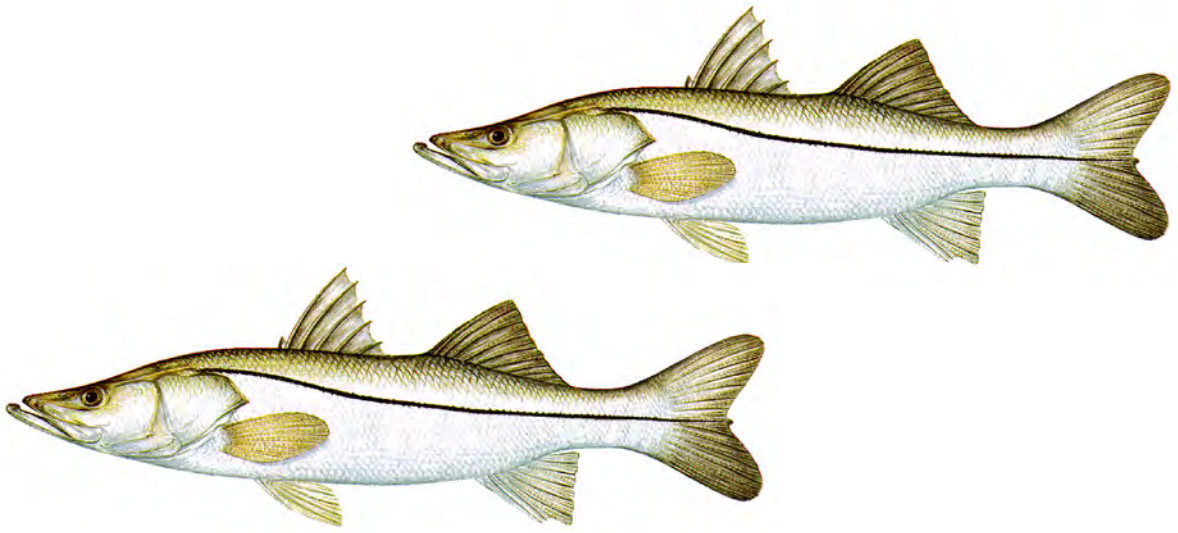

THE 2000 STOCK ASSESSMENT UPDATE OF COMMON SNOOK, *Centropomus undecimalis*

Robert G. Muller

July 12, 2000

Fish and Wildlife Conservation Commission
Florida Marine Research Institute
100 Eighth Avenue Southeast
St. Petersburg, Florida 33701-5095

EXECUTIVE SUMMARY

- This assessment integrates life history studies and fishery data from Florida Marine Research Institute's (FMRI) snook project, angler-supplied snook carcass data, the National Marine Fisheries Service's Marine Recreational Fishery Statistics Survey (MRFSS), and the Everglades National Park's creel survey (ENP) into age-based assessments of snook populations on Florida's Atlantic and Gulf coasts.

- Median total harvest estimates for snook in 1999 were higher than 1998 but still lower than the 1997 estimates which were the highest recorded on either coast during the period 1987-1999. The number of fish released alive is sufficiently large that approximately 21% of the estimated 1999 total harvest on both the Atlantic and Gulf coasts were attributed to deaths that occurred after snook were caught and released alive.

- In 1999, snook were the fourth most highly targeted species on the Atlantic coast and fifth on the Gulf coast as indicated by MRFSS-interviewed anglers who had indicated a preference for which type of fish they were trying to catch. Several measures of effort, such as species preference, estimated number of directed snook fishing trips, and sales of snook stamps, indicate that the fishing effort directed at snook is high.

- On the Atlantic coast, MRFSS catch rates have shown no consistent increasing or decreasing trend since at least 1994 and fishery-independent catch rates have shown increases in recent years except for 1999. On the Gulf coast both the MRFSS and the ENP catch rates may be lower than occurred in 1993 or 1994 but appear to be stable.

- The method of assigning lengths to the harvest was changed in this assessment to use length frequencies developed on a two-month basis to capture seasonal effects instead of using annual length frequencies.

- The 1999 estimate of average fishing mortality for ages 6 - 10 on the Atlantic coast was 0.16 per year which was down from the 1997 and 1998 estimates of 0.31 and 0.49 per year, respectively. On the Gulf coast in 1999, the average fishing mortality for the same ages was much higher at 0.94 per year but has decreased from the 1997 high value of 1.27 per year. The spawning biomass of snook in 1999 increased relative to 1998 on the Atlantic and Gulf coasts. Although the recruitment value for 1999 was higher than previous years, the 1999 was the most uncertain estimate.

- The transitional spawning potential ratio (tSPR) was estimated at 35% on the Atlantic coast with the maturity schedule method and 26% when calculated with the preferred sex ratio method. Thus, the point estimate is below the management objective of maintaining SPR at or above 40%. The tSPR values averaged 41% (32% with the sex-ratio method) during the period of 1987-1998 and the 1998 value was the lowest. On the Gulf coast, the tSPR for 1999 was estimated as 27% (25% with the sex ratio method). The tSPR values have averaged 35% (32% with the sex ratio method) during the period of 1987-1998 with

the 1998 and 1999 values being the lowest. The recent low values for the Gulf reflect the high landings in 1997. The static SPR values indicate that if the low fishing mortality rates in 1999 continues then Atlantic snook would not be overfished; Snook are currently being overfished on the Gulf coast under the management objective of 40% SPR.

- Anglers had high compliance with the new 26" - 34" slot limit that was implemented in January 1999 with 82% of the fish harvested on the Atlantic coast and 84% of the fish on the Gulf coast were within the allowable slot limit. There were more fish larger than 34" harvested on the Atlantic coast (12%) than on the Gulf coast (2%). Only four out of 2,716 snook anglers interviewed in 1999 kept more than the two fish bag limit.

INTRODUCTION

Evaluating the condition of a stock requires combining life history aspects with the fishery characteristics to provide managers with information on how anglers impact the stock and whether the stock is increasing, decreasing, or stable. Common snook, *Centropomus undecimalis*, is one of Florida's most popular gamefish. We are including information on snook genetics, habitat, feeding, reproduction, and growth from previous stock assessments for the convenience of the reader. Also, there are summaries of the harvest patterns, changes in effort, standardization of catch rates, and population and recruitment estimates from age-structured sequential population analyses. Finally, we evaluate regulatory compliance after the Commission implemented a 26"-34" allowable harvest slot limit in January 1999.

I. BIOLOGICAL CHARACTERISTICS

Data Sources

The biology and population dynamics of common snook in Florida has been investigated for populations statewide (Tringali and Bert 1996), in southwest Florida (Fore and Schmidt 1973; Bruger unpublished manuscript.; Thue et al. 1982), the Indian River Lagoon and Southeast Florida (Gilmore et al. 1983; Tucker and Campbell 1988; Taylor et al 1993, 1998a, 2000a), and Tampa Bay (Taylor et al. 1993, 1998a, 2000a; McMichael et al. 1989). Much unpublished data on snook population dynamics were made available by the Fish and Wildlife Conservation Commission's Florida Marine Research Institute (FWC-FMRI); R. Taylor, personal communication and by the National Park Service's South Florida Natural Resources Center in Everglades National Park (ENP); T. Schmidt, personal communication.

Stock Distribution

Common snook, *Centropomus undecimalis*, are found in estuaries and adjacent rivers and in nearshore waters of the tropical and sub-tropical western Atlantic (Gilmore et al. 1983, Rivas 1986). Fishes in the genus *Centropomus* are found in coastal waters bounded by intercepts of the 24EC water isotherm in the North Atlantic during February to the coastal intercepts of the 24EC water isotherm in the South Atlantic coastal waters during August (Rivas 1986). Common snook are the most widely distributed species within the genus. Snook have been reported from as far north as New York (Schaefer 1972) along the Atlantic seaboard and throughout the Gulf of Mexico. Common snook occur in abundance on the Atlantic coast of Florida from about Cape Canaveral south through the Keys and Dry Tortugas and north to about Cedar Key on the Gulf coast. Further west from there, they occur infrequently until about Galveston, Texas and then more or less continuously south to about Rio de Janeiro, Brazil (Gilmore et al. 1983, Rivas 1986).

Differences among the genetic diversity and genotype frequencies of common snook from the Gulf coast of Florida, the Atlantic coast of Florida, and islands in the Caribbean are evidence for reproductive isolation among these populations (Tringali and Bert 1996). In Florida, snook from the Atlantic and Gulf coasts are sufficiently isolated and have sufficiently different life histories that each group could be managed separately (Tringali and Bert 1996; Taylor et al.

1993).

Habitat Requirements and Distribution Pattern

Eggs and larval snook are found in polyhaline and euryhaline waters near estuarine passes or adjacent river mouths (Peters et al., 1998a; Tolley et al. 1987; R. Taylor, personal communication). Newly hatched larvae spend about 2.5 weeks in nearshore waters prior to their arrival in shallow-water nursery sites (Peters et al. 1998). Larvae have been found in euryhaline and oligohaline waters and apparently settle out of the plankton near mangrove prop-roots. Very few larval snook have been reported collected. Extensive estuarine sampling of Naples Bay, Florida, produced 14 larval snook (Tolley et al. 1987). The lengths and distribution of larvae suggest that they hatch near the mouth of that estuary and remain near the bottom where flood tides transport them into the bay. Larvae have been successfully reared between 25E and 32E C, with maximum yolk utilization efficiency at 26E C (Limouzy 1993). Below 25E C and above 33E C larval snook did not survive for long after hatching.

Small juvenile snook prefer low-energy, shallow waters, often near overhanging shoreline vegetation or seagrass meadows. Primary nursery habitat has been described as brackish, shallow warm water streams or dredged canals with slow currents, unvegetated bottoms and overhanging or submerged mangrove prop-roots (Fore and Schmidt 1973). Three distinct nursery habitats for snook on the Florida Atlantic coast are freshwater tributaries to estuaries, salt marshes, and seagrass beds (Gilmore et al. 1983). Snook move from shallow riparian habitats to seagrass meadows, mangrove fringe, and other deeper estuarine waters as they grow. Juvenile snook survive in waters with lower oxygen levels than can adults, correlating well with typical oxygen stress faced by snook during ontogenic shifts in habitat (Peterson and Gilmore 1991).

The distribution of adult common snook closely approximates the distribution of mangroves which are their principal habitat (Marshall 1958; Gilmore et al. 1983) although they also occur along beaches, river mouths, nearshore reefs, salt marshes, seagrass meadows, and lakes. Adult snook appear to be less sensitive to cold water temperatures than larvae or small juveniles (Shafland and Foote 1983). The lower lethal limit to water temperature is 9E - 14E C for juveniles and 6E-13E C for adults.

Food Habits

Larval snook probably eat copepods although the few collected have had empty stomachs (Tolley et al. 1987).

Small juvenile snook feed mainly on copepods and mysids (McMichael et al. 1989). Gilmore et al. (1983) also found that small snook found in marshes fed mainly on microcrustaceans until large enough to take paleomonid shrimp and fish. Larger juveniles feed on paleomonid shrimp and cyprinodontid and poeciliid fishes (McMichael et al. 1989; Gilmore et al. 1983). A transition from intake of crustaceans to an intake of fishes apparently occurs at 45 mm (1.8 in) long. Large juveniles fed mainly on the abundant fishes found in seagrass beds and most organisms reported as food for adults are species associated with the water column.

Reproductive Life History

Histological evidence shows that common snook are protandric hermaphrodites; i.e. snook begin life as males and then after maturation the fish become females (Taylor et al. 2000a). Observed transitional fish ranged from 240-824 mm FL (9.4-32.4 in) and from 1-7 years old. Gonads of sex-reversing snook simultaneously contain sex cells of both sexes: ovigerous lamellae and dorsal remnants of ducts containing sperm. Protandry and differences in growth and mortality between sexes result in significantly skewed sex ratios. The majority of small snook are male and most large snook are female. Sex ratios reported from southwest Florida snook showed similarly skewed sex ratios (Volpe 1959, Thue et al. 1982).

Males reach sexual maturity during their first year when 150-200 mm (5.9-7.9 in) FL which is much smaller and younger than previously suspected (Taylor et al. 2000a). In addition, current research indicates that mature females arise directly from mature males when the transitional gonadal tissue is reorganized shortly after spawning. If all males have the capacity to become female at some point in their life then the maturation schedule for females would simply reflect the schedule of transition from males to females (see sex ratio relations below). However, if some portion of males do not have the capacity to change into females, then the expected proportion of mature females at a given length or age would be greater than that predicted by the sex ratio method.

The probability that a snook of a particular size will be a female increases with length or age and is closely approximated by coast-specific logistic regressions. We therefore calculated coast-specific models for the probability of a snook being a female. These were updated using all sex-length (n = 5116 Atlantic coast and n = 4,720 Gulf coast) or sex-age (n = 4,549 Atlantic coast and n = 4,401 Gulf coast) data available through 1999:

$$\text{Prob(female)} = (e^{-7.005 + 0.2187 \text{ Total length in inches}}) / (1 + e^{-7.005 + 0.2187 \text{ Total length in inches}})$$
$$\text{Prob(female)} = (e^{-2.725 + 03480 \text{ Age in years}}) / (1 + e^{-2.725 + 03480 \text{ Age in years}})$$

on the Atlantic coast and

$$\text{Prob(female)} = (e^{-4.557 + 01728 \text{ Total length in inches}}) / (1 + e^{-4.557 + 01728 \text{ Total length in inches}})$$
$$\text{Prob(female)} = (e^{-1.129 + 0.1620 \text{ Age in years}}) / (1 + e^{-1.129 + 0.1620 \text{ Age in years}})$$

on the Gulf coast. When these models were used as a proxy for maturity in calculating spawning potential ratios, we called this the sex ratio method. For snook at 26" TL, the sex ratio is significantly skewed toward males on the Atlantic coast with about 3.7 males for each female and approximately even on the Gulf coast (1.1 males for each female). For 34" TL snook, the sex ratio is skewed in favor of females, with 1.5 females for each male on the Atlantic coast and 3.7 females for each male on the Gulf coast.

The reproductive season for common snook on both coasts of Florida extends over at least six months: on the Gulf coast, from April through September and on the Atlantic coast from April through October (Taylor et al. 1998). Marshall (1958) found common snook from southwest Florida spawning from May to November with peak activity during May and June. Volpe (1959) determined that the spawning season for snook from Lee and Collier counties was

during June and July based on specimens with flowing gametes. In September, he found no snook extruding gametes and concluded that peak spawning had passed. Based on observations of running-ripe male snook, Fore and Schmidt (1973) reported the spawning season in the Ten Thousand Island area of southwest Florida to be from the first of May to about the middle of November. Gilmore et al. (1983) suggested a protracted spawning season of April to December for snook along the east-central coast of Florida based on back-calculated hatching dates of recruiting juveniles. They noted two peaks in spawning activity, one during June and July, and another during the period of August to October. Using oocyte diameters and GSIs, Tucker and Campbell (1988) showed that spawning along the east-central coast of Florida occurred from early May until early October. The spawning season in Tampa Bay was determined by McMichael et al. (1989) to be from April until December based on back-calculated dates from juvenile otoliths. These temporal variations are to be expected, because physical parameters, especially temperature, which appears to mediate spawning (Gilmore et al. 1983, Bye 1984), vary from one location to the next.

Spawning occurs only after the water temperature warms to 25EC from winter minima. Taylor et al. (1998) found that out of the variables moon phase, tide, amplitude, velocity, and time of day, the only significant physical factor correlated to maximum oocyte diameters was time of the day. Spawning occurred between 14:00 and 20:00 hours. Spawning frequency of snook was inferred from the proportion of females found to contain either post-ovulatory follicles or hydrated oocytes. Using the proportion of the samples with post-ovulatory follicles, the estimated interval between spawning events ranged between 1.1 and 2.5 days. Using the hydrated oocyte method, the average spawning frequency for common snook in Tampa Bay was about once every 1.4 days (Taylor et al. 1993).

Because initial assessments of snook used the snook maturity schedule, we will continue to present spawning potential ratios (the ratio of mature female biomass with fishing to that without fishing mortality) calculated with the maturation schedule and call this the maturity schedule method. We present estimates of SPR based on both the maturity schedule methods and the sex ratio method. The probability that a female snook is mature as she grows older was modeled by:

$$\text{Prob(mature)} = (e^{-5.8868 + 1.6853\ age}) / (1 + e^{-5.8868 + 1.6853\ age})$$ on the Atlantic coast and

$$\text{Prob(mature)} = (e^{-5.5328 + 1.9878\ age}) / (1 + e^{-5.5328 + 1.9878\ age})$$ on the Gulf coast (Taylor et al. 1993).

These equations predict 50% maturity at younger ages (3.5 years old on the Atlantic coast and 2.8 years old on the Gulf coast) than the sex-ratio method. This difference causes more mature females to be estimated in the population and therefore higher SPR estimates result.

Growth Patterns

Snook on the Atlantic coast of Florida attain larger sizes than do snook on the Gulf coast of Florida. The average observed sizes at age one for Atlantic and Gulf coast male snook was 231 and 264 mm (9.1 and 10.4 in) FL, respectively (Taylor et al. 2000a). At age two, Atlantic

coast males were also smaller than Gulf coast males but Atlantic coast males continue to grow at a relatively rapid rate and surpass the average Gulf coast male size-at-age by age four. Predicted sizes at age for females are larger for all ages on the Atlantic coast than on the Gulf coast.

Snook can reach about 20 years old and over 1,100 mm FL (43.3 in). On the Atlantic coast, the oldest sexed common snook sampled by Taylor et al. (2000a) was an eighteen-year-old female and the largest was also a female (1,105 mm, 43.5 in) but she was only age sixteen. The oldest male was 15 years old and 865 mm (34.0 in) and the largest male was 908 mm (35.7 in) at age eleven. On the Gulf coast, the oldest common snook was a 15-year-old female and the largest snook was also a female (1,032 mm, 40.6 in) but she was only age ten. The oldest male was 12 years old and 810 mm (31.9 in) and the largest male on the Gulf coast was 925 mm (36.4 in) but only age four.

Volpe (1959) reported a maximum age for combined sexes to be seven years, while Thue et al. (1982) reported eight years for southwest Florida snook. The maximum age for snook in Taylor et al. (2000a) was 21 years for both coasts. The differences in age among these studies are probably attributable to the different age determination methodology -- scale ages by Thue et al. (1982), whole otoliths by Volpe (1959), and otolith sections by Taylor et al. (2000a) -- and to the different methods of capture -- hook and line was the primary gear in the older studies whereas seines were used by Taylor et al. (1998). Maximum observed sizes of 1,105 and 1,032 mm (43.5 in and 40.6 in), for Atlantic and Gulf coast females (Taylor et al. 2000a) are larger than those reported previously by Volpe (1959, .970 mm or 38.2 in) or Thue et al. (1982, .950 mm or 37.4 in). These differences may also be the result of different sampling gear or the effects of having less stringent harvest regulations on the fishery during the time of the earlier research.

Coast-specific predictive equations for fork length at age (Taylor et al. 2000a) are:

Fork length (mm) = $989 (1 - e^{-0.235(Age - 0.0976)})$ on the Atlantic coast and
Fork length (mm) = $947 (1 - e^{-0.175(Age + 1.352)})$ on the Gulf coast.

Morphometrics

Coast-specific length-length and weight-length relationships were developed by Taylor et al. (2000a) using snook collected during the period 1986 - 1991. The estimated length - length and length - weight relationships for Atlantic coast snook were:

Fork length (mm) = 0.953 * Total length (mm) - 10.85,
Fork length (mm) = 1.111 * Standard length (mm) + 7.12, and
Weight (g) = $8.28*10^{-6}$ * Fork length $^{3.04}$(mm).

The estimated length - length and length - weight relationships for Gulf coast snook were:

Fork length (mm) = 0.9512 * Total length (mm) - 14.86,
Fork length (mm) = 1.0630 * Standard length (mm) + 20.09, and
Weight (g) = $4.40\ 10^{-6}$ * Fork length $^{3.11}$ (mm).

These relations predict that a 26" total length snook on the Atlantic coast would weigh 7.0

lb and that the same size snook on the Gulf coast would weigh about 5.8 lb.

II. FISHERY CHARACTERISTICS

Commercial Harvest

There has been no legal commercial harvest of snook in Florida since the Legislature declared snook a gamefish in 1957 and prohibited the sale of snook.

Recreational Harvest

The State of Florida continues to obtain estimates of recreational angler activity from the National Marine Fisheries Service's Marine Recreational Fisheries Statistical Survey (MRFSS). The MRFSS's Web address is: **http://www.st.nmfs.gov/st1/recreational/database/index.html**. After FMRI personnel began conducting the creel survey interviews in 1998 for MRFSS, they have been able to increase the annual number of interviews from approximately 12,000 interviews to 20,000 interviews on each coast of Florida. Information collected during the angler interviews include the types of fish that anglers catch, how many fish are caught, kept, and released, as well as obtain demographic information on the anglers, and the lengths and weights of landed fish. In 1987, the proportion of interviews made with anglers fishing from shore was decreased and those interviews were reallocated to anglers fishing from boats. Therefore for consistency, we present landings information from 1982 but will confine most of this assessment's analyses to the period from 1987 through 1999. Catch and harvest estimates are made for each coast of Florida separately, during each of six two-month periods a year, within specific fishing modes (e.g., from shore, charterboat/guide boats, and private/rental boats), and for anglers catching fish in inshore waters, state territorial waters, or in federal offshore waters. Thus, the annual estimates of catch and harvest are aggregates of the strata estimates. To evaluate the variability in catch and harvest estimates, we calculated 1,000 values for each stratum using the stratum's estimate and variance (each of the 1,000 values was calculated as the stratum's estimate plus a random, normal deviate times the square root of the stratum's variance), re-aggregated the values by year and coast, and then sorted these values to identify the median, quartiles, and 95% confidence limits. We used the median estimated number of fish kept and median estimated number of fish released in the subsequent analyses.

Angler interviews indicate that recreational anglers in Florida release approximately 90% of the snook that they catch (Table 1, Figure 1). The total catch of snook including the number of fish released peaked at 725,000 snook in 1995 on the Atlantic coast and at 945,000 fish in 1997 on the Gulf coast. On the Atlantic coast in 1999, the total catch was 440,000 fish and 736,000 fish on the Gulf coast. The median total harvest of common snook in 1999, meaning those snook that were retained by the angler plus those snook that died after being released alive, was similar to the median harvest in 1998 on both coasts. The median harvest for 1999 was estimated at 43,800 fish (95% confidence interval: 31,300-57,100 fish) on the Atlantic coast and 72,500 fish (95% confidence interval: 46,300-109,200 fish) on the Gulf coast (Figure 2). The median total snook harvest on the Atlantic coast during the past 18 years has been variable but generally

increasing (t = 4.95, $d.f.$ = 16, $P < 0.05$). Similarly, the median harvest on the Gulf coast also has been variable with a general increase over the period (t = 4.53, $d.f.$ = 16, $P < 0.05$).

As mentioned above, the estimates of harvest include the estimated number of fish that died as a result of being captured and released. Estimates of the percentage of snook that die after being released alive average 2.13 % (Taylor et al. 2000b). These data indicate that the mortality due to hooking injuries or catch-and-release stress can represent, in certain years, up to one-quarter of the estimated total harvest (Table 1). With approximately 90% of the snook caught being released, even the low release mortality rate of 2.13% accounted for about 9,000 (21%) of the 43,800 fish total harvest made in 1999 on the Atlantic coast and a similar proportion of about 15,500 (21%) of the 72,500 fish total harvest made in 1999 on the Gulf coast (Figure 3).

The two coasts differ as to when landings and releases occur. On the Atlantic coast, forty percent of the landings typically occurred in the September-October and only 1% of the landings occurred in July-August when the fishery is closed (Table 2). On the Gulf coast, more than half the landings occur in May and June and 5% of the landings occurred in July and August when the season is closed. For the most part, the seasonal distribution of releases mirrors that of landings except during the closed season.

Recreational effort

Based on MRFSS interviews with anglers who indicated preferences for particular species during their fishing trips, snook was the fifth, down from third, most targeted fish on the Atlantic coast and fourth, down from third, on the Gulf coast in 1999 (Table 3). Although the top-five species on the Atlantic coast in 1999 were the same as in 1998, their ranks were different; on the Gulf coast groupers switched positions with snook in 1999 and Spanish mackerel dropped to sixth place. As noted last year, snook was not in the top five species on either coast in 1987. Since 1993, snook has been the most frequently noted target species in the creel surveys conducted in Everglades National Park followed by spotted seatrout and red drum (ENP unpublished data). In 1999, forty-nine percent of ENP anglers who specified a target species (2,372 anglers) said that they were targeting snook. Spotted seatrout was a distant second (22%).

Reflecting that change in popularity, effort for snook has increased on the Atlantic coast with a peak in 1995 and directed trips for snook peaked on the Gulf coast in 1997 (Figure 4). Snook fishing trips are not counted directly but were calculated by dividing the estimated total catch (harvest + releases) by the estimated standardized number of fish caught per trip (described below). The estimate of the number of directed snook fishing trips was normalized to the 1999 number of trips because trends in these data are probably more accurate than are the absolute estimates of the numbers of directed trips. Relative effort increased exponentially on the Atlantic coast until 1995 and the number of directed trips on the Gulf coast increased six-fold between the periods 1982-1990 and 1991-1999 (Figure 4). Over the period, the harvest and effort have tracked each other, indicating that catch rates have been similar for the most part (Figure 5).

Changes in the annual sales of snook stamps can be regarded as another measure of changes in recreational effort for snook. The Saltwater Fishing License records were not edited sufficiently at the time of writing to be able to distinguish sales by coast. Since snook stamps were required in 1990, the statewide sales have increased from 113,100 to 218,100 stamps (t = 9.16,

d.f. = 7, $P < 0.05$) while the statewide sales of resident licenses has been fluctuating about an average of 540,700 licenses ($t = 1.99$, *d.f.* = 7, $P = 0.086$) (Figure 6). In 1998-1999, thirty-six percent, down from 41% last year, of all residential license holders statewide purchased snook stamps.

Lengths of fish caught by anglers

Lengths of fish caught by anglers came from MRFSS interviews (1982-1999), Everglades National Park creel surveys (1979-1999), snook carcasses voluntarily supplied to FMRI by anglers (1996-1999), and by FMRI interviews targeting snook anglers (1998-99). Under the regulations in effect prior to 1999, anglers could keep snook with total lengths longer than 24 inches and one fish longer than 34 inches. In January 1999, the size limits were changed to a minimum size of 26 inches and a maximum size of 34 inches. Lengths of snook landed by anglers and sampled by creel clerks in 1999 ranged from 15 inches to 43 inches (Table 4 a and b, Figure 7). The maximum lengths were similar on each coast (43 inches on the Atlantic and 42 inches on the Gulf). The median length of snook landed on the Atlantic coast decreased from 33 inches to 30 inches and the median length of snook landed on the Gulf coast increased from 26 inches to 28 inches.

Bycatch

Snook were occasionally caught as by-catch to the inshore gill-net fishery (Motta 1993). However, the constitutional net ban, implemented in July 1995, eliminated entangling nets from inshore waters and from use in all likely snook habitats.

Combined Harvest

When Florida's Legislature made snook a gamefish in 1957, it prohibited the sale of snook eliminating the commercial fishery. Therefore, the harvest from the recreational fishery is the only legal harvest.

III. ASSESSMENT

Trends in availability

The underlying assumption in stock assessment is that the availability of fish as measured by catch rates reflects population size. On the Atlantic coast, we continue to use the same two measures of availability as in last two years' assessment: the total number of snook caught per trip from MRFSS angler interviews and the total number of snook caught per trip in Jupiter Inlet during June through August from FMRI's tagging project which continued sampling without tagging after 1997. Similarly on the Gulf coast, the measures of availability included the MRFSS and the ENP angler survey catch rates. Catch rates have several sources of variability and general linear models (GLM) (Hilborn and Walters 1992) were used to reduce the variability by standardizing the number of fish per trip for the number of anglers, length of fishing trip in hours,

geographic location, month that the trip was conducted, and whether the angler targeted snook. In Figure 8, the catch rates were normalized to their means to facilitate comparisons by focussing on relative changes shown by the indices and not on their magnitudes. All of the other sources of variability were significant in the GLM ($P < 0.05$).

Common snook availability on the Atlantic coast, as measured by standardized MRFSS catch rates, increased between 1983 and 1994 and then has remained level since 1995 (Figure 8a). Catch rates from FMRI's snook tagging/catch rate project on the Atlantic coast were variable but showed a general increase over the entire time period except for 1999 wherein there were only 23 sampling trips (Figure 8 b). On the Gulf coast, standardized MRFSS catch rates showed declined through 1986, steadily increased through 1994, and after the drop in 1995, have remained relatively stable. (Figure 8 c). The catch rates from both Gulf data sets had higher values in 1999. Standardized ENP catch rates from 1987 through 1999 were similar to those from MRFSS (correlation coefficient = 0.88, $df = 11$, $P < 0.05$) but differed in the earlier years (Figure 8 d). A possible explanation for this difference may be the different susceptibilities of ENP snook and the more northern Gulf coast fish to the hard freeze that occurred in December 1983.

Mortality Estimates

Fishing mortality rates and population size were estimated with a separable, virtual population model (SVPA)(Integrated Catch at Age Analysis, version 1.4, Patterson 1998). In last year's assessment, the modified DeLury Depletion model (Rosenberg et al. 1990) was considered very uncertain and so it has been discontinued this year. Separable, virtual population analysis uses numbers of fish harvested by age and year and natural mortality rates to estimate fishing mortality rates. Fishing mortality is broken into two, independent components: an annual fishing mortality rate on fully recruited fish (F-multiplier) and the selectivity of each age standardized to the age at full recruitment. This means that the fishing mortality rate for any given age in a given year can be determined as the product of the F-multiplier for the year and the selectivity for the age. Population size by year and age is determined from total mortality (fishing mortality rate plus natural mortality rate) and catch.

As the two previous stock assessments, mortality rates were estimated for both sexes combined after the numbers of fish harvested by year and age had been determined for each sex. Sex-specific estimates would be inappropriate because the sexes are not independent: all male snook can potentially transition and become a female.

Before the number of fish harvested by age could be determined, the landings had to be converted to numbers of fish by size by year. Numbers of fish landed were distributed across length classes based on length data collected by the MRFSS, the ENP creel survey, from snook carcasses supplied to FMRI by anglers, and from interviews conducted by FMRI personnel. We converted all length measurements into inches total length because regulations are expressed in total length and most anglers are more comfortable with English units of measure. If the sex of a particular fish was unavailable, it was predicted based on its length using the appropriate logistic equation describing the probability that a snook of that total length was female (See *Reproductive Life History* section). On the Atlantic coast, the available length data were aggregated by two-month period into five annual time periods (1987-1992, 1993-1996, 1997, 1998 and 1999) and these aggregate length frequencies were applied to the two-month harvest estimates to calculate

the actual length composition of annual harvests within each of these periods (Table 4 a). On the Gulf coast, adequate length data were available each year so that year-specific length frequencies by two-month period could be applied to determine the length composition of each year's two-month harvest (Table 4 b).

During 1999, FMRI personnel on both coasts interviewed anglers and collected otoliths (ear bones) from a total of 399 snook that were measured, aged and had sex recorded. In addition, another 823 fish were obtained from the Fishery Independent Sampling program. The lengths and ages from snook sampled on each coast were tallied by sex into one-inch total length categories and five time-periods: 1987-1992, 1993-1996, 1997, 1998 and 1999. Thus, twenty age-length keys (two coasts, two sexes, five time-periods) were used to assign ages to length frequencies of the harvested snook. The numbers of fish by sex and age were then combined within each coast for the subsequent analyses (Table 5 a and b). Snook are partially recruited to the fishery when as young as age 2 and their vulnerability increases as they get older. Snook were considered fully recruited to the Atlantic coast fishery at age-5 and to the Gulf coast fishery at age-6 (these were listed in last year's assessment as age-6 and age-7). Fish older than 15 years old on the Atlantic coast and 11 years old on the Gulf coast were not consistently harvested in all years, so we combined all Atlantic coast snook that were 15 year old and older into a 15+ age category and all Gulf coast snook 11 years old and older into a 11+ age category. We omitted the age-1 fish from the analyses because they were infrequently caught.

The instantaneous natural mortality rates were the same as those used in previous snook analyses, 0.20 per year on the Atlantic coast and 0.25 per year on the Gulf coast. The rationale for the difference between the coasts was that snook on the Gulf coast appear to be more susceptible to cold kills than are snook on the Atlantic coast.

Integrated catch-at-age analysis estimates fishing mortality rates and population sizes by minimizing the differences between the observed catch-at-age and the predicted and the observed indices of abundance with their predicted values. The use of indices is particularly important for improving the accuracy of the mortality rate estimates for the most recent one or two years of harvest information. Because several observed indices are often available for each population and these indices may show different trends, the contribution of each index is weighted according to the inverse of its variance. In addition to the indices mentioned above, indices were developed from Fishery Independent Monitoring (FIM) 600 ft seine sampling from 1997-1999 on each coast that covered ages two through six. On the Atlantic coast, none of the ages in the FIM index were significant while only age-two was significant on the Gulf coast. Therefore, runs were conducted on the Atlantic coast using both reweighting and equal weighting of the MRFSS index and the composite FIM index. On the Gulf coast, runs were conducted using the both reweighting and equal weighting of the MRFSS, Everglades National Park, and the age-two FIM index. The new size limits probably have changed the selectivity in 1999 but it is not possible to separate year effects from selectivity effects with one year's data. This effect is considered minimal because the new size limit spans the same ages as previous years (Figure 9); thus, all runs of the SVPA model fitted selectivity across all 13 years. On both coasts, the models with reweighted indices and fitted selectivity to all 13 years had the lowest sum of squared residuals between the observed catch rates and the predicted catch rates (Figure 10). The results from this configuration of the model are presented and used in the subsequent discussions.

Using the estimates of fishing mortality from the SVPA for ages 6 through 10 as

representative of the fishing mortality on fully exploited snook, the estimated mean fishing mortality rate on the Atlantic coast in 1999 (0.16 per year) was among the lowest of the time series To put these rates into perspective, the 1999 fishing mortality rate was below $F_{0.1}$ (F = 0.24 per year), a common fishery management objective, and the Commission's objective of $F_{40\% SPR}$ (F = 0.17 or F = 0.23 per year depending upon the sex-ratio method or the maturity schedule method respectively). It must be remembered that there is uncertainty surrounding these estimates and the 95% confidence interval for the 1999 estimate encompasses from 0.09 to 0.31 per year (Figure 11 a). Although the fishing mortality rates over the period 1987-98 are a little higher than estimates presented in last year's assessment, they follow the same pattern.

On the Gulf coast, estimates of mean fishing mortality for ages 6-10 suggest that the decreasing trend in harvests between 1992 and 1995 may have been the combined result of slight decreases in fishing mortality rates and stable or slowly decreasing total population sizes (Table 6 b). However, the estimated confidence limits around the estimates of fishing mortality on the Gulf coast indicate that there was little actual change in F during the period 1991- 1996 (Figure 11 b). Furthermore, the very low harvest in 1990 appears to have been the result of significantly lower fishing mortality that year. However, the increase in harvest in 1997 was the result of higher fishing mortality (Figure 11 b) on a population of snook that possibly was smaller than the previous year's population (Table 6 b). Fishing mortality rates on the Gulf have been slowly decreasing from the 1997 high but are still higher than the rates in the earlier years. Furthermore, the recent fishing mortality rate estimates are higher than either $F_{0.1}$ (0.34 per year) or $F_{40\% SPR}$ (0.30 per year with the sex ratio method or 0.38 per year with the maturity schedule method).

Population trends

The overall trends in snook population abundance from the SVPA were similar on the Atlantic and Gulf coasts. The SVPA-estimated number of age 2^+ snook on the Atlantic coast increased from about 366,000 fish in 1987 to 577,000 fish in 1994 and then decreased afterwards to 495,000 fish in 1998 (Table 6 a). The number of age-2 fish in 1999 is very large and very uncertain (maximum likelihood estimate of 854,100 with a 95% confidence limit of 275,000-2,656,000). The population of fully exploited fish (age-6 and older) peaked in 1997 at 126,000 fish and then decreased to an estimate of 99,000 fish in 1999. Spawning biomass generally increased until 1997 and then declined (Figure 12 a). The population of age 2+ snook on the Gulf coast generally increased between 1987 and 1992 reaching a peak of about 636,000 fish in 1992. The population then declined to 528,000 fish in 1996. In last year's assessment, the 1998 estimate was very high (824,000) with most of the fish in the age-2 category (558,000) and we noted that it probably should be discounted. In this assessment with another year's information, the age 2+ population estimate for 1998 has dropped to 532,000 fish and the number of age-2 fish has dropped to 205,000. This change illustrates the high uncertainty in the estimates of the most recent year's younger ages that are not fully recruited into the fishery. The population of fully exploited fish (age-6 and older) on the Gulf coast ranged from a low of 36,000 fish in 1989 to a high of 96,000 snook in 1996 decreasing to an estimated 39,000 fish in 1999 (Table 6 b). Spawning biomass of snook increased from the 1980s and then was flat until it decreased in 1997. With the more restrictive 26-34 inch slot implemented, the 1999 spawning biomass was up from the 1997-98 level even though the number of fish was down (Figure 12 b).

Recruitment

The trends in the estimated numbers of newly recruited snook available to anglers each year were somewhat similar between coasts -- recruitment increased then decreased and the estimates for 1999 were up. Recruitment as the number of age-2 fish on the Atlantic coast increased to 187,000 fish in 1993 and then decreased to 126,000 fish in 1996 and then increased such that the 1998 estimate is 150,000 fish (Table 6 a, Figure 13 a). As noted earlier, the estimate for 1999 was 854,000 fish but that is the most uncertain estimate in the analyses (95% confidence limits of 275,000-2,656,000). The estimate of recruitment in the most recent year, in this case 1999, is solely determined by the harvest and the selectivity -- there is not a time series of harvests from a particular year class of fish to condition the estimate. Some analysts do not provide the estimates of the youngest age in the most recent year in their output. The increasing recruitment between 1989 and 1994 probably accounts for much of the increase in the harvest after 1993 until 1998. Recruitment on the Gulf coast, also estimated as the number of age-2 snook, increased from 131,000 fish in 1987 to 242,000 fish in 1992 followed by a decline to 143,000 fish by 1996 (Table 6 b, Figure 13 b). As predicted in the last assessment, the estimates of recruitment for 1998 changed from 558,000 fish to 205,000 fish with the addition of the 1999 information.

Spawning potential ratio

In 1994, the Marine Fisheries Commission chose a management objective of maintaining the snook stocks at spawning potential ratios (SPR) of at least 40%. Following the example from the management of other species in the southeast U.S., transitional spawning potential ratios (tSPR) are used to determine whether the stock meets the management objective because they are based on the estimated total mortality rates (Gulf of Mexico SPR Management Strategy Committee 1996).

The tSPR values for snook on the Atlantic coast in 1999 were 35% (Table 6 a) calculated with the maturity schedule method (or 26% calculated using sex ratio method) which is just under the management objective. Last year, the tSPR was trending downward between 1996 and 1998. However, the most current 1999 tSPR value of 35% was higher than the 1998 value of 33% reflecting the lower fishing mortality rates for 1999. On the Gulf coast, the tSPR value was 27% in 1999 calculated with the maturity schedule method (or 25% calculated using sex ratio method), below the 40% objective (Table 6 b). The tSPR values on the Gulf averaged 35% for the years 1987-98. If the current fishing mortality rates on the Gulf coast were to continue into the future, the transitional SPR values would remain about the current level which is below the Commission's objective (Figure 14).

As noted in the above section on reproductive life history, our current understanding of snook maturation and reproduction has changed since the mid 1990's. Recent analyses suggest that male snook mature at much smaller sizes than previously thought and that all mature females arise from mature males. This is the basis for using the sex ratio method in estimating tSPR. As shown in Table 6, the sex ratio method gives consistently lower estimates of tSPR than the maturity schedule method. The theoretical work on compensation in gonochoristic fish species (the underpinnings of the determination of 'safe' SPR levels) may not apply to a population of

fish with a protandrous life style. Therefore, it is unclear whether the 40% SPR management goal is appropriate for snook. A workshop is scheduled by FMRI in September 2000 on how to incorporate hermaphrodism into stock assessments especially the determination of appropriate fishery benchmarks. In the current assessment, we have continued using the old maturity schedules but recommend that the Commission adopt the sex ratio method and follow advice from workshop participants to reconsider the management objective.

Present and possible future condition of the stock

With tSPR values below 40% on both coasts, snook are possibly overfished on the Atlantic coast and are overfished on the Gulf coast. However, the tighter size limits that were implemented in 1999 should result in lower fishing mortality rates and, ultimately, in higher SPR values in the future. Because of the number of age-classes in the snook fishery, several years will be necessary to see dramatic shifts in SPR.

IV. MANAGEMENT

History of management

Snook are managed under Chapter 46-21 of the Florida Administrative Code. As noted earlier, the Florida Legislature made snook a gamefish in 1957. In July 1985, 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 was extended to all fish of the genus *Centropomus*, added August to the summer closed season permanently, required all fish to be landed in whole condition, and prohibited the use of treble hooks with natural bait while harvesting snook. In March 1994, the management goal was established to maintain snook stocks above 40% SPR, the January-February closure was change 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 are secured and stowed away. In January 1999, the Commission implemented a slot limit of 26 inches to 34 inches with no allowance for fish larger than 34 inches to be retained.

Size limit compliance and bag limit analysis

Angler compliance with the 26-34 inch slot and the two-fish bag limit were evaluated. During the 1987-1998 time period, approximately 16% of the snook measured each year by samplers on the Atlantic coast period were under 26" (Table 7) and in 1999, only 6% were under the limit. Similarly during the 1996-98 period, approximately 24% of the fish landed each year were larger than 34" and in 1999 only 12% were oversized. Thus, eighty-two percent of the fish were of legal size on the Atlantic coast. On the Gulf coast, an average of thirty-two percent of the snook examined each year during the 1987-98 period were less than 26" and in 1999 15% were undersized. Compliance with the maximum size was greater on the Gulf coast with only 2%

being larger than 34" in 1999 as compared to an average of 12% each year during the 1996-98. Overall, the Gulf coast had slightly higher compliance with 84% of the landed fish of legal size in 1999. Angler compliance on the Gulf coast was higher than expected because during the earlier period the median size of snook landed was 26" which is now the minimum size.

Snook angler compliance with the two fish bag limit is very high. Following a recommendation by Dr. Tom Fraser, a former Marine Fisheries Commissioner, the bag limit analyses included only interviews conducted when the snook fishery was open. During the 1987-1999 period, only 10 anglers out of 6,396 snook anglers that were interviewed by samplers on the Atlantic coast kept more than two fish on a trip (Table 8a). Considering only data from 1999, only two out of 1,048 snook anglers kept more than two fish on the Atlantic coast (Table 8b). On the Gulf coast the numbers were similar, only 13 anglers out of 10,186 snook anglers kept more than two fish (Table 8a). Only two anglers out of 1,668 snook anglers interviewed kept more than two fish on the Gulf coast in 1999 (Table 8b).

V. RESEARCH and DATA NEEDS

In addition to the fishery information on harvest, releases, and catch rates, the most critical need for future assessments of snook populations if management continues to use SPR as its management objective is to collect age, sex, and length information from the fishery. Access to fish is complicated because most of the fish are released. Beginning in 1998, FMRI interviewers have been visiting fishing sites where anglers typically fish for snook and asking anglers if they can measure the anglers' fish and determine the sexes of the fish and whether the samplers can collect the ear bones. The most appropriate method for collecting this type of information would be to supplement the intercept portion of MRFSS, with an emphasis on shore modes. On a biological level, we need information regarding the movements of snook, reproductive state and cues, and whether catch-and-release fishing on spawning aggregations during the summer closed season has a negative impact on reproduction. A pilot study in 1998 tagged snook and then recaptured them on the following day to determine whether the fish would spawn in spite of being captured and released. Of the few snook caught as part of the feasibility study and at least one of the recaptured fish had hydrated eggs. Finally, we need to understand how snook interact with their habitat throughout the lives. This assessment did not address any relationships with snook and their prey nor with snook and the environment.

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LIST OF TABLES

Table 1. Median number from 1,000 iterations of snook landed by anglers, the number of fish caught and released alive, the total number caught, the precent released alive, the number that died after being released alive, total harvest (landings plus those that died after being released alive), the total number of fish caught per trip, and the estimated number of trips directed at snook. The number of fish that died after release is estimated from the number of fish released alive times the release mortality rate of 2.13%.

Atlantic

Year	Landings	Released alive	Total catch	Percent release	Died after being released alive	Total harvest	Total fish per trip	Directed Trips
1982	5,177	15,457	20,423	76%	686	5,863	0.76	35,710
1983	5,164	2,424	8,212	30%	504	5,668	0.69	16,162
1984	33,802	15,433	48,159	32%	968	34,769	0.73	87,392
1985	5,974	35,424	40,106	88%	716	6,690	0.78	68,200
1986	11,825	53,134	65,273	81%	1,299	13,125	0.77	111,507
1987	28,520	52,772	81,218	65%	557	29,077	0.85	124,897
1988	32,831	62,638	95,245	66%	1,596	34,427	0.85	146,128
1989	14,375	232,765	245,634	95%	4,691	19,066	0.95	328,046
1990	10,623	182,587	192,505	95%	3,798	14,420	0.96	254,024
1991	27,822	213,543	241,347	88%	5,174	32,996	0.97	318,022
1992	33,257	385,270	419,445	92%	7,631	40,888	0.97	547,385
1993	27,037	193,333	219,288	88%	3,271	30,308	0.86	330,581
1994	54,323	514,073	566,392	91%	11,333	65,656	1.13	625,792
1995	45,343	681,017	725,199	94%	14,941	60,284	1.09	829,747
1996	61,124	392,380	451,125	87%	8,910	70,034	1.01	568,103
1997	72,184	447,938	519,153	86%	9,341	81,525	0.99	663,828
1998	33,463	335,844	365,903	92%	7,310	40,774	0.96	488,384
1999	34,786	407,430	440,142	93%	8,997	43,783	1.04	536,975

Gulf

Year	Landings	Released alive	Total catch	Percent release	Died after being released alive	Total harvest	Total fish per trip	Directed Trips
1982	20,344	11,494	31,568	36%	410	20,754	0.97	43,180
1983	30,811	49,282	79,930	62%	1,884	32,695	1.08	96,770
1984	385	2,985	3,031	99%	46	432	0.76	5,467
1985	12,894	31,224	45,067	69%	319	13,213	0.79	78,410
1986	4,654	48,296	54,503	89%	1,254	5,908	0.66	117,045
1987	18,081	18,036	36,642	49%	511	18,591	0.84	59,134
1988	69,369	174,246	241,423	72%	2,313	71,682	0.99	321,704
1989	14,187	138,680	150,959	92%	3,086	17,273	0.94	212,089
1990	7,763	71,488	78,881	91%	1,737	9,500	0.90	116,783
1991	42,000	506,373	541,638	93%	10,488	52,488	1.05	672,074
1992	85,616	598,038	684,061	87%	11,961	97,577	1.12	787,046
1993	61,931	674,569	736,439	92%	13,975	75,906	1.19	787,071
1994	50,443	739,202	784,453	94%	15,320	65,763	1.28	775,258
1995	43,819	519,283	559,515	93%	10,646	54,465	1.08	672,445
1996	48,435	727,218	779,142	93%	14,671	63,106	1.12	907,605
1997	97,738	852,209	945,356	90%	18,699	116,437	1.15	1,053,274
1998	64,243	531,571	593,359	90%	11,376	75,618	1.03	759,704
1999	56,976	676,861	736,357	92%	15,478	72,454	1.20	792,071

Table 2. Seasonal distribution of numbers of fish landed and released alive by coa expressed as percentages based on two-month wave averages from 1993-1998 and 1999

1993-1998

	Atlantic		Gulf	
Wave	**Landings**	**Releases**	**Landings**	**Releases**
Jan-Feb	7%	6%	3%	7%
Mar-Apr	19%	13%	34%	20%
May-Jun	18%	22%	25%	32%
Jul-Aug	1%	21%	5%	17%
Sep-Oct	41%	26%	23%	16%
Nov-Dec	13%	12%	9%	9%
Annual	100%	100%	100%	100%

1999

	Atlantic		Gulf	
Wave	**Landings**	**Releases**	**Landings**	**Releases**
Jan-Feb	26%	10%	5%	6%
Mar-Apr	13%	10%	21%	12%
May-Jun	22%	13%	48%	31%
Jul-Aug	0%	23%	0%	18%
Sep-Oct	21%	32%	15%	21%
Nov-Dec	17%	12%	11%	13%
Annual	100%	100%	100%	100%

Table 3. The five most commonly preferred species as indicated by MRFSS angler interviews made during 1987, 1998, and 1999. The total number of interviews is given, as is the number of interviews that identified a species preference.

Atlantic Coast

1987			1998			1999		
Rank	Description	Percent of Intercepts	Rank	Description	Percent of Intercepts	Rank	Description	Percent of Intercepts
1	Dolphin	27%	1	Dolphin	19%	1	Red Drum	21%
2	Sailfish	17%	2	Red drum	16%	2	Dolphin	18%
3	Spotted seatrout	15%	3	Snook	13%	3	Spotted seatrout	13%
4	King mackerel	13%	4	King mackerel	12%	4	King mackerel	10%
5	Bluefish	7%	5	Spotted seatrout	12%	5	Snook	9%
8	Snook	4%						
Total Intercepts		4,659			11,955			18,029
Intercepts with preference		2,235			4,466			8,406

Gulf Coast

1987			1998			1999		
Rank	Description	Percent of Intercepts		Description	Percent of Intercepts		Description	Percent of Intercepts
1	King mackerel	18%	1	Spotted seatrout	26%	1	Spotted seatrout	24%
2	Spotted seatrout	17%	2	Red drum	23%	2	Red drum	19%
3	Spanish mackerel	10%	3	Snook	12%	3	Groupers	12%
4	Groupers	6%	4	Groupers	11%	4	Snook	9%
5	Red drum	6%	5	Spanish mackerel	7%	5	King mackerel	6%
> 20	Snook		6	King mackerel	6%	6	Spanish mackerel	6%
Total Intercepts		7,961			18,152			28,975
Intercepts with preference		4,381			8,971			13,538

Table 4 a. Numbers of fish harvested, including 2.13% release mortality, by size, coast, and year. The probability of a snook being female or male is given for each total-length size class (inches).

Atlantic Coast

Females

Prob Fem	Total Length (in)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
		Year												
0.06	19	0	0	0	0	0	0	0	0	0	0	83	0	0
0.07	20	0	0	0	0	0	0	0	0	0	0	0	0	0
0.09	21	0	0	0	0	0	0	0	0	0	0	0	0	0
0.11	22	0	0	0	0	0	0	0	0	0	0	0	0	0
0.13	23	0	0	0	0	0	0	182	610	419	412	103	0	0
0.16	24	0	0	0	0	0	0	202	742	482	684	611	248	191
0.19	25	698	305	259	237	340	797	17	92	426	361	76	843	0
0.23	26	689	305	259	233	334	765	832	1,569	1,095	1,890	800	106	534
0.27	27	698	305	259	237	340	797	199	702	845	774	584	142	643
0.32	28	994	3,672	1,070	740	2,963	1,599	1,175	2,933	2,131	2,043	1,091	753	830
0.37	29	689	305	259	233	334	765	488	758	579	936	797	143	376
0.42	30	706	305	259	241	346	830	845	1,898	2,144	1,941	1,265	383	2,957
0.47	31	1,387	609	517	470	674	1,562	2,610	4,456	4,299	3,313	1,626	923	2,235
0.53	32	1,194	2,182	2,357	694	1,923	3,415	1,051	2,680	2,263	2,535	2,098	929	3,969
0.58	33	49	1,375	1,563	203	1,528	1,688	422	1,576	1,390	1,729	2,766	1,196	1,116
0.63	34	689	305	259	233	334	765	456	1,814	1,121	2,046	3,414	1,648	654
0.68	35	698	305	259	237	340	797	37	225	489	633	4,774	979	556
0.73	36	1,252	3,473	793	728	3,253	1,499	1,661	2,107	3,212	2,940	3,580	1,386	573
0.77	37	0	0	0	0	0	0	1,042	1,399	1,509	1,464	2,721	968	327
0.80	38	689	305	259	233	334	765	51	330	157	678	2,107	1,333	217
0.84	39	689	305	259	233	334	765	61	396	188	814	2,622	941	300
0.86	40	0	0	0	0	0	0	10	66	31	136	1,605	465	135
0.89	41	1,186	2,127	273	574	1,781	958	0	0	0	0	1,087	435	27
0.91	42	0	0	0	0	0	0	629	827	613	1,206	1,117	359	27
0.92	43	0	0	0	0	0	0	10	66	31	136	691	29	27
0.94	44	0	0	0	0	0	0	0	0	0	0	0	36	0
	Females	12,307	16,183	8,904	5,526	15,158	17,767	11,980	25,246	23,424	26,671	35,618	14,245	15,694

Males

Prob Male	Total Length (in)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
		Year												
0.98	14	0	0	0	0	0	0	0	0	0	0	0	36	0
0.97	15	0	0	0	0	0	0	0	0	0	0	0	0	191
0.97	16	0	0	0	0	0	0	0	0	0	0	0	0	0
0.96	17	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95	18	0	0	0	0	0	0	0	0	0	0	0	0	0
0.94	19	0	0	0	0	0	0	437	428	422	258	0	0	0
0.93	20	0	0	0	0	0	0	0	0	0	0	0	0	0
0.91	21	0	0	0	0	0	0	0	0	0	0	0	0	0
0.89	22	698	305	259	237	340	797	454	520	848	619	0	843	0
0.87	23	505	1,822	14	345	1,453	226	553	1,856	1,653	1,463	787	1,850	94
0.84	24	2,093	914	776	711	1,021	2,392	2,568	3,862	3,990	5,508	2,470	2,361	549
0.81	25	3,446	1,523	1,293	1,165	1,670	3,824	772	2,029	1,312	2,705	3,167	3,725	1,538
0.77	26	698	305	259	237	340	797	493	2,039	1,610	2,678	2,638	1,675	4,009
0.73	27	1,243	3,501	1,835	782	3,315	2,679	2,182	5,033	4,372	4,525	1,815	2,767	1,891
0.68	28	49	1,375	1,563	203	1,528	1,688	1,071	2,812	2,326	2,806	2,384	1,478	3,429
0.63	29	1,387	609	517	470	674	1,562	291	1,297	1,128	1,995	3,441	2,223	1,477
0.58	30	706	305	259	241	346	830	3,173	6,102	5,724	5,311	4,970	1,490	4,095
0.53	31	1,665	4,438	1,950	2,614	2,696	3,707	1,683	3,757	4,928	4,644	4,687	2,543	2,084
0.47	32	1,378	609	517	466	668	1,529	2,037	4,978	3,580	3,940	6,571	1,181	4,543
0.42	33	497	1,822	14	341	1,447	193	660	1,302	967	1,213	5,070	1,491	1,739
0.37	34	689	305	259	233	334	765	394	1,418	933	1,232	2,564	1,125	1,582
0.32	35	689	305	259	233	334	765	832	1,569	1,095	1,890	2,518	763	670
0.27	36	689	305	259	233	334	765	20	132	63	271	1,886	409	0
0.23	37	0	0	0	0	0	0	202	742	482	684	628	189	0
0.20	38	0	0	0	0	0	0	619	761	582	1,070	442	206	27
0.16	39	689	305	259	233	334	765	0	0	0	0	169	0	0
0.14	40	0	0	0	0	0	0	0	0	0	0	0	0	0
0.11	41	0	0	0	0	0	0	0	0	0	0	0	0	0
0.09	42	0	0	0	0	0	0	0	0	0	0	0	0	0
0.08	43	0	0	0	0	0	0	0	0	0	0	0	0	0
	Males	17,121	18,748	10,292	8,744	16,834	23,284	18,441	40,637	36,015	42,812	46,207	26,355	27,918
	Total	29,428	34,931	19,196	14,270	31,992	41,051	30,421	65,883	59,439	69,483	81,825	40,600	43,612
	% Female	42%	46%	46%	39%	47%	43%	39%	38%	39%	38%	44%	35%	36%

Table 4 b. Numbers of fish harvested, including 2.13% release mortality, by size, coast, and year. The probability of a snook being female or male is given for each total-length size class (inches).

Gulf Coast

Females

Prob Fem	Total Len (in)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
		Year												
0.11	14	7	4	1	6	19	39	20	26	25	13	0	70	0
0.13	15	15	64	10	4	35	56	121	91	87	83	0	0	0
0.15	16	12	45	7	8	56	111	50	44	42	34	0	0	0
0.18	17	0	0	0	0	0	0	0	0	0	0	0	0	0
0.20	18	0	0	0	0	0	0	0	0	0	0	0	0	0
0.23	19	7	32	4	8	34	68	69	55	44	55	2,378	259	241
0.27	20	0	0	0	0	0	0	179	176	167	125	0	0	0
0.30	21	47	170	26	21	133	240	98	93	87	72	0	0	374
0.34	22	183	586	101	53	441	773	98	106	92	76	2,185	329	388
0.38	23	267	1,007	166	94	815	1,488	750	674	552	625	3,529	711	725
0.42	24	581	2,053	339	207	1,642	2,969	3,604	3,020	2,547	2,932	5,240	5,657	585
0.46	25	811	2,665	444	324	2,318	4,255	4,664	3,923	3,235	3,805	4,065	5,729	3,142
0.51	26	900	2,803	501	421	2,358	4,304	3,384	2,842	2,387	2,794	3,761	5,462	5,364
0.55	27	1,464	4,338	820	705	3,533	6,385	5,357	4,898	4,074	4,650	6,925	4,830	6,726
0.59	28	781	2,671	455	374	2,416	4,521	4,469	4,105	3,408	3,886	2,863	3,185	5,182
0.63	29	869	3,437	880	490	2,605	4,956	2,552	2,180	1,791	2,069	1,975	2,756	4,355
0.67	30	985	4,051	1,264	477	2,973	5,759	3,045	2,631	2,147	2,504	3,765	3,117	4,402
0.71	31	591	2,283	404	348	1,699	3,104	3,095	2,588	2,147	2,494	3,162	1,917	3,677
0.74	32	492	1,743	321	311	1,294	2,354	2,739	2,299	2,031	2,227	2,477	2,111	3,011
0.77	33	405	1,293	241	143	947	1,663	1,869	1,553	1,262	1,551	2,496	1,552	3,320
0.80	34	520	3,069	1,366	105	1,518	3,037	2,583	1,970	1,715	2,006	2,699	1,361	777
0.83	35	369	1,840	593	158	1,082	2,058	1,852	1,531	1,300	1,473	2,276	647	147
0.85	36	376	1,062	215	191	775	1,359	1,089	919	789	844	649	872	147
0.87	37	283	1,054	188	123	735	1,304	886	720	634	662	538	922	0
0.89	38	261	867	150	51	528	858	888	661	597	660	1,624	234	0
0.91	39	92	521	77	36	373	685	454	416	368	350	1,039	187	0
0.92	40	172	640	118	90	413	722	190	163	147	138	0	234	0
0.93	41	137	644	103	36	443	791	107	87	66	92	94	57	0
0.94	42	7	4	1	6	19	39	120	108	103	83	125	0	0
0.95	43	0	0	0	0	0	0	30	17	16	21	0	0	0
0.96	44	0	28	3	2	15	29	29	24	15	28	0	0	0
0.96	45	0	0	0	0	0	0	0	0	0	0	0	0	0
	Females	10,600	38,861	8,780	4,774	29,109	53,721	44,200	37,759	31,721	36,222	53,865	42,129	42,563

Males

Prob Male	Total Len (in)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
		Years												
1.00	10	0	0	0	0	0	0	61	57	54	40	0	0	0
1.00	11	15	36	7	2	19	27	120	130	125	81	0	0	0
1.00	12	0	0	0	0	0	0	49	55	52	36	0	0	0
1.00	13	52	111	22	10	76	118	230	161	137	175	0	0	0
0.89	14	32	78	14	15	83	155	306	244	220	232	0	0	0
0.87	15	25	147	30	76	144	308	267	228	185	213	0	0	0
0.85	16	36	64	12	26	123	249	288	256	245	237	0	0	0
0.82	17	62	1,223	764	84	424	1,056	197	172	146	155	2,771	353	241
0.80	18	29	649	401	128	250	641	152	109	103	104	7,379	647	602
0.77	19	57	96	30	77	118	239	178	171	161	128	5,564	329	241
0.73	20	22	155	22	15	145	286	298	291	269	215	5,126	357	467
0.70	21	94	371	70	87	294	559	113	119	114	97	319	99	0
0.66	22	240	654	121	60	508	876	376	337	280	323	444	0	0
0.62	23	562	1,775	315	233	1,400	2,507	1,147	1,020	880	949	2,496	1,380	147
0.58	24	1,046	4,606	1,314	369	3,040	5,702	4,419	4,185	3,524	3,892	5,205	6,889	600
0.54	25	1,251	3,441	623	372	2,862	5,062	5,111	4,460	3,719	4,221	4,321	5,163	2,717
0.49	26	1,159	3,691	647	526	3,115	5,692	3,576	3,213	2,822	2,898	4,437	4,376	5,550
0.45	27	1,102	5,194	1,744	610	3,504	6,879	3,630	3,168	2,546	3,106	4,363	3,767	6,166
0.41	28	626	2,235	392	321	1,792	3,290	2,563	2,170	1,814	2,068	3,319	2,871	4,015
0.37	29	535	1,574	333	534	1,451	2,803	1,654	1,387	1,126	1,368	3,372	1,857	2,351
0.33	30	440	1,947	619	189	1,281	2,451	2,032	1,709	1,385	1,693	2,100	1,441	2,641
0.29	31	327	993	195	207	804	1,474	1,418	1,148	935	1,180	2,300	1,047	1,874
0.26	32	248	710	127	58	478	790	1,095	910	783	857	831	850	1,197
0.23	33	204	634	123	99	449	789	645	502	416	538	2,136	542	698
0.20	34	64	269	41	27	194	347	383	313	240	320	506	580	258
0.17	35	45	207	32	18	151	274	441	355	299	359	1,451	354	0
0.15	36	31	639	381	10	210	504	298	233	197	230	825	119	0
0.13	37	45	163	27	9	88	138	198	161	136	153	444	89	0
0.11	38	22	152	20	16	100	183	136	107	97	114	490	90	0
0.09	39	17	42	9	2	30	48	0	0	0	0	0	0	0
0.08	40	0	28	3	2	15	29	0	0	0	0	0	0	0
0.07	41	17	42	9	2	30	48	0	0	0	0	0	0	0
0.06	42	0	0	0	0	0	0	0	0	0	0	319	0	0
0.05	43	0	0	0	0	0	0	0	0	0	0	0	0	0
0.04	44	0	0	0	0	0	0	0	0	0	0	0	0	0
0.04	45	0	0	0	0	0	0	0	0	0	0	0	0	0
	Males	8,245	31,490	8,362	4,055	22,733	42,667	30,060	26,240	21,992	24,968	60,518	33,200	29,765
	Total	18,845	70,351	17,142	8,829	51,842	96,388	74,260	63,999	53,713	61,190	114,383	75,329	72,328
	%Females	56%	55%	51%	54%	56%	56%	60%	59%	59%	59%	47%	56%	59%

Table 5 a. Annual estimated numbers of snook harvested by coast, sex and age. The category 'unaged' lists the fish with lengths outside the length range of the age-length keys.

Atlantic coast

Females

	Year												
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	29	106	69	98	28	62	214
3	1,298	1,434	671	548	1,292	1,591	102	350	236	263	746	481	1,006
4	2,140	2,146	1,381	893	1,991	2,988	2,466	5,963	5,150	5,797	3,191	1,302	2,219
5	2,439	2,784	2,189	1,067	2,723	4,062	4,294	9,936	8,870	9,466	5,142	2,036	3,600
6	1,767	2,848	1,980	877	2,723	3,315	1,930	3,999	3,938	4,462	8,742	2,205	4,168
7	984	1,480	915	466	1,438	1,641	616	1,039	1,242	1,382	5,272	2,866	1,722
8	1,045	1,906	814	523	1,779	1,519	1,541	2,171	2,502	2,535	3,736	2,028	1,717
9	686	834	339	292	784	809	135	254	278	379	1,014	741	622
10	422	502	193	176	491	481	128	228	237	374	890	512	187
11	458	495	158	186	454	463	224	365	291	583	2,120	598	59
12	395	709	91	191	594	319	148	259	193	425	2,779	632	9
13	188	297	48	87	252	161	165	249	197	387	854	511	78
14	217	310	58	96	266	193	56	81	57	123	212	102	0
15	158	284	36	77	237	128	60	108	71	180	519	67	68
16	79	142	18	38	119	64	30	44	31	68	169	0	27
17	30	13	11	10	15	33	4	24	11	49	202	62	0
18	0	0	0	0	0	0	52	69	51	101	0	40	0
Unaged	0	0	0	0	0	0	0	0	0	0	0	0	0
Females	12,307	16,183	8,904	5,526	15,158	17,767	11,980	25,246	23,424	26,671	35,618	14,245	15,694

Males

	Year												
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0	0	0	0	0	6	353
2	130	57	48	44	63	149	170	166	164	100	143	127	349
3	1,954	1,545	917	743	1,541	2,344	1,236	2,295	2,240	2,731	2,060	2,940	1,066
4	3,205	3,480	1,965	1,630	3,147	4,414	3,882	9,021	8,053	11,058	7,146	5,794	4,204
5	3,953	4,904	2,834	2,150	4,427	5,894	7,026	16,198	14,464	16,012	10,498	5,348	6,526
6	2,583	3,397	1,615	1,470	2,932	3,577	2,378	5,137	4,587	4,698	10,739	4,066	4,910
7	1,701	2,405	1,195	1,100	1,998	2,517	1,312	2,926	2,677	2,905	7,523	3,832	5,095
8	853	938	514	388	882	1,136	770	1,621	1,294	1,571	2,500	2,331	1,946
9	1,507	1,245	680	741	1,074	1,819	438	1,015	859	1,086	1,227	918	2,006
10	372	198	136	130	206	408	390	708	560	807	1,513	304	1,120
11	167	164	104	68	163	225	473	781	564	953	1,311	388	0
12	95	42	36	32	46	106	95	246	167	251	545	99	0
13	107	123	67	78	90	156	61	121	108	147	111	107	198
14	10	38	0	7	30	4	17	62	40	57	0	54	145
15	138	61	52	47	67	153	168	245	179	333	291	39	0
16	345	153	130	117	167	383	13	54	33	65	531	0	0
17	0	0	0	0	0	0	11	41	27	38	70	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
Unaged	0	0	0	0	0	0	0	0	0	0	0	0	0
Males	17,121	18,748	10,292	8,744	16,834	23,284	18,441	40,637	36,015	42,812	46,207	26,355	27,918

Sexes Combined

	Year												
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0	0	0	0	0	6	353
2	130	57	48	44	63	149	199	272	233	198	171	189	563
3	3,252	2,979	1,588	1,290	2,833	3,935	1,338	2,645	2,476	2,993	2,806	3,421	2,072
4	5,345	5,626	3,346	2,523	5,138	7,402	6,348	14,984	13,203	16,855	10,337	7,096	6,423
5	6,392	7,688	5,023	3,218	7,150	9,956	11,320	26,134	23,334	25,478	15,640	7,384	10,126
6	4,351	6,245	3,595	2,347	5,655	6,892	4,308	9,136	8,525	9,160	19,482	6,272	9,078
7	2,684	3,885	2,110	1,566	3,436	4,158	1,928	3,965	3,919	4,287	12,795	6,698	6,816
8	1,898	2,843	1,329	911	2,661	2,654	2,311	3,792	3,796	4,107	6,236	4,360	3,664
9	2,193	2,079	1,018	1,033	1,858	2,628	573	1,269	1,137	1,465	2,241	1,660	2,627
10	794	700	329	305	696	889	518	936	797	1,181	2,403	816	1,307
11	625	659	262	254	618	689	697	1,146	855	1,536	3,431	986	59
12	491	751	127	224	640	425	243	505	359	676	3,323	731	9
13	295	420	115	165	342	317	226	370	305	534	965	619	276
14	227	348	59	103	296	197	73	142	98	180	212	156	145
15	296	345	88	123	304	281	228	353	249	512	810	106	68
16	424	294	148	155	286	446	43	98	64	133	701	0	27
17	30	13	11	10	15	33	15	65	38	87	271	62	0
18	0	0	0	0	0	0	52	69	51	101	0	40	0
Unaged	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	29,428	34,931	19,196	14,270	31,992	41,051	30,421	65,883	59,439	69,483	81,825	40,600	43,612

Table 5 b. Annual estimated numbers of snook harvested by coast, sex and age. The category 'Unaged' lists the fish with lengths outside the length range of the age-length keys.

Gulf coast

Females

	Year												
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	1	4	1	0	3	6	0	0	0	0	0	0	0
2	50	183	29	22	150	274	177	164	140	141	679	1,157	1,457
3	1,272	4,354	810	531	3,546	6,496	845	718	612	677	3,491	3,028	5,723
4	2,232	7,575	1,523	1,062	6,131	11,312	9,572	8,185	6,822	7,887	13,238	9,799	8,355
5	1,827	6,594	1,421	897	5,141	9,536	12,551	10,951	9,096	10,486	15,229	11,615	12,315
6	2,465	9,220	2,281	1,100	6,701	12,428	10,601	9,099	7,637	8,779	10,441	9,360	8,535
7	1,523	6,123	1,735	666	4,126	7,716	5,620	4,659	3,969	4,515	6,215	3,589	4,545
8	664	2,468	589	290	1,732	3,167	2,094	1,698	1,456	1,632	2,235	1,472	394
9	162	630	107	57	422	736	1,776	1,504	1,307	1,369	953	1,864	901
10	177	754	127	69	513	913	529	425	374	400	895	58	18
11	89	339	58	31	224	387	16	14	12	12	488	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	25
13	4	2	1	3	10	20	227	195	169	175	0	187	0
14	97	429	71	33	290	516	16	14	12	12	0	0	0
15	37	159	25	10	106	186	148	110	100	110	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
Unaged	0	28	3	2	15	29	29	24	15	28	0	0	294
Females	10,600	38,861	8,780	4,774	29,109	53,721	44,200	37,759	31,721	36,222	53,865	42,129	42,563

Males

	Year												
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	4	78	49	8	28	70	0	0	0	0	0	49	10
2	105	1,205	696	178	518	1,228	53	47	42	40	4162	1149	1086
3	705	3,120	990	387	2,084	4,024	4,386	3,947	3,392	3,630	8095	2103	2968
4	1,721	6,258	1,532	792	4,720	8,795	8,628	7,687	6,498	7,195	16463	6298	7266
5	1,684	6,133	1,529	830	4,603	8,601	5,263	4,580	3,823	4,409	14948	9962	9088
6	2,283	8,100	1,899	1,071	6,098	11,278	6,594	5,670	4,634	5,521	8820	7247	4992
7	1,254	4,267	931	597	3,283	6,031	3,406	2,897	2,414	2,777	3194	3298	3124
8	324	1,157	266	135	850	1,558	522	430	357	420	2504	2215	525
9	45	163	27	9	88	138	901	741	623	729	606	723	550
10	50	425	211	22	180	384	170	134	112	133	802	60	147
11	38	472	211	21	205	435	136	107	97	114	0	0	10
12	0	0	0	0	0	0	0	0	0	0	606	60	0
13	0	0	0	0	0	0	0	0	0	0	0	36	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
Unaged	34	112	21	6	75	125	0	0	0	0	319	0	0
Males	8,245	31,490	8,362	4,055	22,733	42,667	30,060	26,240	21,992	24,968	60,518	33,200	29,765

Sexes combined

	Year												
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	5	82	49	9	31	76	0	0	0	0	0	49	10
2	155	1,387	725	199	668	1,503	229	211	182	181	4,841	2,306	2,543
3	1,978	7,474	1,799	919	5,630	10,520	5,231	4,665	4,004	4,308	11,586	5,131	8,690
4	3,953	13,833	3,056	1,854	10,852	20,107	18,201	15,872	13,320	15,082	29,701	16,098	15,621
5	3,511	12,727	2,951	1,726	9,743	18,137	17,814	15,531	12,919	14,895	30,177	21,577	21,403
6	4,748	17,320	4,180	2,171	12,799	23,706	17,195	14,770	12,271	14,299	19,261	16,607	13,527
7	2,777	10,391	2,666	1,263	7,409	13,747	9,026	7,556	6,382	7,292	9,409	6,887	7,670
8	988	3,625	855	425	2,582	4,725	2,617	2,128	1,813	2,052	4,739	3,687	918
9	207	793	134	66	510	874	2,676	2,245	1,930	2,098	1,559	2,587	1,452
10	226	1,179	338	91	693	1,297	700	559	486	532	1,697	118	165
11	127	811	268	52	429	822	152	121	109	126	488	0	10
12	0	0	0	0	0	0	0	0	0	0	606	60	25
13	4	2	1	3	10	20	227	195	169	175	0	223	0
14	97	429	71	33	290	516	16	14	12	12	0	0	0
15	37	159	25	10	106	186	148	110	100	110	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0
Unaged	34	140	24	8	90	154	29	24	15	28	319	0	294
Total	18,845	70,351	17,142	8,829	51,842	96,388	74,260	63,999	53,713	61,190	114,383	75,329	72,328

Table 6 a. Number of snook harvested by coast, estimated population size, fishing mortality rates, average fishing mortality rate for ages 6-10 by year, and two transitional spawning potential ratios -- one using the maturity schedule and the other using the sex-ratio method. The natural mortality rates used in the analyses were 0.20 per year on the Atlantic and 0.25 per year on the Gulf.

Index Weighting: **Inverse variance** **Atlantic coast**

Number Harvested

	Year												
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
2	130	57	48	44	63	149	199	272	233	198	171	189	563
3	3,252	2,979	1,588	1,290	2,833	3,935	1,338	2,645	2,476	2,993	2,806	3,421	2,072
4	5,345	5,626	3,346	2,523	5,138	7,402	6,348	14,984	13,203	16,855	10,337	7,096	6,423
5	6,392	7,688	5,023	3,218	7,150	9,956	11,320	26,134	23,334	25,478	15,640	7,384	10,126
6	4,351	6,245	3,595	2,347	5,655	6,892	4,308	9,136	8,525	9,160	19,482	6,272	9,078
7	2,684	3,885	2,110	1,566	3,436	4,158	1,928	3,965	3,919	4,287	12,795	6,698	6,816
8	1,898	2,843	1,329	911	2,661	2,654	2,311	3,792	3,796	4,107	6,236	4,360	3,664
9	2,193	2,079	1,018	1,033	1,858	2,628	573	1,269	1,137	1,465	2,241	1,660	2,627
10	794	700	329	305	696	889	518	936	797	1,181	2,403	816	1,307
11	625	659	262	254	618	689	697	1,146	855	1,536	3,431	986	59
12	491	751	127	224	640	425	243	505	359	676	3,323	731	9
13	295	420	115	165	342	317	226	370	305	534	965	619	276
14	227	348	59	103	296	197	73	142	98	180	212	156	145
15+	749	652	247	288	605	760	338	585	402	833	1,782	208	95
Ages 2-5	15,120	16,349	10,005	7,075	15,185	21,441	19,205	44,035	39,246	45,525	28,954	18,090	19,184
Ages 6+	14,308	18,582	9,191	7,195	16,807	19,610	11,216	21,848	20,193	23,958	52,871	22,504	24,075
Total Ages 2+	29,428	34,931	19,196	14,270	31,992	41,051	30,421	65,883	59,439	69,483	81,825	40,594	43,259

Population size (January 1)

	Year												
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
2	115,770	104,590	79,429	90,268	129,620	156,520	187,370	166,040	146,200	126,120	126,290	149,660	854,100
3	73,791	94,681	85,516	64,994	73,869	106,010	127,980	153,300	135,770	119,570	103,120	103,170	122,360
4	59,717	58,729	74,917	68,984	52,537	58,829	83,951	102,830	121,430	108,140	94,504	79,800	81,463
5	40,920	43,803	42,115	57,904	53,743	38,632	42,325	63,890	74,054	89,325	77,207	62,155	56,754
6	24,226	26,743	27,329	30,639	42,819	35,302	24,266	29,831	40,211	48,679	55,231	40,345	38,128
7	16,149	15,669	16,477	19,774	22,551	27,842	21,905	16,985	18,549	26,166	29,712	28,269	24,421
8	10,660	10,494	9,710	11,952	14,585	14,731	17,372	15,381	10,620	12,126	16,066	15,352	17,216
9	7,475	6,607	6,141	6,870	8,629	9,096	8,693	11,819	9,099	6,629	7,018	7,552	8,798
10	4,816	4,688	3,922	4,373	4,987	5,444	5,443	5,961	7,090	5,746	3,894	3,378	4,395
11	3,582	3,185	2,967	2,871	3,251	3,313	3,467	3,866	3,804	4,714	3,605	2,083	2,104
12	2,173	2,284	1,929	2,131	2,100	2,085	2,022	2,404	2,365	2,441	2,827	1,794	1,238
13	1,827	1,432	1,440	1,410	1,582	1,391	1,323	1,433	1,528	1,568	1,526	1,503	1,113
14	1,259	1,098	807	1,002	1,004	957	791	881	817	925	873	674	827
15+	4,081	3,010	2,442	3,277	3,364	3,586	2,673	2,779	2,242	3,737	5,395	911	744
Ages 2-5	290,198	301,803	281,977	282,150	309,769	359,991	441,626	486,060	477,454	443,155	401,121	394,785	1,114,677
Ages 6+	76,248	75,209	73,163	84,299	104,870	103,747	87,955	91,341	96,324	112,731	126,145	101,860	98,983
Total Ages 2+	366,446	377,012	355,140	366,449	414,639	463,738	529,581	577,401	573,778	555,886	527,266	496,645	1,213,660

Fishing Mortality rates per year (F)

	Year													1999
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Selectivity
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.005
3	0.03	0.03	0.01	0.01	0.03	0.03	0.02	0.03	0.03	0.04	0.06	0.04	0.02	0.126
4	0.11	0.13	0.06	0.05	0.11	0.13	0.07	0.13	0.11	0.14	0.22	0.14	0.07	0.488
5	**0.23**	**0.27**	**0.12**	**0.10**	**0.22**	**0.27**	**0.15**	**0.26**	**0.22**	**0.28**	**0.45**	**0.29**	**0.15**	**1.000**
6	0.24	0.28	0.12	0.11	0.23	0.28	0.16	0.28	0.23	0.29	0.47	0.30	0.16	1.046
7	0.23	0.28	0.12	0.10	0.23	0.27	0.15	0.27	0.23	0.29	0.46	0.30	0.16	1.025
8	0.28	0.34	0.15	0.13	0.27	0.33	0.19	0.32	0.27	0.35	0.55	0.36	0.19	1.236
9	0.27	0.32	0.14	0.12	0.26	0.31	0.18	0.31	0.26	0.33	0.53	0.34	0.18	1.183
10	0.21	0.26	0.11	0.10	0.21	0.25	0.14	0.25	0.21	0.27	0.43	0.27	0.14	0.948
11	0.25	0.30	0.13	0.11	0.24	0.29	0.17	0.29	0.24	0.31	0.50	0.32	0.17	1.109
12	0.22	0.26	0.11	0.10	0.21	0.25	0.14	0.25	0.21	0.27	0.43	0.28	0.15	0.962
13	0.31	0.37	0.16	0.14	0.30	0.36	0.21	0.36	0.30	0.39	0.62	0.40	0.21	1.375
14	0.23	0.27	0.12	0.10	0.22	0.27	0.15	0.26	0.22	0.28	0.45	0.29	0.15	1.000
15+	0.23	0.27	0.12	0.10	0.22	0.27	0.15	0.26	0.22	0.28	0.45	0.29	0.15	1.000
Average Ages 6-10	0.25	0.30	0.13	0.11	0.24	0.29	0.16	0.29	0.24	0.31	0.49	0.31	0.16	

Transitional spawning potential ratios

	Year												
Method	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Maturity Schedule	40%	39%	40%	44%	46%	43%	43%	43%	41%	40%	35%	33%	35%
Sex Ratio	30%	30%	31%	34%	35%	34%	34%	34%	33%	31%	28%	25%	26%

Table 6 b. Number of snook harvested by coast, estimated population size, fishing mortality rates, average fishing mortality rate for ages 6-10 by year, and two transitional spawning potential ratios -- one using the maturity schedule and the other using the sex-ratio method. The natural mortality rates used in the analyses were 0.20 per year on the Atlantic and 0.25 per year on the Gulf.

Index Weighting: **Inverse variance** **Gulf coast**

Number Harvested

	Year												
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
2	155	1,387	725	199	668	1,503	229	211	182	181	4,841	2,306	2,543
3	1,978	7,474	1,799	919	5,630	10,520	5,231	4,665	4,004	4,308	11,586	5,131	8,690
4	3,953	13,833	3,056	1,854	10,852	20,107	18,201	15,872	13,320	15,082	29,701	16,098	15,621
5	3,511	12,727	2,951	1,726	9,743	18,137	17,814	15,531	12,919	14,895	30,177	21,577	21,403
6	4,748	17,320	4,180	2,171	12,799	23,706	17,195	14,770	12,271	14,299	19,261	16,607	13,527
7	2,777	10,391	2,666	1,263	7,409	13,747	9,026	7,556	6,382	7,292	9,409	6,887	7,670
8	988	3,625	855	425	2,582	4,725	2,617	2,128	1,813	2,052	4,739	3,687	918
9	207	793	134	66	510	874	2,676	2,245	1,930	2,098	1,559	2,587	1,452
10	226	1,179	338	91	693	1,297	700	559	486	532	1,697	118	165
11+	299	1,540	389	106	925	1,697	572	463	405	450	1,413	283	328
Ages 2-5	9,597	35,421	8,531	4,698	26,893	50,266	41,475	36,278	30,426	34,466	76,305	45,111	48,257
Ages 6+	9,243	34,848	8,562	4,122	24,918	46,046	32,785	27,721	23,287	26,724	38,078	30,169	24,061
Total Ages 2	18,840	70,269	17,093	8,820	51,811	96,312	74,260	63,999	53,713	61,190	114,383	75,280	72,318

Population size (January 1)

	Year												
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
2	131,350	137,490	168,330	149,110	201,860	242,350	150,410	175,220	164,520	143,000	195,000	204,800	371,600
3	105,610	102,120	106,190	130,810	116,040	156,710	187,800	116,670	135,930	127,690	110,970	150,430	158,320
4	58,291	80,779	72,793	80,801	101,070	87,386	115,700	140,190	87,195	102,030	95,736	78,134	108,260
5	47,782	42,513	45,580	52,092	61,143	69,655	56,026	77,236	93,980	59,371	69,202	51,650	45,645
6	25,471	33,429	19,556	30,914	38,706	38,996	39,477	33,920	47,081	58,766	36,890	29,582	25,144
7	9,141	15,968	8,972	11,514	21,892	20,123	15,965	18,472	16,093	23,518	28,981	8,536	8,905
8	5,000	5,453	3,360	4,955	7,978	10,377	7,113	6,650	7,825	7,263	10,448	5,082	2,068
9	1,986	3,130	1,453	1,974	3,507	4,136	4,229	3,316	3,144	3,897	3,570	2,397	1,519
10	1,309	1,246	842	856	1,398	1,825	1,696	1,981	1,575	1,572	1,924	828	723
11+	1,725	2,599	1,791	1,318	3,119	3,991	1,603	1,325	1,265	1,374	2,217	511	615
Ages 2-5	343,033	362,902	392,893	412,813	480,113	556,101	509,936	509,316	481,625	432,091	470,908	485,014	683,825
Ages 6+	44,632	61,825	35,974	51,531	76,600	79,447	70,082	65,664	76,983	96,389	84,030	46,937	38,974
Total Ages 2	387,665	424,727	428,867	464,344	556,713	635,548	580,018	574,980	558,608	528,480	554,938	531,951	722,799

Fishing mortality rates per year (F)

	Year													1999
Age (yr)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Selectivity
2	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.008
3	0.02	0.09	0.02	0.01	0.03	0.05	0.04	0.04	0.04	0.04	0.10	0.08	0.07	0.083
4	0.07	0.32	0.08	0.03	0.12	0.19	0.15	0.15	0.13	0.14	0.37	0.29	0.27	0.303
5	0.11	0.53	0.14	0.05	0.20	0.32	0.25	0.25	0.22	0.23	0.60	0.47	0.44	0.494
6	**0.22**	**1.07**	**0.28**	**0.10**	**0.40**	**0.64**	**0.51**	**0.50**	**0.44**	**0.46**	**1.21**	**0.95**	**0.90**	**1.000**
7	0.27	1.31	0.34	0.12	0.50	0.79	0.63	0.61	0.55	0.56	1.49	1.17	1.10	1.229
8	0.22	1.07	0.28	0.10	0.41	0.65	0.51	0.50	0.45	0.46	1.22	0.96	0.90	1.007
9	0.22	1.06	0.28	0.09	0.40	0.64	0.51	0.49	0.44	0.46	1.21	0.95	0.89	0.998
10	0.22	1.07	0.28	0.10	0.40	0.64	0.51	0.50	0.44	0.46	1.21	0.95	0.90	1.000
11+	0.22	1.07	0.28	0.10	0.40	0.64	0.51	0.50	0.44	0.46	1.21	0.95	0.90	1.000
Average Ages 6-10	0.23	1.12	0.29	0.10	0.42	0.67	0.53	0.52	0.46	0.48	1.27	1.00	0.94	

Transitional spawning potential ratios

	Year												
Method	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Maturity Schedule	37%	34%	33%	39%	42%	38%	36%	36%	36%	37%	31%	27%	27%
Sex Ratio	34%	31%	30%	35%	37%	35%	33%	33%	33%	33%	29%	26%	25%

Table 7. Comparison of sizes of fish with regard to current and previous size limits by coast weighted by the number of fish harvested per time period.

Atlantic

	Time period					Total
	1987-1992	1993-1996	1997	1998	1999	measured
Total measured	55	288	729	591	263	1926

Percentages

						Average
	1987-1992	1993-1996	1997	1998	1999	1987-98
Less than 24 in.	4%	5%	1%	7%	1%	4%
24-25 inches	14%	11%	8%	18%	5%	12%
26-34 inches	60%	64%	52%	48%	82%	60%
34 in. or larger	23%	19%	39%	28%	12%	24%
Sum	100%	100%	100%	100%	100%	100%
Undersized	4%	5%	1%	7%	6%	4%
Oversized	n.a.	n.a.	n.a.	n.a.	12%	n.a.

Gulf

	Time period					Total
	1987-1992	1993-1996	1997	1998	1999	measured
Total measured	3,261	3,646	1,497	1,224	779	10,407

Percentages

						Average
	1987-1992	1993-1996	1997	1998	1999	1987-98
Less than 24 in.	10%	7%	28%	6%	5%	11%
24-25 inches	18%	24%	16%	31%	10%	21%
26-34 inches	58%	57%	44%	55%	84%	55%
34 in. or larger	14%	12%	11%	8%	2%	12%
Sum	100%	100%	100%	100%	100%	100%
Undersized	10%	7%	28%	6%	14%	11%
Oversized	n.a.	n.a.	n.a.	n.a.	2%	n.a.

SPECIES : SNOOK MRFSS DATA : 1987 - 1999 OPEN SEASON ONLY
COAST : Atlantic
DATA SOURCE : NMFS Marine Recreational Fisheries Statistical Survey

********** BASED ON FISH KEPT **********

Number of Fish Kept per Angler	Number of Years	Number of Trips	Number of Anglers	Average Number of Anglers per Trip	Cumulative Percentage of Anglers	Number of Fish Caught	Number of Fish Retained	Cumulative Percentages of Fish Caught	Cumulative Percentages of Fish Retained
0	9	5895	6028	1.02	94.25	3799	4	81.73	0.80
1	9	276	295	1.07	98.86	541	290	93.37	58.45
2	7	56	63	1.13	99.84	207	124	97.83	83.10
3	3	3	3	1.00	99.89	23	9	98.32	84.89
4	2	2	2	1.00	99.92	9	8	98.52	86.48
5	1	1	1	1.00	99.94	5	5	98.62	87.48
8	1	1	1	1.00	99.95	8	8	98.80	89.07
12	1	1	1	1.00	99.97	12	12	99.05	91.45
19	1	1	1	1.00	99.98	20	19	99.48	95.23
24	1	1	1	1.00	100.00	24	24	100.00	100.00
Totals		6237	6396			4648	503		

Expected Harvest Reductions Associated with Particular Bag Limits
Number of Intercepts per Iteration 100
Number of Iterations 1000

	BAG LIMITS									
	1	2	3	4	5	6	7	8	9	10
Mean	16	5	4	3	3	3	3	2	2	2
Std Dev	18.5	15.9	14.7	13.7	12.7	11.7	10.9	9.8	9.1	8.3
Min	0	0	0	0	0	0	0	0	0	0
Max	77	73	70	67	63	60	57	53	50	47

COAST : Gulf

********** BASED ON FISH KEPT **********

Number of Fish Kept per Angler	Number of Years	Number of Trips	Number of Anglers	Average Number of Anglers per Trip	Cumulative Percentage of Anglers	Number of Fish Caught	Number of Fish Retained	Cumulative Percentages of Fish Caught	Cumulative Percentages of Fish Retained
0	9	9129	9518	1.04	93.44	5582	16	74.04	1.93
1	9	452	541	1.20	98.75	1193	503	89.87	62.61
2	8	94	114	1.21	99.87	606	215	97.90	88.54
3	2	2	2	1.00	99.89	8	6	98.01	89.26
4	2	4	5	1.25	99.94	44	20	98.59	91.68
5	1	2	2	1.00	99.96	10	10	98.73	92.88
6	1	1	1	1.00	99.97	6	6	98.81	93.61
13	1	1	1	1.00	99.98	13	13	98.98	95.17
20	1	2	2	1.00	100.00	77	40	100.00	100.00
Totals		9687	10186			7539	829		

Expected Harvest Reductions Associated with Particular Bag Limits
Number of Intercepts per Iteration 100
Number of Iterations 1000

	BAG LIMITS									
	1	2	3	4	5	6	7	8	9	10
Mean	20	7	6	5	5	4	4	3	3	3
Std Dev	21.7	19.2	17.4	15.7	14.4	12.9	11.8	10.8	9.7	8.8
Min	0	0	0	0	0	0	0	0	0	0
Max	75	65	61	57	54	50	46	43	39	36

SPECIES : SNOOK MRFSS DATA : 1999 - 1999 OPEN SEASON ONLY
COAST : Atlantic
DATA SOURCE : NMFS Marine Recreational Fisheries Statistical Survey

********** BASED ON FISH KEPT **********

Number of Fish Kept per Angler	Number of Years	Number of Trips	Number of Anglers	Average Number of Anglers per Trip	Cumulative Percentage of Anglers	Number of Fish Caught	Number of Fish Retained	Cumulative Percentages of Fish Caught	Cumulative Percentages of Fish Retained
0	1	950	992	1.04	94.66	824	2	88.22	2.70
1	1	39	45	1.15	98.95	65	43	95.18	60.81
2	1	6	9	1.50	99.81	32	17	98.61	83.78
4	1	1	1	1.00	99.90	5	4	99.14	89.19
8	1	1	1	1.00	100.00	8	8	100.00	100.00
Totals		997	1048			934	74		

Expected Harvest Reductions Associated with Particular Bag Limits
Number of Intercepts per Iteration 100
Number of Iterations 1000

	BAG LIMITS								
	1	2	3	4	5	6	7	8	9	10
Mean	24	11	8	6	4	3	1	0	0	0
Std Dev	20.7	17.7	14.6	11.8	8.9	5.9	3.0	0.0	0.0	0.0
Min	0	0	0	0	0	0	0	0	0	0
Max	62	50	42	33	25	17	8	0	0	0

COAST : Gulf

********** BASED ON FISH KEPT **********

Number of Fish Kept per Angler	Number of Years	Number of Trips	Number of Anglers	Average Number of Anglers per Trip	Cumulative Percentage of Anglers	Number of Fish Caught	Number of Fish Retained	Cumulative Percentages of Fish Caught	Cumulative Percentages of Fish Retained
0	1	1504	1565	1.04	93.82	1280	1	82.85	0.78
1	1	67	89	1.33	99.16	209	80	96.38	62.79
2	1	9	12	1.33	99.88	31	23	98.38	80.62
5	1	1	1	1.00	99.94	5	5	98.71	84.50
20	1	1	1	1.00	100.00	20	20	100.00	100.00
Totals		1582	1668			1545	129		

Expected Harvest Reductions Associated with Particular Bag Limits
Number of Intercepts per Iteration 100
Number of Iterations 1000

	BAG LIMITS								
	1	2	3	4	5	6	7	8	9	10
Mean	13	6	5	3	1	1	1	1	1	1
Std Dev	18.8	14.4	11.6	9.3	7.9	7.3	6.8	6.3	5.7	5.2
Min	0	0	0	0	0	0	0	0	0	0
Max	74	62	56	50	44	41	38	35	32	29

LIST OF FIGURES

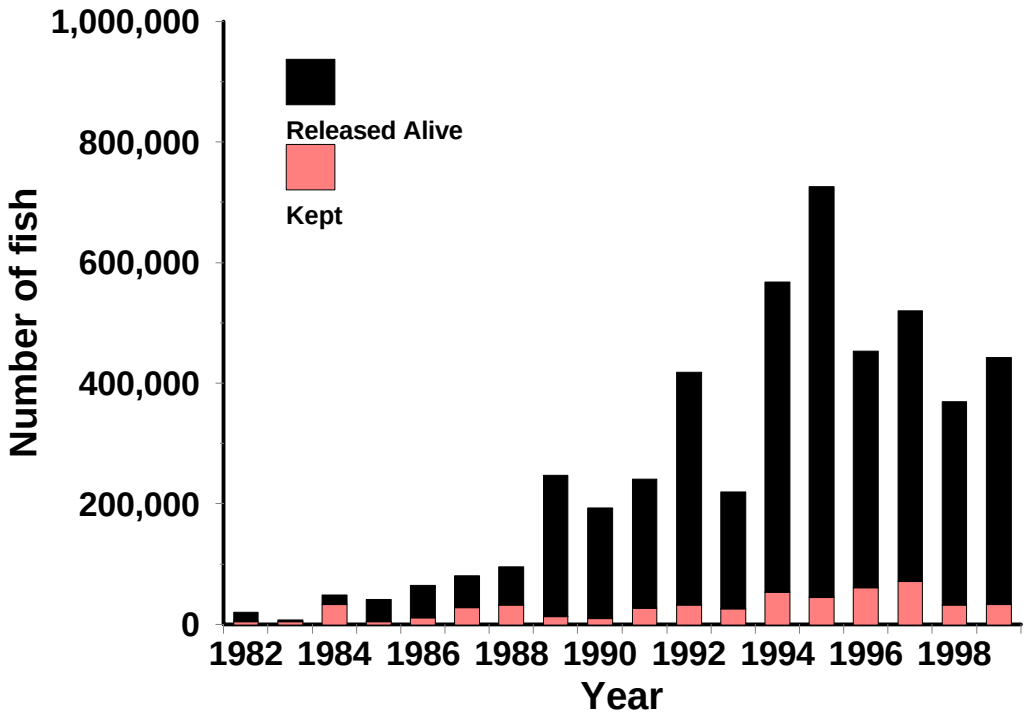
11. Mean fishing mortality rates per year for ages 6-10 by coast and year. The horizontal line is the median of 1000 simulation runs, the box is the interquartile range, and the vertical line is the 95% confidence interval.

12. Estimated spawning biomass by coast and year. The horizontal line is the median of 1000 simulation runs, the box is the interquartile range, and the vertical line is the 95% confidence interval.

13. Estimated recruitment of age-2 fish by coast and year. The horizontal line is the median of 1000 simulation runs, the box is the interquartile range, and the vertical line is the 95% confidence interval.

14. Yield per recruit (solid line and open circles) and static spawning potential ratios (solid line) line) for a range of fishing mortality rates. The 1999 transitional SPR (solid point), and the 40% SPR goal (dashed line) are also given. The instantaneous natural mortality rates used in these analyses were 0.20 per year on the Atlantic coast and 0.25 per year on the Gulf coast. Transitional SPR's are plotted at the estimated, fully-recruited fishing mortality for 1999.

a. Atlantic



b. Gulf

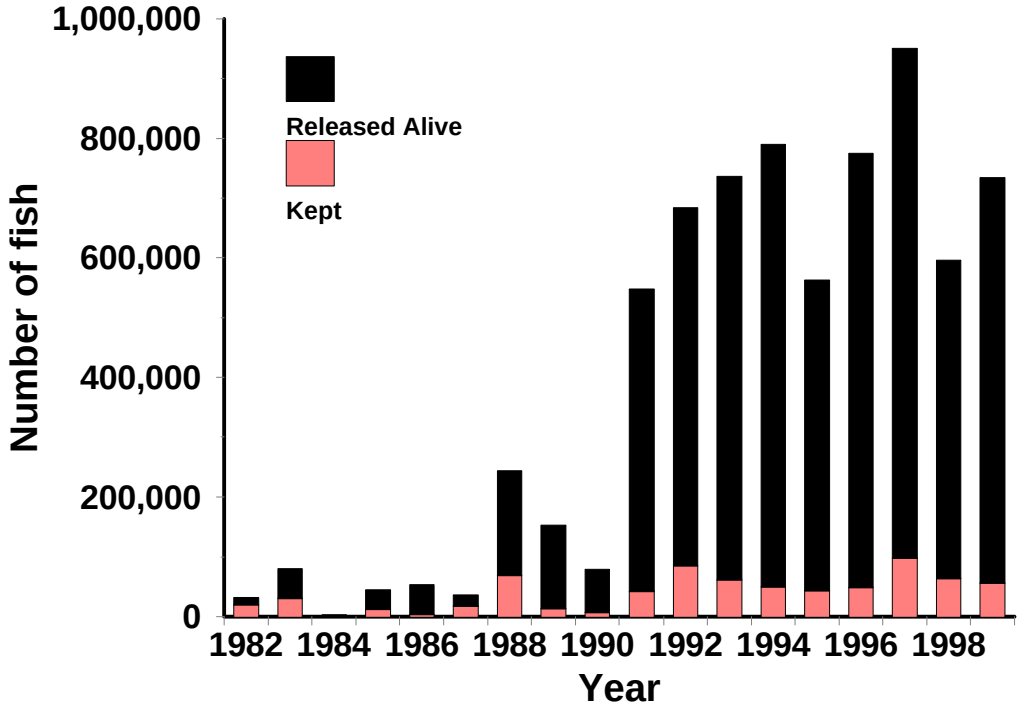
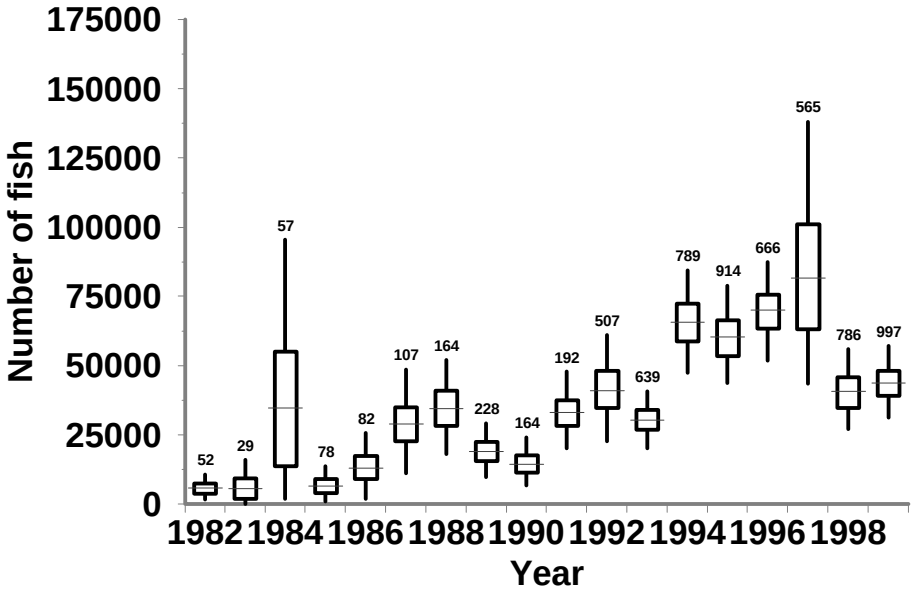


Figure 1. Median annual total recreational catch of snook including both fish released alive and fish kept.

a. Atlantic



b. Gulf

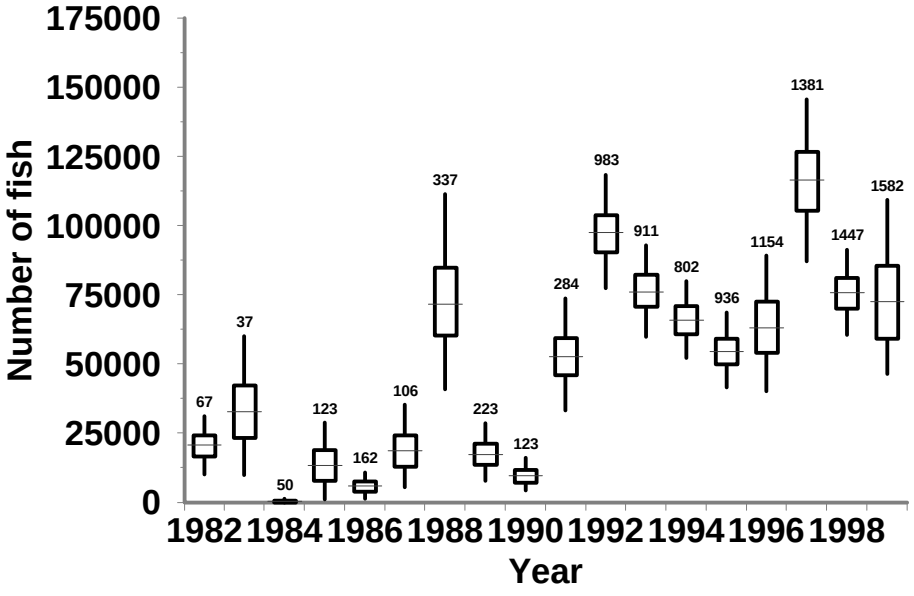
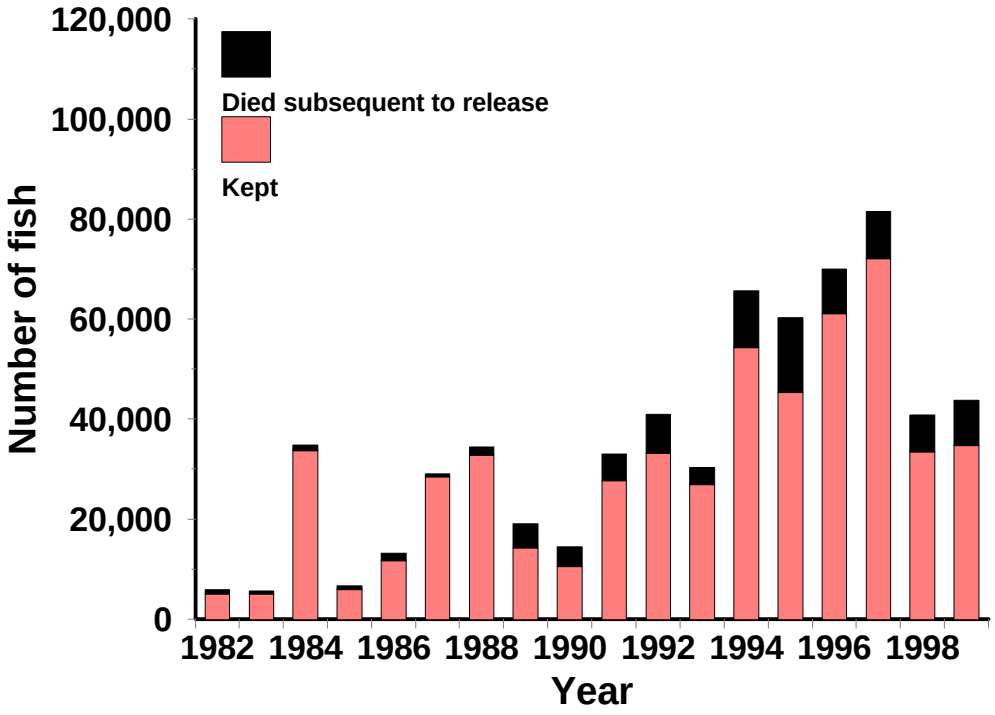


Figure 2. Estimated annual recreational harvest of common snook. Harvest includes the estimated number of fish landed and kept and the number of fish that died after being released alive (2.13% of those released alive). The number above each data symbol is the number of interviews in which an number of interviews in which an angler reported catching or targeting a snook, the horizontal line is the median, the box is the interquartile range, and the vertical line is the 95% confidence interval.

a. Atlantic



b. Gulf

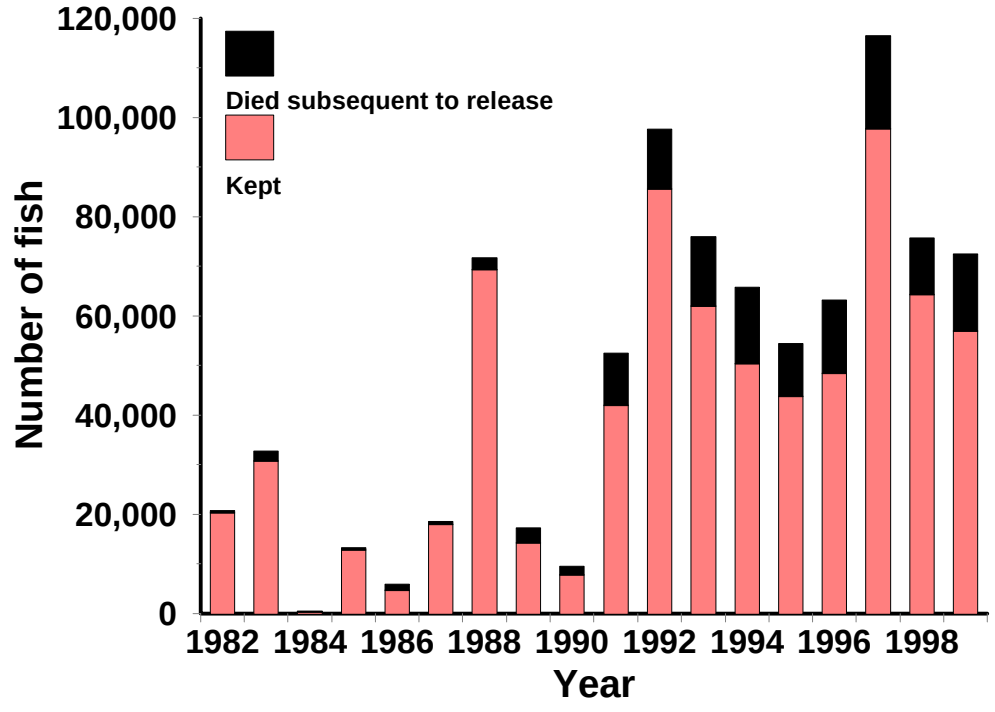
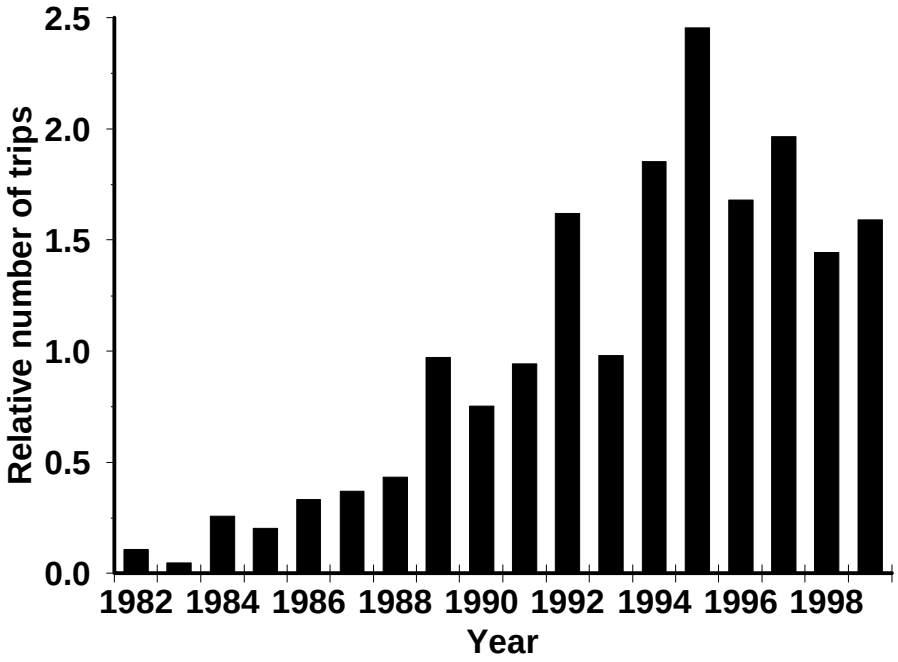


Figure 3. Median annual recreational harvest of snook, including those landed and kept plus those that died after being released alive.

a. Atlantic



b. Gulf

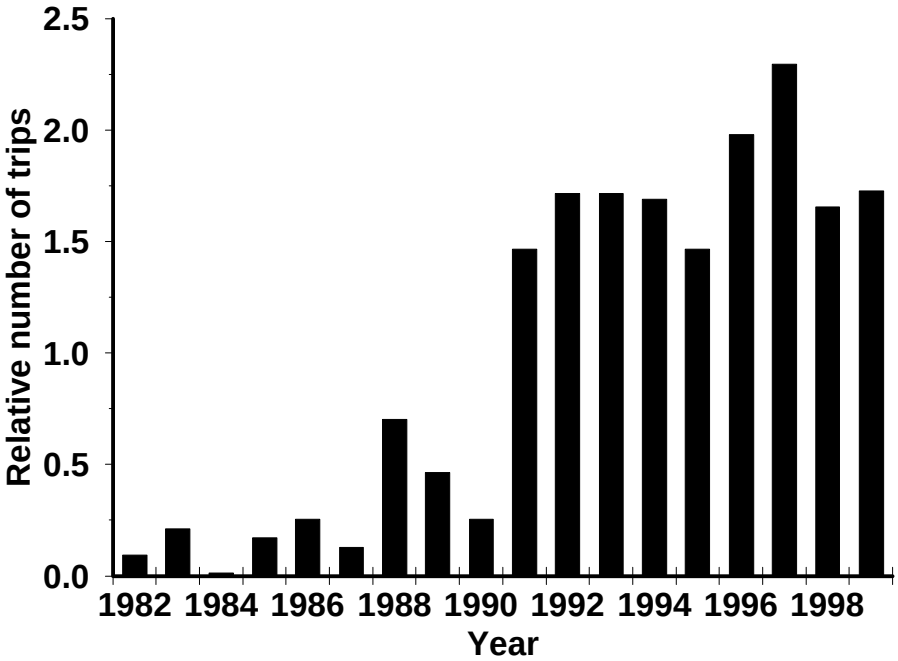
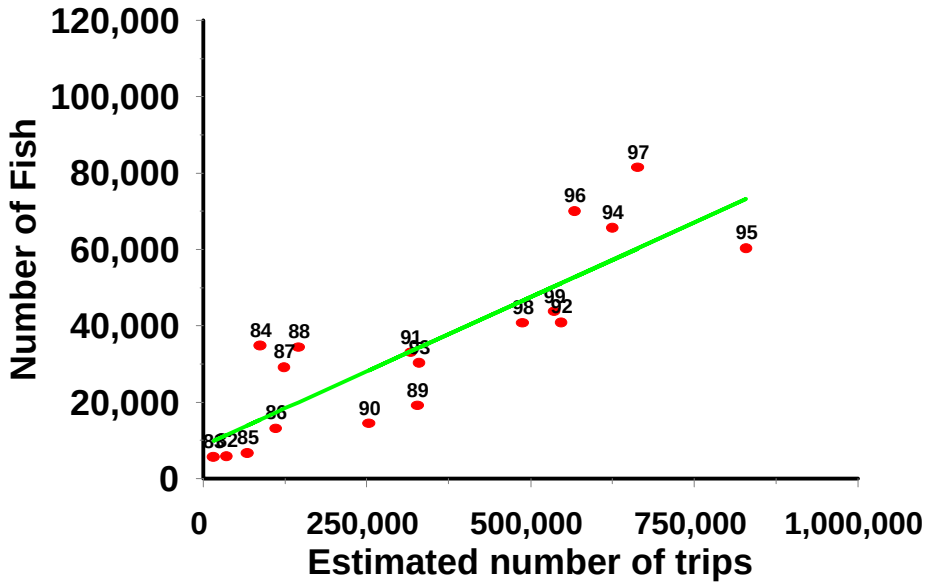


Figure 4. Relative number of recreational trips as calculated by dividing the estimated total catch by the estimated total catch per trip and expressing this relative to the 1982-1999 average.

a. Atlantic



b. Gulf

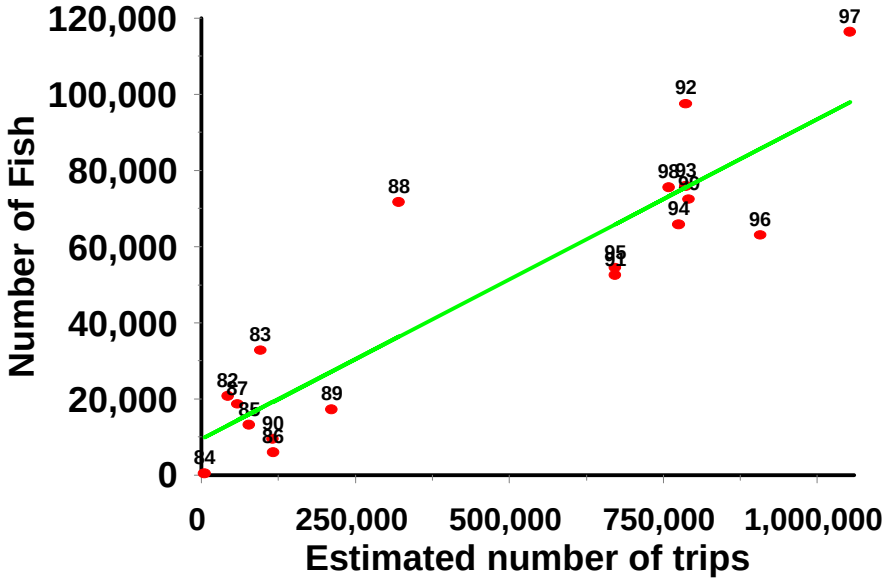
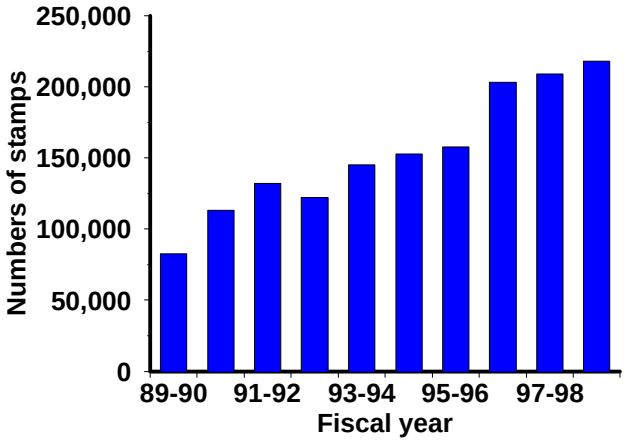
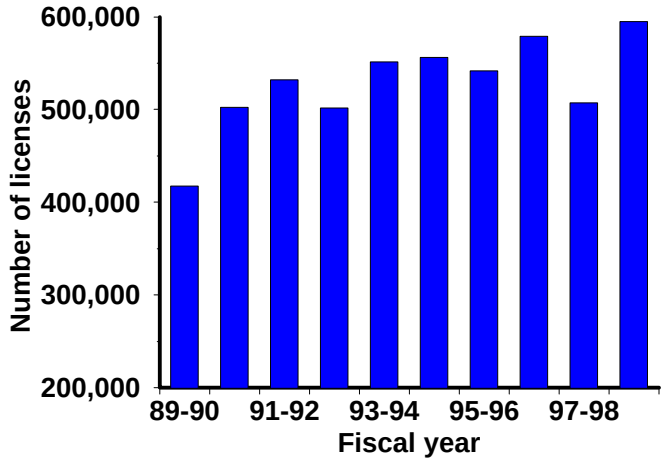


Figure 5. Annual harvest of snook and the associated estimate of the number of directed snook fishing trips made on the Atlantic and Gulf coasts during 1982-1999. The number over each data point represents the year.

a. Snook stamp sales



b. Resident Saltwater Fishing License sales



c. Ratio of snook stamps to resident licenses.

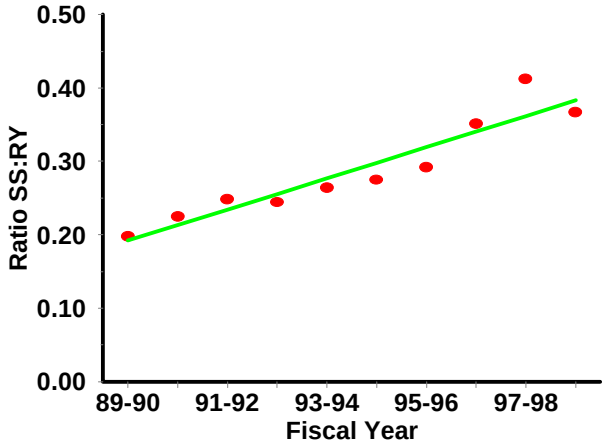
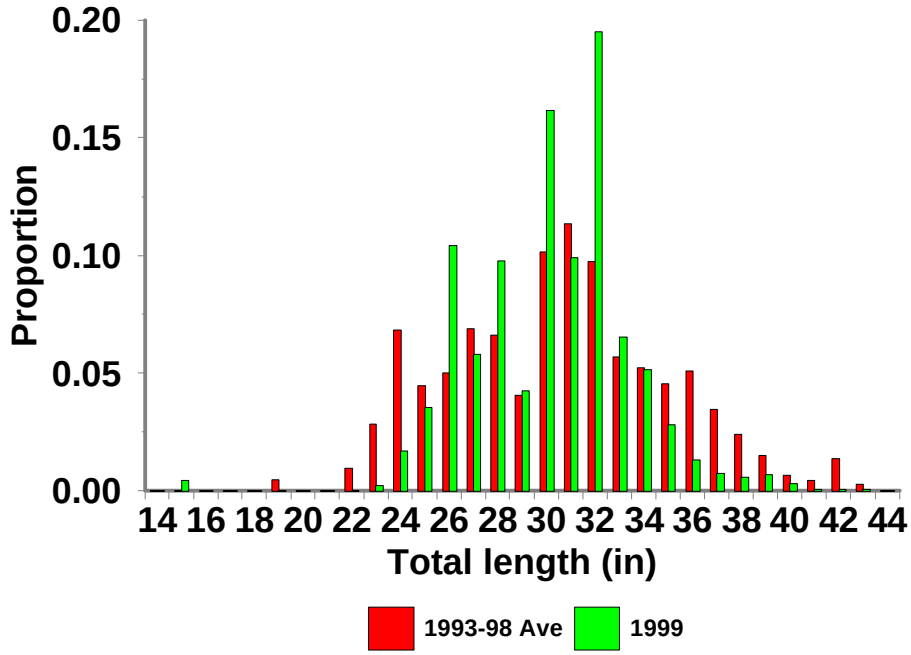


Figure 6. Statewide sales of snook stamps, annual resident Saltwater Fishing Licenses, and the ratio of snook stamp sales to resident licenses by fiscal year.

a. Atlantic



b. Gulf

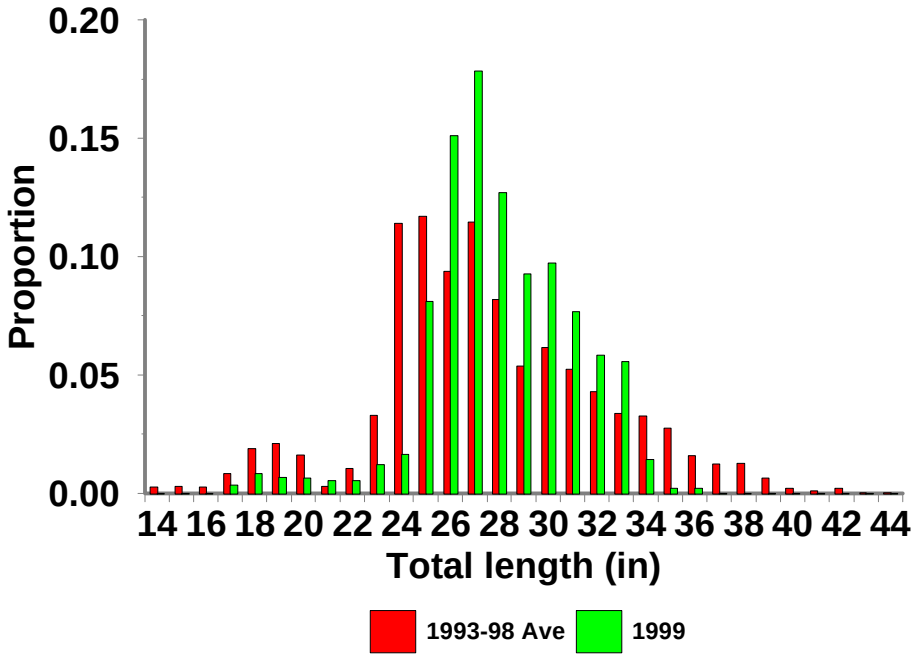
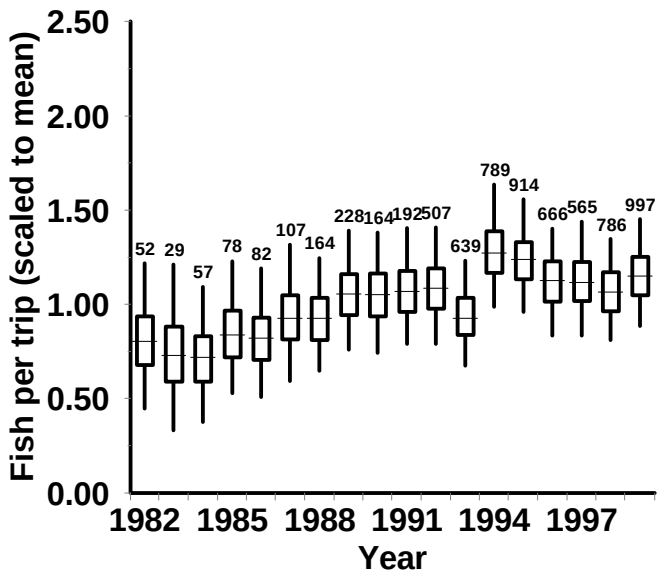
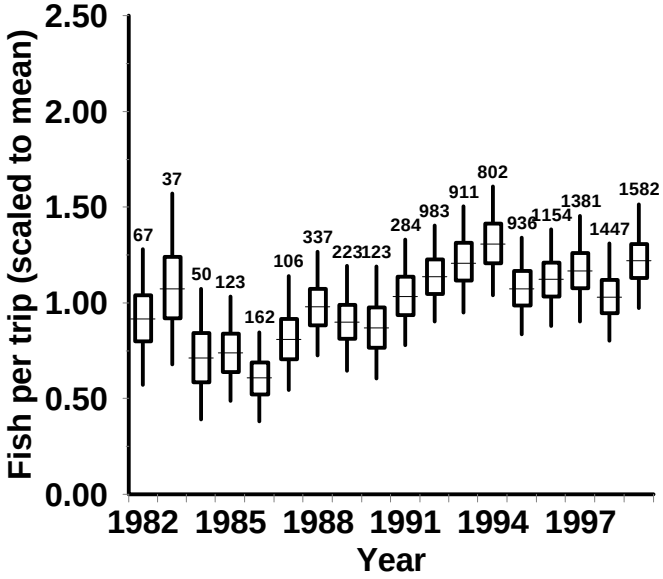


Figure 7. Total lengths of snook landed during 1993-98 and in 1999 by coast. Atlantic data from MRFSS, FMRI angler interviews, and carcass drop-offs. Gulf data are from MRFSS, FMRI angler interviews, carcass drop-offs, and the Everglades National Park creel survey.

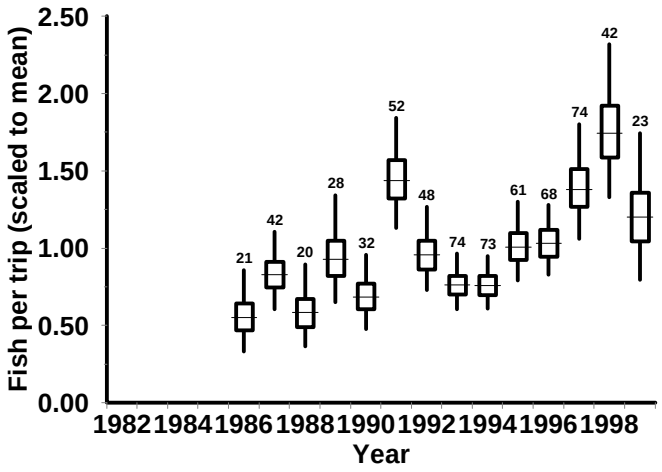
a. Atlantic coast - MRFSS



c. Gulf coast - MRFSS



b. Atlantic coast - Fishery Independent Sampling



d. Gulf coast - Everglades National Park Creel Survey

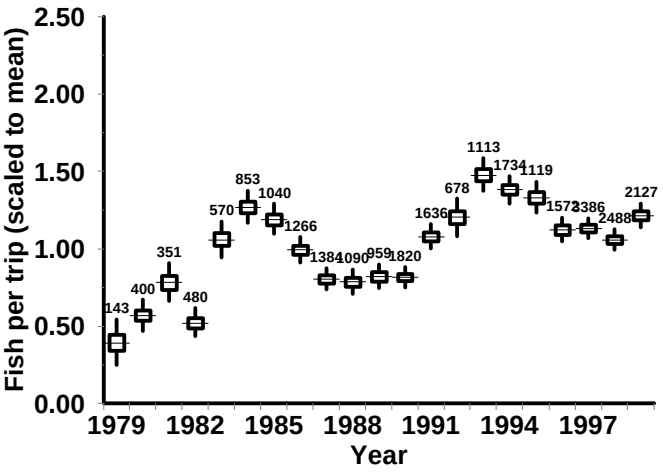
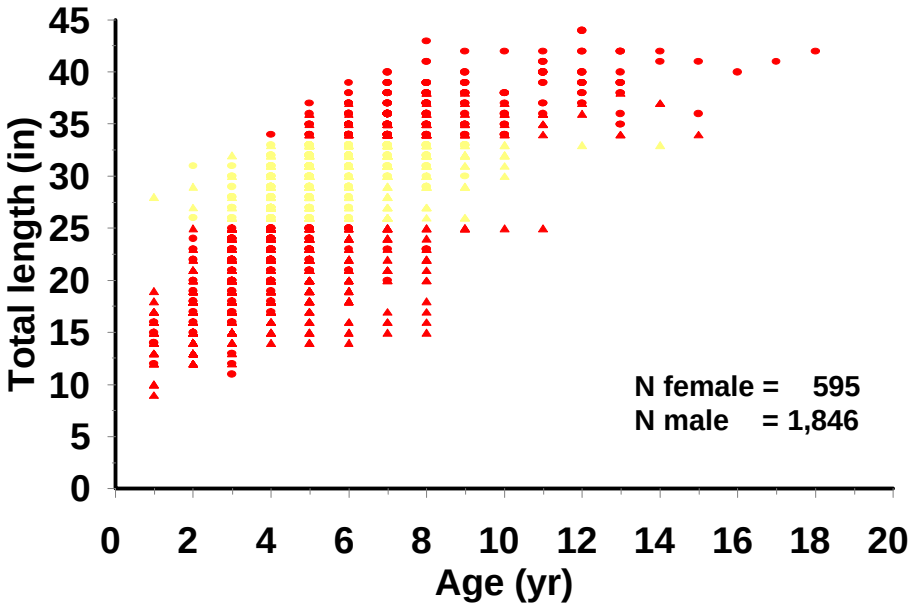


Figure 8. Relative number of snook caught per trip after standardization with a general linear model and normalization their means. The numbers are the number of trips that either caught or targeted snook, the horizontal lines are the medians, the boxes are the inter-quartile ranges, and the vertical lines are the 95% confidence intervals.

a. Atlantic



b. Gulf

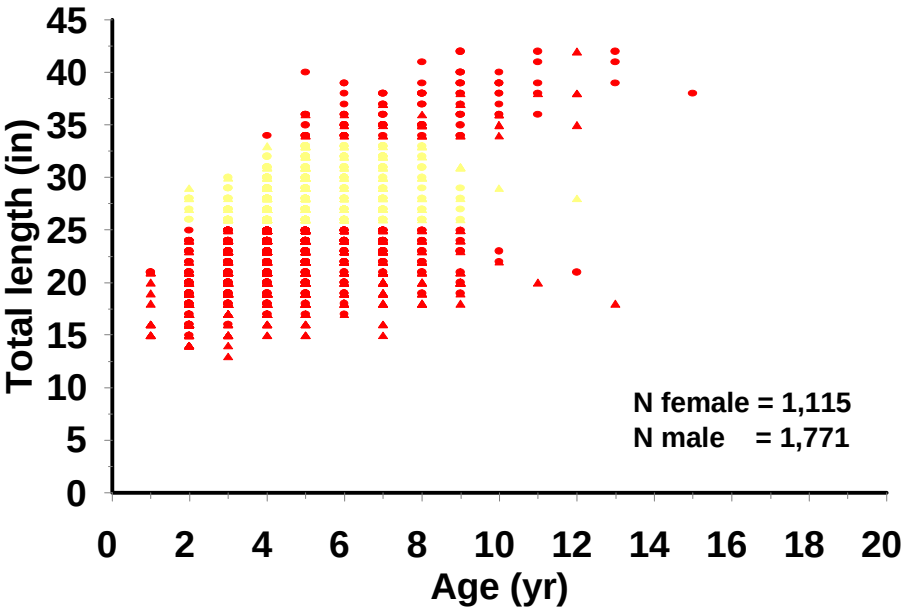
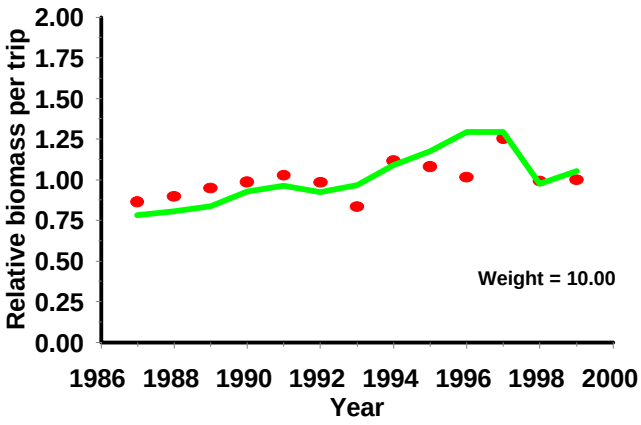
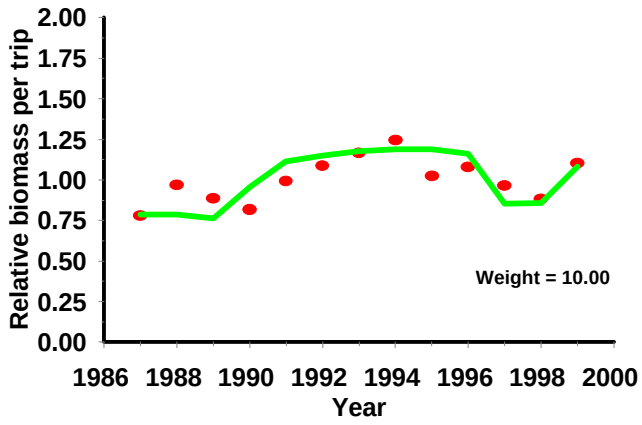


Figure 9. Ages and total lengths of snook measured by FMRI samplers during the period of 1993-1999. The lighter points are in the current legal harvesting size slot range. The circles represent females and the triangles represent males.

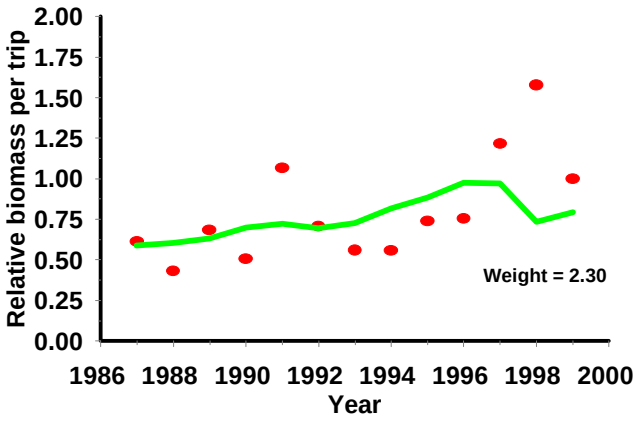
a. Atlantic coast - MRFSS



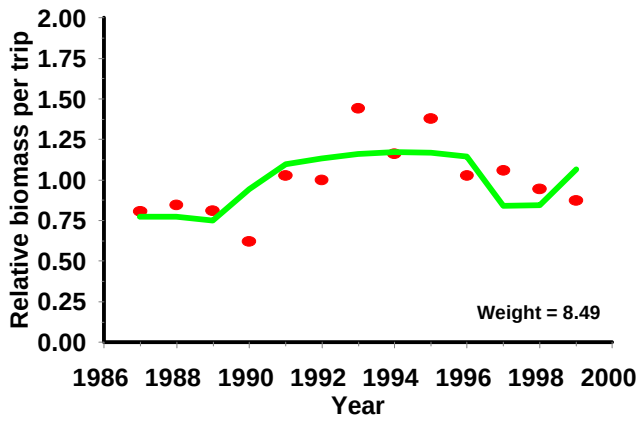
c. Gulf coast - MRFSS



b. Atlantic coast -- Fishery Independent Sampling



d. Gulf coast -- Everglades National Park Creel Survey



e. Gulf coast -- Age-2 fish from 600 ' seine

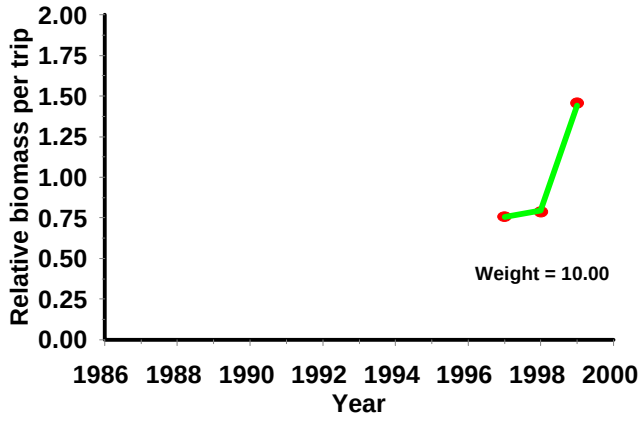
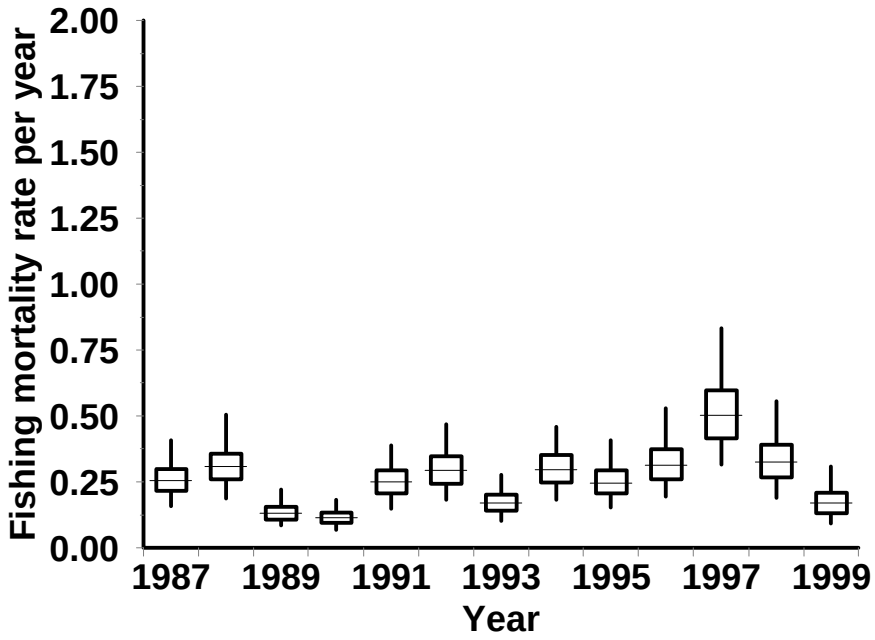


Figure 10. Comparison of observed (ellipses) and predicted (lines) snook biomass per trip or number of age-2 fish per sampling trip used to tune the SVPA model. The weight refers to the influence of an index on the coast's model solution.

a. Atlantic



b. Gulf

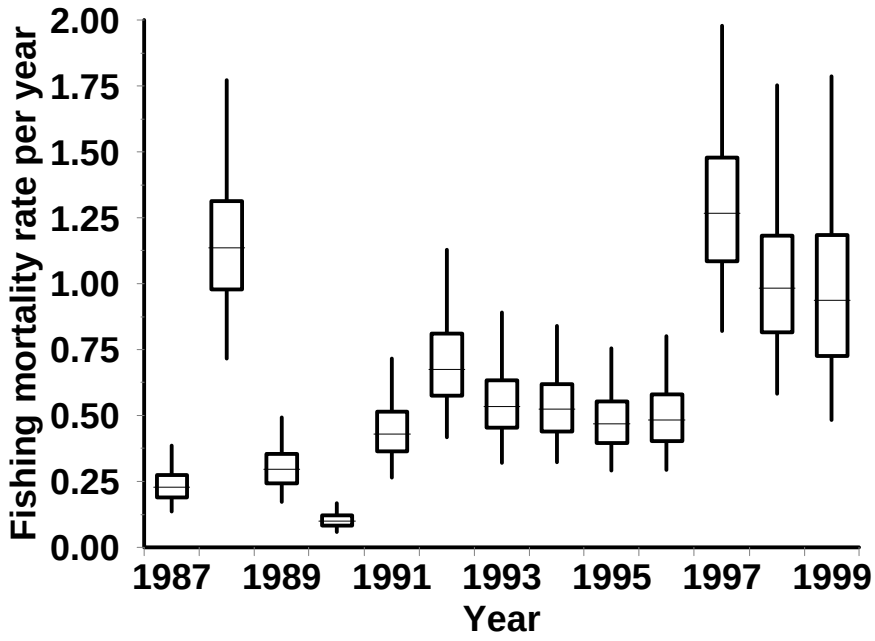
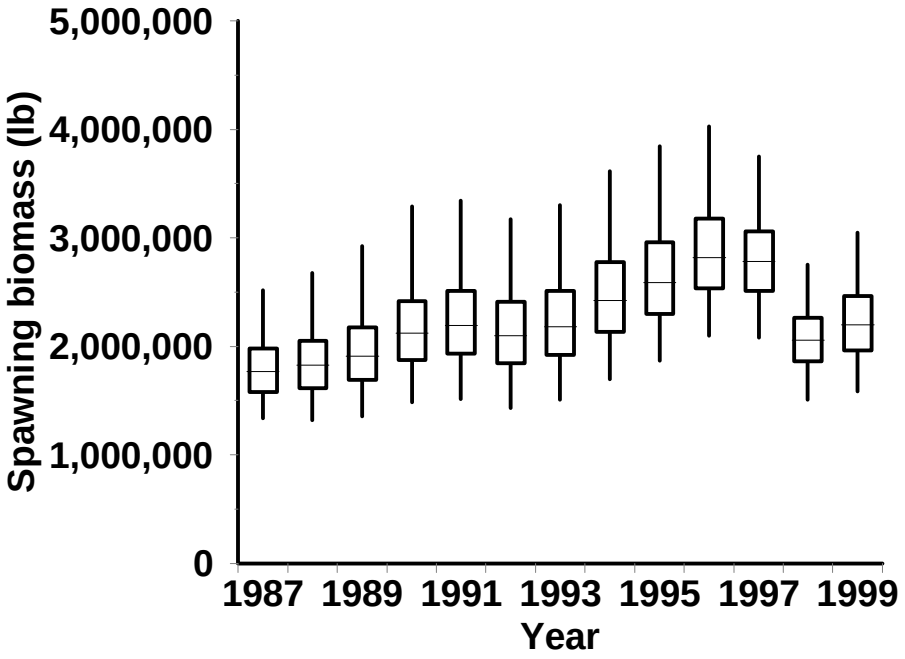


Figure 11. Mean fishing mortality rates per year for ages 6-10 by coast and year. The horizontal line is the median of 1000 simulation runs, the box is the interquartile range, and the vertical line is the 95% confidence interval.

a. Atlantic



b. Gulf

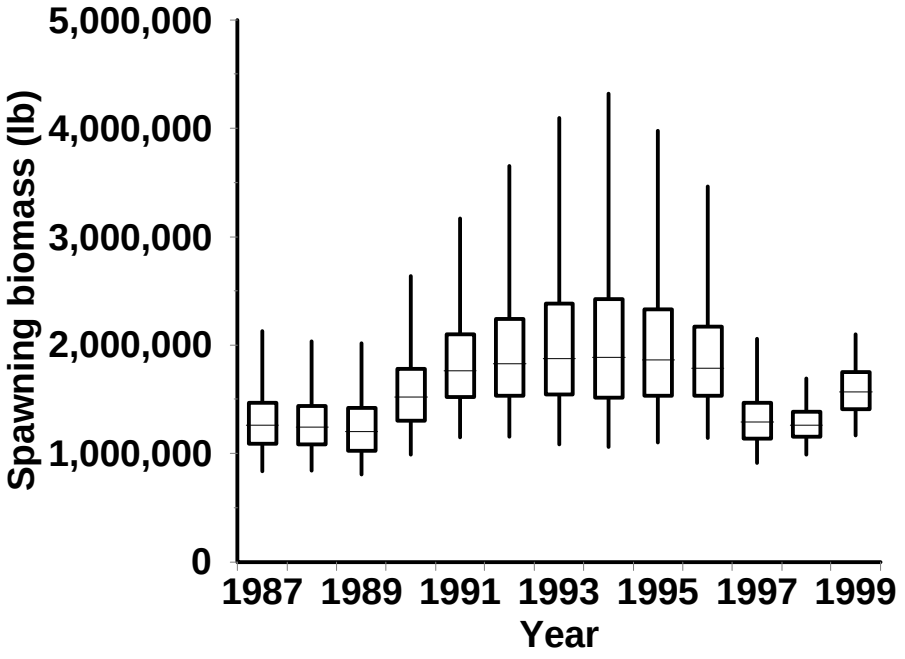
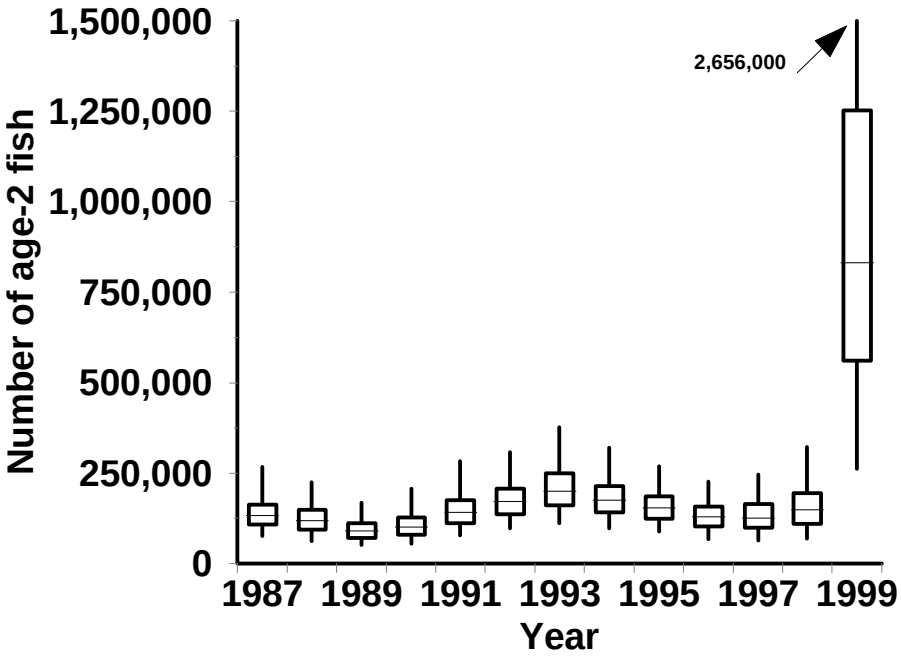


Figure 12. Estimated spawning biomass by coast and year. The horizontal line is the median of 1000 simulations, the box is the interquartile range, and the vertical line is the 95% confidence interval.

a. Atlantic



b. Gulf

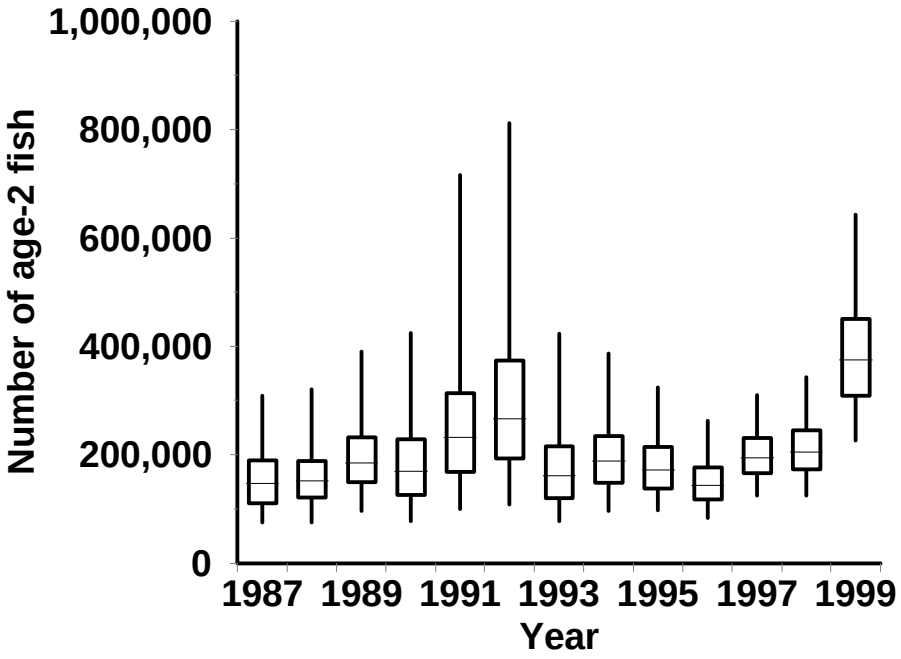
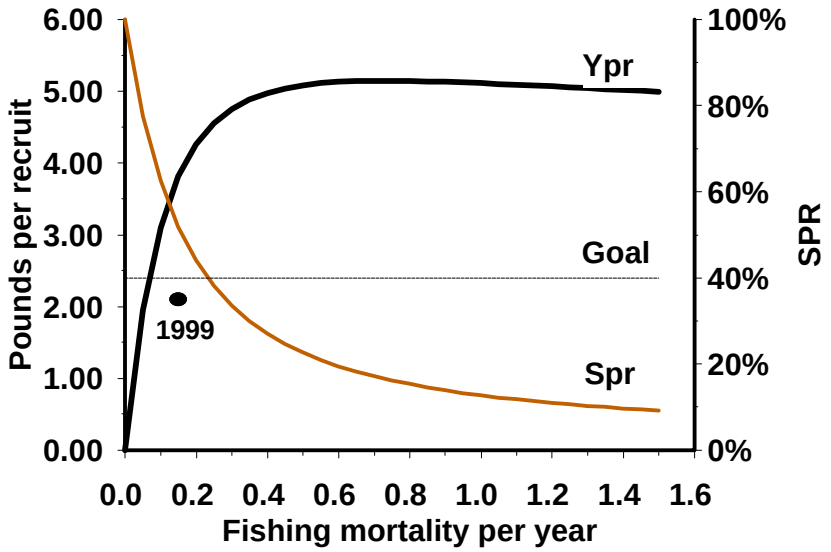


Figure 13. Estimated recruitment of age-2 fish by coast and year. The horizontal line is the median of 1000 simulations, the box is the interquartile range, and the vertical line is the 95% confidence interval.

a. Atlantic



b. Gulf

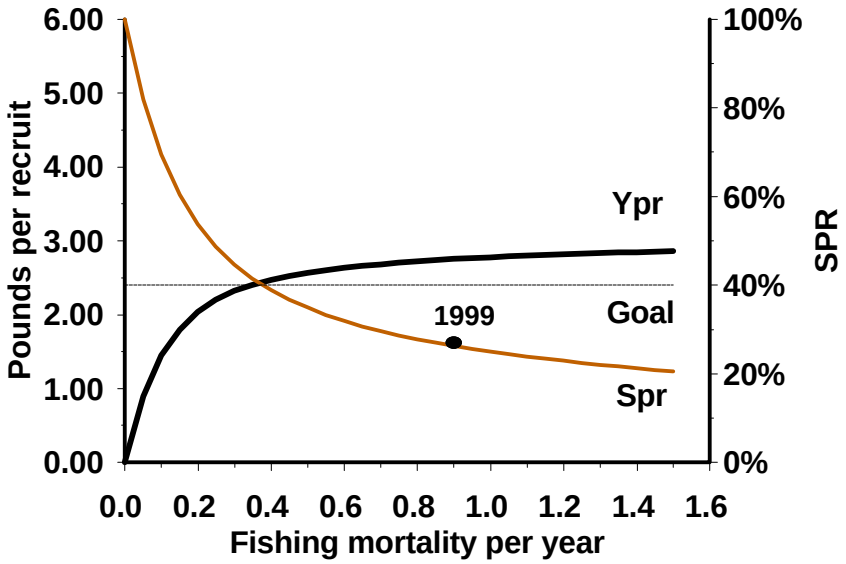


Figure 14. Yield per recruit and static spawning potential ratios for a range of fishing mortality rates. The 1999 transitional SPR (solid point), and the 40% SPR goal are also given. The instantaneous natural mortality rates used in these analyses were 0.20 per year on the Atlantic coast and 0.25 per year on the Gulf coast. The transitional SPRs are plotted at the fishing mortality rate for fully-recruited snook in 1999.