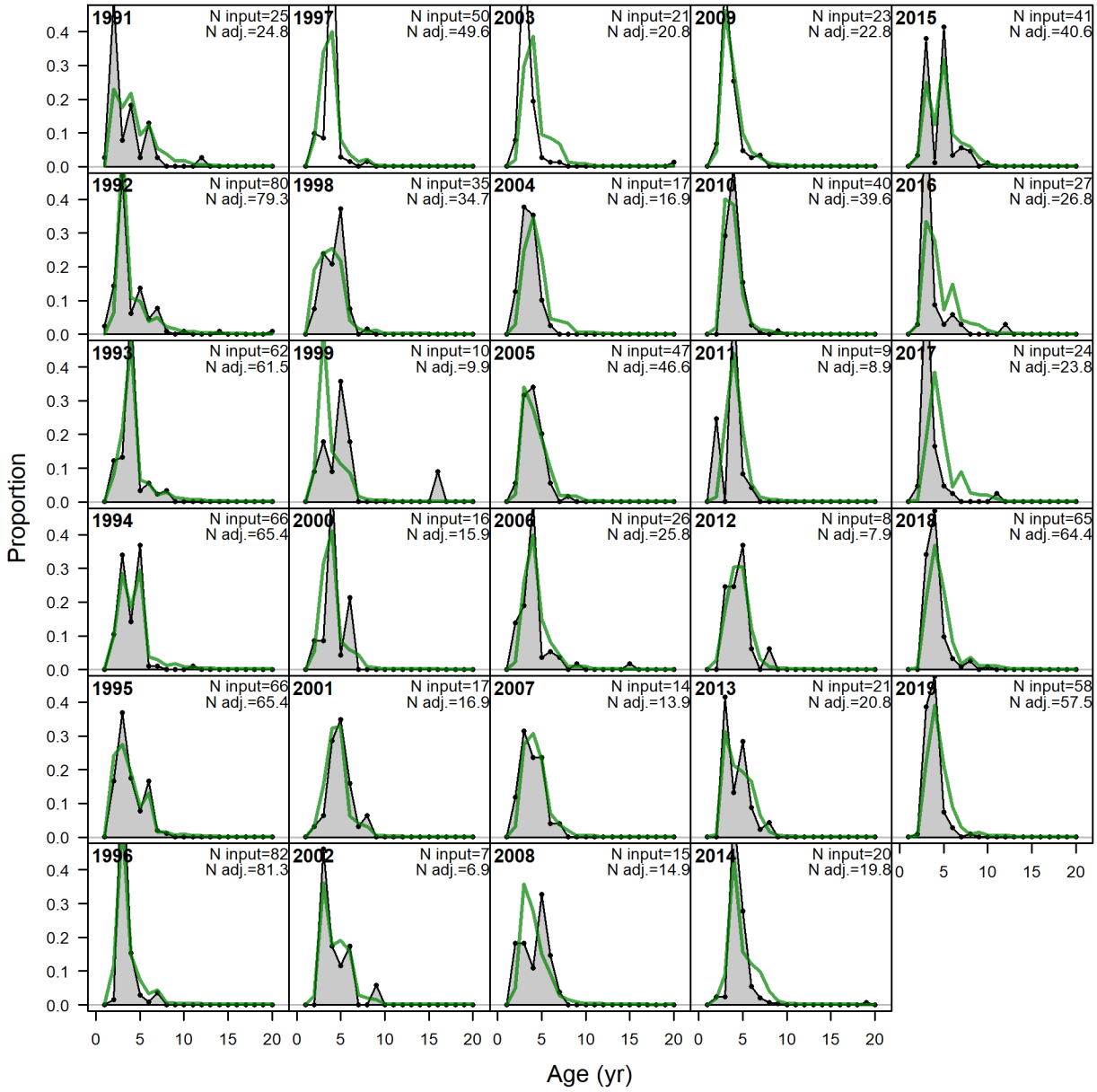


Figure 55. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample size and '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

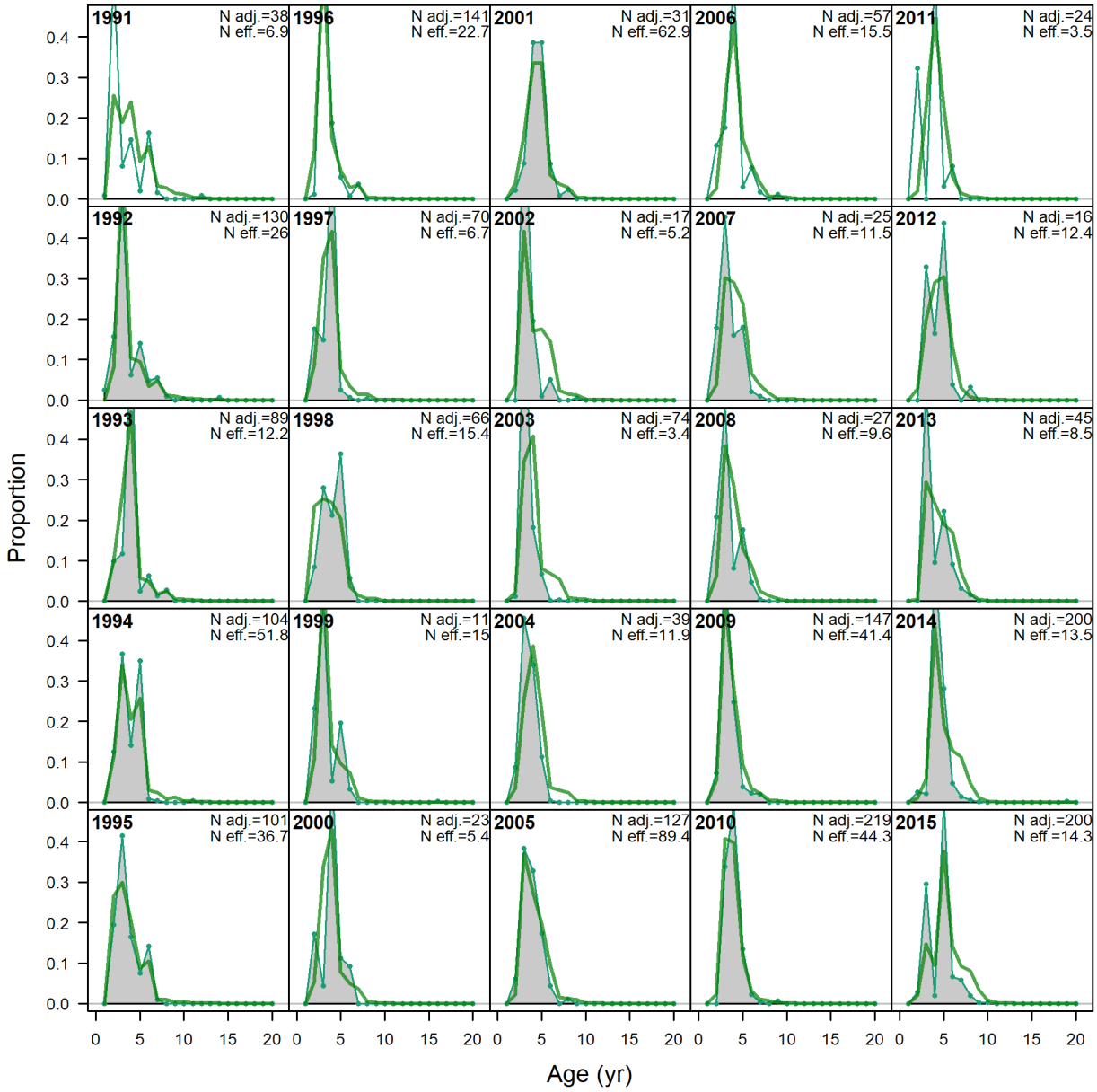


Figure 55 Continued. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Headboat fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

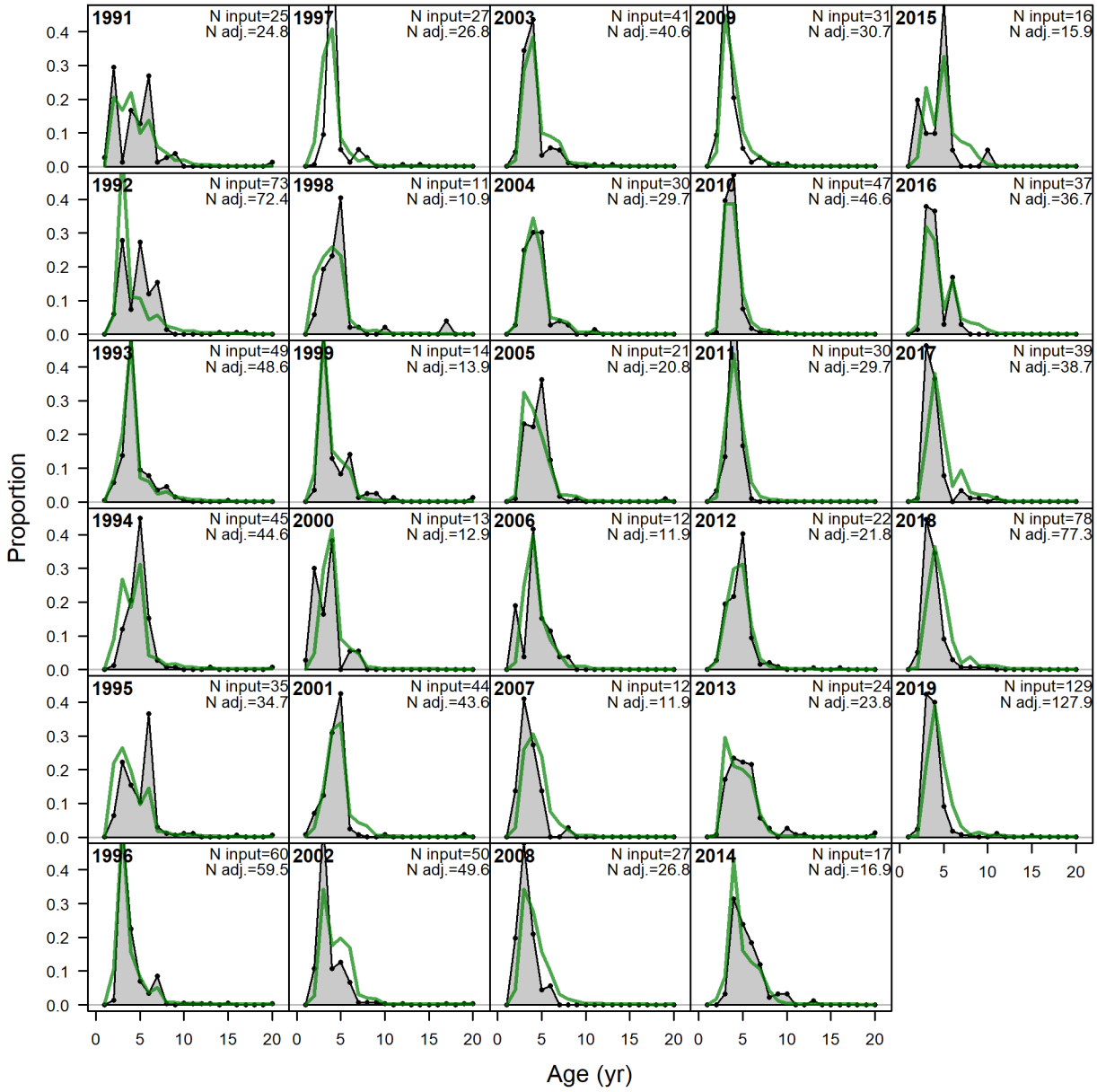


Figure 56. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Charter fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample size and '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

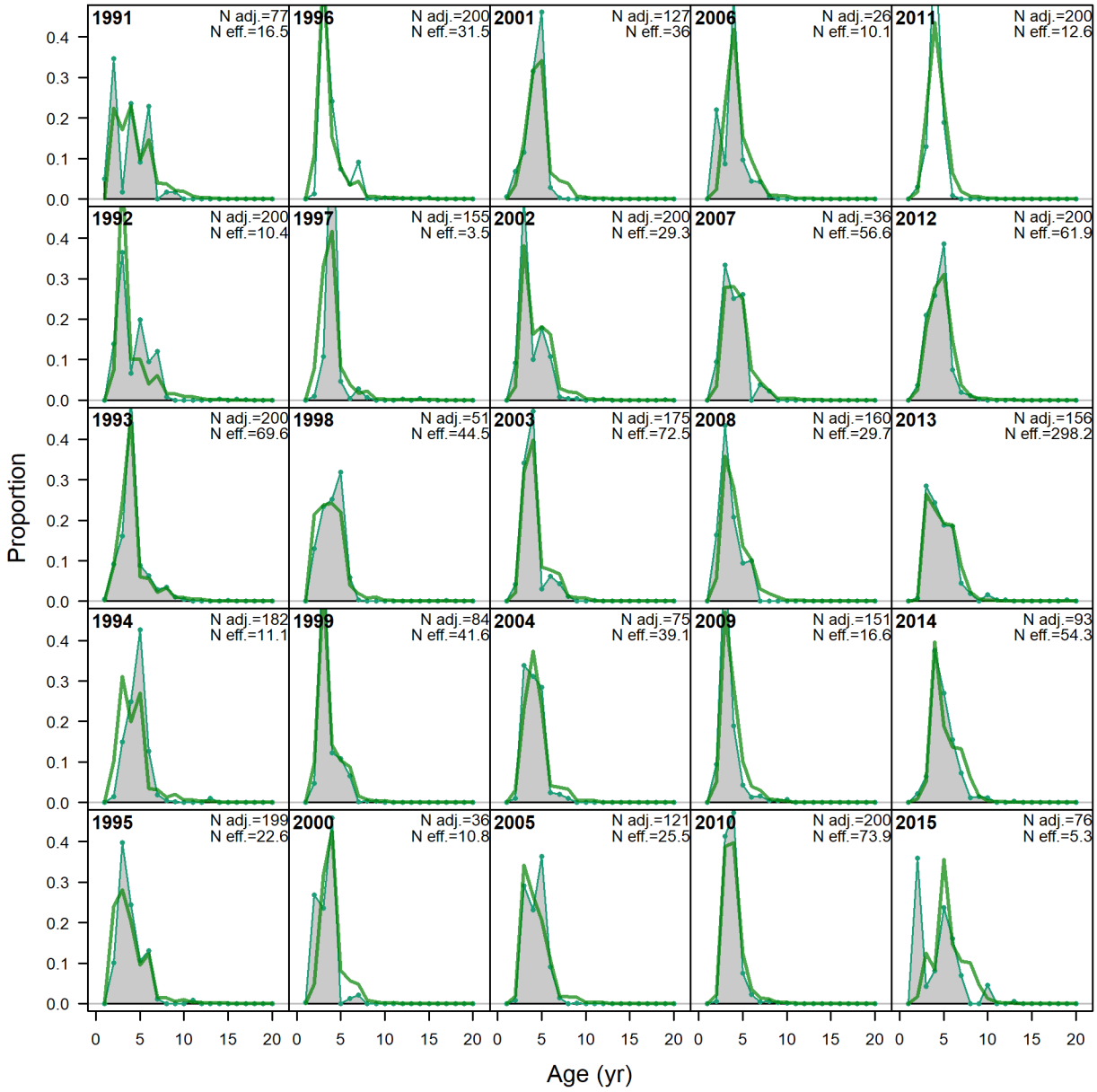


Figure 56 Continued. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Charter fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

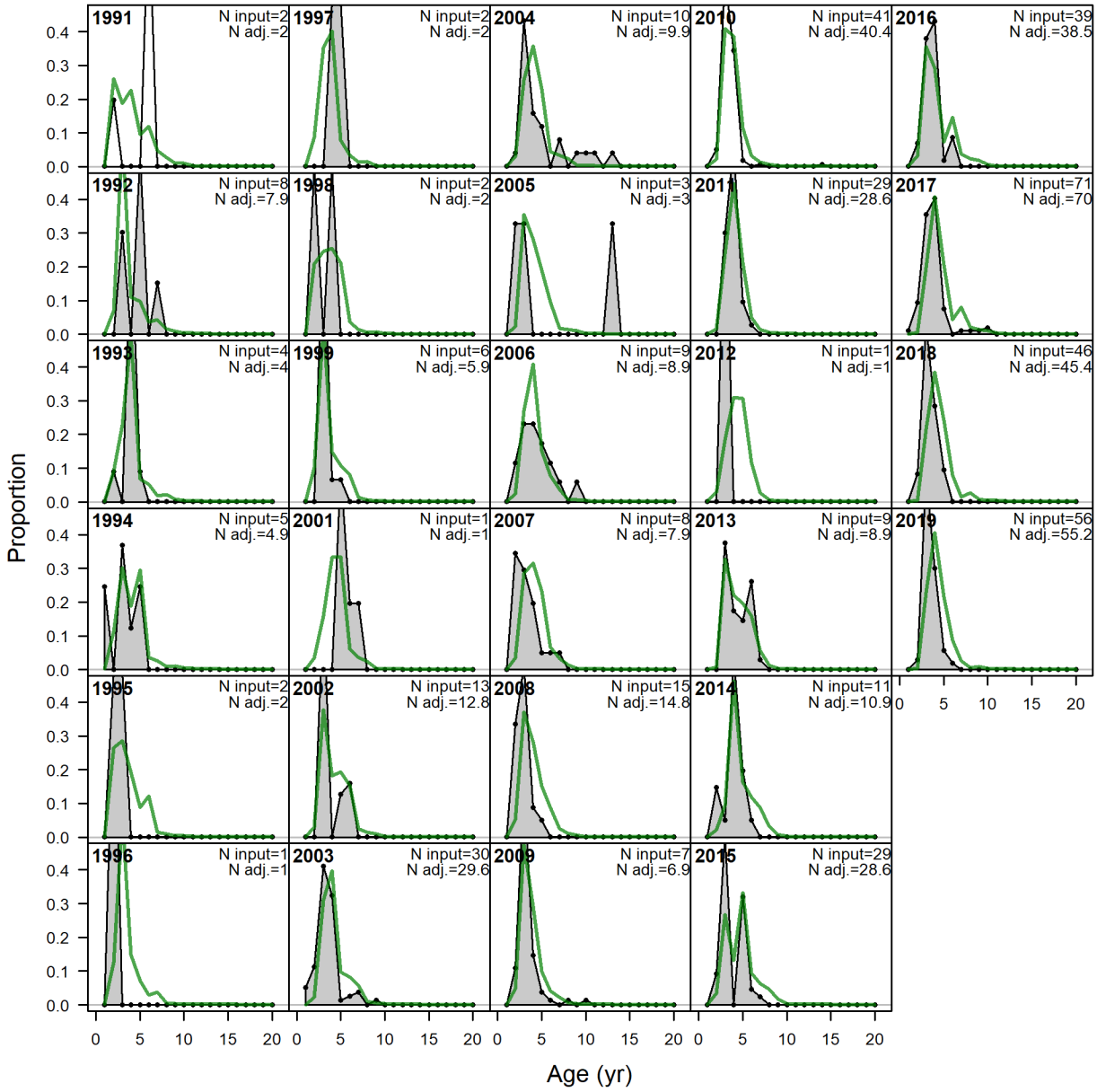


Figure 57. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Private + Shore fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input sample 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

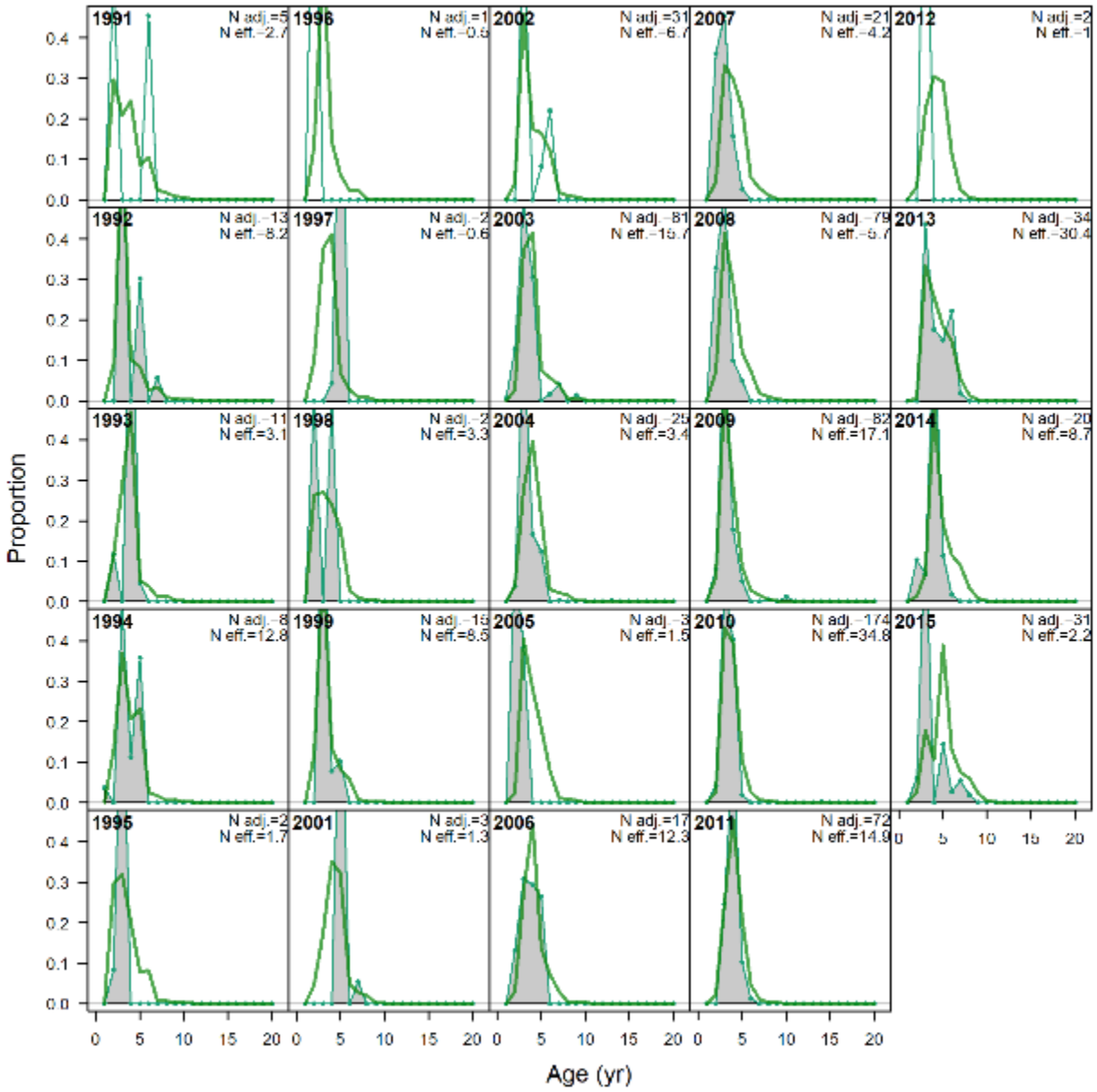


Figure 57 Continued. Observed and predicted age compositions (retained) for Gulf of Mexico Gag Grouper in the Recreational Private + Shore fishery. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'N input' is the input 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

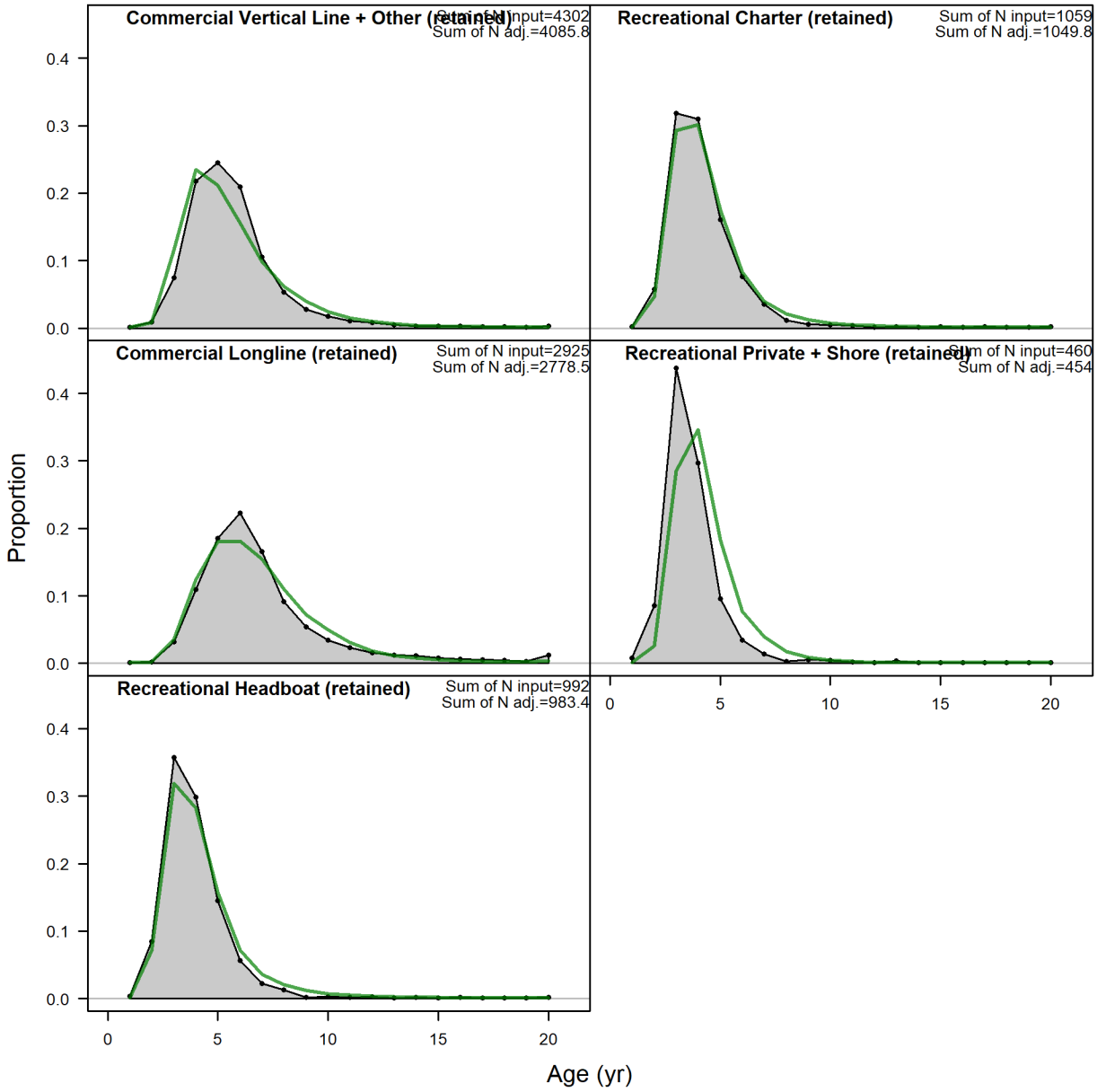


Figure 58. Model fits to the age composition of retained catch aggregated across years within a given fleet for Gulf of Mexico Gag Grouper. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'Sum of N input' is the total 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

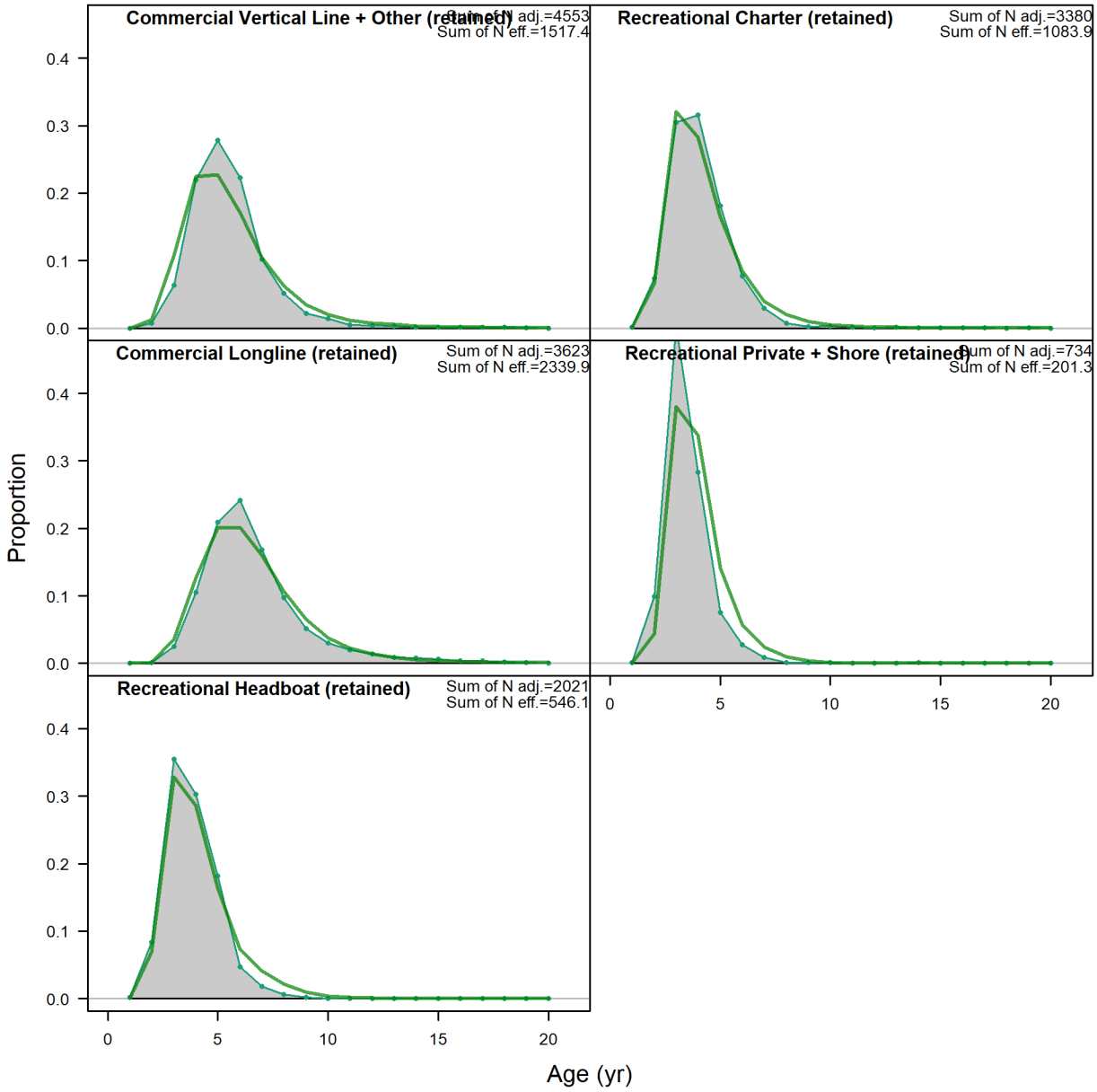


Figure 58 Continued. Model fits to the age composition of retained catch aggregated across years within a given fleet for Gulf of Mexico Gag Grouper. Green lines represent predicted length compositions, while grey shaded regions represent observed length compositions. For SRFS Run, 'Sum of N input' is 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

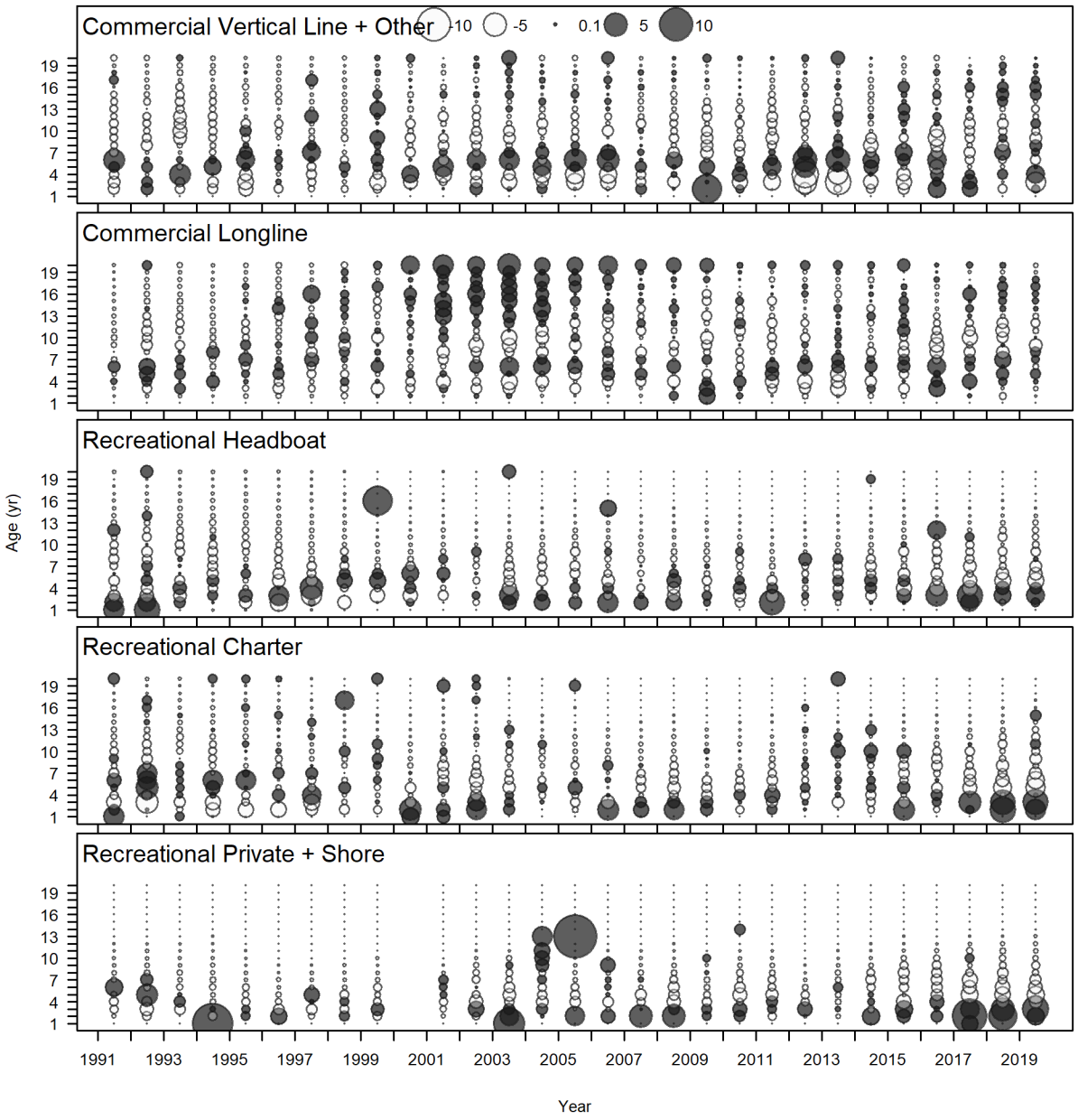


Figure 59. Pearson residuals for retained age composition data by year compared across fleets for Gulf of Mexico Gag Grouper for SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

SEDAR 33U

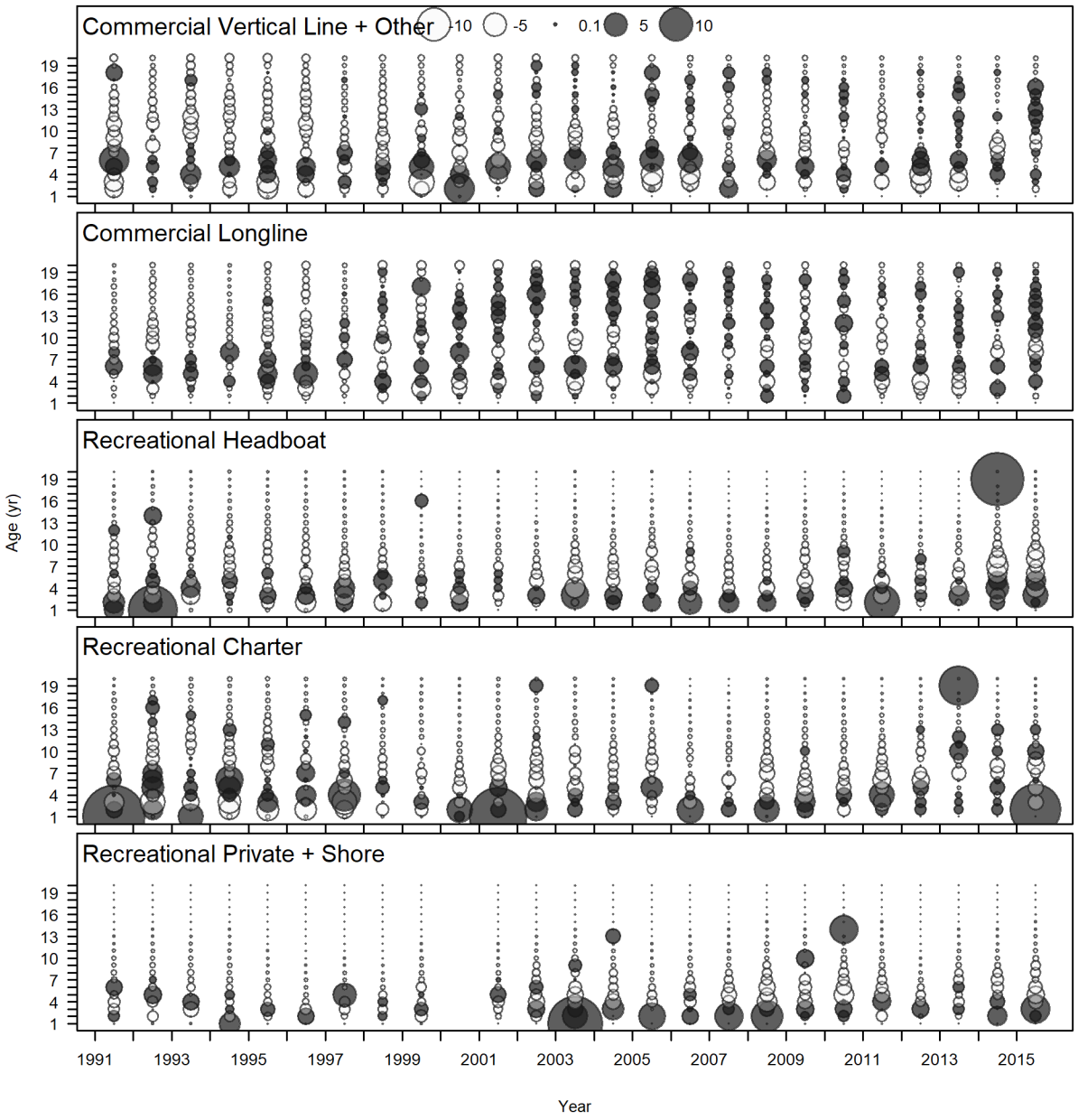


Figure 59 Continued. Pearson residuals for retained age composition data by year compared across fleets for Gulf of Mexico Gag Grouper for SRFS Run (Upper panel) and SEDAR 33U (Lower Panel). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

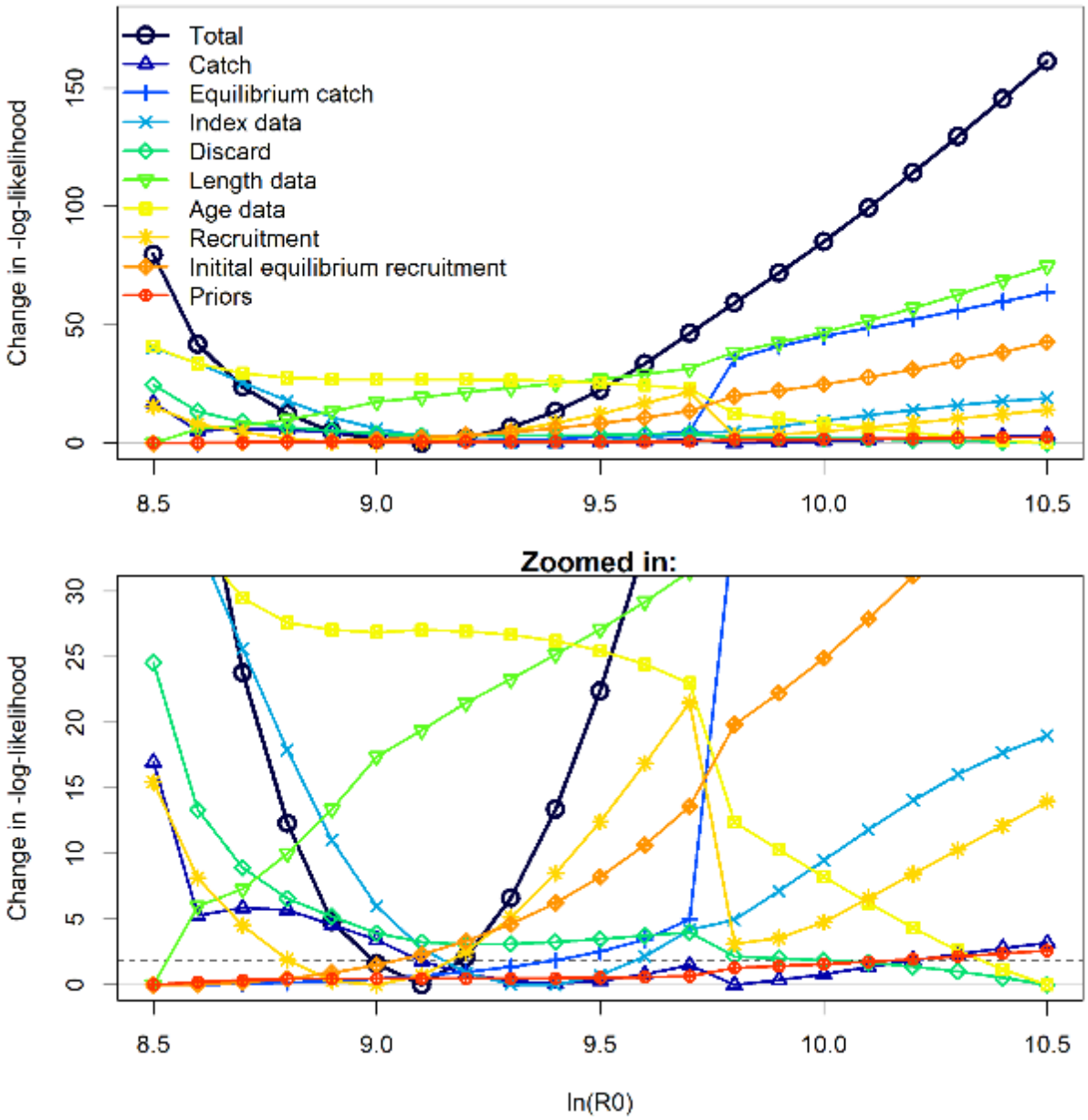


Figure 60. The profile likelihood for the natural log of the unfished recruitment parameter of the Beverton – Holt stock-recruit function for Gulf of Mexico Gag Grouper. Each line represents the change in negative log-likelihood value for each of the data sources fit in the model across the range of fixed steepness values tested in the profile diagnostic run. The MLE for the SRFS Run was 9.075. The bottom panel shows a close up of the top panel to better detect significant differences between runs.

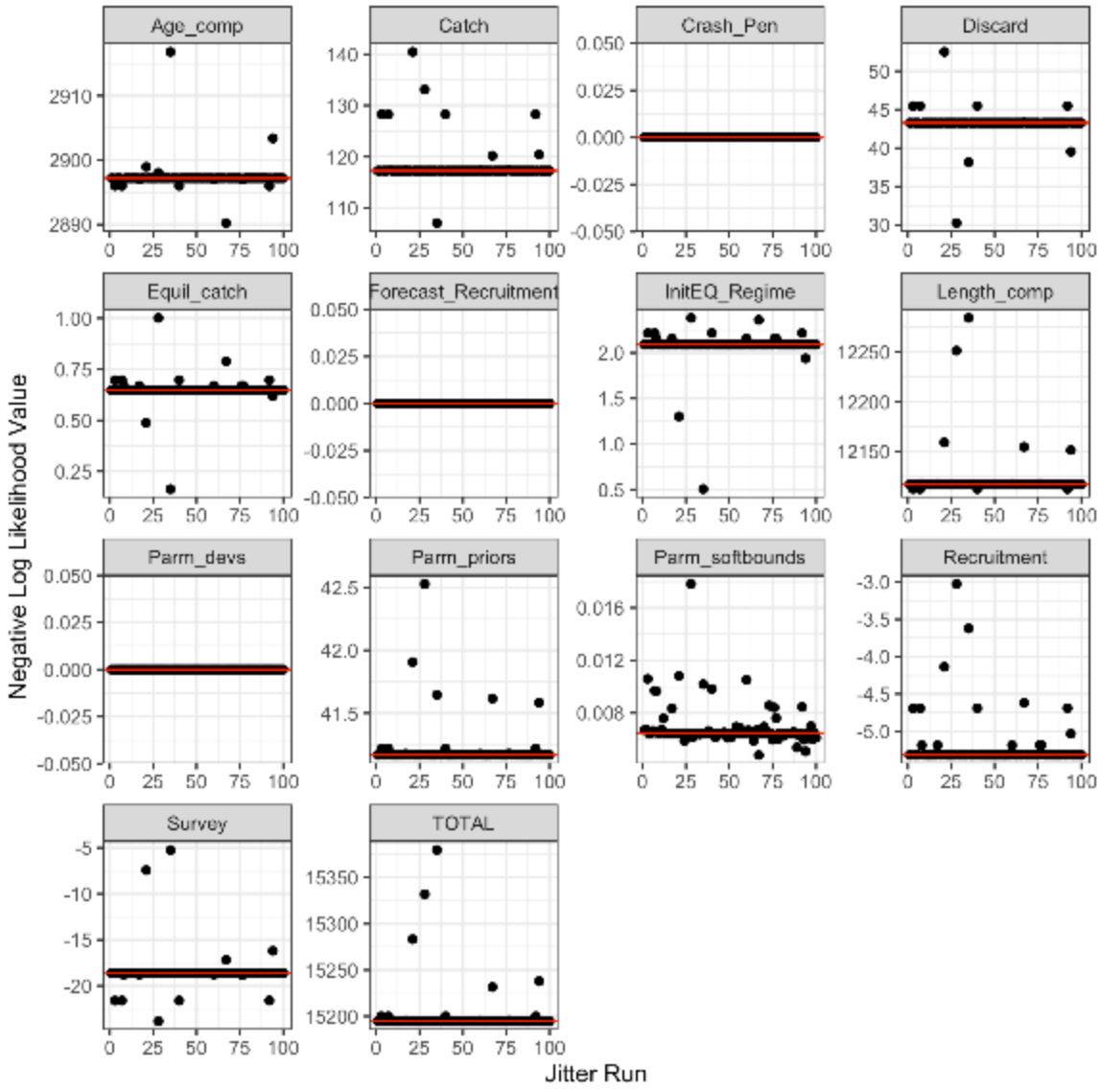


Figure 61. Results of the jitter analysis for various likelihood components for the Gulf of Mexico Gag Grouper SRFS Run. Each panel gives the results of 100 model runs where the starting parameter values for each run were randomly changed ('jittered') by 10% from the base model best fit values. The Base Run value for each panel is indicated by a red line.

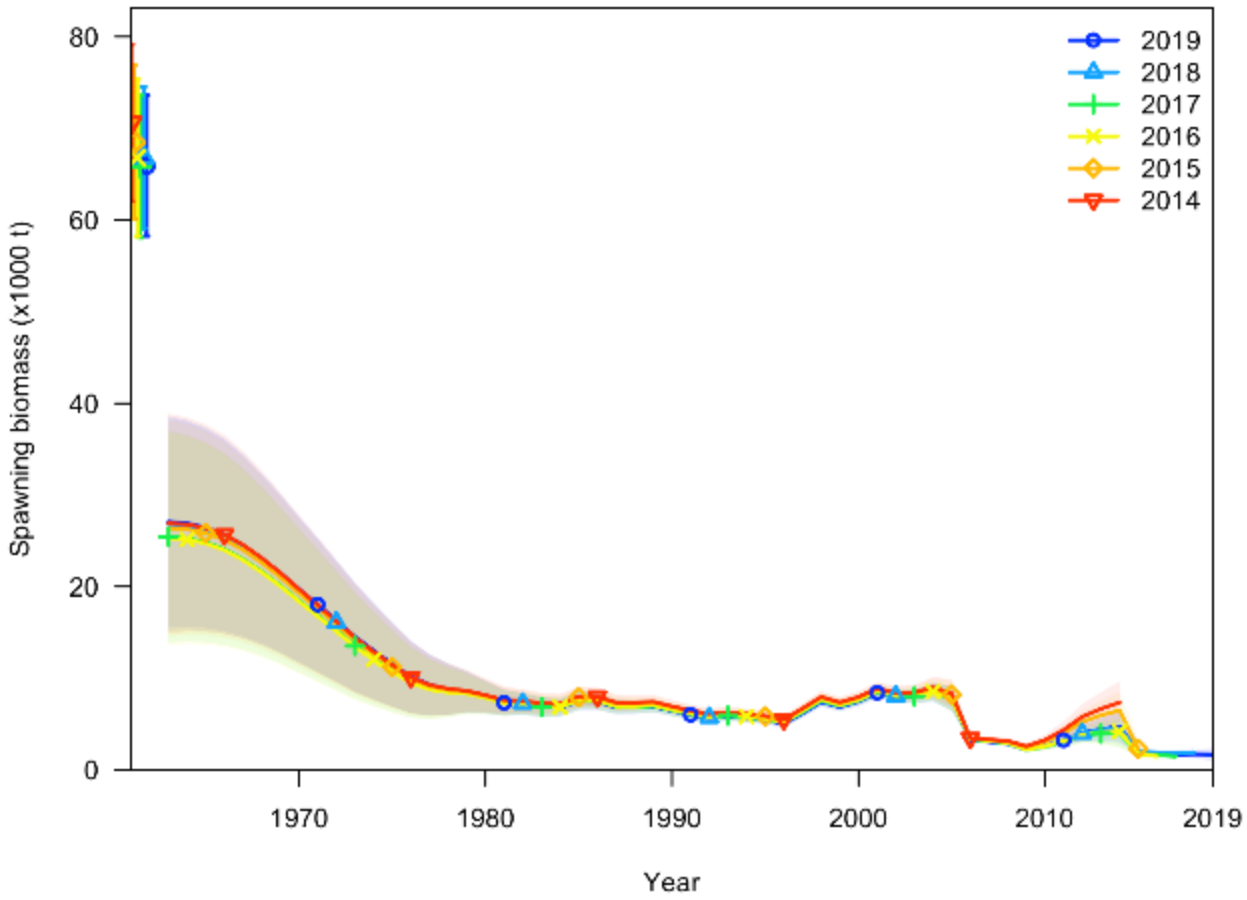


Figure 62. Results of a five year retrospective analysis for spawning biomass (metric tons) for the Gulf of Mexico Gag Grouper SRFS Run. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities.

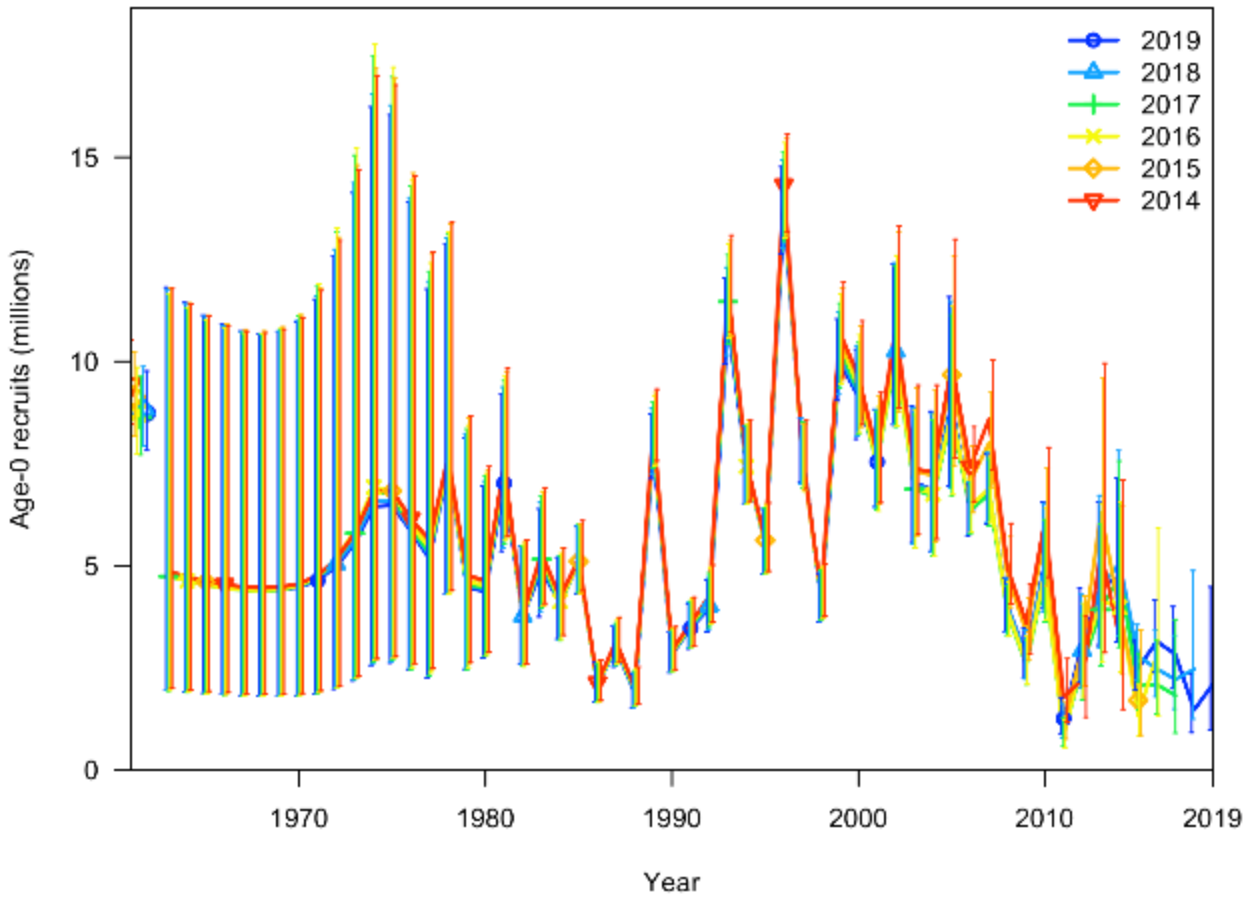


Figure 63. Results of a five year retrospective analysis for recruitment (millions of fish) for the Gulf of Mexico Gag Grouper SRFS Run. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities.

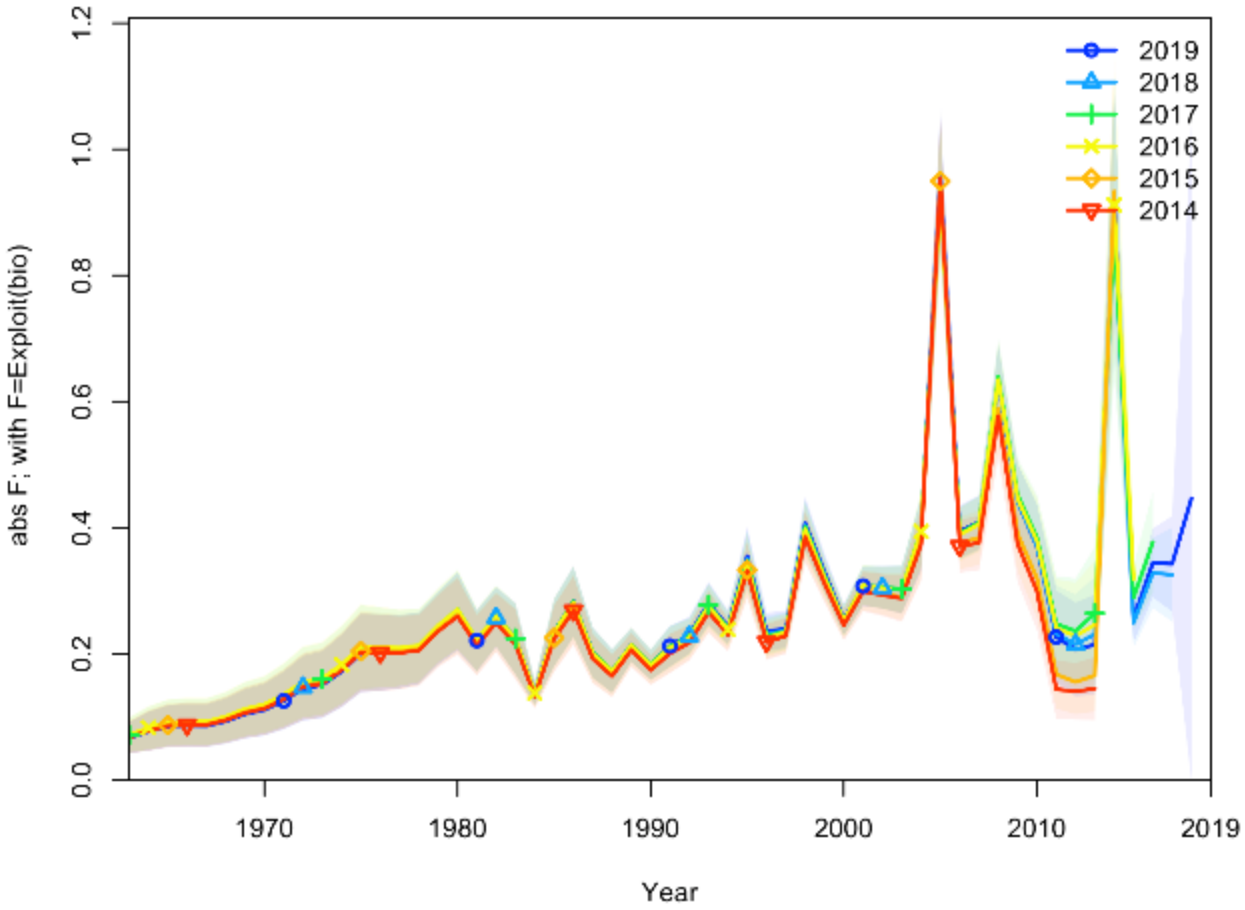


Figure 64. Results of a five year retrospective analysis for spawning biomass fishing mortality (total biomass killed / total biomass age 3+; bottom panel) for the Gulf of Mexico Gag Grouper SRFS Run. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities.

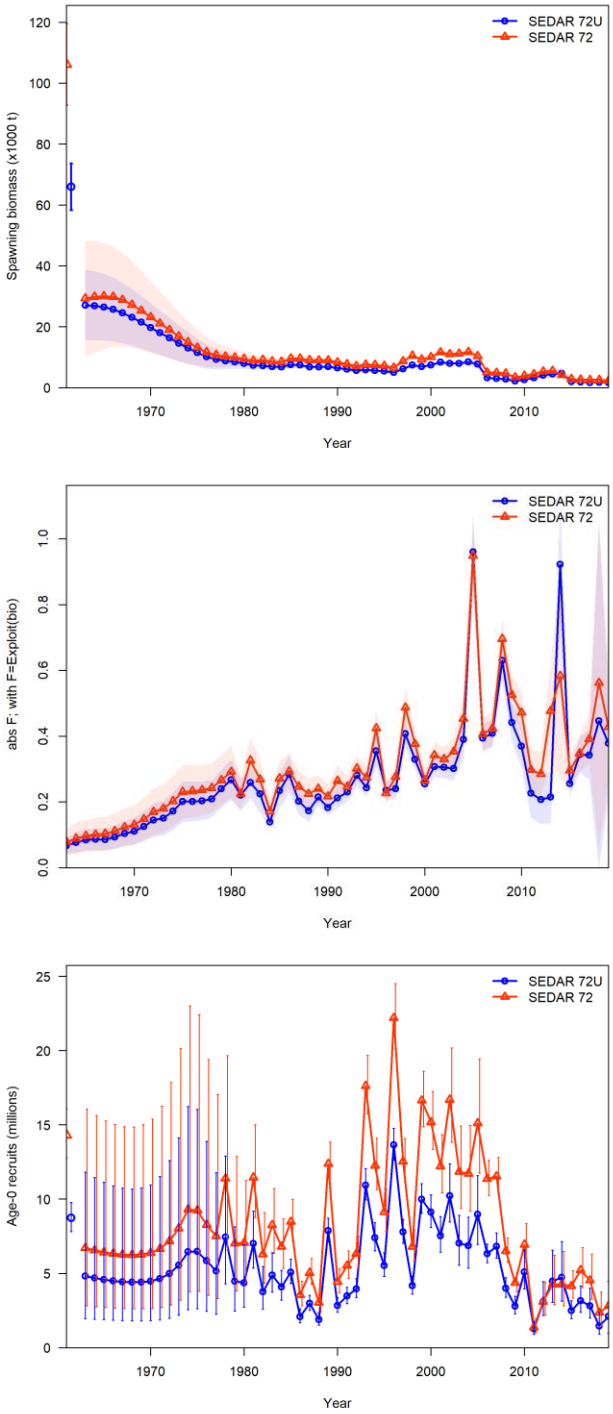


Figure 65. Differences in SSB estimates (top panel), annual exploitation rates (total biomass killed / total biomass age 3+) (middle panel) and annual recruitment (bottom panel), and associated uncertainty between the SEDAR 72 base run and the SRFS Run.

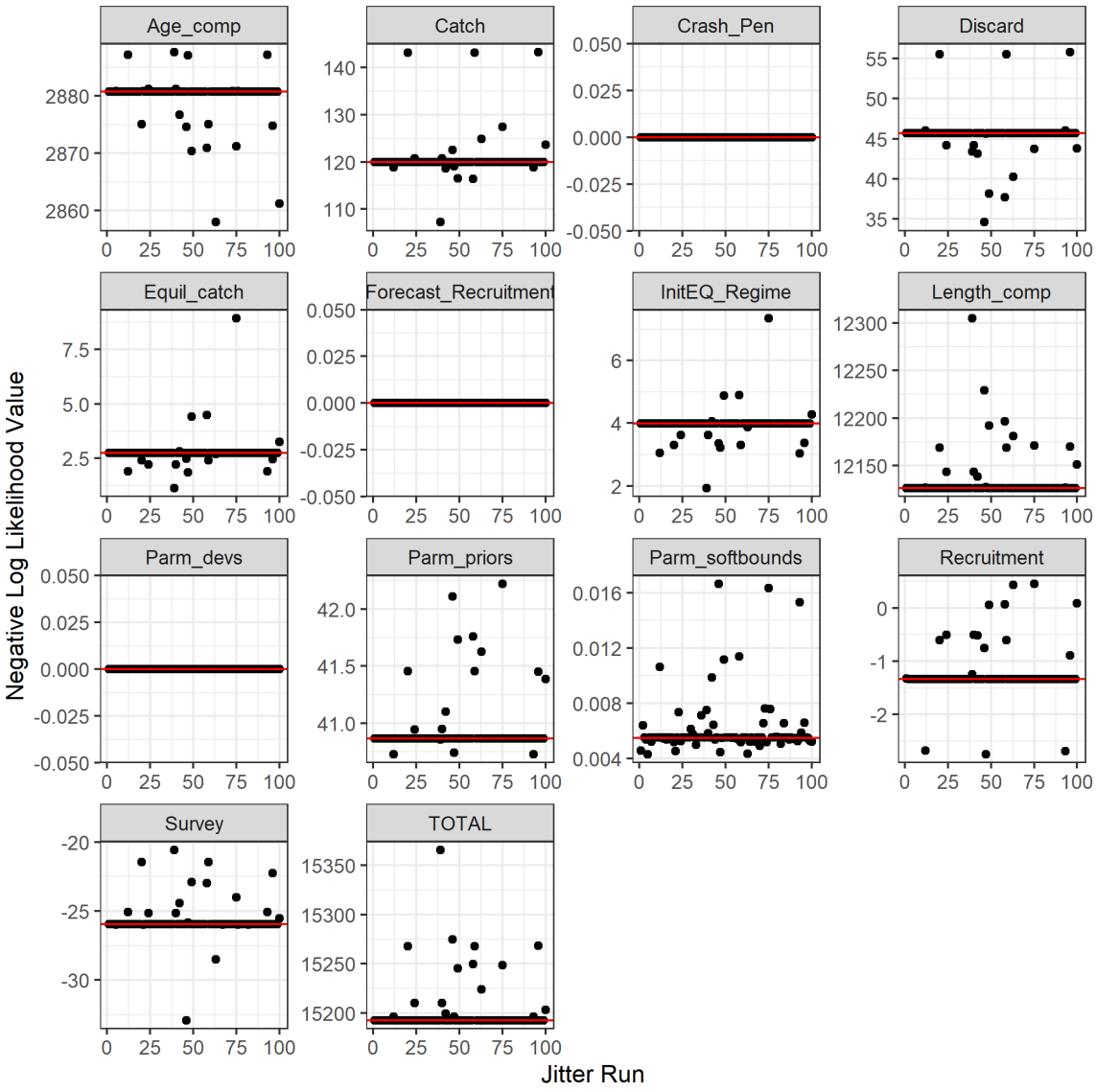


Figure 66. Results of the jitter analysis for various likelihood components for the Gulf of Mexico Gag Grouper for SEDAR 72 model. Each panel gives the results of 100 model runs where the starting parameter values for each run were randomly changed ('jittered') by 10% from the base model best fit values. The Base Run value for each panel is indicated by a red line.

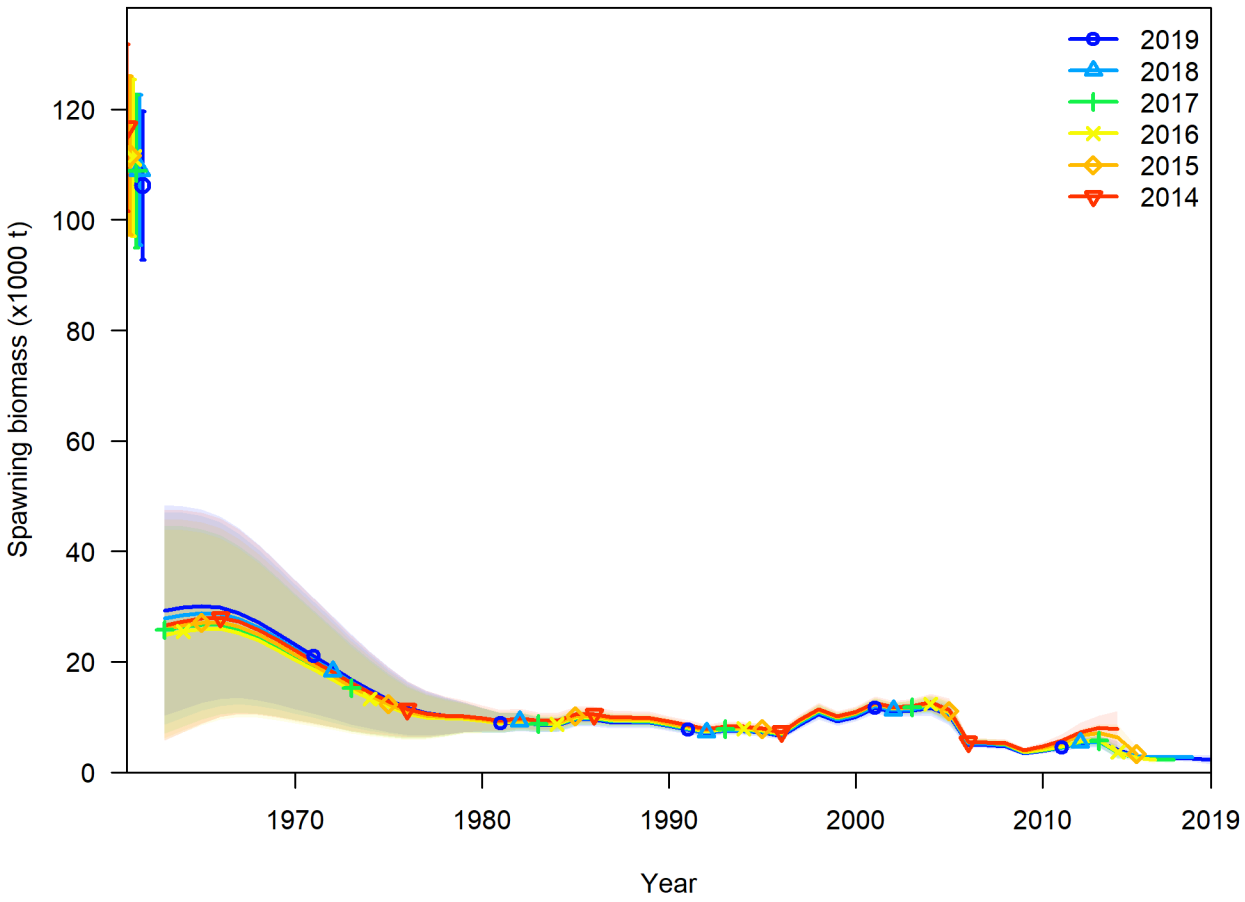


Figure 67. Results of a five year retrospective analysis for spawning biomass (metric tons) for the Gulf of Mexico Gag Grouper SEDAR 72 model. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities.

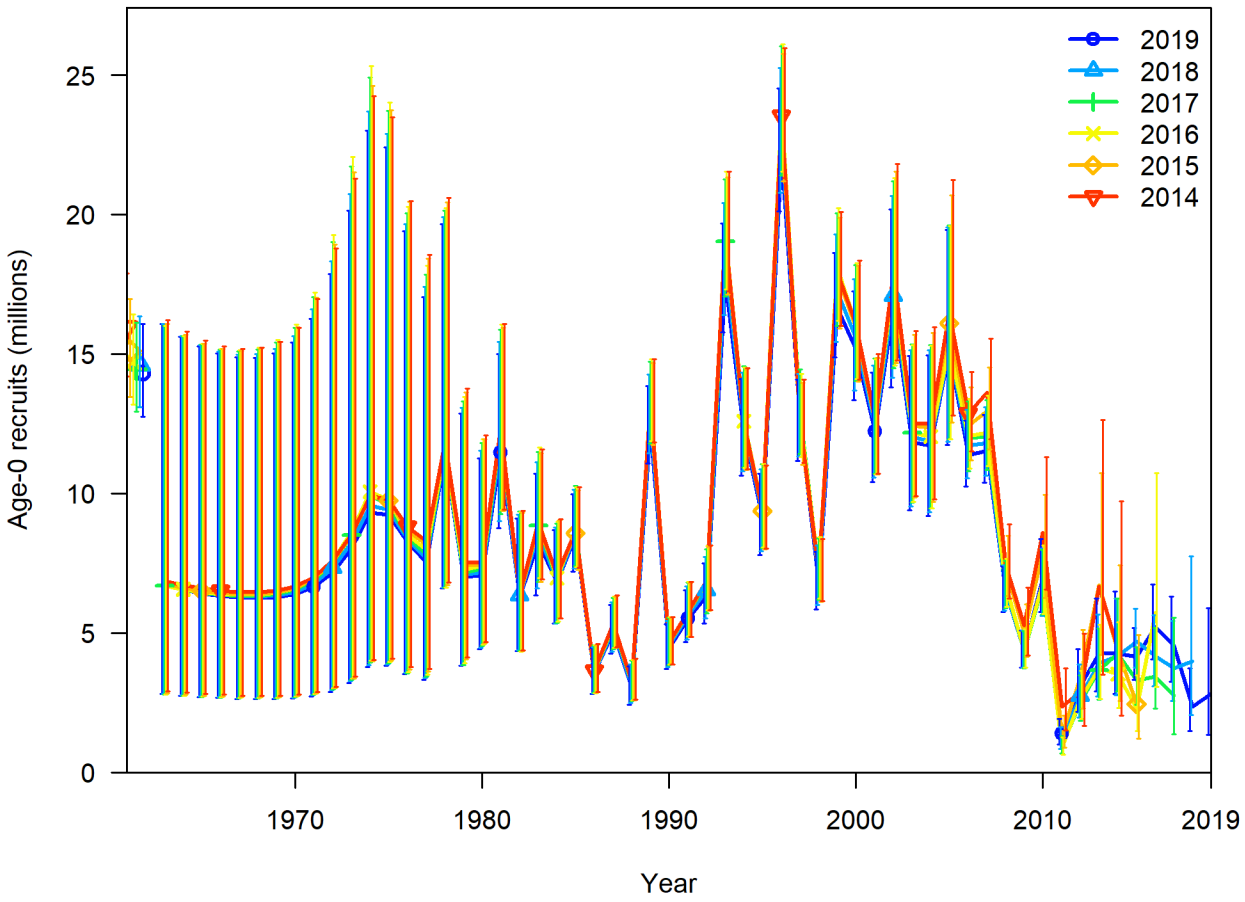


Figure 68. Results of a five year retrospective analysis for recruitment (millions of fish) for the Gulf of Mexico Gag Grouper SEDAR 72 model. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities.

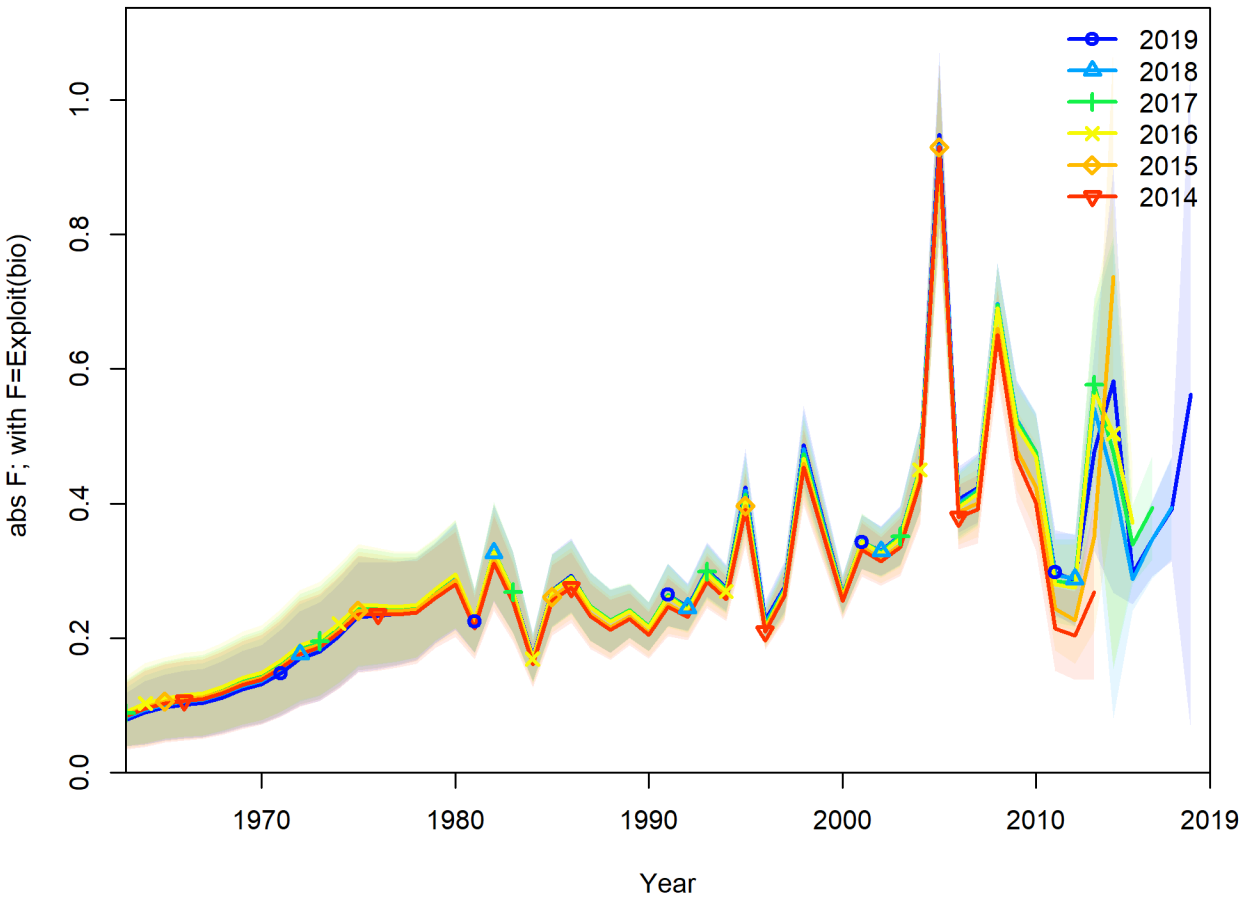


Figure 69. Results of a five year retrospective analysis for spawning biomass fishing mortality (total biomass killed / total biomass age 3+; bottom panel) for the Gulf of Mexico Gag Grouper for SEDAR 72 model. There is no discernible systematic bias because each data peel is not consistently over or underestimating any of the population quantities.

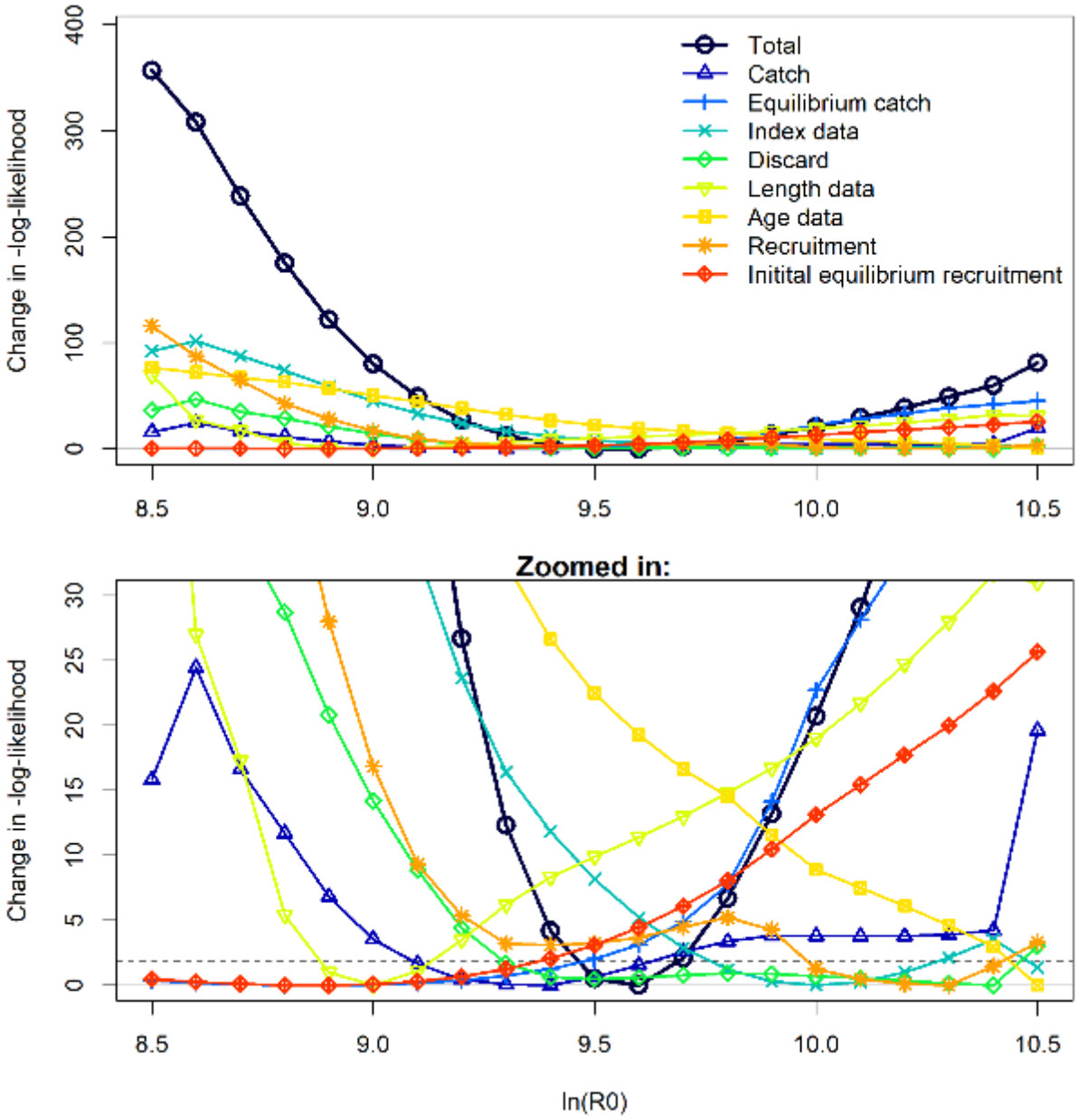


Figure 70. The profile likelihood for the natural log of the unfished recruitment parameter of the Beverton – Holt stock-recruit function for Gulf of Mexico Gag Grouper for SEDAR 72 model. Each line represents the change in negative log-likelihood value for each of the data sources fit in the model across the range of fixed steepness values tested in the profile diagnostic run. The MLE for the base model was 9.569. The bottom panel shows a close up of the top panel to better detect significant differences between runs.

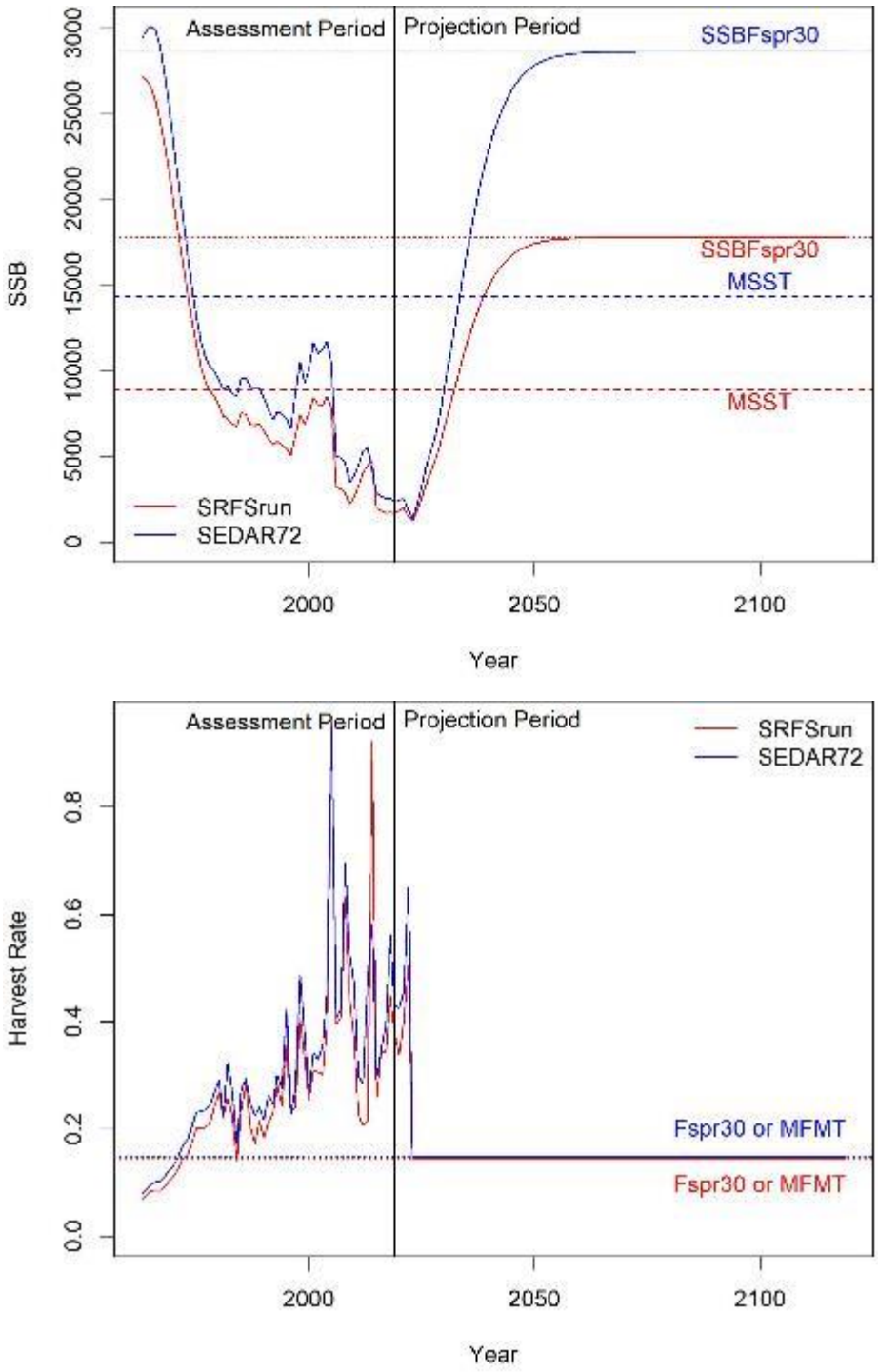


Figure 71. Time series of SSB and harvest rate (total biomass killed / total biomass age 3+) for the SRFS Run and the SEDAR 72 base run with respect to status determination criteria for the Gulf of Mexico Gag Grouper assessment.

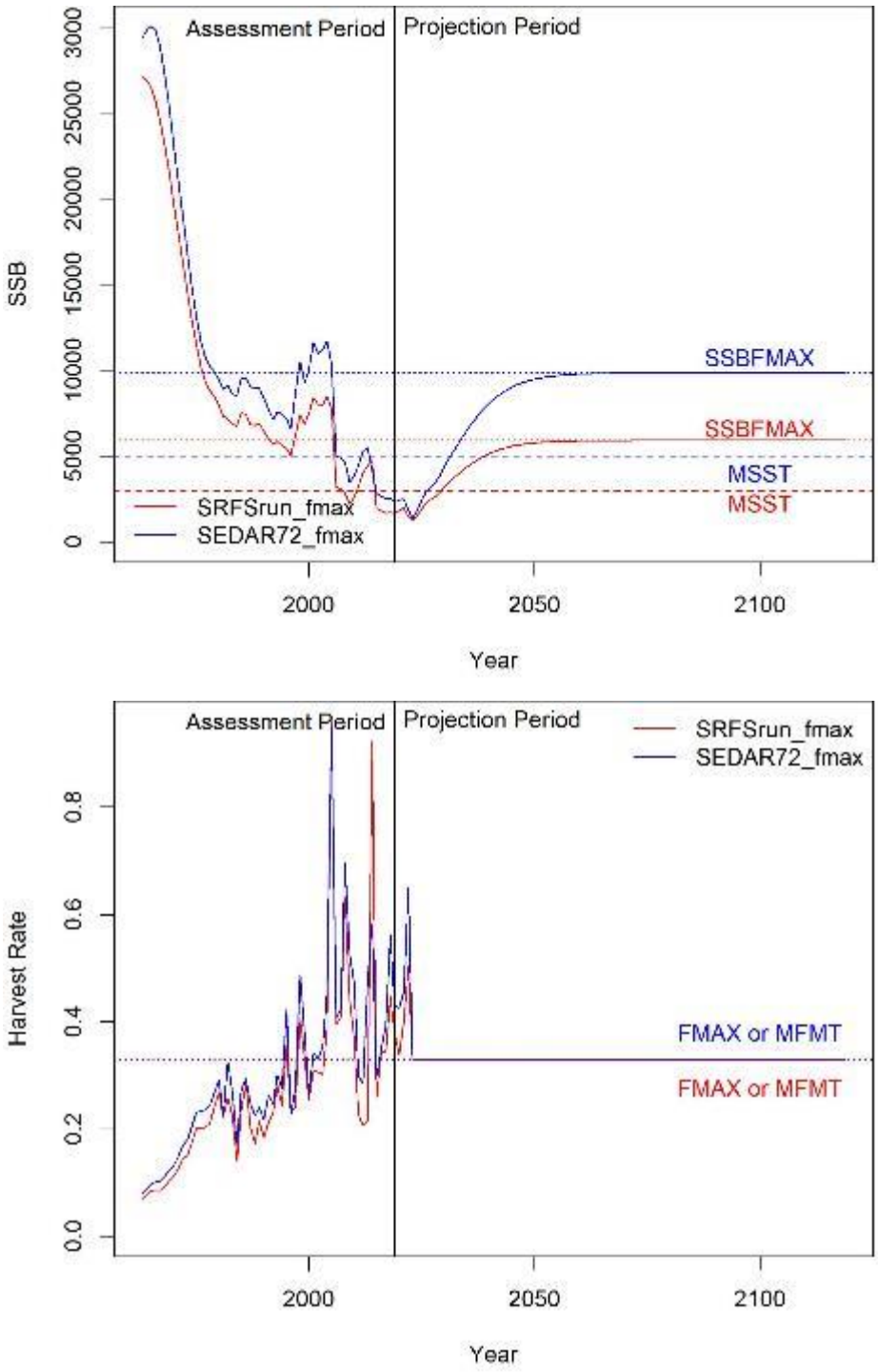


Figure 72. Time series of SSB and harvest rate (total biomass killed / total biomass age 3+) for the SRFS Run and the SEDAR 72 base run with respect to status determination criteria for the Gulf of Mexico Gag Grouper assessment.

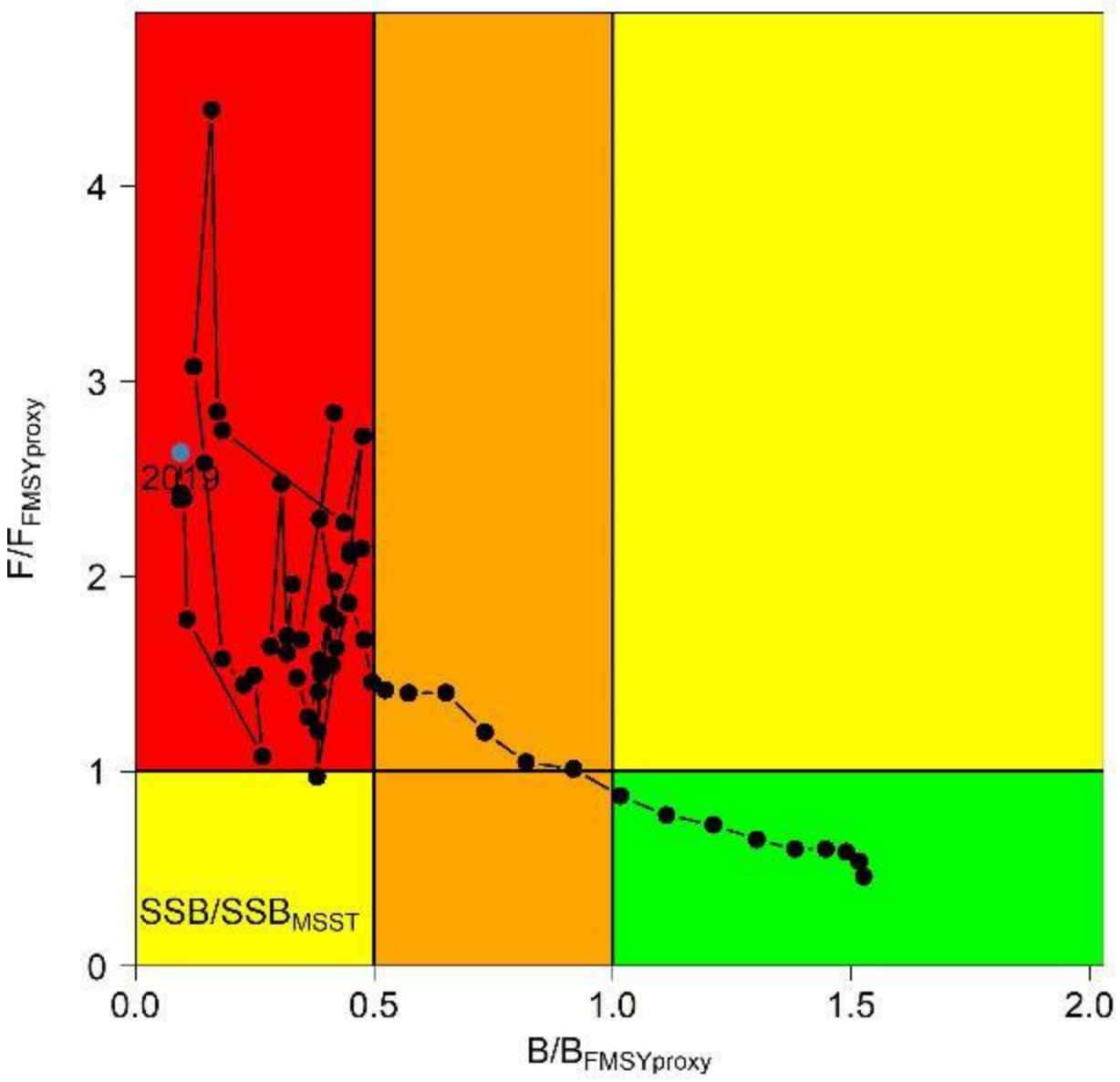


Figure 73. Kobe plot illustrating the trajectory of stock status for the SRFS Run. The orange coloring indicates regions where the stock is below the biomass target but above the biomass threshold (MSST = 0.5 x $SSB_{FMSYproxy}$). The 2019 terminal year stock status is indicated by the gray dot. Annual exploitation rates used to calculate $F/F_{MSYproxy}$ exclude red tide mortality. ***$F_{MSYproxy}$ defined as F_{SPR30}.***

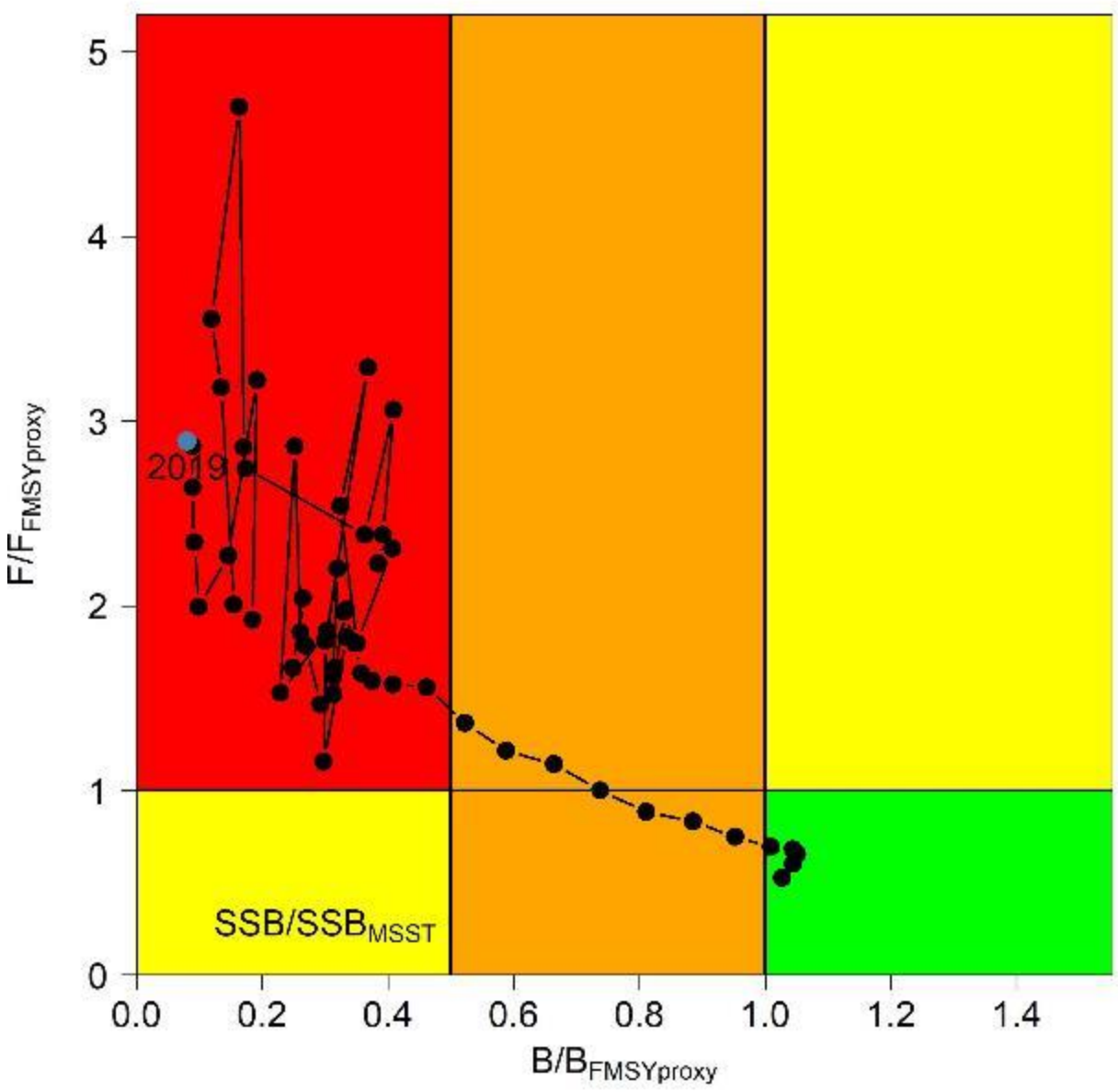


Figure 74. Kobe plot illustrating the trajectory of stock status for SEDAR 72. The orange coloring indicates regions where the stock is below the biomass target but above the biomass threshold (MSST = 0.5 x $SSB_{FMSYproxy}$). The 2019 terminal year stock status is indicated by the gray dot. Annual exploitation rates used to calculate $F/F_{MSYproxy}$ exclude red tide mortality. ***$F_{MSYproxy}$ defined as F_{SPR30}.***

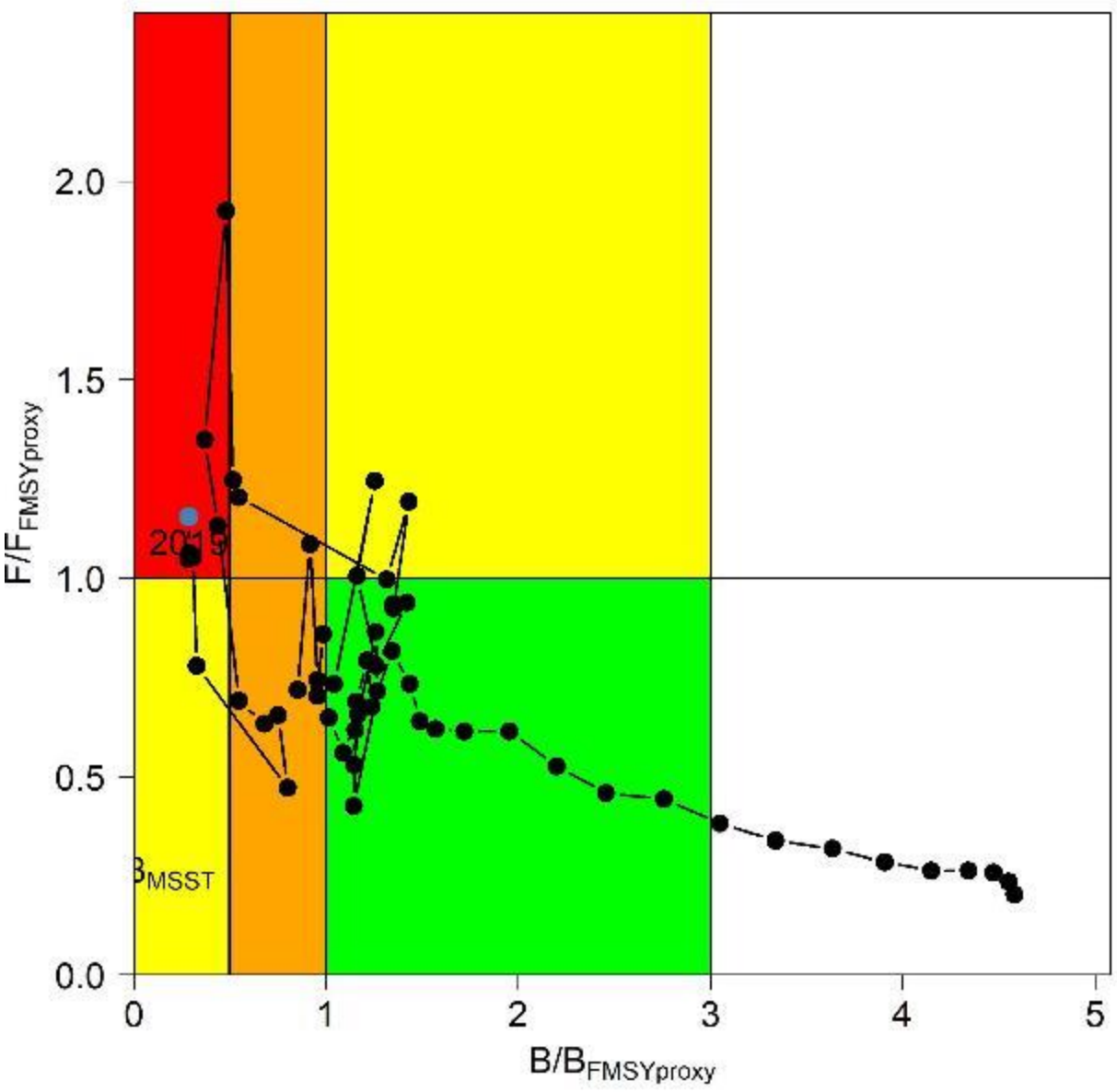


Figure 75. Kobe plot illustrating the trajectory of stock status for the SRFS Run. The orange coloring indicates regions where the stock is below the biomass target but above the biomass threshold (MSST = 0.5 x $SSB_{FMSYproxy}$). The 2019 terminal year stock status is indicated by the gray dot. Annual exploitation rates used to calculate $F/F_{MSYproxy}$ exclude red tide mortality. ***$F_{MSYproxy}$ defined as F_{MAX}.***

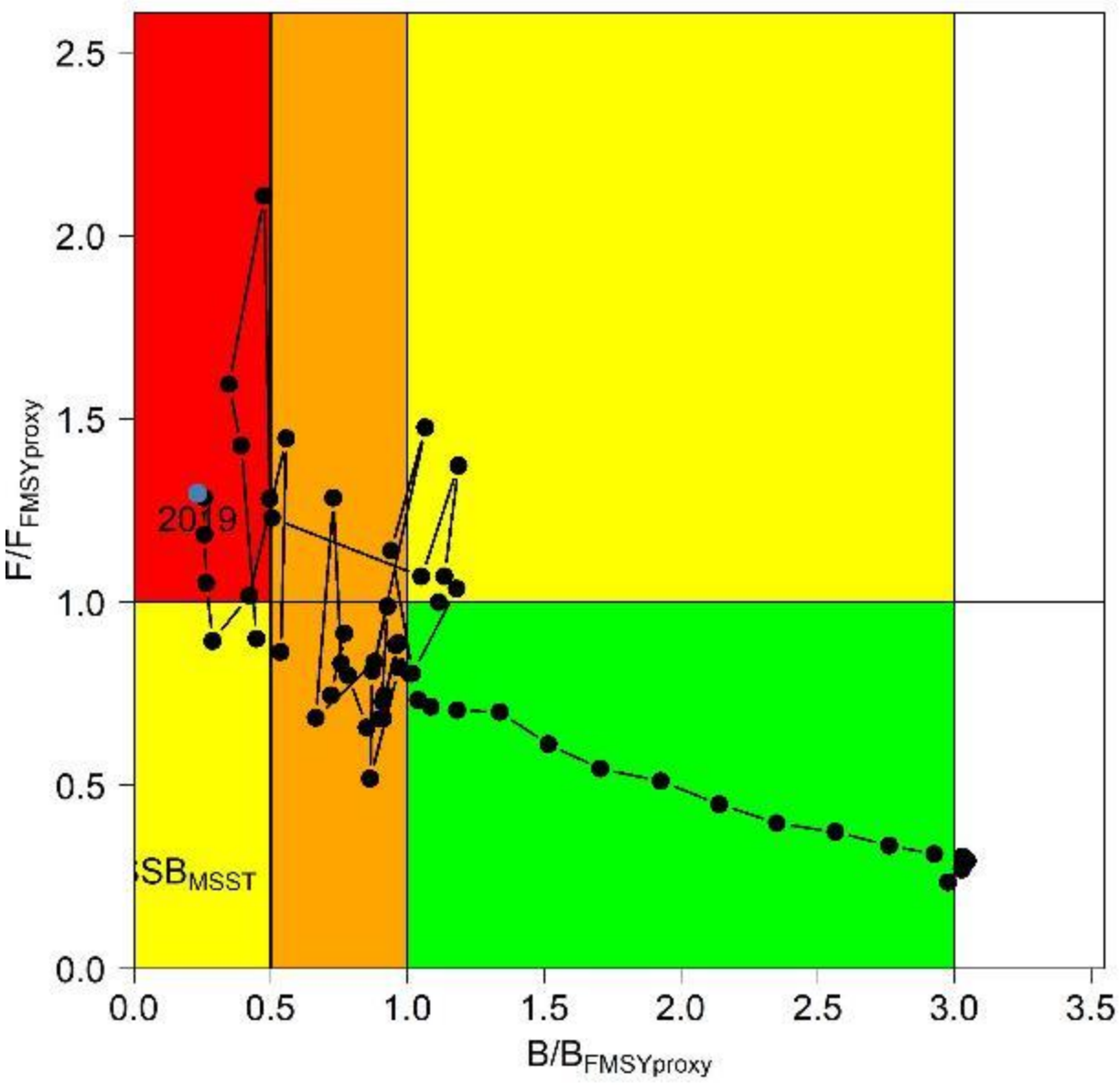


Figure 76. Kobe plot illustrating the trajectory of stock status for SEDAR 72. The orange coloring indicates regions where the stock is below the biomass target but above the biomass threshold (MSST = 0.5 x $SSB_{FMSYproxy}$). The 2019 terminal year stock status is indicated by the gray dot. Annual exploitation rates used to calculate F/F_{MAX} exclude red tide mortality. ***$F_{MSYproxy}$ defined as F_{MAX}.***