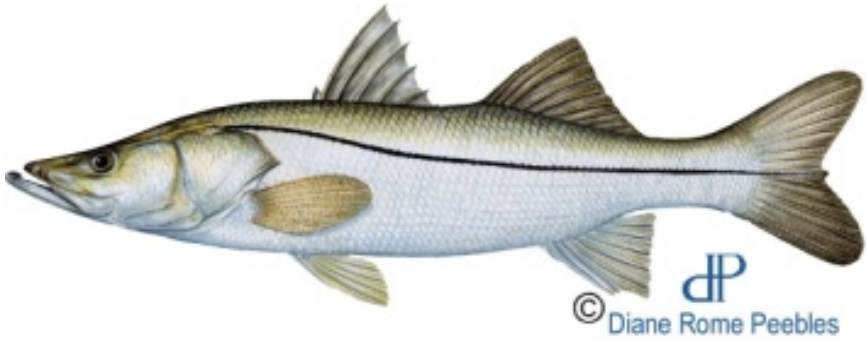

THE 2013 STOCK ASSESSMENT UPDATE OF COMMON SNOOK, *Centropomus undecimalis*

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EXECUTIVE SUMMARY

- This assessment update includes data through 2012, albeit the 2012 data are preliminary.

- Because of a severe cold spell in January 2010, the snook fishery remained closed by executive order until 31 August 2010. The fishery briefly opened on 1 September 2010 but was closed again by executive order on 17 September 2010 until 31 August 2011. The fishery on the Atlantic coast opened 1 September 2011 but the fishery on gulf coast has remained closed to harvest; however, the executive order keeping the fishery closed expires 31 August 2013.

- In 2012, based on recreational interviews with anglers who indicated the type of fish that they were targeting, snook dropped to the tenth most targeted species on both coasts (down from fifth place in 2009 on the Atlantic coast and from third place in 2009 on the gulf coast).

- As in previous assessments, total catch rates for MRFSS-MRIP and Everglades National Park creel data were calculated with generalized linear models. The variables that significantly reduced the deviance in the estimated catch rates included: for MRFSS-MRIP,-year, two-month wave, time fished, fishing mode, and fisher avidity and for the Everglades National Park creel survey, catch rates the variables were year, month, time fished, and area fished.

- On the Atlantic coast, recreational total-catch rates were flat from 1996 through 2009 then dropped in 2010 and 2011 and a slight increase in 2012 while the catch rates on the gulf coast were generally increasing until the drop after the 2005 red tide event then again the rates were increasing until a severe drop in 2010 and modest increases after.

- Total catch rates from the Everglades National Park creel survey, which were applied to the gulf coast analyses, showed similar increases in recent years as did the recreational index for the gulf coast and catch rates in the park also experienced the sharp drop in 2010 followed by increases afterwards.

- The fishery-independent haul seine catch rates in numbers of snook per set provided by the FWC's Fishery Independent Monitoring program on the Atlantic coast decreased from 1997to 2001 and then were stable until the drop in-2010, afterwards the catch rates increased slightly while catch rates on the gulf coast from 1996 to 2008 were mostly stable and then dropped in 2009 and 2010 to the lowest catch rate in the series. The gulf catch rates on the gulf increased after 2010. We used length data by coast for age-2 fish from the fishery independent samples to identify age-2 fish in the seine hauls and then repeated

the standardization process to generate indices just for age-2 fish by coast. The patterns in age-2 fish resembled the adult catch rates.

- The sizes of fish that anglers released were estimated from angler interviews, logbooks, the Snook and Gamefish Foundation's Angler Action Program, and a fishery independent catch-and-release fishing program. Data from the first three programs were available beginning in 2002 and the Angler Action Program beginning in 2010. The fishery independent catch and release fishing program operated from 2002 through 2005. We used the average lengths from 2002-2005 by coast to assign lengths to the released fish in the years 1999 to 2002 and fish less than 24 in TL for the earlier years..

- As with the 2012 assessment, we used the National Marine Fisheries Service's Age-Structured Assessment Program (ASAP) because ASAP is more flexible than the previously used Integrated Catch-at-Age model especially in terms of numbers of indices, years with age data for estimating selectivity, linking discards to their fisheries, differential weighting of population parameters, and other technical details.

- Fishing mortality rates on the Atlantic coast tracked those estimated in earlier assessments until 1998 and then the rates were higher for 1999-2003 and then similar from 2004 and later. After the extended season closure, from January 2010 until September 2011 on the Atlantic coast, the estimate of average fishing mortality for reference age (age-8) was 0.49 per year in 2011 and 0.15 per year in 2012. On the gulf coast, the fishing mortality rates declined after the slot limit was implemented in 1999 and the fishing mortality for the reference age (age-7) was 0.04 per year in 2010 which was down from the 1997 high value of 0.76 per year. The fishing mortality rate during the closure was 0.075 in 2011 and 0.066 per year in 2012. Most of the mortality on the gulf coast came from release mortality.

- The estimated recruitment on the Atlantic coast in 2007 through 2011 was the lowest over the 27 year time period and recruitment on the gulf coast from 2005 through 2009 was the lowest since 1992. The low numbers of recruits on the gulf coast occurred at the highest spawning biomass values. Low recruitment stemming from high spawning biomass indicates that environmental effects are important determinants of year class strength.

- The spawning biomass of snook decreased on the Atlantic coast until 2001 and then has slowly increased until 2010 and then decreased again. The spawning biomass on the gulf coast increased over the time series until 2010 then dropped and was a little lower in 2012 followed by an increase in 2012.

- In July 2007, the Commission implemented the Snook Work Group's recommendations to adopt a one-fish bag limit statewide and to narrow the slot limits to 28-32 inches total length (TL) on the Atlantic coast and 28-33 inches TL on the gulf coast. Bag limit adherence was higher on both coasts. During 2008–2012, only three out of 1,874 anglers intercepted on the Atlantic coast

(two out of 1,169 trips) kept more than one fish per angler while during the period 2002-2012 on the gulf coast, thirteen out of 8,125 anglers intercepted on the gulf coast (seven out of 6,491 trips) kept more than one fish per angler. Based upon the average lengths of kept fish recorded recreational samplers for the 2008-2012 time period, anglers on the Atlantic coast had reasonable compliance with 82% of the kept fish being within the 28–32 in slot limit and anglers on the gulf coast had less compliance with only 59% of the kept fish being within the 28-33 in slot limit. On the Atlantic coast 5% of the fish were undersized (less than 28 in) and 13% were oversized (greater than 32 in) while on the gulf coast 39% of the fish caught were undersized and only 2% were oversized (greater than 33 inches).

- The Commission's management objective for snook is to maintain the spawning potential ratio (SPR) at or above 40%. The transitional SPR (tSPR) values in 2012 approached the Commission's objective on the Atlantic coast (34%) and exceeded their objective on the gulf coast (58%).

1.0. INTRODUCTION

Common Snook, *Centropomus undecimalis,* is one of Florida's most popular gamefish. However, Florida is located at the northern extent of the snook geographical distribution and snook become subject to thermal stress when water temperatures decline in the winter months. Prolonged cold conditions in January 2010 produced many reports of fish cold-kills and many of the dead fish were snook. The Commission closed the fishery statewide in January 2010; they reopened the fishery on the Atlantic coast in September 2011 while keeping the fishery on the gulf coast closed. This assessment update primarily examines how snook on each coast have responded after 2010.

Evaluating the condition of a stock involves combining life history and fishery characteristics to provide managers with information on how anglers and the stocks interact and whether the stocks are increasing, decreasing, or stable. In this update, we refer the reader to the 2012 assessment (Muller and Taylor 2012) for the life history information on snook genetics, habitat, feeding, reproduction, and growth data. We provide summaries of harvest patterns, changes in effort, standardization of catch rates, and develop population and recruitment estimates from age-structured, separable population analyses. Regulations change how anglers can interact with the underlying stock. We evaluated regulatory compliance after the Commission implemented the Snook Work Group's recommendations in July 2007 which included implementing a one-fish bag limit statewide (a one-fish bag limit had been implemented on the gulf coast in January 2002), a 28"–32" allowable harvest slot limit on the Atlantic coast and a 28-33" allowable harvest slot on the gulf coast. The Commission extended the winter closure on the gulf coast to prohibit possession of snook from December 1 through February.

This update used the same primary analytical assessment method as used in the 2012 assessment (Muller and Taylor 2012) and benefited from improvements in the analyses identified in the National Marine Fisheries Service's (NMFS) Southeast Data, Assessment, and Review (SEDAR) process for other species.

2.0. BIOLOGICAL CHARACTERISTICS

The reader is referred to Section 2.0 of the 2012 assessment for the biological characteristics of Common Snook and the differences by coast.

3.0. FISHERY CHARACTERISTICS

3.1. Commercial Harvest

The reader is referred to Section 3.1 of the 2012 assessment for the commercial harvest which was prohibited in 1957.

3.2. Recreational Harvest

The State of Florida obtains estimates of recreational landings from two National Marine Fisheries Service programs: the Beaufort Headboat survey and the Marine Recreational Fisheries Statistics Survey which has recently undergone a major

revamp and has been renamed the Marine Recreational Information Program (MRFSS-MRIP). The headboat survey reported only 69 snook landed in the southeast United States during 1986-2012; therefore, we did not include the headboat landings and considered MRFSS-MRIP as the sole source of our snook landings.

The MRFSS-MRIP web address for data inquiries has been changed to: **http://www.st.nmfs.noaa.gov/recreational-fisheries/index.** MRFSS-MRIP began sampling in 1979 but the first two years can be considered a pilot study and the change in the survey's calculation methodology in 1994 precluded the use of those first two years; thus MRFSS-MRIP uses 1981 as the start of the program. Information collected during angler interviews includes the types of fish anglers catch; how many fish are caught, kept and released; the lengths and weights of landed fish; and demographic information on the anglers. In 1986, extra interviews were conducted in Florida to improve the estimates for king mackerel and in 1987 MRFSS-MRIP adjusted their sampling allocations by reducing the number of interviews with anglers fishing from shore and increasing the interviews of anglers fishing from private or rental boats. In the 1992, Congress allocated more funding such that the overall numbers of interviews were increased by approximately 250%. After FWC-FWRI personnel began conducting the creel survey interviews for MRFSS-MRIP in 1998, the annual number of interviews increased from approximately 12,000 interviews on each coast of Florida to 12,700 interviews on the Atlantic coast and 25,600 interviews on the gulf coast in 2012. Consequently, for consistency, we present landings information from 1981 but confine most of this update's analyses to the period 1986–2012 with the 2012 data (downloaded from MRFSS-MRIP, 2 May 2013) being preliminary and subject to change.

Catch and landings estimates were calculated for the Atlantic and gulf coasts of Florida separately, for each of six two-month waves of the year, for specific fishing modes (e.g., from shore, charterboat/guide boats, or private/rental boats), and for specific geographic regions along each coast (in inshore waters, state territorial waters, or in federal offshore waters). Thus, the annual estimates of catch or landings are aggregates of the individual stratum estimates.

The catch estimates do not match those from earlier assessments because NMFS-MRIP has recommended that the new MRIP methods and estimates be used where possible and to adjust the estimates for the years prior to MRIP (data from prior to 2004) using the procedures given by the Ad Hoc Recalibration Working Group (NMFS 2012). The patterns remain the same but the magnitude of the landings and releases were different (Fig. 3.2.1).

To evaluate the variability in catch and landings estimates, we used a Monte Carlo approach to calculate 5,000 values within each stratum using the stratum's mean estimate and variance (each of the 5,000 values was calculated as the stratum mean estimate plus a random, normal deviate (μ=0, σ=1) times the square root of the stratum variance), and then tallied the different stratum estimates by coast and year to identify the mean, median, quartiles, and 95% confidence limits. We used the mean estimated number of fish kept (Types *a* and *b1* fish in MRFSS) and mean estimated number of fish released alive (Type *b2* fish) in the subsequent analyses. This is the same approach that was adopted in previous stock assessments for

snook
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Recreational angler interviews indicate that anglers in Florida continue to release more than 95% of the snook they catch (Table 3.2.1, Fig. 3.2.2). In 2012, the total catch, including the number of fish released, was 236,000 fish on the Atlantic coast and 1,034,000 fish on the gulf coast. On the Atlantic coast, the total catch of snook peaked at 689,000 fish in 1995 and, on the gulf coast, at 2,343,000 fish in 2005. The estimated total harvest of snook, meaning those snook that were retained by the angler plus those snook that were estimated to have died after being released alive, was around 32,000 fish from 1998 through 2004 on the Atlantic coast and has been lower since then, with only 6,500 fish harvested in 2010, when the fishery was only open for less than three weeks during the fall (September 1 through September 17, 2010). The gulf harvest peaked at about 150,000 fish in 1996-97 then dipped and rose to about 115,000 fish in 2004-05 before dropping to very low levels after 2009 (<25,000, Fig. 3.2.3). The variability in the harvest estimates is shown in Fig. 3.2.3 and you will see that the harvests in 1996 on both coasts were poorly estimated. The very low harvests from 2010 and later reflect the closure on the gulf coast since January 2010.

As mentioned above, the term 'harvest' includes the estimated number of fish that died after being released as well as the number of snook that were landed. Taylor et al. (2001) estimated the overall, average release mortality rate, which is the percentage of snook that die after having been released alive, as only 2.13 % for snook. Although this rate is low, because anglers release most of the snook they catch, the number of deaths due to hooking injuries or catch-and-release stress can be appreciable (Table 3.2.1). Release mortality accounted for about 4,900 out of the 9,200 fish harvested (54%) in 2012 on the Atlantic coast while on the gulf coast the proportion of total harvest that was attributed to live-release deaths was nearly 100% because only 368 fish were reported landed in 2012 (Table 3.2.1, Fig. 3.2.4). The percentage of harvest due to release mortality has increased significantly since 1981 on both coasts (*t*-test that the slope is zero, $t = 7.45$, $df = 30$, $P < 0.05$ on the Atlantic coast and $t = 8.54$, $df = 30$, $P < 0.05$ on the gulf coast).

The two coasts differ as to when landings and releases occur. On the Atlantic coast, an average of 48% of the annual landings of snook occurred during the September–October wave while an average of 43% of the annual landings on the gulf coast were taken during the March–April wave (Table 3.2.2, Fig. 3.2.5).

3.3. Recreational effort

Recreational trips are not classified by species; therefore, we have to estimate the number of trips that were directed towards a particular species. MRFSS-MRIP developed a program to estimate directed fishing trips for a particular species by prorating the total number of trips in each stratum by the number of trips that caught the species of interest and then adding up the trips across strata. Directed effort for snook generally increased on the Atlantic coast until 2007 and then declined (Fig. 3.3.1). The decline in 2008 coincided with the weakening of the U.S economy and peak in gasoline prices (Fig. 3.3.2). The number of trips on the gulf coast increased until 2005 and then declined. Snook effort increased on both coasts until 2001 after which anglers on the gulf took more trips per year for snook

than did those on the Atlantic and, as expected, the numbers of snook trips dropped on both coasts in 2010.

Total catch which includes the fish which anglers kept and the fish which anglers released alive tracked the number of trips by year on the Atlantic coast until 1998 and then, while effort continued to increase until 2008, the total catch of snook declined, possibly in response to the regulatory changes (Fig. 3.3.3). On the gulf coast, total catch tracked effort until 2005 and then declined reaching bottom in 2010 and then increased again. Coincident with these two sharp declines in effort were an extensive red tide in 2005 and the cold temperatures in January 2010.

Changing popularity with anglers can possibly can be considered as another indicator of changes in effort. Based on MRFSS-MRIP interviews with anglers who indicated preferences for catching a particular species during their fishing trips, snook was the fifth most targeted fish on the Atlantic coast up to 2009 but dropped to tenth place in 2012 (Table 3.3.1). Snook was the third most targeted species on the gulf coast in 2009 but also dropped to tenth place in 2012. The ranks of the top five species on the Atlantic coast were the same in 2009 as in 2000; on the gulf coast, snook had moved up to third. As noted in earlier assessments, anglers did not rank snook in the top five target species on either coast in 1987. Since 1993, snook has been the most frequently noted target species in the Everglades National Park Creel Survey; however in 2012, snook had dropped to third place. In the Everglades National Park Creel Survey, the top three species specified by anglers has been snook, spotted seatrout and red drum. In 2009, thirty-seven percent of ENP anglers who specified a target species (265 out of 715 interviews with preferences) said that they were fishing for snook, red drum was the second most targeted species at 18%, and spotted seatrout was third at 11%. In 2012 with the snook season closures, red drum was the most targeted at 53% (332 out of 632 interviews with preferences), spotted seatrout was second at 17% and snook had dropped to the third most targeted species (9%).

The number of snook permits also can be considered as a measure of recreational effort for snook. With the addition of five-year snook permits, lifetime, Gold Sportsman, and Saltwater shoreline licenses, we had to combine the annual sales of resident snook permits with these other licenses to arrive at the total number of snook permits in a given year. This process estimates the number of licenses and permits because some of the multi-year license holders may not be active. Resident snook permits were initially required beginning in 1990, the statewide number of active permits has increased from 113,500 stamps in fiscal year (FY) 1990–91 to 289,000 stamps in FY 2006–07 and then remained at close to that level until a drop in FY 2010-11 and FY 2011-12 (Fig. 3.3.4a). The number of resident snook stamps in FY 2011/12 was 142,000 stamps. We combined resident Saltwater Fishing licenses in a manner similar to what we did for snook permits. The number of active Saltwater Fishing licenses has increased significantly since 1989–90 (t-test for slope equals zero, $t= 9.41$, $df = 21$, $P < 0.05$), reaching 956,800 licenses in FY 2011–12 (Fig. 3.3.4b). The ratio of snook permits to resident licenses no longer is increasing (t-test for slope equals zero, $t= 1.05$, $df = 21$, $P = 0.31$, Fig. 3.3.4c). The highest percentage of Saltwater Fishing license holders with snook permits (47%) occurred in FY 2007–08, and this percentage is surprising considering that snook only occur in the southern portion of the state

3.4. Lengths of fish caught by anglers

The size limits for snook in Florida have been revised several times since the establishment of the Marine Fisheries Commission in 1983. In 1985, the minimum size was increased from 18 inches to 24 inches total length with the provision that only one snook could be longer than 34 in total length (TL). In January 1999, the size limits were changed to a minimum size of 26 in TL and a maximum size of 34 in TL with no allowance for keeping larger snook. In July 2006, the Commission narrowed the slow by raising the minimum size to 27 in (686 mm) TL to account for measuring length as maximum total length (tail squeezed) as opposed to measuring total length with the tail relaxed. In July 2007, the Commission narrowed the allowable harvest slot limits to 28-32 in (711-813 mm) TL on the Atlantic coast and to 28-33 in (711-838 mm) TL on the gulf coast based upon the recommendations of the 2007 Snook Work Group.

Lengths of fish caught by anglers came from MRFSS-MRIP interviews (1981–2012), Everglades National Park Creel Survey (1979–2012), snook carcasses that anglers voluntarily supplied to FWRI (1997–2012), FWRI interviews targeting snook anglers (1998–2012), and logbook records. MRFSS-MRIP and ENP samplers record fish lengths in millimeters fork length, thus we converted the fork lengths to maximum total lengths (defined below) using the length-length equations in Taylor et al. (2000). When FWC samplers measured total length, they squeezed the tail; thus, all of the subsequent analyses will use the term 'total length' to mean total length with the tail squeezed or maximum total length. We converted all length measurements into integer inches total length (TL) because regulations are expressed in total length (in).

Lengths of snook landed by anglers and sampled by creel clerks in 2008-2012 (2,753 fish) ranged from 13 in to 37 in TL (Table 3.4.1). The maximum lengths of recreationally caught snook measured over the assessment period were 44 in on the Atlantic coast and 46 in on the gulf coast (Fig. 3.4.1). The lengths of snook measured by samplers showed that snook landed on the Atlantic coast were larger than those landed on the gulf coast (Fig. 3.4.2, Kolmogorov-Smirnov two-sample test, max difference = 0.33, test difference = 0.10, reject the null hypothesis). Anglers on the Atlantic coast tend to keep snook at the upper end of the slot while anglers on the gulf coast tend to keep snook at the smaller end of the slot.

We assigned sampled length frequencies to the landings estimates to create the estimated landings-at-length by coast. When available, lengths on a coast were assigned to landings by year and season (spring: Jan-Jun and fall: Jul-Dec).

Given that anglers release many snook, we had to assign lengths and ages to fish that are not available to the samplers for measurement (MRFSS-MRIP catch Type *b1* and Type *b2*). The fish that anglers mention landing but that were unavailable for inspection by the creel clerk (Type *b1*) were assumed to have the same lengths as the landed fish measured by the samplers (Type *a*). As in the previous snook stock assessment (Muller and Taylor 2012), the fish that were released alive (Type *b2*) were assigned the lengths based on logbook data, the FWC Catch-and-Release program, and the Snook and Gamefish Foundation's Angler Action data set. For the years 2002-12, the lengths were assigned directly to the numbers of fish that were

released alive by coast, year, and season. For the 1999-2001 years, the average lengths from 2002-2005 were applied for the years prior to 1999, the lengths of fish less than 24 in were applied to the released fish. The length composition of the fish that were believed to have died after being released fish are presented in Table 3.4.2.

Therefore, the final catch-at-length is the composite of the lengths assigned to the directed fishery and the lengths assigned to the estimated numbers of snook that were released alive and died due to being captured and released (2.13%) tallied by length and year (Table 3.4.3).

3.5. Ages of fish caught by anglers

The ages of snook were determined from sectioned otoliths (ear bones) collected from fish captured by fishery dependent and fishery independent programs (Table 3.5.1). Because the spawning season of snook is in the summer and snook form the annulus (ring) on the otoliths in the spring, fish were assigned to their year class based on the number of annuli and for those fish collected from January to June, age was determined by whether the annulus was on the margin of the otolith. Young of the year fish become age-1 fish on January 1 of the year following hatching. Mostly ages from the fishery dependent samples were used to assign ages to the harvest by coast and year and 98% of the lengths on the Atlantic coast and 97% of the lengths on the gulf coast were matched by coast and year. Lengths without direct fishery dependent ages were assigned ages from fishery-independent sampling (about 1%) and the remaining lengths had their ages assigned from a stochastic process that was derived from the von Bertalanffy growth curves by coast and the root-mean-square error (Muller and Taylor 2012). The years that had ages assigned with non fishery-dependent ages were down-weighted in the stock assessment analysis by assigning an effective sample size of one. The ages of released fish were derived from age specific age-length keys by coast and year that came from fishery dependent sampling, life history studies and fishery-independent sampling.

For the fish lengths that could not assigned ages directly, we calculating the numbers of harvested fish by age and year (catch-at-age matrix, CAA) with the stochastic age-length keys

$$CAA = AK \bullet CAL \qquad (3.5.1)$$

where AK is the appropriate age-length key matrix with dimensions of age and length and CAL is the catch-at-length matrix with dimensions of length and year. The estimated numbers of fish by age, year, and coast are shown in Table 3.5.2. On the Atlantic coast, fish older than 12 years old were not consistently harvested and so we combined all snook that were 12 years old and older into a 12^+ age-category and on the gulf coast fish older than 10 years old were not consistently harvested and we combined all fish 10 years old and older into a 10^+ group.

3.6. Bycatch

The main source of bycatch in the snook fishery is the recreational fishery for snook

and the fish that anglers catch and release because the fish are not within the allowable slot limits or bag limits. These fish that are released alive are estimated as MRFSS-MRIP Type-*b2* fish and included in the assessments and the update. In addition, snook were occasionally caught as by-catch to the inshore gill-net fishery (Motta 1993). However, the constitutional net ban implemented in July 1995 (Article X, Florida Constitution, Section 16) eliminated the use of entangling nets from inshore waters and from use in all likely snook habitats. There is potential for snook to be caught by commercial hook-and-line or cast net fishers but FWC does not have observer data from these fisheries to determine the extent of this bycatch.

3.7. Combined Harvest

The harvest from the recreational fishery is the only legal harvest because Florida's legislature eliminated the commercial fishery by making snook a gamefish in 1957. Bycatch of snook in commercial gear became minimal after 1995 when a constitutional amendment in Florida eliminated entangling gear from state waters and restrictions were placed on other nets.

4.0. ASSESSMENT

4.1. Trends in availability

An underlying assumption in stock assessments is that the availability of fish, as measured by catch rates, reflects abundance or population size. The National Research Council (1998) recommended using fishery-independent indices and, whenever possible, indices for specific ages. In this snook assessment, we used the catch rates from FWC's Fishery Independent Monitoring program's (FIM) stratified, random seine hauls as well as total catch rates from the fishery.

4.1.1. Fishery Independent Indices

The 183 m (600 ft) haul seine deployed by FIM is an ideal gear for sampling snook because the seine catches snook over a wide range of sizes, from 10 in on either coast to a maximum of 45 in on the Atlantic coast and to 43 in on the gulf coast. Data from the FIM haul seine allowed calculating an index for mature male snook (200 - 609 mm SL). To account for various sources of uncertainty in the observed number of snook per seine haul, we standardized the estimated mean number of mature male snook per seine haul with two generalized linear models (GLIM). One model estimated the probability that a haul seine set would catch a snook assuming a binomial distribution and the other model estimated the number of snook caught in successful hauls using a log-normal distribution. The annual index is the product of these two terms by year after they each have been back-calculated from their linear values (for the logit link the transform was $\Pr op = \frac{e^{f(x1+x2+..)}}{1+e^{f(x1+x2+...)}}$ and for the log-normal, the transform was $Y = e^{g(x1+x2+...)}$ where the x1, x2,… refer to the variables included in the respective linear models). Potential variables to be included in the models were bay, year, month, presence/absence of bottom vegetation, water temperature, and salinity. Temperature and salinity were subdivided into several categories to handle any non-linearity in the catch-rate

response. For a variable to be included in the final model, the variable had to meet two criteria: it had to be significant at the 0.05 level and it had to reduce the deviation (a measure of the variability) by at least 0.5%. We used a Monte Carlo simulation approach with 5,000 iterations that used the least-squares mean estimates and their standard errors from the GLIM model. Each iteration used the annual least-squares mean catch rate and added offsets that were calculated by multiplying the standard error by a random normal deviate (μ=0, σ=1). As described above, these values were converted back from their linear scale and multiplied together.

On the Atlantic coast, the GLIM reduced the mean deviance of the proportion-positive by 8% (2,982 seine hauls) and the mean deviance of the positive hauls model (2,694 hauls) by 13%. The number of snook per set on the Atlantic coast reached a low in 2002 and then varied without trend before it dropped to its lowest value in 2010. This decline was followed by an increase in 2011 and 2012 but catch rates have not regained their 2002-2009 levels yet (Fig. 4.1.1.1a). On the gulf coast, the GLIM reduced the mean deviance of the proportion-positive by only 2% (3,388 seine hauls) and the mean deviance of the positive hauls model (3,138 hauls) by 5%. Catch rates on the gulf coast generally increased until 2001-2003 then they declined reaching bottom in 2010 before increasing in 2011 and 2012 (Fig. 4.1.1.1b).

As per FIM sampling protocol, the maximum length of snook that were culled for age or histology was 650 mm SL which is equivalent to total lengths of either 30.6 in on the Atlantic coast or 30.0 in on the gulf coast. In reviewing the haul seine's length and age data, the largest age-2 fish on the Atlantic coast was 29 in and the largest age-2 fish from the gulf coast was 25 in. Therefore, we again used the haul seine data to develop FIM age-2 indices. The index was recalculated using the number of age-2 fish per haul instead of the mature male snook (200 - 609 mm SL) (Fig.4.1.1.2). On the Atlantic the age-2 index had the same shape as did the curve for mature males while on the gulf the pattern was different with a strong drop in the age-2 fish after 2001 the a recovery until the drop in 2009 and 2010 which is the same as for the mature fish.

4.1.2. Fishery Dependent Indices

We developed one fishery dependent index for the Atlantic coast using MRFSS-MRIP intercepts and two fishery dependent indices for the gulf coast, one from MRFSS-MRIP intercepts and one from Everglades National Park's creel survey. While there were some night interviews, the majority of the MRFSS-MRIP interviews were conducted during the daytime; for example, during the years 1999-2012, 94% of the interviews on the Atlantic coast and 95% on the gulf coast were conducted between 7:00 AM and 6:00 PM (Fig.4.1.2.1). We do not assume that the nighttime catch rates are equal to the day time catch rates but only that the overall trends between daytime and nighttime fishing have not changed consistently through time. For the indices, the actual total number of fish caught per intercept is not as important as the trends by year.

When calculating the MRFSS-MRIP indices (the total catch per primary interview), we followed the same procedure as was done in the 2012 assessment which, based

on cluster analysis (Krebs 1989), was to include any intercept that caught snook, Spotted Seatrout, or Red Drum on the Atlantic coast or that caught snook or Red Drum on the gulf coast (Fig. 4.1.2.2).

As with the fishery-independent indices, we used a generalized linear model with a binomial distribution (logit link) for the proportion of positive trips and a second GLMM with a log-normal distribution (identity link) for the number of snook caught on successful trips. The indices by coast were the product of the annual proportion positive times the annual mean number of snook caught on positive trips. Potential variables for the analyses included year, the two-month wave during which the trip was conducted, the number of anglers on a fishing trip, the length of the fishing trip in hours, area fished (bay or nearshore), the mode of fishing (shore, charter, private/rental boat), and avidity (the number of fishing trips that the angler made in the previous two-months). Again, variables were included in the final model if they were statistically significant and they reduced the null mean deviance by at least 0.5%.

On the Atlantic coast, the GLIM reduced the mean deviance of the proportion-positive by 14% (13,745 interviews) and the mean deviance of the positive trips model (4,654 trips) by 5%. The estimated number of snook per trip from MRFSS-MRIP intercepts has generally declined reaching low in 2011 and a slight increase in 2012 (Fig. 4.1.2.3.a). The GLIM for the gulf coast reduced the mean deviance of the proportion-positive model by 5% (16,545 interviews) and 7% for the positive-trips model (8,826 trips). The estimated MRFSS-MRIP catch rates on the gulf coast were more variable but generally increased with the highest value in 2005 (Fig. 4.1.2.3b). The catch rates on the gulf coast also showed a marked drop in 2010 followed by an increase.

Catch rates from Everglades National Park's Creel Survey (ENP) for the years: 1986–2012 were calculated in the same manner as the MRFSS catch rates using cluster analysis on the ENP data which grouped snook with Spotted Seatrout, Red Drum, Ladyfish, Gray Snapper, and Crevalle Jack. Potential variables for ENP were year, month, interview location (Flamingo or Everglades City), area fished (areas 1-6), hours fished, and the number of anglers. The final model reduced the deviance by 17% for the proportion of positive trips (152,435 trips) and 11% for the number of snook caught on positive trips (44,531 trips). The ENP index (Fig.4.1.2.3.c.) was similar to the MRFSS gulf coast index (correlation coefficient = 0.54, $df = 20$, $P < 0.05$) but with higher values especially in 2007-2009.

4.2. Assessment models

As in the 2012 assessment, we used the Age-Structured Assessment Program (ASAP) from NMFS's Northeast Fisheries Science Center's Assessment Toolbox ASAP as the main analytical tool for conducting the update. However to get a rough idea of the levels of expected total mortality rates, we calculated catch curves by coast using the average numbers of fish harvested by age over the period 2008-2012.

4.2.1. Catch Curves

At several of the SEDAR workshops and reviews, participants have asked for some simple analyses as a check on the more complex population models. One of the simplest models for estimating total mortality rates is a catch curve, which is just a plot of the number of fish by age (Ricker 1975). When plotted on a log-scale, this curve becomes linear provided that the total mortality is constant and its slope is an estimate of the total mortality. While this model is rarely used as a final analysis because of assumptions of constant recruitment, all ages being equally vulnerable, and constant mortality it does provide a rough estimate of the expected magnitude of total mortality.

4.2.1.1. Model configuration and Equations

The basic data for a catch curve is the number of fish by age. To get an idea of recent mortality rates, we used the 2008-12 average numbers of fish by age and coast from the total catch-at-age (directed catch plus the number of fish released alive). The analyses were repeated using fishery-independent ages as a check. Instead of simply taking their logarithms and calculating a linear regression, we used the Chapman and Robson approach because it is less sensitive to missing ages and to sampling error (Chapman and Robson 1960, Ricker 1975, Murphy 1997). Using the equations from Ricker (1975), survival, *S*, is:

$$S = \frac{T}{\Sigma N + T - 1} \qquad (4.2.1.1.1)$$

where $T = 0N_0 + 1N_1 + 2N_2 + 3N_3 + \ldots + AN_A$, $\Sigma N = N_0 + N_1 + N_2 + \ldots + N_A$, N_0 is the abundance of the first age considered to be fully available, and *A* is the oldest age. Annual survival can be converted to an instantaneous estimate of total mortality, *Z*, by

$$Z = -\ln(S) \qquad (4.2.1.1.2)$$

where ln() refers to taking the natural logarithm.

4.2.1.2. Parameters estimated

A catch curve estimates a single parameter, survival, which in turn can be expressed as total mortality per year.

4.2.1.3. Uncertainty and Measures of Precision

The variance of survival from a catch curve is:

$$V = S\left(S - \frac{T-1}{\Sigma N + T - 2}\right) \qquad (4.2.1.3)$$

However we have found that the variance tends to be under-estimated and we know that recreational landings do not meet the equilibrium assumptions.

4.2.1.4. Model Results

Using the 2008-2012 average numbers caught at age on the Atlantic coast (Fig. 4.2.1.4a), we calculated a catch curve using the simple rule-of-thumb of starting at the next older age after the modal-abundance age. Thus, the catch curve calculations for the Atlantic coast included ages 5 through 18. The annual survival rate was 0.62, which was equivalent to an instantaneous total mortality rate of 0.48 per year. The standard error of the annual survival rate ($\sqrt{V}$) was 0.0008. When the exercise was repeated using fish collected with the fishery independent, 600-ft (183-m) haul seine and ages 4 through 16 (there were no age 17 or age 18 fish in the fishery independent samples), the annual survival rate was slightly higher at 0.64 which was equivalent to a total mortality rate of 0.45 per year. The consistency of the results using two different sources of snook ages is encouraging. On the gulf coast, the calculations also included ages 5 through 18 (Fig. 4.2.1.4b). The annual survival rate on the gulf coast was 0.54 (SE = 0.0005), which was equivalent to an instantaneous total mortality rate of 0.62 per year. When the calculations were repeated using the ages of fish collected with the fishery independent haul seine (ages 4 through 15), the annual survival rate was 0.56 (SE 0.0104) which was equivalent to a total mortality rate of 0.58 per year. Again, the consistency of the estimates from the two sources of ages is encouraging because it provides evidence that both the recreational fishery and the fishery independent program are sampling the same underlying populations. However it must be remembered that these estimates are only rough numbers because of the underlying assumptions of constant recruitment, constant mortality, and constant selectivity across ages.

4.2.2. Age-Structured Assessment Program (ASAP)

Age-Structured Assessment Program (ASAP) by Legault and Restrepo (1998) is a module in the NMFS Assessment Toolbox developed at the Northeast Fisheries Science Center. ASAP has been used extensively in the southeast US for the red snapper stock assessment (Schirripa and Legault 1999), the red grouper stock assessment (NOAA 2002, SEDAR, 2006), the mutton snapper assessment (SEDAR 2008), the black grouper assessment (SEDAR 2010), and the 2012 snook assessment (Muller and Taylor 2012). This model is a statistical catch-at-age model that allows for multiple fisheries, discards, tuning indices, and the model estimates stock- recruit relationships and biomass-based benchmarks internal to the model. ASAP estimates recruitment and the population sizes in the first year of the time series and then works towards older and more recent years (forward projection). We used ASAP version 3 which was released in November 2012 in this update.

4.2.2.1. Model Configuration and Equations

After the comments we received on the 2012 stock assessment, we configured the model on the gulf coast with two fisheries: the recreational fishery and the removals from red tide and cold kills. The specifics of including the environmental effects into ASAP are in the 2012 assessment.

The basic equations for ASAP were similar to those in any statistical catch-at-age model and recruitment is determined from a Beverton-Holt stock-recruit relationship with annual deviations. Fishing mortality, in the absence of discards, was considered to be the product of selectivity for a particular age and the annual fishing mortality for fully recruited fish ($Fmult_{f,,y}$, selectivity = 1.0). The annual fishing mortality deviations were multiplicative meaning that the fishing mortality multiplier for a given year depended upon the prior year's fishing mortality multiplier, i.e. $Fmult_{f,y} = Fmult_{f,y-1} * Fmult\_dev_{f,y}$. The equation for the fishing mortality at age, *a*, in year, *y*, for fleet, f was:

$$F_{f,a,y} = Sel_{f,a} Fmult_{f,y} \qquad (4.2.2.1.1)$$

where $Sel_{f,a}$ was the selectivity for a given age. In prior assessments, we applied different selectivity patterns when the size limits changed but, since the minimum size has been 24 in TL (610 mm) or greater for the entire time series and because ASAP allows the linkage of the discards to the fish that were kept, it made more sense to use a single, flat-topped selectivity pattern and then account for the different size limits with the proportion of fish that were released by age and year. Because $Fmult_{f,y}$ predicts the total catch, it is a capture rate not a mortality rate with some of the discarded fish surviving especially considering the low release mortality rate. On each coast, the same selectivity pattern was used for the recreational fishery and for the MRFSS-MRIP index. Discards in the snook fishery were those snook that anglers released alive (Type *B2* fish) because the fish were either not in the allowable slot limit, or the angler had already filled his bag limit, or the snook season was not open, or the angler practiced catch-and-release fishing. When discards were linked to the kept fish, the equation for the fishing mortality of the directed fishery at age, *a*, in year, *y*, for fleet, *f*, $F_{f,a,y}$, became:

$$F_{f,a,y} = Sel_{f,a} Fmult_{f,y} (1 - prop\_rel_{f,a,y}) \qquad (4.2.2.1.2)$$

where $prop\_rel_{f,a,y}$ was the proportion of fish that were discarded by each age and year and the corresponding discard mortality, $F\_disc_{f,a,y}$, was:

$$F\_disc_{f,a,y} = Sel_{f,a} * Fmult_{f,y} * prop\_rel_{f,a,y} * rel\_mort \qquad (4.2.2.1.3)$$

where *rel_mort* was the release mortality on the discarded fish.

The number of snook at age and year, $N_{a,y}$, was solved forward from the earliest year using the total fishing mortality by age and year, $F\_tot_{f.a.y}$ ($F\_tot_{f,a,y} = F_{f,a,y} + F\_disc_{f,a,y}$), and the natural mortality rate, $M_{a,y}$, from

$$N_{a+1,y+1} = N_{a,y} \exp(-F\_tot_{f,a,y} - M_{a,y}) \qquad (4.2.2.1.4)$$

The predicted catch-at-age, $\hat{C}_{a,y}$, was calculated from the Baranov catch equation (Murphy 1965, Ricker 1975):

$$\hat{C}_{a,y} = N_{a,y} \frac{F\_tot_{f,a,y}}{(F\_tot_{f,a,y} + M_{a,y})} (1 - \exp(-F\_tot_{f,a,y} - M_{a,y})). \qquad (4.2.2.1.5)$$

Predicted index values were calculated from the estimated number of snook of the appropriate ages from the appropriate selectivity pattern and the index's catchability coefficient, q_j. For an aged index, I_j, the number of snook at age was summed across the fraction of the ages that the index applied to and multiplied by the catchability, q_j, or

$$\hat{I}_{y,j} = q_j \sum_a N_{a,y} \qquad (4.2.2.1.6)$$

Recruitment was predicted with a Beverton-Holt stock-recruit equation with annual deviations. The formulation of the Beverton-Holt equation used in ASAP for the recruitment in year, *y* (R_y), from the spawning biomass in year, *y-1* (SSB_{y-1}), was:

$$R_y = \frac{\alpha SSB_{y-1}}{\beta + SSB_{y-1}} \qquad (4.2.2.1.7)$$

and

$$\alpha = \frac{4hR_0}{5h-1} \qquad (4.2.2.1.8)$$

and

$$\beta = \frac{S_0(1-h)}{(5h-1)} \qquad (4.2.2.1.9)$$

where *h* was the steepness (Francis 1992), S_0 was the virgin spawning biomass and R_0 was the recruitment associated with S_0. Steepness is the ratio of the predicted recruitment at a spawning biomass level of 20% of the spawning biomass without fishing to the recruitment with no fishing and provides a simple, direct way of comparing stock-recruit curves.

4.2.2.2. Parameters Estimated

There were 74 parameters estimated in the Atlantic coast ASAP model and 102 parameters in the gulf coast model with the environmental effects (Table 4.2.2.2). The estimated parameters on the Atlantic coast were: two selectivity parameters for the fishery, 27 fishing mortality estimates (F_{mult} in the initial year (1986) and 26 F_{mult} deviations), 27 recruitment deviations, initial abundances of 11 ages in 1986, three catchability coefficients for the indices, two selectivity parameters for the indices (two for the FIM index), the virgin spawning biomass, and steepness. The estimated parameters on the gulf coast were: two selectivity parameters for the fishery, 27 fishing mortality estimates for the recreational fishery (F_{mult} 1986 and 25 F_{mult} deviations), 27 mortality estimates for the environmental effects (F_{mult} 1986 and 25 F_{mult} deviations), 27 recruitment deviations, initial abundances of nine ages in 1986, four catchability coefficients for the indices, four selectivity parameters for three of the indices (two for FIM and two for ENP), the virgin spawning biomass, and steepness. The sensitivity case without the environmental factors being treated as a fishery on the gulf coast, solved for 75 parameters instead of 102 parameters because that model did not have the 27 mortality parameters for the

environment.

4.2.2.3. Uncertainty and Measures of Precision

Uncertainty was partly evaluated through sensitivity runs with different natural mortality rates and with a run on the gulf coast that did not consider the environmental effects of cold kills or red tides. The precision of the ASAP parameters was evaluated with square root of the diagonals of the covariance-matrices, which are presented in Table 4.2.2.2 and with the Markov Chain – Monte Carlo simulation option in ASAP. We kept 5,001 outcomes with a thinning rate of 2000 for a total of 10,002,000 simulations and then discarded the first outcome to develop density plots of specific parameters from the remaining 5,000 outcomes.

4.2.2.4. Model Results

4.2.2.4.1. Model Fits

The fits to the index age composition were reasonable for both coasts (Table 4.2.2.4.1, Fig. 4.2.2.4.1.1). The fit of the age composition of the landings and dead discards was also close (Fig. 4.2.2.4.1.2 and Fig. 4.2.2.4.1.3). The fits to the index values were much closer (Fig. 4.2.2.4.1.4) than the fits to their age compositions as were the fits to the landings and the discards (Fig. 4.2.2.4.1.5). Based on the mean square errors (MSE, essentially the variance of the individual model components), the model fit the FIM adult snook index and the MRFSS index the closest on the Atlantic coast followed by the FIM age-2 seine index, the recreational direct fishery and finally the discards (Table 4.2.2.4.1) while on the gulf coast, the model also fit the discards the closest, followed by the MRFSS index, the FIM adult index, Everglades National Park index, the FIM Age-2 index, and finally the recreational fishery.

4.2.2.4.2. Fishery Selectivity

The realized selectivities (age-specific ratio to the fully-recruited fishing mortality) reflected the implementation of the slot limits that began with the 26-34 inch slot in 1999. Prior to the slot limit, selectivity increased with age up to age-10 on both coasts while after the slot limit was implemented, the age of full recruitment declined to age-6 on the Atlantic coast (Fig. 4.2.2.4.2.a) and to age-7 on the gulf coast (Fig. 4.2.2.4.2.b). When the harvestable slot limits were narrowed in 2007, the selectivities again changed to age-8 on the Atlantic coast and remained at age-7 on the gulf coast.

4.2.2.4.3. Fishing mortality rates

The estimated fishing mortality rates by coast, year, and age are presented in Table 4.2.2.4.3. Because the current slot limit shifted the age that snook became fully selected, we will focus on a single age for a historical comparison. While the fishing mortality rate in 2010 on the Atlantic coast for age-8 fish was 0.05 per year, the rate bounced up to 0.49 per year in 2011 and then came back down to 0.15 per year (95% confidence interval 0.055-0.337 per year) in 2012. The geometric mean of the fishing mortality rates from 2010 through 2012 was 0.15 per year. On the

gulf coast, the fishing mortality on age-7 fish in 2010 was 0.04 per year and even though the fishery was closed to keeping snook, the fishing mortality rate increased in 2011 to 0.08 per year and was 0.07 per year (95% confidence interval 0.052-0.082 per year) in 2012. The geometric mean of the fishing mortality rates from 2010 through 2012 on the gulf coast was 0.059 per year.

If we look at a trajectory of fishing mortality rates on age-8 fish on the Atlantic coast, we see that fishing mortality rates reached a peak 0.71 per year in 1997 (Fig. 4.2.2.4.3.1a). The average fishing mortality rates weighted by population size (using the data in Tables 4.2.2.4.3 and 4.2.2.4.4) were 0.380 per year during 1999-2005 and 0.051 per year during 2008-2012 after the implementation of the reduced slot limits and the one-fish bag limit. On the gulf coast, the peak fishing mortality rate was similar at 0.76 per year in 1997 (Fig. 4.2.2.4.3.1b). The average fishing mortality rate weighted by population size was 0.261 per year during 1999-2005 and 0.017 per year during 2008-2012. The low, recent level comes from the combination of the closure of the directed fishery since January 2010 as well as the reduced slot limits that were implemented in July 2007.

When fishing mortality rates from the current stock assessment were compared to those from the 2006 (Muller and Taylor, 2006) and 2012 stock assessments using age-7, the rates on the Atlantic coast were very similar between the 2012 assessment and the 2013 update selectivity (Fig. 4.2.2.4.3.2a). These two differed from the 2006 assessment because of the different selectivity pattern associated with the 26-34 in slot limit that was implemented in 1999. On the gulf coast, the fishing mortality rates from the 2012 assessment and this update were similar and mostly lower than those from the 2006 assessment again probably due the different selectivity patterns (Fig. 4.2.2.4.3.2b). In the two recent assessments, we assigned a single flat-topped selectivity for catching snook and then handled the different slot limits through the proportion released while we fit separate selectivity patterns for each slot limit in the 2006 assessment. The rationale for the single selectivity pattern is that anglers fish the same areas using the same gear and the anglers release the fish when the fish is not within the harvestable slot.

4.2.2.4.4. Stock Abundance and Recruitment

The estimated total number of snook has varied across years and by coast. On the Atlantic, the number of snook increased from 405,000 fish in 1986 to 616,000 fish in 1992 and then declined to 271,000 fish in 2010 and has increased slightly to 305,000 fish in 2012 (Table 4.2.2.4.4, Fig. 4.2.2.4.4.1a). On the gulf coast, the number of snook increased from 446,000 fish in 1986 to 2,119,000 in 2004 and then declined to a low of 1,219,000 fish in 2009 and up to 1,254,000 fish in 2012 (Fig. 4.2.2.4.4.1b).

Estimated recruitment of age-1 snook on the Atlantic coast increased from 180,000 fish in 1986 to 255,000 in 1992 then declined to a low of 64,000 fish in 2010 and then has increased to 115,000 snook in 2012 (Table 4.2.2.4.4, Fig. 4.2.2.4.4.2a). On the gulf coast, recruitment was more variable with 175,000 fish in 1986 increasing to 827,000 fish in 2000 before declining to 445,000 fish in 2002 (the year after a January cold kill). Two large recruitment years (843,000 and 877,000) followed in 2003 and 2004 then smaller cohorts after 2004 except for 2010 and

2011 and then back down in 2012 to 400,000 fish, but the estimate of recruitment in 2012 was very uncertain (Fig. 4.2.2.4.4.2b). Recruitment on the gulf coast has been more than three times that of the Atlantic coast (average 3.44) and, for the past decade, five times greater.

When estimated recruitment was compared to that estimated in the 2006 or the 2012 assessments on the Atlantic coast, the recruitment in the update was similar to the 2006 levels and lower than that estimated in 2012 while on the gulf coast the 2012 assessment and the 2013 update were similar and higher than the recruitment in the 2006 assessment (Fig. 4.2.2.4.4.3). The differences within a coast were a matter of scale because the 2013 recruitment patterns were correlated on both coasts (on the Atlantic coast, the correlation coefficients were *0.73* and *0.94*, *df = 16* and *23*, *P < 0.05* and on the gulf coast the correlation coefficients were *0.52* and *0.92*, *df = 16* and *23*, *P < 0.05*). The recruitment on the gulf coast showed a severe drop in 2005 which coincided with the 2005 red tide.

4.2.2.4.5. Stock Biomass (total and spawning stock)

The total biomass on the Atlantic coast reached a peak of 1,069 mt (2,356,000 lb) in 1994 and then declined such that in 2012 the total biomass was 594 mt (1,310,000 lb, Fig. 4.2.2.4.5.1a). The peak biomass reflects the earlier 1991-92 increases in recruitment. The total biomass on the gulf coast has increased from 474 mt (1,045,000 lb) to a peak total biomass of 2099 mt (4,628,000 lb) in 2005 and then decreased to 1,277 mt (2,816,000 lb) in 2011. Total biomass increased slightly to 1,386 mt (3,056,000 lb) in 2012 (Fig. 4.2.2.4.5.1b).

The spawning biomass loosely tracks total biomass. On the Atlantic coast, the spawning biomass decreased from 427 mt (942,000 lb) in 1986 to a low of 234 mt (517,000 lb) in 2001, increased slightly to 280 mt in 2010, and was 256 mt (565,000 lb in 2012 (Fig. 4.2.2.4.5.2a). On the gulf coast, the spawning biomass increased from 229 mt (505,000 lb) in 1986 to 948 mt (2,090,000 lb) in 2009. The estimated spawning biomass in 2012 was 697 mt (1,537,000 lb, Fig. 4.2.2.4.5.2b).

Comparison of spawning biomass between the current update and the 2006 and 2012 assessments is complicated because the earlier version of ASAP (version 1.4.2) that was used in the 2006 assessment calculated spawning biomass at the beginning of the year while the current version of ASAP (version 3.0.9) reduces the estimated population to when the spawning season actually occurs (summer) and uses a separate average biomass-at-age matrix when calculating spawning biomass. Another difference is that the 2006 assessment used separate selectivity patterns for each change in regulations while the 2012 and 2013 analyses use a single selectivity for catching snook but different release rates depending up the regulations. Ignoring the differences in methods, the estimated spawning biomass on the Atlantic coast reported in the 2013 update had the lowest levels and the 2006 assessment had the highest levels but the overall shapes were similar (Fig. 4.2.2.4.5.3), i.e. all three were significantly correlated (for 2006 assessment, *r = 0.94* with 2012 and *r = 0.64* with 2013, *df = 16, P < 0.05*; and *r = 0.75, df = 23*, *P < 0.05* between 2012 and 2013). On the gulf coast, the spawning biomass estimates from the 2012 assessment and the 2013 update were quite similar (correlation coefficient, *r = =0.96, df = 23, P < 0.05*) and less so for comparisons

with the lower values of the 2006 assessment (correlation coefficient between 2006 and 2012*, r = 0.79, df = 16, P < 0.05* and between 2006 and 2013, *r = 0.82, df = 16, P < 0.05*).

4.2.2.4.6. Stock-Recruitment Parameters

The relationship between spawning stock and subsequent recruitment was poorly defined or in other words, much of the variability in recruitment is not explained by variations in the spawning biomass which indicates environmental influences on recruitment. In this 2013 update, we let ASAP solve for steepness directly. The estimated steepness values were 0.66 (*sd = 0.105*) on the Atlantic coast and 0.71 (*sd = 0.095*) on the Gulf coast and these values are consistent for a fish that lives about 20 years (Myers, et al. 1999; Rose, et al. 2001. The magnitude of these values is reversed from those estimated in the 2012 assessment but they are staying in the range of Rose et al. (2001). This magnitude reversal is further evidence of the uncertainty associated with the stock-recruit relationship (Fig. 4.2.2.4.6). For example on the Atlantic coast, recruitment varied about 250% at a low spawning biomass of 250 mt level and then again 250% at a high average spawning biomass of 382 mt while on the gulf coast, recruitment from 1992 through 2011 varied 250% from 350 mt to 877 mt. Hence it should not be surprising that the stock–recruit relationship is not well defined.

The estimated recruitment on the gulf coast from 2005-through 2009 was the lowest since 1992 and occurred at time of the highest spawning biomass values. Note that the year labels in Figure 4.2.2.4.6 are the spawning biomass year and recruitment is a year later.

4.2.2.4.7. Measures of Parameter Uncertainty

Uncertainty evaluated in ASAP is the uncertainty stemming from the input data. The ASAP model estimated 74 parameters and their standard deviations on the Atlantic coast and 102 parameters on the gulf coast and their standard deviations (Table 4.2.2.2). A Monte Carlo approach, after converting the mean and standard deviation vectors to their log-normal distribution equivalents, was used to develop the box-whisker plots of fishing mortality on age-8 fish on the Atlantic coast and age-7 fish on the gulf coast (Fig. 4.2.2.4.3) and recruitment (Fig. 4.2.2.4.4.2) while Markov Chain Monte Carlo simulations evaluated the uncertainty surrounding spawning biomass (Fig. 4.2.2.4.5.2). The box plots only indicate observation error but, because ASAP does not capture the underlying uncertainty in the model configuration, process error was explored with alternative sensitivity runs. Those sensitivity runs included varying the natural mortality rates and excluding environmental effects.

4.2.2.4.8. Management Benchmarks

Given the Commission's objective for snook is to "maintain the SPR at or above 40%" (F. A. C., Chap 68B-21), the transitional SPR (tSPR) is used to determine whether management was meeting the Commission's objective. On the Atlantic and gulf coasts, the tSPR value for 2012 was 34% and 58% respectively. Further, we used $F_{40\%}$ to determine where the recent fishing mortality rates were relative to

the Commission's objective and whether the spawning biomass had rebuilt to a level corresponding to a SPR value of 40%. Because the fishing mortality rate is poorly estimated in the last year of an assessment due to the lack of data beyond the last year to provide scaling and balance, we followed the SEDAR process and used the geometric mean of the last three years ($F.gm = \left(F_{y-2} * F_{y-1} * F_y\right)^{1/3}$) as an estimate of the current fishing mortality rate. On the Atlantic coast, the F.gm value was 0.15 per year, which was less than $F_{40\%}$ (0.19 per year). On the gulf coast, the F-gm value was 0.059 per year which also was less than $F_{40\%}$ (0.29 per year; Table 4.2.2.4.8). Thus, the recent fishing mortality rates were in compliance with the Commission's management objectives. Figure 4.2.2.4.8.1 shows the yield-per-recruit (F_{max} = 1.94 per year Atlantic and 5.91 per year gulf) and static spawning potential ratios with the F.gm highlighted. The mismatch between having the fishing mortality rates meeting the Commission's objective and the spawning biomass or tSPR below their goal means that the low fishing mortality rates have not been in place long enough to rebuild the stocks to the corresponding levels. For example, the observed spawning biomass levels are below the equilibrium spawning biomass value corresponding to F40% on both coasts (256 mt vs. 477 mt on the Atlantic coast and 697 mt vs. 818 mt on the gulf coast).

4.2.2.4.9. Retrospective and Sensitivity Analyses

The simplest retrospective analysis is to compare the results from previous stock assessments to the current update. Age-structured stock assessments have been conducted for snook since 1997 and the results for average fishing mortality rates for ages 6-10, transitional SPR values and the number of snook age 6^+ from the different stock assessments are shown in Table 4.2.2.4.9.1 by coast. The assessments prior to 2006 used Integrated Catch-at-Age (ICA, Patterson 1997) and the assessments for 2006 and later used ASAP. We tested for retrospective bias with a paired t-test comparing the proportional difference between the fishing mortality estimates by year for the successive assessments. We compared the estimates from ICA (1997-2006 assessments) separately from the estimates from ASAP. On the Atlantic coast, there was no retrospective bias in average fishing mortality rates that were estimated with ICA (*t = 0.96, df = 72, P = 0.34*). However, there was a retrospective bias of 18% for the fishing mortality rates estimated by ASAP (*t = 3.27, df = 40, P < 0.05*). This means that the estimates of past fishing mortality rates from ASAP will increase with additional assessments. On the gulf coast, the average fishing mortality estimates did not show a retrospective bias from either method (ICA, *t = 1.17, df = 72, P = 0.24; ASAP, t = 0.83, df = 72, P = 0.41*).

Another way of conducting a retrospective analysis is to use the same data sets as were used in the current base runs with the same starting years but then run ASAP to different terminal years. We ran this type of retrospective using terminal years of 2005 through 2012 for both coasts. The estimated fishing morality rates on the Atlantic coast showed a significant average retrospective bias of 6% per year (*t = 3.05, df = 26, P < 0.05;* Fig.4.2.2.4.9.1b) and, unexpectedly, the spawning biomass also had a significant retrospective bias of -4% per year (*t =- 8.76, df = 26, P < 0.05,* Fig.4.2.2.4.9.1f) while recruitment did not show a retrospective pattern (*t = 0.072, df = 26, P = 0.94,* Fig.4.2.2.4.9.1d). On the gulf coast, there

were no significant retrospective patterns (fishing mortality rates, *t =-0.27, df = 26, P = 0.79;* Fig.4.2.2.4.9.1a; spawning biomass, , *t =-0.13, df = 26, P = 0.90;* Fig.4.2.2.4.9.1e;), and recruitment, , *t =-0.61, df = 26, P = 0.55;* Fig.4.2.2.4.9.1c;).

We did not redo all of the sensitivity runs that were developed in the 2012 stock assessment, but rather we reran ASAP with average natural mortality rates that were estimated with tagging data (B. Pine, pers. comm.; Atlantic 0.27 per year and 0.41 per year on the gulf) and we conducted a sensitivity run on the gulf coast that did not consider the environmental effects. The analyses with higher natural mortality rates were just as expected – they estimated lower fishing mortality rates (an average of 22% lower on the Atlantic coast and 5% lower on the gulf coast, Fig. 4.2.2.4.9.2.a and b), higher recruitment (194% higher on the Atlantic coast and 298% higher on the gulf coast Fig. 4.2.2.4.9.2.c and d), higher spawning biomasses (Fig. 4.2.2.4.9.2.e and f), and higher transitional spawning potential ratios (52% in 2012 on the Atlantic coast and 92% on the gulf coast, Fig. 4.2.2.4.9.2.g and h).

The spawning run on the gulf coast that did not include the environmental effects explicitly had lower recruitment but slightly higher spawning biomass especially in 2011 and 2012 (Fig. 4.2.2.4.9.5)

Using the mean-square-error (MSE) as a measure of the closeness of the fit, the model without the environmental effects had higher MSE values to the harvest, releases, and tuning indices except for the FIM adult index than did the model that included the environmental effects (Table 4.2.2.4.9.2). With two years of additional data to provide better scaling, the cold kill mortality in 2001 was 0.40 per year instead of 0.48 per year in the 2012 assessment, 0.11 per year instead 0f 0.04 per year in 2003, 0.14 per year in 2005 instead of 0.07 per year, and 0.15 per year in 2006 up from 0.06 per year, and 1.17 per year in 2010 instead of 1.02 per year from the cold kill. By including this source of natural mortality in the model, the spawning biomass in 2012 was reduced by 13% (from 805 mt to 697 mt). When the tSPR was recalculated without the environmental effects, the tSPR increased slightly to 59%. With or without considering the environmental effects, the tSPR value on the gulf coast achieved the Commission's management objective.

4.3. Comparison of models

Following the 2012 assessment, we only used two models: catch curves to provide a simple magnitude check and an age-structured statistical model, ASAP.

4.3.1 Fishery Selectivities

There are no age-specific differences in selectivity in a traditional catch curve because all of the included ages are considered to be equally vulnerable to fishing. The assumption of equal vulnerability across ages is a weakness of catch curves. For the fishery dependent catch curves on both coasts, ages five through 18 were considered equally vulnerable while for the fishery independent ages, on the Atlantic coast, all ages from four to 16 were considered equally vulnerable as were ages four through 15 on the gulf coast were considered equally vulnerable. The

lack of selectivity is especially relevant given that the data used in the catch curve came from a fishery, which is partly managed with narrow allowable slot limits. The age-structured model was able to capture the changes in the susceptibility of different ages of fish that were harvested (directly or indirectly) reflecting the changes in the slot limits even though the capture selectivity remained the same, for each coast, during the 27-year time series. Also, the changes in realized selectivities confirmed that after the slot limits were implemented, older fish were less vulnerable to harvest than before (Fig.4.2.2.4.2).

4.3.2. Fishing mortality rates

As discussed above in Section 4.3.1, catch curves assume that all fish of the ages included in the analyses are equally vulnerable to being kept by anglers and this assumption is inconsistent with the slot limits used to partly manage snook also recruitment at given spawning biomass levels was estimated to vary 250%. Consequently, catch curves estimated higher fishing mortality rates than those estimated with ASAP. The estimated total mortality per year on the Atlantic coast for the years 2008-2012 was 0.45 per year while ASAP, by accounting for the differences in vulnerability, had an average total mortality on Age-6^{+} fish of 0.30 per year. Similarly, on the gulf coast, the catch curve estimated an average total mortality rate of 0.58 per year and ASAP estimated a total mortality 0.30 per year using ages-6^{+}. More importantly as discussed in Sections (4.2.2.4.2 and 4.3.1), there were marked differences in the selectivity of different aged fish to capture and retention and ASAP was able to reflect these differences.

4.4. Present and possible future condition of the stock

The stricter regulations for snook, implemented in 2007, coupled to the closures in 2010 showed the expected changes in fishing mortality rates. As noted above in Section 4.2.2.4.8, the tSPR values decreased slightly on the Atlantic coast in this update versus the 2012 assessment and remained below 40% while the SPR values on the gulf coast continue to be above 40%. Furthermore, if the current low levels of fishing effort continue, then stock status (=tSPR) are expected to improve (static SPR >> 40%, Table 4.2.2.4.8). In addition, if the higher natural mortality rates from the tagging data are more appropriate, then the fishing mortality rates would be lower and the tSPR would be even higher (Fig. 4.2.2.4.9.2 g and h). However, the declining recruitment pattern on the Atlantic coast continues to be an enigma because the spawning biomass has been increasing, albeit slowly, since 2001. This situation also occurred on the gulf where the recruitment in 2005 to 2009 were the lowest in the time series while the spawning biomasses were high suggesting that the low levels could be loss of critical nursery habitat or other environmental factors. In 2005, there were many comments as to snook dying on the gulf coast after exposure to red tide. Given that there will be other cold kills and red tides, management should continue to maintain high stock levels as a buffer against environmental effects.

4.5. Regional considerations

This section of the snook stock assessment examines snook populations in finer scale than by coast. While there is no biological basis for splitting populations of

snook at the regional level (i.e. bay system), there may be local depletion issues that can be detected with this examination. In this section we examine recreational catch and effort and Fisheries-Independent Monitoring data for indications of regional differences.

Catch rates from the recreational survey (MRFSS-MRIP) were used to compare the regional snook relative population abundance. Intercepts from MRFSS-MRIP were chosen using cluster analysis of 1991-2010 data in the 2012 assessment. The intercepts were tallied by county and, ultimately, were divided into five regions that included the counties: Volusia – St. Lucie, Martin – Dade, Monroe – Collier, Charlotte - Lee, and Pasco - Sarasota. Estimates of the annual recreational catch rates by region were adjusted with a generalized linear model for year, two-month wave, mode of fishing, area (nearshore and estuary or bay), number of anglers, avidity (number of fishing trips in the previous two months), and time fishing. Not all of the coefficients for these variables were significant in the different models.

Plots of the regional recreational were similar for the regions on the two coasts except for the Collier-Monroe region. Catch rates in the northern region (Volusia-St. Lucie) on the Atlantic coast generally declined but were variable with a drop in 2010 and an increase in 2012 (Fig. 4.5.1b). Catch rates on the southeast Atlantic coast (Martin- Miami-Dade) were variable but mostly flat with a slight drop in 2010 and the rates stayed flat after that (Fig. 4.5.1d). The catch rates from northern-most gulf region (Pasco-Sarasota) were generally increasing until 2005 and declined in 2006. This was followed by an increase through 2009, a sharp drop in 2010 then another recovery (Fig. 4.5.1.a). In Charlotte Lee region, there was an overall increase except for 1998 and 1999 until 2005 then a series of variable years followed by declines in 2010 and 2012 (Fig. 4.5.1.c). The anglers in that region had mentioned the decline in recreational catches after the cold kill in 2010. Catch rates in the southern region (Collier-Monroe) were flat from 1991 to 2006, except for a drop in 1996 – 2001, and then began to increase until a drop in 2010 followed by another drop in 2011 with a slight recovery in 2012 (Fig. 4.5.1e).

If we just look at 2008-2010 time period, the Collier-Monroe had the highest recreational catch rates, Charlotte-Lee and Martin-Miami Dade had the next highest, followed by, Pasco–Sarasota (Tampa Bay area), and Volusia-St. (Fig. 4.5.2).

The FWC Fishery-Independent Monitoring (FIM) program's 183 m (600 ft) haul-seine catch data were also used to investigate snook abundance within regions of Florida. There are four regional FIM laboratories that sample snook: Indian River and Tequesta on the Atlantic coast and Tampa Bay and Charlotte Harbor on the gulf coast. These regions are roughly similar to the MRFSS-MRIP regions except for there is no Collier-Monroe region equivalent with FIM haul seine sampling.

For each FIM region, we calculated the annual mean number of snook caught per set by length categories within regions using the same generalized linear model approach that was used for calculating recreational catch rates. The length categories were snook less than 24 in TL, snook between 24 and 34 in TL, and snook longer than 34 in TL. These length categories do not match the current legal slot limits because of the changes in the slot limits. The full GLIM models by region

and length category adjusted the number of fish per set for year, month, depth, temperature, salinity, shore type, and bottom type; however, not all of these terms were significant in each region and length category; therefore, a reduced model with just the significant terms was used to estimate the adjusted number of snook per haul seine set for each year. In all cases, region explained a significant portion of the variability.

The number per set of snook less than 24 in TL and those 24-34 in TL were variable but mostly flat in the Indian River region until 2008 and then it declined to almost zero (mean = 0.019 snook per haul, 95% confidence interval: 0.009 – 0.033 snook per haul; Fig 4.5.3.a and c) while the number of snook longer than 34 in TL was gradually increasing until their drop in 2010 (Fig. 4.5.3.e). The catch of small snook and the 24-34 in TL snook were declining in the Tequesta region from 1997 until 2008 when there was an increase but then there was a sharp drop in 2010 with an increase afterwards (Fig 4.5.3.b and d). The catch rates of larger snook (TL > 34 in) in the Tequesta region were mostly flat with drops in 1998 and 2010 and peaks in 2000 and 2009 (Fig 4.5.3.f). Catch rates in Tampa Bay for all size categories generally increased from 1996 to 2008 then declined in 2009 followed by declines in 2010 and 2011 with increases in 2012 (Fig 4.5.3.g, i, and k). The Charlotte Harbor catch rates were similar to Tampa Bay with general increases until 2008 with declines in 2009 2010 and increases afterwards (Fig 4.5.3h, j, and k). The Tequesta region had the highest, overall average catch rate on either coast for all three size categories. The Tampa Bay region had the second highest, overall average catch rates for 24-34 in TL snook and snook > 34 in TL.

5.0. MANAGEMENT

5.1. History of management

Snook are managed under Chapter 68B-21 of the Florida Administrative Code. As noted earlier, the Florida Legislature made snook a gamefish in 1957. In July 1985, the FWC (then known as the Florida Marine Fisheries Commission) established a minimum size of 24 inches; a maximum size of 34 inches with an allowance for one fish over 34 inches; closed season of January, February, June, July, and August 1985 and 1986; a bag limit of two fish; and restricted gear to hook-and-line gear. In July 1987, management under this rule was extended to all fish of the genus *Centropomus*, August was permanently added to the summer closed season; all fish were required to be landed in whole condition; and the use of treble hooks with natural bait while harvesting snook was prohibited. In March 1994, the management goal was adopted to maintain snook stocks above 40% SPR, the January–February closure was changed to December 15 to January 31; the definition of total length was clarified, and the possession of snook was allowed on a vessel with cast nets aboard provided that such nets were secured and stowed away. In December 1998, the Commission implemented a slot limit of 26 inches to 34 inches with no allowance for fish larger than 34 inches to be retained. Recent regulations include a prohibition on spearing (July 2000); removal of the "species of special concern" designation (February 2001); and in January 2002, reducing the bag limit to one fish on the Gulf coast and Monroe county, adding May to the closed months on the Gulf coast, and prohibiting landing snook in the Gulf that were harvested north and east of the Dade–Monroe county line. In July 2002, the

Commission allowed for the sale of snook by facilities with a special activities license brood stock in culturing and for aquariums and for other displays. In July 2006, the length measurement was clarified for purposes of determining the legal size of snook, "total length" means the straight line distance from the most forward point of the head with the mouth closed, to the farthest tip of the tail with the tail compressed or squeezed, while the fish is lying on its side. In accordance with that clarification, the Commission increased the minimum size from 26 inches to 27 inches. In July 2007, the Commission established a statewide bag limit of one fish; added December 1-14 and the month of February to the closed season in Florida's Gulf, Everglades National Park and Monroe County waters; allowed for carrying more than one cast net aboard while fishing for snook; and established a snook slot limit of 28-32 inches total length in Atlantic waters and 28-33 inches total length in Florida's Gulf, Everglades National Park and Monroe County waters. An Executive Order (10-03, effective January 16, 2010) prohibited the harvest and possession of snook in state and federal waters through August 31, 2010. Another executive order (10-04, effective September 17, 2010) extended the closure through August 31, 2011. A third executive order (11-16, September 1, 2011) extended the closure only on the gulf coast, Monroe county and Everglades National Park through August 31, 2012. A fourth executive order (12-11, September 1, 2012) extended the closure on the gulf coast, Monroe county and Everglades National Park through August 31, 2013.

5.2. Size limit compliance

Angler compliance with the different allowable harvest slot limits was evaluated using the total lengths of fish measured by MRFSS-MRIP, ENP, or FWC's snook program samplers. Any fish lengths that were measured in fork length or standard length were converted to total length using the morphometric equations in Taylor et al. (2000). On the Atlantic coast an average of 2% of the fish measured during 1986–1998 (1,647 fish) were less than the 24-inch minimum size and there was not a maximum size at this time other than that an angler could not keep more than one fish greater than 34 inches; an average of 5% of the fish measured during 1999-2005 (2,877 fish) were less than the 26-inch minimum size and 10% were greater than the 34 inch maximum size; and an average of 5% of the fish measured during 2007-2010 (1,984 fish) were below the 28 inch minimum size and 13% were greater than the 32-inch maximum size (Table 5.2). On the gulf coast, an average of 7% of the snook measured during 1987–1998 (10,190 fish) were less than 24 inches and there was not a maximum size at that time; an average of 8% of the fish measured during 1999-2005 (8,565 fish) were less than the 26-inch minimum size and only 2% were greater than the 34 inch maximum size; however, compliance was less with the narrower slot limits implemented in 2007 with an average of 39% of the fish measured during 2008-2010 (769 fish) were less than the 28-inch minimum size and only 2% were greater than the 33 inch maximum size.

5.3. Bag limit compliance

Snook angler compliance with the bag limits was high. The bag-limit analyses include only interviews conducted during times when the snook fishery was open from 1986 through 2012. On the Atlantic coast, there was a two-fish bag limit in

effect from 1985 until July 2007 when the bag limit was reduced to one fish. Only eight trips with a total of nine anglers out of 8,033 trips in the 1986-2006 period had more than two fish per angler and the excess fish accounted for 3% of the harvested fish (Table 5.3). In the later period, 2008-2012, there were only two trips with three anglers out of 1,169 trips on the Atlantic coast that exceeded the one-fish bag limit and excess fish kept by those anglers accounted for 6% of the harvested fish that were sampled. On the gulf coast, the one-fish bag limit was implemented earlier in 2002. There were nine trips with 12 anglers out of 6,701 trips in the period 1991-2001 with more than two fish per angler and the excess fish accounted for 6% of the sampled fish. In the later period (2002-2012) with a one-fish bag limit, there were seven trips with 13 anglers out of 6,491 trips that kept more than one fish per angler and their excess fish account for 6% of the sampled fish.

5.4. Overall Effectiveness of the regulations

A simple way of comparing the effectiveness of the regulations is to examine the catchability of the recreational fishery. While ASAP does not explicitly use catchability in calculating fishing mortality rates, we can easily estimate the recreational fishery's catchability using the directed effort (Table 3.2.1, Fig. 3.3.1) and the fishing mortality rates on age-7 or -8 fish depending upon coast (Table 4.2.2.4.3) because the fleet catchability, q, is the fishing mortality (*F*) exerted by one unit of effort (*E*) or $q_t = F_t / E_t$ for each year, *t*. The average fishing mortality rates for the combinations of coast and period were determined from the Baranov catch equation using the estimated population numbers and catches. The combination of reduced bag limits to one fish and the narrowing of the slot limits have reduced the catchability by an average of 68% on the Atlantic coast and an average of 64% on the gulf coast (Table 5.4).

6.0. RESEARCH and DATA NEEDS

In addition to the fishery information on harvest, releases, and catch rates, there continues to be a need for the collection of age, sex, and length information for future assessments of snook populations. Access to fish is complicated because most of the fish are released especially on the gulf coast where the fishery has not been open since November 2009. Since 1998, FWRI interviewers have been visiting sites where anglers typically fish for snook. Samplers ask if they can measure the anglers' fish, determine the sexes of the fish, and whether they can collect the ear bones. This effort was enhanced in 2002; however, the most appropriate method for collecting this type of information would be to supplement the intercept portion of MRFSS with an emphasis on shore and private boat modes.

On a biological level, we need to understand how snook interact with their habitat throughout their lives. In this assessment, we ran a sensitivity run on the gulf coast with a preliminary attempt to include the colds kills in 2001 and 2010 with the red tide kills in 2003, 2005, and 2006 but we need to understand how some snook go offshore while other go up rivers to avoid these lethal factors. We have some information on common snook remaining in the rivers and not returning to the estuaries to spawn every year but the sample size was so small that we have

not been able to define whether that behavior is common after fish transition to female or do only a few individuals exhibit that behavior. Acoustic tagging shows that fish on the Atlantic coast move easily between rivers, estuaries, and the nearshore reefs.

An index of recruitment (age-1 fish) would help the assessment because the current model chooses the numbers of recruits that improve the model's overall fit while an index of age-1 fish could provide guidance to the model such that the model would have better chance of reflecting what was happening to young fish in the population not just fitting the data better. Electrofishing is a possible gear for this index.

7.0 ACKNOWLEDGEMENTS

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Atlantic

Year	Landings	Released	Total	Percent released	Dead releases	Total harvest	Percent discards	Directed trips
1981	13744	10732	24476	43.8%	229	13973	1.6%	134,415
1982	29504	13746	43250	31.8%	293	29797	1.0%	329,831
1983	5023	2213	7236	30.6%	47	5070	0.9%	362,042
1984	23449	13660	37109	36.8%	291	23740	1.2%	540,641
1985	4165	49181	53346	92.2%	1048	5213	20.1%	410,436
1986	8744	48675	57419	84.8%	1037	9781	10.6%	408,639
1987	20165	48819	68984	70.8%	1040	21205	4.9%	436,288
1988	22593	57212	79805	71.7%	1219	23812	5.1%	285,906
1989	10217	213622	223839	95.4%	4550	14767	30.8%	367,573
1990	7210	165921	173131	95.8%	3534	10744	32.9%	275,776
1991	19676	197274	216950	90.9%	4202	23878	17.6%	876,288
1992	22812	356610	379422	94.0%	7596	30408	25.0%	885,211
1993	18527	177739	196266	90.6%	3786	22313	17.0%	788,386
1994	39289	477107	516396	92.4%	10162	49451	20.6%	1,072,533
1995	34077	655083	689160	95.1%	13953	48030	29.1%	1,328,738
1996	43057	371621	414678	89.6%	7916	50973	15.5%	1,128,591
1997	51847	438104	489951	89.4%	9332	61179	15.3%	1,198,236
1998	22285	314630	336915	93.4%	6702	28987	23.1%	1,087,040
1999	24318	382231	406549	94.0%	8142	32460	25.1%	1,171,570
2000	23581	419938	443519	94.7%	8945	32526	27.5%	1,684,305
2001	20500	448708	469208	95.6%	9557	30057	31.8%	1,580,404
2002	20137	290797	310934	93.5%	6194	26331	23.5%	1,428,307
2003	25851	564863	590714	95.6%	12032	37883	31.8%	1,637,831
2004	22573	555613	578186	96.1%	11835	34408	34.4%	1,753,988
2005	13331	475251	488582	97.3%	10123	23454	43.2%	2,409,226
2006	13969	521762	535731	97.4%	11114	25083	44.3%	2,170,346
2007	8695	550760	559455	98.4%	11731	20426	57.4%	2,545,808
2008	14802	418521	433323	96.6%	8914	23716	37.6%	1,821,796
2009	9843	275306	285149	96.5%	5864	15707	37.3%	1,362,647
2010	585	275373	275958	99.8%	5865	6450	90.9%	1,591,281
2011	8021	182763	190784	95.8%	3893	11914	32.7%	1,649,418
2012	4227	232149	236376	98.2%	4945	9172	53.9%	1,489,384

Table 3.2.1 continued. Estimated number of snook landed by anglers, number of fish caught and released alive, total number caught, percent released alive, number that died after being released alive (release mortality rate of 2.13%), total harvest (landings plus those that died after being released alive), and estimated number of trips directed at snook.

Gulf

Year	Landings	Released	Total	Percent released	Dead releases	Total harvest	Percent discards	Directed trips
1981	23526	13268	36794	36.1%	283	23809	1.2%	315,904
1982	20235	16680	36915	45.2%	355	20590	1.7%	317,370
1983	39020	59416	98436	60.4%	1266	40286	3.1%	822,675
1984	523	10362	10885	95.2%	221	744	29.7%	612,022
1985	15653	44141	59794	73.8%	940	16593	5.7%	311,564
1986	4505	166076	170581	97.4%	3537	8042	44.0%	678,326
1987	20503	43021	63524	67.7%	916	21419	4.3%	530,353
1988	68121	190177	258298	73.6%	4051	72172	5.6%	682,207
1989	15300	153626	168926	90.9%	3272	18572	17.6%	546,091
1990	8259	86405	94664	91.3%	1840	10099	18.2%	418,845
1991	40667	535696	576363	92.9%	11410	52077	21.9%	1,238,739
1992	83163	630178	713341	88.3%	13423	96586	13.9%	1,611,204
1993	61807	705772	767579	91.9%	15033	76840	19.6%	1,179,222
1994	68686	841950	910636	92.5%	17934	86620	20.7%	1,327,274
1995	49439	579729	629168	92.1%	12348	61787	20.0%	1,281,188
1996	114500	1363771	1478271	92.3%	29048	143548	20.2%	1,324,541
1997	124257	1144118	1268375	90.2%	24370	148627	16.4%	1,514,618
1998	69396	631335	700731	90.1%	13447	82843	16.2%	1,335,322
1999	70644	835097	905741	92.2%	17788	88432	20.1%	1,239,785
2000	37227	1303230	1340457	97.2%	27759	64986	42.7%	1,685,031
2001	37811	1320234	1358045	97.2%	28121	65932	42.7%	1,661,843
2002	47338	1319270	1366608	96.5%	28100	75438	37.2%	1,775,060
2003	42550	1409559	1452109	97.1%	30024	72574	41.4%	2,140,554
2004	70557	2197457	2268014	96.9%	46806	117363	39.9%	2,402,981
2005	61949	2280821	2342770	97.4%	48581	110530	44.0%	2,803,076
2006	24874	1390595	1415469	98.2%	29620	54494	54.4%	2,646,609
2007	35437	1591148	1626585	97.8%	33891	69328	48.9%	2,671,880
2008	25429	1595274	1620703	98.4%	33979	59408	57.2%	2,535,993
2009	13936	1924431	1938367	99.3%	40990	54926	74.6%	2,102,655
2010	0	600351	600351	100.0%	12787	12787	100.0%	1,634,305
2011	599	746797	747396	99.9%	15907	16506	96.4%	2,220,343
2012	368	1033716	1034084	100.0%	22018	22386	98.4%	2,053,502

Table 3.2.2. Seasonal distribution of numbers of fish landed and number released alive by coast expressed as a percentage of the total annual harvest based on the sum of two-month wave averages over the periods 1986–1998, 1999–2005, and 2008-2012.

1986-1998

	Atlantic		Gulf	
Wave	Landings	Releases	Landings	Releases
Jan-Feb	4%	6%	3%	6%
Mar-Apr	19%	11%	28%	16%
May-Jun	15%	21%	25%	29%
Jul-Aug	2%	26%	6%	17%
Sep-Oct	49%	24%	27%	20%
Nov-Dec	11%	13%	11%	12%
Annual	100%	100%	100%	100%

1999-2005

	Atlantic		Gulf	
Wave	Landings	Releases	Landings	Releases
Jan-Feb	10%	8%	4%	4%
Mar-Apr	21%	13%	38%	17%
May-Jun	15%	14%	12%	25%
Jul-Aug	0%	23%	0%	17%
Sep-Oct	38%	25%	29%	23%
Nov-Dec	15%	16%	17%	15%
Annual	100%	100%	100%	100%

2008-2012

	Atlantic		Gulf	
Wave	Landings	Releases	Landings	Releases
Jan-Feb	9%	10%	1%	7%
Mar-Apr	16%	21%	43%	18%
May-Jun	5%	16%	3%	24%
Jul-Aug	0%	21%	7%	19%
Sep-Oct	48%	19%	30%	17%
Nov-Dec	22%	14%	16%	14%
Annual	100%	100%	100%	100%

Table 3.3.1. The five most commonly sought species by coast as specified in MRFSS angler interviews made during 1987, 2000, 2004, 2009, and 2012. The total number of intercepts and the number of intercepts that identified a species preference are included and the percentages are based on the interviews that specified a preference.

Atlantic

	1987		2000		2004		2009		2012	
Total number of intercepts	4,659		17,058		16,218		14,665		12,661	
Intercepts specifying preferences	2,235		8,648		7,455		6,795		6,363	
Rank	Description	Percent of Intercepts	Description	Percent of Intercepts	Description	Intercepts	Description	Percent of Intercepts	Description	Percent of Intercepts
1	Dolphin	27%	Red drum	25%	Red drum	27%	Red drum	21%	Red drum	27%
2	Sailfish	17%	Dolphin	19%	Dolphin	18%	Dolphin	17%	Spotted seatrout	20%
3	Spotted seatrout	15%	Spotted seatrout	16%	Spotted seatrout	16%	Spotted seatrout	12%	Dolphin	17%
4	King mackerel	13%	King mackerel	10%	King mackerel	10%	King mackerel	10%	Flounders	5%
5	Bluefish	7%	**Common snook**	9%	**Common snook**	8%	**Common snook**	8%	Cobia	5%
	Common snook (8)	4%							**Common snook (10)**	4%

Gulf

	1987		2000		2004		2009		2012	
Total number of intercepts	7,961		27,147		30,880		24,981		25,642	
Intercepts specifying preferences	4,381		12,450		15,709		11,903		12,230	
Rank	Description	Percent of Intercepts	Description	Rank	Description	Intercepts	Description	Percent of Intercepts	Description	Percent of ntercepts
1	King mackerel	18%	Spotted seatrout	20%	Red drum	22%	Red drum	28%	Spotted seatrout	30%
2	Spotted seatrout	17%	Red drum	16%	Spotted seatrout	21%	Spotted seatrout	26%	Red drum	27%
3	Spanish mackerel	10%	Dolphin	11%	Groupers	14%	**Common snook**	11%	Spanish mackerel	10%
4	Seatrouts	10%	Groupers	11%	**Common snook**	12%	Spanish mackerel	8%	King mackerel	8%
5	Groupers	6%	**Common snook**	9%	Spanish mackerel	7%	King mackerel	7%	Red grouper	6%
	Common snook (31)	1%							**Common snook (10)**	3%

Table 3.4.1. Numbers of snook landed (kept) by total length in inches, year, and coast (MRFSS Type a+b1).

Atlantic

	Total Length (in)																	
Year	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2881	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	8216	2054	2054	2054	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	1202	0	1202	1803	1803	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	1640	4919	4919	0	1640	3279	0
1992	0	0	0	0	0	0	0	0	0	0	3259	0	0	6518	0	2173	0	2173
1993	0	0	0	0	0	0	0	0	0	0	639	1278	639	0	1278	1916	2555	0
1994	0	0	0	0	0	0	0	728	728	0	0	1455	728	5820	1455	2183	3638	2910
1995	0	0	0	0	0	0	0	0	0	0	774	2323	2323	774	3098	1549	1549	2323
1996	0	0	0	0	0	0	0	0	0	0	2969	0	8908	1485	0	5939	2969	742
1997	0	0	0	0	0	0	0	0	69	0	0	549	2126	2949	2195	1920	2949	2469
1998	0	0	36	0	0	0	0	0	0	36	36	323	789	754	610	933	610	1435
1999	0	0	83	0	0	0	0	0	0	0	0	83	249	1162	1826	830	1245	1992
2000	0	0	0	0	0	0	0	0	0	0	0	185	185	432	1420	2037	864	1852
2001	0	0	0	0	0	0	0	0	0	0	106	106	159	319	2071	2177	2443	1487
2002	33	0	0	0	0	0	0	0	0	65	0	0	98	1108	2639	2477	2281	2118
2003	0	0	0	0	0	0	0	0	0	0	0	0	64	579	2958	3022	1929	2701
2004	0	0	0	0	62	62	62	0	0	0	0	0	0	925	3454	3207	2405	2282
2005	31	0	31	0	0	0	0	0	31	0	0	62	0	372	1922	1581	1612	1581
2006	0	0	0	0	0	0	0	0	0	0	0	28	0	480	1129	1806	1552	1242
2007	0	0	0	0	27	27	27	0	27	55	55	0	0	82	328	684	820	1559
2008	0	195	97	0	0	0	0	0	0	0	0	0	97	97	0	1948	2824	2142
2009	0	0	0	0	0	0	0	14	0	14	0	0	0	28	43	427	1678	1849
2010	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	23	113	118
2011	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	278	1198	1711
2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	167	631	714

Table 3.4.1 continued. Numbers of snook landed (kept) by total length in inches, year, and coast (MRFSS Type a+b1).

Atlantic

	Total Length (in)																	
Year	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	Total
1986	0	0	0	3747	0	0	0	0	2498	2498	0	0	0	0	0	0	0	8744
1987	0	0	4321	0	1440	5761	2881	0	1440	0	0	1440	0	0	0	0	0	20165
1988	0	4108	0	2054	0	0	0	0	0	0	0	2054	0	0	0	0	0	22593
1989	601	0	2404	1202	0	0	0	0	0	0	0	0	0	0	0	0	0	10216
1990	0	0	2404	0	0	2404	0	0	0	2404	0	0	0	0	0	0	0	7211
1991	0	0	0	1640	0	0	0	0	0	1640	0	0	0	0	0	0	0	19676
1992	2173	4345	0	0	1086	0	1086	0	0	0	0	0	0	0	0	0	0	22813
1993	2555	3833	1278	1278	0	0	639	639	0	0	0	0	0	0	0	0	0	18526
1994	1455	2910	7276	1455	2183	0	1455	2910	0	0	0	0	0	0	0	0	0	39288
1995	3872	6970	1549	3098	1549	0	774	0	774	0	0	0	774	0	0	0	0	34077
1996	3712	4454	2969	742	3712	3712	742	0	0	0	0	0	0	0	0	0	0	43057
1997	4389	4389	4595	4252	3498	3429	3086	2400	1234	2126	823	1166	754	480	0	0	0	51847
1998	1651	2225	1866	2261	1723	1615	1471	1041	1041	861	323	287	323	0	36	0	0	22285
1999	2490	2573	3486	2656	1743	1162	664	498	498	415	415	83	83	83	0	0	0	24318
2000	2284	2408	3766	5988	1420	617	123	0	0	0	0	0	0	0	0	0	0	23582
2001	3027	2124	2390	2337	1168	372	0	53	0	53	0	53	53	0	0	0	0	20500
2002	2053	1955	1694	1760	978	684	98	65	0	33	0	0	0	0	0	0	0	20138
2003	2637	3794	4051	2508	1093	514	0	0	0	0	0	0	0	0	0	0	0	25851
2004	2220	2467	2035	1727	1110	370	62	0	62	62	0	0	0	0	0	0	0	22572
2005	1395	1302	1085	1240	682	124	155	31	93	0	0	0	0	0	0	0	0	13331
2006	1806	1609	1863	1298	790	282	56	0	0	28	0	0	0	0	0	0	0	13969
2007	1422	1449	984	684	301	82	27	0	0	0	27	27	0	0	0	0	0	8696
2008	2921	2435	1655	292	97	0	0	0	0	0	0	0	0	0	0	0	0	14802
2009	2148	2461	896	213	28	14	28	0	0	0	0	0	0	0	0	0	0	9843
2010	108	143	63	11	3	0	0	0	0	0	0	0	0	0	0	0	0	585
2011	2160	1733	706	171	21	0	0	21	0	0	0	0	0	0	0	0	0	8021
2012	929	1143	536	107	0	0	0	0	0	0	0	0	0	0	0	0	0	4227

Table 3.4.1 continued. Numbers of snook landed (kept) by total length in inches, year, and coast (MRFSS Type a+b1).

Gulf

	Total Length (in)																	
Year	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1986	0	0	0	0	12	0	0	24	0	24	36	193	374	447	701	543	338	314
1987	0	0	0	0	0	0	0	0	118	118	157	787	944	1692	2204	3896	2046	2046
1988	0	134	402	268	402	536	0	0	268	402	670	670	2011	2950	4425	9521	5632	10191
1989	0	0	0	74	49	99	123	0	99	345	25	370	641	936	1454	1799	1257	1971
1990	0	0	26	39	52	0	39	39	39	13	13	235	497	1006	876	889	980	954
1991	0	0	0	196	0	0	0	0	0	0	196	2161	6680	5206	6090	4027	3143	3438
1992	0	0	126	506	379	126	126	632	126	379	379	4171	8468	11375	11248	10616	9226	6319
1993	0	309	154	77	231	309	0	154	231	0	154	2238	5556	9105	8102	7408	5479	5093
1994	290	290	1100	985	1042	347	290	811	1795	753	1158	3069	5270	8861	6255	7587	5096	4633
1995	0	0	0	71	214	71	0	0	71	143	571	1998	5636	6135	3710	4708	4994	3852
1996	0	0	0	0	0	0	205	103	205	205	616	2257	12620	16929	12620	13748	10260	7592
1997	0	0	185	0	93	278	1205	1391	1391	93	464	4266	13817	16042	13446	12426	9922	8160
1998	0	0	52	0	0	105	0	0	105	52	52	1883	12394	11714	9518	7269	5805	5334
1999	0	0	0	0	0	0	0	0	174	261	87	523	523	5314	11150	12718	10017	8537
2000	0	56	0	167	56	167	223	56	112	223	223	0	56	1898	5023	7088	4577	4688
2001	0	0	0	0	0	0	0	0	46	0	0	137	273	1868	6196	6287	5011	4054
2002	0	0	33	0	0	0	0	0	0	66	66	33	395	3294	7741	8269	6786	5172
2003	0	0	0	0	0	0	0	0	0	0	0	53	212	3053	7645	8335	7273	5442
2004	0	0	0	0	0	0	0	39	0	39	0	79	394	4882	12442	13899	11458	8898
2005	0	0	0	0	0	0	0	0	43	0	43	130	261	3652	10694	10086	8825	7825
2006	0	0	0	0	0	0	0	23	0	23	0	23	139	860	2650	9926	3278	2139
2007	0	0	0	0	0	0	0	0	0	44	0	87	0	261	1741	13583	6225	4789
2008	0	0	57	0	0	0	57	0	0	0	0	57	0	57	229	10285	4400	3543
2009	0	0	0	0	0	0	0	0	0	0	44	175	0	0	44	4514	2191	2016
2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.4.1 continued. Numbers of snook landed (kept) by total length in inches, year, and coast (MRFSS Type a+b1).

Gulf

	Total Length (in)																	
Year	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	Total
1986	435	302	85	133	60	72	133	48	48	36	72	72	0	0	0	0	0	4505
1987	1299	1181	394	630	315	433	472	433	315	315	236	472	0	0	0	0	0	20503
1988	6168	4157	2816	3889	2011	2682	1207	2011	1475	805	536	1877	0	0	0	0	0	68121
1989	1109	1059	739	468	591	493	345	246	172	296	394	148	0	0	0	0	0	15300
1990	484	327	470	418	222	183	78	105	118	91	52	13	0	0	0	0	0	8259
1991	1866	1768	1081	982	1277	491	491	786	295	295	196	0	0	0	0	0	0	40667
1992	4424	2654	3033	1517	2528	1517	758	632	1011	126	253	126	126	0	126	0	126	83162
1993	3318	2855	2392	2006	1312	2392	926	694	617	386	77	77	154	0	0	0	0	61808
1994	3301	3069	2838	1506	2548	1680	1042	1100	753	637	174	116	116	58	58	0	58	68686
1995	3068	2925	3353	1498	1998	1498	499	999	428	428	285	71	214	0	0	0	0	49439
1996	5438	8208	7695	3283	4001	2975	2052	1539	1334	205	308	0	103	0	0	0	0	114500
1997	6955	8438	6491	5749	4173	3246	2318	649	1576	1020	93	185	185	0	0	0	0	124257
1998	2876	2615	2458	1935	1883	1046	784	784	261	157	209	105	0	0	0	0	0	69395
1999	5662	5749	4530	3833	1394	87	87	0	0	0	0	0	0	0	0	0	0	70645
2000	3460	3126	2233	2847	335	502	0	56	56	0	0	0	0	0	0	0	0	37228
2001	3417	4100	3326	1913	729	273	0	46	0	91	46	0	0	0	0	0	0	37811
2002	4645	3854	2866	2339	1482	132	99	33	33	0	0	0	0	0	0	0	0	47338
2003	3982	2734	1938	1327	425	53	53	0	27	0	0	0	0	0	0	0	0	42551
2004	6418	5158	3268	2166	866	394	118	0	0	0	39	0	0	0	0	0	0	70558
2005	7608	5478	3739	3174	391	0	0	0	0	0	0	0	0	0	0	0	0	61949
2006	2069	1511	1232	674	256	46	0	23	0	0	0	0	0	0	0	0	0	24873
2007	3091	2525	1785	1001	218	87	0	0	0	0	0	0	0	0	0	0	0	35437
2008	2743	2171	1314	343	114	57	0	0	0	0	0	0	0	0	0	0	0	25428
2009	1709	1753	1052	219	131	88	0	0	0	0	0	0	0	0	0	0	0	13937
2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	368	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	368

Table 3.4.2. Numbers of snook released alive by total length in inches, year, and coast (MRFSS Type b2).

Atlantic

	Total Length (in)																	
Year	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1986	995	943	1440	1299	2353	2813	4438	4639	5730	6613	8268	9144	.	.	.	.	.	.
1987	998	945	1444	1303	2360	2821	4452	4653	5747	6633	8293	9171	.	.	.	.	.	.
1988	474	449	686	619	1120	1340	2114	2209	2729	3149	3938	4355	4775	4814	3178	2209	1948	1598
1989	1769	1676	2560	2310	4184	5002	7892	8249	10189	11759	14703	16260	17830	17976	11865	8249	7272	5965
1990	1374	1302	1989	1794	3250	3885	6130	6407	7914	9134	11419	12629	13849	13962	9216	6407	5648	4633
1991	1633	1548	2364	2133	3864	4619	7288	7617	9409	10859	13577	15016	16466	16600	10957	7617	6716	5509
1992	2952	2798	4274	3856	6984	8350	13175	13770	17009	19631	24544	27143	29765	30008	19807	13770	12140	9958
1993	1471	1395	2130	1922	3481	4162	6567	6863	8477	9784	12233	13529	14835	14956	9872	6863	6051	4963
1994	3950	3744	5718	5158	9344	11172	17627	18423	22756	26264	32837	36315	39823	40147	26499	18423	16242	13323
1995	5423	5140	7852	7083	12830	15339	24202	25295	31245	36061	45086	49862	54678	55123	36384	25295	22300	18293
1996	3077	2916	4454	4018	7278	8702	13730	14350	17725	20457	25577	28286	31018	31271	20641	14350	12651	10378
1997	3627	3437	5251	4737	8580	10258	16186	16917	20896	24117	30152	33346	36567	36865	24333	16917	14914	12234
1998	2605	2469	3771	3402	6162	7367	11624	12149	15006	17320	21654	23948	26261	26475	17475	12149	10711	8786
1999	3164	2999	4581	4133	7486	8950	14122	14759	18231	21041	26307	29094	31904	32164	21230	14759	13012	10674
2000	3477	3295	5033	4540	8224	9833	15515	16215	20029	23117	28902	31964	35051	35336	23324	16215	14295	11727
2001	3715	3521	5378	4851	8788	10507	16578	17326	21401	24700	30882	34153	37452	37757	24922	17326	15275	12530
2002	2153	1722	3158	3588	5454	9330	14927	16937	18085	25405	28563	33730	25405	25549	13349	8755	6172	3875
2003	2856	5932	8788	8349	15819	17137	25486	27024	29441	39986	44381	51411	45040	45918	23948	11205	15379	9887
2004	5333	4717	9024	5743	11486	17844	24202	27688	25637	30355	36303	37123	49224	42250	23176	17023	15382	15793
2005	2858	3118	3898	4417	12732	11953	23126	14811	25205	20787	28842	28323	43913	49890	22606	19488	20008	13772
2006	1482	3557	3261	1482	5040	2965	8301	12748	15119	15416	29646	32017	46247	69667	35278	24013	28163	19863
2007	5343	2671	4007	4007	12021	12467	12021	15583	19145	20036	24933	23598	40071	48976	48976	24043	18700	17364
2008	3644	4685	4164	6247	7288	6767	20822	19260	29671	24986	34877	40082	25507	11452	17178	15096	8849	7808
2009	2323	2323	5421	1162	3098	4647	5421	8519	11616	12778	21684	20522	24781	16650	24394	18973	10455	8519
2010	1147	2295	2295	3825	4207	4972	7267	6119	14916	18741	14534	17593	21800	16063	15681	16828	12239	17593
2011	2015	1008	1612	403	2015	3023	4433	4232	9672	12292	15113	19546	15314	11284	9269	9068	6851	4836
2012	6662	2306	4356	6662	3587	3075	5125	4612	5125	4100	8200	9737	17424	17680	21780	13580	9993	9481

Table 3.4.2 continued. Numbers of snook released alive by total length in inches, year, and coast (MRFSS Type b2).

Atlantic

	Total Length (in)																	
Year	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	Total
1986																	0	48675
1987																	0	48820
1988	1661	1873	2191	2503	1849	1230	1071	714	700	491	396	283	262	110	81	46	51	57216
1989	6203	6995	8183	9344	6903	4593	3999	2666	2613	1835	1478	1056	977	409	304	172	185	213625
1990	4818	5433	6356	7258	5361	3567	3106	2071	2030	1425	1148	820	759	318	236	133	143	165924
1991	5728	6460	7557	8629	6374	4241	3693	2462	2413	1694	1365	975	902	378	280	158	171	197272
1992	10355	11677	13660	15599	11523	7667	6676	4450	4362	3062	2468	1763	1630	683	507	286	308	356610
1993	5161	5820	6808	7775	5743	3821	3327	2218	2174	1526	1230	878	813	340	253	143	154	177738
1994	13854	15623	18275	20869	15416	10258	8931	5954	5836	4097	3301	2358	2181	914	678	383	411	477104
1995	19022	21450	25093	28654	21167	14084	12263	8175	8013	5626	4533	3238	2995	1255	931	526	565	655081
1996	10791	12168	14235	16255	12008	7990	6957	4638	4546	3191	2571	1837	1699	712	528	298	322	371625
1997	12721	14345	16781	19163	14156	9419	8201	5468	5359	3762	3031	2165	2003	839	623	352	379	438101
1998	9136	10302	12052	13762	10166	6765	5890	3927	3849	2702	2177	1555	1438	603	447	253	271	314629
1999	11099	12516	14641	16719	12351	8218	7155	4770	4676	3282	2645	1889	1748	732	543	307	332	382233
2000	12194	13751	16086	18369	13569	9029	7861	5241	5137	3606	2906	2076	1920	804	597	337	364	419939
2001	13029	14693	17188	19627	14499	9647	8400	5600	5489	3853	3105	2218	2051	859	638	360	388	448706
2002	5741	4737	6603	7033	5024	2440	2871	2440	1435	1292	1292	718	1148	861	287	431	287	290797
2003	12084	14720	19334	31418	13402	10106	9447	7470	5932	4174	3076	2856	1099	439	879	220	220	564863
2004	14357	19484	17844	27483	20100	16818	9435	6768	7178	5538	2871	2871	3282	1641	820	615	205	555613
2005	11433	12992	20528	18449	12992	8835	9874	7795	6236	4937	3378	3898	2339	780	780	260	0	475253
2006	18973	17787	21345	24902	17491	10376	11562	8894	10969	5336	6226	2372	4150	2075	2075	1186	1778	521762
2007	17810	18700	24488	31167	28050	18700	15583	9795	7569	8014	5788	4898	3562	445	445	445	1335	550756
2008	12493	16658	21343	17178	17699	15616	7808	5726	6247	3123	1041	1562	2082	1041	521		0	418521
2009	10067	12003	14327	9293	9293	2710	5034	774	1162	1549	1549	3098	774				387	275306
2010	17211	13004	6884	9179	10326	4207	3825	2295	3060	1912	2677		1912	382	382		0	275371
2011	6045	9269	9874	8463	6045	4232	3023	1612	605	202	1411						0	182767
2012	8200	10249	12299	8712	10762	5893	7431	2306	5637	3331	2050	769	769	256			0	232149

Table 3.4.2 continued. Numbers of snook released alive by total length in inches, year, and coast (MRFSS Type b2).

Gulf

	Total Length (in)																	
Year	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1986	3156	2634	4509	4224	7689	6882	16660	13029	21667	23993	34672	26959	0	0	0	0	0	0
1987	818	682	1168	1094	1992	1783	4316	3375	5613	6215	8982	6984	0	0	0	0	0	0
1988	2042	1704	2917	2733	4975	4453	10779	8429	14018	15523	22433	17442	21143	15600	8936	6449	6326	5236
1989	1650	1377	2357	2208	4019	3597	8707	6809	11324	12540	18121	14090	17079	12602	7219	5209	5110	4230
1990	928	774	1325	1242	2260	2023	4897	3830	6369	7053	10192	7925	9606	7088	4060	2930	2874	2379
1991	5752	4801	8218	7699	14013	12543	30362	23744	39487	43726	63188	49132	59555	43942	25172	18165	17819	14748
1992	6767	5647	9667	9056	16485	14755	35717	27932	46452	51438	74333	57798	70059	51692	29611	21369	20962	17349
1993	7579	6325	10826	10143	18462	16525	40001	31283	52024	57608	83250	64731	78463	57893	33163	23932	23476	19431
1994	9041	7545	12915	12100	22024	19713	47719	37319	62062	68724	99313	77221	93603	69064	39562	28550	28006	23180
1995	6225	5195	8893	8331	15165	13574	32857	25696	42733	47320	68382	53171	64451	47554	27241	19658	19284	15961
1996	14644	12222	20920	19599	35674	31931	77294	60448	100527	111317	160865	125080	151616	111868	64082	46244	45364	37546
1997	12285	10253	17551	16442	29928	26788	64845	50712	84335	93388	134955	104934	127196	93850	53760	38796	38057	31499
1998	6779	5658	9685	9073	16515	14782	35782	27983	46537	51532	74470	57904	70188	51787	29666	21408	21000	17381
1999	8967	7484	12810	12001	21845	19553	47331	37015	61557	68164	98505	76592	92841	68501	39240	28318	27778	22991
2000	13994	11679	19991	18729	34091	30513	73863	57765	96064	106375	153723	119528	144885	106901	61237	44192	43350	35879
2001	14177	11832	20252	18973	34535	30911	74827	58518	97317	107763	155729	121087	146776	108296	62036	44768	43915	36347
2002	4228	0	8457	8457	34885	33827	84040	68712	91968	124210	168609	141652	168080	147995	42813	36470	35413	34356
2003	20017	16788	20017	17434	16788	15497	47136	56821	78129	142054	220829	158842	189189	136888	69735	54239	40033	15497
2004	24565	27543	41686	37220	62529	27543	95283	84117	152601	192799	346144	227785	270960	158556	97516	69229	59552	66251
2005	38905	31611	43768	36474	65653	97263	170210	167779	257747	179937	221274	189663	223705	126442	75379	63221	72947	38905
2006	17912	3257	19540	26053	52107	45593	118868	73275	161205	94443	99328	107470	125382	78160	73275	35823	53735	43965
2007	12915	12915	25830	36162	56827	51661	111070	51661	108487	56827	134318	95572	116236	98155	85240	100738	92989	67159
2008	9038	18077	40673	9038	36154	54230	117499	40673	158172	135576	131057	63269	126537	72307	99422	49711	45192	67788
2009	9558	9558	19117	15931	22303	28675	60537	54164	79654	108329	73281	121073	213472	254891	194355	92398	140190	105143
2010	6646	0	22153	15507	28799	22153	86397	24368	44306	35445	22153	24368	31014	19938	22153	22153	17723	17723
2011	17897	26032	16270	24405	17897	27659	53691	29286	52064	42302	55318	42302	55318	21151	24405	22778	43929	30913
2012	15662	7831	18795	17229	43855	45421	61083	45421	84577	57951	54818	72047	70481	86143	70481	36023	23494	29758

Table 3.4.2 continued. Numbers of snook released alive by total length in inches, year, and coast (MRFSS Type b2).

Gulf

	Total Length (in)																	
Year	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	Total
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166074
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43022
1988	4560	2856	3025	2196	1535	783	1213	583	829	384	599	123	215	77	15	31	15	190177
1989	3684	2307	2443	1774	1240	633	980	471	670	310	484	99	174	62	12	25	12	153628
1990	2072	1298	1374	998	698	356	551	265	377	174	272	56	98	35	7	14	7	86407
1991	12845	8045	8520	6185	4325	2206	3417	1644	2336	1081	1687	346	606	216	43	87	43	535698
1992	15111	9463	10023	7276	5088	2595	4019	1933	2747	1272	1984	407	712	254	51	102	51	630177
1993	16923	10599	11225	8148	5698	2906	4502	2165	3077	1425	2222	456	798	285	57	114	57	705772
1994	20189	12644	13391	9721	6798	3467	5370	2583	3671	1699	2651	544	952	340	68	136	68	841953
1995	13901	8706	9221	6693	4681	2387	3698	1779	2527	1170	1825	374	655	234	47	94	47	579730
1996	32701	20480	21691	15745	11011	5615	8698	4184	5946	2753	4294	881	1541	551	110	220	110	1363772
1997	27434	17181	18197	13209	9237	4711	7297	3510	4988	2309	3603	739	1293	462	92	185	92	1144113
1998	15139	9481	10041	7289	5097	2600	4027	1937	2752	1274	1988	408	714	255	51	102	51	631336
1999	20025	12541	13282	9641	6742	3439	5326	2562	3641	1686	2629	539	944	337	67	135	67	835096
2000	31250	19571	20728	15046	10522	5366	8312	3998	5682	2630	4104	842	1473	526	105	210	105	1303229
2001	31657	19826	20998	15242	10659	5436	8421	4050	5756	2665	4157	853	1492	533	107	213	107	1320231
2002	20085	16914	12685	13742	4757	4757	5286	2643	1586	529	1057	0	0	1057	0	0	0	1319270
2003	32931	16788	12914	9040	6457	1291	3874	2583	3228	2583	646	0	646	0	0	646	0	1409560
2004	37964	18610	24565	20843	11910	5211	9677	3722	9677	2978	5211	2978	1489	744	0	0	0	2197458
2005	46200	34042	17021	21884	9726	19452	14589	2432	9726	2432	0	0	0	0	0	2432	0	2280819
2006	26053	14655	22797	11398	8142	8142	19540	14655	19540	8142	6513	1628	0	0	0	0	0	1390596
2007	80074	10332	38745	36162	25830	5166	18081	5166	7749	7749	23247	2583	7749	2583	2583	0	2583	1591144
2008	40673	36154	54230	67788	45192	9038	22596	9038	18077	9038	4519	0	4519	0	0	0	0	1595275
2009	63723	92398	66909	35048	31861	6372	0	6372	6372	3186	3186	3186	0	3186	0	0	0	1924428
2010	19938	22153	17723	4431	4431	2215	11077	15507	2215	4431	22153	2215	8861	0	0	0	0	600349
2011	47183	14643	26032	13016	6508	9762	11389	1627	1627	1627	4881	0	4881	0	0	0	0	746793
2012	37590	31325	42288	14096	31325	10964	12530	0	9397	1566	1566	0	0	0	0	0	0	1033717

Table 3.4.3. Total recreational catch (numbers of snook kept or released alive) by total length in inches, year, and coast (MRFSS Type a+b1+b2).

Atlantic

	Total Length (in)																	
Year	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1986	23	22	33	30	55	65	0	0	0	0	0	0	0	0	0	0	0	0
1987	2	2	4	3	6	7	11	26565	14	2967	20	22	24	25	16	11	10	8
1988	5	5	7	6	11	13	0	0	0	0	0	0	0	0	0	0	0	0
1989	29	28	43	38	70	83	0	0	0	0	0	0	0	0	0	0	0	0
1990	21	20	31	28	51	61	96	100	123	142	178	1863	833	0	1666	0	0	0
1991	21	20	31	28	50	60	95	99	122	141	176	195	0	0	0	0	0	0
1992	21	20	31	28	50	60	95	99	122	141	177	195	0	0	0	0	2881	0
1993	10	10	15	13	24	29	45	47	58	67	84	93	102	8318	2122	2101	2095	34
1994	38	36	55	49	89	107	168	176	217	250	313	346	1582	383	1455	1979	1958	127
1995	29	28	42	38	69	83	131	136	169	195	243	269	295	297	196	136	120	99
1996	35	33	50	45	82	98	155	162	200	231	289	1960	5270	5273	233	1802	3422	117
1997	63	60	91	82	149	178	281	293	362	418	3782	578	634	7157	422	2466	259	2385
1998	31	30	45	41	74	89	140	146	181	208	899	1566	955	319	1488	2063	2684	106
1999	84	80	122	110	199	238	375	1120	1212	559	699	2229	1576	6676	2020	2575	3984	3194
2000	116	109	167	151	273	327	516	539	666	768	1735	3385	3488	1949	3873	2088	2024	2713
2001	66	62	95	86	155	185	292	306	378	436	3514	602	9569	2151	440	6245	3239	963
2002	77	73	112	101	183	218	345	360	514	514	642	1259	2905	3734	2713	2281	3267	2729
2003	55	53	116	72	131	157	248	259	320	405	497	833	1349	1318	982	1192	838	1623
2004	67	64	181	88	159	191	301	314	388	448	560	703	929	1847	2278	1144	1522	2219
2005	74	70	107	97	175	209	330	345	427	492	616	866	932	1185	1917	2383	1169	2102
2006	79	75	115	103	187	224	353	369	456	526	764	834	957	1123	2602	2547	2768	1754
2007	78	37	67	76	116	199	318	361	385	606	608	718	639	1652	2924	2663	2412	2201
2008	61	126	187	178	337	365	543	576	627	852	945	1095	1024	1557	3468	3261	2257	2911
2009	114	100	192	122	306	442	577	590	546	647	773	791	1048	1825	3947	3570	2733	2618
2010	92	66	114	94	271	255	493	315	568	443	614	665	935	1435	2404	1996	2038	1874
2011	32	76	69	32	107	63	177	272	322	328	631	710	985	1964	1880	2318	2152	1665
2012	114	57	85	85	283	293	283	332	435	481	586	503	854	1125	1371	1196	1219	1929

Table 3.4.3 continued. Total recreational catch (numbers of snook kept or released alive) by total length in inches, year, and coast (MRFSS Type a+b1+b2)

Atlantic

	Total Length (in)																	
Year	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	Total
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	229
1987	8	10	11	13	9	6	5	4	4	3	2	1	1	1	0	0	0	29797
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47
1989	0	0	0	11725	11725	0	0	0	0	0	0	0	0	0	0	0	0	23740
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5213
1991	0	0	0	3747	0	0	0	0	2498	2498	0	0	0	0	0	0	0	9781
1992	0	0	4321	0	1440	5761	2881	0	1440	0	0	1440	0	0	0	0	0	21205
1993	35	4148	47	2107	39	26	23	15	15	10	8	2060	6	2	2	1	1	23812
1994	733	149	2578	1401	147	98	85	57	56	39	31	22	21	9	6	4	4	14766
1995	103	116	2539	155	114	2480	66	44	43	2434	24	17	16	7	5	3	3	10745
1996	122	138	161	1823	136	90	79	52	51	1676	29	21	19	8	6	3	4	23878
1997	2393	4594	291	332	1332	163	1229	95	93	65	53	38	35	15	11	6	7	30409
1998	2665	3957	1423	1443	122	81	710	686	46	33	26	19	17	7	5	3	3	22312
1999	1750	3243	7665	1900	2511	218	1645	3037	124	87	70	50	46	19	14	8	9	49450
2000	4278	7427	2083	3708	2000	300	1036	174	945	120	97	69	838	27	20	11	12	48030
2001	3942	4713	3273	1089	3968	3882	891	99	97	68	55	39	36	15	11	6	7	50973
2002	4660	4695	4952	4660	3799	3630	3261	2517	1349	2206	888	1212	797	498	13	7	8	61179
2003	1845	2444	2123	2554	1939	1759	1597	1124	1123	919	369	320	354	13	45	5	6	28987
2004	2726	2839	3798	3012	2006	1337	816	600	598	485	471	123	120	99	12	7	7	32460
2005	2544	2700	4108	6379	1709	810	291	112	109	77	62	44	41	17	13	7	8	32527
2006	3305	2437	2756	2755	1477	577	179	172	117	135	66	100	97	18	14	8	8	30057
2007	2175	2056	1835	1909	1085	736	159	117	31	60	28	15	24	18	6	9	6	26332
2008	2894	4108	4463	3177	1379	730	201	159	126	89	66	61	23	9	19	5	5	37883
2009	2526	2882	2415	2312	1538	728	263	144	215	180	61	61	70	35	17	13	4	34407
2010	1639	1579	1522	1633	959	312	365	197	226	105	72	83	50	17	17	6	0	23454
2011	2210	1987	2317	1829	1163	503	303	189	234	142	133	51	88	44	44	25	38	25083
2012	1801	1848	1506	1348	898	480	359	209	161	171	151	132	76	9	9	9	28	20427

Table 3.4.3 continued. Total recreational catch (numbers of snook kept or released alive) by total length in inches, year, and coast (MRFSS Type a+b1+b2)

Gulf

	Total Length (in)																	
Year	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1986	31	26	44	41	75	67	0	603	1207	603	2413	603	603	1207	3620	1207	1810	2413
1987	39	32	166	273	94	84	221	0	221	442	1216	663	663	1548	553	1548	1659	332
1988	757	734	351	339	334	609	619	1858	2013	3561	2632	3407	1394	1703	774	2323	774	1084
1989	24	20	34	32	64	59	4	23	37	35	32	49	40	46	32	30	11	21
1990	18	15	69	24	44	39	182	597	602	1226	894	1199	1177	1090	1090	1439	1177	741
1991	67	56	96	90	176	147	355	302	462	535	775	767	374	447	701	543	338	314
1992	17	15	25	23	42	38	92	72	238	250	349	936	944	1692	2204	3896	2046	2046
1993	43	170	464	326	508	631	230	180	567	733	1148	1042	2462	3282	4616	9658	5767	10303
1994	35	29	50	121	135	175	309	145	340	612	411	670	1004	1205	1607	1910	1365	2061
1995	20	16	54	66	100	43	144	121	175	163	230	404	701	1157	962	951	1041	1005
1996	123	102	175	360	298	267	647	506	841	931	1542	3208	7948	6142	6626	4414	3523	3752
1997	144	120	332	698	730	441	887	1227	1116	1475	1962	5402	9960	12476	11879	11072	9673	6689
1998	161	443	385	293	625	661	852	821	1340	1227	1928	3617	7227	10338	8809	7917	5979	5507
1999	482	450	1375	1242	1512	767	1306	1606	3117	2217	3274	4714	7264	10332	7097	8195	5693	5127
2000	133	111	189	249	537	360	700	547	982	1151	2027	3130	7009	7148	4290	5127	5405	4192
2001	312	260	446	417	760	680	1852	1390	2346	2576	4042	4921	15849	19312	13985	14733	11226	8392
2002	262	218	559	350	730	849	2587	2471	3187	2082	3338	6501	16526	18041	14591	13252	10733	8831
2003	144	121	259	193	352	419	762	596	1096	1150	1639	3116	13889	12817	10150	7725	6252	5704
2004	191	159	273	256	465	416	1008	788	1485	1713	2185	2154	2500	6773	11986	13321	10609	9026
2005	298	305	426	566	782	817	1797	1286	2158	2489	3498	2546	3142	4175	6328	8030	5500	5453
2006	302	252	431	404	736	658	1594	1246	2118	2295	3317	2716	3400	4174	7517	7240	5946	4829
2007	90	0	213	180	743	721	1790	1464	1959	2712	3657	3050	3975	6447	8653	9045	7540	5904
2008	426	358	426	371	358	330	1004	1210	1664	3026	4704	3436	4242	5968	9130	9490	8126	5772
2009	523	587	888	793	1332	587	2030	1831	3250	4146	7373	4931	6165	8260	14519	15374	12726	10310
2010	829	673	932	777	1398	2072	3625	3574	5533	3833	4757	4170	5026	6345	12300	11432	10379	8654
2011	382	69	416	555	1110	971	2532	1584	3434	2035	2116	2312	2810	2525	4211	10689	4422	3075
2012	275	275	550	770	1210	1100	2366	1100	2311	1254	2861	2123	2476	2352	3557	15728	8206	6219

Table 3.4.3 continued. Total recreational catch (numbers of snook kept or released alive) by total length in inches, year, and coast (MRFSS Type a+b1+b2)

Gulf

	Total Length (in)																	
Year	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	Total
1986	2413	1810	2413	0	603	0	0	0	0	0	0	0	0	0	0	0	0	23810
1987	1880	1106	1990	1548	663	995	663	332	442	0	553	663	0	0	0	0	0	20590
1988	1239	1084	2942	1394	1084	2013	619	1084	929	619	774	1239	0	0	0	0	0	40286
1989	25	11	12	26	9	12	12	19	5	4	5	12	0	0	0	0	0	744
1990	1090	698	392	349	262	436	174	392	436	87	218	436	0	0	0	0	0	16594
1991	435	302	85	133	60	72	133	48	48	36	72	72	0	0	0	0	0	8042
1992	1299	1181	394	630	315	433	472	433	315	315	236	472	0	0	0	0	0	21419
1993	6266	4218	2880	3936	2044	2699	1233	2024	1493	813	549	1880	5	2	0	1	0	72172
1994	1187	1109	791	506	618	506	366	256	187	302	405	150	4	1	0	1	0	18572
1995	528	354	500	439	237	191	90	110	126	95	58	14	2	1	0	0	0	10099
1996	2140	1939	1262	1114	1369	538	564	821	344	318	232	7	13	5	1	2	1	52077
1997	4745	2856	3247	1672	2636	1572	844	673	1070	153	295	135	142	5	127	2	127	96585
1998	3678	3081	2631	2180	1433	2454	1022	741	683	416	124	87	171	6	1	2	1	76841
1999	3731	3339	3123	1713	2693	1753	1157	1155	831	673	230	127	136	65	59	3	59	86620
2000	3364	3110	3549	1641	2097	1549	578	1037	482	453	324	79	228	5	1	2	1	61787
2001	6134	8644	8157	3619	4236	3095	2237	1628	1460	264	399	19	135	12	2	5	2	143548
2002	7539	8804	6879	6031	4370	3346	2474	724	1683	1069	169	201	213	10	2	4	2	148627
2003	3199	2817	2672	2090	1991	1101	870	826	320	184	252	113	15	5	1	2	1	82842
2004	6089	6016	4813	4038	1537	160	201	55	78	36	56	11	20	7	1	3	1	88433
2005	4126	3542	2674	3167	559	617	177	141	177	56	87	18	31	11	2	4	2	64987
2006	4091	4522	3773	2238	956	389	179	132	123	148	134	18	32	11	2	5	2	65932
2007	5073	4215	3136	2632	1584	233	211	89	67	11	23	0	0	23	0	0	0	75438
2008	4683	3092	2213	1520	562	81	136	55	95	55	14	0	14	0	0	14	0	72575
2009	7227	5554	3791	2610	1120	505	324	79	206	63	150	63	32	16	0	0	0	117364
2010	8592	6203	4101	3640	598	414	311	52	207	52	0	0	0	0	0	52	0	110530
2011	2624	1823	1718	917	429	220	416	335	416	173	139	35	0	0	0	0	0	54493
2012	4797	2745	2610	1772	768	197	385	110	165	165	495	55	165	55	55	0	55	69328

Table 3.5.1. The number of snook ages by coast, year, and source.

	Atlantic		Gulf	
	Fishery Dependent	Fishery independent	Fishery Dependent	Fishery independent
Year	Num fish	Num fish	Num fish	Num fish
1986	0	0	0	19
1987	0	19	0	42
1988	0	305	0	614
1989	0	417	0	405
1990	0	195	0	23
1991	0	434	0	0
1992	0	1	0	2
1993	0	3	0	5
1994	0	5	0	540
1995	0	258	0	125
1996	0	112	0	127
1997	679	891	537	1,707
1998	569	434	389	467
1999	219	344	154	503
2000	296	291	127	646
2001	317	451	138	839
2002	544	304	970	403
2003	301	292	998	382
2004	318	311	1,215	479
2005	394	287	985	574
2006	438	249	727	526
2007	290	295	568	513
2008	128	291	267	557
2009	667	282	199	580
2010	407	209	0	236
2011	360	170	0	308
2012	291	219	0	502
Total	6,218	7,069	7,274	11,124

Table 3.5.2. Numbers of snook harvested by coast, age, and year. All fish aged 12 and older on the Atlantic coast and aged 10 and older on the gulf coast have been aggregated into a plus group.

Atlantic

	Number of fish by age												
Year	1	2	3	4	5	6	7	8	9	10	11	12+	Total
1986	89	276	341	338	577	893	1,083	1,115	1,042	921	788	2,315	9,780
1987	47	358	512	1,161	2,069	2,729	2,886	2,659	2,256	1,823	1,426	3,279	21,207
1988	29	243	6,721	6,300	4,562	3,147	669	221	162	186	199	1,372	23,811
1989	38	245	2,134	3,461	3,115	2,186	2,279	1,014	84	70	39	104	14,768
1990	50	54	270	1,285	1,101	912	1,154	1,592	1,344	224	1,479	1,279	10,745
1991	31	216	1,013	2,454	8,649	5,365	1,395	875	1,609	989	1,138	146	23,880
1992	250	1,527	4,299	5,885	5,466	4,255	3,028	2,057	1,364	889	569	817	30,408
1993	118	830	2,077	3,574	4,045	3,563	2,719	1,923	1,302	858	550	754	22,312
1994	296	1,984	5,321	7,686	8,184	7,193	5,679	4,215	3,020	2,115	1,452	2,306	49,450
1995	166	1,834	3,447	17,337	9,190	9,229	1,336	1,227	1,030	823	638	1,770	48,028
1996	70	545	4,568	16,785	17,451	3,086	4,700	1,130	690	580	462	905	50,971
1997	55	720	3,375	9,730	11,830	13,242	8,152	4,396	1,545	1,555	2,293	4,290	61,181
1998	121	580	2,000	3,750	4,864	4,405	5,181	3,526	1,393	743	812	1,614	28,988
1999	235	1,046	1,666	4,947	5,974	5,754	4,798	3,536	2,242	1,103	306	855	32,461
2000	229	572	2,041	4,423	6,453	6,032	5,382	2,593	2,478	1,349	549	425	32,527
2001	326	1,217	4,133	6,251	5,382	4,996	3,224	1,955	1,148	626	440	357	30,056
2002	113	502	2,915	7,200	6,064	3,418	2,561	1,298	988	480	430	362	26,331
2003	175	1,099	2,115	7,849	11,457	6,279	2,908	3,150	1,287	589	311	663	37,883
2004	214	819	4,331	8,874	9,231	5,018	2,603	1,192	1,230	386	135	375	34,409
2005	75	800	2,692	5,583	4,167	4,286	2,378	1,439	967	57	393	617	23,455
2006	33	470	1,781	4,036	4,770	4,280	4,068	2,427	1,342	573	523	776	25,080
2007	206	231	2,675	4,261	6,225	2,851	1,518	902	483	201	188	684	20,426
2008	240	471	2,432	4,402	6,420	5,124	1,738	862	1,093	500	294	140	23,717
2009	114	342	1,130	4,472	4,861	2,969	858	462	195	128	68	109	15,708
2010	129	180	1,075	1,418	1,658	943	468	183	115	131	21	130	6,451
2011	104	193	978	3,090	2,539	2,096	1,584	705	275	235	60	55	11,913
2012	387	380	721	1,587	1,698	1,463	1,234	542	386	308	147	318	9,170

Table 3.5.2 continued. Numbers of snook harvested by coast, age, and year. All fish aged 12 and older on the Atlantic coast and aged 10 and older on the gulf coast have been aggregated into a plus group.

Gulf

	Number of fish by age										
Year	1	2	3	4	5	6	7	8	9	10+	Total
1986	316	565	1,721	2,109	818	1,075	430	233	174	604	8,045
1987	57	910	3,511	4,811	7,359	2,137	639	350	330	1,312	21,418
1988	1,128	1,626	3,707	9,103	14,821	24,234	9,800	3,766	1,517	2,472	72,174
1989	141	598	3,413	5,655	1,805	1,802	2,965	992	450	750	18,572
1990	150	467	1,166	1,652	1,556	1,253	956	718	538	1,646	10,100
1991	695	2,502	7,596	9,586	8,084	6,079	4,471	3,294	2,445	7,325	52,076
1992	1,120	4,207	13,489	17,209	15,274	11,664	8,587	6,311	4,675	14,048	96,585
1993	1,060	3,100	11,054	13,151	11,785	9,196	6,905	5,141	3,835	11,614	76,841
1994	535	1,209	5,832	7,055	26,303	7,271	21,884	7,924	2,984	5,622	86,620
1995	662	928	5,313	14,936	12,453	5,693	4,429	3,307	5,646	8,420	61,787
1996	948	4,140	14,406	33,369	38,919	32,977	9,477	3,384	1,878	4,050	143,548
1997	477	2,507	11,885	39,608	40,382	28,944	12,281	5,660	3,480	3,403	148,627
1998	718	1,604	4,596	21,126	22,555	16,858	8,057	4,301	2,518	511	82,843
1999	572	3,461	15,054	15,596	25,046	15,443	9,504	1,634	1,618	503	88,431
2000	901	5,001	10,805	9,982	14,528	10,749	8,370	1,697	1,071	1,881	64,985
2001	521	2,835	12,216	18,851	11,053	9,765	3,797	3,822	1,421	1,652	65,932
2002	493	1,630	9,581	28,542	17,811	9,462	3,569	2,542	911	898	75,438
2003	1,721	1,926	5,700	23,569	27,043	7,742	2,156	1,010	684	1,021	72,572
2004	1,546	5,445	7,202	30,549	38,882	23,853	6,100	1,684	1,002	1,101	117,364
2005	1,733	6,501	12,642	18,699	35,218	22,128	9,190	2,572	1,168	682	110,532
2006	1,486	3,231	10,660	19,366	6,736	6,723	3,532	1,464	736	561	54,495
2007	822	4,529	8,518	28,504	16,461	2,191	3,370	2,128	902	1,904	69,328
2008	1,755	4,351	7,468	11,444	19,038	11,753	1,229	945	466	958	59,408
2009	516	1,629	4,805	18,482	9,745	13,404	4,580	735	287	743	54,926
2010	1,216	2,030	2,054	2,441	2,755	406	816	631	85	353	12,787
2011	1,334	2,703	3,641	1,053	2,713	2,164	1,218	460	354	267	15,907
2012	1,184	3,296	6,162	4,240	2,696	2,650	1,499	149	244	266	22,387

Table 4.2.2.2. Parameter estimates and their precisions (standard errors) from ASAP by coast.

Coast	Parameter number	Parameter	Estimate	Standard error
Atlantic	1	Fleet select alpha	3.3521	0.092402
Atlantic	2	Fleet select beta	0.58704	0.036988
Atlantic	3	log_Fmult_1986	-1.6647	0.21262
Atlantic	4	log_Fmult_devs_1987	0.54169	0.19917
Atlantic	5	log_Fmult_devs_1988	0.20283	0.15476
Atlantic	6	log_Fmult_devs_1989	1.196	0.17569
Atlantic	7	log_Fmult_devs_1990	-0.70683	0.19122
Atlantic	8	log_Fmult_devs_1991	0.37958	0.17444
Atlantic	9	log_Fmult_devs_1992	0.69761	0.12925
Atlantic	10	log_Fmult_devs_1993	-0.66614	0.10674
Atlantic	11	log_Fmult_devs_1994	0.91641	0.092807
Atlantic	12	log_Fmult_devs_1995	0.26236	0.082986
Atlantic	13	log_Fmult_devs_1996	-0.48461	0.084527
Atlantic	14	log_Fmult_devs_1997	0.053284	0.1283
Atlantic	15	log_Fmult_devs_1998	0.022651	0.11654
Atlantic	16	log_Fmult_devs_1999	0.14068	0.090065
Atlantic	17	log_Fmult_devs_2000	0.051762	0.083243
Atlantic	18	log_Fmult_devs_2001	0.021438	0.087686
Atlantic	19	log_Fmult_devs_2002	-0.5596	0.084609
Atlantic	20	log_Fmult_devs_2003	0.73323	0.08174
Atlantic	21	log_Fmult_devs_2004	0.12411	0.081498
Atlantic	22	log_Fmult_devs_2005	-0.085656	0.083938
Atlantic	23	log_Fmult_devs_2006	0.19676	0.091448
Atlantic	24	log_Fmult_devs_2007	0.056345	0.091407
Atlantic	25	log_Fmult_devs_2008	-0.26868	0.095207
Atlantic	26	log_Fmult_devs_2009	-0.43266	0.10284
Atlantic	27	log_Fmult_devs_2010	-0.089231	0.11562
Atlantic	28	log_Fmult_devs_2011	0.90686	0.42067
Atlantic	29	log_Fmult_devs_2012	-0.40778	0.53506
Atlantic	30	log_recruit_devs 1986	0.1688	0.22203
Atlantic	31	log_recruit_devs 1987	0.36134	0.20036
Atlantic	32	log_recruit_devs 1988	-0.32411	0.26684
Atlantic	33	log_recruit_devs 1989	-0.33351	0.28379
Atlantic	34	log_recruit_devs 1990	-0.027148	0.23666
Atlantic	35	log_recruit_devs 1991	0.3212	0.17704
Atlantic	36	log_recruit_devs 1992	0.54099	0.13653
Atlantic	37	log_recruit_devs 1993	0.23424	0.14435

Table 4.2.2.2 continued. Parameter estimates and their precisions (standard errors) from ASAP by coast.

Coast	Parameter number	Parameter	Estimate	Standard error
Atlantic	38	log_recruit_devs 1994	0.11561	0.13185
Atlantic	39	log_recruit_devs 1995	0.034362	0.12062
Atlantic	40	log_recruit_devs 1996	0.11258	0.087108
Atlantic	41	log_recruit_devs 1997	0.049217	0.083667
Atlantic	42	log_recruit_devs 1998	0.23105	0.0853
Atlantic	43	log_recruit_devs 1999	0.28456	0.091527
Atlantic	44	log_recruit_devs 2000	0.22235	0.096321
Atlantic	45	log_recruit_devs 2001	0.033556	0.10675
Atlantic	46	log_recruit_devs 2002	0.19804	0.098525
Atlantic	47	log_recruit_devs 2003	0.14369	0.092741
Atlantic	48	log_recruit_devs 2004	-0.10735	0.098657
Atlantic	49	log_recruit_devs 2005	0.081927	0.097715
Atlantic	50	log_recruit_devs 2006	-0.071897	0.09986
Atlantic	51	log_recruit_devs 2007	-0.19835	0.10252
Atlantic	52	log_recruit_devs 2008	-0.30691	0.11286
Atlantic	53	log_recruit_devs 2009	-0.63222	0.14799
Atlantic	54	log_recruit_devs 2010	-0.66602	0.16797
Atlantic	55	log_recruit_devs 2011	-0.36009	0.18075
Atlantic	56	log_recruit_devs 2012	-0.10589	0.48861
Atlantic	57	log_N_year_1986_devs_age_2	-5.844	0.31311
Atlantic	58	log_N_year_1986_devs_age_3	-6.2065	0.35174
Atlantic	59	log_N_year_1986_devs_age_4	-6.2873	0.34077
Atlantic	60	log_N_year_1986_devs_age_5	-6.4636	0.51453
Atlantic	61	log_N_year_1986_devs_age_6	-7.2623	0.84994
Atlantic	62	log_N_year_1986_devs_age_7	-7.0631	0.85807
Atlantic	63	log_N_year_1986_devs_age_8	-7.2107	1.1894
Atlantic	64	log_N_year_1986_devs_age_9	-5.5362	1.341
Atlantic	65	log_N_year_1986_devs_age_10	-4.2423	1.213
Atlantic	66	log_N_year_1986_devs_age_11	-7.0291	3.3002
Atlantic	67	log_N_year_1986_devs_age_12+	-5.4763	1.3504
Atlantic	68	log_q_year_1986 FIM index	-4.4967	0.058351
Atlantic	69	log_q_year_1986 MRFSS index	-4.7125	0.062435
Atlantic	70	log_q_year_1986 FIM age-2 index	-4.4024	0.046193
Atlantic	71	FIM index select alpha	1.8802	0.086213
Atlantic	72	FIM index select beta	0.29007	0.038394
Atlantic	73	log_SSB unexploited	7.3436	0.28961
Atlantic	74	Steepness	0.66397	0.105

Table 4.2.2.2 continued. Parameter estimates and their precisions (standard errors) from ASAP by coast.

Coast	Parameter number	Parameter	Estimate	Standard error
Gulf	1	Fleet1_select_alpha	4.1488	0.060608
Gulf	2	Fleet1_select_beta	0.80944	0.032878
Gulf	3	log_Fleet1_Fmult_year_1986	-0.45368	0.3275
Gulf	4	log_Environ_Fmult_year_1986	-6.1047	0.35613
Gulf	5	log_Fleet1_Fmult_devs_1987	-0.37991	0.361
Gulf	6	log_Fleet1_Fmult_devs_1988	1.375	0.2478
Gulf	7	log_Fleet1_Fmult_devs_1989	-0.25651	0.21252
Gulf	8	log_Fleet1_Fmult_devs_1990	-0.71676	0.24733
Gulf	9	log_Fleet1_Fmult_devs_1991	1.286	0.22994
Gulf	10	log_Fleet1_Fmult_devs_1992	0.13722	0.1522
Gulf	11	log_Fleet1_Fmult_devs_1993	-0.0035555	0.1006
Gulf	12	log_Fleet1_Fmult_devs_1994	0.21958	0.10504
Gulf	13	log_Fleet1_Fmult_devs_1995	-0.42671	0.11148
Gulf	14	log_Fleet1_Fmult_devs_1996	0.60653	0.090697
Gulf	15	log_Fleet1_Fmult_devs_1997	0.00014199	0.0078782
Gulf	16	log_Fleet1_Fmult_devs_1998	-0.2751	0.075724
Gulf	17	log_Fleet1_Fmult_devs_1999	-0.08051	0.099192
Gulf	18	log_Fleet1_Fmult_devs_2000	0.33199	0.10829
Gulf	19	log_Fleet1_Fmult_devs_2001	-0.047547	0.10318
Gulf	20	log_Fleet1_Fmult_devs_2002	-0.086368	0.083831
Gulf	21	log_Fleet1_Fmult_devs_2003	-0.13277	0.080421
Gulf	22	log_Fleet1_Fmult_devs_2004	0.29013	0.065628
Gulf	23	log_Fleet1_Fmult_devs_2005	-0.0004596	0.0078502
Gulf	24	log_Fleet1_Fmult_devs_2006	-0.42442	0.067172
Gulf	25	log_Fleet1_Fmult_devs_2007	0.25433	0.08307
Gulf	26	log_Fleet1_Fmult_devs_2008	0.0036869	0.08394
Gulf	27	log_Fleet1_Fmult_devs_2009	0.16673	0.070244
Gulf	28	log_Fleet1_Fmult_devs_2010	-0.67925	0.18493
Gulf	29	log_Fleet1_Fmult_devs_2011	0.1416	0.20665
Gulf	30	log_Fleet1_Fmult_devs_2012	0.28127	0.13413
Gulf	31	log_Environ_Fmult_devs_1987	-0.40464	0.44469
Gulf	32	log_Environ_Fmult_devs_1988	-0.14684	0.44703
Gulf	33	log_Environ_Fmult_devs_1989	-0.15854	0.44693
Gulf	34	log_Environ_Fmult_devs_1990	-0.35747	0.44797
Gulf	35	log_Environ_Fmult_devs_1991	-0.24973	0.44673
Gulf	36	log_Environ_Fmult_devs_1992	-0.13441	0.44534
Gulf	37	log_Environ_Fmult_devs_1993	0.028002	0.44437

Table 4.2.2.2 continued. Parameter estimates and their precisions (standard errors) from ASAP by coast.

Coast	Parameter number	Parameter	Estimate	Standard error
Gulf	38	log_Environ_Fmult_devs_1994	0.082309	0.44434
Gulf	39	log_Environ_Fmult_devs_1995	-0.033722	0.44475
Gulf	40	log_Environ_Fmult_devs_1996	-0.011699	0.44478
Gulf	41	log_Environ_Fmult_devs_1997	0.084427	0.44459
Gulf	42	log_Environ_Fmult_devs_1998	0.037106	0.44466
Gulf	43	log_Environ_Fmult_devs_1999	0.026094	0.44429
Gulf	44	log_Environ_Fmult_devs_2000	0.91445	0.44091
Gulf	45	log_Environ_Fmult_devs_2001	5.5095	0.34912
Gulf	46	log_Environ_Fmult_devs_2002	-4.608	0.34932
Gulf	47	log_Environ_Fmult_devs_2003	3.3299	0.34944
Gulf	48	log_Environ_Fmult_devs_2004	-3.5462	0.34044
Gulf	49	log_Environ_Fmult_devs_2005	3.8101	0.34062
Gulf	50	log_Environ_Fmult_devs_2006	0.063609	0.096816
Gulf	51	log_Environ_Fmult_devs_2007	-4.8575	0.34656
Gulf	52	log_Environ_Fmult_devs_2008	-0.64023	0.44103
Gulf	53	log_Environ_Fmult_devs_2009	1.1477	0.44536
Gulf	54	log_Environ_Fmult_devs_2010	6.3811	0.35662
Gulf	55	log_Environ_Fmult_devs_2011	-5.5147	0.34606
Gulf	56	log_Environ_Fmult_devs_2012	-1.2928	0.45733
Gulf	57	log_recruit_devs 1986	-0.53335	0.24878
Gulf	58	log_recruit_devs 1987	-0.34202	0.24916
Gulf	59	log_recruit_devs 1988	0.28065	0.23131
Gulf	60	log_recruit_devs 1989	0.40748	0.2243
Gulf	61	log_recruit_devs 1990	0.40962	0.1826
Gulf	62	log_recruit_devs 1991	-0.33369	0.1752
Gulf	63	log_recruit_devs 1992	-0.37069	0.12385
Gulf	64	log_recruit_devs 1993	-0.12962	0.099254
Gulf	65	log_recruit_devs 1994	-0.054699	0.086622
Gulf	66	log_recruit_devs 1995	-0.16205	0.086275
Gulf	67	log_recruit_devs 1996	-0.17308	0.094086
Gulf	68	log_recruit_devs 1997	-0.043606	0.089195
Gulf	69	log_recruit_devs 1998	0.35931	0.071909
Gulf	70	log_recruit_devs 1999	0.54919	0.06151
Gulf	71	log_recruit_devs 2000	0.57605	0.057939
Gulf	72	log_recruit_devs 2001	0.40527	0.076094
Gulf	73	log_recruit_devs 2002	-0.11165	0.10187
Gulf	74	log_recruit_devs 2003	0.5252	0.084679

Table 4.2.2.2 continued. Parameter estimates and their precisions (standard errors) from ASAP by coast.

Coast	Parameter number	Parameter	Estimate	Standard error
Gulf	75	log_recruit_devs 2004	0.53042	0.10183
Gulf	76	log_recruit_devs 2005	-0.33913	0.11366
Gulf	77	log_recruit_devs 2006	-0.29474	0.10838
Gulf	78	log_recruit_devs 2007	-0.24499	0.10926
Gulf	79	log_recruit_devs 2008	-0.40264	0.12327
Gulf	80	log_recruit_devs 2009	-0.41728	0.15477
Gulf	81	log_recruit_devs 2010	-0.073749	0.14145
Gulf	82	log_recruit_devs 2011	0.17299	0.11896
Gulf	83	log_recruit_devs 2012	-0.18921	0.44202
Gulf	84	log_N_year_1986_devs_age_2	-3.6668	0.26227
Gulf	85	log_N_year_1986_devs_age_3	-4.4006	0.25426
Gulf	86	log_N_year_1986_devs_age_4	-5.9694	0.25664
Gulf	87	log_N_year_1986_devs_age_5	-6.8081	0.46472
Gulf	88	log_N_year_1986_devs_age_6	-7.0398	0.74568
Gulf	89	log_N_year_1986_devs_age_7	-8.3262	1.4119
Gulf	90	log_N_year_1986_devs_age_8	-7.0906	1.2563
Gulf	91	log_N_year_1986_devs_age_9	-7.8838	2.2322
Gulf	92	log_N_year_1986_devs_age_10	-9.2753	2.1287
Gulf	93	log_catchability_1986_FIM	-5.3077	0.065358
Gulf	94	log_catchability_1986_MRFSS	-5.3548	0.031024
Gulf	95	log_catchability_1986_ENP	-5.7326	0.073482
Gulf	96	log_catchability_1986_FIM_Age_2	-5.8743	0.037179
Gulf	97	FIM_index_select_alpha	2.5966	0.15001
Gulf	98	FIM_index_sel_beta	0.66262	0.08054
Gulf	99	ENP_index_sel_alpha	4.3697	0.13961
Gulf	100	ENP_index_sel_beta	0.4497	0.041753
Gulf	101	log_SSB unexploited	7.8402	0.19861
Gulf	102	Steepness	0.71097	0.095173

Table 4.2.2.4.1. Objective function component totals for ASAP base run. Legend: RSS - residual sum of squares, nobs -- the number of observations, MSE -- the mean square error, lambda (λ) -- the weight assigned to component, and the objective function is the log-likelihood that was minimized.

Atlantic

Component	RSS	nobs	MSE	Lambda	Objective Function
Catch_Fleet_Total	1.1688	27	0.0450	1	95.667
Discard_Fleet_Total	2.5711	27	0.0989	1	-30.442
FIM adult	0.2544	16	0.0170	1	3.198
MRFSS	0.3945	22	0.0188	1	-0.436
FIM Age-2	0.2951	16	0.0197	1	-14.327
Catch age composition					215.728
Discard age composition					257.908
Survey age composition					331.270
Selectivity fleet				2	13.126
Selectivity FIM				2	2.449
Catchability for indices				3	-12.527
Fmult year 1 Fleet				1	6.287
Recruitment deviations				1	145.554
SRR_steepness				0.7	-0.936
Objective function total					1011.658

Table 4.2.2.4.1 continued. Objective function component totals for ASAP base run. Legend: RSS - residual sum of squares, nobs -- the number of observations, MSE -- the mean square error, lambda (λ) -- the weight assigned to component, and likelihood is the log-likelihood that was minimized.

Gulf

Component	RSS	nobs	MSE	Lambda	Objective Function
Catch_Fleet_Total	15.5005	26	0.6200	1	138.148
Environmental	0.0414	5	0.0104	50	3049.05
Discard_Fleet_Total	0.3214	27	0.0124	2	-15.4763
FIM adult index	0.5939	17	0.0371	1	26.386
MRFSS index	0.6882	22	0.0328	1	43.9734
END index	1.7645	27	0.0679	1	188.073
FIM Age-2 index	1.1404	17	0.0713	1	14.8277
Catch age composition				ee_below	193.863
Discard age composition				ee_below	278.938
Survey age composition				ee_below	449.2
Selectivity fleet				2	35.0174
Selectivity FIM index				2	12.137222
Selectivity ENP index				2	21.26453
Catchability indices				4	-18.7456
Environmental				1	-2.05242
Fmult year 1 Fleet1				1	5.73291
Environmental				1	160.072
Recruitment deviations				0.7	125.367
SRR_steepness				0.7	-0.981733
Fmult penalty					0.0484267
Objective function total					4704.843

Table 4.2.2.4.3. Estimated fishing mortality per year from ASAP and transitional spawning potential ratios (tSPR). The average natural mortality rates used in the analyses were 0.20 per year on the Atlantic coast and 0.25 per year on the Gulf coast.

Atlantic

	Instantaneous fishing mortality per year												
	Ages(yr)												
Year	1	2	3	4	5	6	7	8	9	10	11	12+	tSPR
1986	0.00	0.00	0.00	0.01	0.02	0.04	0.06	0.07	0.10	0.11	0.10	0.13	0.43
1987	0.00	0.00	0.01	0.02	0.10	0.13	0.18	0.18	0.21	0.24	0.26	0.22	0.44
1988	0.00	0.00	0.04	0.10	0.18	0.14	0.14	0.15	0.20	0.19	0.23	0.21	0.43
1989	0.00	0.00	0.02	0.07	0.14	0.13	0.14	0.14	0.14	0.07	0.08	0.05	0.43
1990	0.00	0.00	0.00	0.01	0.03	0.06	0.08	0.10	0.15	0.11	0.19	0.21	0.44
1991	0.00	0.00	0.04	0.10	0.13	0.13	0.15	0.16	0.16	0.08	0.12	0.20	0.45
1992	0.00	0.01	0.05	0.12	0.27	0.18	0.22	0.21	0.28	0.33	0.15	0.11	0.44
1993	0.00	0.00	0.03	0.07	0.19	0.16	0.20	0.19	0.20	0.24	0.13	0.09	0.42
1994	0.00	0.01	0.06	0.16	0.36	0.32	0.39	0.40	0.47	0.49	0.43	0.32	0.38
1995	0.00	0.01	0.06	0.14	0.37	0.31	0.38	0.35	0.40	0.53	0.28	0.33	0.32
1996	0.00	0.00	0.06	0.17	0.43	0.38	0.47	0.46	0.43	0.51	0.40	0.20	0.28
1997	0.00	0.00	0.03	0.15	0.40	0.32	0.67	0.71	0.77	0.83	0.90	0.82	0.23
1998	0.00	0.00	0.03	0.08	0.27	0.28	0.34	0.39	0.50	0.67	0.65	0.58	0.21
1999	0.00	0.01	0.02	0.10	0.30	0.51	0.42	0.22	0.47	0.40	0.35	0.36	0.21
2000	0.00	0.00	0.03	0.10	0.28	0.53	0.52	0.51	0.47	0.56	0.53	0.09	0.21
2001	0.00	0.01	0.04	0.11	0.27	0.40	0.34	0.35	0.28	0.38	0.36	0.16	0.21
2002	0.00	0.00	0.03	0.08	0.27	0.25	0.28	0.24	0.33	0.28	0.33	0.17	0.23
2003	0.00	0.01	0.03	0.13	0.43	0.43	0.35	0.16	0.31	0.32	0.24	0.19	0.23
2004	0.00	0.01	0.06	0.17	0.37	0.45	0.36	0.24	0.36	0.46	0.24	0.12	0.23
2005	0.00	0.01	0.05	0.12	0.24	0.26	0.24	0.26	0.24	0.12	0.19	0.10	0.24
2006	0.00	0.01	0.05	0.14	0.27	0.22	0.32	0.22	0.22	0.27	0.23	0.16	0.25
2007	0.00	0.01	0.04	0.13	0.18	0.21	0.17	0.31	0.16	0.11	0.13	0.11	0.26
2008	0.00	0.01	0.03	0.13	0.28	0.27	0.17	0.25	0.27	0.36	0.22	0.07	0.27
2009	0.00	0.00	0.02	0.11	0.18	0.15	0.12	0.10	0.12	0.08	0.06	0.05	0.29
2010	0.00	0.00	0.01	0.04	0.05	0.05	0.05	0.05	0.04	0.05	0.05	0.04	0.33
2011	0.00	0.01	0.04	0.12	0.31	0.37	0.28	0.49	0.37	0.19	0.36	0.17	0.34
2012	0.00	0.01	0.02	0.06	0.15	0.15	0.14	0.15	0.20	0.15	0.08	0.08	0.34

Table 4.2.2.4.3 continued. Estimated fishing mortality per year from ASAP and transitional spawning potential ratios (tSPR). The average natural mortality rates used in the analyses were 0.20 per year on the Atlantic coast and 0.25 per year on the Gulf coast.

Gulf

	Instantaneous fishing mortality per year										
	Ages(yr)										
Year	1	2	3	4	5	6	7	8	9	10+	tSPR
1986	0.00	0.00	0.01	0.03	0.05	0.07	0.09	0.09	0.14	0.21	41%
1987	0.00	0.00	0.02	0.10	0.17	0.21	0.27	0.27	0.32	0.37	44%
1988	0.00	0.01	0.04	0.21	0.40	0.47	0.70	0.71	0.90	1.27	39%
1989	0.00	0.00	0.01	0.07	0.12	0.14	0.21	0.22	0.40	0.53	37%
1990	0.00	0.00	0.01	0.03	0.06	0.07	0.11	0.10	0.14	0.21	41%
1991	0.00	0.00	0.02	0.10	0.19	0.23	0.32	0.28	0.42	0.55	43%
1992	0.00	0.01	0.04	0.17	0.32	0.37	0.52	0.50	0.68	0.91	40%
1993	0.00	0.01	0.03	0.12	0.23	0.27	0.39	0.37	0.48	0.79	38%
1994	0.00	0.01	0.04	0.11	0.21	0.26	0.37	0.35	0.51	0.86	37%
1995	0.00	0.00	0.02	0.09	0.17	0.21	0.32	0.29	0.45	0.64	38%
1996	0.00	0.01	0.03	0.13	0.26	0.31	0.47	0.42	0.61	0.87	37%
1997	0.00	0.01	0.05	0.20	0.47	0.44	0.76	0.78	0.97	1.21	34%
1998	0.00	0.00	0.04	0.16	0.32	0.39	0.57	0.46	0.58	0.66	32%
1999	0.00	0.00	0.04	0.14	0.22	0.27	0.69	0.55	0.24	0.27	32%
2000	0.00	0.01	0.03	0.07	0.19	0.18	0.46	0.13	0.27	0.45	34%
2001	0.00	0.01	0.03	0.10	0.11	0.20	0.41	0.20	0.12	0.46	35%
2002	0.00	0.00	0.03	0.10	0.22	0.15	0.39	0.12	0.32	0.36	35%
2003	0.00	0.00	0.02	0.11	0.11	0.15	0.32	0.10	0.19	0.14	38%
2004	0.00	0.01	0.03	0.14	0.21	0.16	0.40	0.11	0.18	0.21	41%
2005	0.00	0.01	0.02	0.10	0.16	0.23	0.21	0.43	0.14	1.13	42%
2006	0.00	0.00	0.02	0.09	0.11	0.09	0.17	0.11	0.07	0.09	43%
2007	0.00	0.00	0.02	0.08	0.14	0.17	0.15	0.09	0.12	0.27	47%
2008	0.00	0.00	0.02	0.05	0.16	0.11	0.13	0.12	0.07	0.07	51%
2009	0.00	0.01	0.02	0.05	0.12	0.14	0.17	0.10	0.09	0.09	55%
2010	0.00	0.00	0.01	0.02	0.03	0.04	0.04	0.04	0.04	0.04	54%
2011	0.00	0.00	0.01	0.03	0.06	0.09	0.08	0.06	0.07	0.35	53%
2012	0.00	0.00	0.01	0.03	0.05	0.07	0.07	0.07	0.07	0.07	58%

Table 4.2.2.4.4. Estimated population size from ASAP at the beginning of each year by coast and age. All tuning indices were equally weighted.

Atlantic

	Number of fish												
	Age (yr												
Year	1	2	3	4	5	6	7	8	9	10	11	12+	Total
1986	180,206	62,545	34,000	32,995	17,476	8,559	8,877	5,986	12,376	23,488	1,683	16,642	404,834
1987	219,466	117,922	45,039	25,763	25,686	13,672	6,711	6,874	4,608	9,281	17,536	13,712	506,269
1988	107,818	143,606	84,893	33,816	19,741	18,615	9,766	4,613	4,742	3,123	6,085	20,697	457,516
1989	104,954	70,548	103,369	61,787	23,912	13,241	13,180	6,942	3,278	3,240	2,159	18,222	424,832
1990	142,212	68,650	50,691	76,744	45,289	16,701	9,481	9,398	5,014	2,375	2,517	16,362	445,434
1991	203,045	93,044	49,391	38,277	59,333	35,003	12,828	7,175	7,055	3,594	1,781	12,970	523,495
1992	254,633	132,829	66,903	35,969	27,061	41,852	24,841	9,049	5,044	4,985	2,780	10,358	616,303
1993	187,376	166,517	94,897	48,124	24,963	16,457	28,428	16,409	6,080	3,182	3,005	9,838	605,276
1994	167,285	122,578	119,631	70,011	35,283	16,491	11,356	19,043	11,183	4,149	2,088	9,843	588,939
1995	151,560	109,373	87,749	85,551	46,785	19,757	9,752	6,286	10,543	5,809	2,120	7,192	542,476
1996	157,618	99,064	78,238	62,952	58,353	25,937	11,724	5,482	3,650	5,858	2,855	5,717	517,448
1997	142,481	103,072	71,079	55,963	41,456	30,242	14,441	5,988	2,858	1,982	2,954	5,588	478,104
1998	159,005	93,169	73,912	52,118	37,635	22,218	17,763	6,052	2,431	1,098	726	3,095	469,222
1999	161,280	103,973	66,841	54,591	37,519	23,050	13,690	10,353	3,388	1,227	469	1,791	478,173
2000	151,302	105,425	74,498	49,585	38,806	22,169	11,280	7,381	6,886	1,769	688	1,340	471,129
2001	123,579	98,919	75,568	55,052	35,068	23,435	10,561	5,502	3,654	3,569	844	1,378	437,128
2002	145,280	80,792	70,897	55,356	38,550	21,357	12,786	6,172	3,207	2,290	2,034	1,492	440,212
2003	140,174	95,021	57,931	52,288	39,903	23,626	13,462	7,907	4,001	1,926	1,453	2,296	439,988
2004	109,928	91,624	68,037	42,658	35,850	20,804	12,545	7,793	5,589	2,435	1,167	2,558	400,987
2005	130,743	71,843	65,553	48,813	28,149	19,732	10,806	7,202	5,087	3,240	1,288	2,689	395,146
2006	112,177	85,442	51,326	47,514	33,935	17,741	12,361	6,959	4,600	3,342	2,406	2,951	380,752
2007	99,873	73,301	61,016	37,086	32,284	20,754	11,556	7,378	4,627	3,077	2,136	3,747	356,835
2008	90,683	65,256	52,379	44,540	25,457	21,571	13,674	8,003	4,463	3,289	2,318	4,403	336,036
2009	65,928	59,174	46,718	38,585	30,587	15,408	13,359	9,496	5,181	2,844	1,929	5,046	294,255
2010	64,470	43,111	42,456	34,726	26,953	20,419	10,816	9,702	7,122	3,838	2,187	5,586	271,384
2011	90,479	42,160	30,942	31,759	26,186	20,616	15,733	8,468	7,671	5,675	3,068	6,291	289,048
2012	115,139	59,106	30,088	22,596	22,062	15,396	11,512	9,746	4,297	4,404	3,938	6,295	304,580

Table 4.2.2.4.4 continued. Estimated population size from ASAP at the beginning of each year by coast and age. All tuning indices were equally weighted.

Gulf

	Number of fish										
	Age (yr)										
Year	1	2	3	4	5	6	7	8	9	10+	Total
1986	175,135	94,693	67,142	46,180	21,997	12,917	5,258	13,096	6,203	2,995	445,615
1987	219,971	112,313	66,125	48,713	33,697	15,917	9,359	3,737	9,454	6,189	525,474
1988	433,996	141,078	78,467	47,273	33,191	21,627	10,000	5,608	2,255	8,810	782,306
1989	497,095	277,057	97,273	55,317	28,801	16,991	10,422	3,878	2,163	2,704	991,699
1990	532,808	318,580	193,008	70,196	38,919	19,586	11,441	6,574	2,456	2,414	1,195,980
1991	288,669	341,596	222,313	140,181	51,072	27,983	14,134	8,052	4,665	3,246	1,101,912
1992	300,379	184,900	237,908	158,618	95,622	32,410	17,285	8,036	4,814	3,906	1,043,878
1993	391,694	192,146	128,326	167,147	100,710	53,329	17,384	8,020	3,841	3,190	1,065,787
1994	426,049	250,600	133,450	91,191	111,783	61,503	31,586	9,252	4,375	3,020	1,122,810
1995	387,500	272,298	172,726	94,154	61,140	69,126	36,946	17,150	5,151	3,091	1,119,281
1996	387,611	248,337	189,562	123,718	64,795	39,381	43,645	21,002	10,084	3,896	1,132,032
1997	442,015	248,215	172,635	134,017	81,249	38,311	22,339	21,310	10,877	5,637	1,176,606
1998	643,502	283,053	172,150	120,377	82,395	38,853	19,048	8,165	7,657	4,602	1,379,802
1999	774,181	412,200	196,918	121,217	76,833	45,602	20,309	8,457	4,071	5,285	1,665,072
2000	826,637	496,016	286,976	138,027	78,843	47,399	26,883	7,983	3,854	5,734	1,918,352
2001	734,510	529,252	344,337	203,441	96,369	49,725	30,555	13,256	5,530	5,246	2,012,220
2002	445,457	470,413	368,059	164,237	92,850	44,356	21,097	10,609	8,529	6,545	1,632,153
2003	843,225	285,290	327,282	260,789	111,305	57,089	29,457	11,103	7,418	8,529	1,941,487
2004	876,913	540,208	198,604	209,930	157,391	68,298	34,160	15,006	7,925	10,793	2,119,228
2005	376,331	561,548	375,534	141,113	136,528	97,516	45,192	17,816	10,607	12,158	1,774,342
2006	393,877	240,991	390,370	232,184	83,009	76,715	52,174	24,756	9,157	10,406	1,513,641
2007	410,749	252,377	167,854	240,848	137,356	49,006	46,610	29,571	17,485	14,330	1,366,186
2008	351,751	263,102	175,598	120,622	166,624	90,959	31,925	31,358	21,189	21,031	1,274,159
2009	350,404	225,295	183,057	126,413	86,285	108,728	63,310	21,897	21,951	31,181	1,218,520
2010	497,470	224,388	156,617	131,424	90,461	58,232	73,065	41,704	15,599	38,577	1,327,537
2011	606,804	318,834	156,419	35,134	29,951	20,731	13,423	16,947	31,460	41,254	1,270,957
2012	399,897	388,855	222,159	112,754	25,575	21,590	14,583	9,700	12,558	46,255	1,253,926

Table 4.2.2.4.8. Management benchmarks including $F_{40\%}$, F_gm (geometric mean of fishing mortality rates from 2010-2012) on the reference age fish, static spawning potential ratio (sSPR) and transitional spawning potential ratio from ASAP.

Coast	Reference age	$F_{40\%}$	F_{gm}	sSPR	tSPR
Atlantic	8	0.19	0.15	48%	34%
Gulf	7	0.29	0.06	77%	58%

Table 4.2.2.4.9.1. Retrospective comparison of the results from 1997–2012 stock assessments including average fishing mortality rates on ages 6–10, transitional spawning potential ratios, and numbers of age-6 and older fish by coast.

Atlantic

Average fishing mortality rate on ages 6-10

	Assessment								
Year	1997	1998	1999	2000	2001	2002	2006	2010	2012
1987	0.26	0.24	0.21	0.25	0.26	0.18	0.26	0.29	0.40
1988	0.29	0.28	0.25	0.30	0.27	0.21	0.29	0.19	0.13
1989	0.16	0.15	0.14	0.13	0.15	0.14	0.15	0.13	0.17
1990	0.10	0.10	0.09	0.11	0.10	0.10	0.12	0.11	0.14
1991	0.21	0.21	0.20	0.24	0.19	0.19	0.22	0.18	0.19
1992	0.26	0.25	0.24	0.29	0.25	0.26	0.37	0.17	0.16
1993	0.17	0.12	0.11	0.16	0.14	0.14	0.16	0.19	0.18
1994	0.36	0.24	0.22	0.29	0.25	0.29	0.21	0.54	0.50
1995	0.38	0.22	0.19	0.24	0.21	0.25	0.31	0.53	0.34
1996	0.53	0.27	0.22	0.31	0.23	0.29	0.35	0.49	0.24
1997		0.59	0.37	0.49	0.30	0.34	0.49	0.55	0.84
1998			0.26	0.31	0.16	0.22	0.30	0.36	0.41
1999				0.16	0.20	0.17	0.25	0.43	0.46
2000					0.21	0.26	0.33	0.46	0.50
2001						0.17	0.27	0.32	0.33
2002							0.24	0.23	0.24
2003							0.31	0.34	0.37
2004							0.26	0.21	0.27
2005								0.21	0.25
2006								0.30	0.37
2007								0.12	0.15
2008								0.19	0.22
2009								0.09	0.12
2010								0.03	0.04
2011									0.10
2012									0.10

Table 4.2.2.4.9.1 continued. Retrospective comparison of the results from 1997–2012 stock assessments including average fishing mortality rates on ages 6–10, transitional spawning potential ratios, and numbers of age-6 and older fish by coast.

Atlantic

Transitional spawning potential ratios

	Assessment								
Year	1997	1998	1999	2000	2001	2002	2006	2010	2012
1987	0.38	0.35	0.31	0.30	0.31	0.37	0.28	0.30	0.44
1988	0.37	0.35	0.31	0.30	0.30	0.36	0.27	0.30	0.43
1989	0.36	0.33	0.32	0.31	0.31	0.36	0.28	0.32	0.43
1990	0.40	0.37	0.34	0.34	0.34	0.38	0.30	0.35	0.44
1991	0.45	0.41	0.36	0.35	0.36	0.39	0.32	0.37	0.45
1992	0.43	0.39	0.35	0.34	0.36	0.37	0.31	0.38	0.44
1993	0.40	0.37	0.36	0.34	0.36	0.36	0.30	0.38	0.42
1994	0.43	0.41	0.36	0.34	0.37	0.35	0.31	0.36	0.38
1995	0.36	0.37	0.36	0.33	0.36	0.33	0.31	0.33	0.32
1996	0.32	0.36	0.35	0.31	0.35	0.31	0.29	0.30	0.28
1997		0.33	0.32	0.28	0.33	0.28	0.25	0.25	0.23
1998			0.29	0.25	0.33	0.27	0.23	0.22	0.21
1999				0.26	0.34	0.28	0.24	0.22	0.21
2000					0.34	0.29	0.24	0.21	0.21
2001						0.30	0.24	0.22	0.21
2002							0.25	0.23	0.23
2003							0.25	0.23	0.23
2004							0.25	0.24	0.23
2005								0.25	0.24
2006								0.26	0.25
2007								0.28	0.26
2008								0.30	0.27
2009								0.32	0.29
2010								0.36	0.33
2011									0.34
2012									0.34

Table 4.2.2.4.9.1 continued. Retrospective comparison of the results from 1997–2012 stock assessments including average fishing mortality rates on ages 6–10, transitional spawning potential ratios, and numbers of age-6 and older fish by coast.

Atlantic

Number of fish ages 6+

	Assessment								
Year	1997	1998	1999	2000	2001	2002	2006	2010	2012
1987	68,874	119,931	77,979	76,248	78,750	100,008	65,052	92,565	72,394
1988	70,067	119,668	78,125	75,209	79,965	94,854	65,908	88,837	67,641
1989	65,018	113,942	75,367	73,163	73,203	82,731	57,518	88,509	60,261
1990	68,309	129,119	84,102	84,299	84,376	81,343	61,452	96,768	61,848
1991	75,464	149,561	101,769	104,870	99,907	87,924	76,991	104,591	80,406
1992	73,973	146,684	104,371	103,747	95,330	83,632	93,269	135,001	98,909
1993	71,188	144,513	100,522	87,955	98,041	82,828	90,480	120,027	83,399
1994	78,572	161,452	114,260	91,341	114,565	94,265	92,391	103,739	74,152
1995	73,119	152,882	121,074	96,324	122,769	105,752	110,671	96,105	61,458
1996	67,514	145,925	133,876	112,731	151,462	122,541	128,871	111,785	61,223
1997		118,368	150,375	126,145	194,974	142,938	140,712	120,240	64,053
1998			119,656	101,860	170,496	128,112	100,851	92,120	53,383
1999				98,983	146,172	136,533	89,800	81,795	53,969
2000					136,589	136,841	80,502	74,306	51,513
2001						116,890	71,388	68,563	48,943
2002							68,715	71,177	49,337
2003							73,111	75,558	54,672
2004							73,131	75,284	52,890
2005								77,397	50,045
2006								78,198	50,359
2007								81,865	53,274
2008								91,646	57,722
2009								88,390	53,263
2010								96,319	59,669
2011									67,522
2012									55,589

Table 4.2.2.4.9.1 continued. Retrospective comparison of the results from 1997–2012 stock assessments including average fishing mortality rates on ages 6–10, transitional spawning potential ratios, and numbers of age-6 and older fish by coast.

Gulf

Average fishing mortality rate on ages 6-10

	Assessment								
Year	1997	1998	1999	2000	2001	2002	2006	2010	2010
1987	0.20	0.20	0.22	0.23	0.22	0.23	0.35	0.20	0.13
1988	0.79	1.08	1.31	1.12	0.96	1.06	1.52	1.77	2.64
1989	0.20	0.32	0.38	0.29	0.24	0.28	0.49	0.28	0.24
1990	0.08	0.09	0.10	0.10	0.08	0.10	0.16	0.08	0.15
1991	0.37	0.38	0.43	0.42	0.37	0.44	0.55	0.44	0.60
1992	0.76	0.57	0.66	0.67	0.64	0.76	0.94	1.05	1.37
1993	0.57	0.47	0.55	0.53	0.50	0.59	0.82	0.48	0.64
1994	0.51	0.50	0.61	0.52	0.47	0.60	0.68	0.30	0.62
1995	0.40	0.38	0.48	0.46	0.39	0.50	0.48	0.22	0.27
1996	0.42	0.42	0.51	0.48	0.40	0.50	0.43	0.30	0.67
1997		1.10	1.21	1.27	0.93	1.08	0.74	0.69	0.92
1998			1.01	1.00	0.56	0.62	0.57	0.68	0.61
1999				0.94	0.59	0.38	0.15	0.36	0.48
2000					0.65	0.38	0.20	0.37	0.34
2001						0.34	0.20	0.37	0.25
2002							0.19	0.19	0.24
2003							0.15	0.13	0.13
2004							0.26	0.27	0.32
2005								0.25	0.25
2006								0.13	0.09
2007								0.06	0.08
2008								0.06	0.09
2009								0.06	0.09
2010								0.02	0.01
2011									0.04
2012									0.05

Table 4.2.2.4.9.1 continued. Retrospective comparison of the results from 1997–2012 stock assessments including average fishing mortality rates on ages 6–10, transitional spawning potential ratios, and numbers of age-6 and older fish by coast.

Gulf

Transitional spawning potential ratios

	Assessment								
Year	1997	1998	1999	2000	2001	2002	2006	2010	2012
1987	0.43	0.29	0.32	0.34	0.34	0.31	0.26	0.38	44%
1988	0.40	0.35	0.29	0.31	0.31	0.28	0.23	0.35	39%
1989	0.39	0.24	0.28	0.30	0.30	0.27	0.22	0.34	37%
1990	0.45	0.30	0.33	0.35	0.35	0.32	0.27	0.38	41%
1991	0.47	0.38	0.35	0.37	0.38	0.34	0.30	0.41	43%
1992	0.41	0.35	0.34	0.35	0.35	0.31	0.30	0.40	40%
1993	0.36	0.30	0.32	0.33	0.33	0.28	0.29	0.37	38%
1994	0.36	0.31	0.32	0.33	0.32	0.27	0.28	0.36	37%
1995	0.37	0.30	0.32	0.33	0.33	0.27	0.28	0.36	38%
1996	0.38	0.32	0.32	0.33	0.33	0.28	0.29	0.35	37%
1997		0.31	0.29	0.29	0.30	0.25	0.29	0.32	34%
1998			0.26	0.26	0.28	0.23	0.28	0.30	32%
1999				0.25	0.28	0.24	0.29	0.31	32%
2000					0.28	0.25	0.30	0.32	34%
2001						0.26	0.30	0.34	35%
2002							0.31	0.35	35%
2003							0.32	0.37	38%
2004							0.32	0.39	41%
2005								0.38	42%
2006								0.39	43%
2007								0.43	47%
2008								0.46	51%
2009								0.49	55%
2010								0.51	54%
2011									53%
2012									58%

Table 4.2.2.4.9.1 continued. Retrospective comparison of the results from 1997–2012 stock assessments including average fishing mortality rates on ages 6–10, transitional spawning potential ratios, and numbers of age-6 and older fish by coast.

Gulf

Number of fish ages 6+

	Assessment								
Year	1997	1998	1999	2000	2001	2002	2006	2010	2012
1987	45,083	53,804	46,574	44,632	45,045	37,434	34,400	53,995	44,656
1988	57,741	67,463	59,435	61,825	60,769	50,433	46,777	45,363	48,300
1989	43,410	35,045	31,125	35,974	37,284	31,677	22,554	36,016	36,157
1990	58,877	51,014	46,141	51,531	52,382	44,621	30,787	55,471	42,469
1991	86,421	83,457	69,653	76,600	79,409	67,318	57,018	69,488	58,081
1992	94,633	83,938	75,039	79,447	90,049	76,563	68,919	69,599	66,451
1993	73,626	75,678	68,776	70,082	82,786	58,408	56,648	95,119	85,764
1994	73,019	79,424	68,310	65,664	76,096	58,009	61,572	114,046	109,737
1995	75,269	79,370	73,990	76,983	84,317	73,238	70,895	141,142	131,463
1996	83,469	93,767	90,838	96,389	99,831	87,062	84,505	122,019	118,008
1997		99,420	84,622	84,030	92,498	93,787	89,807	99,103	98,475
1998			54,478	46,937	56,855	57,482	86,150	71,225	78,325
1999				38,974	52,477	59,667	95,074	82,660	83,723
2000					52,734	58,269	117,335	96,445	91,853
2001						52,300	103,882	88,694	104,311
2002							84,884	125,656	91,137
2003							93,171	140,423	113,596
2004							111,034	170,088	136,182
2005								209,489	183,288
2006								185,329	173,209
2007								195,423	157,002
2008								297,450	196,462
2009								344,992	247,067
2010								280,923	227,177
2011									123,815
2012									104,686

Table 4.2.2.4.9.2. Comparison of model fits of the run with environmental effects and the sensitivity run without including the environmental effects. Legend: RSS – sum of squared residuals, nobs – number of observations, and MSE – mean square error. A lower mean square error (MSE) indicates a closer model fit.

Run	Component	RSS	nobs	MSE
w/Environment	Catch Fleet total	15.500	27	0.596
	Discard Fleet total	0.321	27	0.012
	FIM adult index	0.594	17	0.037
	MRFSS index	0.688	22	0.033
	ENP index	1.764	27	0.068
	FIM Age-2 index	1.140	17	0.071
w/o Environmental effects	Catch Fleet total	16.209	27	0.623
	Discard Fleet total	1.258	27	0.048
	FIM adult index	0.307	17	0.019
	MRFSS index	0.796	22	0.038
	ENP index	2.335	27	0.090
	FIM Age-2 index	2.101	17	0.131

Table 5.2. Numbers of fish measured from the fishery and comparison of sizes of fish with regard to current and previous size limits (shaded) by coast. Data from 2006 and 2007 were omitted because a 27-inch minimum size limit was in effect only from July 2006 to July 2007.

		Time periods			
Coast		1986-98	1999-05	2008-12	Total
Atlantic	Number measured	1,647	2,877	1,984	6,508
		Time periods			
	Length categories	1986-98	1999-05	2008-12	
	< 24 in	2%	1%	0%	
	24-25 in	10%	4%	0%	
	26-27 in	8%	22%	5%	
	28-32 in	28%	40%	82%	
	32-34 in	17%	23%	12%	
	> 32 in	52%	33%	13%	
	> 34 in	34%	10%	1%	
	Undersized	2%	5%	5%	
	Oversized	--	10%	13%	
Gulf	Number measured	10,190	8,565	769	19,524
		Time periods			
	Length categories	1986-98	1999-05	2008-12	
	< 24 in	7%	1%	1%	
	24-25 in	23%	7%	0%	
	26-27 in	24%	35%	38%	
	28-33 in	33%	51%	59%	
	33-34 in	3%	5%	1%	
	> 33 in	8%	7%	2%	
	> 34 in	6%	2%	1%	
	Undersized	7%	8%	39%	
	Oversized	--	2%	2%	

Table 5.3. Bag-limit analysis of the Atlantic coast using 1986-2006 (two-fish bag limit) and 2008–2012 (one-fish bag limit) MRFSS-MRIP intercept data from the open seasons and 1986-2001 (two-fish bag limit) and 2002-2012 (one-fish bag limit) intercept data from the gulf coast.

Coast	Period	Bag limit	Number of fish kept per angler	Number of years	Number of trips	Number of anglers	Average number of anglers per trip	Number of fish caught	Number of fish retained
Atlantic	1986-06	2	0	21	7,555	11,070	1.47	5,408	49
			1	21	390	554	1.42	1,055	456
			2	18	80	115	1.44	359	214
			3	3	3	3	1.00	19	9
			4	3	3	3	1.00	13	12
			5	1	1	1	1.00	5	5
			6	1	1	2	2.00	25	12
			Totals		8,033	11,748		6,884	757
	2008-12	1	0	5	1,123	1,801	1.60	1,238	6
			1	5	44	70	1.59	149	54
			2	1	1	1	1.00	2	2
			3	1	1	2	2.00	5	5
			Totals		1,169	1,874		1,394	67
Gulf	1986-01	2	0	16	6,220	10,212	1.64	6,100	72
			1	16	394	675	1.71	1,424	487
			2	14	78	119	1.53	613	218
			3	3	3	4	1.33	18	11
			4	2	3	4	1.33	40	16
			5	1	1	1	1.00	5	5
			11	1	1	2	2.00	114	22
			20	1	1	1	1.00	20	20
			Totals		6,701	11,018		8,334	851
	2002-12	1	0	11	6079	11907	1.96	13,545	97
			1	8	406	790	1.95	2,921	544
			2	2	5	10	2.00	70	18
			3	1	1	1	1.00	3	3
			4	1	1	2	2.00	14	8
			Totals		6,491	8,125		16,539	662

Table 5.4. Estimated annual catchability for fully selected fish by coast and the percent change in catchability with regulatory changes.

	Coast					
	Atlantic			Gulf		
Year	Directed trips	Fishing mortality (age-8)	Catchability	Directed trips	Fishing mortality (age-7)	Catchability
1986	64,523	0.07	1.127E-06	221,224	0.09	4.255E-07
1987	128,962	0.18	1.413E-06	53,396	0.27	4.976E-06
1988	111,697	0.15	1.367E-06	338,010	0.70	2.074E-06
1989	181,967	0.14	7.492E-07	391,497	0.21	5.485E-07
1990	143,835	0.10	6.797E-07	158,752	0.11	6.644E-07
1991	181,183	0.16	9.015E-07	742,208	0.32	4.299E-07
1992	360,958	0.21	5.780E-07	981,584	0.52	5.322E-07
1993	314,138	0.19	6.190E-07	812,580	0.39	4.740E-07
1994	233,313	0.40	1.724E-06	774,509	0.37	4.715E-07
1995	299,738	0.35	1.183E-06	863,217	0.32	3.699E-07
1996	224,846	0.46	2.056E-06	937,548	0.47	5.028E-07
1997	266,371	0.71	2.674E-06	1,198,047	0.76	6.351E-07
1998	307,265	0.39	1.273E-06	964,956	0.57	5.869E-07
1999	299,373	0.22	7.308E-07	736,879	0.69	9.337E-07
2000	381,460	0.51	1.348E-06	1,065,746	0.46	4.320E-07
2001	366,080	0.35	9.584E-07	1,140,880	0.41	3.631E-07
2002	268,085	0.24	9.119E-07	1,203,613	0.39	3.265E-07
2003	464,913	0.16	3.398E-07	1,452,018	0.32	2.193E-07
2004	327,043	0.24	7.265E-07	1,514,525	0.40	2.660E-07
2005	469,504	0.26	5.523E-07	1,695,283	0.21	1.252E-07
2006	425,199	0.22	5.155E-07	1,349,563	0.17	1.250E-07
2007	611,187	0.31	5.131E-07	1,712,510	0.15	8.769E-08
2008	413,833	0.25	5.943E-07	1,286,401	0.13	1.021E-07
2009	317,475	0.10	3.112E-07	1,094,874	0.17	1.557E-07
2010	217,265	0.05	2.112E-07	413,667	0.04	1.016E-07
2011	157,878	0.49	3.100E-06	454,321	0.08	1.653E-07
2012	117,975	0.15	1.286E-06	466,603	0.07	1.413E-07
Averages						
1999-05	368,066	0.22	6.079E-07	1,258,421	0.26	7.414E-08
2008-12	244,885	0.05	1.940E-07	743,174	0.06	2.083E-07
% change from 1999-05			-68%			-64%

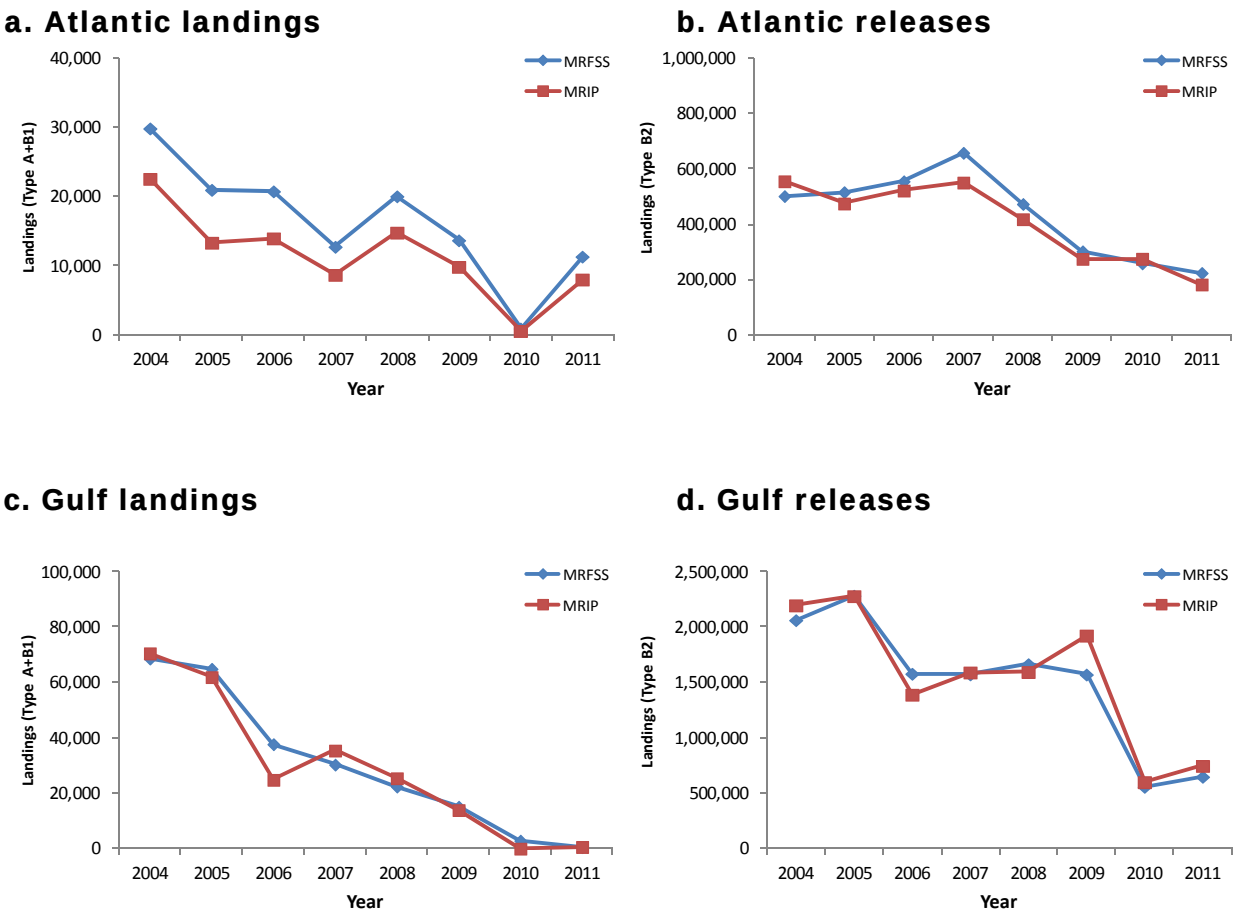
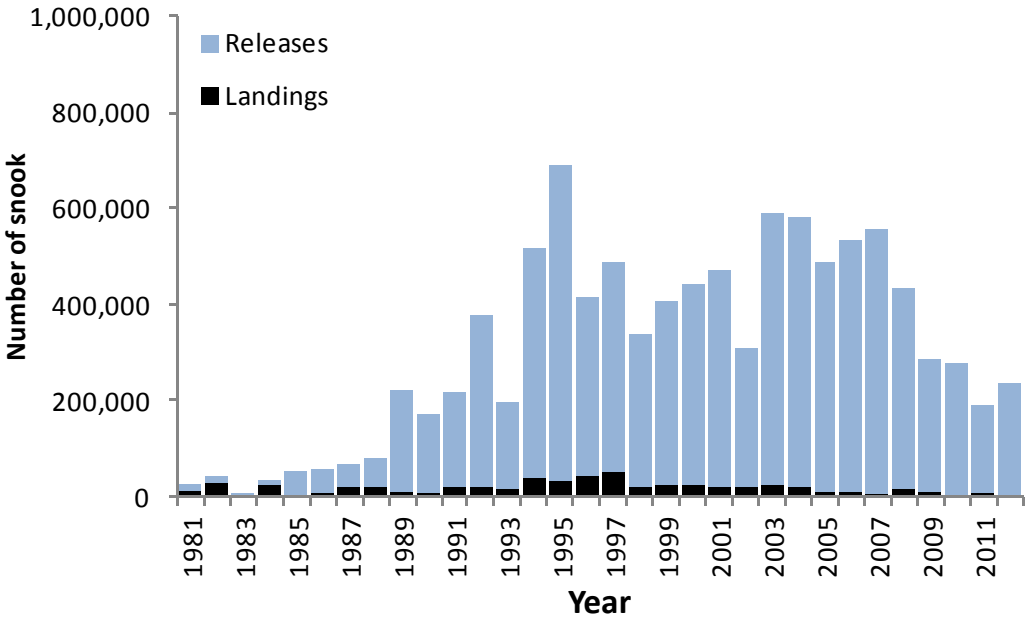


Figure 3.2.1. Comparison of estimates by MRFSS and MRIP procedures for snook by coast.

a. Atlantic



b. Gulf

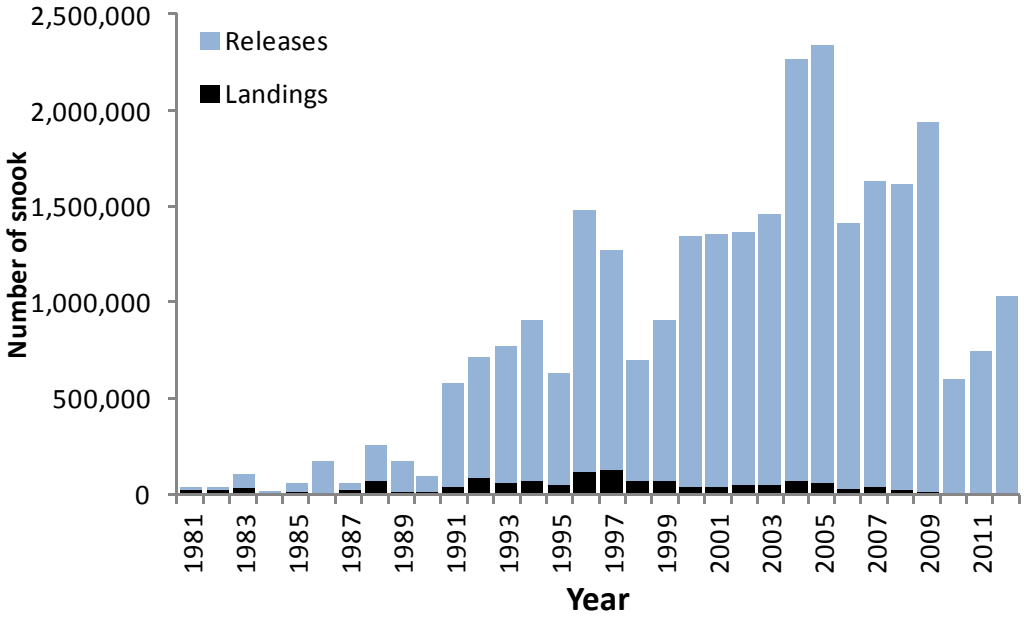
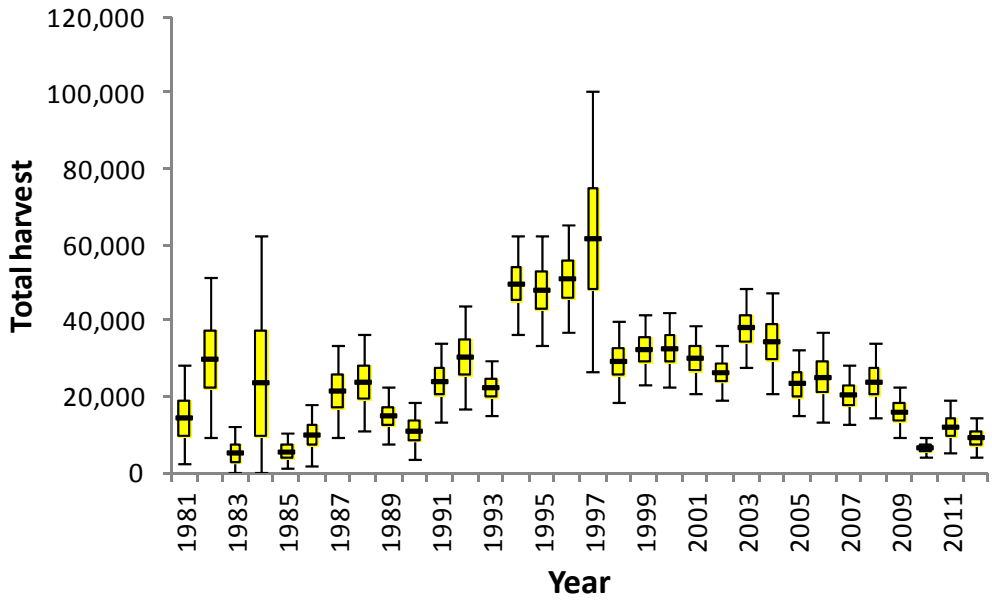


Figure 3.2.2. Annual total recreational catch of snook including both fish released alive and fish kept by coast from MRFSS-MRIP.

a. Atlantic



b. Gulf

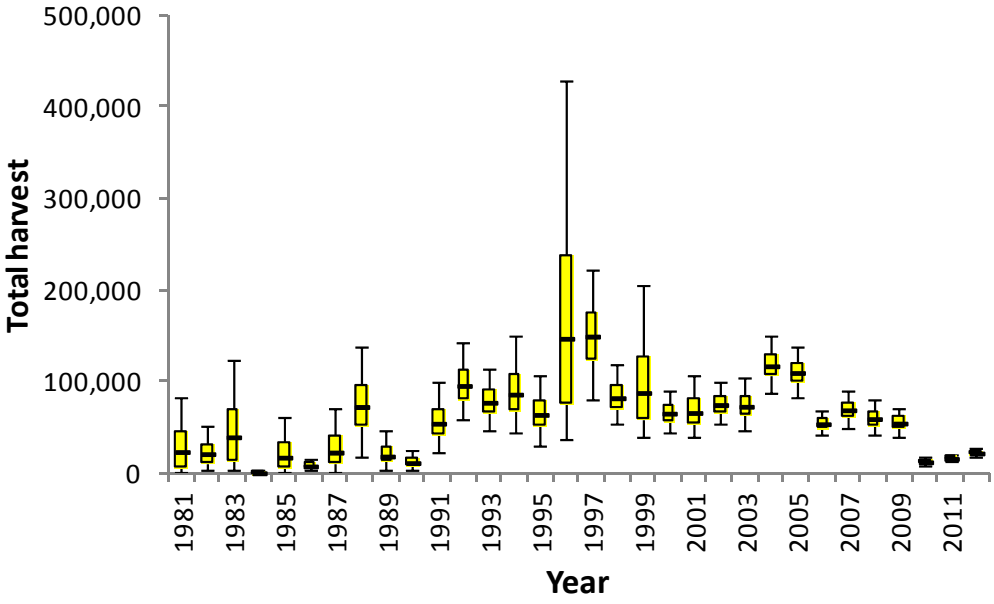
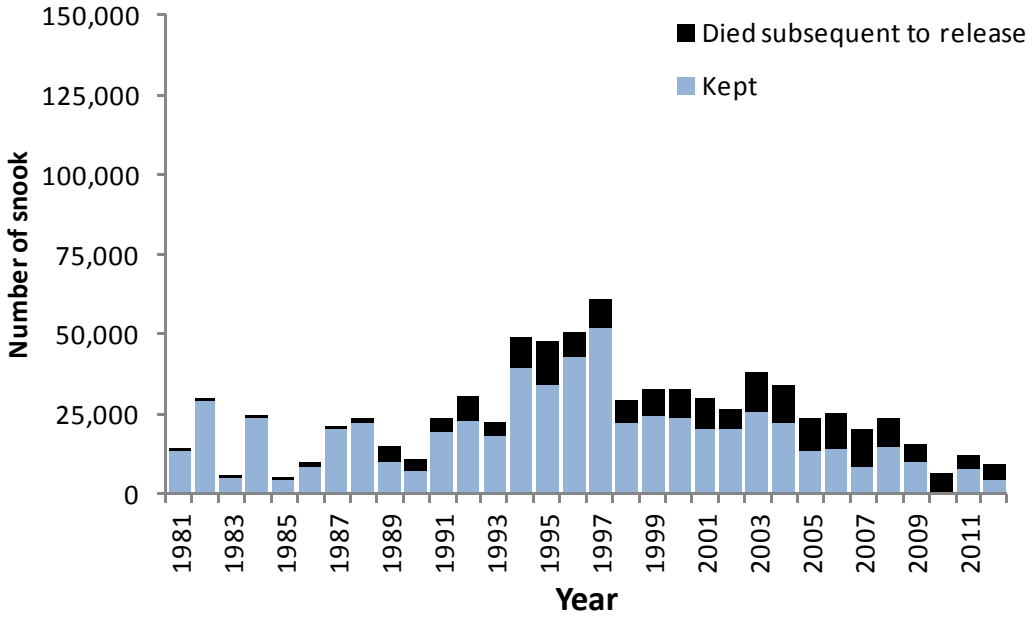


Figure 3.2.3. Distribution of total recreational harvest of common snook by coast. Harvest includes the estimated number of fish landed and kept and the number of fish that died subsequent to being released alive (2.13% of those released alive). The horizontal line is the median; the box is the inter-quartile range, and the vertical line is the 95% confidence interval.

a. Atlantic



b. Gulf

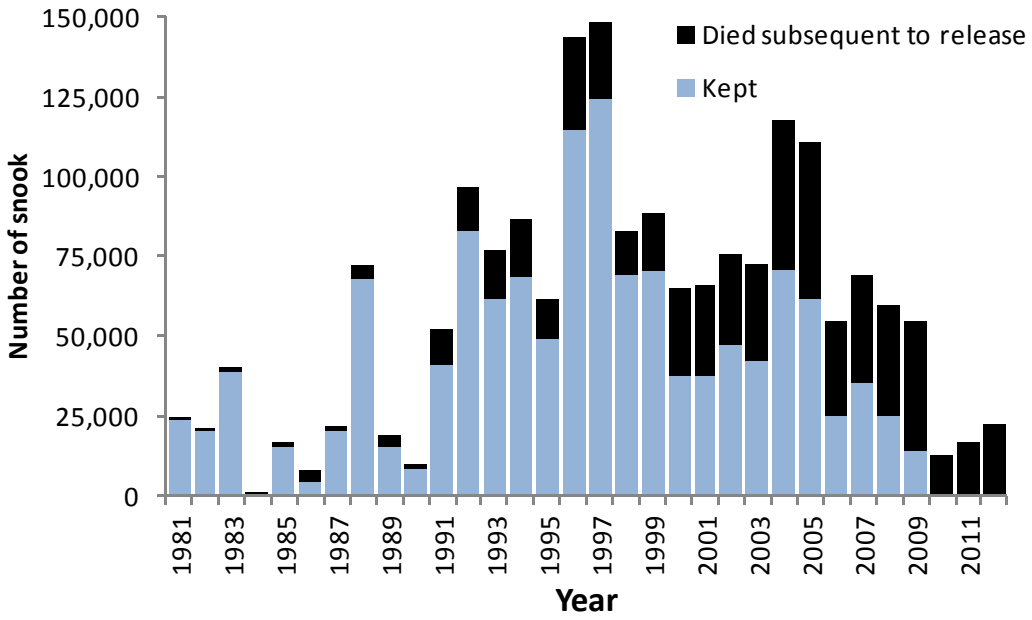
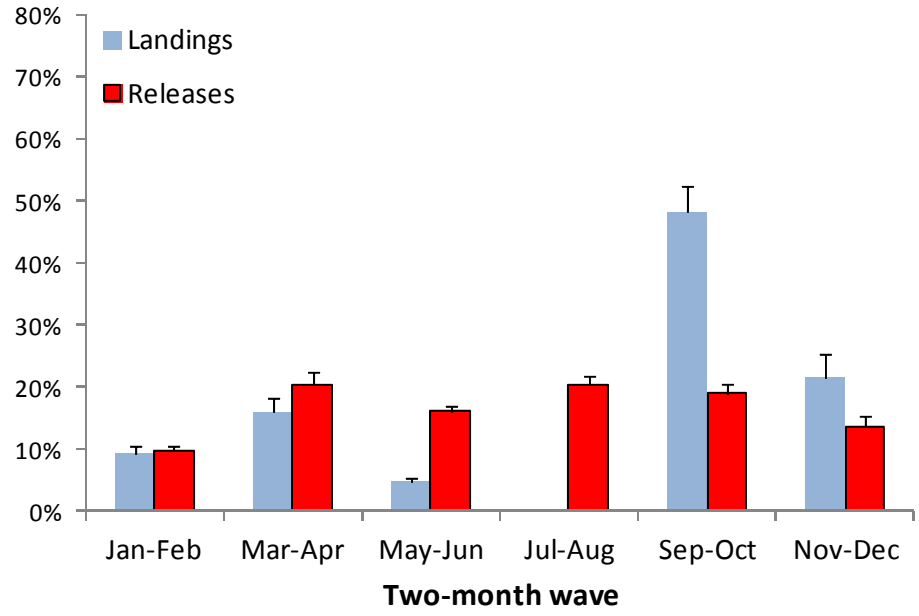


Figure 3.2.4. Total recreational harvest of snook, including those landed and kept plus those that died after being released alive by coast.

a. Atlantic



b. Gulf

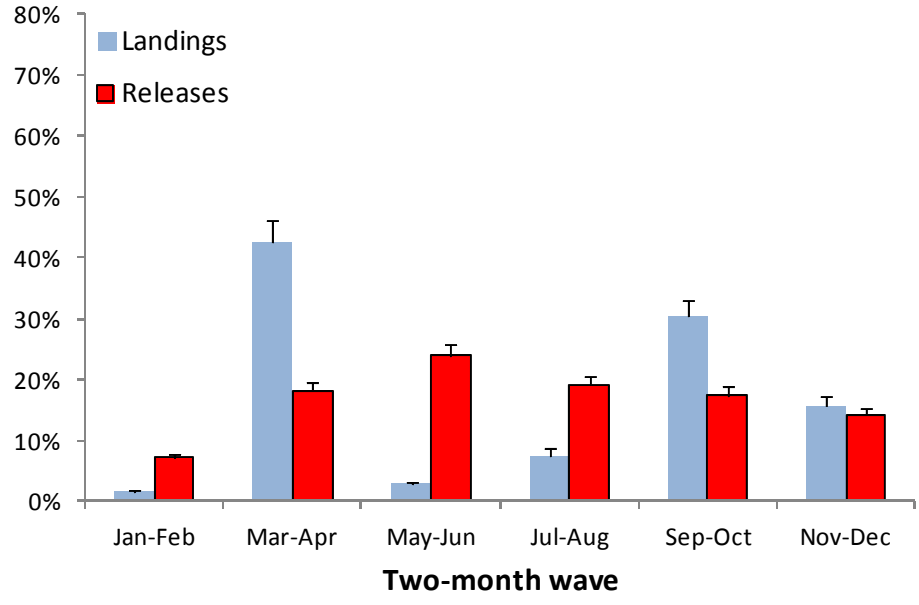


Figure 3.2.5. Percentages of snook landed and released by two-month wave and coast for 2008-12. The lines above the bars are standard errors.

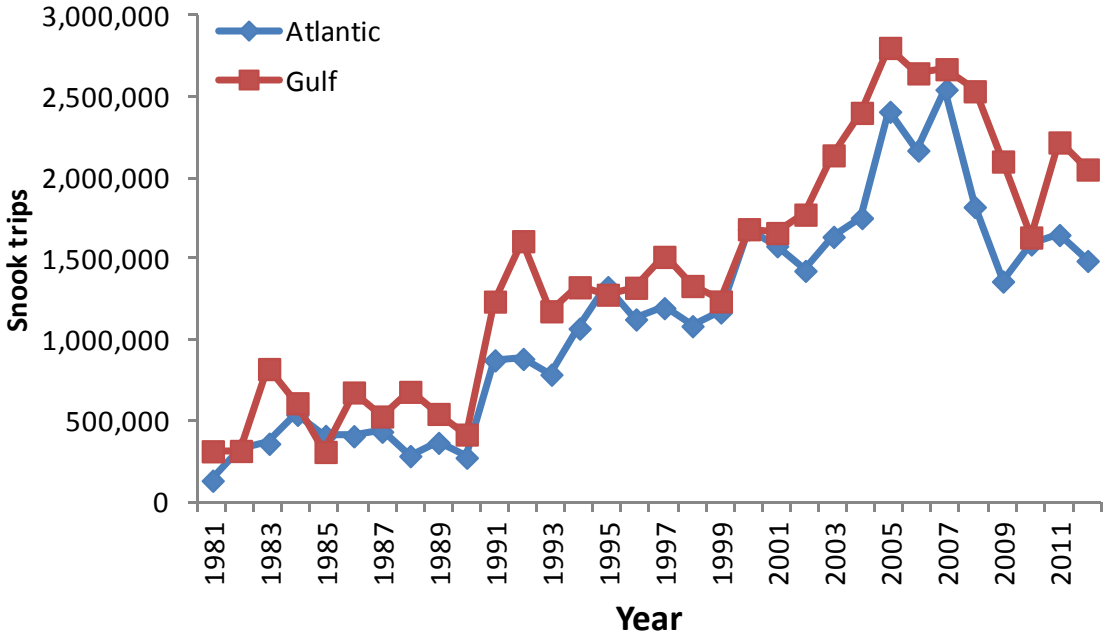


Figure 3.3.1. Estimated number of trips for snook by coast calculated by prorating the MRFSS-MRIP intercepts that caught or targeted Common Snook by stratum and the number of trips in the stratum. These numbers were MRIP effort adjusted.

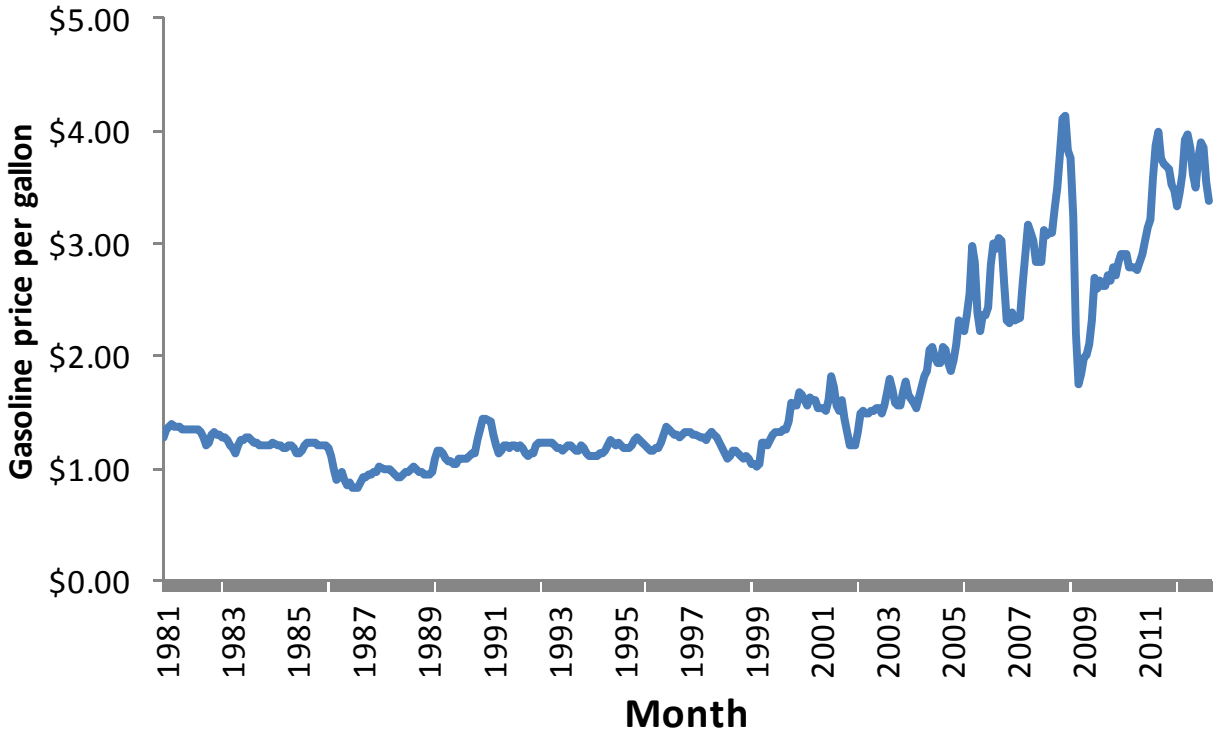
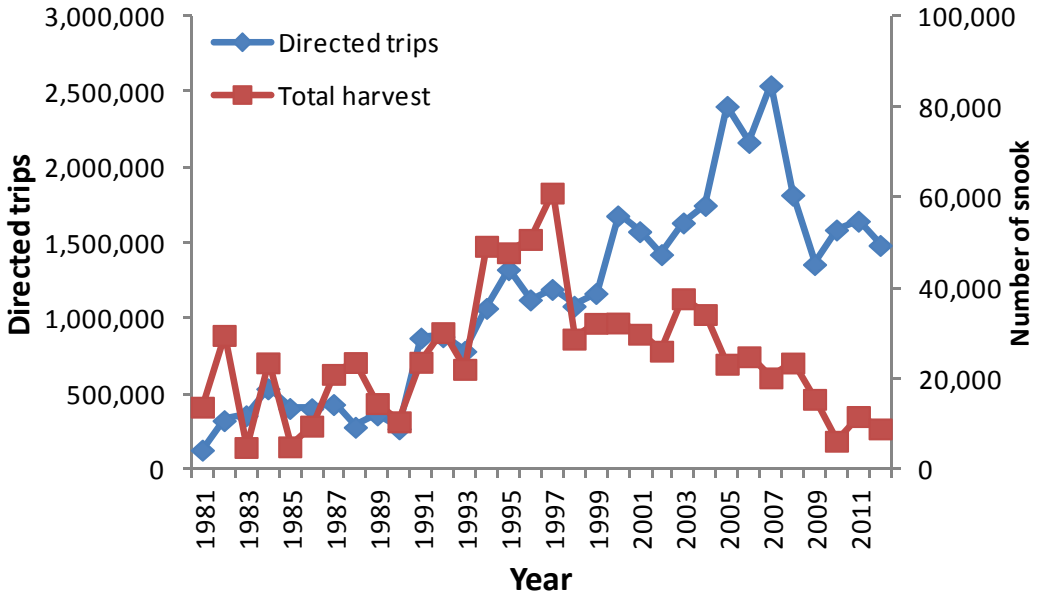


Figure 3.3.2. Gasoline prices by month adjusted for inflation (U.S. Bureau of Labor Statistics, Consumer Price Index).

a. Atlantic



b. Gulf

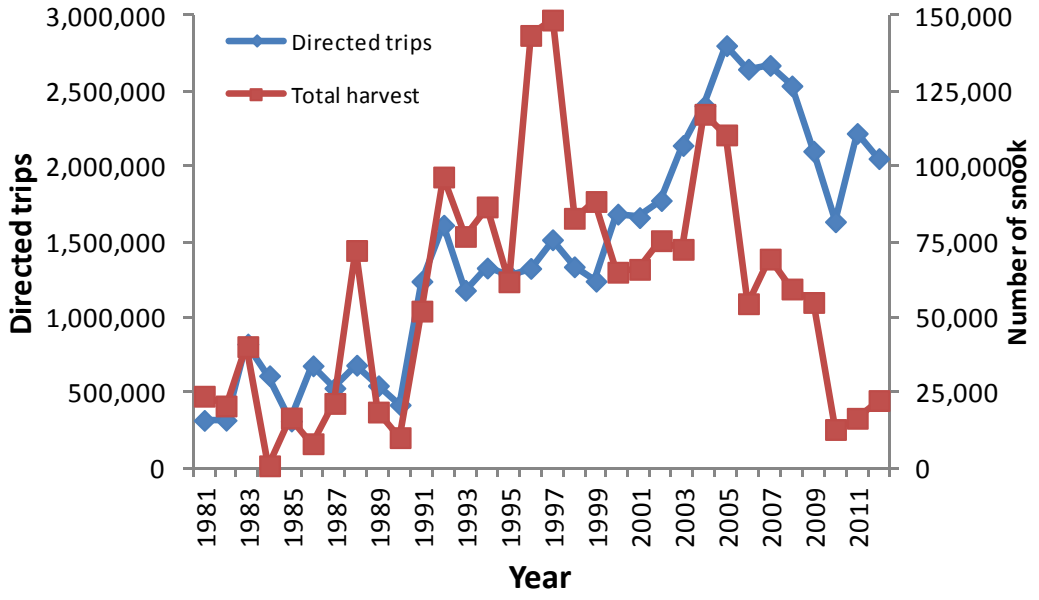
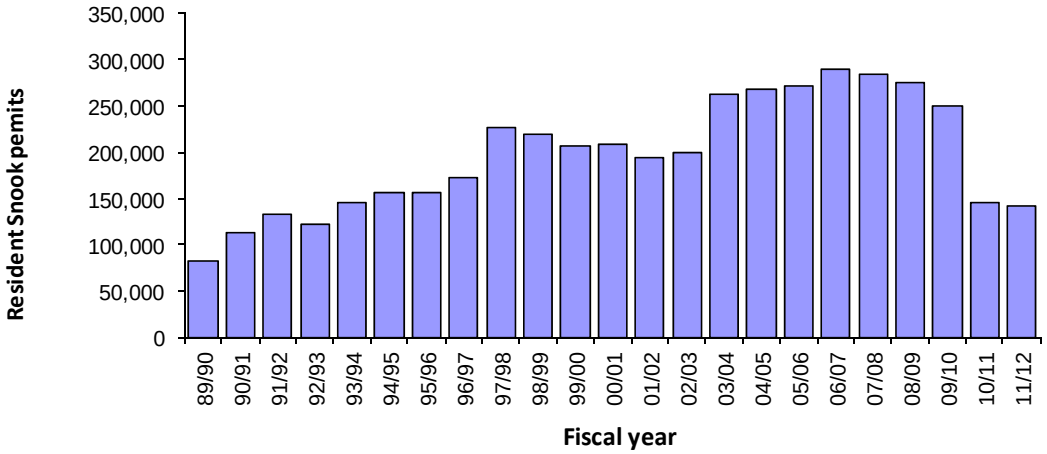
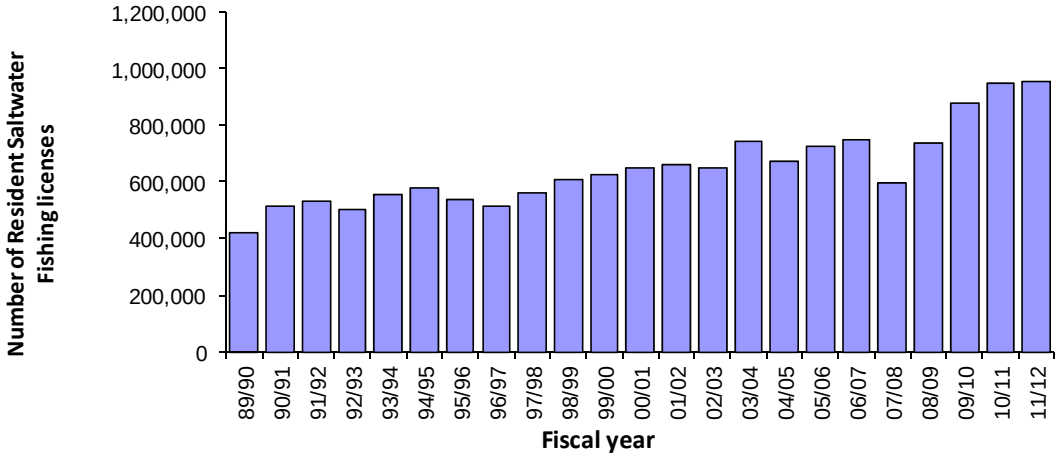


Figure 3.3.3. Total harvest of snook and the associated estimates of the number of directed snook fishing trips made during 1981–2012 by coast.

a. Statewide sales of snook permits



b. Number of resident Saltwater Fishing licenses



c. Ratio of snook stamp sales to resident license sales

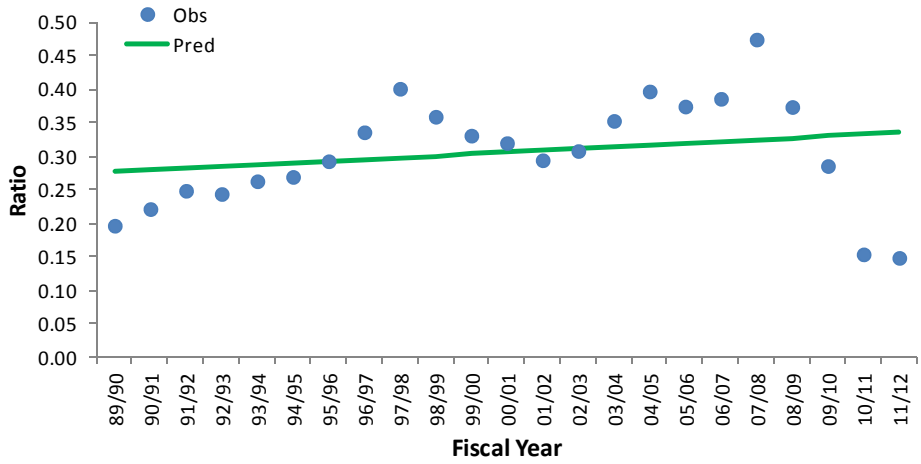
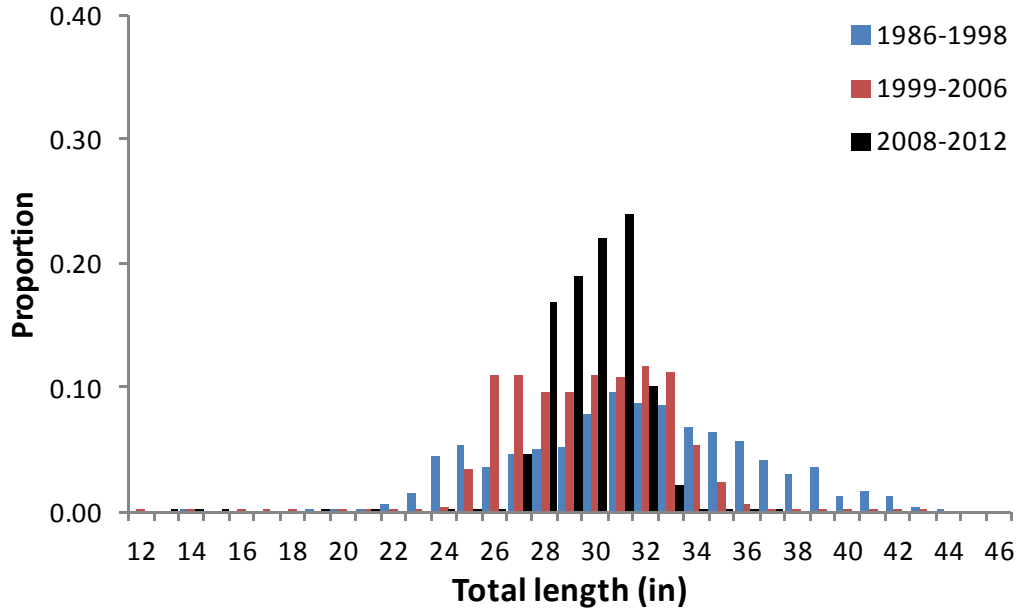


Figure 3.3.4. Statewide sales of snook permits (a), annual resident Saltwater Fishing Licenses (b), and the ratio of snook stamp sales to resident license sales (c) by fiscal year.

a. Atlantic



b. Gulf

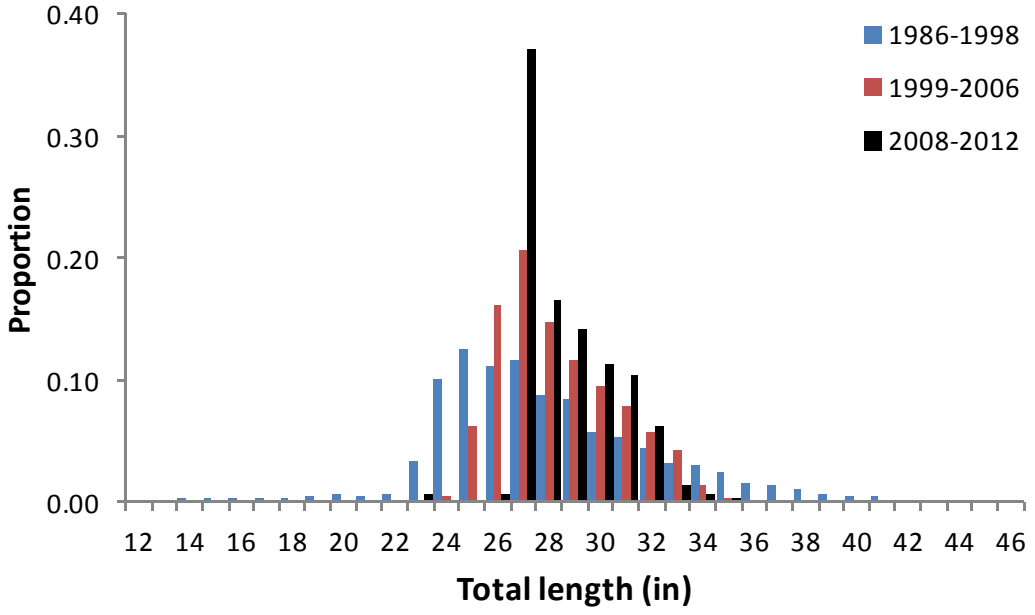
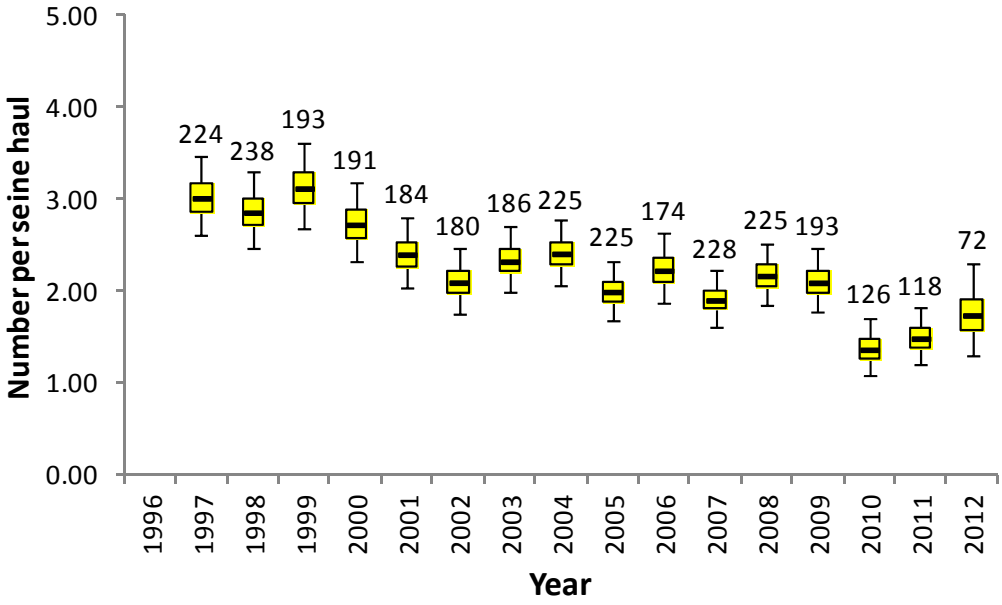


Figure 3.4.1. Total lengths of snook landed during three periods: 1986-1999, 1999-06 and 2008–2012 by coast. Atlantic lengths were from the MRFSS, FWRI angler interviews, and carcass drop-offs and the gulf lengths were from the MRFSS, FWRI angler interviews, carcass drop-offs, and the Everglades National Park creel survey.

a. Atlantic



b. Gulf

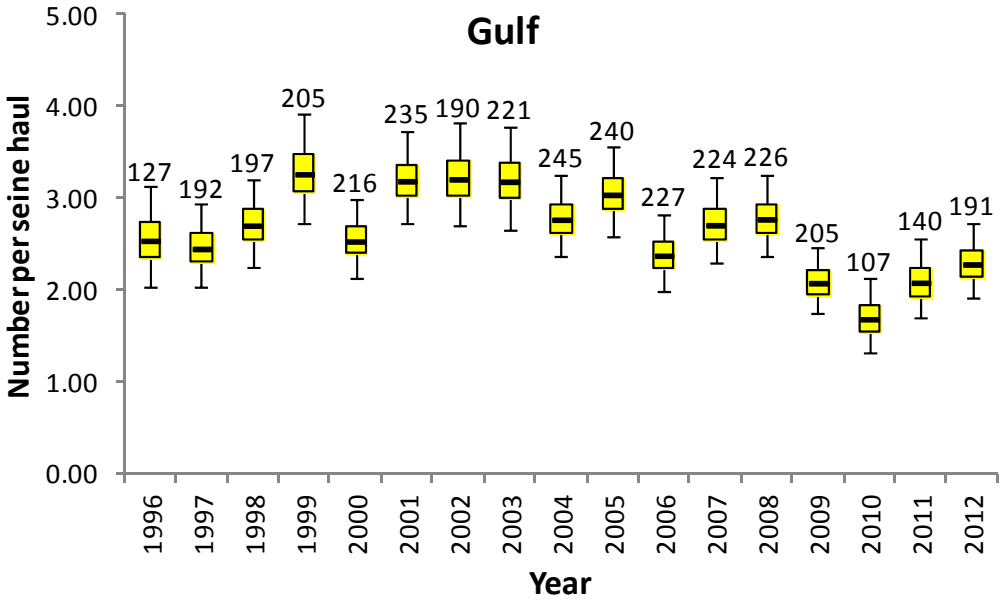
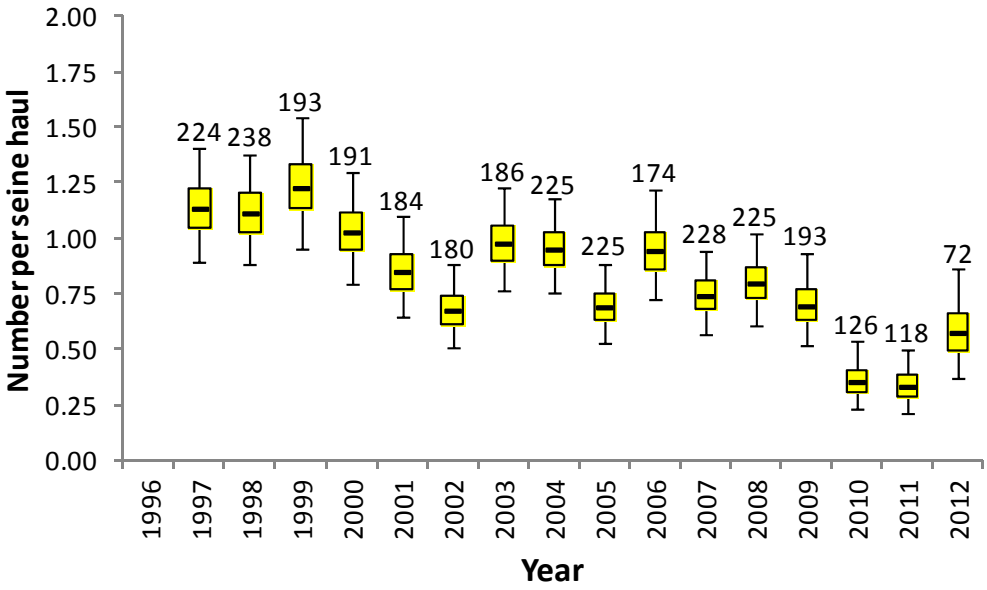


Figure 4.1.1.1. The number of snook caught per haul seine set by year and coast. The numbers above the figures indicate the number of sets for the FIM haul seines. The horizontal lines are the medians; the boxes are the inter-quartile ranges, and the vertical lines are the 95% confidence intervals.

a. Atlantic



b. Gulf

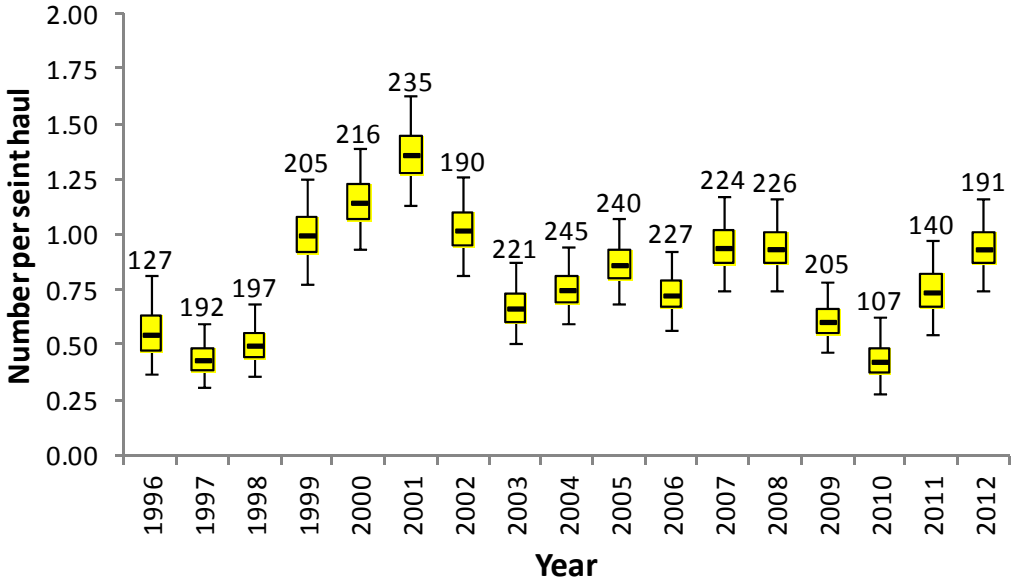
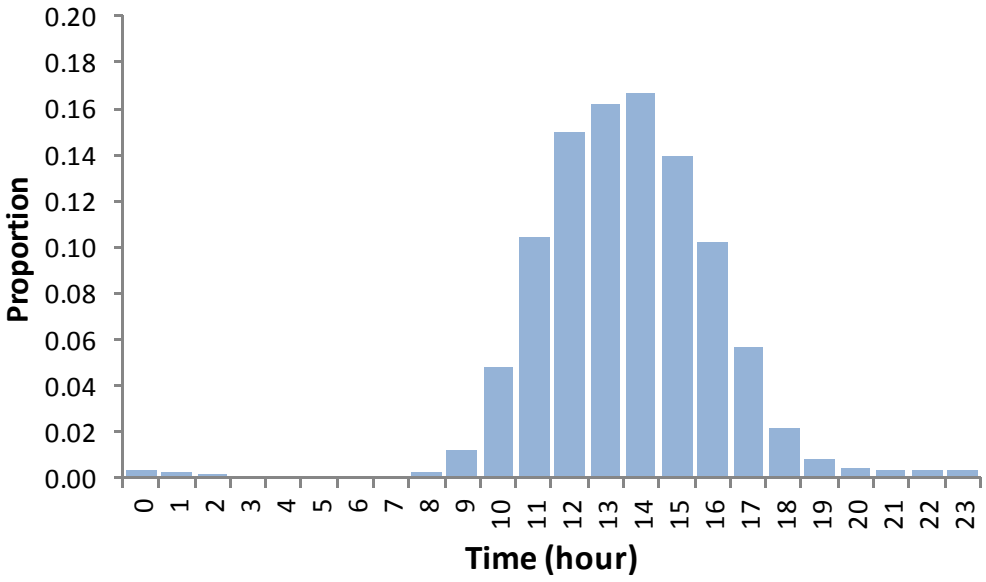


Figure 4.1.1.2. The number of age-2 snook caught per haul seine by coast as calculated from the FIM adult haul seine index and the proportion of age-2 fish caught in the seine sets. The numbers above the figures indicate the number of sets for the FIM haul seines. The horizontal lines are the medians; the boxes are the inter-quartile ranges, and the vertical lines are the 95% confidence intervals.

a.Atlantic



b.Gulf

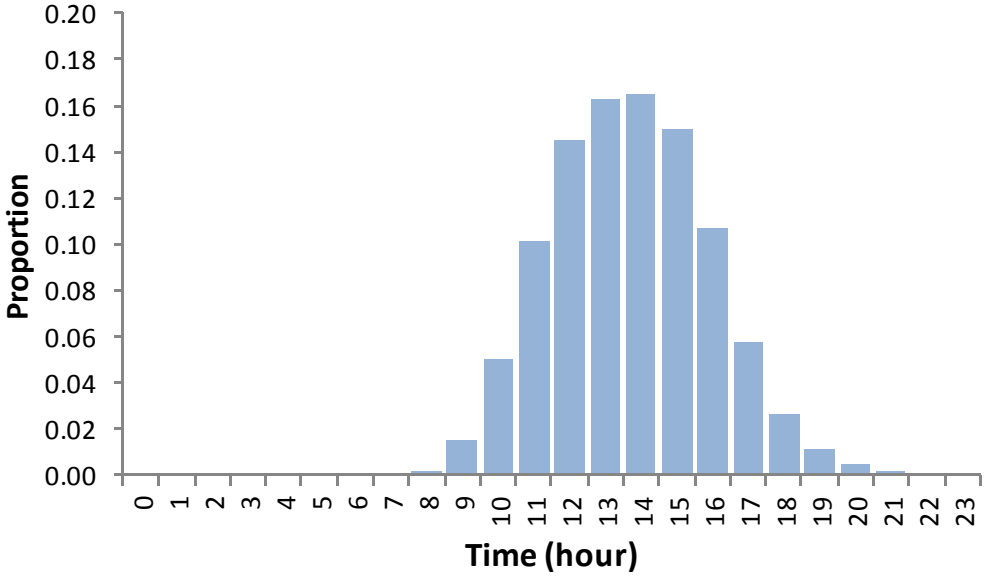
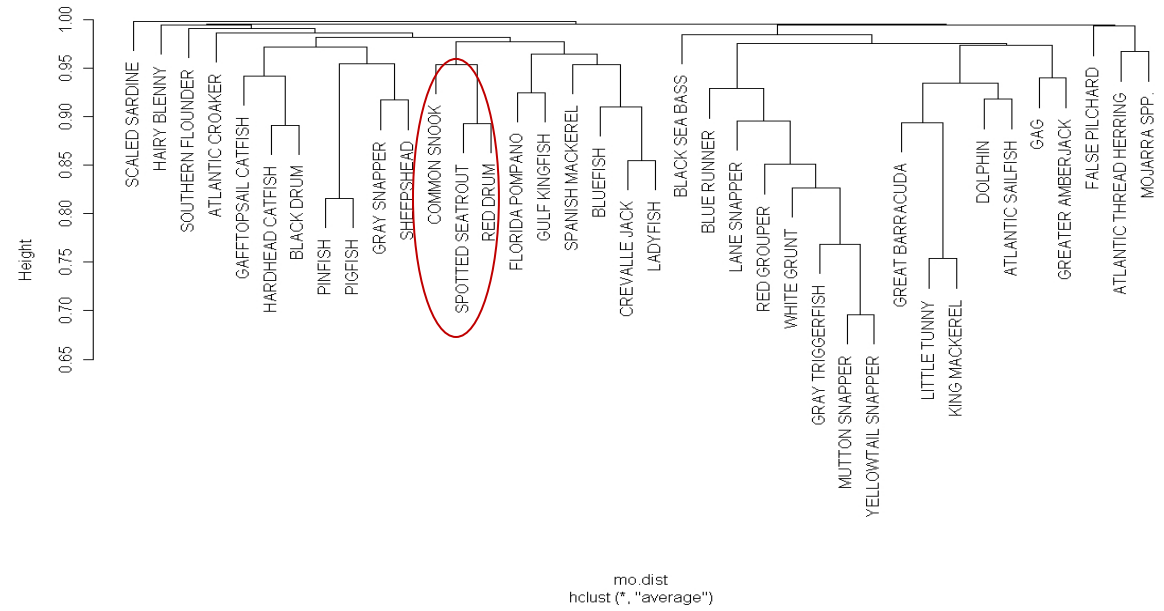


Figure 4.1.2.1. Times of day that MRFSS-MRIP intercepts were conducted by coast during the period 1999-2012.

a. Atlantic



b. Gulf

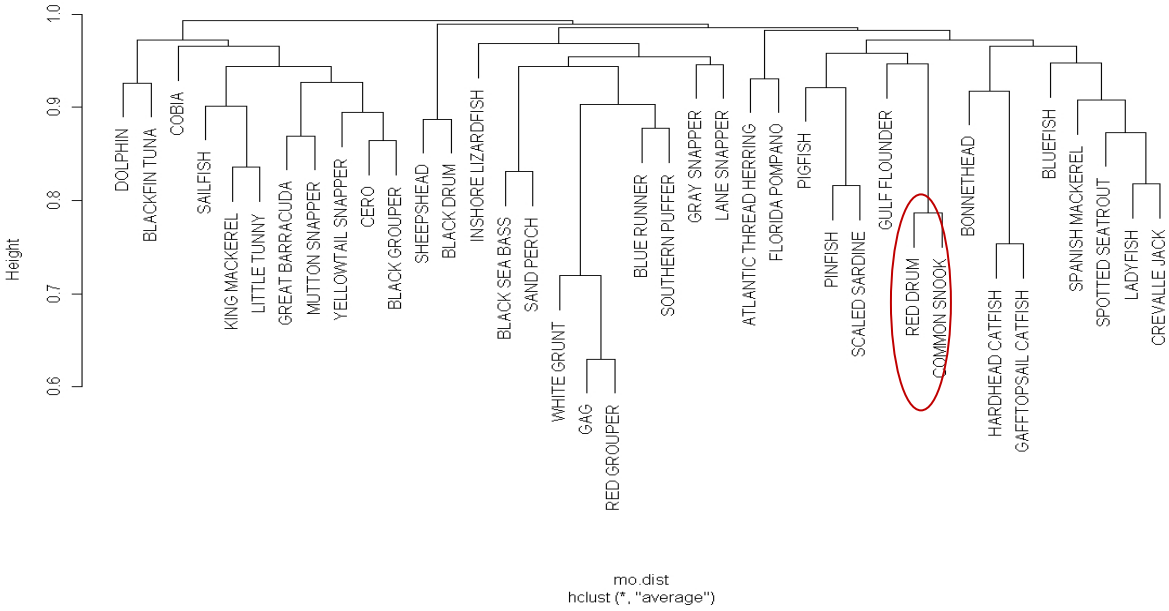


Figure 4.1.2.2. Cluster analysis of the MRFSS (1991-2010) and Everglades National Park Creel Survey (1986-2010) catch data by species and coast.

c. Everglades National Park Creel Survey

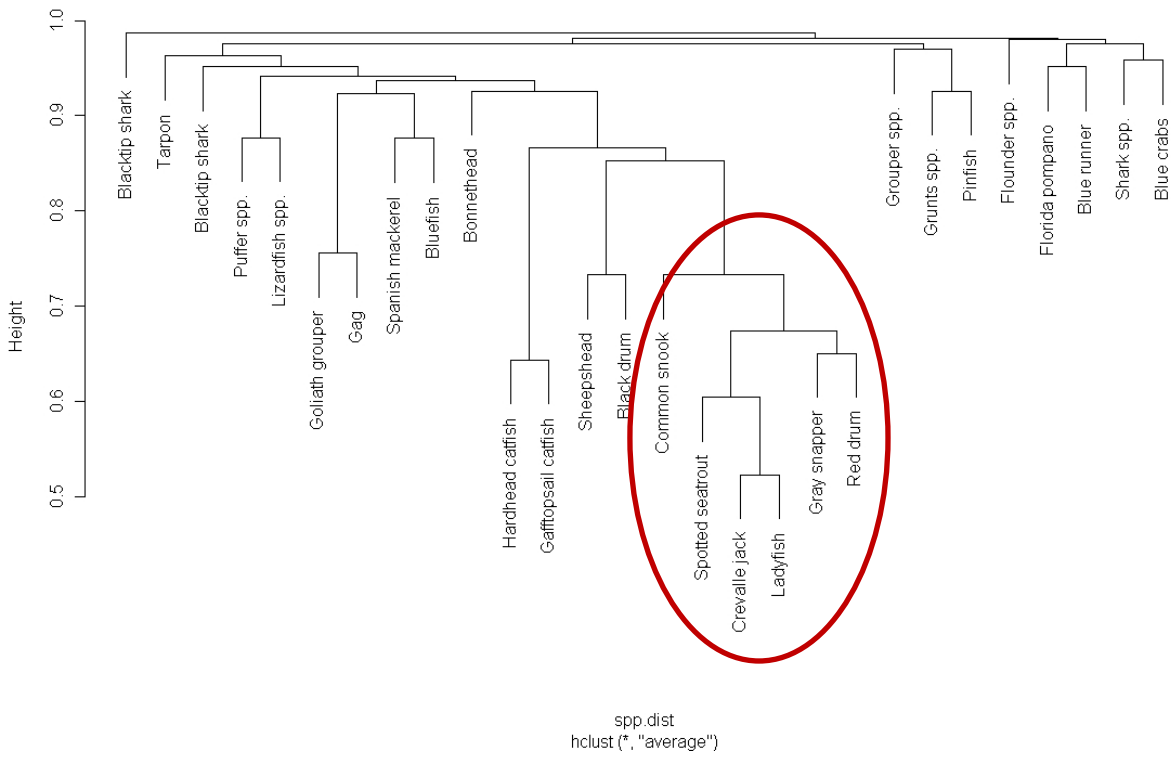
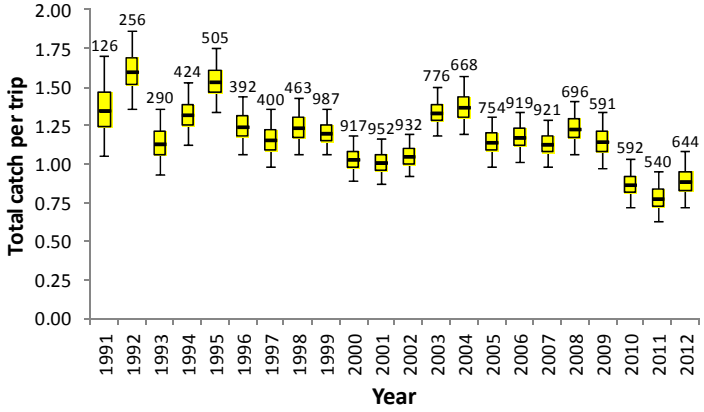
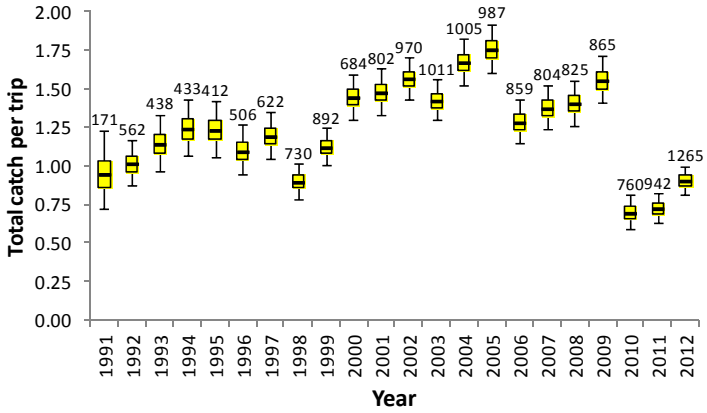


Figure 4.1.2.2 continued. Cluster analysis of the MRFSS (1991-2010) and Everglades National Park Creel Survey (1986-2010) catch data by species and coast.

a. MRFSS-MRIP Atlantic



b. MRFSS-MRIP Gulf



c. Everglades National Park

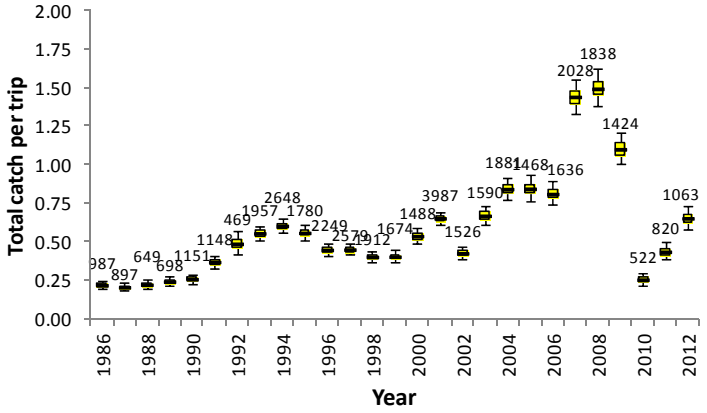
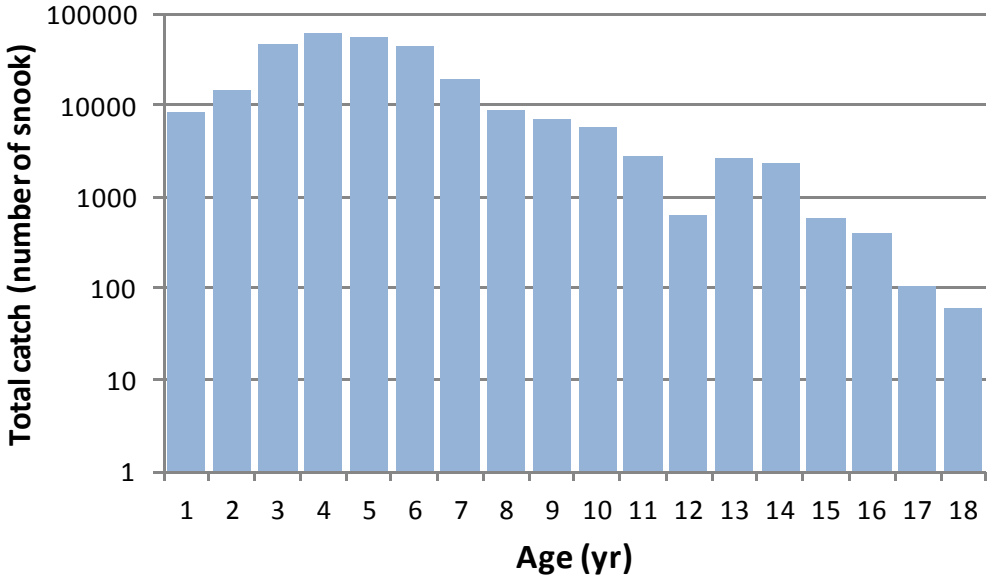


Figure 4.1.2.3. Fishery dependent tuning indices from the Marine Recreational Fisheries Statistics Survey-Marine Recreational Information Program numbers above the figures indicate the number of intercepts, the horizontal lines are the medians; the boxes are the inter-quartile ranges, and the vertical lines are the 95% confidence intervals.

a. Atlantic



b. Gulf

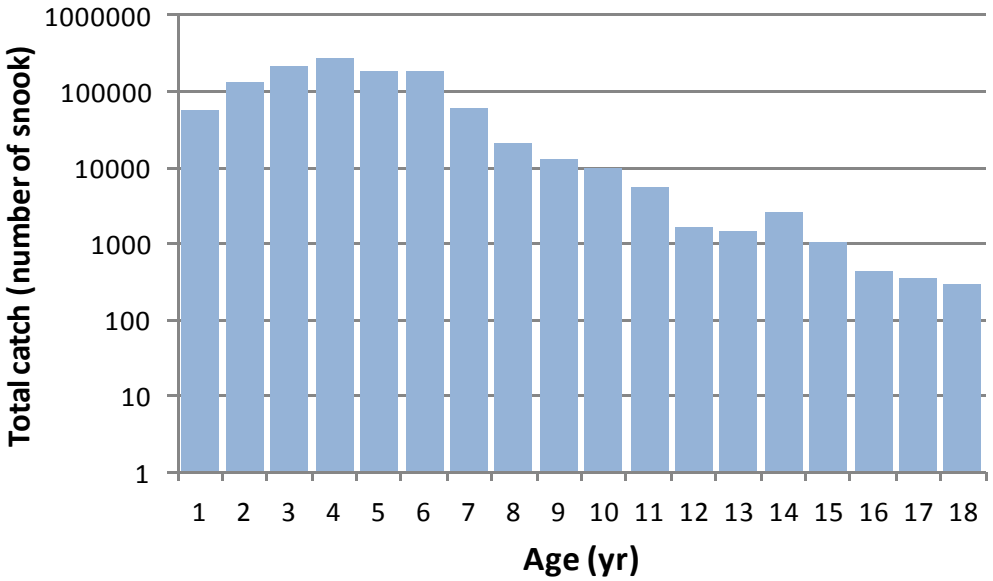


Figure 4.2.1.4. Average numbers of snook at age by coast for the period 2008-12. Note that the vertical axes are on a logarithmic scale.

a. Atlantic

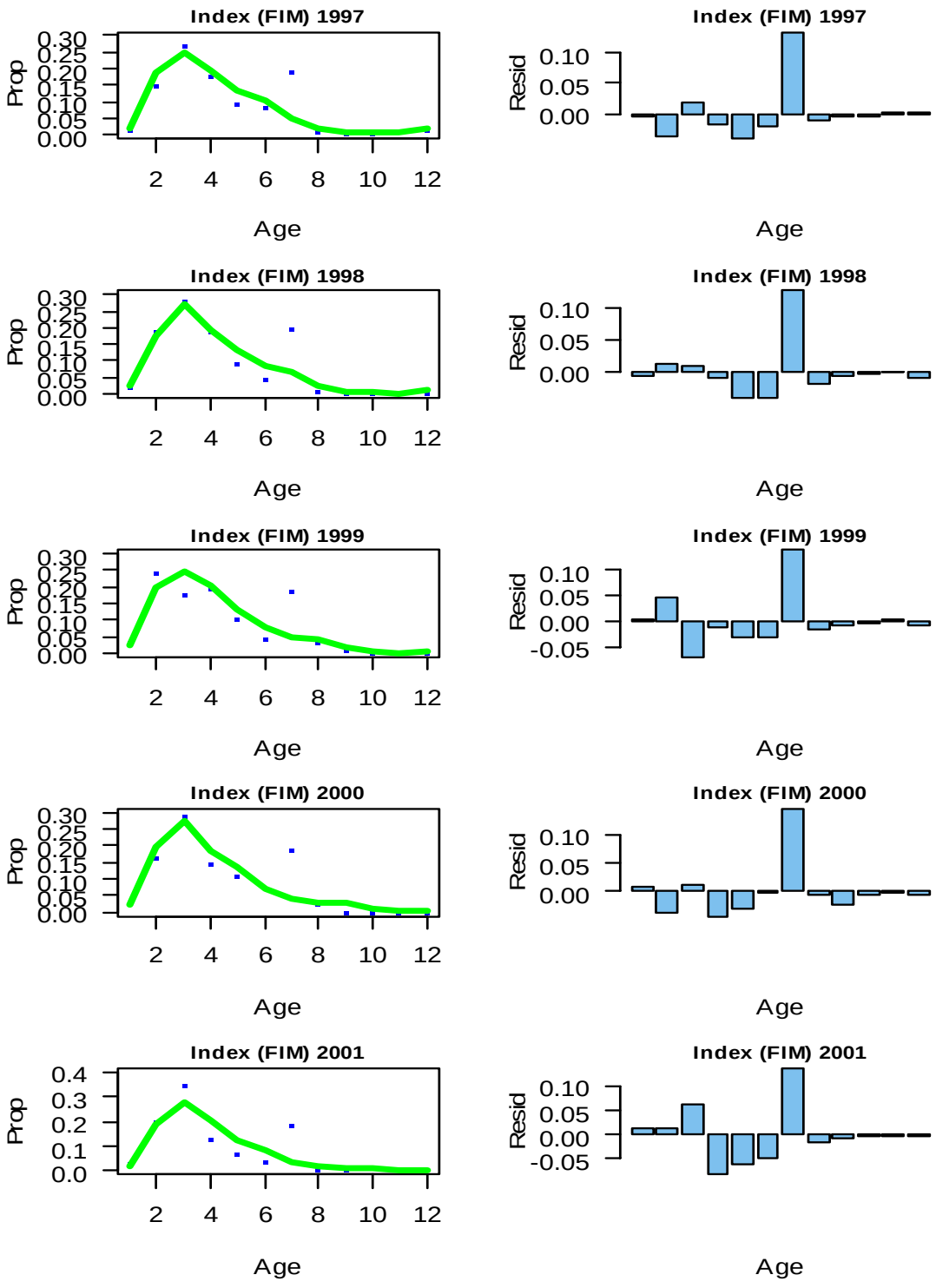


Figure 4.2.2.4.1.1. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

a. Atlantic

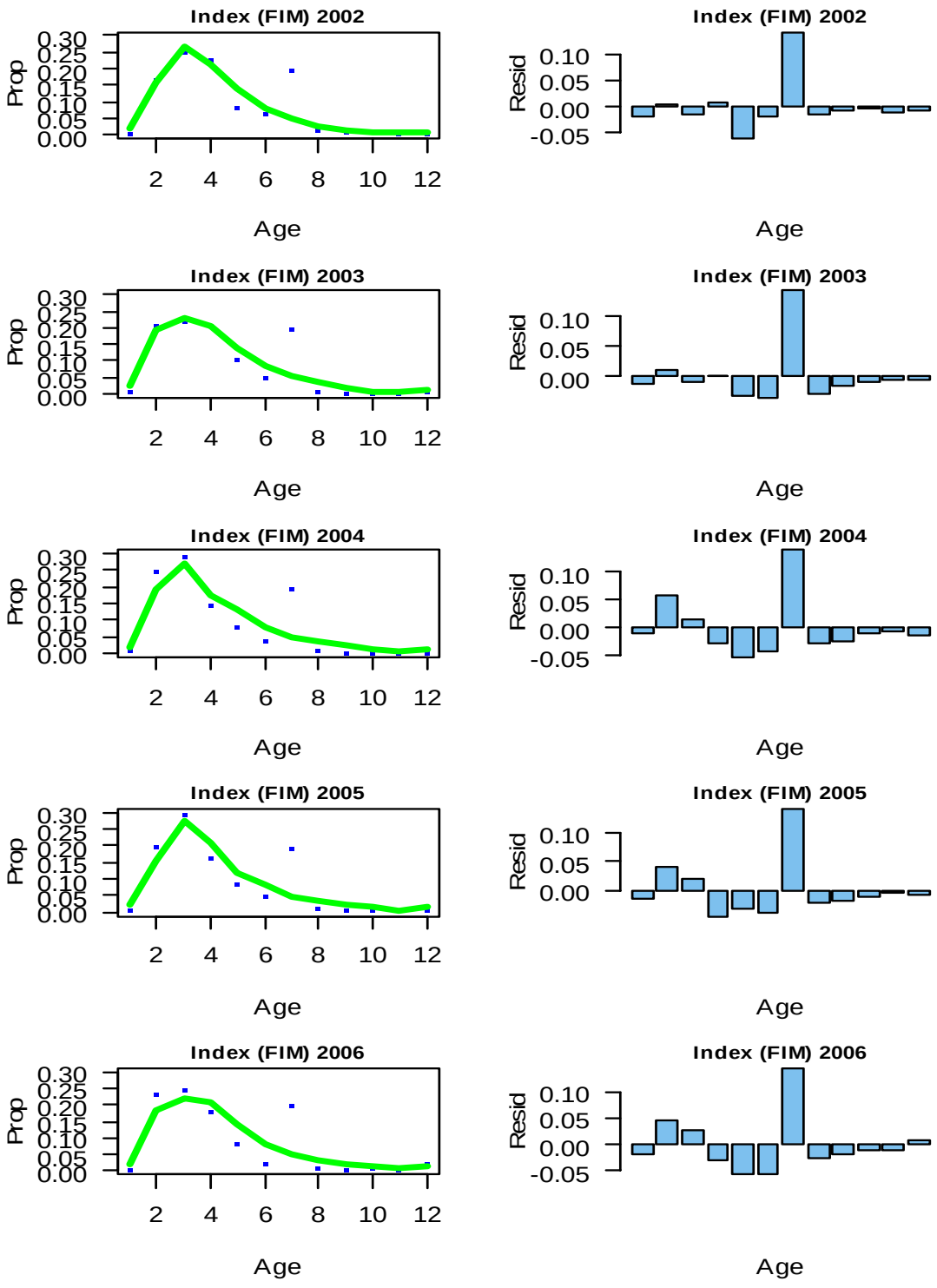


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

a. Atlantic

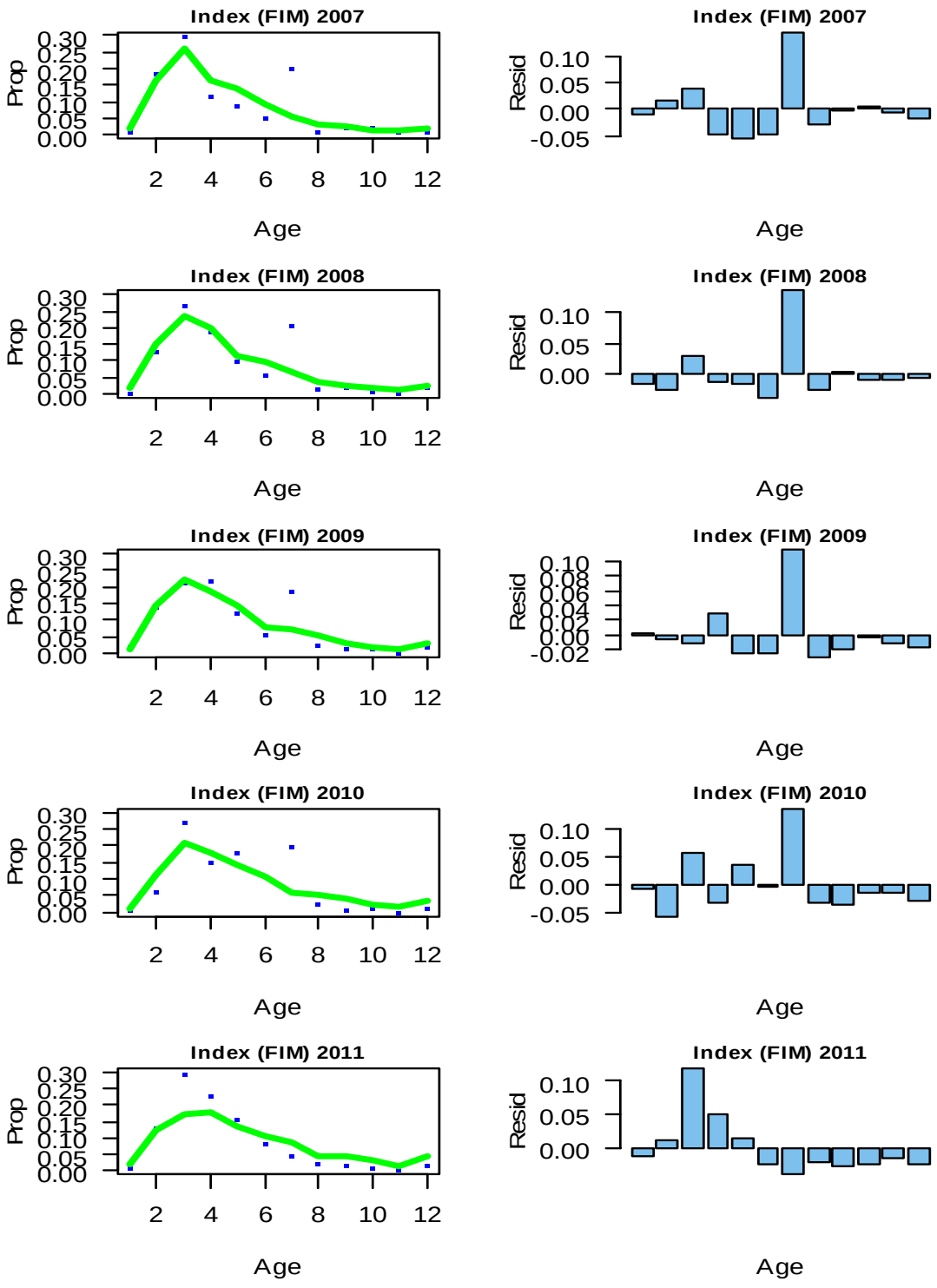


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

a. Atlantic

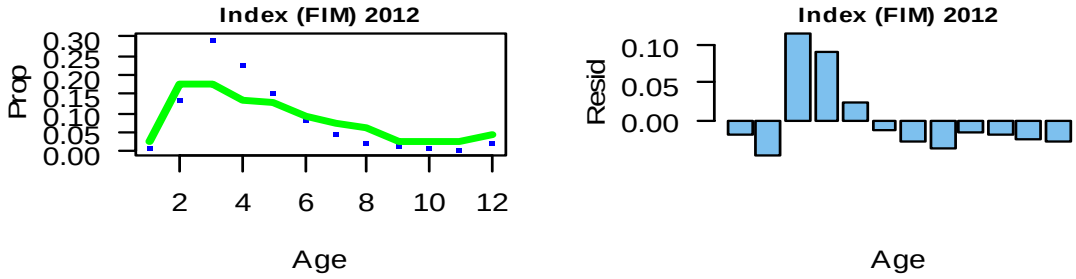


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

a. Atlantic

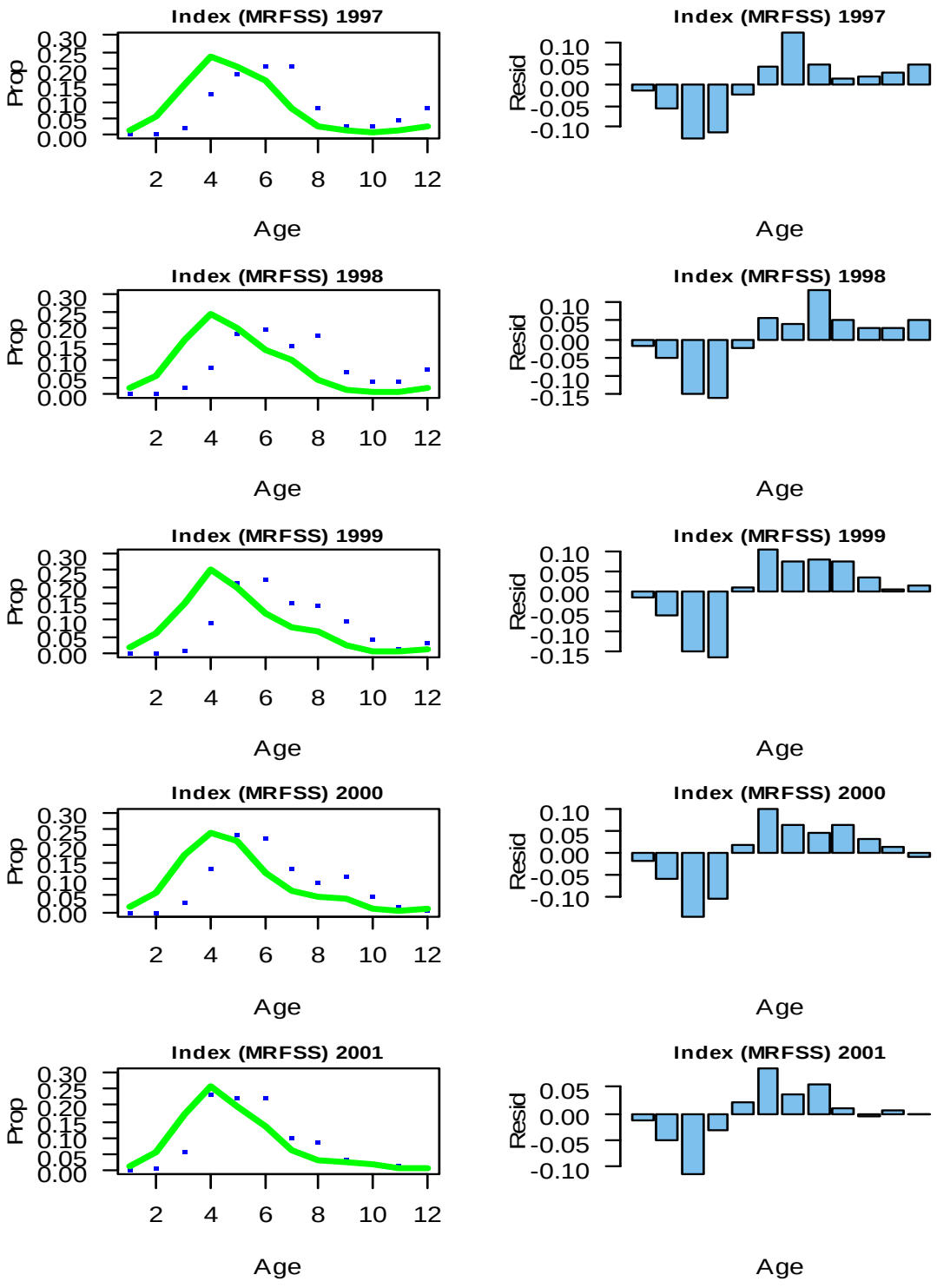


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

a. Atlantic

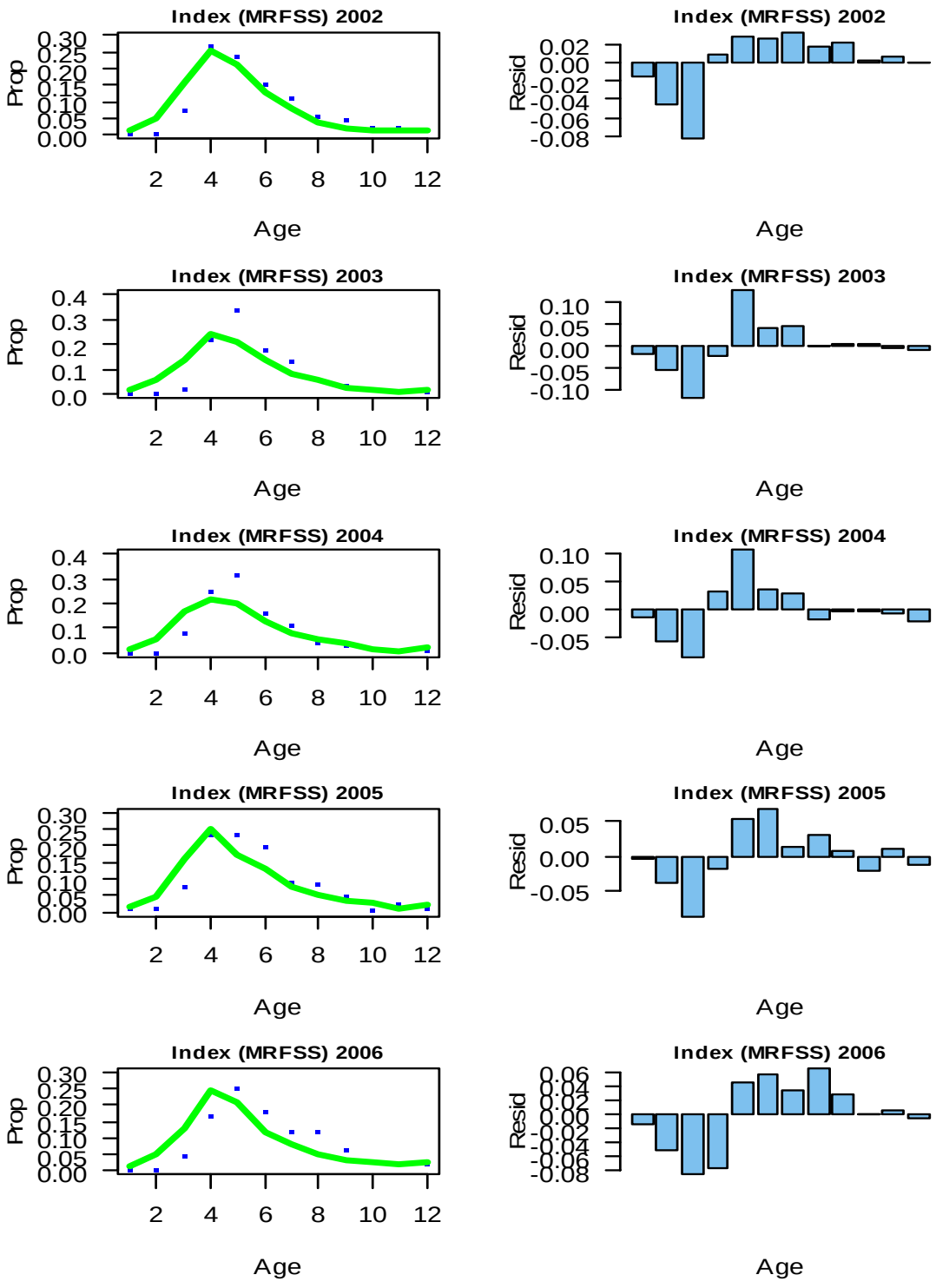


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

a. Atlantic

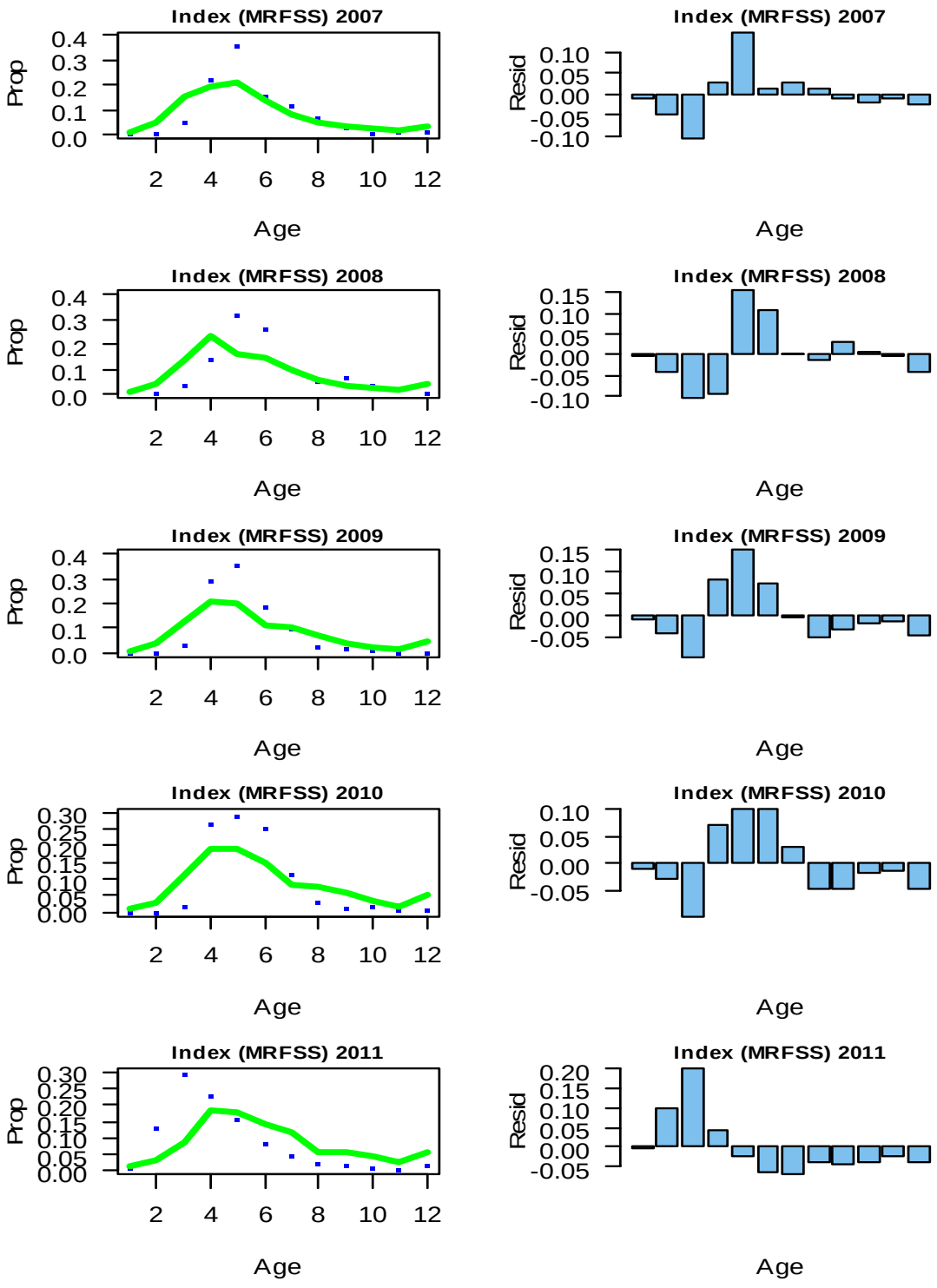


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

a. Atlantic

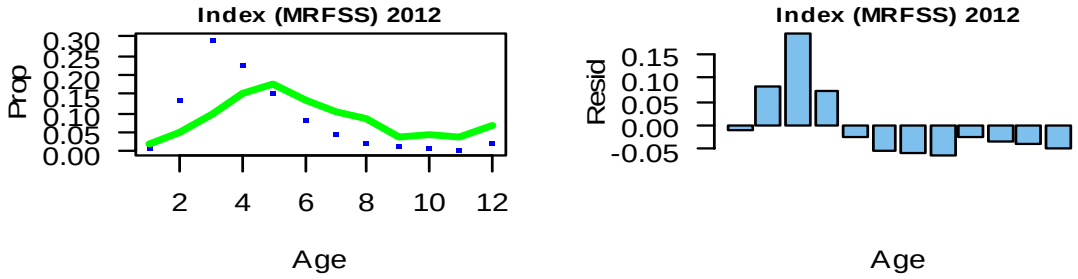


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

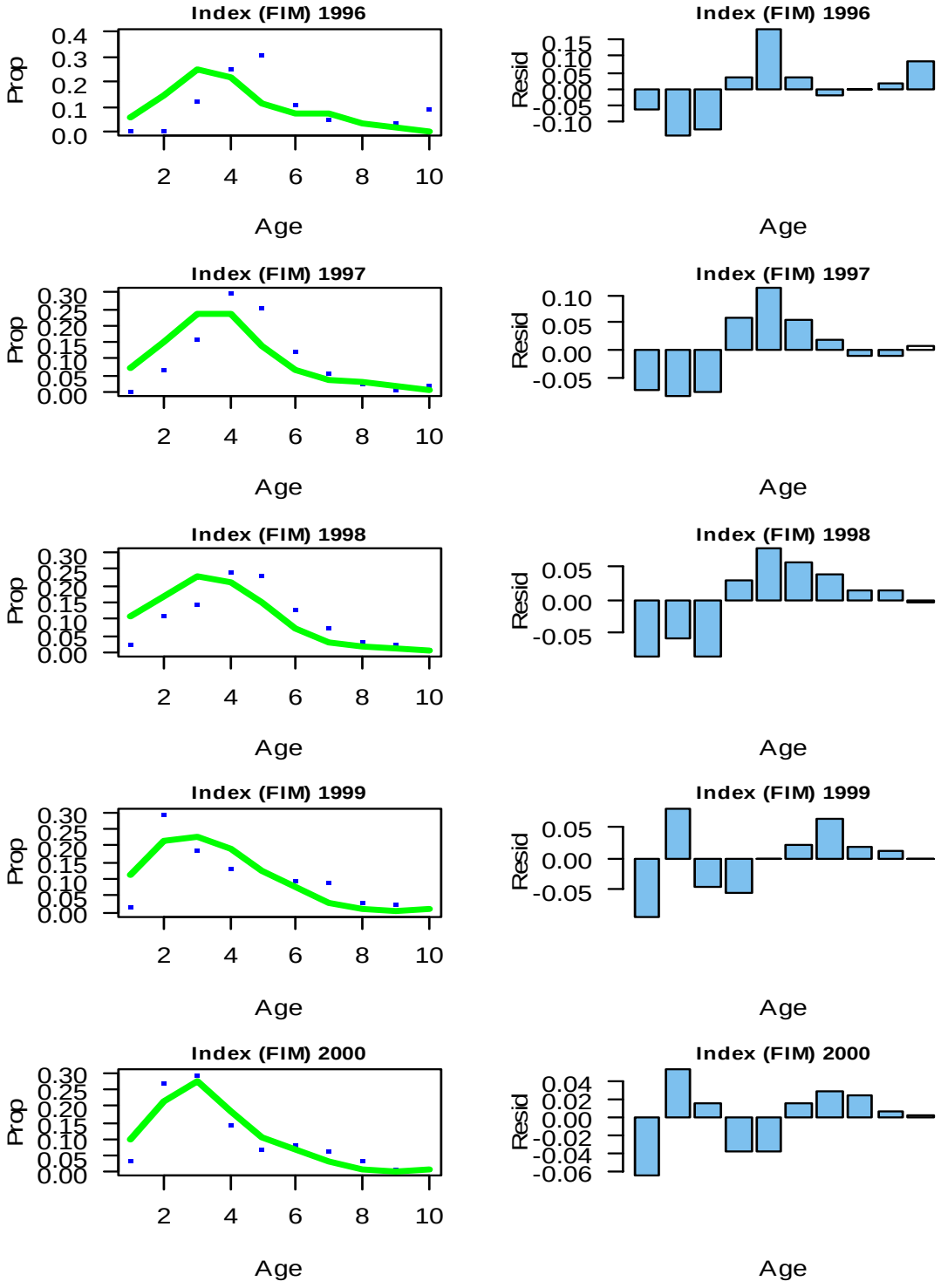


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

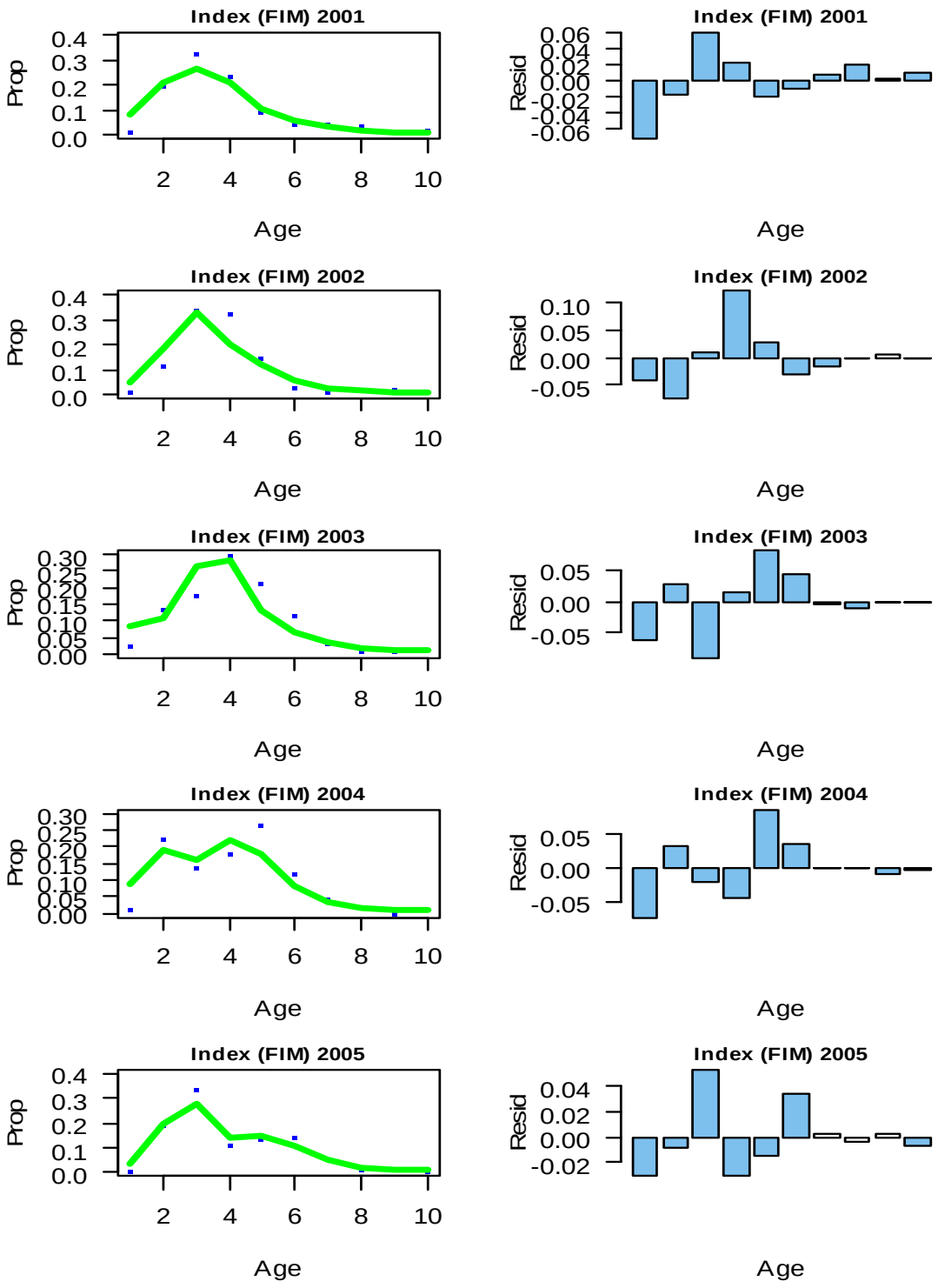


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

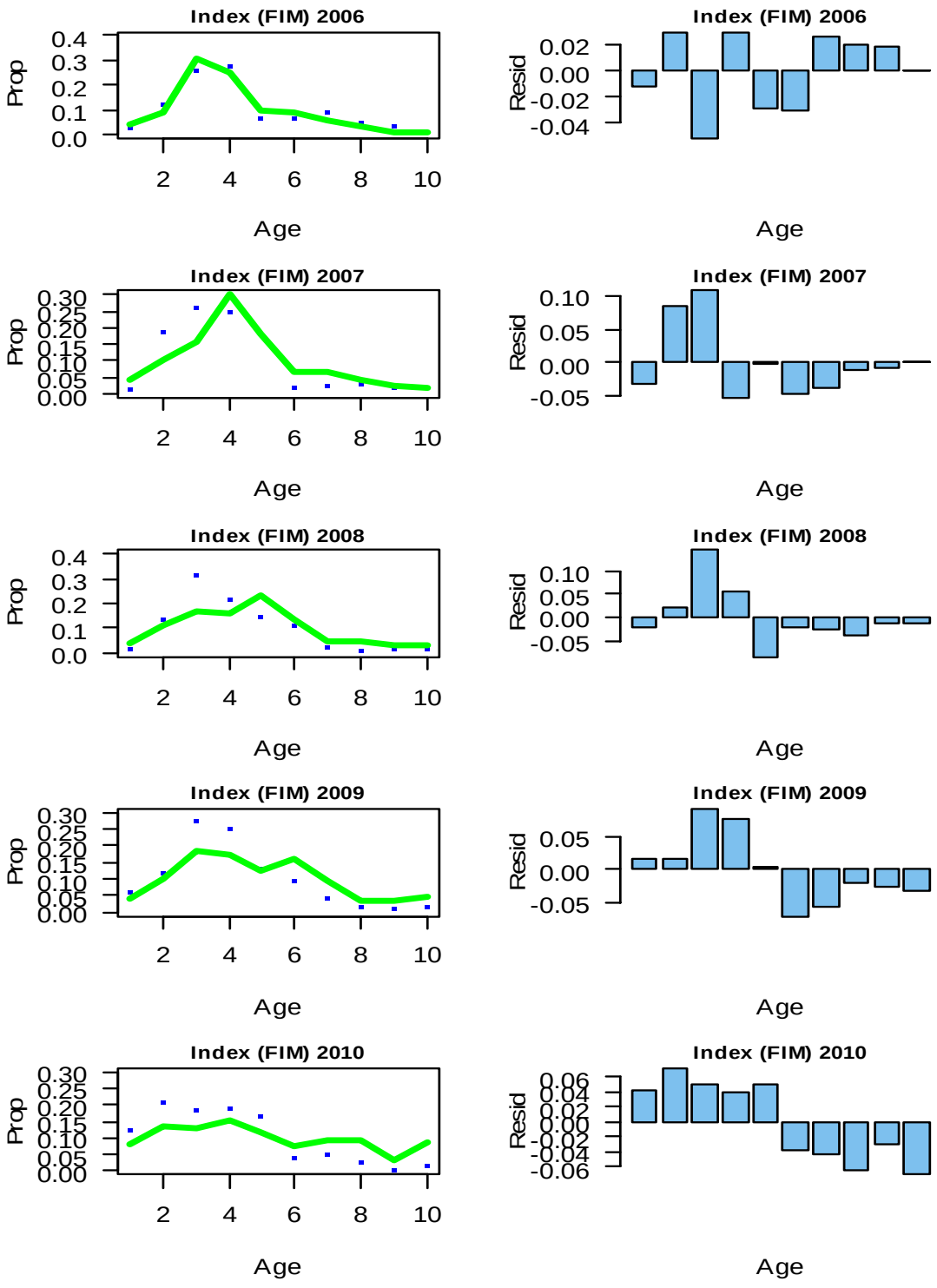


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

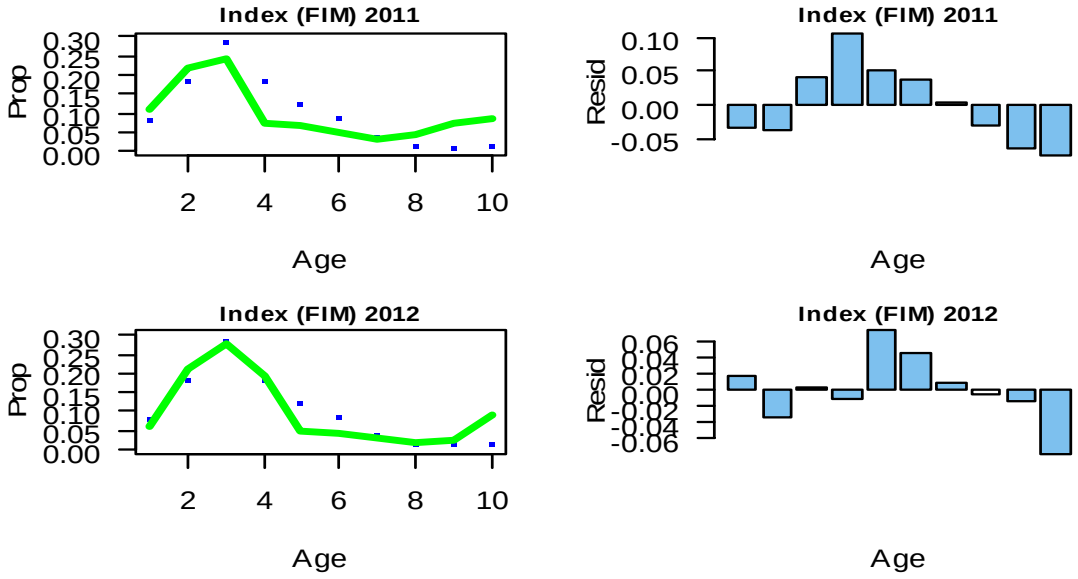


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

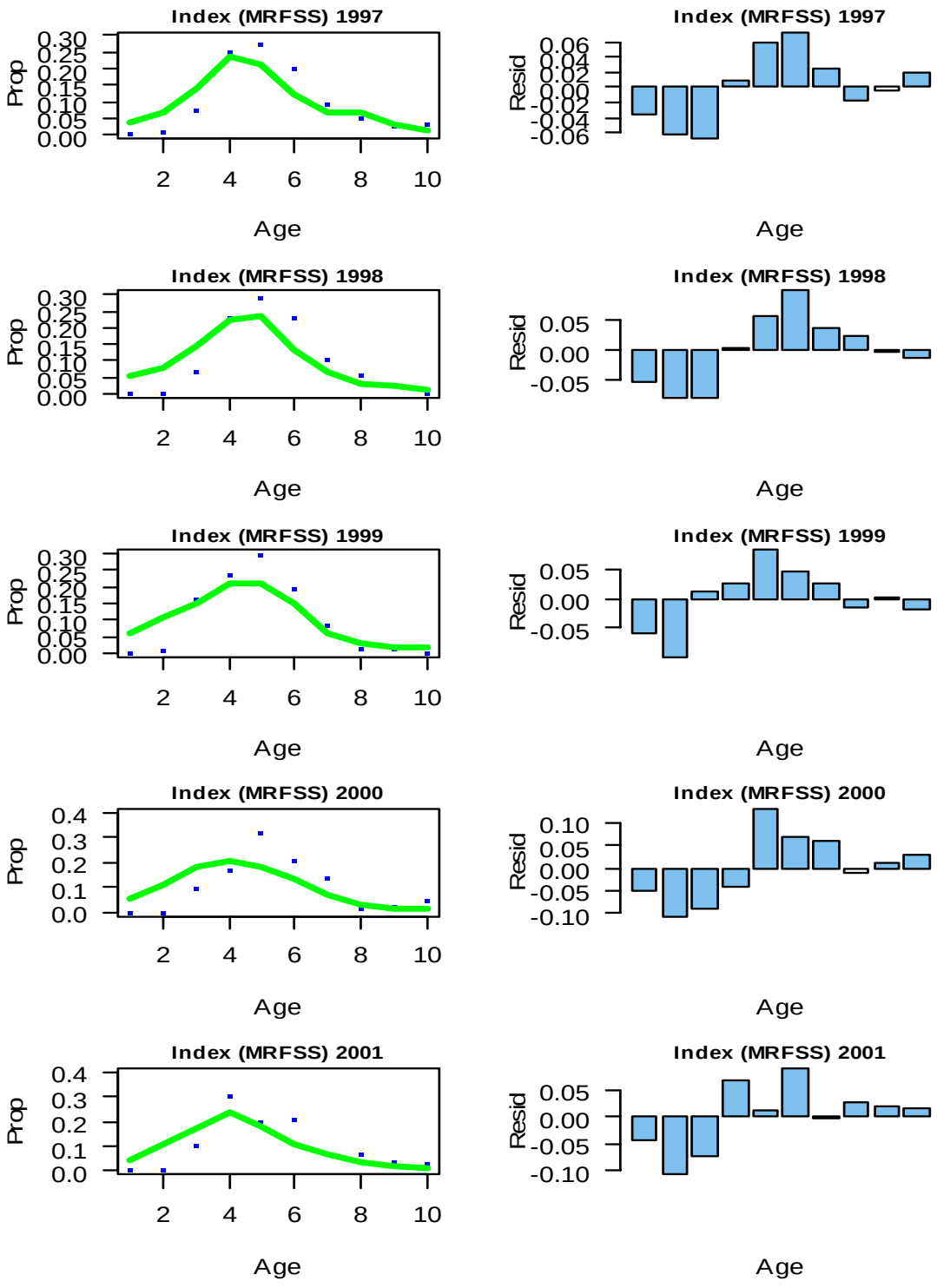


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

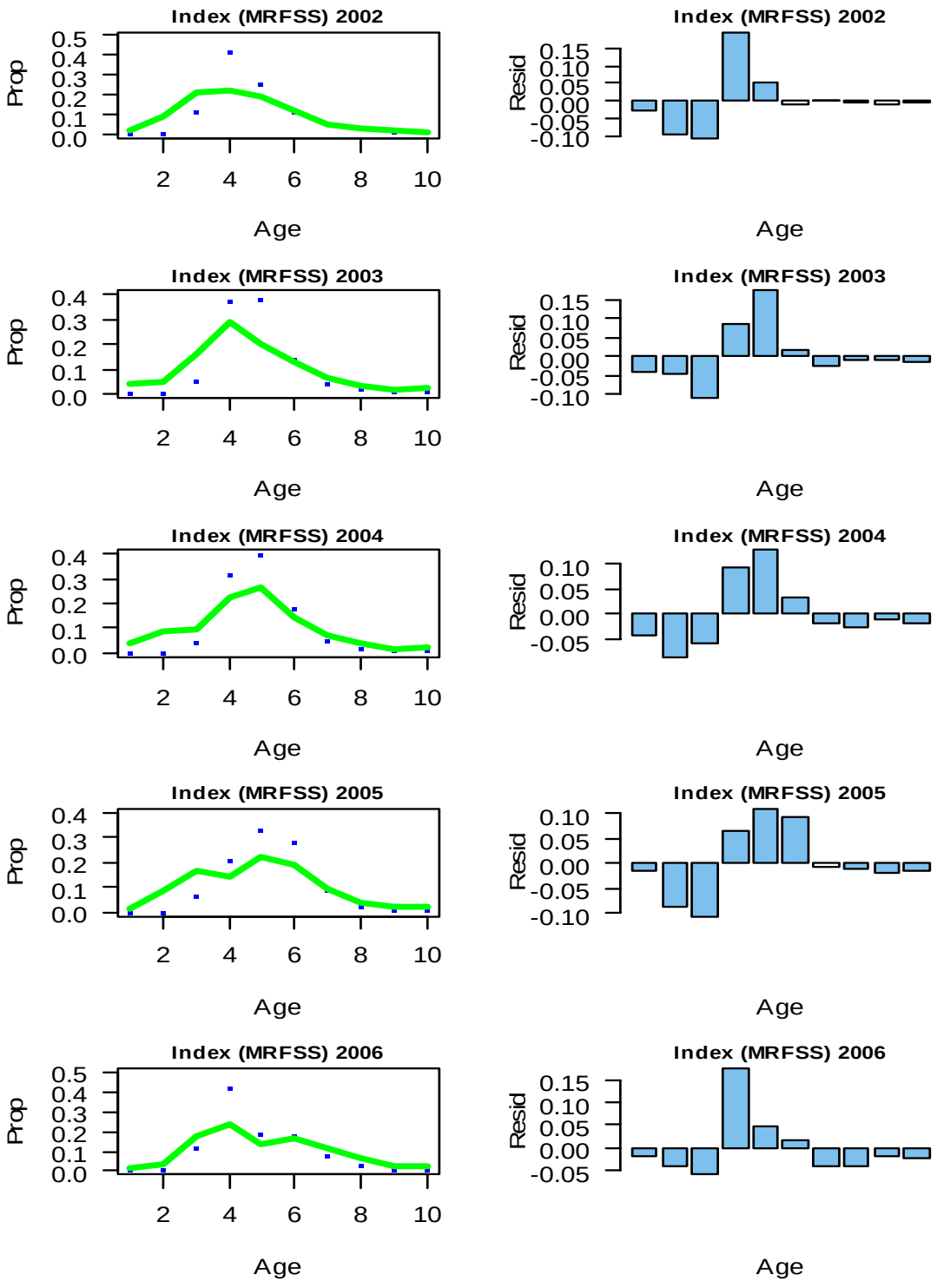


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

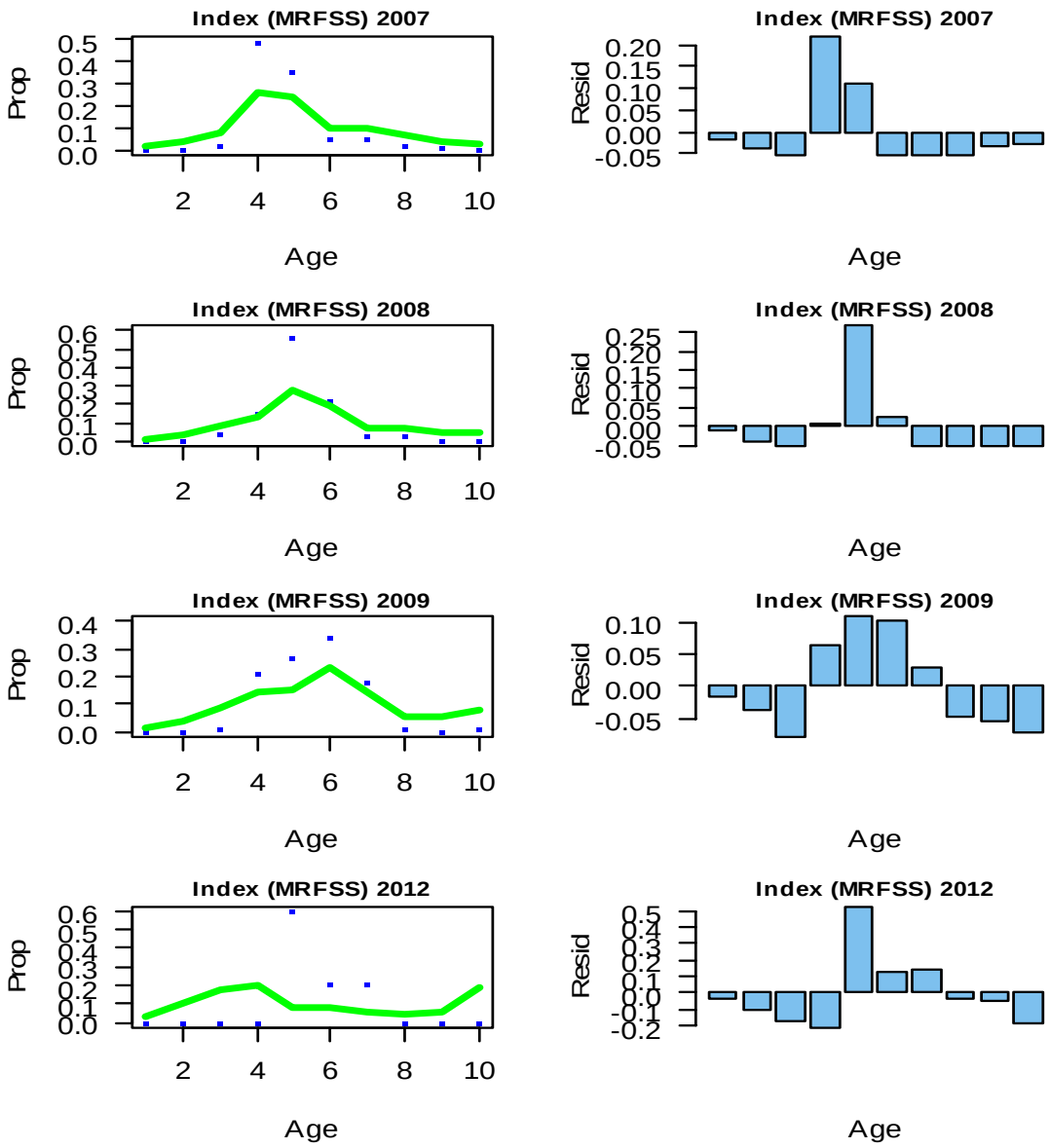


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

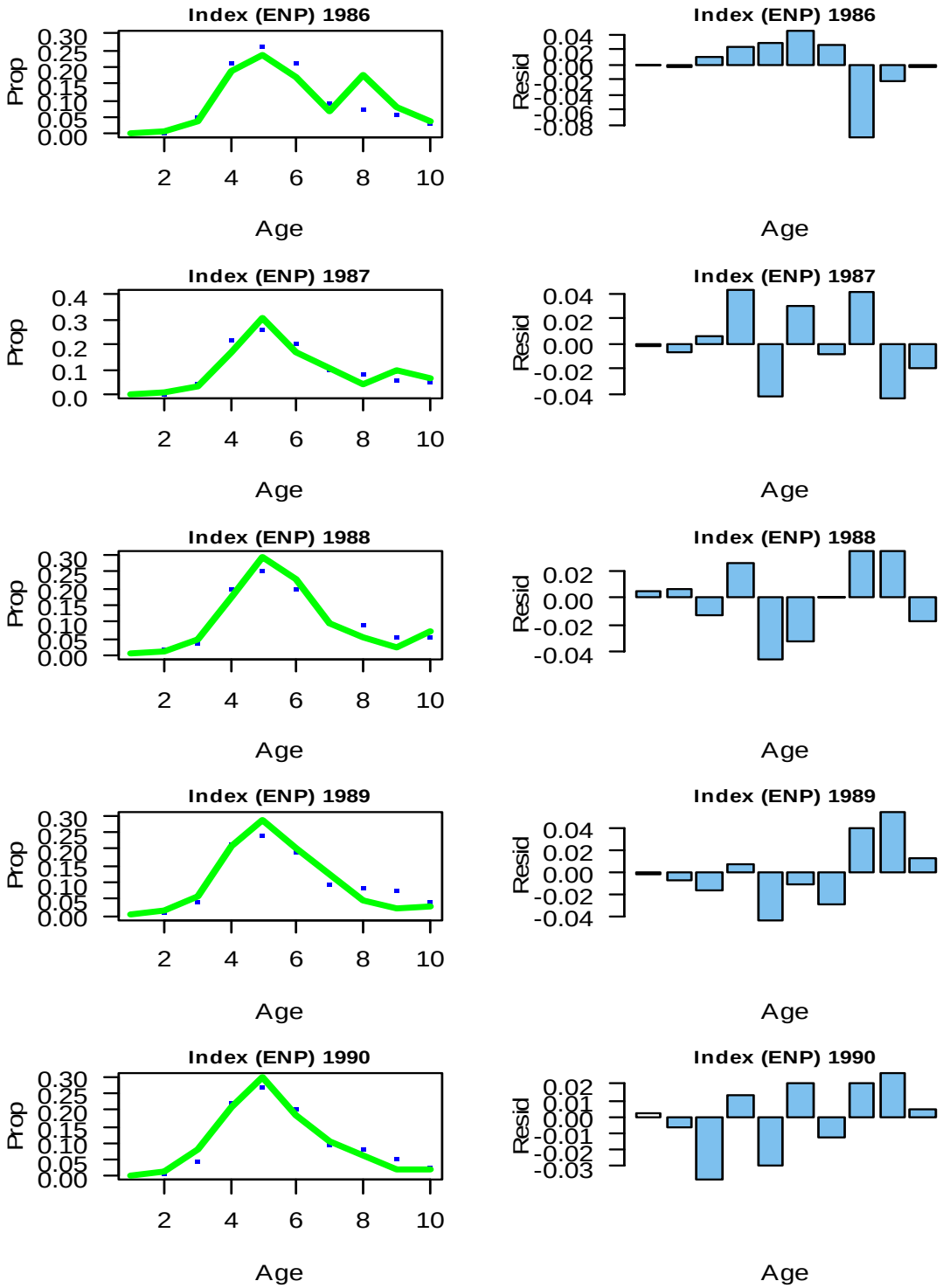


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

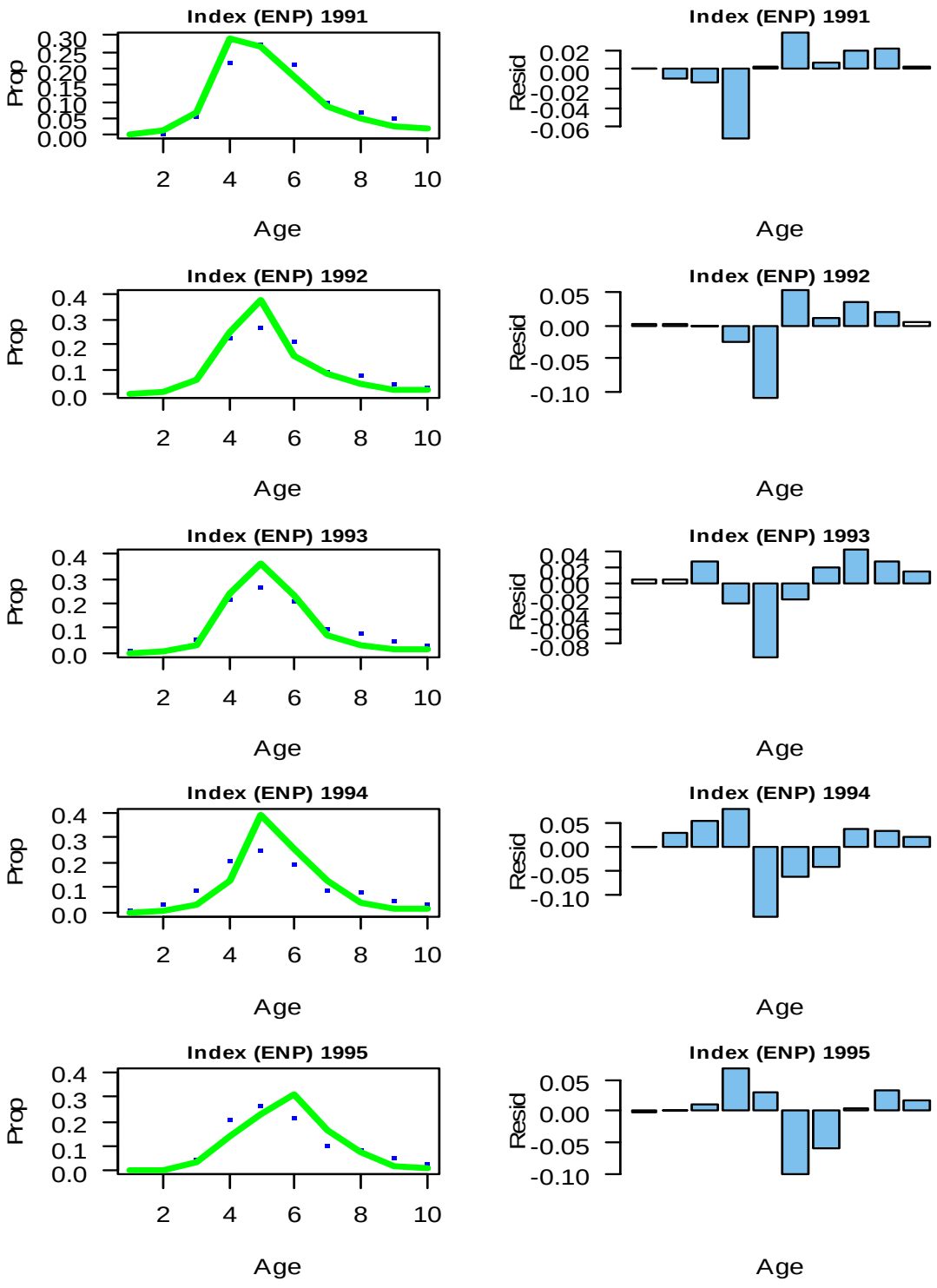


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

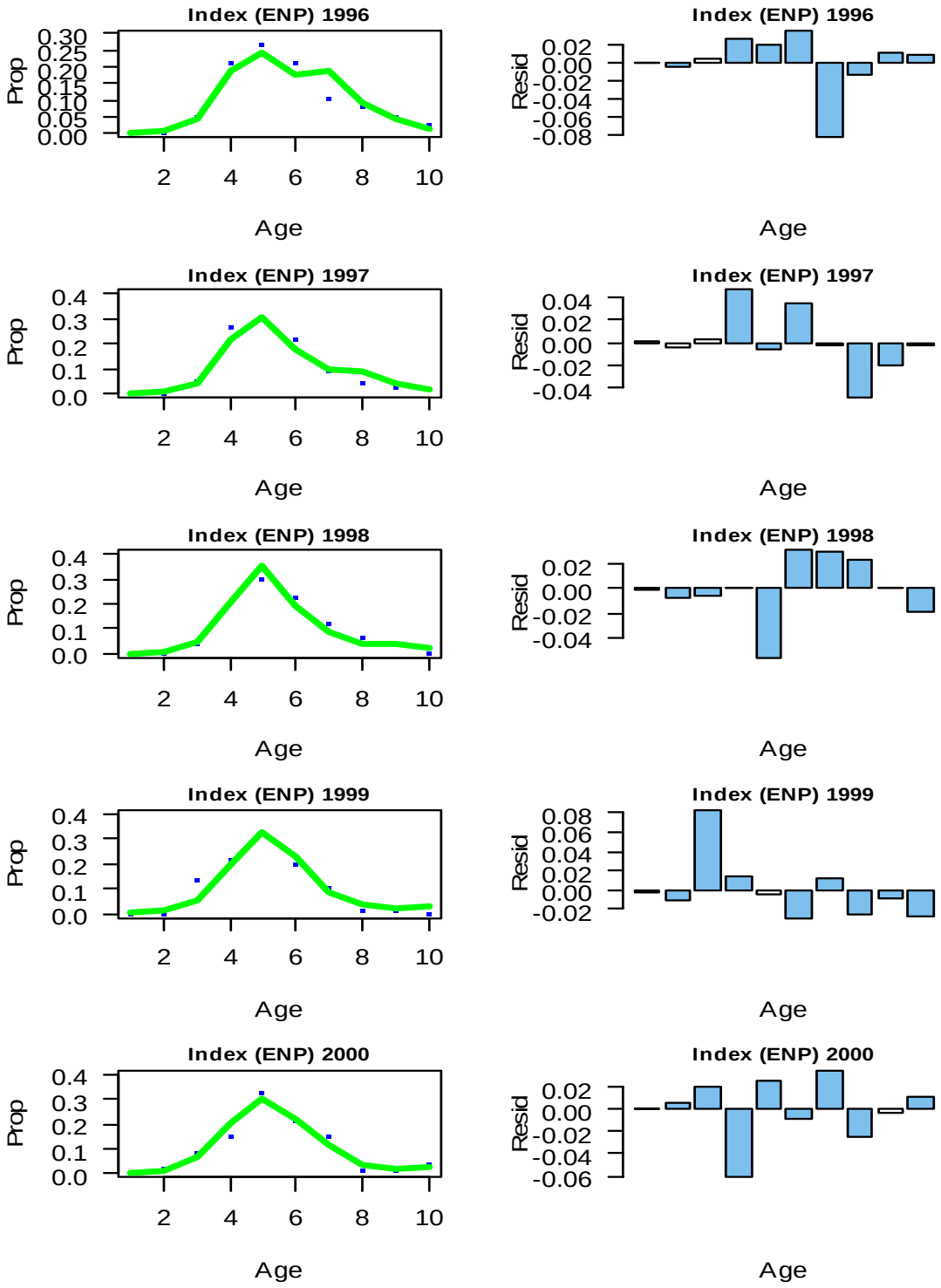


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

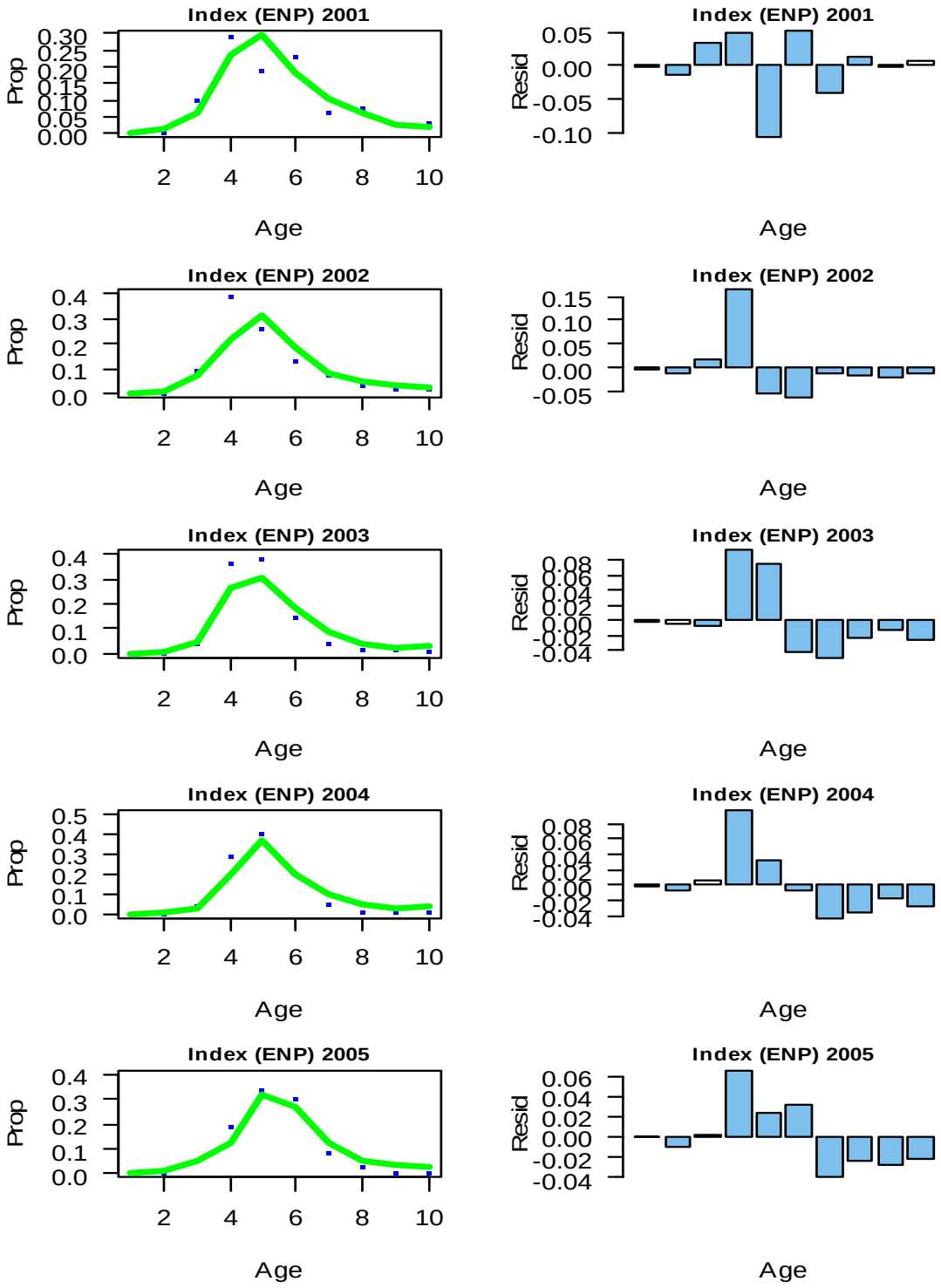


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

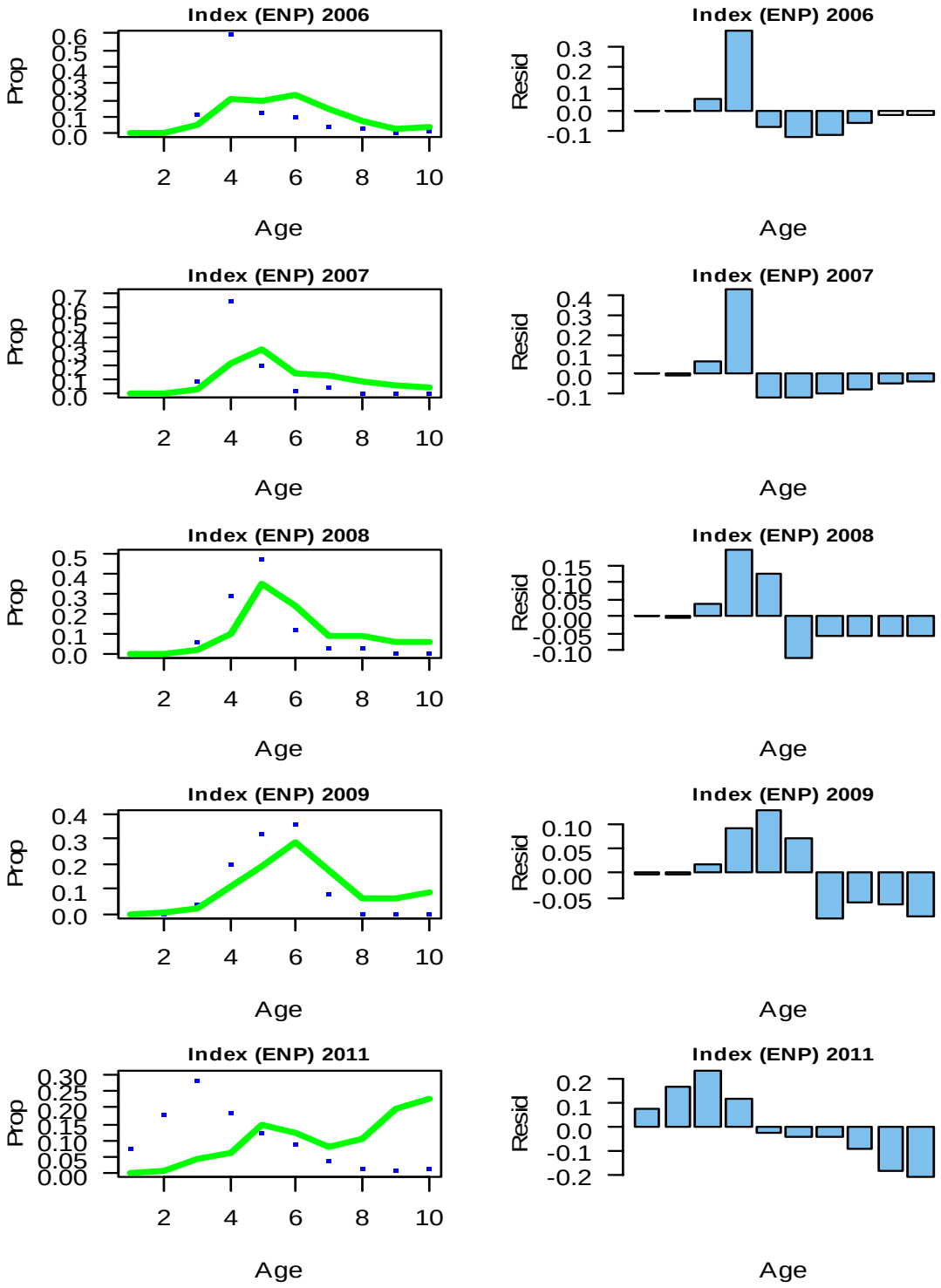


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

b. Gulf

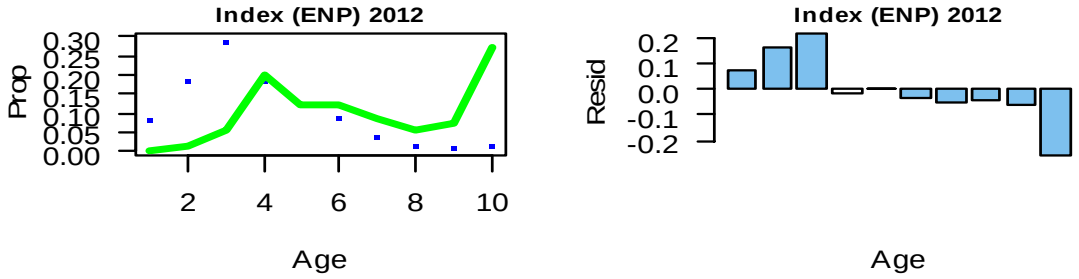


Figure 4.2.2.4.1.1 continued. Comparison of observed (ellipses) and predicted (line) proportion of at age by index, year, and coast from ASAP.

a. Atlantic

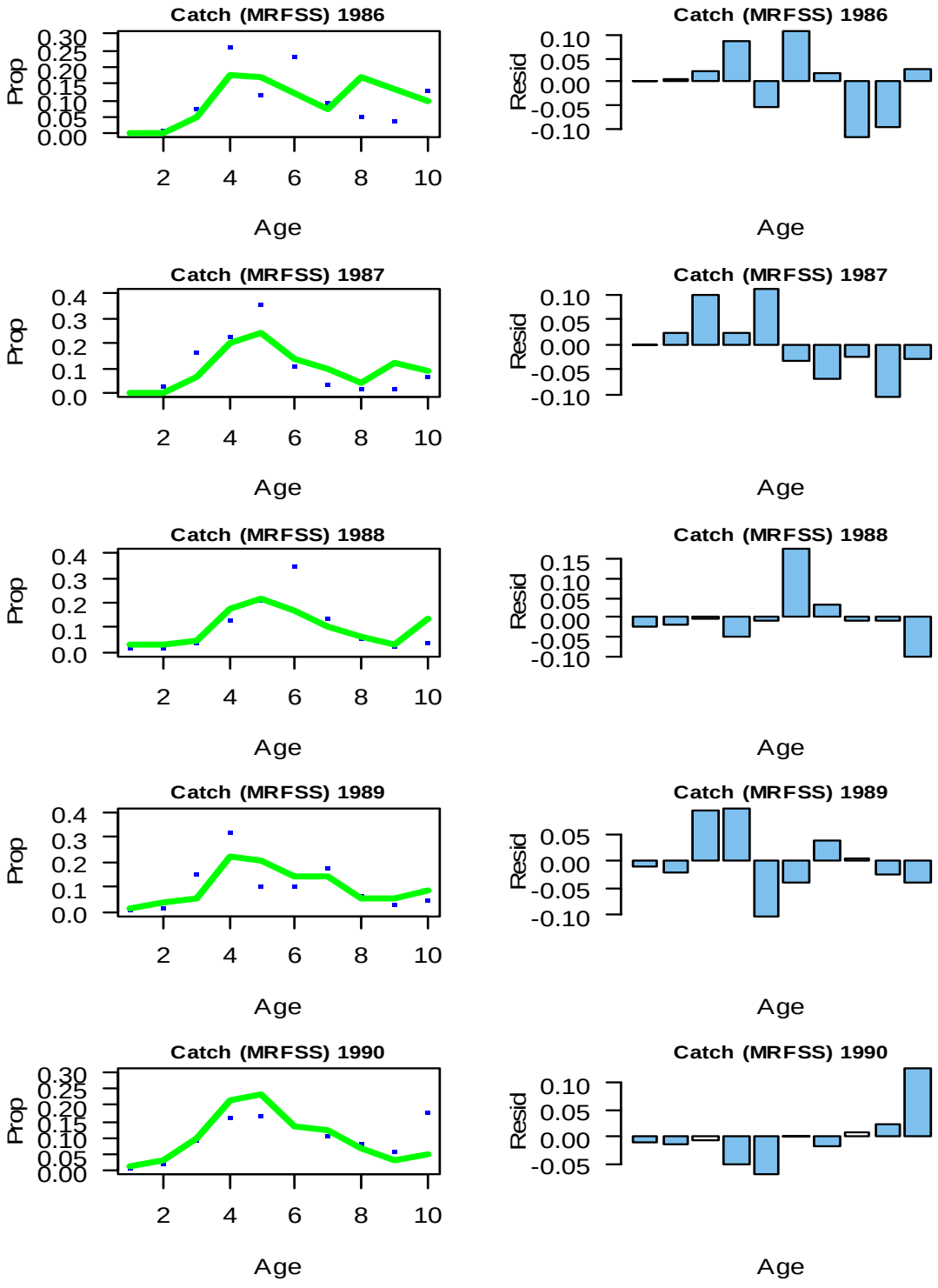


Figure 4.2.2.4.1.2. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

a. Atlantic

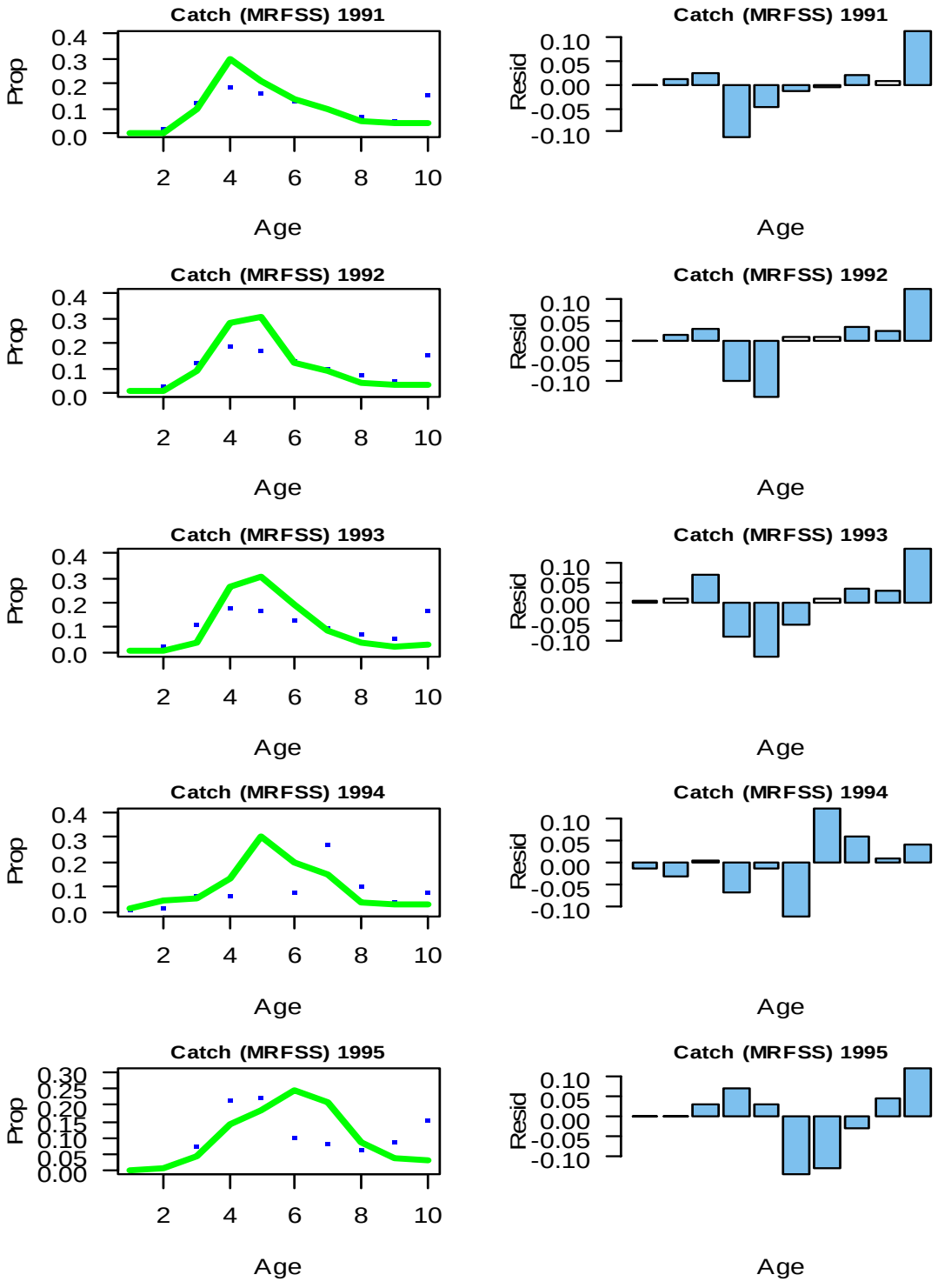


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

a. Atlantic

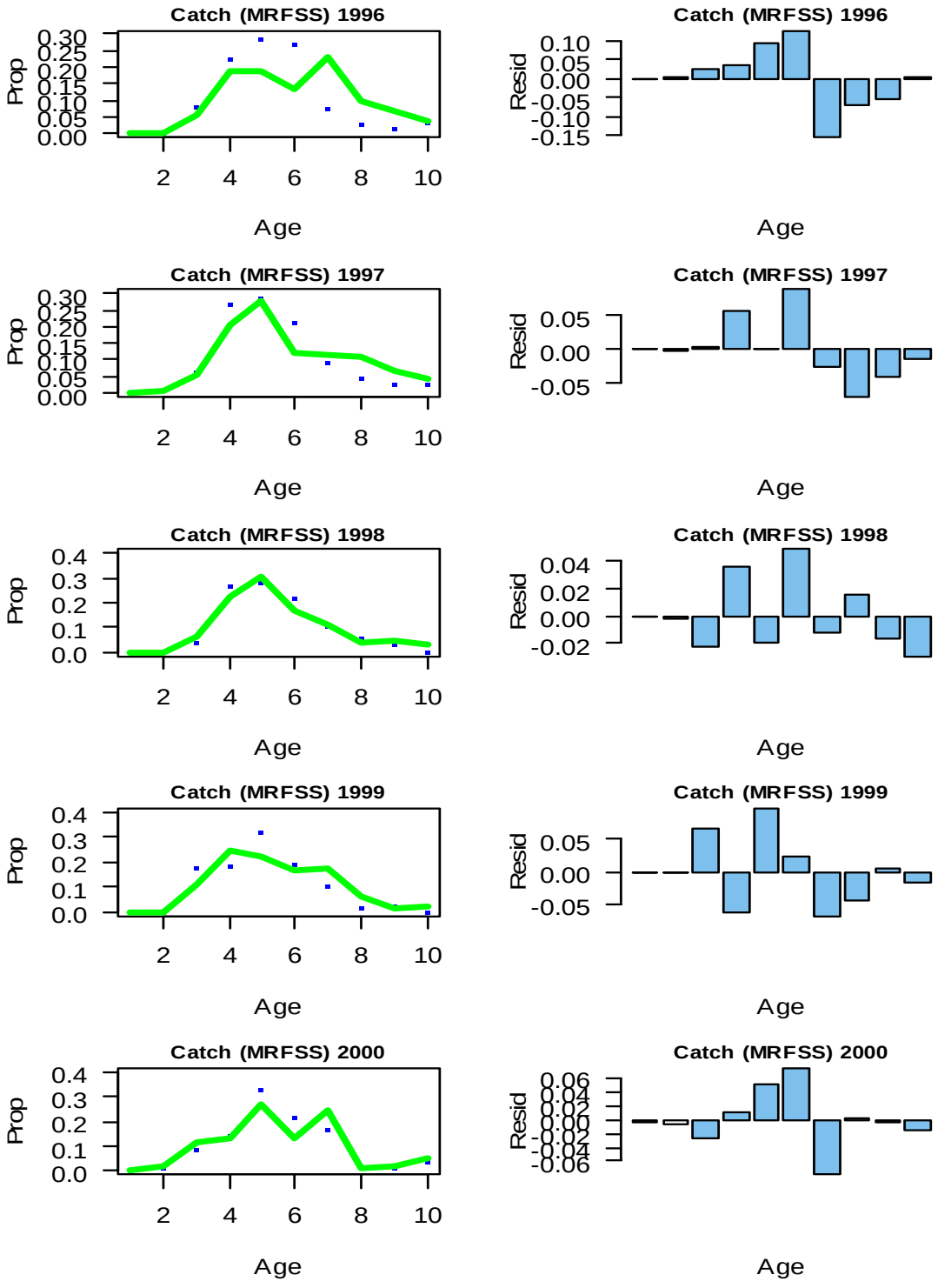


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

a. Atlantic

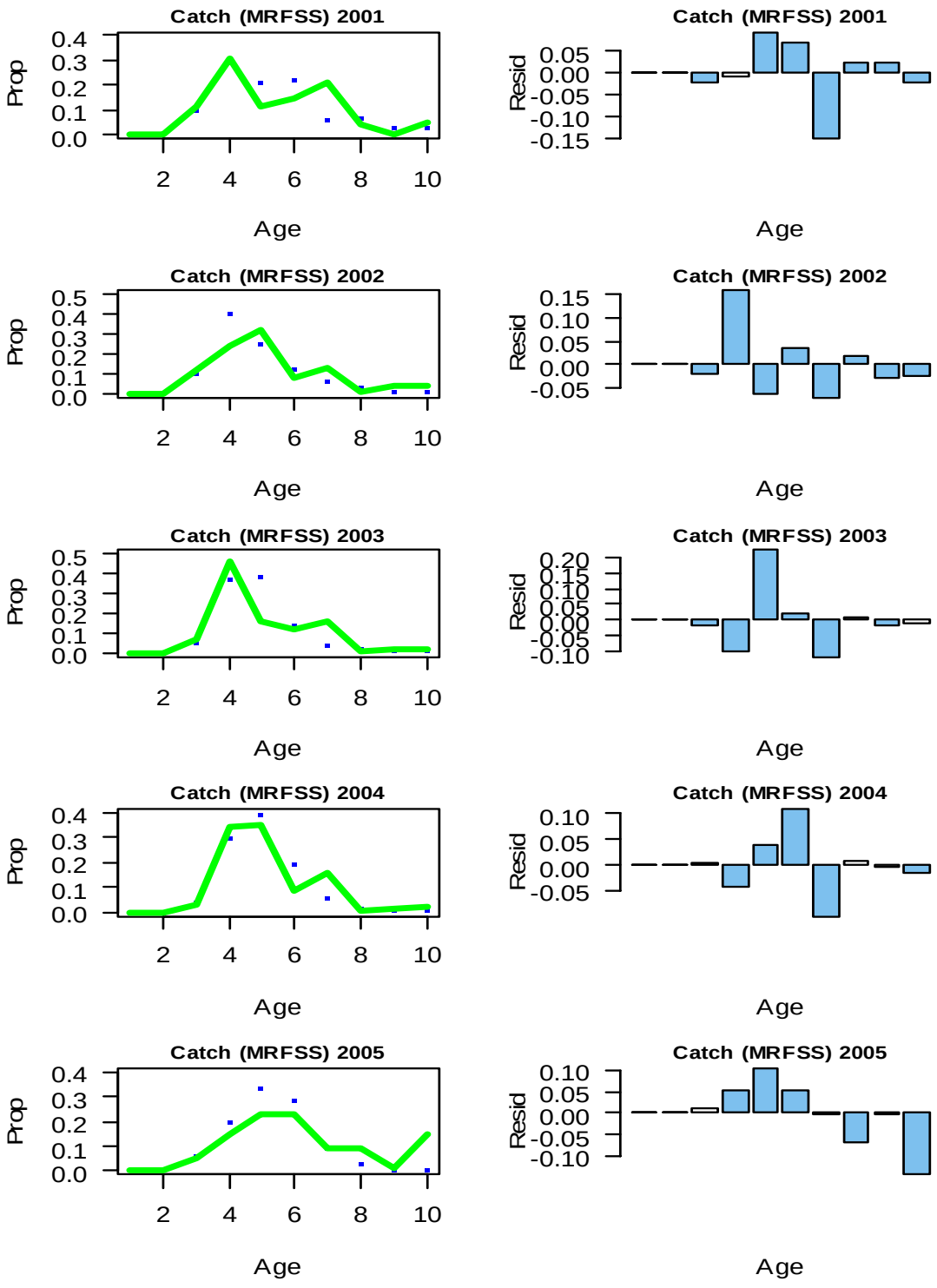


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

a. Atlantic

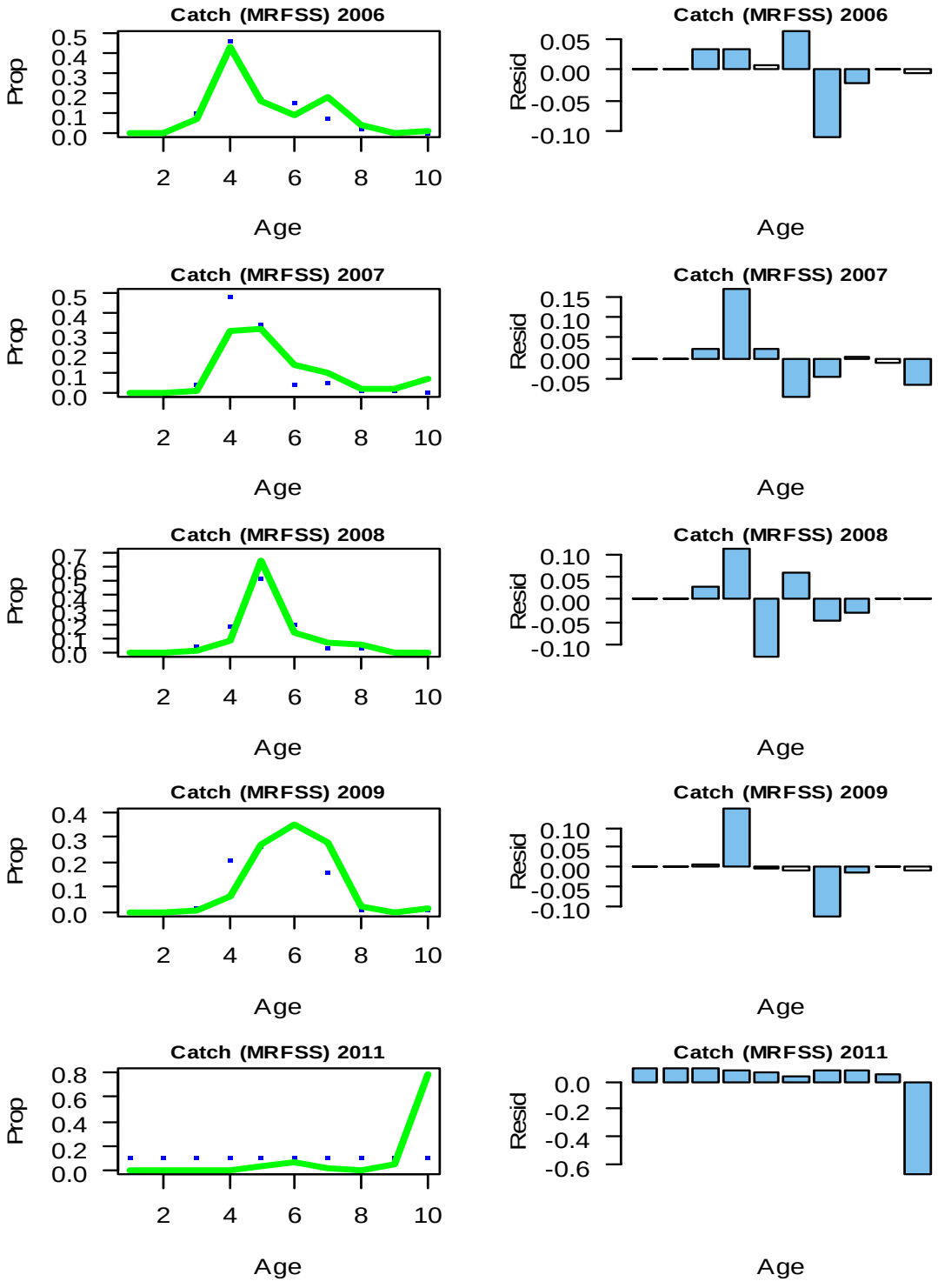


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

a. Atlantic

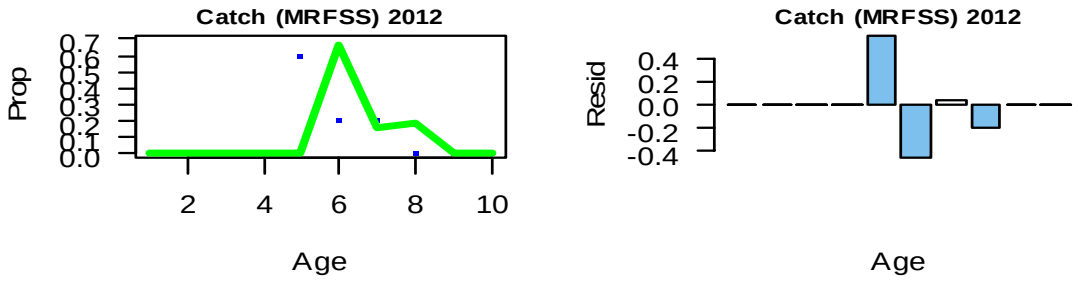


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

a. Gulf

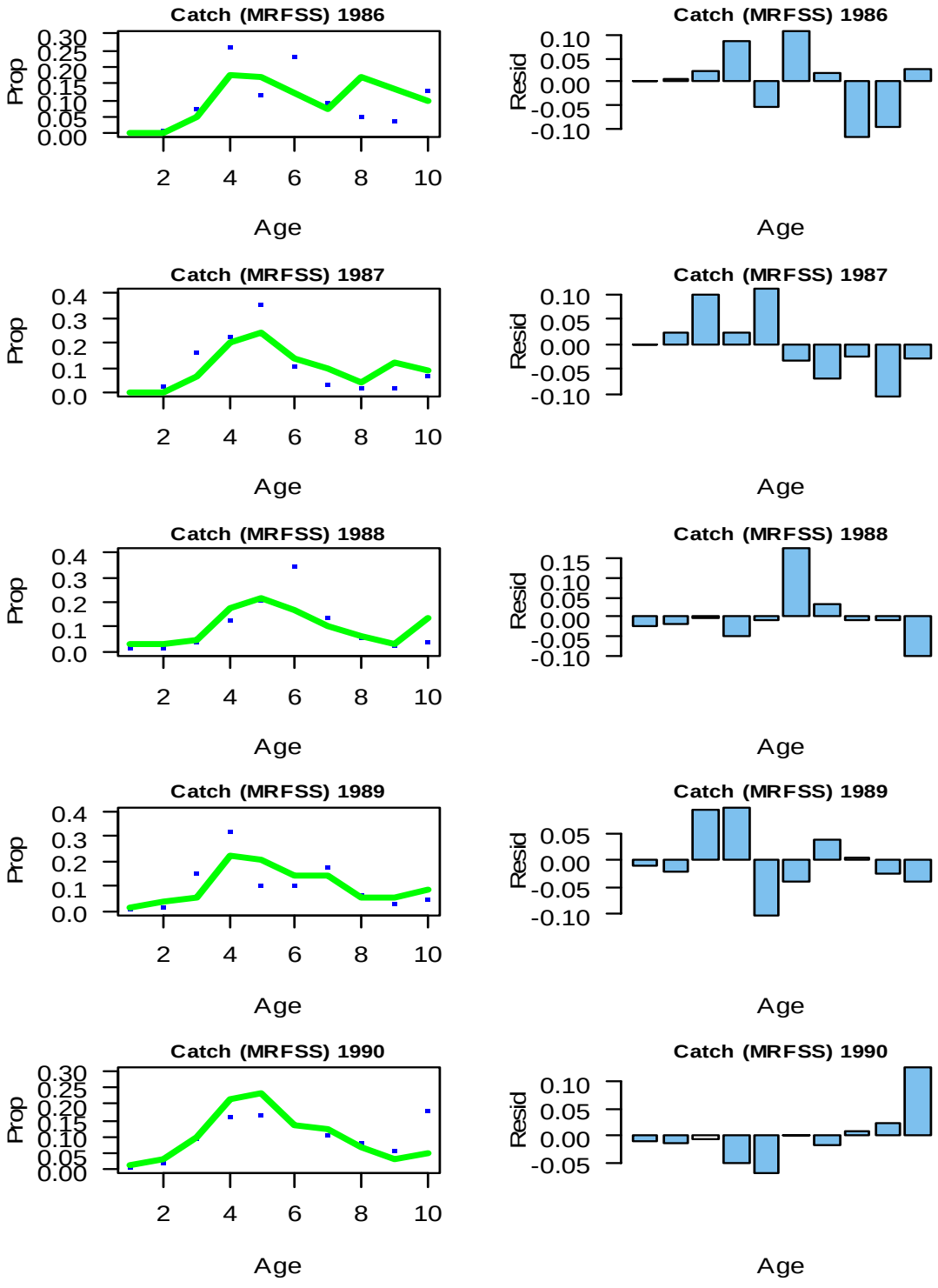


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

a. Gulf

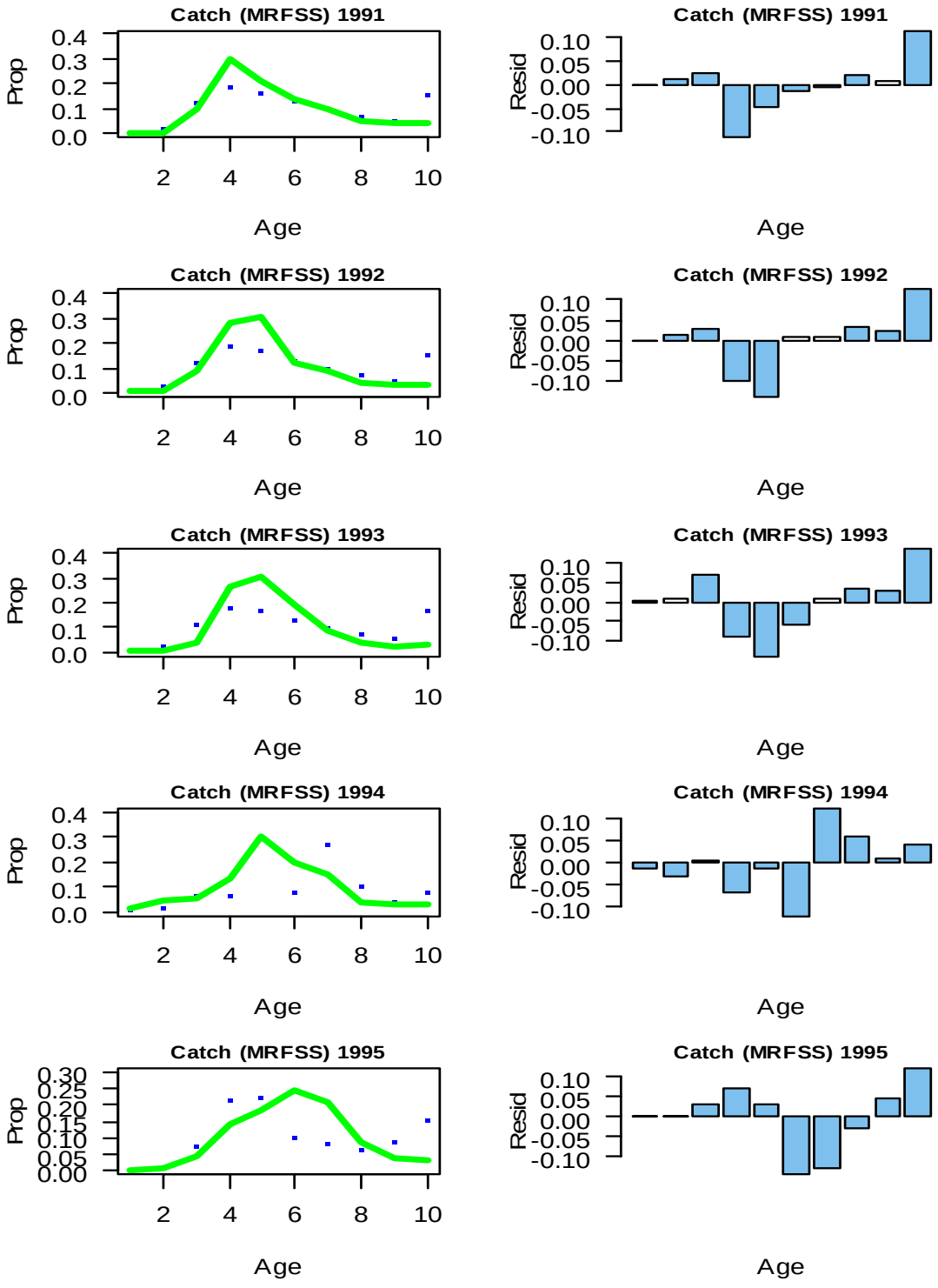


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

a. Gulf

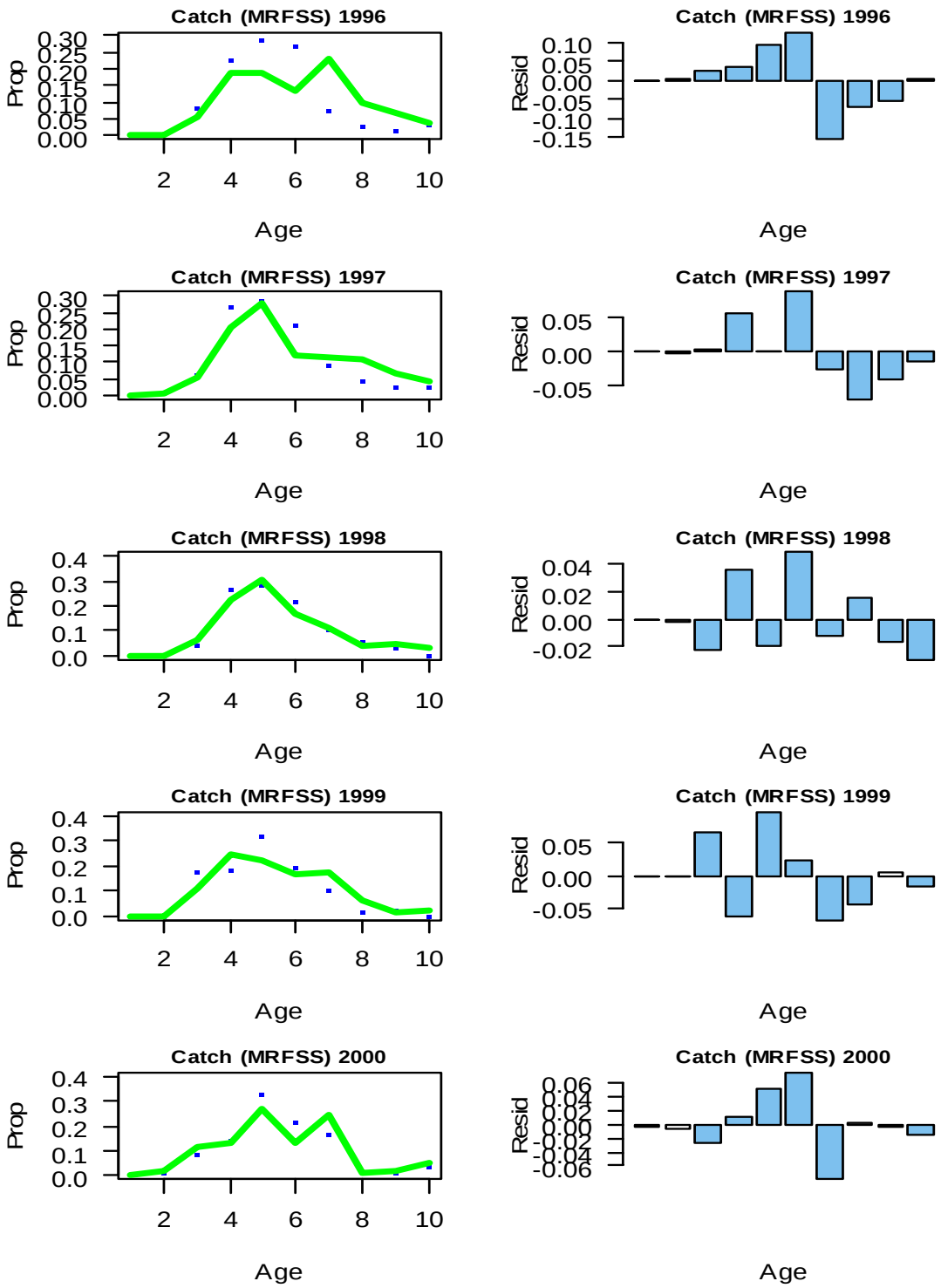


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

b. Gulf

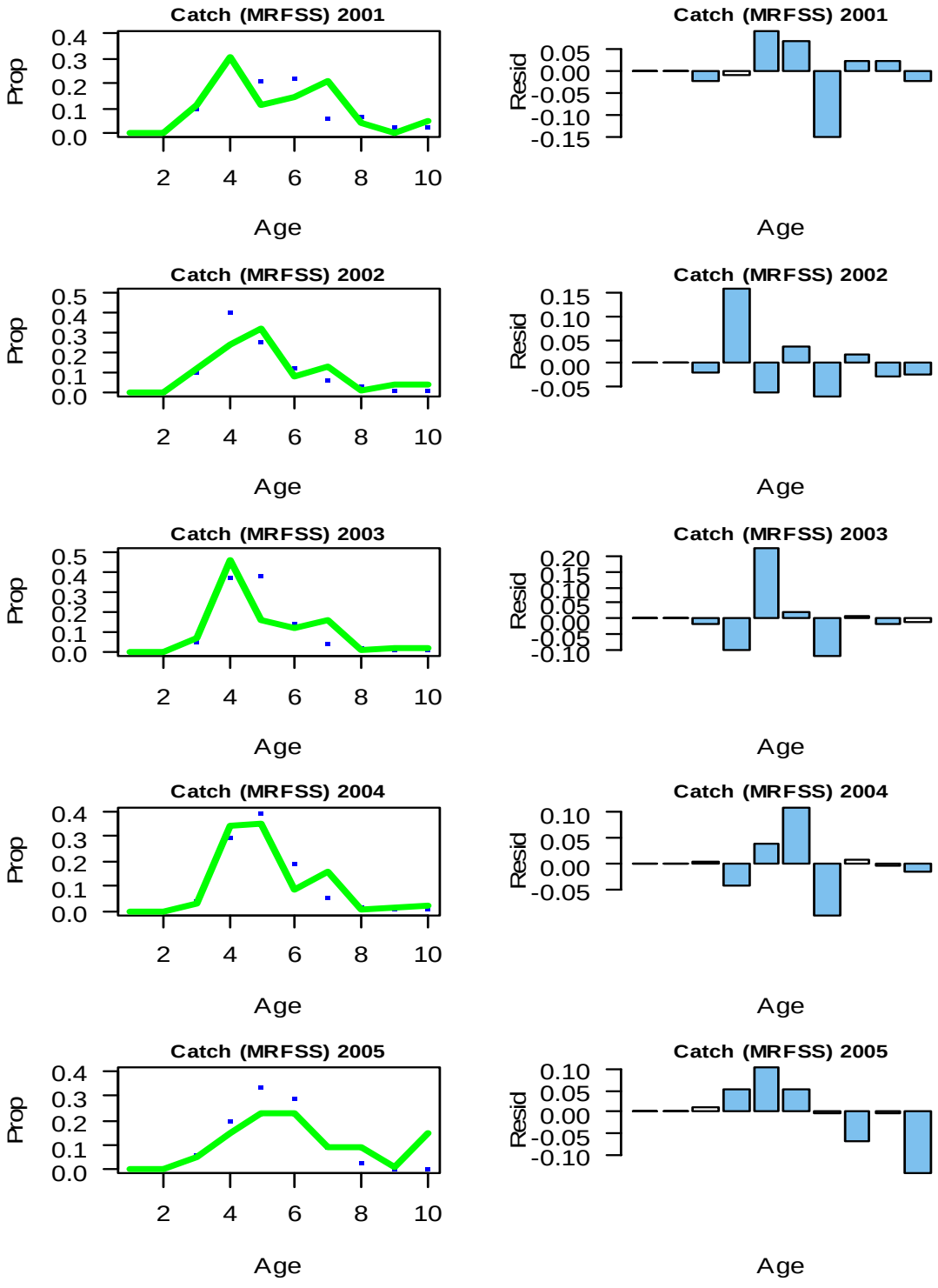


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

b. Gulf

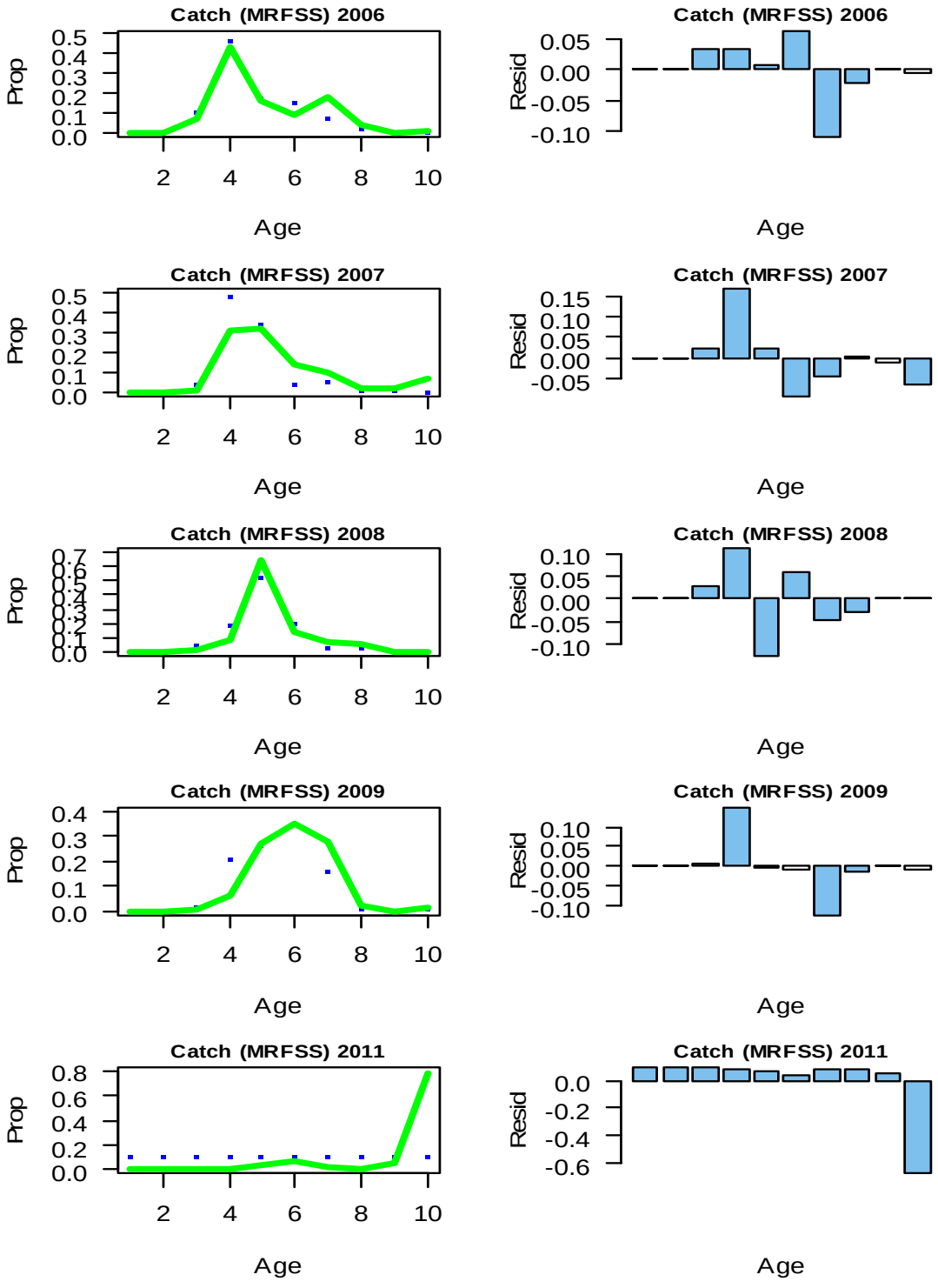


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

b. Gulf

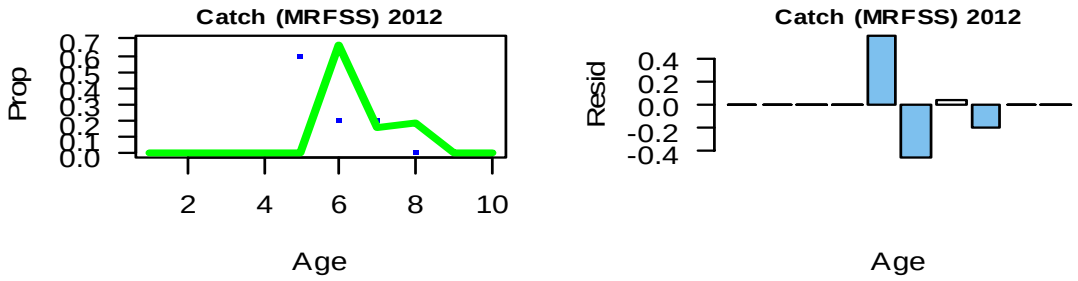


Figure 4.2.2.4.1.2 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of directed fishery from ASAP.

a. Atlantic

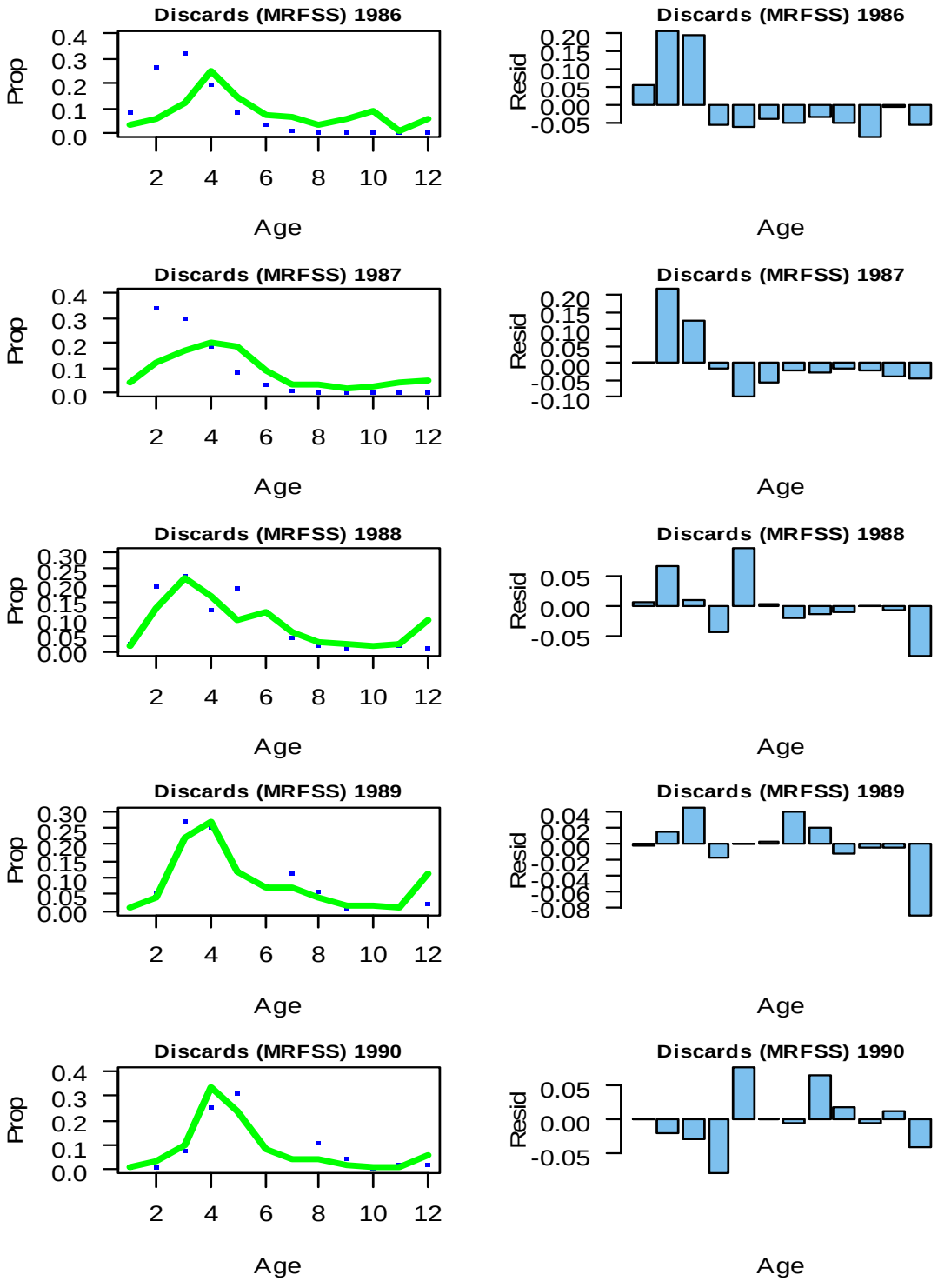


Figure 4.2.2.4.1.3. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

a. Atlantic

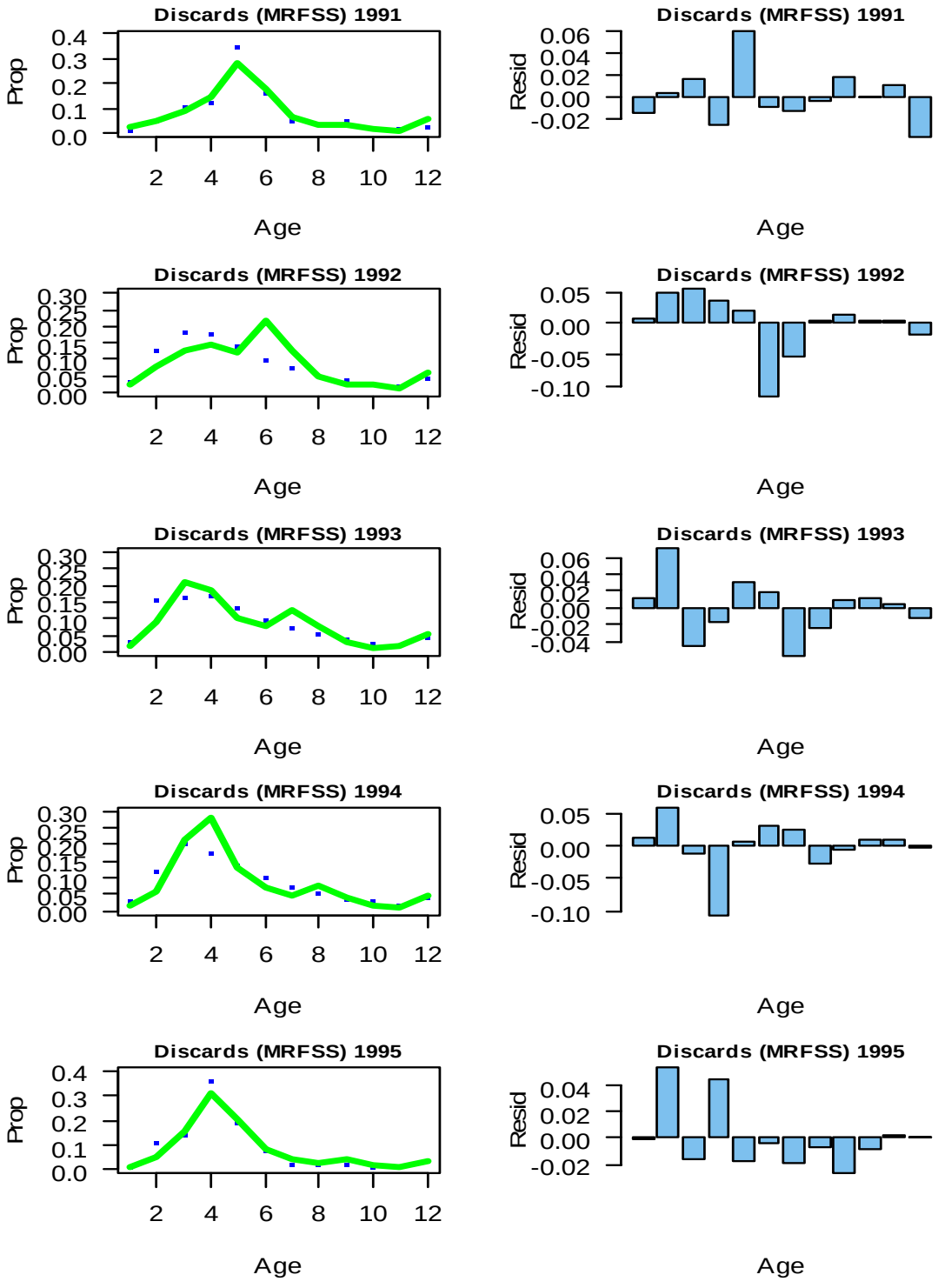


Figure 4.2.2.4.1.3 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

a. Atlantic

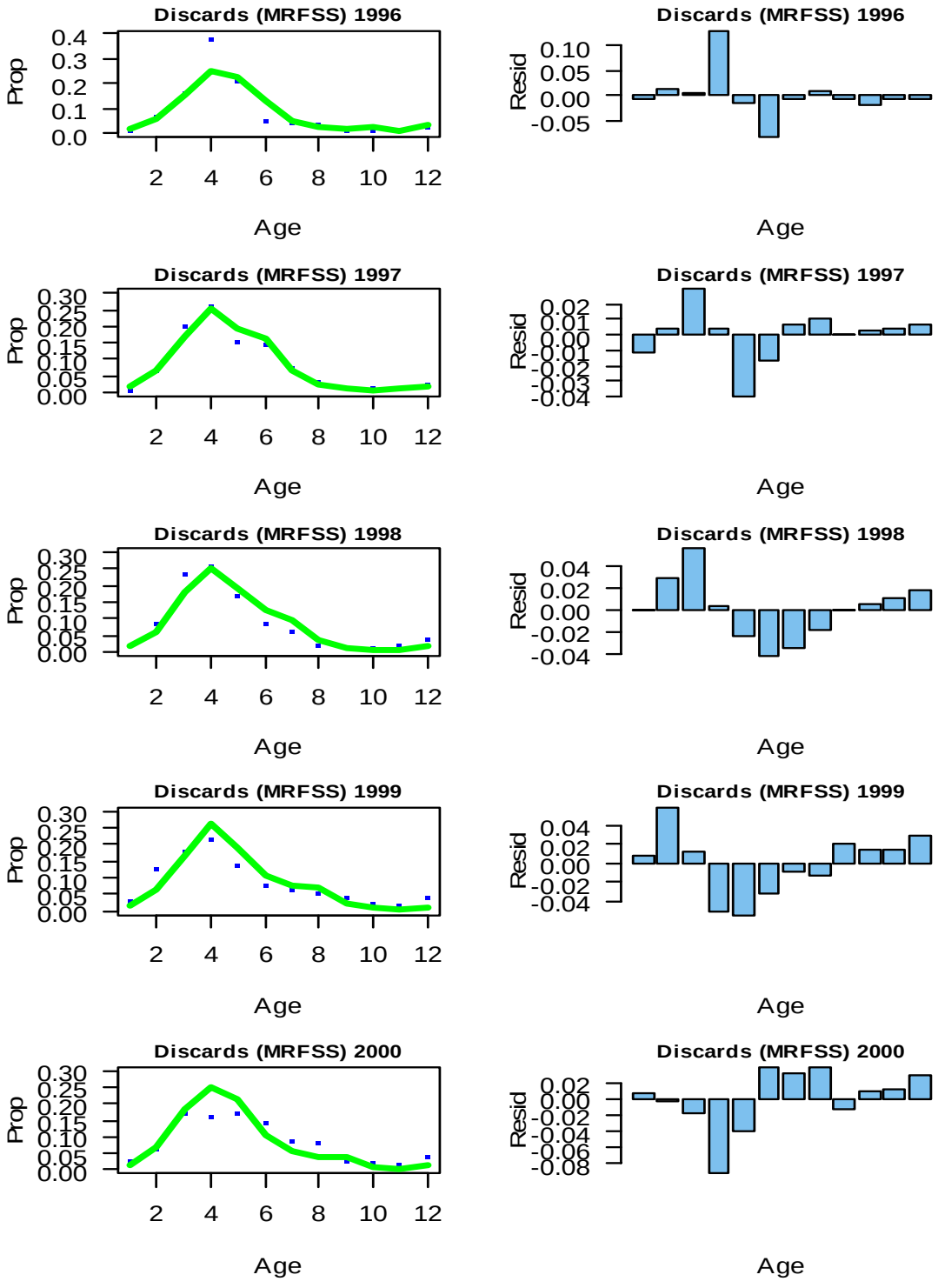


Figure 4.2.2.4.1.3 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

a. Atlantic

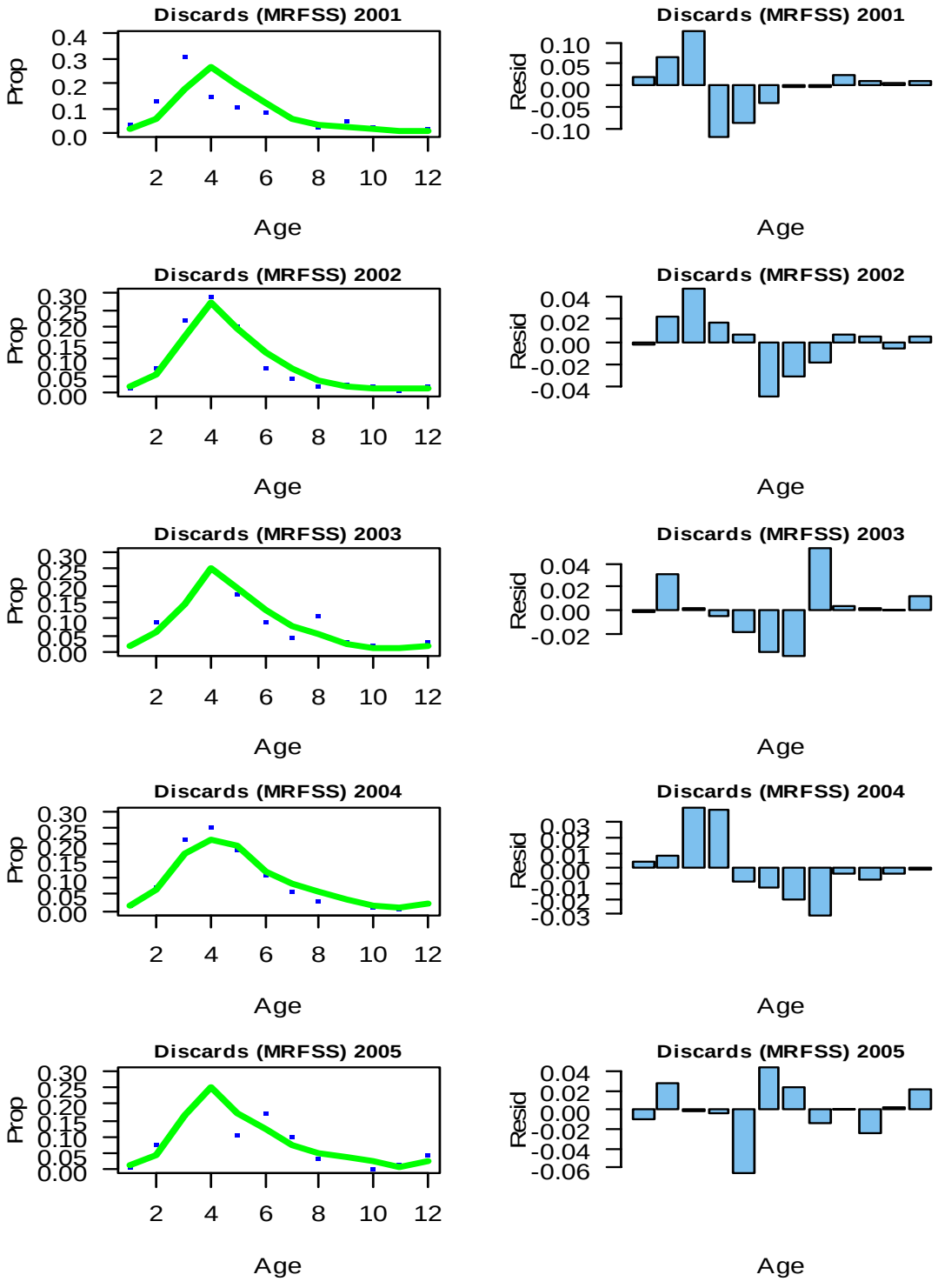


Figure 4.2.2.4.1.3 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

a. Atlantic

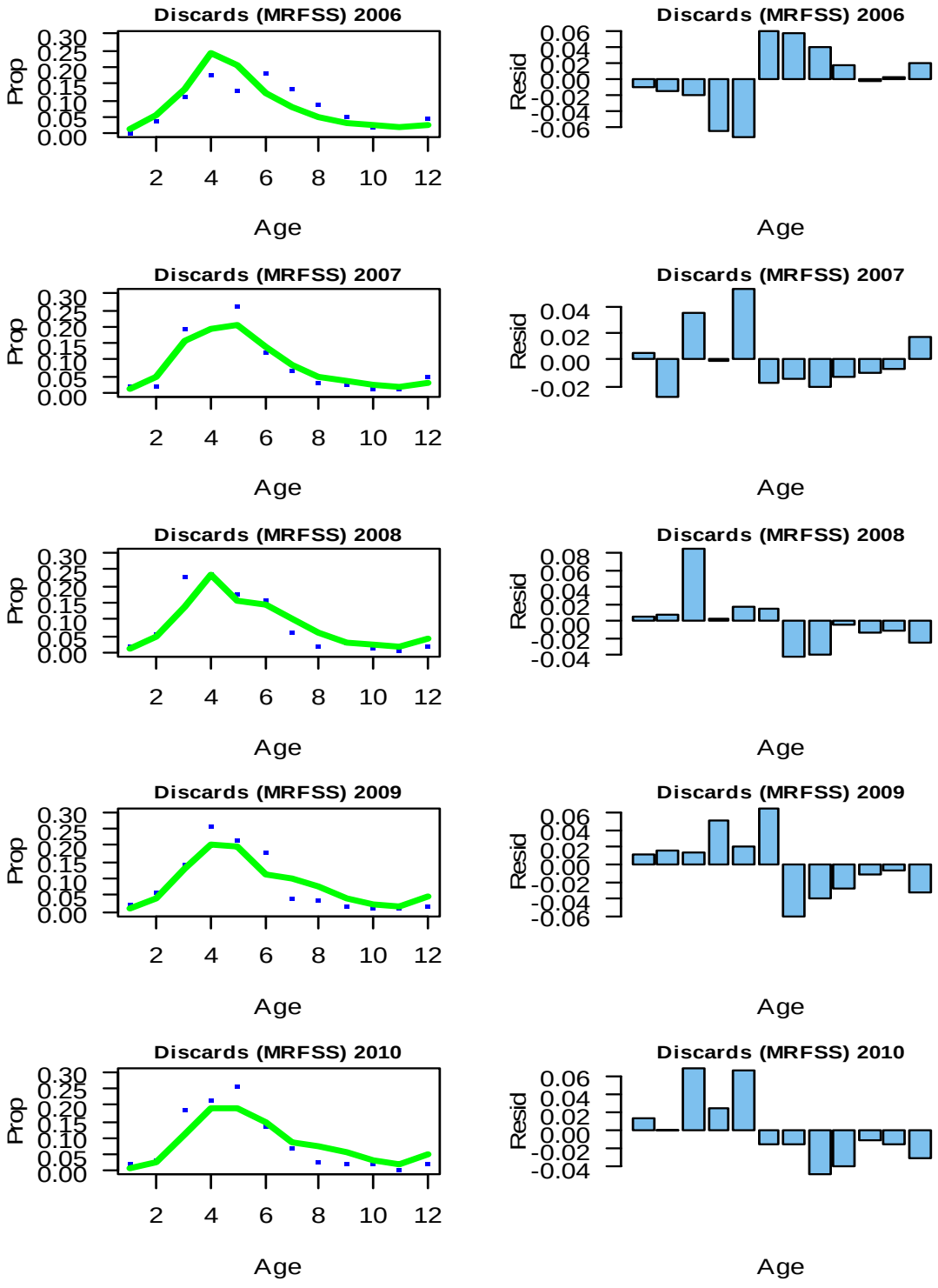


Figure 4.2.2.4.1.3 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

a. Atlantic

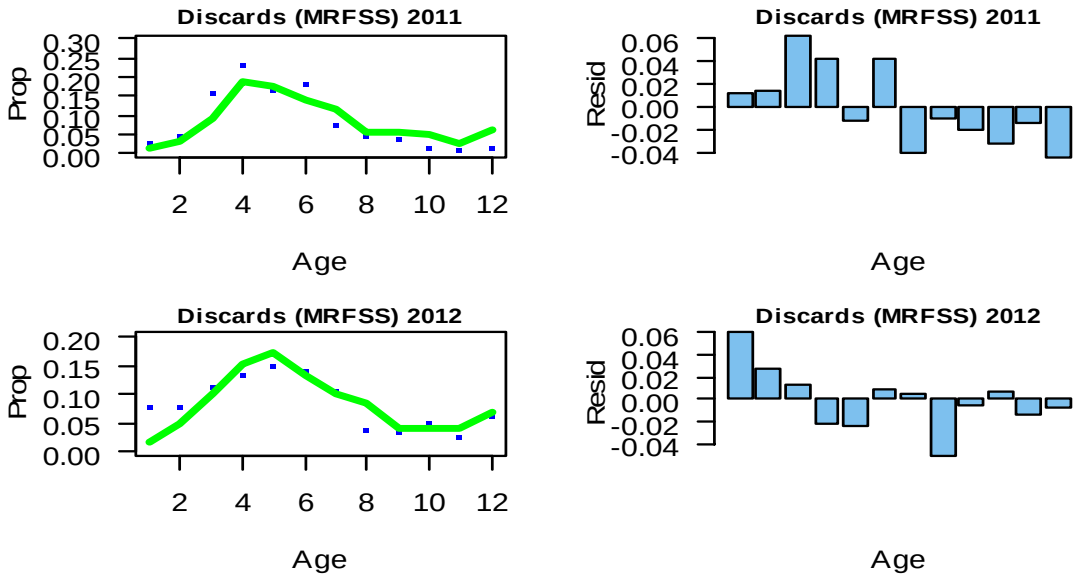


Figure 4.2.2.4.1.3 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

b. Gulf

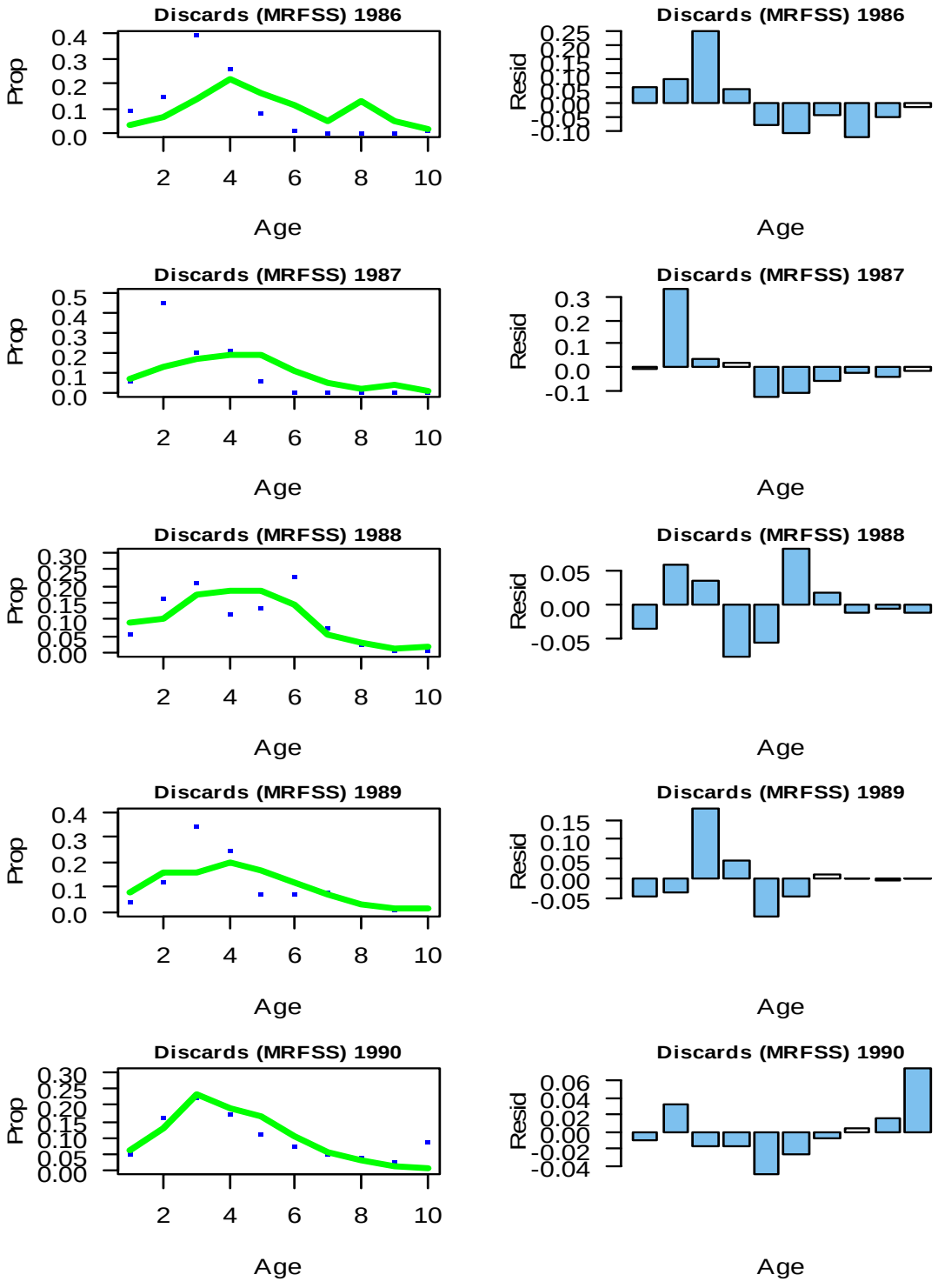


Figure 4.2.2.4.1.3 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

b. Gulf

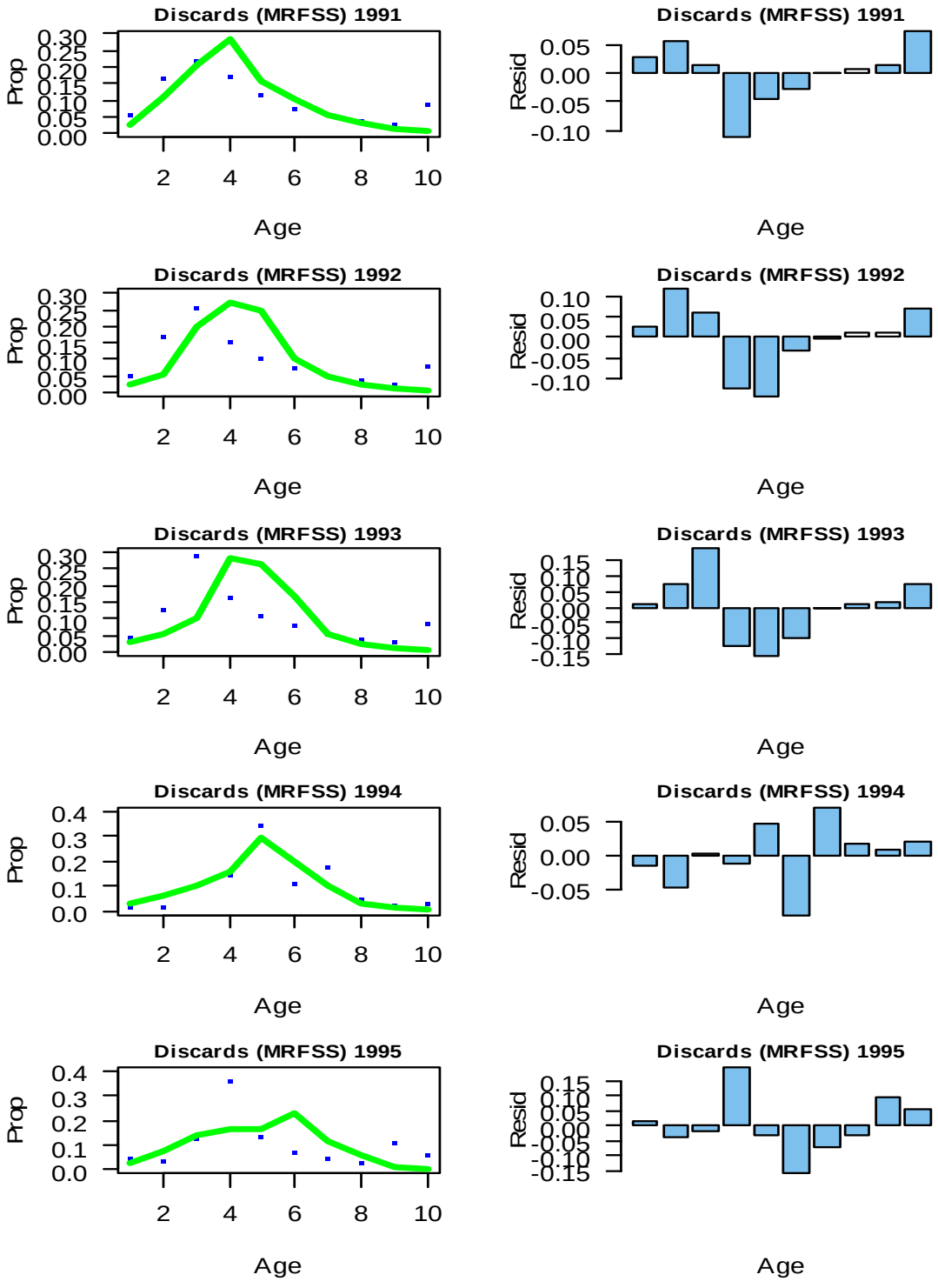


Figure 4.2.2.4.1.3. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

b. Gulf

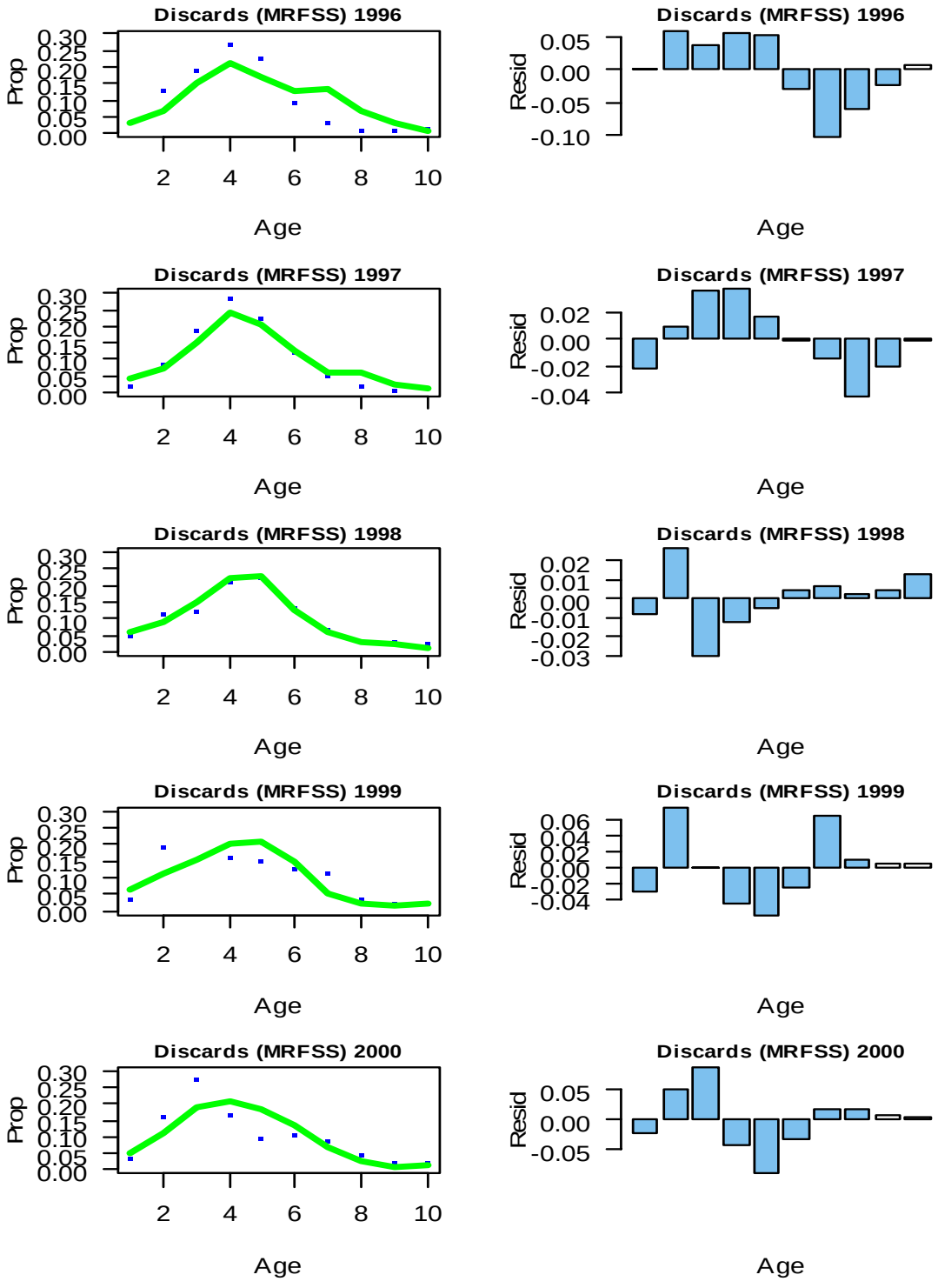


Figure 4.2.2.4.1.3 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

b. Gulf

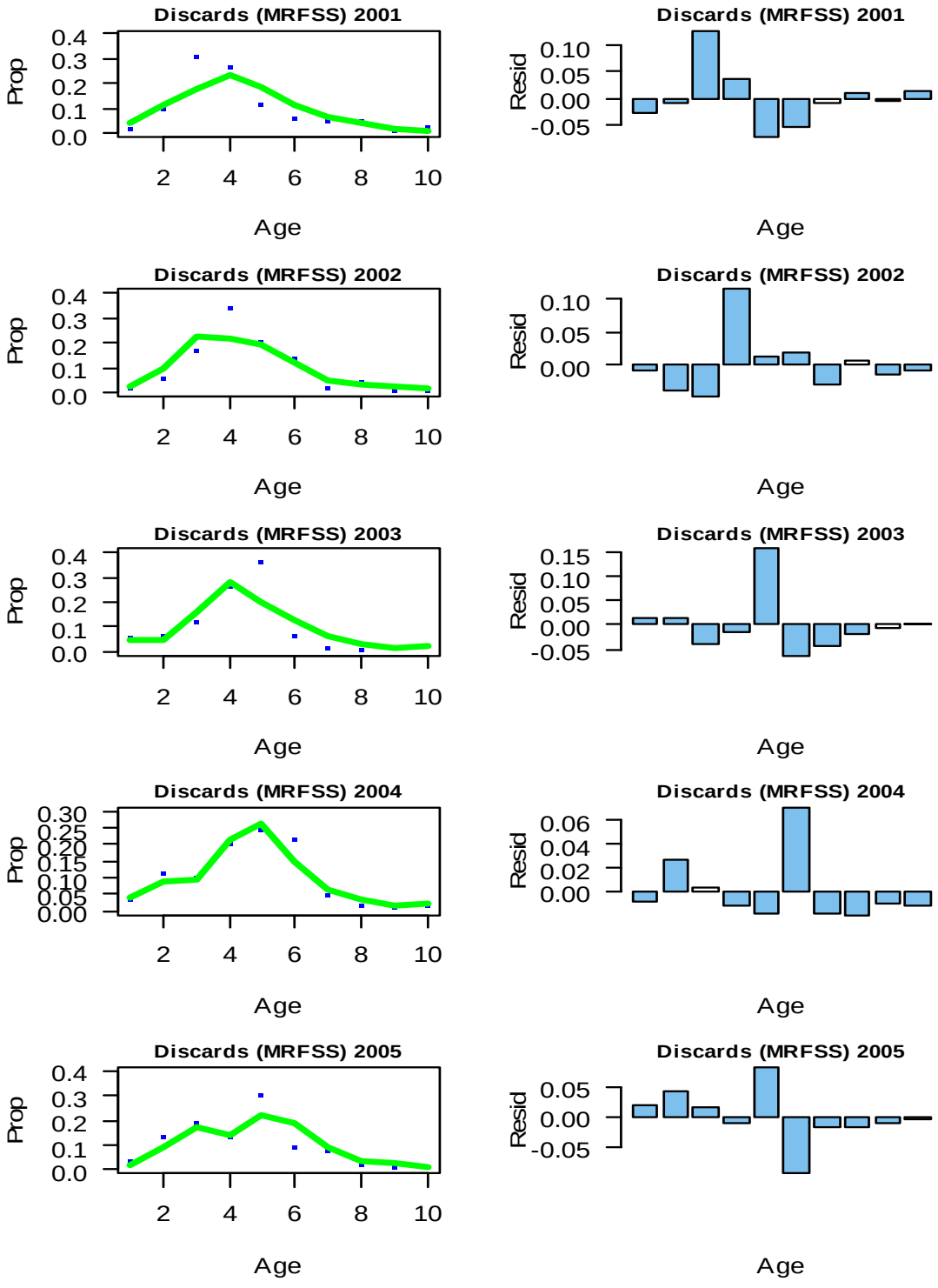


Figure 4.2.2.4.1.3 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

b. Gulf

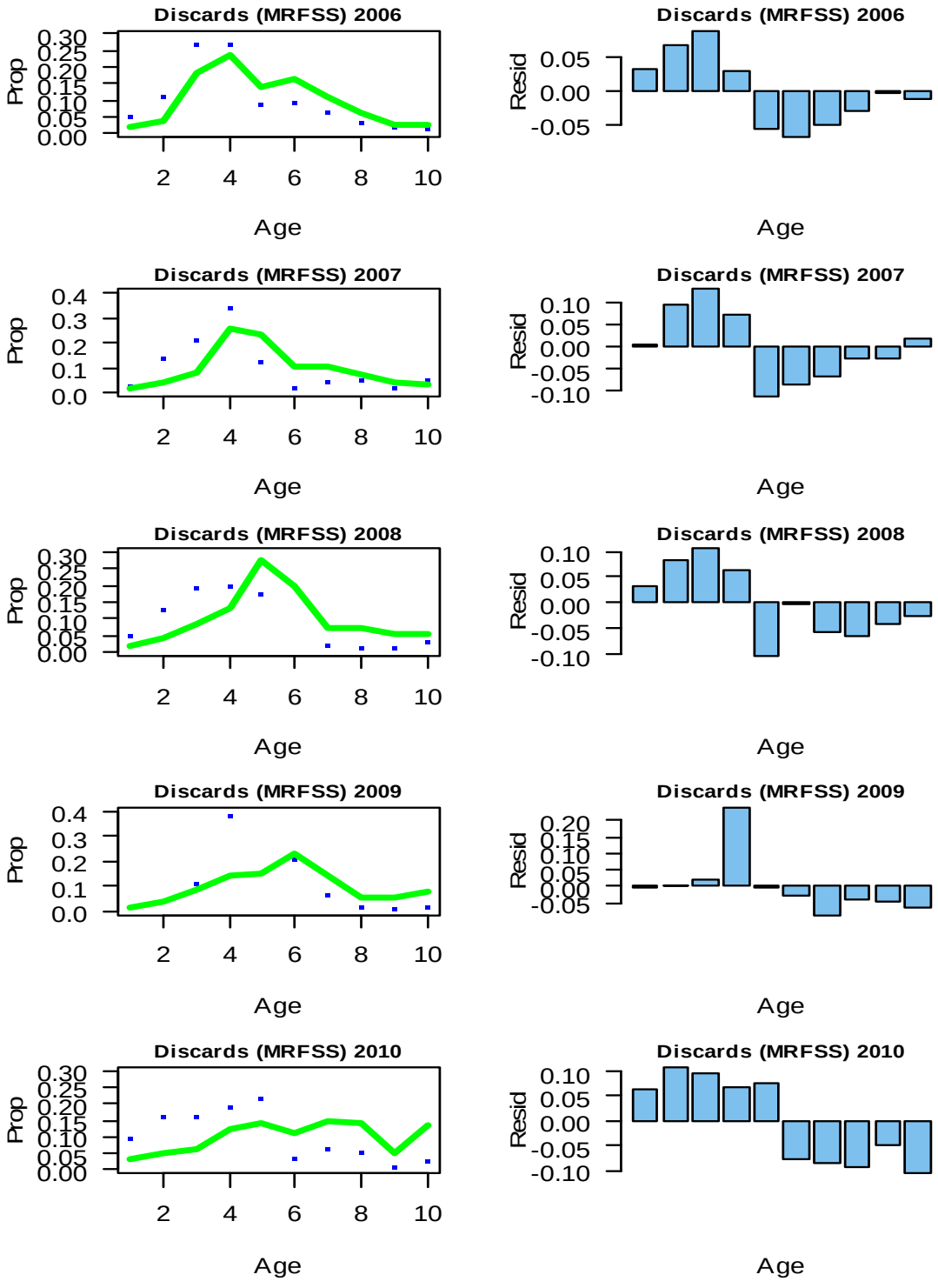


Figure 4.2.2.4.1.3 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

b. Gulf

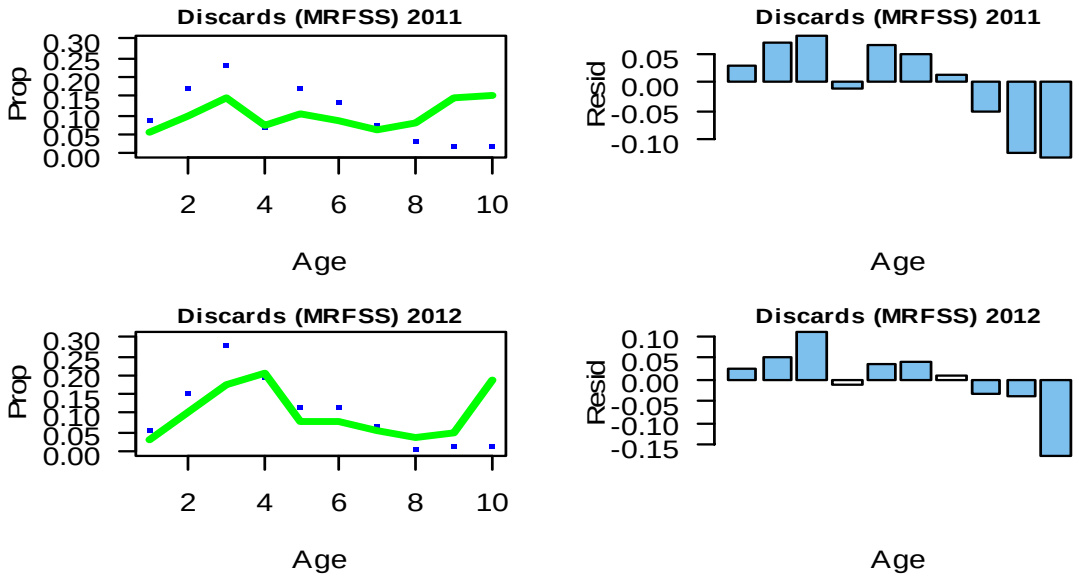


Figure 4.2.2.4.1.3 continued. Comparison of observed (ellipses) and predicted (line) proportion by age, year, and coast of dead discards from ASAP.

Atlantic

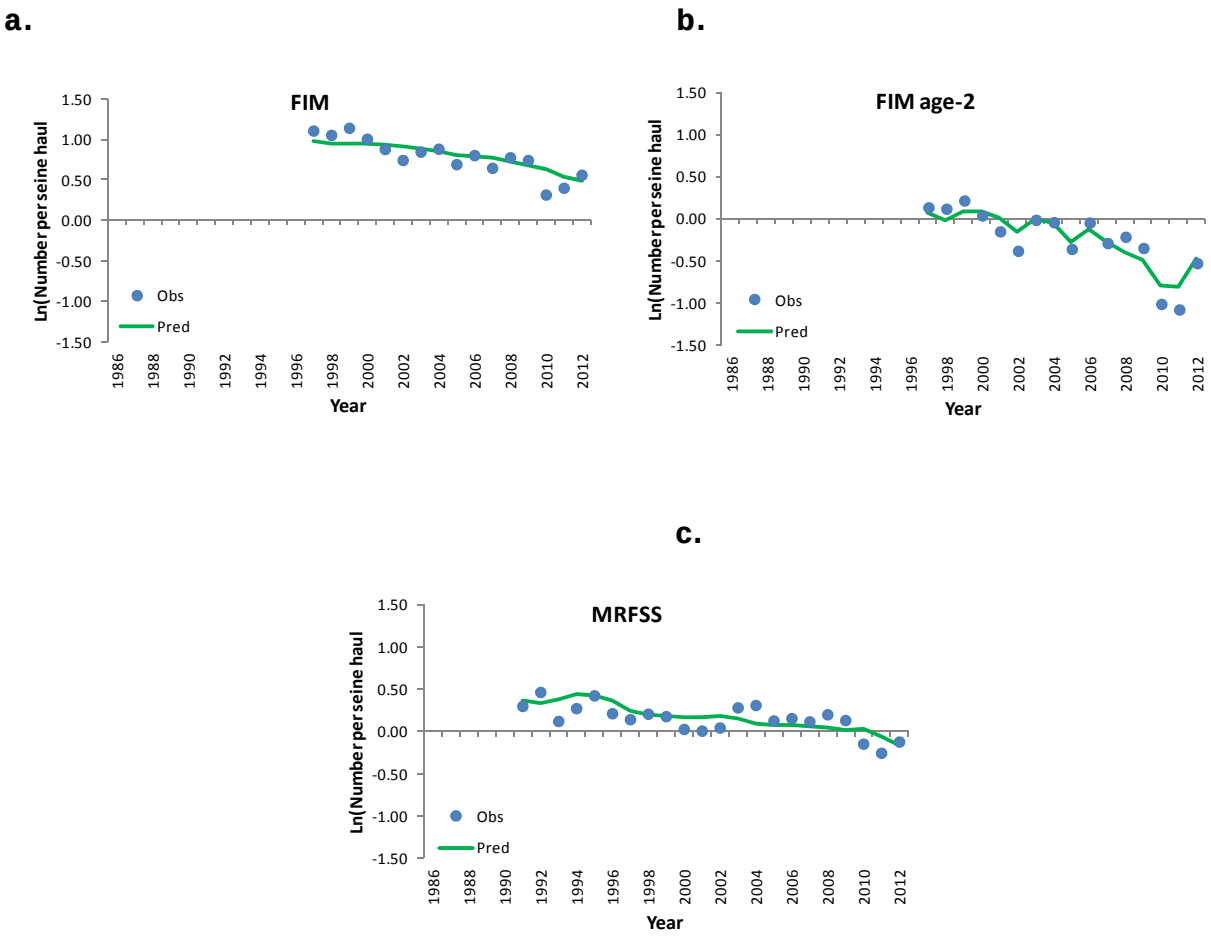
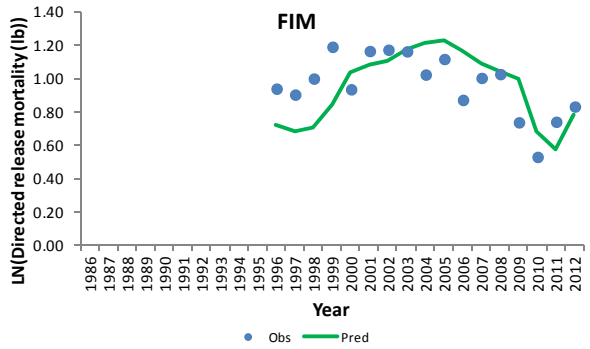


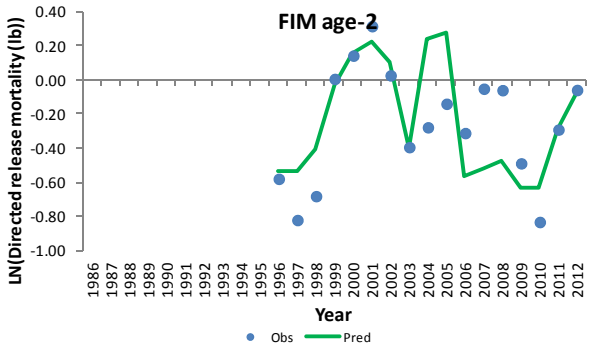
Figure 4.2.2.4.1.4. Comparison of observed (ellipses) and predicted (line) tuning index values by coast (Atlantic a-c and gulf d-g) from ASAP. All tuning indices were equally weighted in the analyses.

Gulf

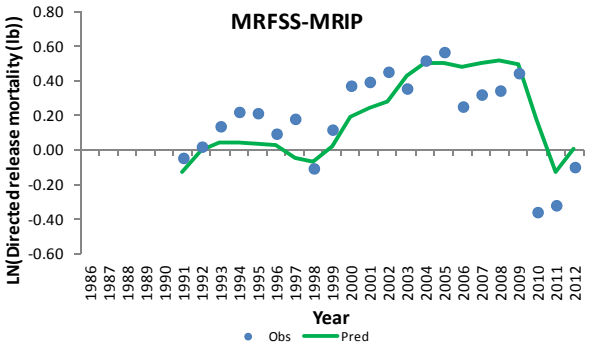
d.



e.



f.



g.

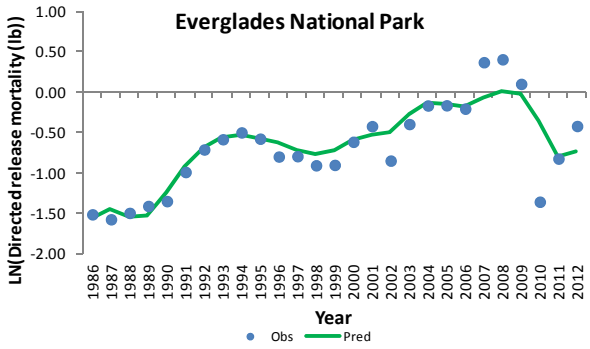
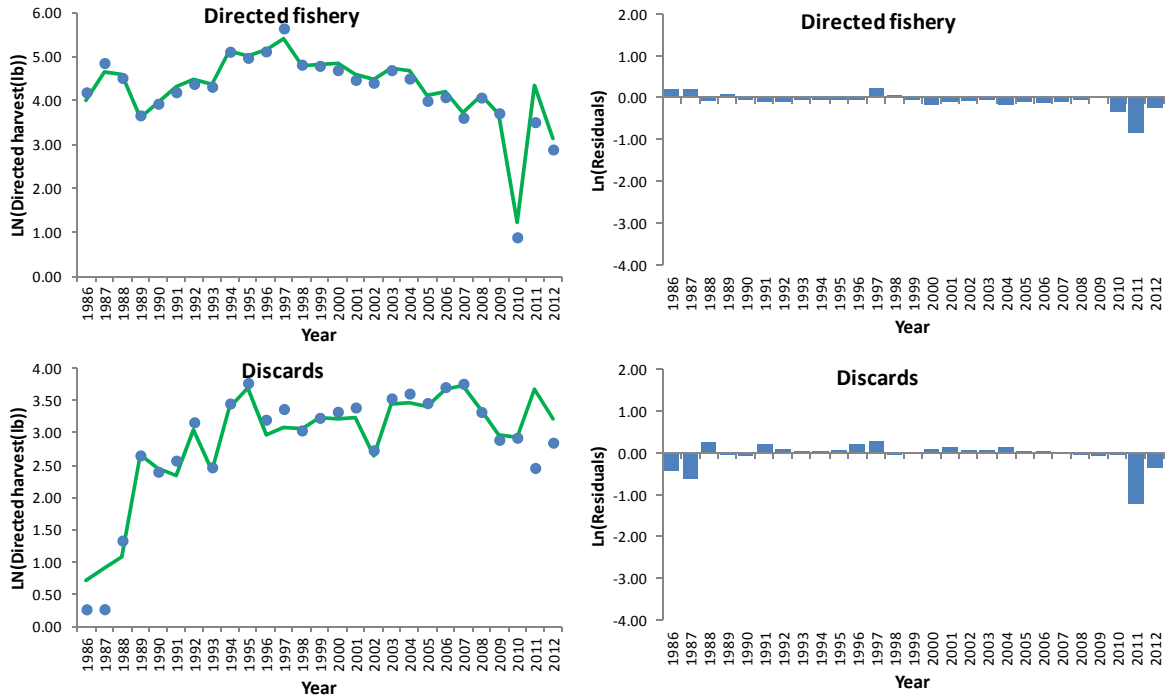


Figure 4.2.2.4.1.4 continued. Comparison of observed (ellipses) and predicted (line) tuning index values by coast (Atlantic a-c and gulf d-g) from ASAP. All tuning indices were equally weighted in the analyses.

a. Atlantic



b. Gulf

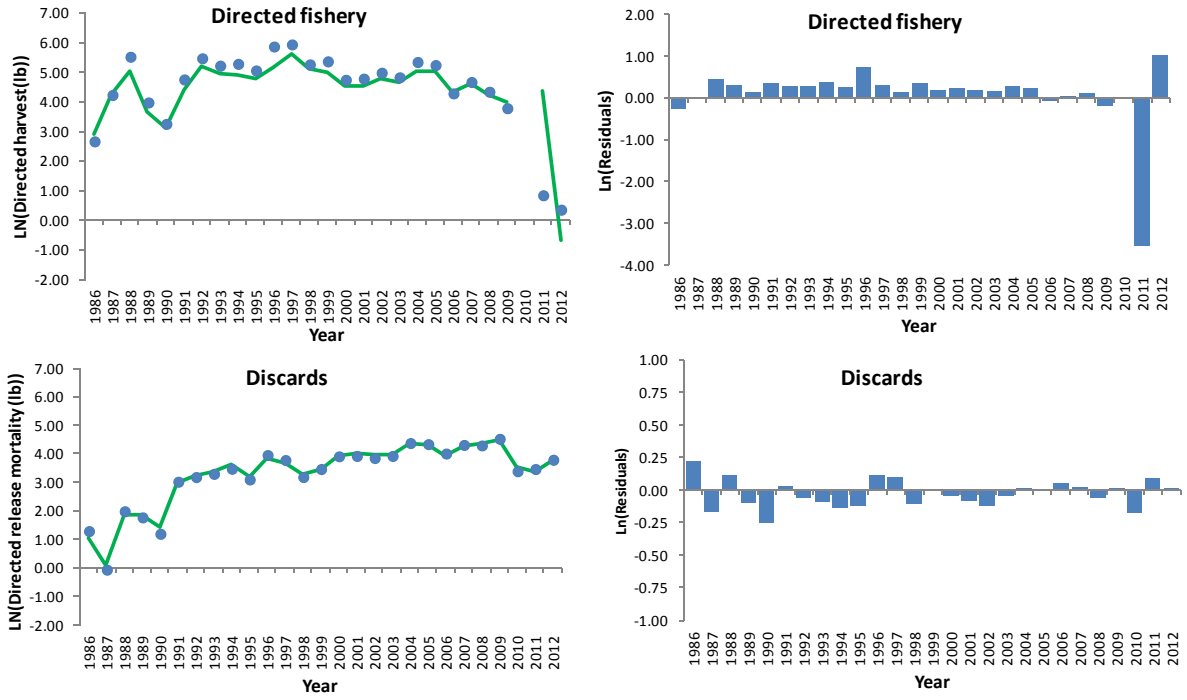
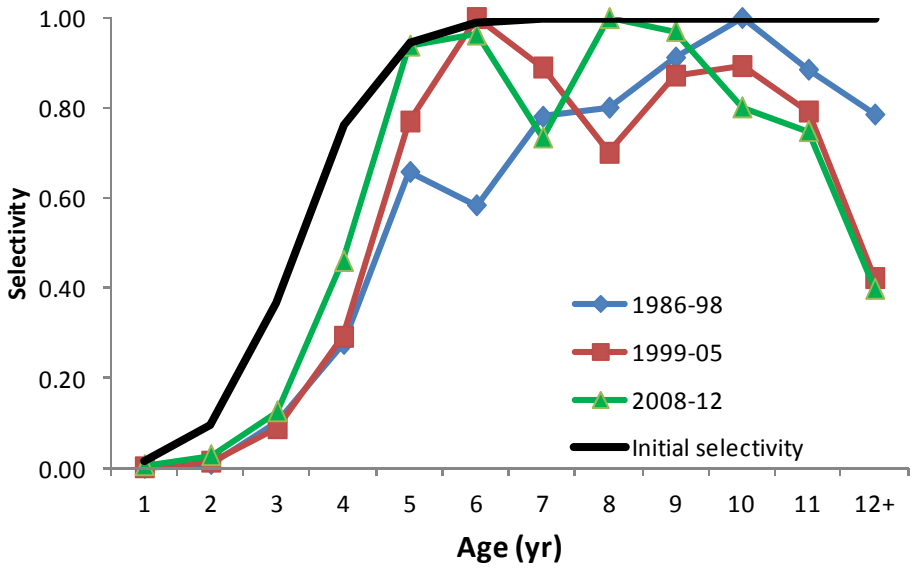


Figure 4.2.2.4.1.5. Comparison of observed (ellipses) and predicted (line) harvest and dead discards and the residuals by coast from ASAP.

a. Atlantic



b. Gulf

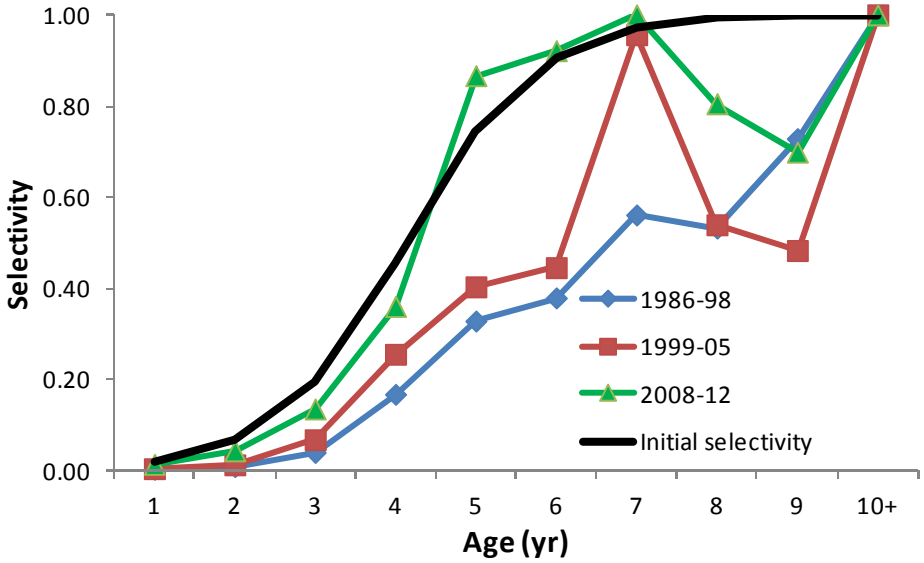
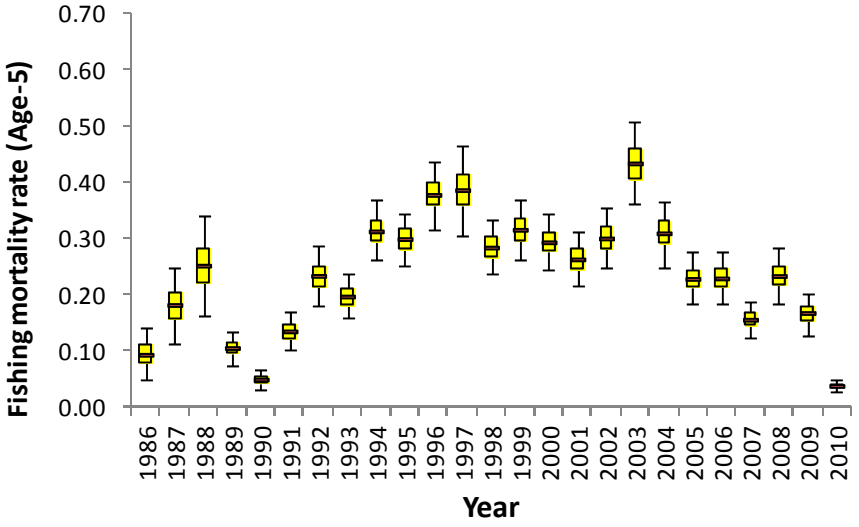


Figure 4.2.2.4.2. Normalized average age-specific selectivities from the estimated fishing mortality rates from ASAP by coast for before (1986-1998) and after implementing slot limits (1999-05 and 2008-12).

a. Atlantic



b. Gulf

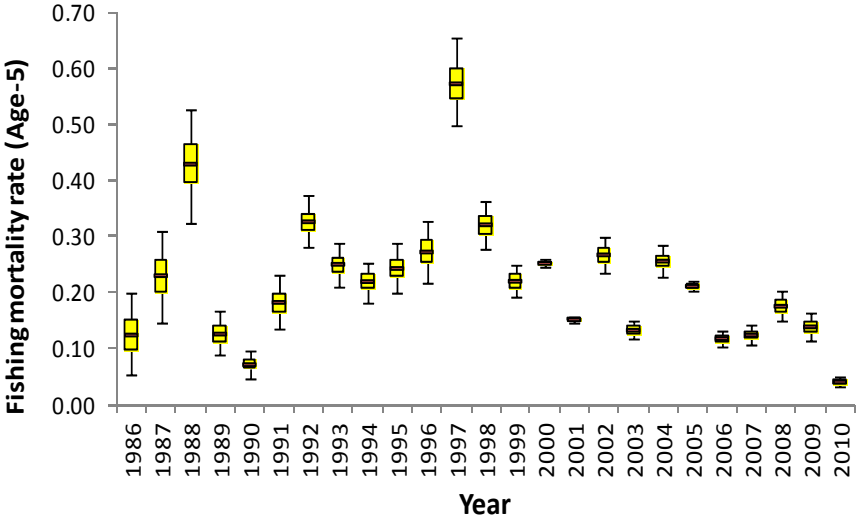
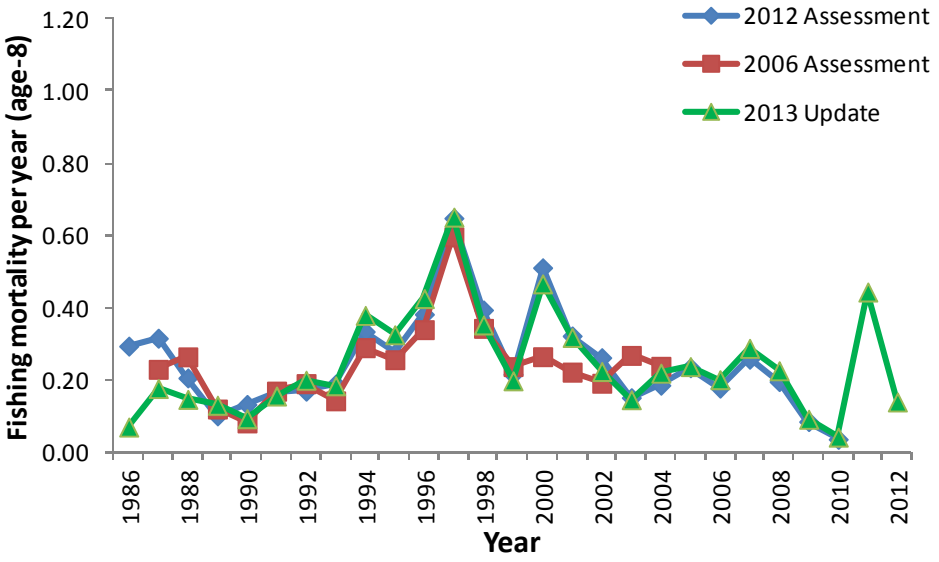


Figure 4.2.2.4.3.1. Distribution of annual fishing mortality rates per year for age-8 on the Atlantic coast and age-7 on the gulf coast estimated from ASAP with 5,000 Monte Carlo simulations. The horizontal line is the median estimate; the box is the inter-quartile range, and the vertical line is the 95% confidence interval.

a. Atlantic



b. Gulf

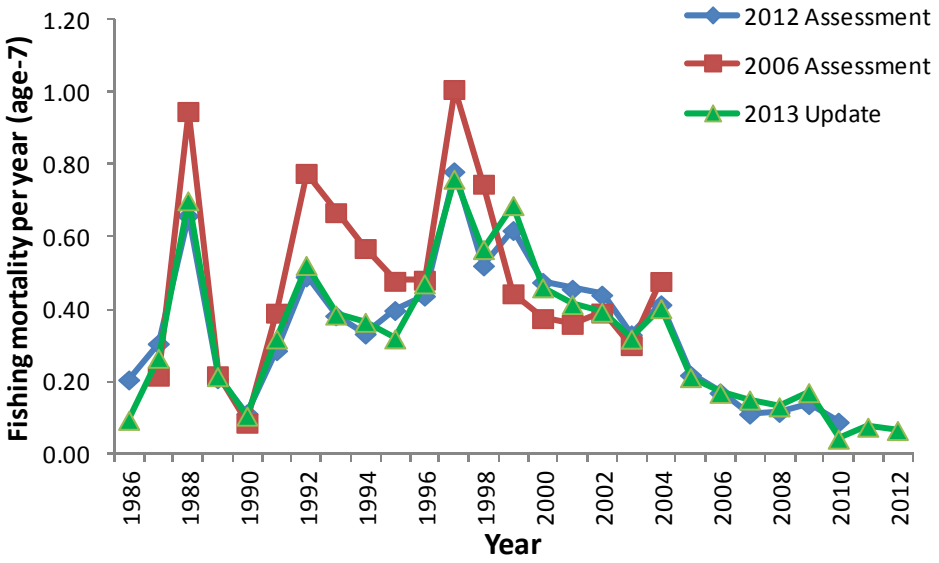
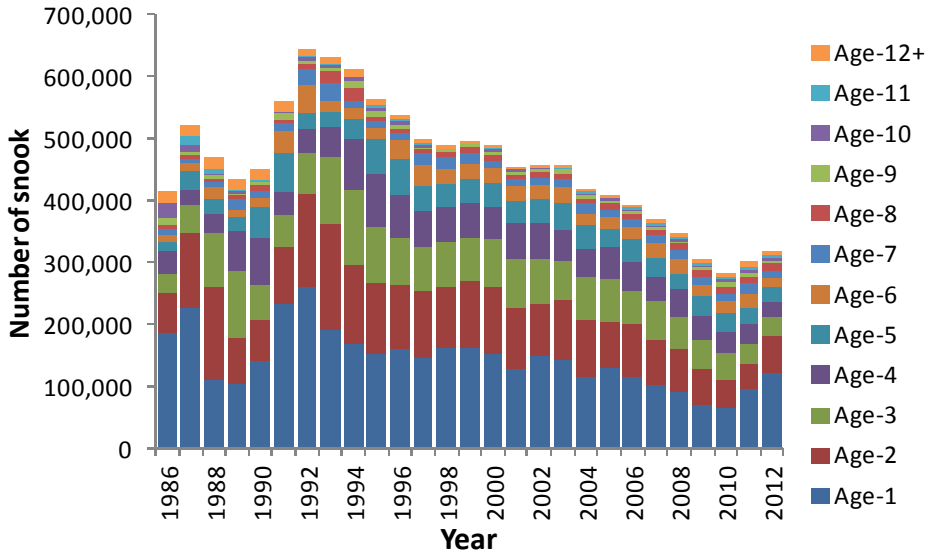


Figure 4.2.2.4.3.2. Comparison of fishing mortality rates estimated by ASAP for the 2006 and 2012 stock assessments and this update by year and coast: Atlantic (a) and gulf (b).

a. Atlantic



b. Gulf

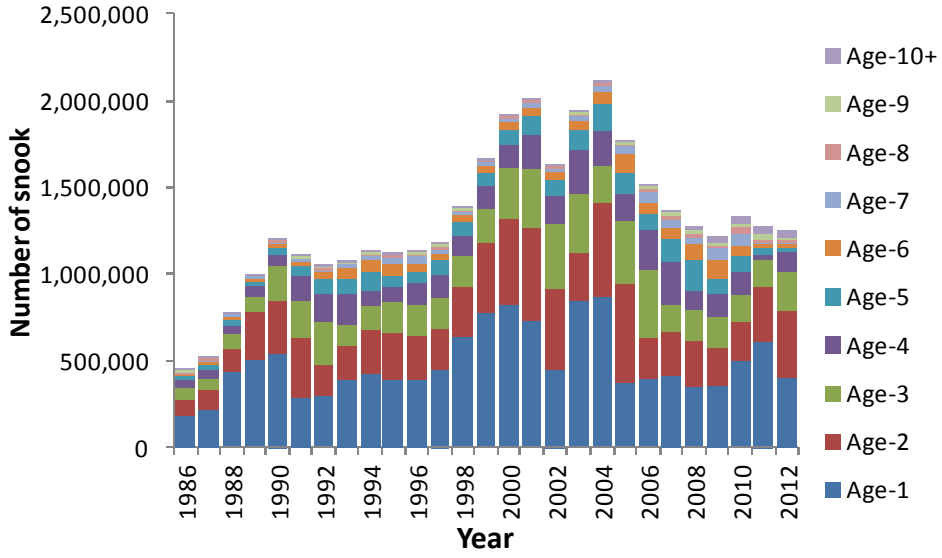
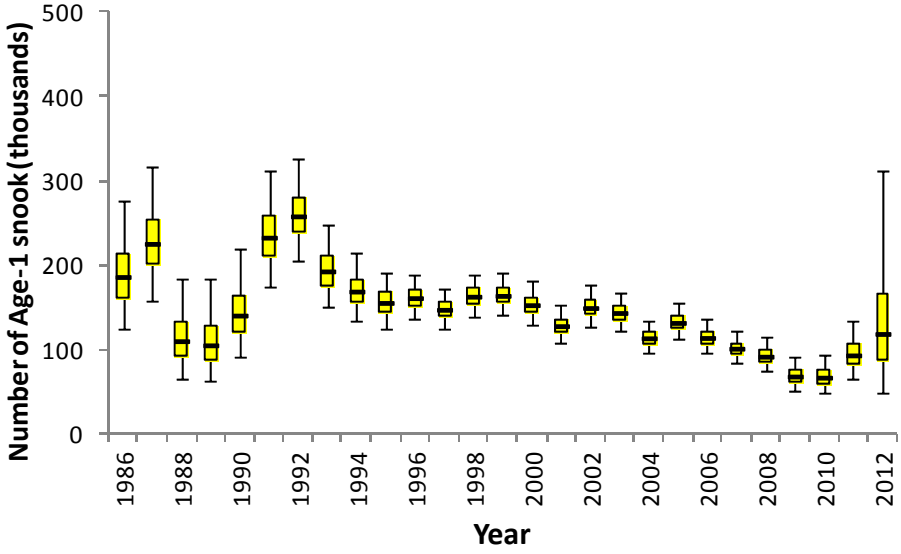


Figure 4.2.2.4.4.1. Estimated total numbers of snook by coast and year from ASAP.

a. Atlantic



b. Gulf

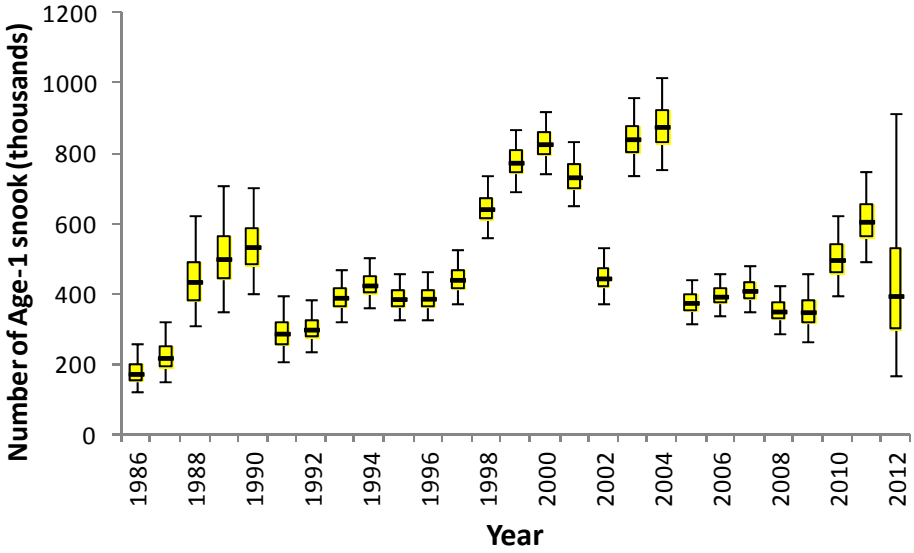
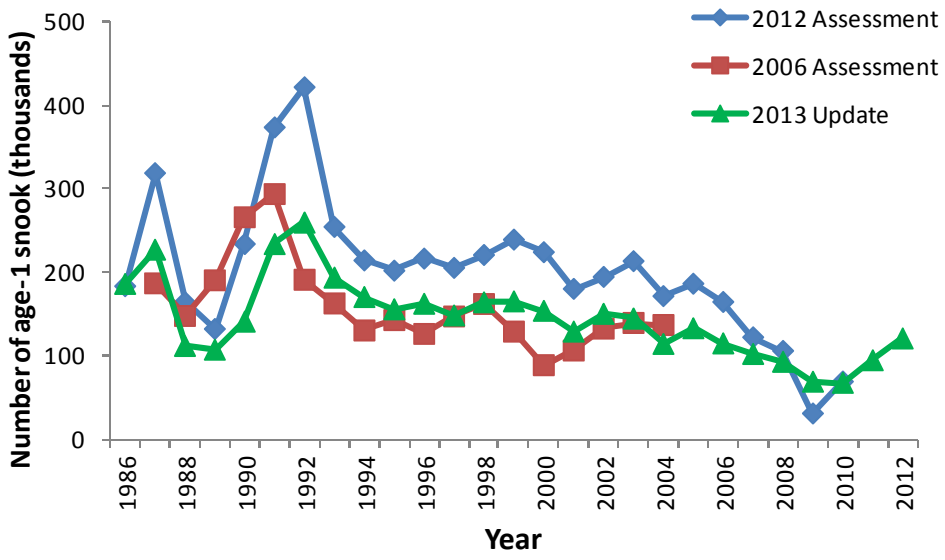


Figure 4.2.2.4.4.2. Distribution of recruitment of age-1 snook by coast and year estimated from ASAP with 5,000 Monte Carlo simulations. The horizontal line is the median estimate; the box is the inter-quartile range, and the vertical line is the 95% confidence interval. Note that the vertical scales are different between the coasts.

a. Atlantic



b. Gulf

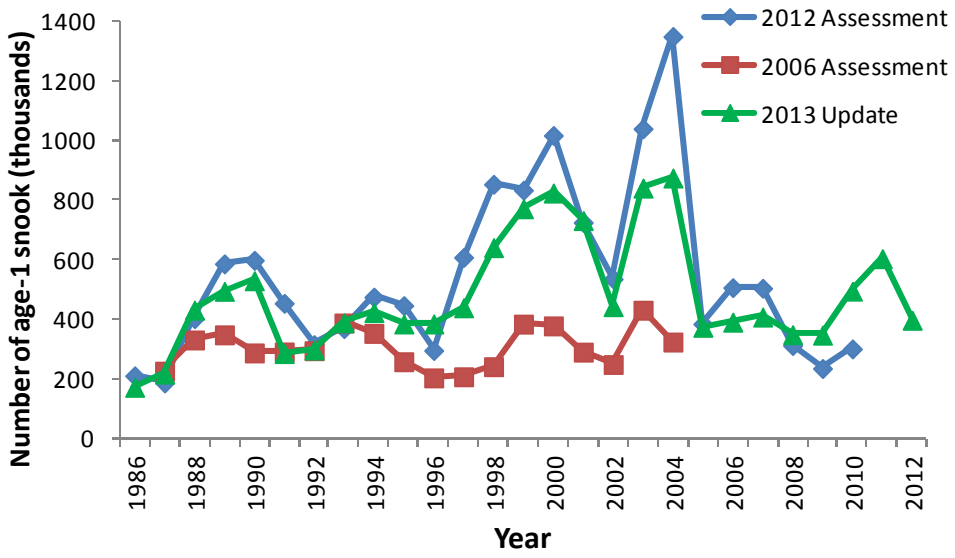
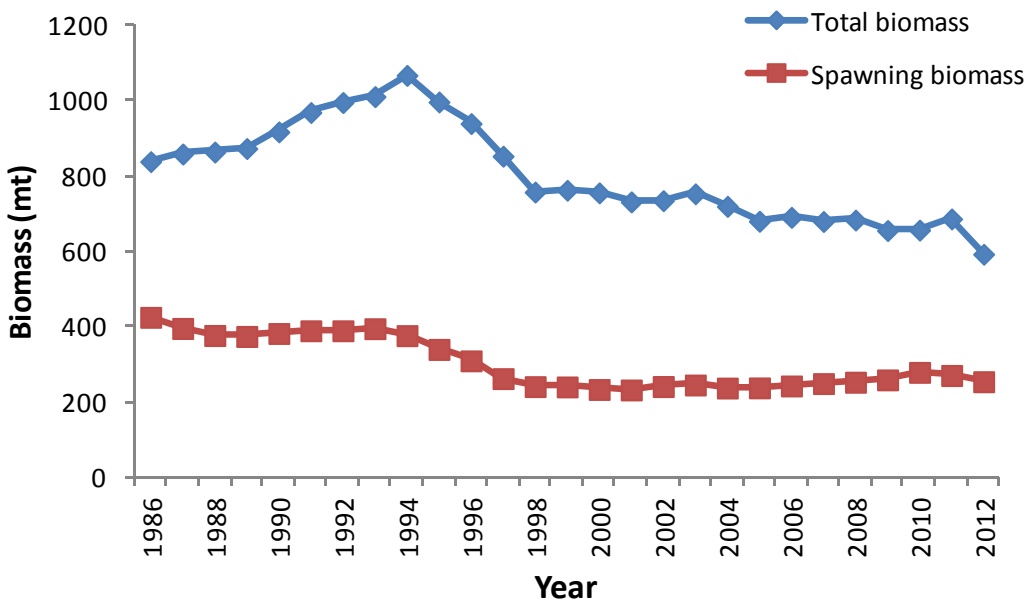


Figure 4.2.2.4.4.3. Comparison of recruitment (number of age-1 snook) by year and coast estimated from ASAP: Atlantic (a) and gulf (b). Note that the vertical scales differ by coast.

a. Atlantic



b. Gulf

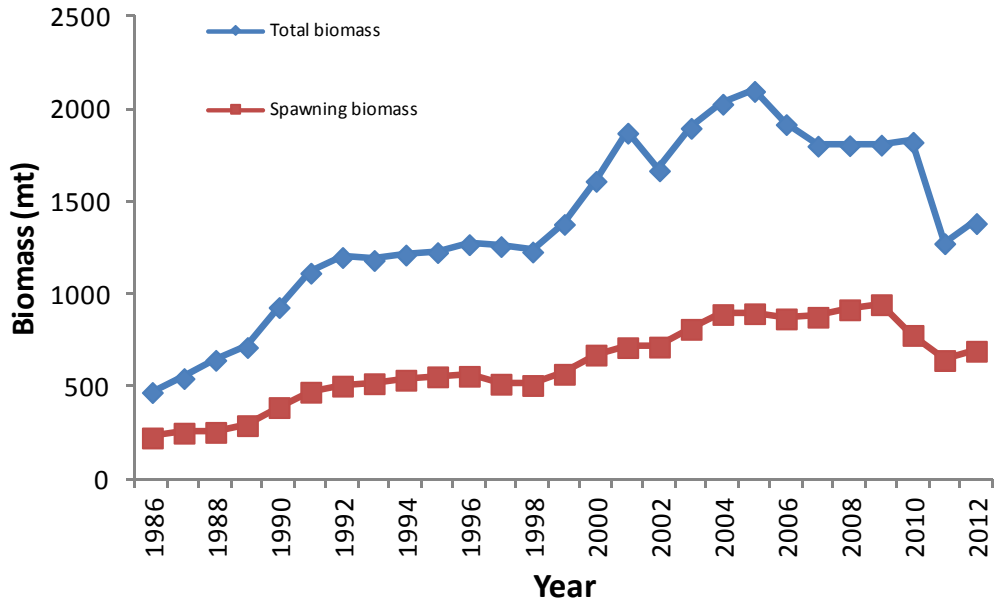
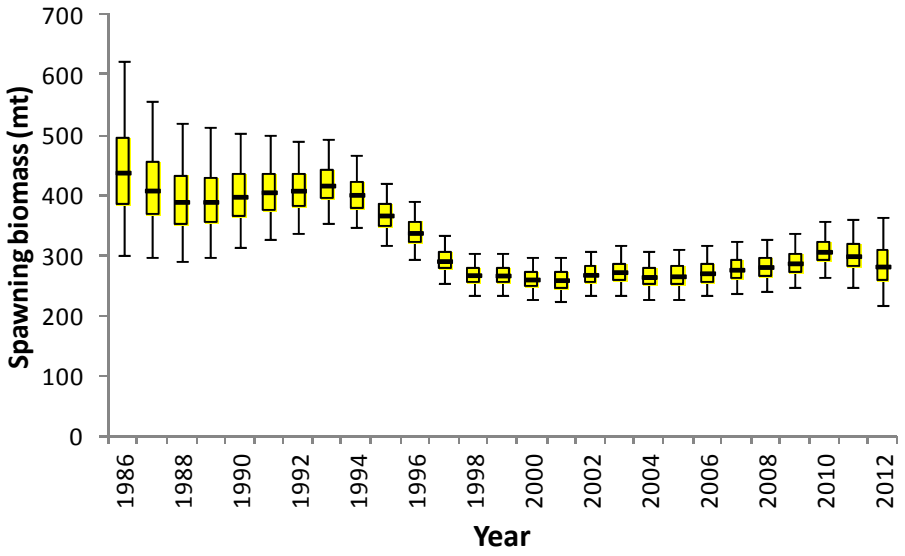


Figure 4.2.2.4.5.1. Estimated total and spawning biomass by coast and year. Note that the vertical scales are different between the coasts.

a. Atlantic



b. Gulf

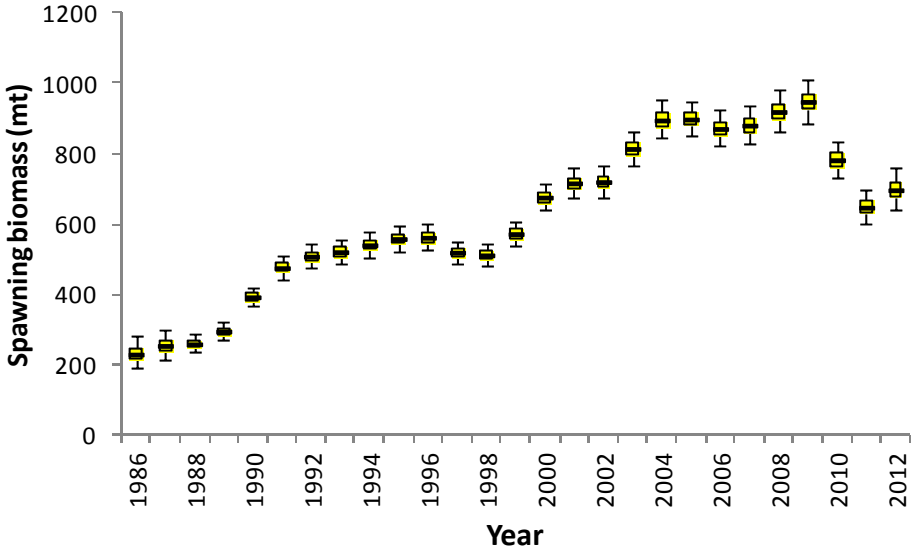
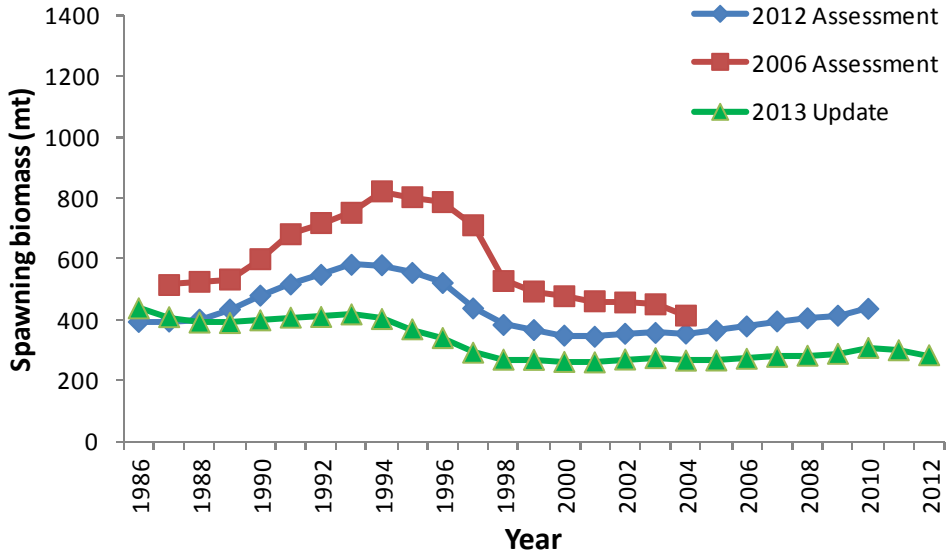


Figure 4.2.2.4.5.2. Distribution of spawning biomass by coast and year estimated from ASAP with 5,000 Monte Carlo simulations. The horizontal line is the median estimate; the box is the inter-quartile range, and the vertical line is the 95% confidence interval. Note that the vertical scales are different between the coasts.

a. Atlantic



b. Gulf

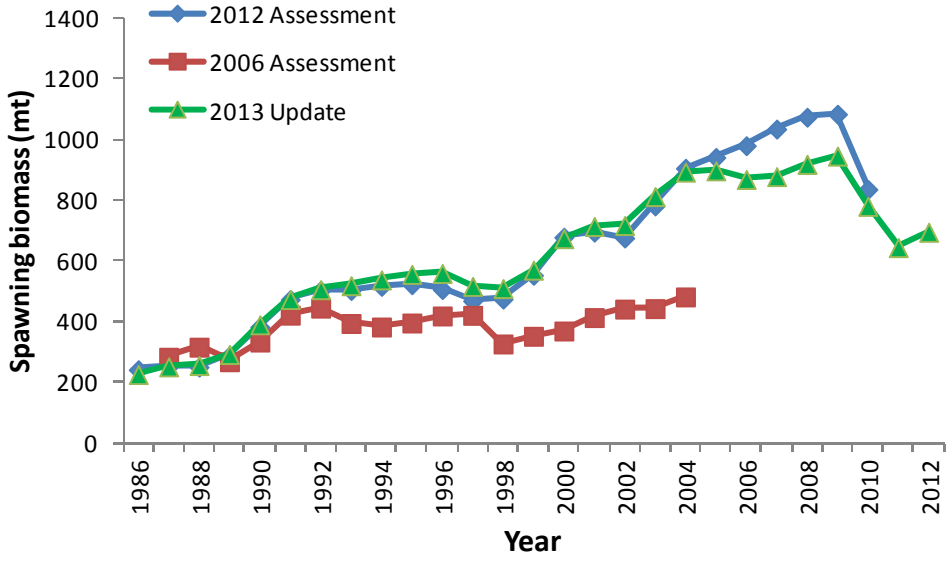
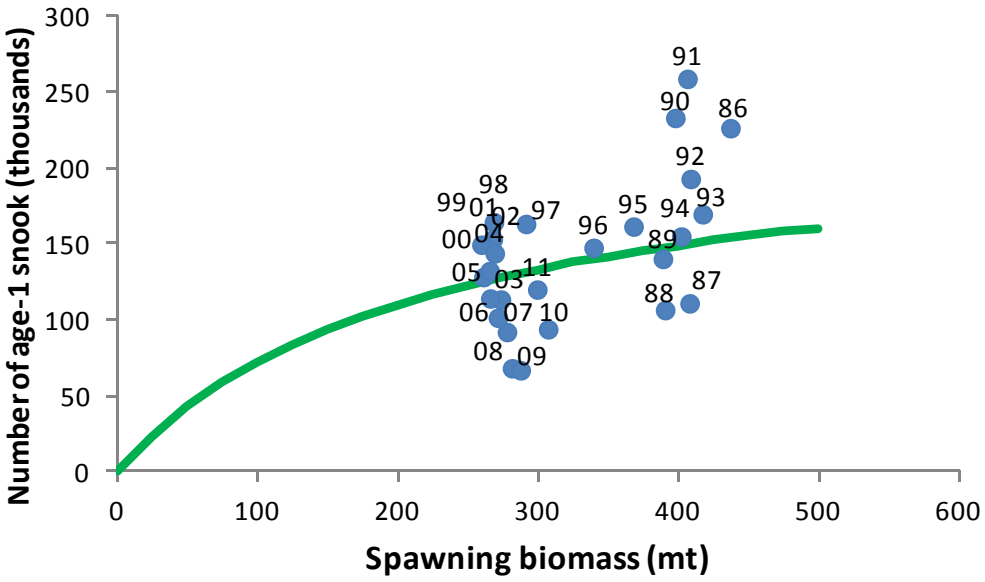


Figure 4.2.2.4.5.3. Comparison of the spawning biomass by year and coast estimated from ASAP from the 2006 and 2012 assessments and this update.

a. Atlantic



b. Gulf

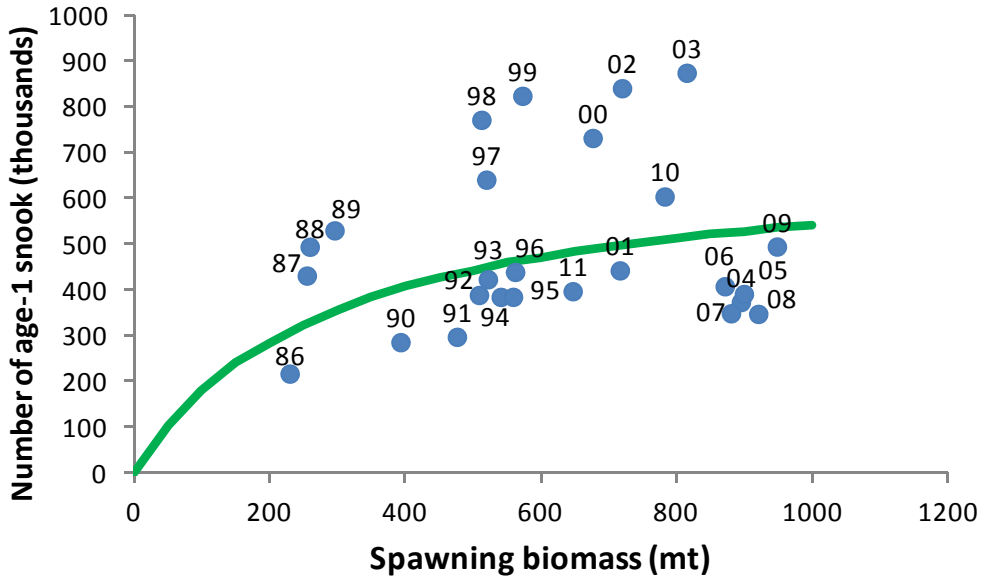
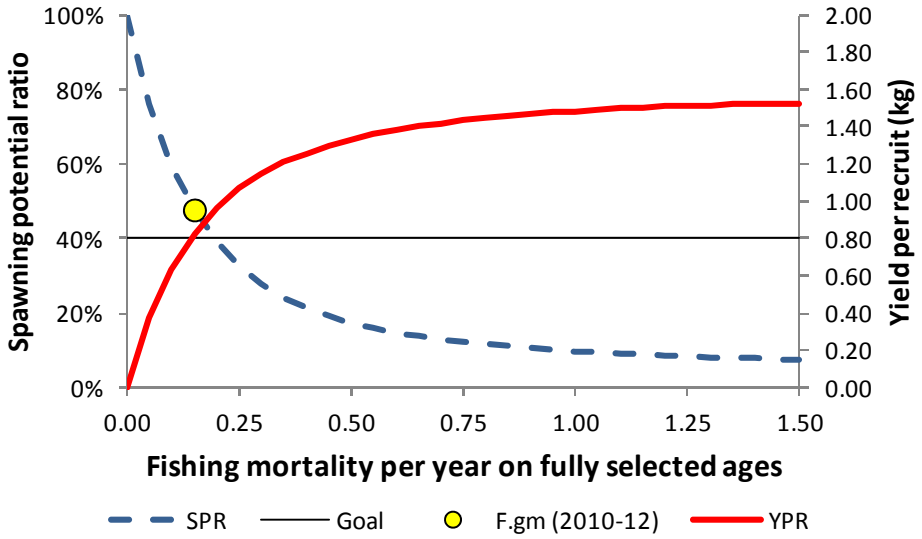


Figure 4.2.2.4.6. Beverton-Holt stock recruitment relationship estimated by ASAP with the steepness on the Atlantic coast (a) of 0.66 and 0.71 on the gulf coast (b). The points are the estimated values and the line is predicted from the equation. Note that the vertical scales differ by coast.

a. Atlantic



b. Gulf

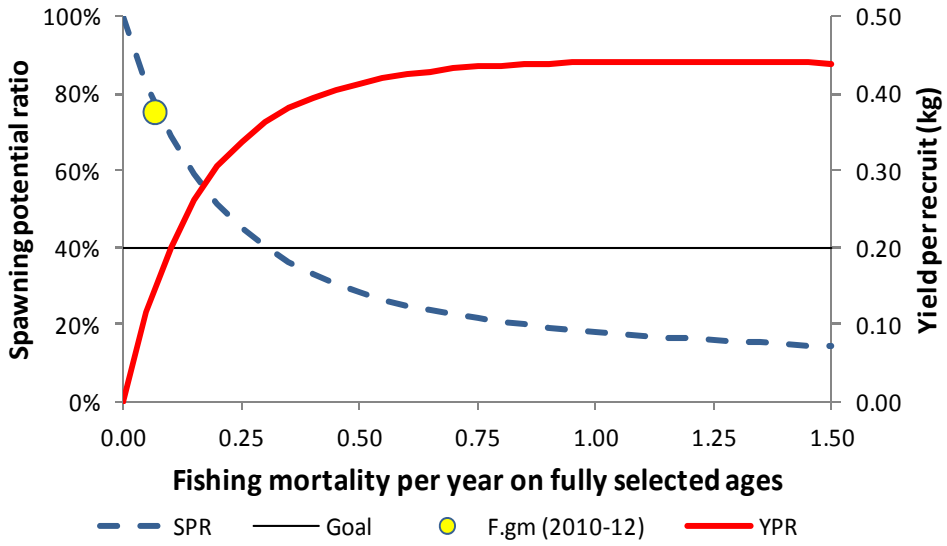
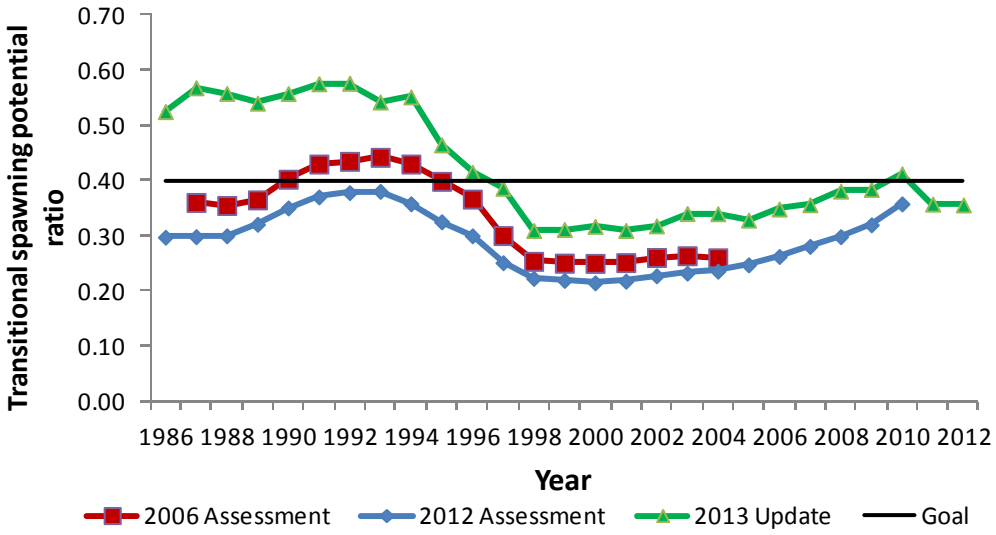
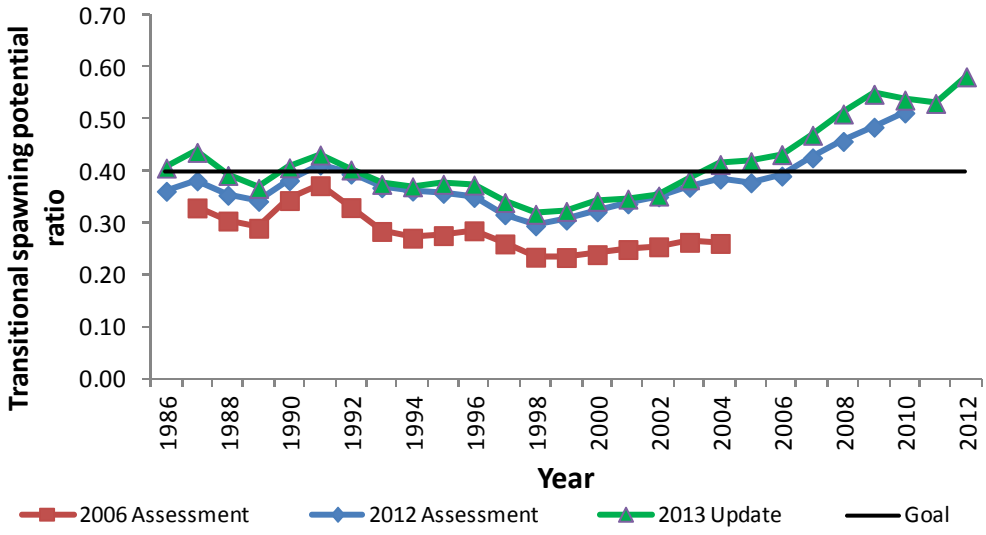


Figure 4.2.2.4.8.1. Yield per recruit and static spawning potential ratios over a range of fishing mortality rates plus the geometric mean fishing mortality rate (F.gm, solid point) from ASAP with the 40% SPR goal. The average instantaneous natural mortality rates used in these analyses averaged 0.2 per year on the Atlantic coast and 0.25 per year on the Gulf coast.

a. Atlantic



b. Gulf



(Revised 22 May 2012)

Figure 4.2.2.4.8.2. Comparison of the transitional spawning potential ratios by year and coast estimated from ASAP from the 2006, 2012 assessments, this update, and the Commission's 40% management goal.

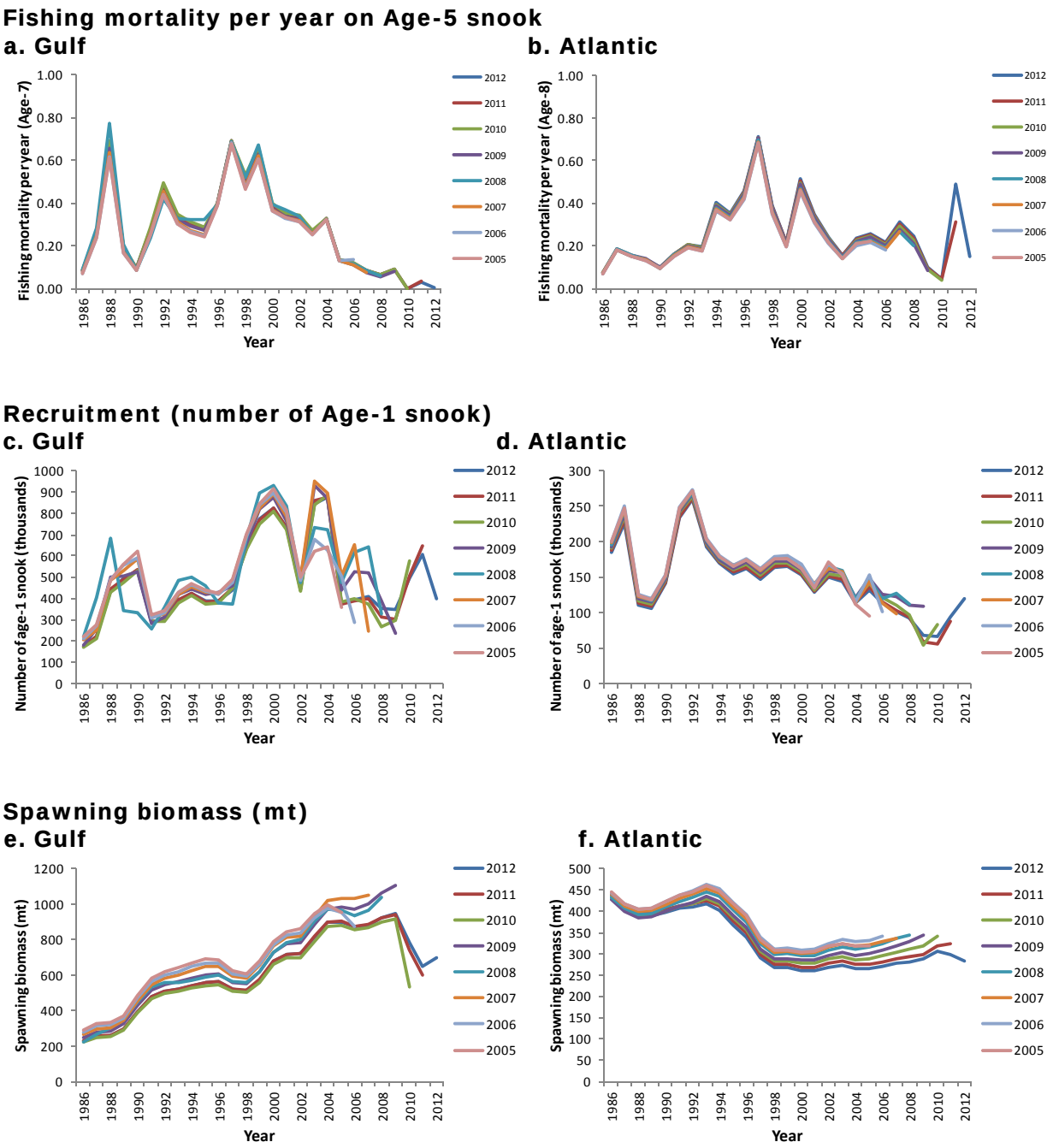


Figure 4.2.2.4.9.1. Retrospective analyses of population parameters by coast using terminal years from 2005 through 2012.

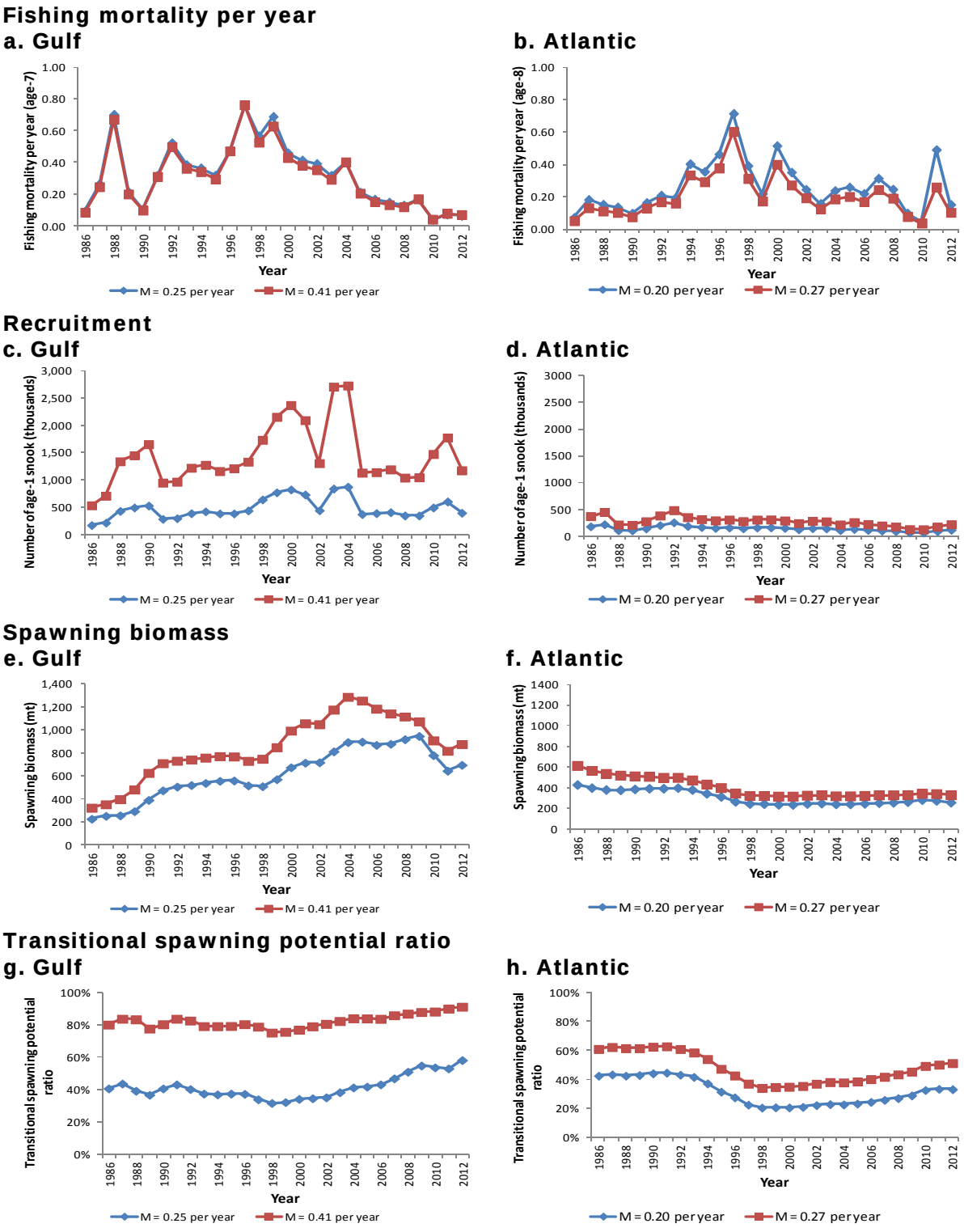
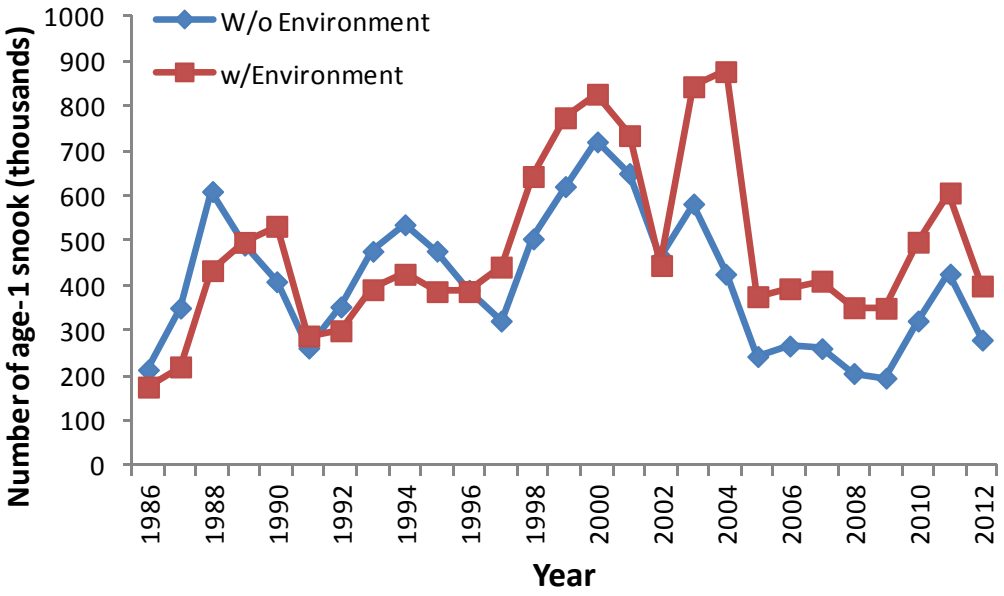


Figure 4.2.2.4.9.2. Population parameters from sensitivity runs with natural mortality rates of 0.27 as compared to 0.20 per year on the Atlantic coast (a) and 0.41 per year as compared to 0.25 per year on the gulf coast (b).

a. Recruitment



b. Spawning biomass

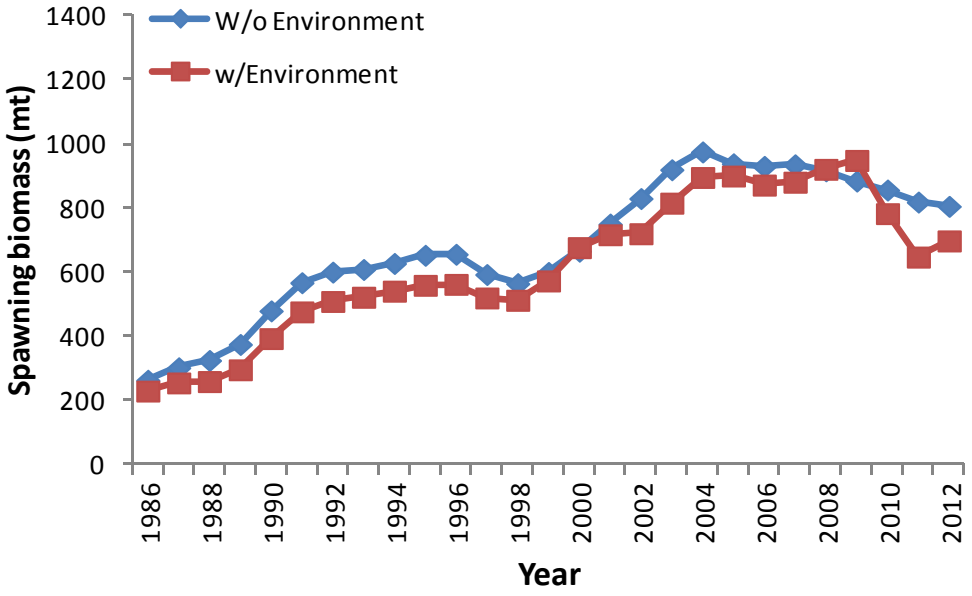
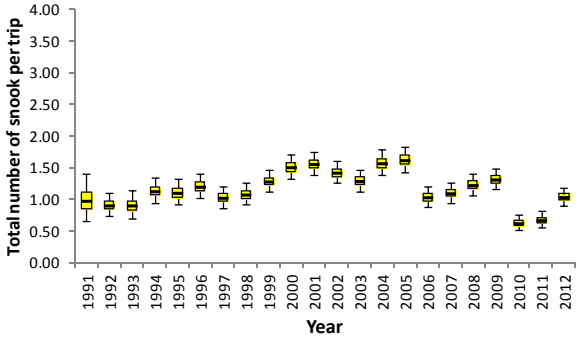
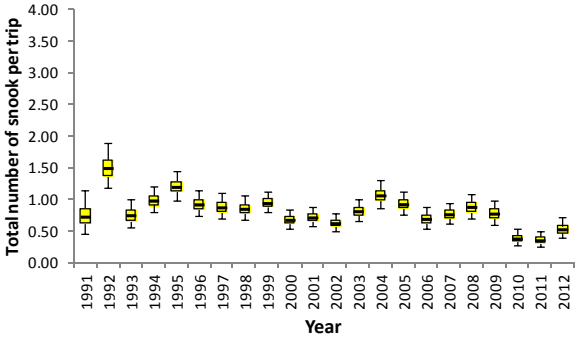


Figure 4.2.2.4.9.5. Recruitment (a) and spawning biomass (b) from the sensitivity run that omitted cold kills and red tide effects (W/o Environmental effects). The equivalent values from the base run are also shown.

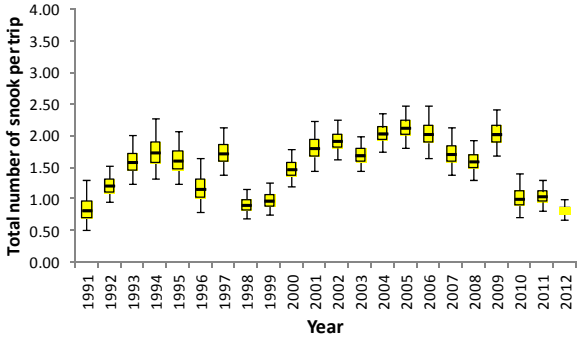
a. Pasco-Sarasota



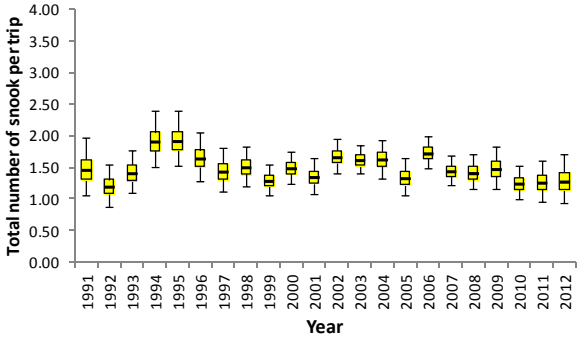
b. Volusia-St. Lucie



c. Charlotte-Lee



d. Martin – Miami-Dade



e. Collier-Monroe

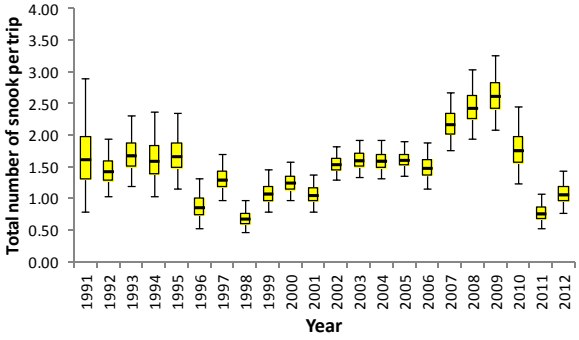


Figure 4.5.1. Distribution of angler total catch rates from MRFSS-MRIP intercepts by year and region. The horizontal line is the median estimate; the box is the inter-quartile range, and the vertical line is the 95% confidence interval. The number of intercepts by year is shown above the confidence interval.

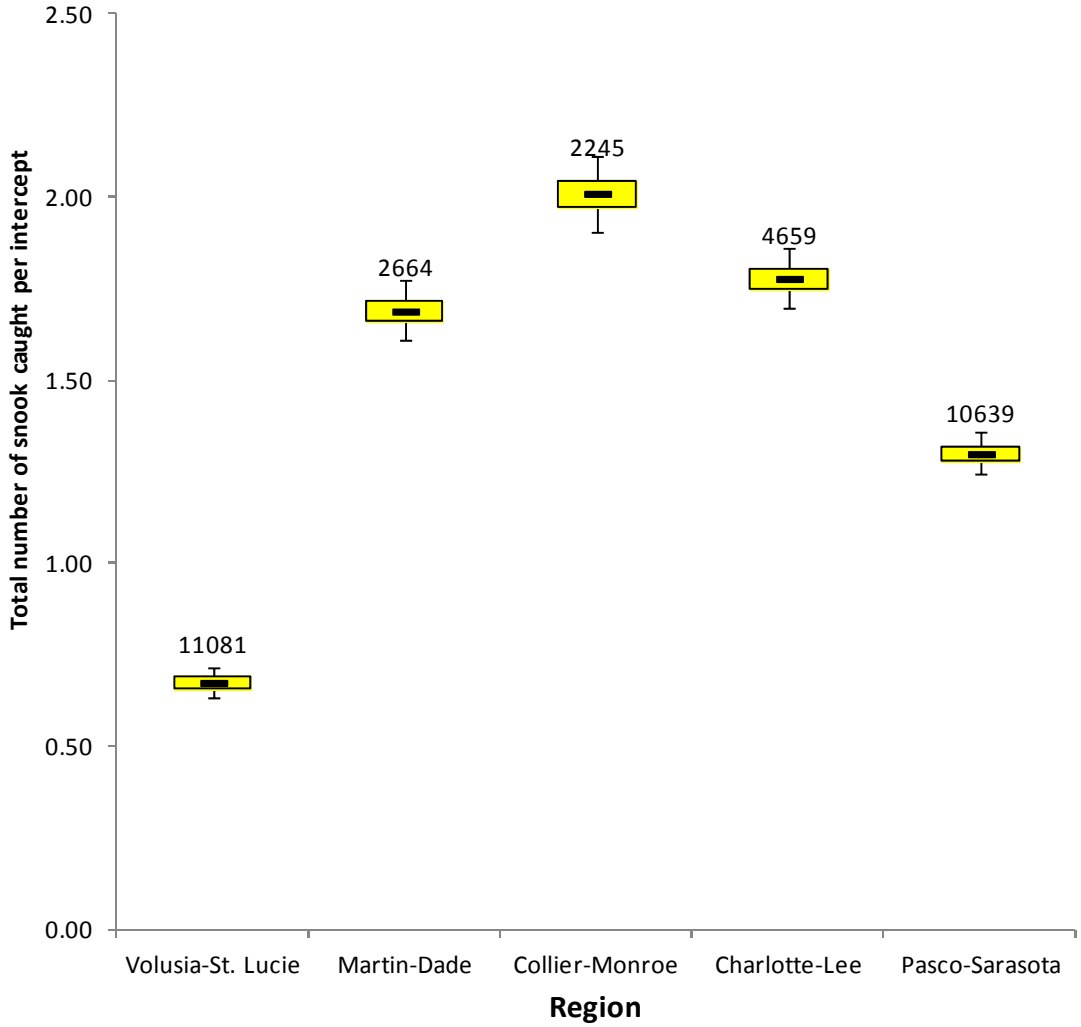


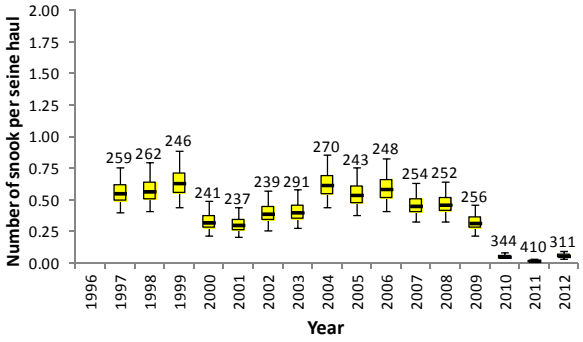
Figure 4.5.2. Comparisons of the total number of recreational fish caught per trip by anglers targeting snook by region during the open season in 2008-2012. The horizontal line is the median estimate; the box is the inter-quartile range, and the vertical line is the 95% confidence interval. The number of intercepts by year is shown above the confidence interval.

Atlantic coast

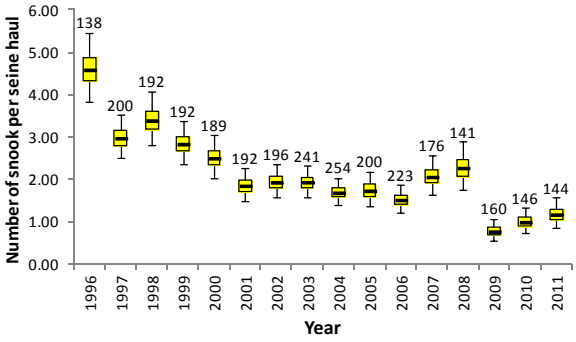
Indian River (IR)

Tequesta (TQ)

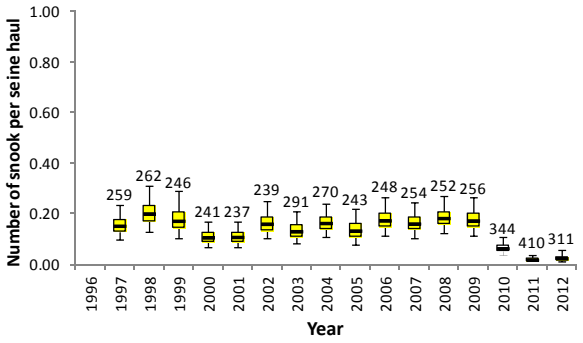
a. Less than 24 inches



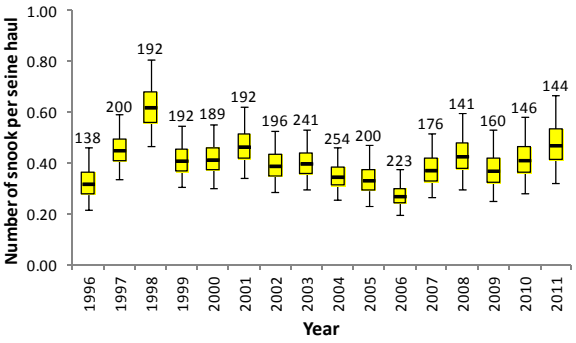
b. Less than 24 inches



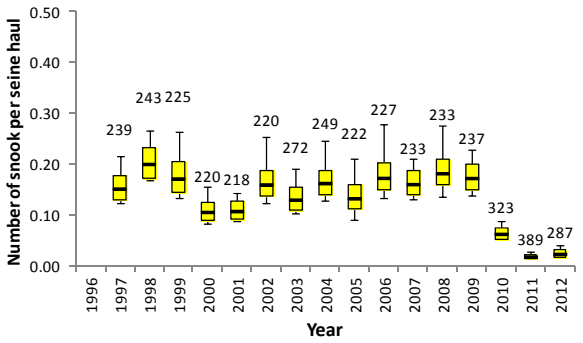
c. IR 24 - 34 inches



d. TQ 24 – 34 inches



e. IR Greater than 34 inches



f. TQ Greater than 34 inches

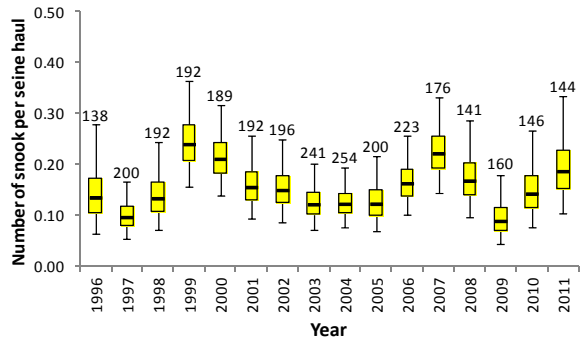


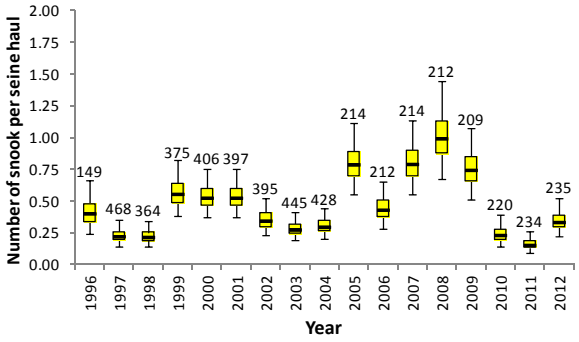
Figure 4.5.3. Distributions of the numbers of fish per seine haul by coast, bay (Indian River, Tequesta, Tampa Bay, and Charlotte Harbor), and size categories from the FIM 183 m haul seines. The horizontal line is the median estimate; the box is the inter-quartile range, and the vertical line is the 95% confidence interval. The number of seine hauls by year is shown above the confidence interval.

Gulf coast

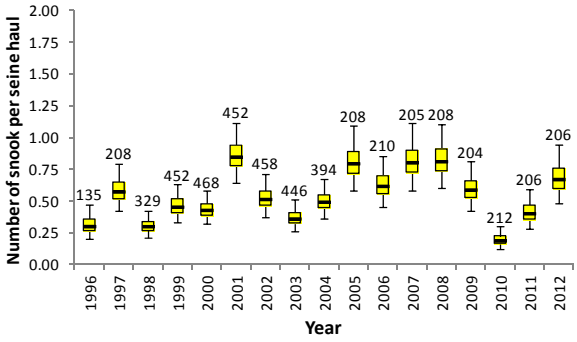
Tampa Bay (TB)

Charlotte Harbor (CH)

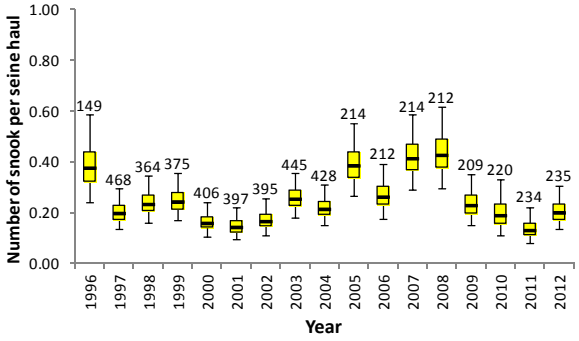
g. Less than 24 inches



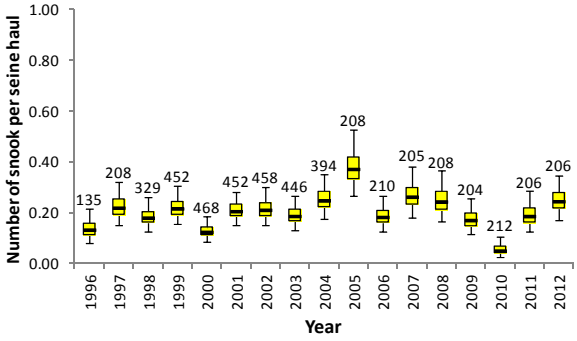
h. Less than 24 inches



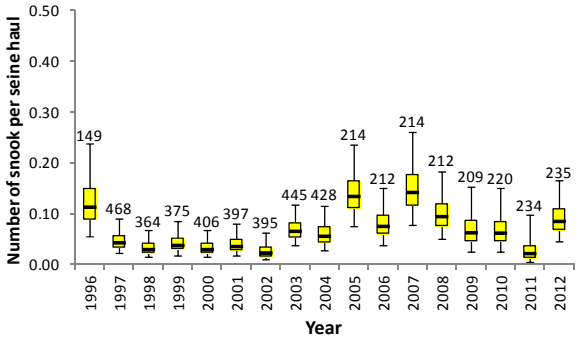
i. TB 24 - 34 inches



j. CH 24 – 34 inches



k. TB Greater than 34 inches



l. CH Greater than 34 inches

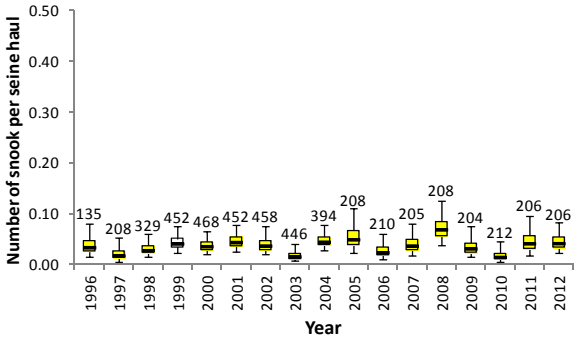


Figure 4.5.3 continued. Distributions of the numbers of fish per seine haul by coast, bay (Indian River, Tequesta, Tampa Bay, and Charlotte Harbor), and size categories from the FIM 183 m haul seines. The horizontal line is the median estimate; the box is the inter-quartile range, and the vertical line is the 95% confidence interval. The number of seine hauls by year is shown above the confidence interval.