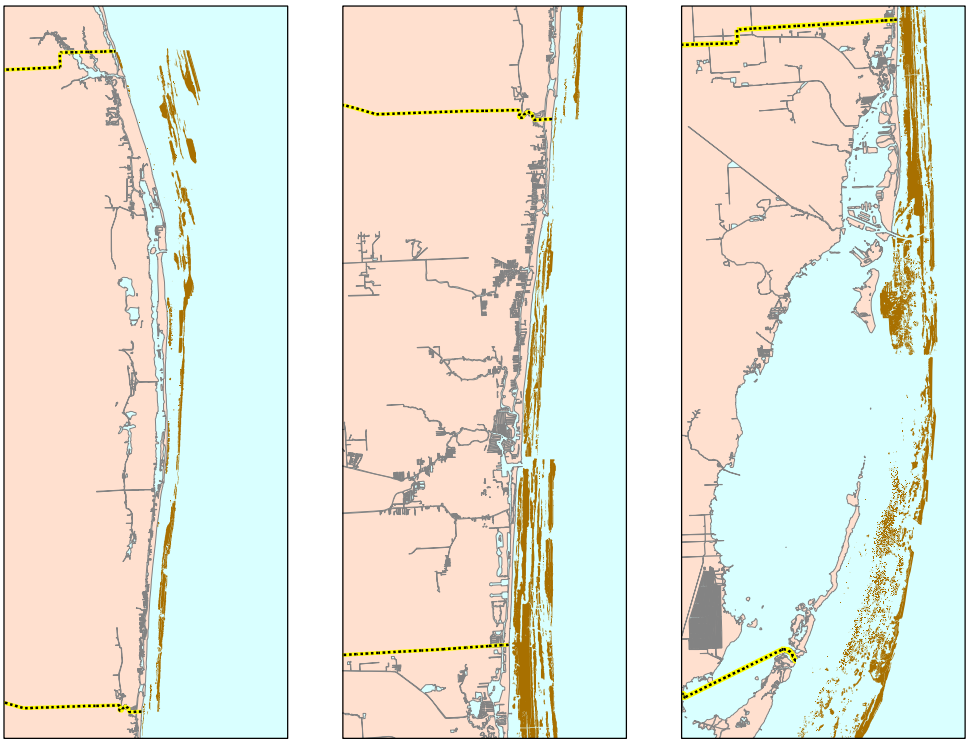
NOAA Technical Memorandum NMFS-SEFSC-550

# Description and Discussion of Southeast Florida Fishery Landings, 1990-2000



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January 2007

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# Description and Discussion of Southeast Florida Fishery Landings, 1990-2000

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## ABSTRACT

The Southeast Florida Coral Reef Initiative (SEFCRI) was established as a local action strategy in 2003 to better manage coral reefs in southeastern Florida (Miami-Dade, Broward, Palm Beach, and Martin counties). To support that effort, we profiled all commercial and recreational marine fisheries (reef fish, coastal, offshore pelagic, and invertebrates) in the SEFCRI region using available data for 1990-2000. Over the 11 yrs, at least 261 species were recorded in landings[1]. Mean total annual landings for all fisheries was 21.4 million lbs/yr (range 17.7-26.9) and consisted of 66% recreational, 31% commercial, and 3% headboat landings. Total finfish landings declined 22% (23.2 to 18.1 million lbs) over the study period ($p = 0.022$).

Landing composition by sector was 27% reef, 23% coastal, and 50% offshore pelagic species for recreational fisheries; 38% reef, 30% coastal, and 32% offshore pelagic species for headboats; and 17% reef, 43% coastal, 20% offshore pelagic, and 20% invertebrate species for commercial fisheries.

For the recreational sector, no statistically significant trends were detected in total annual landings, number of fishing trips, or landings/trip (mean = 13.1 million lbs/yr, 4.3 million trips/yr, 3.0 lbs/trip, $p > 0.05$). For the headboat sector, total annual landings and fishing trips both declined 48% ($p < 0.001$ in both cases), although total annual CPUE did not change significantly over the study period (mean = 7.1 lbs/angler/day, range 6.6 - 8.1, $p > 0.05$). For the commercial sector, total landings declined 33% (9.3 to 6.2 million pounds) between 1990 and 2000, although total annual landings of invertebrates increased 370% from 0.6 to 2.3 million pounds ($p < 0.001$), primarily because of increased catches of shrimp and blue crab. Total commercial finfish landings declined 55% from 8.7 to 3.9 million lbs (coastal 4.4 to 1.9, $p < 0.023$; offshore pelagic 2.5 to 1.2, $p < 0.001$; reef 1.9 to 0.8, $p < 0.001$).

For reef fishes alone, total annual landings over the 11 yr study period from all sectors averaged 4.79 million lbs and were composed of 68% recreational, 5% headboat, and 27% commercial landings. No significant trend was detected in total annual reef fish landings for the recreational fishery (mean = 3.27 million lbs/yr) between 1990 and 2000. Significant declines were detected for both headboat (-65%; 0.32 to 0.11 million lbs, $p = 0.002$) and commercial sectors (-56%, 1.74 to 0.76 million lbs, $p < 0.001$). Total annual headboat reef fish landings declined in response to a 48% reduction in the number of angler days between 1990 and 2000 and a 60% decline in CPUE (lbs/angler/day, $p = 0.002$) since 1993.

Landings trends can reflect many factors including changes in fishing regulations, resource productivity, and total fishing effort. Changes in fishing effort can reflect changes in number of participants, reporting levels and methodology, fishing technology, resource availability, weather, and economic factors such as fuel prices and market prices. Over the study period, fishery landings in the SEFCRI region were likely influenced by increased coastal urbanization and human population growth, changes in fishing effort, and fishery regulations.

[1] 39 additional, broader taxonomic groupings were recorded in landings (e.g., triggerfish species, flounders, parrotfishes, etc.), which may have contained additional species.

## INTRODUCTION

The Southeast Florida Coral Reef Initiative (SEFCRI) is a collaborative local, state and federal effort which has brought together marine resource professionals, scientists, non-governmental organizations and interested stakeholders to better protect coral reefs in southeastern Florida, including Miami-Dade, Broward, Palm Beach, and Martin Counties (SEFCRI Team, 2004). Many previous coral reef management efforts have focused on the reef tract south of Miami, which includes the Florida Keys and the Dry Tortugas in Monroe County. In comparison, relatively little attention has been paid to the reef tract that extends northward on Florida's east coast from the Monroe/Miami-Dade County line to St. Lucie Inlet in Martin County (SEFCRI Team, 2004). Concern over the condition of reefs in the northern reef tract led to the creation of the Southeast Florida Action Strategy Team (SEFAST) in 2003 as a joint effort by Florida and NOAA with support from the U.S. Coral Reef Task Force under the Coral Reef Protection Act. SEFAST, which in 2005 was renamed the SEFCRI Team, developed a Local Action Strategy (LAS) known as the Southeast Florida Coral Reef Initiative to better protect the coral reef ecosystem (SEFCRI Team, 2004). The goal of the SEFCRI Team is to develop an effective strategy to preserve and protect southeast Florida's coral reefs and associated reef resources, emphasizing balance between resource use and protection, in cooperation with all interested parties. As part of the SEFCRI effort, this study reviews fishery landings trends to better understand human impacts.

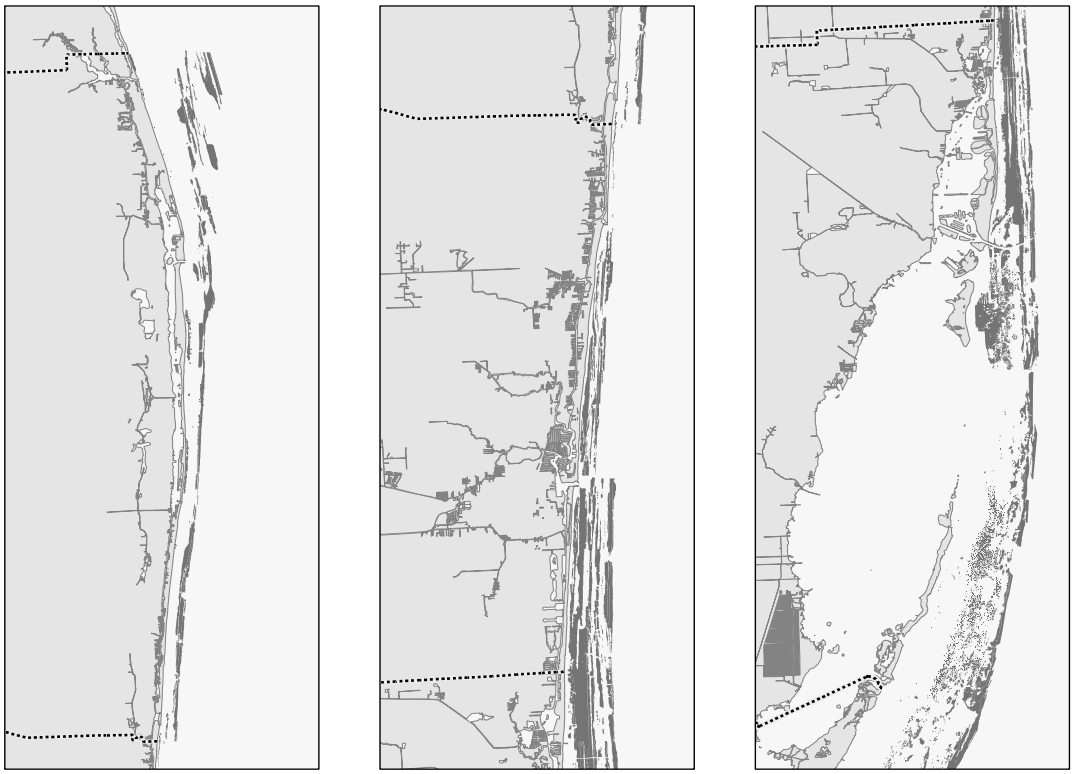
The SEFCRI reef tract stretches 150 mi from Miami-Dade County to the St. Lucie Inlet in Martin County and consists of a series of discontinuous reef lines (terraces) that run parallel to shore and are separated by sand. These reefs lie < 3 na mi from shore and are entirely within the jurisdiction of Florida, except in the southern portion of Dade County (Fig. 1). The reefs are at the northern range of hard Scleractinian coral distribution and serve as a transitional ecotone between subtropical and warm temperate species. The benthic habitats are dominated by algae, high densities of octocorals and sponges, and include 33 of 43 coral species reported from Florida (Blair and Flynn, 1989; FFWCC, 2005).

Reefs in the SEFCRI region are economically important. In 2000 they were credited with generating ~$6 billion in income and sales, and supporting 61,000 jobs (Johns et al., 2001). Despite the economic and ecological importance of the area, there is considerable pressure on the reef ecosystem from intense usage and other anthropogenic impacts related to a fast growing human population of over five million people, about a third of Florida's total population.

Marine fisheries in the SEFCRI region are complex (Bannerot, 1990; McKenna, 1997; Ault et al., 2005). Commercial and recreational fishers target reef fishes, coastal and offshore pelagic fishes, and invertebrates (spiny lobster, blue crab, stone crab, and shrimp) for food and sport around bridges, on patch and barrier reefs, and in nearshore and offshore waters. Fisheries also target live fishes and invertebrates for marine aquaria (Larkin and Adams, 2003). Juvenile pink shrimp are commercially targeted as live bait for recreational fishing in coastal bays and near barrier islands. Finally, pre-spawning subadult pink shrimp are targeted by both commercial and recreational fisheries as they emigrate from coastal bay nursery grounds to offshore spawning grounds.

Fisheries in the SEFCRI area are regulated in state waters, which extend from shore to 3 na mi offshore, by the Florida Fish and Wildlife Conservation Commission (FFWCC). The South Atlantic Fishery Management Council (SAFMC) manages fisheries in federal waters,

which extend from 3 na mi offshore to a line separating the Exclusive Economic Zone (EEZ) of the United States of America from the Bahamas.



Palm Beach / So. Martin counties  Broward County  Miami-Dade County

**Figure 1. Map of SEFCRI region showing reef distribution. Figure source: Florida Fish and Wildlife Conservation Commission (FWC).**

Many previous fishery studies relevant to southern Florida have focused on much larger geographical regions than the SEFCRI focus area, or on the FL Keys (Monroe County, immediately south of the SEFCRI focus area). Such studies include stock assessments for reef fish (including red grouper, gag grouper, red snapper, yellowtail snapper, and amberjack), coastal fish (including Spanish and king mackerel), offshore pelagics (including dolphinfish and wahoo), and invertebrates (include spiny lobster, queen conch, stone crab, blue crab, and pink shrimp). Florida Keys fishery profiles include studies by Bohnsack et al. (2004) and Ault et al. (2005).

Many fish- or fishery-related studies have occurred in the SEFCRI focus area including gear-related studies of fish traps (Sutherland and Harper, 1983; Bohnsack et al., 1989) and shrimp trawls (Tilmant, 1979). Johnson et al. (2006) examined the Biscayne Bay food and bait shrimp fisheries. Harper et al. (2000) described recreational fishing in Biscayne National Park off Miami-Dade County during 1976 to 1991 from analysis of creel census data. They found declines over time in the overall number of fish caught per trip and the catch rate (number of fish/100 trips) of important recreational species, including jolthead porgy, hogfish, yellowtail snapper, gray snapper, and white grunt. Ault et al. (2001) examined the fishery resources in Biscayne National Park (Miami-Dade County) using fishery independent and dependent data. They concluded that 77% of the 35 individual stocks that could be analyzed were overfished

according to federal standards. McKenna (1997) examined the structure and dynamics of commercial fisheries in Broward County during 1989 and found that fishing trips clustered in distinct groups associated with different habitats and gear. The number of species reported in commercial landings was relatively small compared with that of the natural marine fish community in Florida, demonstrating the selectivity of commercial fishing. He suggested that the commonly landed species were the most valuable economically and that fishermen focused individual trips on a restricted subset of available species. Finally, Fleur et al. (2005) conducted a 4-year visual census of reef fishes of Broward County (1998-2002) to examine fish species composition, abundance, and biomass on the three reef tracts (inshore, middle, and offshore). They found that total species diversity and abundance was higher north of Port Everglades than to the south. Abundance of fishes tended to increase from south to north for the entire study area. Numbers of fish and total biomass increased from inshore to offshore.

In this study we take a geographical perspective to profile commercial and recreational fisheries in the SEFCRI area over an 11-year period, 1990-2000[2]. We identify trends (or lack thereof) in commercial and recreational landings, effort, and catch-per-unit-effort for (1) reef fish, (2) coastal fish, (3) offshore pelagic fish, and (4) invertebrates. In doing so, we address two objectives under Issue 2 (Direct Extractive Impacts) in the Fishing, Diving and Other Uses Action Plan of the SEFCRI Local Action Strategy (SEFCRI Team, 2004). One objective was to determine the relative importance of reef versus offshore fisheries in terms of participation and extraction levels from existing data (Project 11) under *Objective 1: Compile existing information on reef condition and user activities for the SEFCRI geographic region*. A second objective was to identify the types, quantity, and trends of commercial and recreational extractive use (Project 12) under *Objective 2: Assess the current condition and threats to reef resources from fishing and recreational extractive activities*. We conclude with a synopsis of overall fishery trends for the SEFCRI area.

## METHODS

Data from available fishery datasets in the SEFCRI region were compiled and analyzed to profile trends in landings, fishing effort and catch-per-unit-effort for the recreational and commercial fishery sectors. The sale of landings distinguishes the commercial sector from the recreational sector. Fisheries were classified based on species composition into four categories: reef, coastal, offshore pelagic, and invertebrate. Some species are common to more than one fishery category and could easily be assigned to another category. Species such as tilefish, gray snapper, pigfish, and sheepshead were designated as reef species because they are managed as part of the SAFMC snapper-grouper reef fish complex. We report trends starting in 1990 because prior to the late 1980s, some data sets either did not exist or were reported in broad categories (i.e. snapper, grouper) that did not distinguish landings by species. Trends were analyzed statistically using generalized linear models to categorize the slope of the fitted trendlines as increasing (pos) or decreasing (neg) at the $p < 0.05$ significance level; or unchanged (i.e., non-significant/non-existent trends, $p > 0.05$) (n.s.). Species or higher taxa with five or fewer years of annual landings data were excluded from the trend analysis.

[2] At the initiation of this study, 1990-2000 represented the period during which all landings data of interest were available. Effort data were not available prior to 1993; effort data were used from 1993-2003 to result in an 11-year time span to match the time span of the landings data.

***Data Sources***

The following data sources were utilized: Marine Recreational Fishing Statistical Survey (MRFSS), Florida Fish and Wildlife Research Institute (FWRI) Florida Spiny Lobster mail survey data, NMFS Headboat Survey, commercial fisheries data from the Accumulative Landings System (ALS), and commercial fisheries data from the Fisheries Logbook System (FLS), marine life landings data from FWRI, and commercial license data from FWRI. Self-reported logbook data from the commercial handline fishery was used to evaluate catch per unit effort. Common names are used in tables, figures, and text. Scientific names are listed in Appendix A.

## Recreational Fishing Sector

### Marine Recreational Fishing Statistical Survey

Recreational landings are those collected from shore-based fishing, private boats, or charter "for hire" vessels. We analyzed trends in U.S. marine recreational landings using Marine Recreational Fisheries Statistics Survey data[3] for 1990 through 2000. MRFSS data for the SEFCRI area were generated using a standard procedure for producing estimates for smaller geographic areas within a state that relies on relative fishing activity by county as reflected by the distribution of intercept interviews (T. Sminkey, pers. comm.).

MRFSS focuses on finfish data, and with minor exceptions does not include invertebrate (lobster, shrimp and crab) landings. Recreational spiny lobster landings and effort data were available from a separate source and are described below. No recreational landings or effort data were available for shrimp, blue crabs, or stone crabs. MRFSS estimates total catch (the number of fish caught but not necessarily brought ashore), total landings, and the combined total of releases and discards by state based on phone interviews and creel surveys (Department of Commerce, 2002). Phone surveys determine marine recreational angler participation and effort while creel surveys document landings and collect information about how many fish were caught and their disposition as landed (brought to shore), released (caught and released alive), discarded (if dead), or consumed as food or bait at sea. In the MRFSS, fishing effort is defined as the estimated number of fishing trips taken by individual anglers. It was not possible to partition recreational effort into the species categories (i.e., reef, coastal, and offshore pelagic). Thus, while it was possible to determine landings for reef, coastal, and offshore pelagic fisheries, it was not possible to determine effort or CPUE for these species groupings.

MRFSS was the subject of a recent review by the Committee on the Review of Recreational Fishing Survey Methods (formed under the National Research Council of the National Academies) (NRC, 2006). The Committee recommended multiple methods by which the accuracy and precision of data collected under MRFSS could be improved. MRFSS data were used for this study because MRFSS provides the best available data to assess trends in recreational fishing statistics over spatial scales such as the SEFCRI region.

### FL Spiny Lobster Data

Spiny lobster recreational landings data for the SEFCRI region were obtained from the Florida Fish and Wildlife Research Institute (FWRI). Recreational landings data were available for the years 1992-2003. Landings data were generated by mail survey to recreational participants, as described in Sharp et al. (2005). Landings data were collected for both the two-

[3] available at: http://www.st.nmfs.gov/recreational/index.html

day sport season, which occurs the last Wednesday and Thursday in July each year, and the first month of the regular recreational season, which occurs from Aug 6th to March 31st each year.

**NMFS Headboat Survey Sector**

Headboats are large fishing vessels that carry multiple recreational anglers who pay "by the head" to fish. Headboat data came from surveys conducted by the NMFS Beaufort Laboratory (Huntsman, 1976; Chester et al., 1984; Huntsman and Willis, 1989). We used headboat landings by species and angler days as a measure of fishing effort for 1990 through 2001 from Miami through Ft. Pierce, FL (St. Lucie County).

**Commercial Fishing Sector**

**Accumulative Landings System (ALS).**

Annual commercial landings from 1990 through 2000 for Miami-Dade, Broward, Palm Beach, and Martin counties were obtained from the Accumulative Landings System (ALS). The ALS contains the general canvass landings statistics maintained by the NOAA Fisheries Service. These data consist of the quantity and value of seafood products landed by commercial fishers and sold to established seafood dealers or brokers. Data are reported by dealers or brokers to the fisheries agency in each state. The NOAA Southeast Fisheries Science Center (SEFSC) has a cooperative agreement with the state of Florida to utilize a mixture of state and federal employees to collect and process these data. Beginning in 1997, all Florida landings in ALS are from trip ticket data collected by the state of Florida. The general canvass landings data are monthly totals of the quantities landed and the value of the landings for each species. Because these data are summaries, they do not contain information on the identification of individual fishermen or vessels.

**Fisheries Logbook System (FLS).**

The Fisheries Logbook System (FLS) was used to estimate commercial fishing effort and catch per effort. The FLS records the fishing activity of permitted commercial fishing vessels using mandatory logbook forms[4]. The Southeast Fisheries Science Center has several vessel logbook programs. In 1986, a comprehensive program was initiated for the offshore pelagic longline fisheries along the eastern seaboard, in the Gulf of Mexico, and in the Caribbean. In 1990, the Gulf of Mexico Fishery Management Council initiated logbook reporting for vessels catching reef species included in the reef fish management plan for the Gulf of Mexico. In 1992, the South Atlantic Fishery Management Council initiated a similar logbook program for commercial vessels catching reef species included in the South Atlantic snapper-grouper management plan. One hundred percent compliance was achieved in 1993 for Florida (J. Poffenberger, NMFS, personal communication). In 1993, a comprehensive logbook program was initiated for the federally managed shark fisheries (NMFS). In 1999, logbook reporting was initiated for all vessels catching king and Spanish mackerel (Gulf of Mexico and South Atlantic Fishery Management Councils).

There are two kinds of logbook forms utilized in reporting programs. One is used for offshore pelagic longline fisheries. Because these fisheries use gear that is deployed for a relatively long period (6 to 10 hours), catch and effort data are collected for each set and a separate form is required for each set. Fishermen are required to report the numbers of each

[4] See http://www.sefsc.noaa.gov/fls.jsp

species caught and the numbers of animals retained, discarded alive, or discarded dead (longline gear is non-selective, and unwanted or prohibited species such as billfishes, sea turtles, etc., must be returned to the water). Fishermen must also report the location of the set, the types and size of gear, and the duration of the set.

A second logbook form is used to report catch and effort data for Gulf of Mexico reef fish, and for South Atlantic snapper-grouper, coastal shark, and king and Spanish mackerel fisheries. Because the soak time for these fisheries is relatively short, fishermen report catch and effort data for the entire trip, which are reported on a single form (i.e., one form per trip). The types of information required on this trip form include quantity caught for each species (reported in pounds), the area of catch, the type and quantity of gear, the date of departure and return, the dealer and location (county and state where the catch is unloaded), the duration of the trip (time away from dock), an estimate of the fishing time, and the number of crew. For the purposes of this report, we focused our logbook analysis on handline fishing gear from 1993 through 2004. Since the majority of logbook forms for the SEFCRI region reported handlines as the fishing gear and this gear is used extensively in the reef, coastal, and offshore pelagic fisheries, comparisons between catch-per-unit-effort (CPUE) for the commercial sector could be made.

## RESULTS AND DISCUSSION

### General Trends (1990-2000)

Total annual finfish landings (i.e., reef fish, coastal and offshore pelagic landings) for the combined recreational, commercial, and headboat sectors in the SEFCRI region decreased 22% by weight between 1990 and 2000 ($p = 0.022$; Fig. 2). There was no significant trend over time in recreational landings. Both commercial and headboat landings exhibited statistically significant declining trends ($p < 0.001$ in both cases) during the same time period, resulting in total decreases of ~55% and 48% respectively from 1990 and 2000 (Fig. 2a). For combined landings from 1990 through 2000, the recreational sector accounted for 66% of the total finfish landings, followed by the commercial (31%) and headboat (3%) sectors (Fig. 2b). During the study period, the recreational proportion of total landings exhibited a statistically significant increasing trend ($p = 0.011$). Analysis of trends in SEFCRI commercial landings, by species or higher taxonomic group, indicated 7 statistically significant increasing trends, 24 statistically significant decreasing trends, 1 marginally significant decreasing trend ($.05 > p < 0.10$), and 38 non-significant or non-existent trends, and 6 species for which landings data were insufficient to determine trends (Table 1). Analysis of recreational landings, by species or higher taxonomic group, indicated 6 significant increasing trends, 2 marginally significant increasing trends ($.05 > p < 0.10$), 4 significantly decreasing trends, 67 non-significant or non-existent trends, and 128 species for which landings data were insufficient to determine trends (Table 2). Headboat landings indicated 1 significantly increasing trend, 1 marginally significant increasing trend ($.05 > p < 0.10$), 20 significantly decreasing trends, 3 marginally significant decreasing trends ($.05 > p < 0.10$), 63 non-significant or non-existent trends, and 73 species for which landings data were insufficient to determine trends (Table 3).

Total annual reef fish landings varied without trend over the study period, although total landings during the last three years were the lowest recorded during the study period (Fig. 3). As was the case for the total finfish landings discussed in the preceding paragraph, the recreational

component of total reef fish landings varied without trend over the study period, while both commercial and headboat landings declined significantly over time (Fig. 3).

We used the number of registered commercial and recreational vessels as an index of fishing effort, noting that not all registered vessels were necessarily used for saltwater fishing (e.g., vessels may have been used solely in freshwater systems, or for non-fishing saltwater activities). The total number of registered recreational vessels in the SEFCRI region increased 329% between 1964 and 2000 (Fig. 4a,c) and 14% between 1990 and 2000. In comparison, total commercial vessels increased 91% between 1964 and 2000 and 10% between 1990 and 2000 (Fig. 4a,b). The number of SEFCRI region registered commercial vessels in 1997 was 2.3 times that in 1964. Registered commercial vessel numbers peaked at 5,846 in 1997, and declined 25% between 1997 and 2000 (Fig. 4b). The number of registered recreational boats by county reflected its total population: Miami-Dade County with the largest population had the most registered recreational boats, followed by Broward, Palm Beach and Martin counties, respectively (Fig. 4c). The percentage increase over time in number of recreational vessels in the three most populated counties was similar.

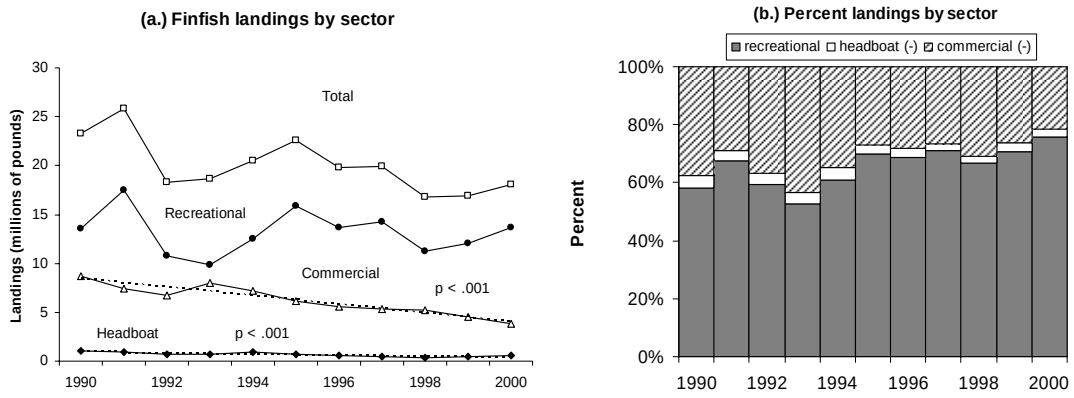



Figure 2. Total annual finfish landings (millions of pounds) in the SEFCRI region (a.) by recreational, commercial, and headboat sources, (b.) percent contribution by source. Dotted lines show significant ($p < 0.05$) linear trends.

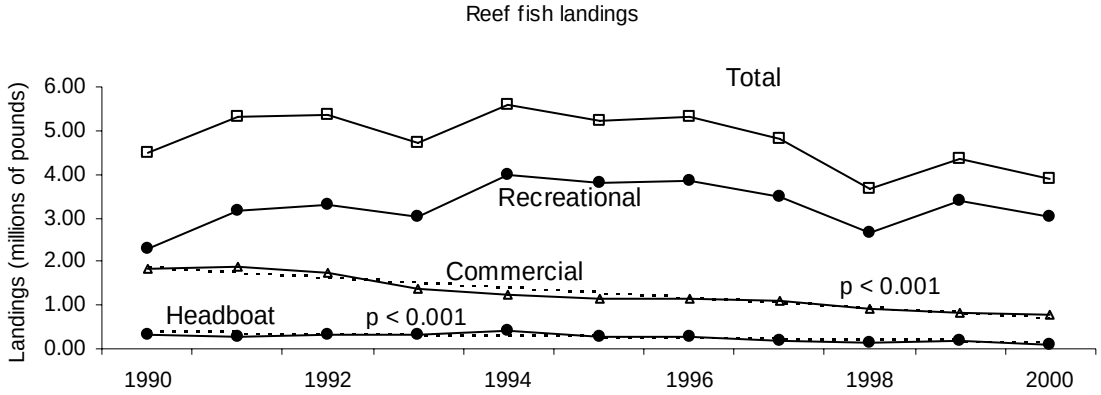



Figure 3. Reef fish landings (in millions of pounds) for the Headboat, Commercial, and Recreational sectors, and for all sectors combined (Total).

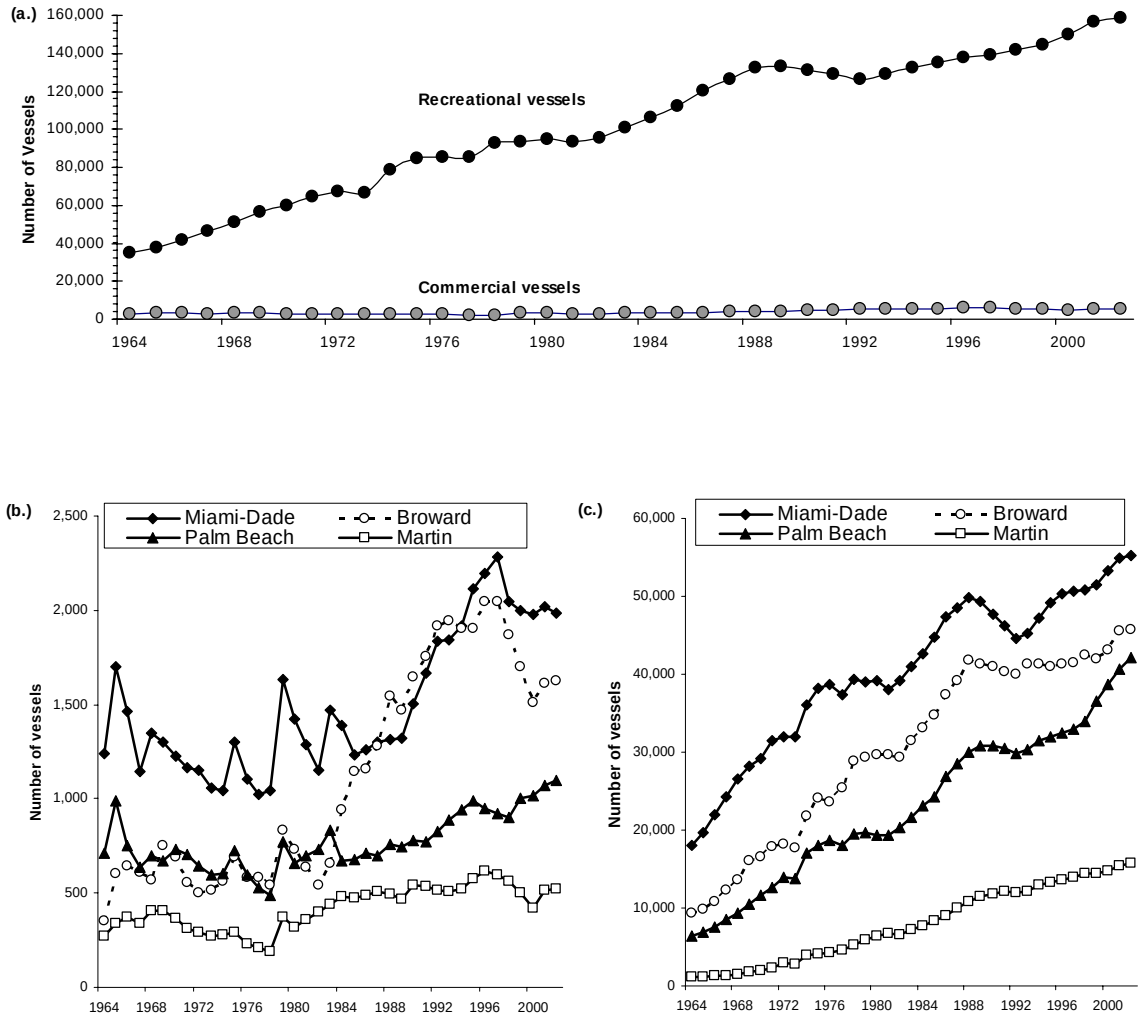



Figure 4. Trends in total registered vessels in the SEFCRI region, 1964-2001. (a.) Total number of registered recreational and commercial vessels. (b.) Number of registered commercial vessels by county. (c.) Number of registered recreational vessels by county.

**Table 1. Annual reported commercial landings by weight (pounds, whole weight) for southeast Florida, 1990-2000. (Miami-Dade, Broward, Palm Beach and Martin counties) with decadal trend and p-value of significant trends**

| Species/Market Category | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlantic thread herring | Coastal | 37,859 | 97 | 41,068 | 56,756 | 9,046 | 11,952 | 257,768 | 544,305 | 857,580 | 566,888 | 9,384 | n.s. | |
| Ballyhoo | Coastal | 531,781 | 620,658 | 348,618 | 326,782 | 286,465 | 280,488 | 194,663 | 223,788 | 433,695 | 282,453 | 206,774 | **neg** | 0.025 |
| Black drum | Coastal | 2,118 | 4,768 | 4,856 | 559 | 1,019 | 449 | 536 | 884 | 734 | 498 | 1,517 | n.s. | |
| Bluefish | Coastal | 502,090 | 657,752 | 511,979 | 407,765 | 413,526 | 233,206 | 41,705 | 61,406 | 86,854 | 18,872 | 10,288 | **neg** | <0.001 |
| Coastal fishes | Coastal | 507,463 | 306,898 | 480,646 | 624,551 | 839,861 | 252,123 | 138,014 | 309,516 | 272,009 | 190,221 | 82,549 | **neg** | 0.049 |
| Finfish, uncl. | Coastal | 221,548 | 286,228 | 181,475 | 171,311 | 132,751 | 70,806 | 34,928 | 5,218 | 1,609 | 5,101 | 11,277 | **neg** | <0.001 |
| Finfishes, food | Coastal | 221,402 | 59,247 | 72,619 | 49,776 | 77,441 | 168,555 | 109,326 | 64,611 | 29,459 | 67,222 | 49,930 | n.s. | |
| Florida pompano | Coastal | 101,790 | 75,926 | 54,741 | 70,070 | 73,544 | 62,199 | 32,589 | 64,106 | 59,220 | 30,772 | 41,384 | **neg** | 0.007 |
| Flounders | Coastal | 6,463 | 5,155 | 3,339 | 6,103 | 5,971 | 2,858 | 1,622 | 1,918 | 3,021 | 903 | 2,040 | **neg** | 0.003 |
| King mackerel | Coastal | 647,839 | 554,659 | 355,676 | 866,745 | 682,288 | 693,873 | 1,016,030 | 885,543 | 635,057 | 664,797 | 764,797 | n.s. | |
| Menhadens | Coastal | 430,020 | 3,847 | 2,184 | 11,700 | 2,580 | 6,951 | 72,299 | 54,751 | 100,510 | 68,292 | 59,247 | n.s. | |
| Permit | Coastal | 2,241 | 2,773 | 2,792 | 3,397 | 2,783 | 3,262 | 935 | 1,887 | 1,020 | 307 | 1,243 | n.s. | |
| Spanish mackerel | Coastal | 517,707 | 275,078 | 642,759 | 1,808,956 | 1,574,361 | 1,456,484 | 664,638 | 340,230 | 240,733 | 178,294 | 447,219 | **neg** | 0.012 |
| Spanish sardine | Coastal | 54,328 | 31,489 | 158,714 | 105,617 | 123,014 | 72,481 | 186,904 | 281,602 | 311,690 | 371,591 | 7,088 | n.s. | |
| Spotted seatrout | Coastal | 8,354 | 2,138 | 3,951 | 1,684 | 1,014 | 1,266 | 98 | 71 | 29 | 13 | 68 | **neg** | 0.004 |
| Striped mullet | Coastal | 437,534 | 250,897 | 281,951 | 302,948 | 277,223 | 109,394 | 185,017 | 166,454 | 160,503 | 83,989 | 84,902 | **neg** | <0.001 |
| White mullet | Coastal | 135,126 | 97,329 | 50,974 | 111,938 | 91,298 | 49,031 | 78,539 | 78,000 | 85,227 | 105,057 | 100,280 | n.s. | |
| White seatrout | Coastal | 207 | 99 | 66 | 453 | 790 | 14 | 3 | 2 | 3 | 2 | | n.s. | |
| TOTAL COASTAL | | 4,328,011 | 3,234,941 | 3,157,340 | 4,870,355 | 4,585,929 | 3,463,440 | 2,757,846 | 2,539,987 | 2,421,373 | 2,068,384 | 1,870,603 | **neg** | 0.007 |
| | | | | | | | | | | | | | | |
| Blue crab | Invertebrates | 54,301 | 45,554 | 131,037 | 165,364 | 157,916 | 183,364 | 207,010 | 195,875 | 159,169 | 246,224 | 325,861 | **pos** | <0.001 |
| Brown shrimp | Invertebrates | | | | | | | 3,370 | | | 343 | 52 | ~ | |
| Invertebrates | Invertebrates | 4,698 | 15,338 | 6,593 | 20,612 | 5,180 | 188,188 | 271,188 | 358,152 | 179,544 | 246,855 | 489,122 | **pos** | <0.001 |
| Pink shrimp | Invertebrates | | | | 88,155 | 81,004 | 111,931 | 220,163 | 336,057 | 306,882 | 278,021 | 228,347 | **pos** | 0.025 |
| Shrimp, unidentified | Invertebrates | | | | 242,781 | 338,635 | 382,703 | 454,368 | 541,271 | 540,731 | 488,453 | 710,849 | **pos** | <0.001 |
| Spiny lobster | Invertebrates | 530,179 | 916,660 | 428,903 | 825,110 | 757,709 | 656,493 | 635,300 | 559,492 | 494,232 | 666,736 | 509,475 | n.s. | |
| Stone crab (claws) | Invertebrates | 44,842 | 34,640 | 76,642 | 56,234 | 122,226 | 57,166 | 49,434 | 134,478 | 77,180 | 61,773 | 74,019 | n.s. | |
| White shrimp | Invertebrates | | | | | 101 | | | | | 550 | 200 | ~ | |
| Total invertebrates | | 634,020 | 1,012,192 | 643,175 | 1,398,256 | 1,462,771 | 1,579,845 | 1,840,833 | 2,125,325 | 1,757,738 | 1,988,955 | 2,337,925 | **pos** | <0.001 |
| | | | | | | | | | | | | | | |
| Sponge, grass ** | Sponges | 14,558 | 9,153 | 17,806 | 13,590 | 5,835 | 96,619 | 4,261 | 680 | 5,401 | | 1,000 | n.s. | |
| Sponge, sheepswool ** | Sponges | 117,443 | 89,639 | 68,731 | 57,228 | 17,614 | 59,235 | 21,752 | 3,025 | 7,057 | | 6 | **neg** | <0.001 |
| Sponge, yellow ** | Sponges | 22,956 | 12,826 | 7,887 | 18,321 | 5,443 | 53,716 | 3,307 | 126 | | | | n.s. | |
| | | | | | | | | | | | | | | |
| Atlantic bonito | Pelagic | 6,142 | 2,590 | 4,917 | 3,288 | 13,556 | | | | | | | ~ | |
| Blackfin tuna | Pelagic | 4,679 | 4,728 | 5,842 | 6,551 | 5,092 | 4,830 | 7,209 | 5,420 | 3,461 | 5,329 | 6,082 | n.s. | |
| Bluefin tuna | Pelagic | 7,863 | 7,303 | 2,256 | 1,106 | 5,112 | 23 | 743 | 318 | 4,535 | 1,958 | 4,598 | n.s. | |

**Table 1 (cont). Annual reported commercial landings by weight (pounds, whole weight) for southeast Florida, 1990-2000. (Miami-Dade, Broward, Palm Beach and Martin counties) with decadal trend and p-value of significant trends**

| Species/Market Category | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cobia | Pelagic | 12,828 | 17,670 | 19,176 | 16,879 | 18,969 | 21,967 | 33,893 | 19,837 | 15,193 | 12,613 | 12,062 | n.s. | |
| Dolphinfish | Pelagic | 178,013 | 273,495 | 97,817 | 147,624 | 178,671 | 196,378 | 127,408 | 155,728 | 116,113 | 117,548 | 140,050 | n.s. | |
| Pelagic fishes | Pelagic | | 72 | 4,457 | 6,100 | 5,752 | 912 | 3,660 | 1,371 | 3,896 | 204 | 2,352 | n.s. | |
| Shark, uncl. | Pelagic | 411,608 | 424,299 | 376,514 | 240,118 | 236,753 | 449,796 | 593,445 | 238,315 | 114,805 | 183,851 | 207,399 | n.s. | |
| Swordfish | Pelagic | 1,698,280 | 1,507,832 | 1,162,114 | 1,217,241 | 804,022 | 699,808 | 519,523 | 546,750 | 641,166 | 550,259 | 740,268 | **neg** | <0.001 |
| Tunas, uncl. | Pelagic | 70,266 | 63,591 | 46,233 | 71,055 | 33,680 | 65,143 | 53,818 | 100,321 | 89,354 | 85,973 | 72,847 | n.s. | |
| Wahoo | Pelagic | 4,737 | 7,566 | 8,118 | 5,572 | 5,554 | 7,981 | 9,110 | 8,585 | 12,888 | 11,263 | 8,122 | **pos** | 0.018 |
| Yellowfin tuna | Pelagic | 74,297 | 57,192 | 50,166 | 45,592 | 34,290 | 28,885 | 11,294 | 20,923 | 19,397 | 38,888 | 35,146 | **neg** | 0.013 |
| TOTAL PELAGIC | | 2,468,713 | 2,366,338 | 1,777,610 | 1,761,126 | 1,341,451 | 1,475,723 | 1,360,103 | 1,097,568 | 1,020,808 | 1,007,886 | 1,228,926 | **neg** | <0.001 |
| | | | | | | | | | | | | | | |
| Almaco jack | Reef Fish | | 287 | 535 | 1,485 | 1,282 | 981 | 2,582 | 1,461 | 3,394 | 5,574 | 2,675 | **pos** | 0.006 |
| Banded rudderfish | Reef Fish | | 29 | 47 | 206 | 2,760 | 414 | 3,306 | 11,971 | 6,258 | 18,001 | 25,351 | **pos** | 0.001 |
| Bar jack | Reef Fish | | | | 102 | 27 | 30 | 493 | 167 | 289 | 770 | 262 | n.s. | |
| Barracuda | Reef Fish | | 1,151 | 2,883 | 8,641 | 43,435 | 54,831 | 101,708 | 58,469 | 39,317 | 24,761 | 36,652 | n.s. | |
| Black grouper | Reef Fish | 81,843 | 63,001 | 34,826 | 49,971 | 34,679 | 30,731 | 39,526 | 33,089 | 23,213 | 15,978 | 17,901 | **neg** | <0.001 |
| Blackfin snapper | Reef Fish | | 56 | | 4 | | 4 | 11 | 67 | | | 10 | n.s. | |
| Blue runner | Reef Fish | 36,711 | 29,764 | 24,542 | 45,288 | 24,501 | 36,318 | 34,136 | 61,633 | 102,979 | 60,516 | 46,038 | n.s.(neg) | 0.056 |
| Coney | Reef Fish | | | | 2 | 5 | | 4 | 39 | | 6 | | ~ | |
| Crevalle jack | Reef Fish | 358,191 | 234,447 | 307,785 | 157,918 | 140,549 | 182,579 | 113,072 | 52,891 | 78,926 | 74,709 | 47,908 | **neg** | <0.001 |
| Cubera snapper | Reef Fish | 5,070 | 832 | 278 | 2,430 | 972 | 1,726 | 2,517 | 1,439 | 1,143 | 629 | 540 | n.s. | |
| Dog snapper | Reef Fish | | 87 | 123 | 40 | 98 | 47 | 693 | 594 | 777 | 131 | 18 | n.s. | |
| Gag grouper | Reef Fish | 23,283 | 72,287 | 84,532 | 74,133 | 55,445 | 46,912 | 86,856 | 61,315 | 62,914 | 26,742 | 19,788 | n.s. | |
| Goliath grouper | Reef Fish | 593 | | | | | | | | | | | ~ | |
| Gray snapper | Reef Fish | 21,864 | 30,494 | 18,804 | 16,618 | 23,217 | 18,393 | 31,225 | 33,376 | 24,442 | 20,488 | 17,763 | n.s. | |
| Graysby | Reef Fish | | 1,756 | 628 | 946 | 83 | 289 | 489 | 64 | 223 | 11 | 42 | **neg** | 0.008 |
| Greater amberjack | Reef Fish | 311,359 | 376,533 | 391,561 | 138,103 | 118,483 | 144,591 | 135,872 | 136,609 | 62,938 | 104,420 | 89,398 | **neg** | <0.001 |
| Groupers, uncl. | Reef Fish | 19,288 | 22,006 | 14,493 | 10,959 | 5,712 | 2,757 | 2,592 | 2,678 | 1,827 | 1,307 | 1,356 | **neg** | 0.002 |
| Grunts, uncl. | Reef Fish | 77,036 | 67,620 | 29,154 | 28,891 | 29,986 | 44,615 | 31,710 | 69,275 | 48,330 | 54,901 | 33,274 | n.s. | |
| Hogfish | Reef Fish | 22,923 | 28,662 | 16,145 | 18,876 | 14,113 | 11,209 | 12,828 | 13,448 | 7,827 | 7,021 | 4,507 | **neg** | <0.001 |
| Lane snapper | Reef Fish | 2,509 | 4,868 | 2,956 | 5,020 | 6,351 | 3,942 | 6,279 | 5,766 | 7,181 | 5,447 | 4,851 | n.s. | |
| Mahogany snapper | Reef Fish | | 16 | | 22 | 105 | | 67 | 2 | 26 | 58 | 17 | n.s. | |
| Mojarra | Reef Fish | 273,682 | 269,049 | 330,966 | 275,094 | 247,924 | 195,915 | 177,439 | 155,414 | 136,394 | 126,513 | 134,704 | **neg** | <0.001 |
| Mutton snapper | Reef Fish | 134,806 | 131,006 | 61,876 | 109,718 | 66,698 | 59,151 | 62,469 | 56,905 | 59,791 | 46,503 | 23,602 | **neg** | <0.001 |
| Nassau grouper | Reef Fish | 421 | 1,277 | 1,377 | 144 | 75 | | | | | | | ~ | |
| Red grouper | Reef Fish | 16,525 | 26,156 | 10,694 | 21,368 | 11,866 | 10,558 | 21,464 | 17,315 | 13,907 | 20,799 | 7,672 | n.s. | |
| Red snapper | Reef Fish | 2,816 | 3,846 | 2,791 | 23,586 | 3,954 | 10,159 | 5,743 | 6,017 | 2,476 | 1,225 | 1,826 | n.s. | |
| Reef fishes | Reef Fish | 221,238 | 235,217 | 163,505 | 114,402 | 182,731 | 124,212 | 142,144 | 134,184 | 91,230 | 68,321 | 130,120 | **neg** | 0.004 |

**Table 1 (cont). Annual reported commercial landings by weight (pounds, whole weight) for southeast Florida, 1990-2000. (Miami-Dade, Broward, Palm Beach and Martin counties) with decadal trend and p-value of significant trends**

| Species/Market Category | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scamp | Reef Fish | 1,516 | 3,868 | 86 | 275 | 804 | 645 | 1,480 | 4,700 | 2,103 | 2,533 | 457 | n.s. | |
| Schoolmaster | Reef Fish | | | 24 | 3 | | 59 | 13 | 22 | 54 | 42 | | n.s. | |
| Silk snapper | Reef Fish | 1,623 | 3,251 | 782 | 1,393 | 587 | 821 | 554 | 3,100 | 884 | 2,674 | 3,115 | n.s. | |
| Snappers | Reef Fish | 73,864 | 67,926 | 52,149 | 39,762 | 21,087 | 18,384 | 10,993 | 2,616 | 342 | 1,070 | 2,556 | **neg** | <0.001 |
| Snowy grouper | Reef Fish | 16,730 | 16,084 | 10,384 | 15,819 | 10,958 | 15,648 | 17,672 | 41,262 | 13,282 | 13,452 | 10,083 | n.s. | |
| Vermilion snapper | Reef Fish | 16,449 | 13,806 | 3,399 | 6,505 | 2,662 | 11,111 | 4,948 | 12,204 | 3,000 | 3,739 | 6,831 | n.s. | |
| Warsaw grouper | Reef Fish | 5,978 | 4,054 | 2,588 | 3,140 | 1,320 | 165 | 207 | | 94 | 811 | 336 | **neg** | 0.002 |
| Yellowedge grouper | Reef Fish | 906 | 10,668 | 258 | 330 | 39 | 1,928 | 4,741 | 80 | 46 | 102 | 516 | n.s. | |
| Yellowfin grouper | Reef Fish | 708 | 339 | 506 | 1,241 | 73 | 357 | 287 | 241 | 262 | 582 | 188 | n.s. | |
| Yellowtail snapper | Reef Fish | 127,008 | 144,743 | 164,983 | 183,075 | 164,505 | 125,452 | 106,480 | 142,618 | 123,060 | 117,189 | 91,979 | **neg** | 0.048 |
| TOTAL REEF FISH | | 1,854,940 | 1,865,186 | 1,735,660 | 1,355,510 | 1,217,086 | 1,154,934 | 1,162,600 | 1,121,031 | 918,929 | 827,025 | 762,336 | **neg** | <0.001 |
| Total coastal, pelagic, reef fish, and invertebrates | | 9,285,684 | 8,478,657 | 7,313,785 | 9,385,247 | 8,607,237 | 7,673,942 | 7,121,382 | 6,883,911 | 6,118,848 | 5,892,250 | 6,199,790 | **neg** | <0.001 |

*1990-2000 Trends

**pos** increasing landings trend; trendline slope > 0 ($p<0.05$)
**neg** decreasing landings trend; trendline slope < 0 ($p<0.05$)
n.s. non-significant or non-existent landings trend; trendline slope = 0 ($p>0.05$)
~ insufficient annual data (5 or fewer reporting years) for trend analysis

** Sponge landings are reported in "pieces" instead of weight.

## Recreational Fishing Sector

### Marine Recreational Fishing Statistical Survey (1990-2000).

Recreational landings were similar in 1990 (13.5 million pounds) and in 2000 (13.7 million pounds) (Fig. 2a). Between 1990 and 2000, the lowest landings (9.8 million pounds) were in 1993, the year after Hurricane Andrew hit Miami-Dade County, and the highest landings (17.5 million pounds) were in 1991. Recreational landings by species and year are presented in Table 2. Figure 5a shows the reef fish, coastal, and offshore pelagic landings by year. Between 1990 and 2000, offshore pelagic species accounted for 50% of the total recreational landings (Fig. 5b), followed by reef species (27%) and coastal species (23%). In the SEFCRI region, recreational fishing effort (estimated in angler trips) was 4.1 million in 1990 and 4.4 million in 2000 and averaged 4.2 million annual angler trips from 1990 through 2000 (Fig. 5c). The highest effort (4.9 million trips) was in 1992, but effort declined by 0.8 million trips in 1993 which was the year following Hurricane Andrew's landfall in Miami-Dade County. No significant trends were found in overall recreational landings or by fishery category.

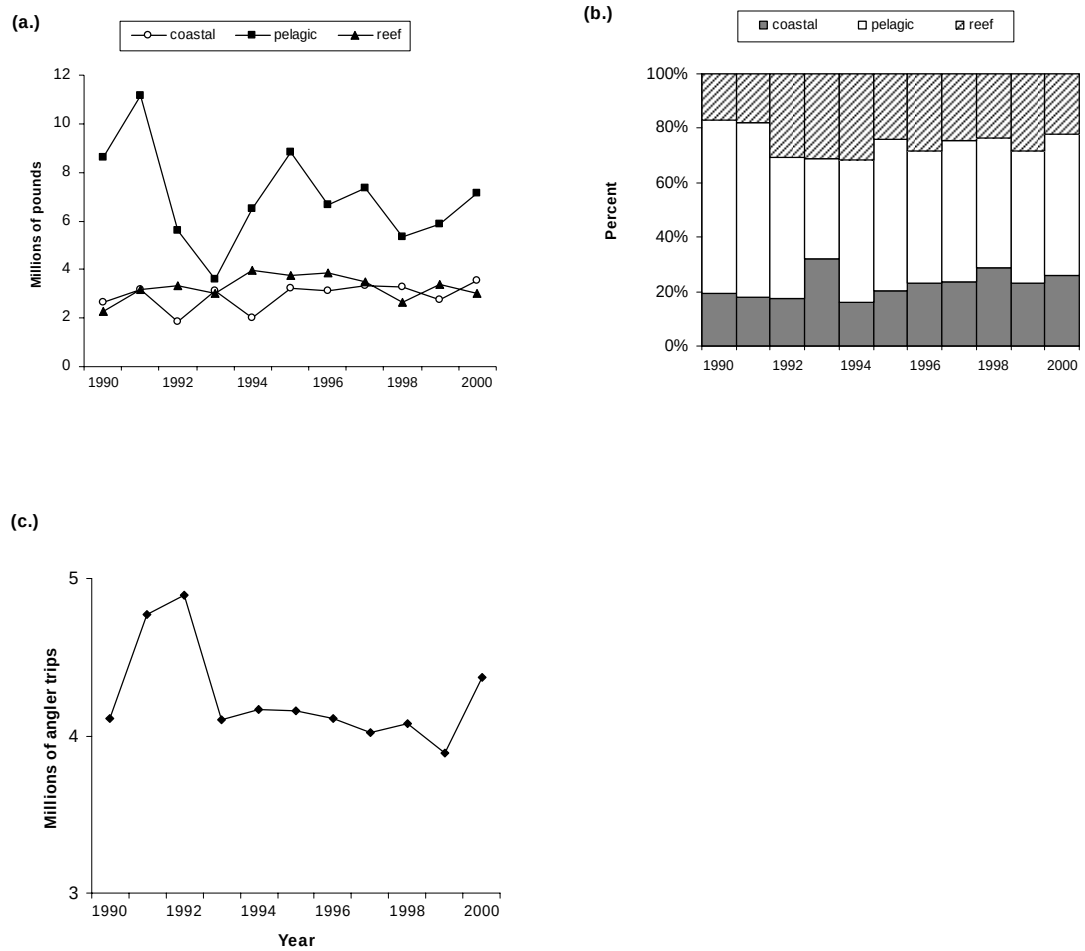



Figure 5. Marine Recreational Fishery Statistics Survey estimates for the SEFCRI area 1990-2000. (a.) recreational landings (millions of pounds) by fishery type, (b.) percent composition by type, (c.) fishing effort (angler trips).

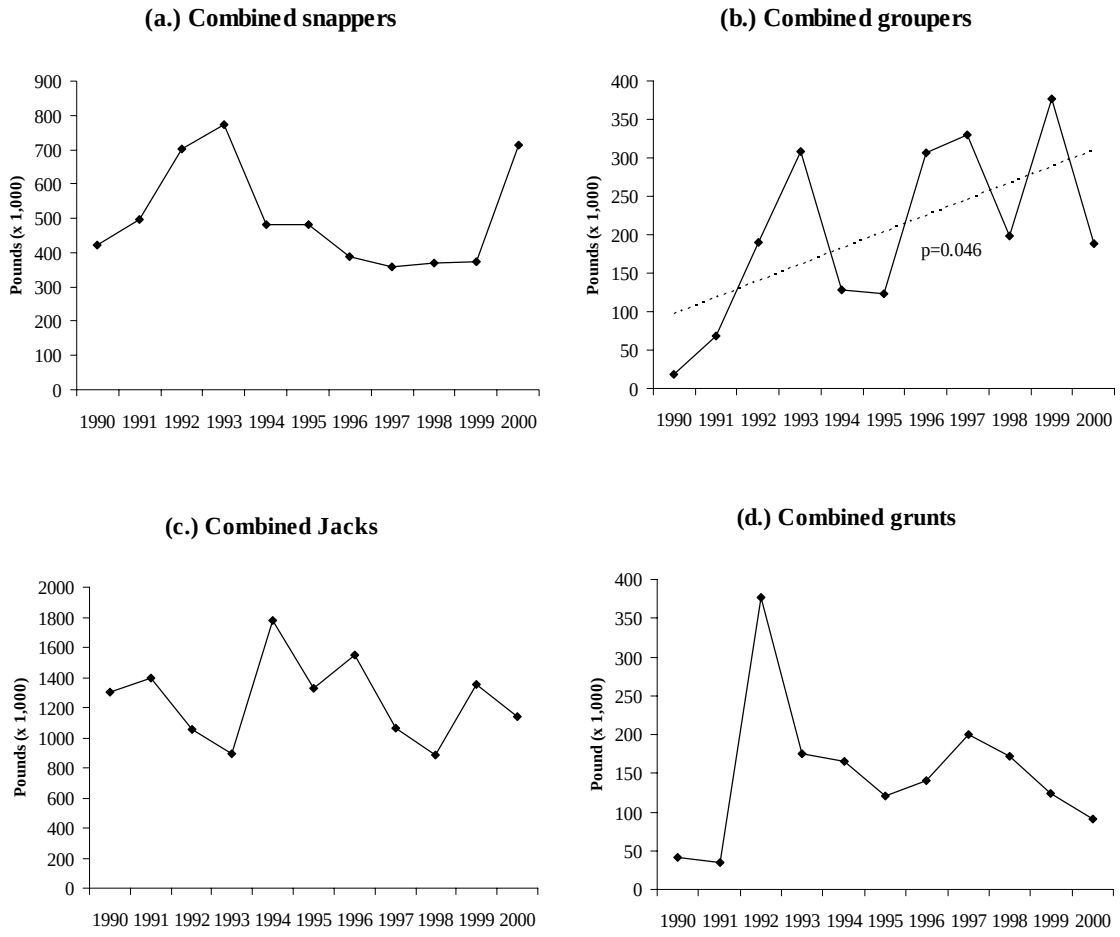



Figure 6. Marine Recreational Fishery Statistics Survey estimates by major species groups in the reef fishery for the SEFCRI area 1990-2000. (a.) combined snappers, (b.) combined groupers (c.) combined jacks (d.) combined grunts. Dotted lines show significant ($p < 0.05$) linear trends.

*Reef fish species*

Recreational reef fish landings during 1990-2000 averaged 3.27 million pounds and showed no statistically significant trends (Fig. 5a). The most important reef fishes in terms of percent landings during the study period were barracuda (23%), amberjack (14%), Mycteroperca groupers (13%), blue runner (13%), crevalle jack (9%), gray snapper (5%), mutton snapper (5%), and sheepshead (4%). From 1990 through 2000, there was no trend in landings for combined snappers (Fig. 6a), while combined groupers increased significantly ($p = 0.046$; Fig. 6b). Landings of total jacks and grunts fluctuated without significant trend, averaging approximately 1.2 million and 162 thousand pounds, respectively (Fig. 6c,d). Landings of most snappers fluctuated without trend over the decade (Fig. 7a), with the exception of schoolmaster, which decreased significantly ($p = 0.043$; Table 2). No trends were evident in landings of Epinephelus or Mycteroperca groupers, or of black sea bass (Fig. 7b). There were no significant trends in landings of pigfish or white grunts over the study period, while landings of bluestriped grunts decreased ($p = 0.015$) (Fig. 7c). No significant trend was found for sheepshead or red porgy (Fig. 7d), while jolthead porgy landings increased ($p = 0.046$). Blue runner landings increased

significantly (p = 0.027; Fig. 7e) and yellow jack decreased (p = 0.040; Table 2), while greater amberjack and crevalle jack landings fluctuated without trend (Fig. 7e). Barracuda landings fluctuated without trend, but exhibited an overall increasing trend from 1990 through 1995 followed by a decreasing trend through 2000 (Fig. 7f). Barracuda landings averaged over one-half million pounds annually. Gray triggerfish exhibited a significant decline in landings (p = 0.003; Table 2).

*Coastal species*

Recreational landings for the coastal fisheries fluctuated between 1.9 and 3.5 million pounds, but without trend from 1990 through 2000 (Fig. 5a). The most important species in terms of landings in the coastal recreational fishery were king mackerel (60%), sciaenid fishes (21%), Spanish mackerel (10%), and bluefish (7%). King and Spanish mackerel landings exhibited increasing but non-significant trends (Fig. 8a). Bluefish landings decreased from highs in 1991-1993, but the trend was not significant (Fig. 8b). There were no trends in the major sciaenid species or combined sciaenid landings (Fig. 8c,d). Positive trends were found for pinfish and Irish pompano (p = 0.018 and 0.039, respectively; Table 2).

Landings of coastal species were likely influenced by regulations listed in Table 4. Minimum-size limits on king mackerel were established in 1993, and annual regulations including quotas (commercial sector) and bag limits (recreational sector) have occurred. In 1989, red drum size and catch limits were established and sales of native red drum were prohibited. In 1998, shore fishermen with a valid saltwater products license and a restricted species endorsement were allowed to land the commercial limit of black drum. In 1996, recreational size limits were established for spotted seatrout, and commercial landings were restricted to 75 fish/day, with allowable gear restricted to hook and line and cast nets. In 2000, recreational bag limits were reduced from five to four seatrout/day. In 1996, regulations were established for sheepshead, which included a 50-pound commercial daily vessel limit, size limits, restricted gears, recreational bag limits and spearfishing restrictions. Recreational bag limits were increased from 10 to 15 fish/person/day in 1997, and commercial spearfishing was allowed.

*Offshore pelagic species*

Recreational landings of offshore pelagic species fluctuated without trend over the study period, with a peak of 11.1 million pounds in 1991 and a low of 3.6 million pounds in 1993 following Hurricane Andrew in 1992 (Fig. 5a). The most important recreational offshore pelagic species in landings were dolphinfish (68%), little tunny/Atlantic bonito (23%), and other tunas (4%). Dolphinfish landings fluctuated considerably during the early 1990's with a high in 1991 and a low in 1993 (Fig. 9a). Recreational regulations for dolphinfish remained consistent over the decade with a daily bag limit of ten fish. Little tunny/Atlantic bonito peak landings occurred in 1996 but have since declined to about 40% of the 1996 high (Fig. 9b). Blackfin tuna landings were flat during the early 1990’s but increased substantially in 2000 (Table 2), while other (grouped) tunas varied without significant trend (Fig. 9b).

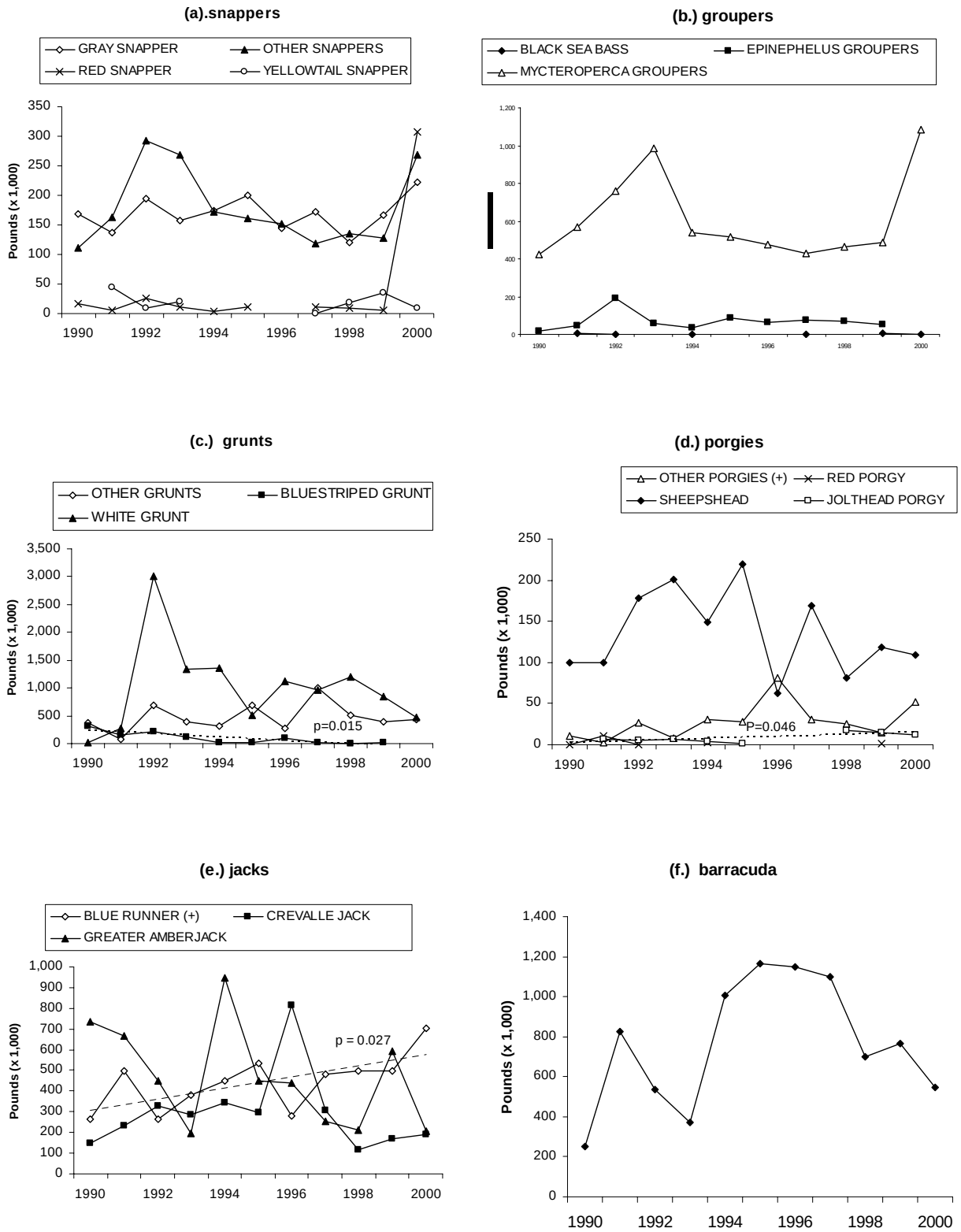



Figure 7. Recreational landings of major species in reef fishery for SEFCRI region 1990-2000. (a.) snappers, (b.) groupers, (c.) grunts, (d.) porgies, (e.) jacks (f.) barracuda. Dotted lines show significant ($p < 0.05$) linear trends.

**Table 2. Southeast Florida recreational (MRFSS) estimated annual landings in pounds with decadal trend and p-value of significant trends**

| Common name | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 trend* | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlantic croaker | Coastal | | 40,877 | 30,387 | 24,341 | 6,232 | 35,340 | | 3,095 | 28,507 | 37,865 | 64,566 | n.s. | |
| Atlantic cutlassfish | Coastal | 784 | | | | | | | | | | | ~ | |
| Atlantic moonfish | Coastal | | | | 1,908 | | | | | | | | ~ | |
| Atlantic needlefish | Coastal | 2,003 | | | | 185 | | | | 862 | | | ~ | |
| Atlantic stingray | Coastal | | | | | 2,007 | | | | | | | ~ | |
| Atlantic thread herring | Coastal | | 2,507 | | | | | | | | | | ~ | |
| Atlantic threadfin | Coastal | | | | | | | 1,441 | | | | 1,221 | ~ | |
| Ballyhoo | Coastal | | | | | | 4,376 | | | | | | ~ | |
| Banded drum | Coastal | | | 34,167 | | | | | | | | | ~ | |
| Bigeye scad | Coastal | | | | 353 | 32,688 | | | | | | | ~ | |
| Blueback herring | Coastal | 1,240 | | | | | | | | | | | ~ | |
| Bluefish | Coastal | 155,094 | 660,836 | 209,946 | 333,422 | 144,747 | 158,443 | 50,514 | 87,527 | 123,276 | 73,635 | 221,373 | n.s. | |
| Bonefish | Coastal | | | 820 | | | | | | | | | ~ | |
| Bullet mackerel | Coastal | | | | | | | | | 881 | | | ~ | |
| Common snook | Coastal | 120,291 | 131,637 | 57,471 | 109,379 | 116,116 | 68,270 | 180,683 | 205,206 | 134,615 | 80,134 | 39,089 | n.s. | |
| Dwarf sand perch | Coastal | | | | | | 2,507 | 965 | | | 165 | | ~ | |
| False pilchard | Coastal | 77,293 | 136,538 | | | | | 490 | | | | | ~ | |
| Flat needlefish | Coastal | | 1,649 | | | | | | | | | | ~ | |
| Florida pompano | Coastal | 71,968 | 59,116 | 20,417 | 10,261 | 7,312 | 208,483 | 25,937 | 190,591 | 151,004 | 60,934 | 162,548 | n.s. | |
| Gafftopsail catfish | Coastal | 11,158 | 14,328 | 6,609 | 2,534 | 3,867 | 31,635 | 29,602 | 1,826 | 11,709 | 6,242 | 72,524 | n.s. | |
| Guaguanche | Coastal | | | 740 | | | | 1,483 | | | | | ~ | |
| Gulf flounder | Coastal | | | | | | | | | | 1,645 | | ~ | |
| Gulf kingfish | Coastal | | | | 6,801 | 5,666 | 2,264 | 2,148 | 28,924 | 15,387 | 7,441 | 6,865 | n.s. | |
| Gulf toadfish | Coastal | | | | | 430 | | | | | | | ~ | |
| Hardhead catfish | Coastal | 2,064 | 4,573 | 1,138 | 9,267 | 693 | 21,443 | 2,513 | | 5,429 | 3,499 | 22,130 | n.s. | |
| Houndfish | Coastal | | | | 4,627 | 370 | 3,729 | | 3,091 | | 3,529 | | ~ | |
| Inshore lizardfish | Coastal | 3,208 | 552 | | | | 197 | 2,663 | | 1,099 | 396 | | n.s. | |
| Irish pompano | Coastal | | 39,256 | 25,184 | 35,398 | 40,516 | 63,570 | 51,711 | 79,551 | 24,782 | 65,073 | 149,562 | **pos** | 0.039 |
| King mackerel | Coastal | 1,665,983 | 1,193,210 | 1,112,660 | 1,893,494 | 1,212,525 | 2,063,194 | 2,174,073 | 2,341,216 | 2,227,605 | 1,586,008 | 1,826,639 | n.s. | |
| Ladyfish | Coastal | 71,132 | | | 1,615 | | 49,271 | | | 2,626 | 5,120 | 22,097 | n.s. | |
| Leatherjacket | Coastal | | | | | 370 | 430 | 1,170 | | | | | ~ | |
| Lookdown | Coastal | | | 3,086 | | 3,996 | 3,881 | | 438 | 1,420 | 9,167 | 2,872 | n.s. | |
| Mackerel scad | Coastal | | | | 309 | | | | | | | | ~ | |
| Northern kingfish | Coastal | | | | | | 430 | | | | | 4,930 | ~ | |
| Northern sennet | Coastal | | | | | | | | | | 630 | | ~ | |
| Ocellated flounder | Coastal | | | | | | | | | 627 | | | ~ | |
| Palometa | Coastal | | | | | | | 9,041 | | | | 3,071 | ~ | |
| Permit | Coastal | | | 5,348 | | | | | 19,406 | | 39,255 | 15,937 | ~ | |
| Pinfish | Coastal | 4,165 | | 21,077 | 66,327 | 63,144 | 42,467 | 56,167 | 56,770 | 36,177 | 105,554 | 79,743 | **pos** | 0.018 |
| Pompano dolphin | Coastal | | | | | | | | | 4,534 | 2,096 | 20,827 | ~ | |
| Red drum | Coastal | 14,525 | 26,829 | 59,665 | 8,106 | 7,454 | 16,653 | 6,982 | | 11,820 | 12,503 | 6,454 | n.s. | |
| Redeye mullet | Coastal | | | | 1,969 | | | | | | | | ~ | |
| Remora | Coastal | | | 4,950 | | | 10,339 | | 5,968 | 2,669 | 4,936 | | ~ | |
| Round scad | Coastal | | | | | | | 69,257 | | | | | ~ | |
| Sand diver | Coastal | | | | | | | | | 754 | | | ~ | |
| Sand drum | Coastal | | | | | 3,808 | 43,612 | 2,949 | 23,901 | 5,552 | 4,610 | 17,333 | n.s. | |
| Sand perch | Coastal | 5,258 | | 1,002 | 7,430 | 3,718 | 3,040 | 1,163 | 3,379 | | 6,824 | 14,443 | n.s. | |

**Table 2 (cont). Southeast Florida recreational (MRFSS) estimated annual landings in pounds with decadal trend and p-value of significant trends**

| Common name | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 trend* | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scaled sardine | Coastal | | | | 1,797 | | | | | | | | ~ | |
| Scup | Coastal | | | | 1,084 | | | | | | | | ~ | |
| Sea bream | Coastal | | | 4,989 | 492 | | | 2,971 | 3,244 | | 2,361 | 7,857 | n.s. | |
| Silver perch | Coastal | | | 258 | 1,313 | | | | | 608 | | | ~ | |
| Silver seatrout | Coastal | | | | | 275 | | | | | | | ~ | |
| Smooth skate | Coastal | 8,069 | | | | | | | | | | | ~ | |
| Southern flounder | Coastal | 60,129 | 1,029 | 1,924 | 23,837 | | 1,456 | 1,681 | 12,648 | 6,547 | 3,030 | 11,680 | n.s. | |
| Southern kingfish | Coastal | 1,723 | 5,022 | | 444 | | | 562 | | | 442 | | ~ | |
| Southern stingray | Coastal | | | | | | | 12,186 | | | | | ~ | |
| Spanish mackerel | Coastal | 206,383 | 438,900 | 129,810 | 307,527 | 223,287 | 195,322 | 354,659 | 103,793 | 199,209 | 431,384 | 681,026 | n.s. | |
| Spot | Coastal | | | | | | | | | | 12,354 | 468 | ~ | |
| Spotfin mojarra | Coastal | | | | 165 | | | | | 63 | | | ~ | |
| Spottail pinfish | Coastal | 55,230 | 26,810 | 20,566 | 4,689 | 30,342 | 28,468 | 32,033 | 33,474 | 154,870 | 75,779 | | n.s. | |
| Spotted seatrout | Coastal | 40,044 | 98,423 | 33,101 | 12,391 | 21,479 | 51,351 | 26,079 | 81,338 | 91,925 | 57,157 | 18,175 | n.s. | |
| Striped mojarra | Coastal | 29,489 | 275,066 | 72,101 | | 16,612 | 52,786 | 9,722 | | | | | n.s. | |
| Striped mullet | Coastal | 17,670 | | 2,908 | 27,548 | 810 | | | 30,388 | 8,694 | | 7,938 | n.s. | |
| Summer flounder | Coastal | | | | | | | | | | | 2,840 | ~ | |
| Tarpon snook | Coastal | | | | | 7,014 | | | | | | | ~ | |
| Timucu | Coastal | | | 733 | | | | | | | | | ~ | |
| Tripletail | Coastal | | | 9,046 | 41,291 | 43,924 | 47,439 | 27,544 | 20,355 | 6,982 | 20,072 | 30,241 | n.s. | |
| Weakfishes | Coastal | | | 802 | | 315 | | | | | | | ~ | |
| White mullet | Coastal | | | | 196,712 | | 519 | | | | 28,136 | 5,510 | ~ | |
| Yellowfin mojarra | Coastal | 3,219 | | 5,396 | 7,287 | 15,707 | 3,475 | 2,207 | 2,685 | 433 | 3,021 | 4,494 | n.s. | |
| TOTAL COASTAL | | 2,628,121 | 3,157,158 | 1,876,300 | 3,144,117 | 2,015,607 | 3,214,390 | 3,140,597 | 3,338,814 | 3,260,667 | 2,750,996 | 3,524,452 | n.s. | |
| | | | | | | | | | | | | | ~ | |
| Albacore | Pelagic | 4,808 | | | | | | | | | | | ~ | |
| Atlantic bonito | Pelagic | 8,331 | 7,147 | | | | | | | | | 250 | ~ | |
| Atlantic sharpnose shark | Pelagic | | | | | 13,009 | | | | 10,875 | 5,308 | 8,666 | ~ | |
| Bigeye tuna | Pelagic | | | | | | | | | 8,423 | | | ~ | |
| Blackfin tuna | Pelagic | 24,843 | 54,036 | 59,202 | 34,020 | 84,318 | 22,443 | 15,784 | 56,189 | 44,830 | 92,815 | 172,814 | n.s. (pos) | 0.074 |
| Blacknose shark | Pelagic | | | | | | | | | 16,240 | | | ~ | |
| Blacktip shark | Pelagic | | | 23,595 | | | | | 3,518 | 4,841 | 2,889 | 3,990 | ~ | |
| Blue marlin | Pelagic | | | 84,321 | | | | | | | | | ~ | |
| Bluefin tuna | Pelagic | | | | | 10,900 | | | | | | | ~ | |
| Bonnethead | Pelagic | | | 4,841 | 1,863 | 7,883 | | 1,813 | 1,320 | 1,648 | 3,071 | 18,628 | n.s. | |
| Bull shark | Pelagic | 1,106,712 | | | | | | | | | 121,872 | 147,017 | ~ | |
| Cobia | Pelagic | 41,452 | | 76,243 | 109,109 | 100,811 | 74,223 | 17,409 | 176,852 | 63,576 | 117,065 | 213,554 | n.s. (pos) | 0.099 |
| Dolphinfish | Pelagic | 5,294,863 | 9,172,641 | 3,796,694 | 2,072,090 | 4,922,110 | 6,702,772 | 3,989,665 | 4,166,294 | 3,083,699 | 3,550,412 | 4,984,231 | n.s. | |
| Great hammerhead | Pelagic | 19,000 | | | | | | | | | | | ~ | |
| Little tunny | Pelagic | 2,023,678 | 1,595,561 | 1,143,329 | 1,242,936 | 1,035,826 | 1,542,499 | 2,451,793 | 2,050,471 | 1,827,407 | 1,330,810 | 1,183,107 | n.s. | |
| Marlinsucker | Pelagic | | | | | | | | | 3,240 | | | ~ | |
| Nurse shark | Pelagic | | | | | | 4,085 | | 8,394 | | | 8,312 | ~ | |
| Reef shark | Pelagic | | | | | 99,679 | | | | | | | ~ | |
| Sailfish | Pelagic | 59,753 | 94,980 | 132,745 | 13,773 | 37,826 | 219,654 | | 697,989 | 63,214 | 246,161 | 85,011 | n.s. | |
| Scalloped hammerhead | Pelagic | 23,700 | | | | | | | | | | | ~ | |
| Silky shark | Pelagic | | | | | 7,461 | 13,853 | | | 5,289 | 11,321 | 17,360 | ~ | |
| Skipjack tuna | Pelagic | | | 40,318 | 3,703 | | 25,756 | | 2,924 | 73,879 | 53,210 | 10,337 | n.s. | |

**Table 2 (cont). Southeast Florida recreational (MRFSS) estimated annual landings in pounds with decadal trend and p-value of significant trends**

| Common name | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 trend* | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Smooth hammerhead | Pelagic | | 46,267 | | | | | | | | | | ~ | |
| Spinner shark | Pelagic | | | 4,915 | | 11,703 | 10,039 | | | | 9,260 | | ~ | |
| Wahoo | Pelagic | 15,010 | 207,536 | 214,148 | 124,463 | 159,348 | 209,309 | 162,156 | 186,768 | 155,035 | 310,184 | 268,601 | **pos** | 0.035 |
| Yellowfin tuna | Pelagic | | | | 10,930 | | | | | | | | ~ | |
| TOTAL PELAGIC | | 8,622,149 | 11,178,168 | 5,580,350 | 3,612,886 | 6,490,875 | 8,824,632 | 6,638,620 | 7,350,719 | 5,362,195 | 5,854,377 | 7,121,879 | n.s. | |
| African pompano | Reef fish | 16,273 | | 3,481 | 50,246 | 23,627 | 84,805 | 10,426 | 51,031 | 34,905 | 77,580 | 26,082 | n.s. | |
| Almaco jack | Reef fish | | | 2,584 | 863 | 4,881 | 839 | | | 23,106 | 65,575 | 16,073 | n.s. | |
| Atlantic spadefish | Reef fish | | | | 4,334 | 1,414 | 1,074 | | 1,305 | 6,829 | 454 | 1,701 | n.s. | |
| Balloonfish | Reef fish | | 1,786 | | | | | | | | | | ~ | |
| Banded rudderfish | Reef fish | | | | | | | | 7,655 | 2,137 | 7,758 | 21,318 | ~ | |
| Bandtail puffer | Reef fish | | | | | | | | | | 908 | 776 | ~ | |
| Bar jack | Reef fish | 7,822 | 2,222 | | 6,663 | 3,982 | | 7,311 | 9,451 | 10,142 | 825 | | n.s. | |
| Bermuda chub | Reef fish | | | | | 6,056 | 36,724 | | | 1,906 | 1,509 | | ~ | |
| Bigeye | Reef fish | | | 944 | | 1,249 | | 1,528 | 593 | | 689 | | ~ | |
| Bigeye soldierfish | Reef fish | | | | | | | | | 374 | | | ~ | |
| Black grouper | Reef fish | | | 3,756 | | 26,689 | 38,326 | 131,411 | 76,180 | 73,982 | 35,151 | 34,630 | n.s. | |
| Black margate | Reef fish | 1,905 | 4,400 | 7,076 | 7,120 | 3,040 | 5,733 | 754 | 64,358 | 23,889 | 11,122 | 22,524 | n.s. | |
| Black sea bass | Reef fish | | 7,395 | 1,714 | | 368 | | | 267 | | 7,745 | 588 | n.s. | |
| Blackbelly rosefish | Reef fish | | | | | 9,673 | | | | | | | ~ | |
| Blackfin snapper | Reef fish | | | | | | | | | | 509 | 2,714 | ~ | |
| Blackline tilefish | Reef fish | | | | | | | | | 307 | | | ~ | |
| Blue runner | Reef fish | 262,480 | 495,449 | 266,006 | 381,221 | 447,939 | 535,329 | 277,915 | 480,935 | 498,997 | 499,813 | 703,187 | **pos** | 0.027 |
| Blueline tilefish | Reef fish | | | | 9,849 | | | | | | | | ~ | |
| Bluestriped grunt | Reef fish | 23,636 | | 60,123 | 31,335 | 15,093 | 21,871 | 12,000 | 2,631 | 2,434 | 9,498 | 1,396 | **neg** | 0.015 |
| Caesar grunt | Reef fish | | | | 343 | | | | 767 | 635 | 675 | | ~ | |
| Cero | Reef fish | 6,950 | 940 | 3,799 | 29,604 | 9,310 | 13,013 | 63,899 | 44,924 | 21,727 | 4,202 | 20,607 | n.s. | |
| Checkered puffer | Reef fish | | | | 366 | 302 | 3,874 | 5,495 | 3,243 | 20,051 | 6,541 | 2,068 | n.s. | |
| Coney | Reef fish | | | | 2,730 | | | 1,438 | | 614 | 217 | 2,338 | ~ | |
| Crevalle jack | Reef fish | 147,721 | 230,758 | 328,990 | 286,846 | 343,981 | 295,343 | 817,243 | 309,168 | 116,145 | 170,669 | 187,842 | n.s. | |
| Cubera snapper | Reef fish | | | | 13,737 | | 4,125 | 1,433 | | | 574 | 2,850 | ~ | |
| Dog snapper | Reef fish | | | | 549 | | | 409 | | 338 | 391 | 233 | ~ | |
| French grunt | Reef fish | | | 1,012 | 159 | 520 | 854 | | 24,722 | | 992 | | n.s. | |
| Gag | Reef fish | 17,759 | 42,921 | 139,646 | 114,260 | 45,383 | 50,182 | 85,644 | 189,609 | 44,848 | 255,759 | 100,954 | n.s. | |
| Glasseye snapper | Reef fish | | | | | 1,667 | | | | | | | ~ | |
| Grass porgy | Reef fish | | | 292 | | | | | 682 | | | | ~ | |
| Gray angelfish | Reef fish | | | | 1,360 | 736 | | | | | | | ~ | |
| Gray snapper | Reef fish | 167,640 | 137,355 | 195,306 | 157,677 | 173,225 | 199,513 | 143,806 | 171,615 | 120,913 | 167,143 | 222,561 | n.s. | |
| Gray triggerfish | Reef fish | 97,571 | 122,308 | 108,440 | 34,561 | 18,557 | 13,501 | 11,576 | 24,977 | 13,497 | 15,299 | 15,294 | **neg** | 0.003 |
| Graysby | Reef fish | | | 157 | 926 | 487 | | 900 | | | 916 | | ~ | |
| Great barracuda | Reef fish | 253,319 | 826,427 | 536,307 | 372,989 | 1,007,571 | 1,164,617 | 1,147,212 | 1,098,745 | 697,996 | 766,882 | 545,046 | n.s. | |
| Greater amberjack | Reef fish | 732,814 | 667,348 | 448,624 | 194,782 | 947,189 | 449,456 | 436,939 | 252,620 | 209,776 | 592,592 | 205,083 | n.s. | |
| Grunts, uncl. | Reef fish | | | | | | 34,956 | | | | | | ~ | |
| Hogfish | Reef fish | 2,018 | 52,106 | 67,246 | 82,869 | 84,434 | 103,364 | 75,805 | 44,894 | 33,898 | 73,965 | 34,256 | n.s. | |
| Honeycomb cowfish | Reef fish | | | 786 | | | 1,750 | | | | | | ~ | |
| Horse-eye jack | Reef fish | | | | 276 | 1,089 | 1,034 | 816 | | | 666 | | ~ | |
| Jolthead porgy | Reef fish | | 7,165 | 5,031 | 6,448 | 4,513 | 1,444 | | | 17,106 | 14,679 | 12,121 | **pos** | 0.046 |

**Table 2 (cont). Southeast Florida recreational (MRFSS) estimated annual landings in pounds with decadal trend and p-value of significant trends**

| Common name | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 trend* | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Knobbed porgy | Reef fish | | | | | 639 | | | | 2,753 | 2,102 | 1,177 | ~ | |
| Lane snapper | Reef fish | 14,060 | 23,735 | 18,592 | 31,237 | 14,500 | 19,542 | 18,311 | 32,873 | 15,851 | 20,097 | 64,767 | n.s. | |
| Least puffer | Reef fish | | | | | | 1,193 | | | | | | ~ | |
| Lesser amberjack | Reef fish | | | | 1,278 | | | 493 | | 4,389 | 2,117 | 806 | ~ | |
| Littlehead porgy | Reef fish | | | 7,541 | 677 | | 3,420 | 30,286 | | 3,974 | 615 | 9,433 | n.s. | |
| Longspine porgy | Reef fish | | | | | 645 | | | | | | | ~ | |
| Mahogany snapper | Reef fish | | | | | | | | | | 1,937 | | ~ | |
| Margate | Reef fish | 5,209 | | | | 11,756 | 5,837 | 13,539 | | 23,628 | 15,753 | 17,466 | **pos** | 0.039 |
| Mutton snapper | Reef fish | 111,283 | 118,017 | 278,170 | 225,649 | 169,859 | 153,342 | 149,626 | 116,690 | 114,946 | 87,694 | 252,813 | n.s. | |
| Nassau grouper | Reef fish | | 11,406 | | 1,746 | 3,517 | | 1,843 | | | | | ~ | |
| Northern puffer | Reef fish | | | | 732 | | 385 | | | | | | ~ | |
| Ocean surgeon | Reef fish | | | 1,481 | | | | | | 388 | | | ~ | |
| Ocean triggerfish | Reef fish | | | 6,427 | 46,920 | 21,026 | 51,260 | 6,278 | 54,453 | 21,738 | 7,266 | 13,522 | n.s. | |
| Painted wrasse | Reef fish | | | | | | | | 560 | | | | ~ | |
| Pigfish | Reef fish | 3,473 | | 7,287 | | 746 | 402 | 453 | 4,575 | 1,292 | 586 | 1,214 | n.s. | |
| Porgy | Reef fish | | | | 677 | | | 3,778 | | | | | ~ | |
| Porkfish | Reef fish | 628 | 2,515 | 3,056 | 2,506 | 3,709 | 1,238 | 939 | 2,043 | 6,445 | 1,731 | 3,174 | n.s. | |
| Puddingwife | Reef fish | | | 472 | 685 | | | 1,623 | | | | 1,466 | ~ | |
| Pygmy moray | Reef fish | 395 | | | | | | | | | | | ~ | |
| Queen parrotfish | Reef fish | | | | | | | 1,340 | | | 472 | | ~ | |
| Queen snapper | Reef fish | | | | | | | 470 | | | 249 | | ~ | |
| Queen triggerfish | Reef fish | 7,379 | | 3,254 | 6,337 | | | | 774 | 5,659 | 3,353 | 4,187 | n.s. | |
| Rainbow runner | Reef fish | 25,057 | 3,214 | 4,167 | 3,389 | 10,029 | 27,420 | 4,060 | 4,357 | 21,544 | 20,594 | 20,310 | n.s. | |
| Rainbow wrasse | Reef fish | | | | | | | | 560 | | | | ~ | |
| Red grouper | Reef fish | | 6,168 | 41,385 | 92,846 | 42,751 | 19,373 | 78,760 | 62,518 | 66,112 | 43,575 | 48,172 | n.s. | |
| Red hind | Reef fish | | | 2,059 | 5,608 | 84 | 679 | | | 2,618 | 1,409 | | n.s. | |
| Red hogfish | Reef fish | 1,335 | | 2,928 | | | | | | | | | ~ | |
| Red porgy | Reef fish | 196 | 11,286 | 616 | | 2,429 | | | | | 1,238 | | ~ | |
| Red snapper | Reef fish | 15,917 | 5,930 | 25,784 | 10,422 | 2,997 | 10,624 | | 11,600 | 9,880 | 4,833 | | n.s. | |
| Redband parrotfish | Reef fish | | | | 510 | | | | | | | | ~ | |
| Redfin parrotfish | Reef fish | | | 16,635 | | | | | | | | 742 | ~ | |
| Redtail parrotfish | Reef fish | | | 1,848 | | | | | | | 606 | | ~ | |
| Rock hind | Reef fish | | | 1,603 | 2,228 | | 954 | 1,337 | 2,085 | 1,514 | 136 | 653 | n.s. | |
| Sailor's choice | Reef fish | 12,546 | 19,511 | 931 | 7,437 | 8,525 | 358 | 5,571 | 601 | 14,358 | 10,894 | 10,765 | n.s. | |
| Sand tilefish | Reef fish | | 1,963 | | 1,197 | | | 1,711 | 715 | 3,447 | 120 | | n.s. | |
| Saucereye porgy | Reef fish | | | 1,057 | 2,611 | 8,166 | 13,795 | | | 733 | 1,555 | 746 | n.s. | |
| Scamp | Reef fish | | | | | | | | | 3,787 | 10,917 | 1,306 | ~ | |
| Schoolmaster | Reef fish | | | 3,932 | 9,349 | 2,667 | 3,679 | 999 | 615 | 2,312 | 957 | 932 | **neg** | 0.043 |
| Scrawled cowfish | Reef fish | | 5,780 | | 164 | 920 | 394 | | | | | 3,257 | ~ | |
| Scrawled filefish | Reef fish | | | 1,702 | 5,141 | | | | | | | | ~ | |
| Sergeant major | Reef fish | | | 308 | | | | | | | | | ~ | |
| Sheepshead | Reef fish | 99,806 | 99,788 | 177,577 | 200,523 | 148,902 | 219,521 | 62,601 | 168,644 | 81,120 | 118,384 | 109,122 | n.s. | |
| Sheepshead porgy | Reef fish | | | 2,457 | | | | 247 | 938 | 2,229 | | 888 | ~ | |
| Short Bigeye | Reef fish | | | | | | | | | | 372 | | ~ | |
| Shrimp eel | Reef fish | | | | | | | | | | | 2,671 | ~ | |
| Silk snapper | Reef fish | | | | | | | | | | | 1,803 | ~ | |
| Silver porgy | Reef fish | 5,654 | 3,087 | 14,734 | 2,272 | 17,319 | 8,569 | 46,110 | 15,098 | 12,664 | 9,870 | 38,469 | n.s. | |

**Table 2 (cont). Southeast Florida recreational (MRFSS) estimated annual landings in pounds with decadal trend and p-value of significant trends**

| Common name | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 trend* | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Snowy grouper | Reef fish | | | | 87,327 | | 13,126 | | | 2,898 | 14,762 | | ~ | |
| Southern puffer | Reef fish | 1,256 | | | | | | 310 | | | 572 | 2,331 | ~ | |
| Spanish grunt | Reef fish | 5,747 | 3,134 | | | | | | | | | | ~ | |
| Spanish hogfish | Reef fish | | 6,268 | 3,983 | 685 | 545 | | 2,192 | | | | | ~ | |
| Speckled hind | Reef fish | | | | | | | | | 658 | 1,468 | | ~ | |
| Spinycheek scorpionfish | Reef fish | | | | | | | | | | 953 | | ~ | |
| Spotted burrfish | Reef fish | | | | | | | | | | | 3,878 | ~ | |
| Squirrelfish | Reef fish | | | 786 | | | | | 597 | 1,258 | | 482 | ~ | |
| Stoplight parrotfish | Reef fish | | | | 705 | 3,525 | 645 | | | | | | ~ | |
| Striped grunt | Reef fish | | | | 984 | | | 1,223 | 5,260 | | | | ~ | |
| Tilefish | Reef fish | | | | | 15,958 | | | 1,976 | 2,216 | 1,150 | 409 | ~ | |
| Tilefishes | Reef fish | | | | | | 1,258 | | | | | | ~ | |
| Tomtate | Reef fish | | | | | 107 | | 247 | 1,679 | | 742 | 1,718 | n.s. | |
| Trunkfish | Reef fish | | | 786 | 1,751 | | | | 1,488 | | 1,018 | 840 | ~ | |
| Unicorn filefish | Reef fish | | | | | | | | | | 3,033 | 1,258 | ~ | |
| Vermilion snapper | Reef fish | | 44,757 | 9,845 | 19,482 | | | | 853 | 17,751 | 35,873 | 8,694 | n.s. | |
| Warsaw grouper | Reef fish | | | 201 | | 9,596 | | | | 1,673 | 5,250 | | ~ | |
| White grunt | Reef fish | 1,962 | 27,052 | 301,413 | 134,443 | 134,695 | 50,546 | 111,865 | 95,592 | 120,021 | 84,977 | 46,341 | n.s. | |
| Whitebone porgy | Reef fish | 5,643 | | 786 | 2,243 | 4,413 | 1,598 | 252 | 13,876 | 2,290 | 217 | 1,132 | n.s. | |
| Yellow chub | Reef fish | | | 15,834 | 857 | 952 | 2,592 | 900 | 9,143 | 2,893 | | | n.s. | |
| Yellow jack | Reef fish | 130,154 | | 1,155 | 18,466 | 24,397 | 15,365 | 4,830 | 8,215 | 529 | 2,602 | 7,503 | **neg** | 0.043 |
| Yellowfin grouper | Reef fish | | | | | | | 4,830 | | | | | ~ | |
| Yellowtail snapper | Reef fish | 111,945 | 167,326 | 168,768 | 305,325 | 117,416 | 90,703 | 75,035 | 24,596 | 87,309 | 55,337 | 156,443 | n.s. | |
| TOTAL REEF FISH | | 2,297,552 | 3,159,520 | 3,310,881 | 3,026,524 | 3,965,763 | 3,779,543 | 3,866,024 | 3,503,348 | 2,639,426 | 3,368,689 | 3,023,131 | n.s. | |
| GRAND TOTAL | | 13,547,822 | 17,494,846 | 10,767,531 | 9,783,527 | 12,472,245 | 15,818,565 | 13,645,241 | 14,192,881 | 11,262,289 | 11,974,062 | 13,669,462 | n.s. | |

*1990-2000 Trends

**pos** increasing landings trend; trendline slope > 0 ($p<0.05$)

**neg** decreasing landings trend; trendline slope < 0 ($p<0.05$)

**n.s.** non-significant or non-existent landings trend; trendline slope = 0 ($p>0.05$)

~ insufficient annual data (5 or fewer reporting years) for trend analysis

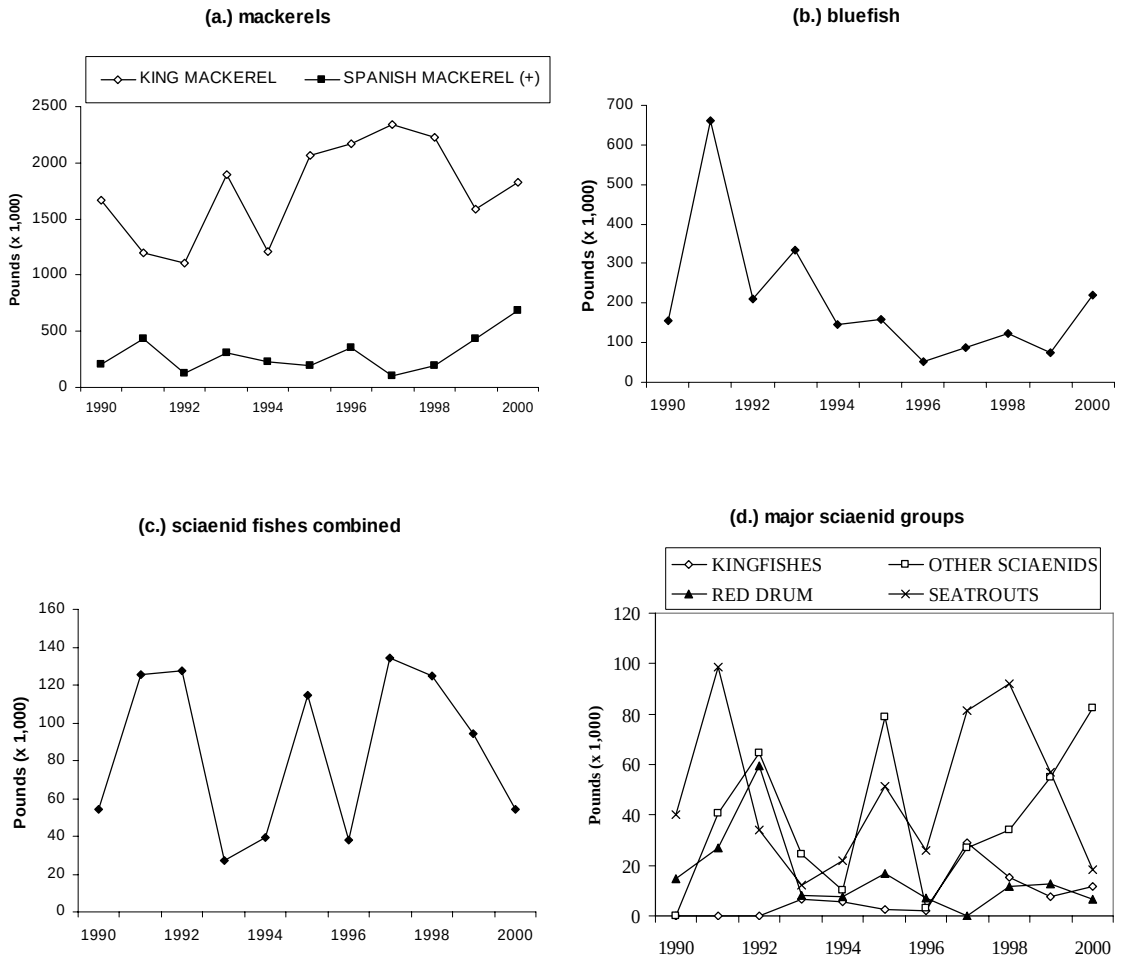
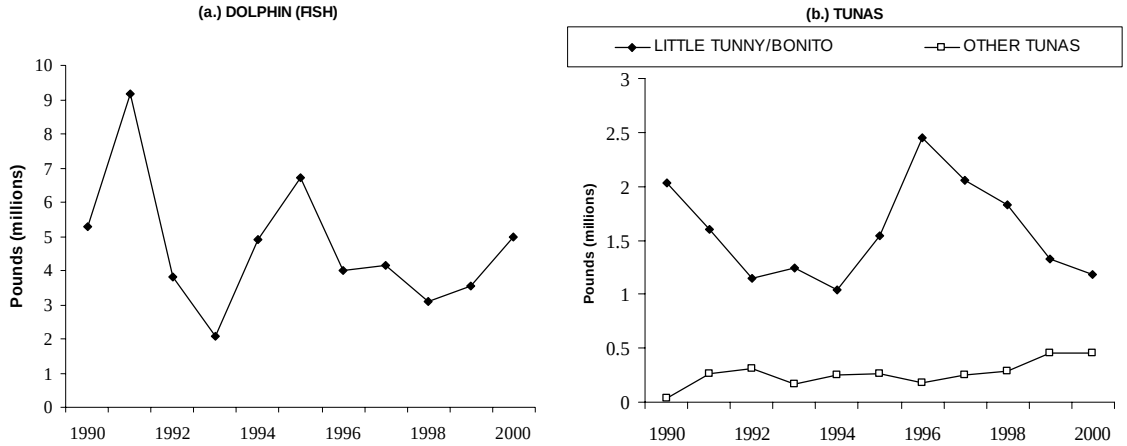



Figure 8. Recreational landings of major species/groups in coastal fishery for SEFCRI region 1990-2000. (a.) mackerels, (b.) bluefish, (c.) sciaenid fishes combined (d.) sciaenid fishes by species/groups: kingfishes, red drum, seatrouts, and other sciaenids. Dotted lines show significant ($p < 0.05$) linear trends.




**Fi**gure 9. Recreational landings of major offshore pelagic species for SEFCRI region 1990-2000. (a.) dolphin (fish), (b) tunas.

**FL Spiny Lobster Data**

For the two-day lobster sport season, landings, effort, and catch per unit effort varied without trend during the period for which data were available (1992-2003; Fig. 10a,b). Recreational landings for the first month of the regular season also varied without trend (Fig. 10c). Recreational effort for the first month of the regular season exhibited a non-significant ($p = 0.117$) declining trend over time (Fig. 10c), while catch per unit effort exhibited a marginally significant increasing trend ($p = 0.055$; Fig. 10d). Low values of landings and catch per unit effort for the recreational season in 1992 were likely related to impacts associated with Hurricane Andrew, which struck Miami-Dade County after the two-day sport season.

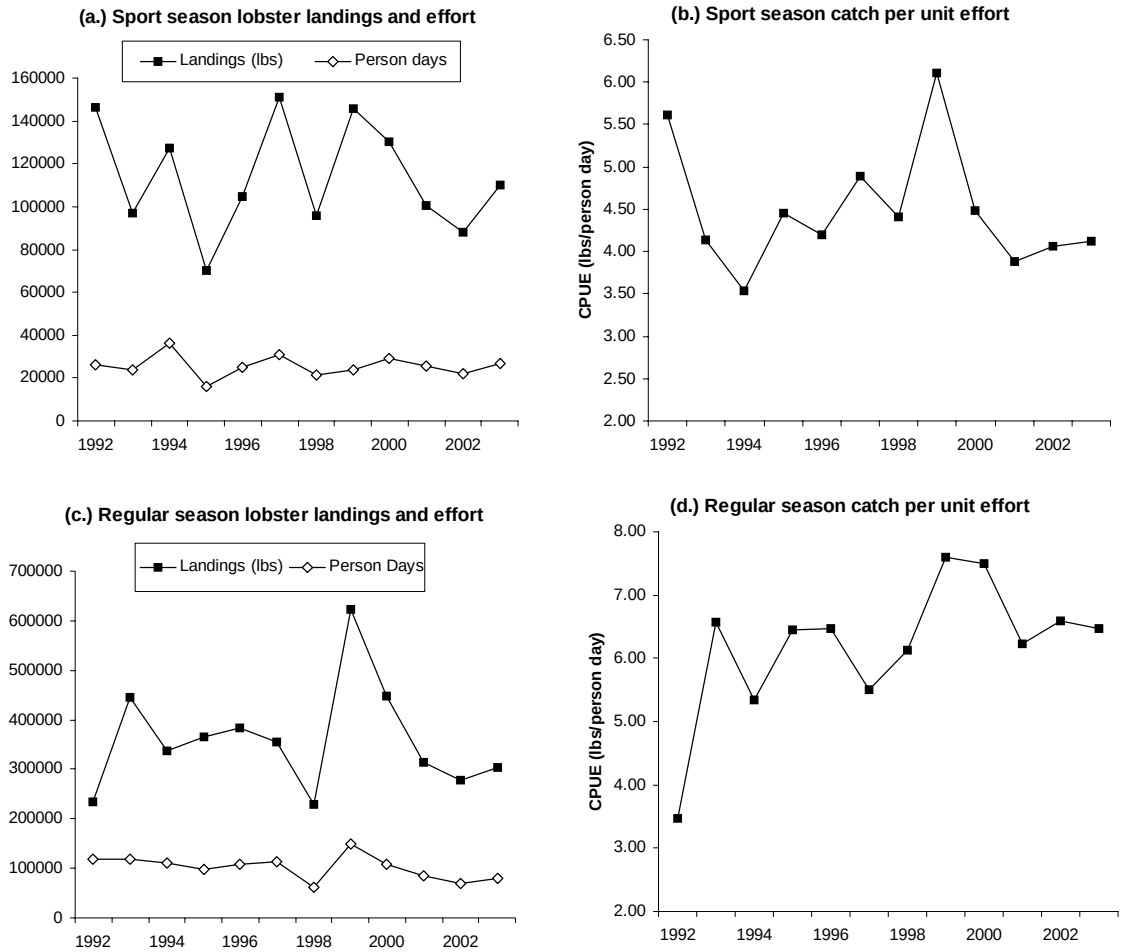



Figure 10. (a.) Recreational landings (lbs) and effort (person days) and (b.) catch per unit effort for the two-day sport season; (c.) recreational landings (lbs) and effort (person days) and (d.) catch per unit effort for the first month of the regular lobster season.

## <u>NMFS Headboat Survey Sector (1990-2000)</u>

Landings from the headboat fishery declined 48% from 1.02 million pounds in 1990 to 0.53 million pounds in 2000 ($p < 0.001$) (Table 3, Fig. 2a). This decline was correlated with a statistically significant ($p < 0.001$) 48% reduction in effort (angler days) from ~147,000 in 1990 to ~76,250 in 2000 (Fig. 11a). The reduction in effort was partially due to a decrease of ~ 20%

in registered headboat vessels during the study period (K. Brennan, pers. comm.). However, it is likely that a combination of actual reductions (e.g., due to vessels leaving the fishery and decreased participation by anglers) and apparent reductions (due to reductions in vessel reporting compliance) was responsible for the observed reduction in effort (K. Brennan and M. Burton, pers. comm.). Declining trends in landings were relatively consistent in magnitude and significant for reef fish ($p = 0.001$), coastal ($p < 0.007$), and offshore pelagic ($p = 0.023$) (Fig. 11b). However, overall catch-per-unit-effort (CPUE; pounds/angler day) for headboats remained relatively constant throughout the decade (Fig. 11c), suggesting that the cause for landings declines is due to reduced (actual or apparent) headboat fishing effort.

During the period from 1990-2000, the reef fishery component was 38% of the total headboat landings, followed by the offshore pelagic fishery (32%), and the coastal fishery component (30%).

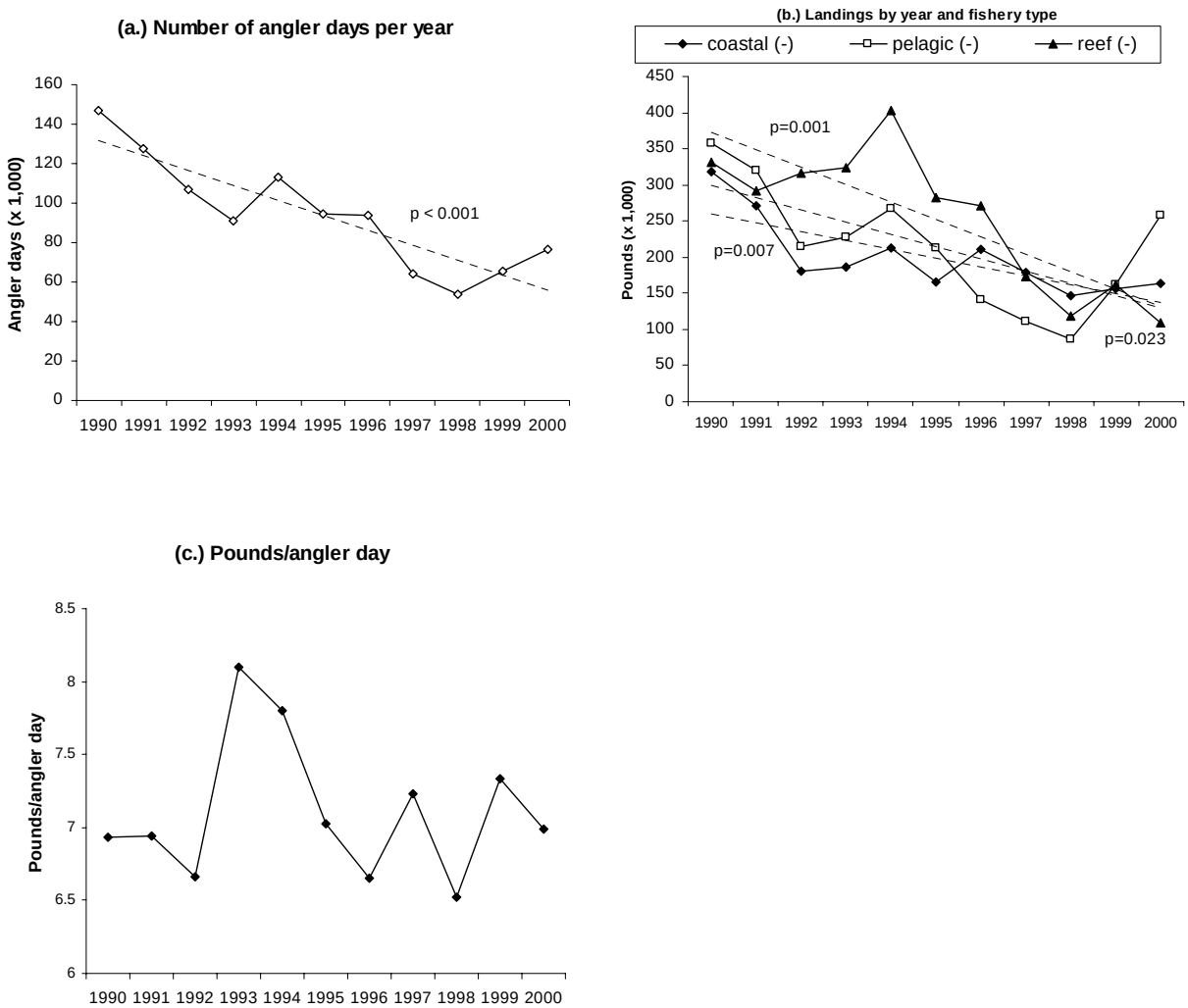



Figure 11. Headboat effort in SEFCRI region 1990-2000 (a). Number of angler days per year for headboat fishery (b.) headboat landings (in pounds) by year and fishery type (c.) Pounds/angler day. Dotted lines show significant ($p < 0.05$) linear trends.

**Table 3. Annual Southeast Florida estimated headboat landings in pounds (Miami to Ft.Pierce) with decadal trend and p-value of significant trends.**

| Species | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 Trend* | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barbfish | Coastal | | | | 30 | | | | | | | | ~ | |
| Bigeye scad | Coastal | | 30 | 6 | | | | | | | | | ~ | |
| Bluefish | Coastal | 4,422 | 1,647 | 28,090 | 4,034 | 13,595 | 7,132 | 3,057 | 402 | 921 | 8,650 | 978 | n.s. | |
| Butterfish | Coastal | | 12 | | | | | | | | | | ~ | |
| Chub mackerel | Coastal | 1 | 2 | 2 | | 8 | | | 65 | | | | ~ | |
| Flying gurnard | Coastal | 6 | 8 | 6 | | 161 | | | 2 | | | | ~ | |
| Gafftopsail catfish | Coastal | | 92 | 55 | | | 153 | | | 69 | | | ~ | |
| Inshore lizardfish | Coastal | | | 32 | 3 | 75 | 3 | | 16 | 15 | | | n.s. | |
| King mackerel | Coastal | 311,250 | 267,749 | 150,633 | 180,402 | 193,486 | 155,851 | 207,142 | 177,015 | 144,029 | 144,126 | 162,293 | **neg** | 0.016 |
| Kingfishes, uncl. | Coastal | | | 2 | | | | | 4 | | | | ~ | |
| Ladyfish | Coastal | 4 | 20 | | 104 | 37 | | | 25 | | | | ~ | |
| Leatherjacket | Coastal | 329 | 244 | 157 | 80 | 69 | 20 | | 22 | | | | **neg** | 0.003 |
| Lefteye flounders | Coastal | 36 | 76 | 72 | 3 | | 40 | | 6 | 7 | | | n.s. | |
| Lookdown | Coastal | | | | | | | | | | 4 | | ~ | |
| Mackerel scad | Coastal | 55 | | 22 | 92 | 39 | 22 | 65 | | 8 | | | n.s. | |
| Northern sennet | Coastal | | 4 | | 44 | 48 | 27 | 6 | | | | | ~ | |
| Offshore lizardfish | Coastal | | 2 | | 1 | | | | 65 | | | | ~ | |
| Peacock flounder | Coastal | | | 3 | | | | | | | | | ~ | |
| Pearly razorfish | Coastal | | | | | 1 | 6 | | | | | | ~ | |
| Permit | Coastal | | | | | 36 | 27 | | | | | | ~ | |
| Red drum | Coastal | | 35 | | | | | | | | | | ~ | |
| Remora | Coastal | 105 | 71 | 180 | 72 | 338 | 83 | 114 | | | | | n.s. | |
| Sand perch | Coastal | 10 | 17 | 78 | 36 | 88 | 138 | 154 | 36 | 32 | 3 | 9 | n.s. | |
| Scup | Coastal | | | 1 | | | | | | | | | ~ | |
| Silver seatrout | Coastal | | | | | | 17 | | | | | | ~ | |
| Snook, unidentified | Coastal | | 217 | 22 | 82 | 125 | 63 | | 213 | | | | n.s. | |
| Southern hake | Coastal | | | | | | | | 12 | | | | ~ | |
| Southern sennet | Coastal | | | 51 | 56 | | 1 | | 28 | 40 | | | ~ | |
| Spanish mackerel | Coastal | 999 | 1,257 | 1,168 | 735 | 3,941 | 1,869 | 532 | 1,361 | 814 | 2,938 | 992 | n.s. | |
| Spot | Coastal | 57 | 13 | 59 | 6 | | | | | | | | ~ | |
| Spottail pinfish | Coastal | 5 | 274 | 55 | 3 | 20 | 74 | 5 | 3 | 86 | | 43 | n.s. | |
| Stingray family | Coastal | | | | 19 | 137 | | | | | | | ~ | |
| Summer flounder | Coastal | | | 3 | | | | | | | | | ~ | |
| Tripletail | Coastal | | | 10 | | 9 | | 10 | | | | | ~ | |
| Unicornfish | Coastal | | | 13 | 8 | 23 | | | 21 | | | | ~ | |
| Weakfishes | Coastal | | 4 | | | | | | 9 | | | | ~ | |

**Table 3 (cont). Annual Southeast Florida estimated headboat landings in pounds (Miami to Ft.Pierce) with decadal trend and p-value of significant trends.**

| Species | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 Trend* | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL COASTAL | | 317,279 | 271,774 | 180,720 | 185,810 | 212,236 | 165,526 | 211,085 | 179,305 | 146,021 | 155,721 | 164,315 | **neg** | 0.007 |
| | | | | | | | | | | | | | | |
| Atlantic bonito | Pelagic | 11 | | 30 | 45 | 6 | | 4 | | 5 | | | n.s. | |
| Atlantic sharpnose shar | Pelagic | 666 | 357 | 718 | 7 | 8,086 | 9,409 | | 1,071 | 207 | | | n.s. | |
| Blackfin tuna | Pelagic | 5,757 | 7,626 | 7,468 | 1,813 | 3,087 | 3,555 | 4,665 | 2,101 | 826 | 3,144 | 7,822 | n.s. | |
| Blacknose shark | Pelagic | | 90 | | | | | | | | | | ~ | |
| Blacktip shark | Pelagic | 1,261 | 742 | 386 | 612 | 202 | 419 | 108 | 416 | 78 | 260 | | **neg** | 0.010 |
| Bluefin tuna | Pelagic | 28 | | | | | | | | | | | ~ | |
| Bonnethead | Pelagic | | | 18 | | 30 | | | | | | | ~ | |
| Bull shark | Pelagic | 714 | 250 | | 131 | | 199 | | | | | 254 | ~ | |
| Cobia | Pelagic | 18,490 | 16,438 | 13,297 | 18,063 | 16,393 | 10,885 | 11,904 | 3,747 | 6,137 | 5,075 | 7,116 | **neg** | <0.001 |
| Dolphinfish | Pelagic | 46,064 | 36,809 | 17,337 | 12,255 | 9,810 | 25,754 | 34,383 | 14,266 | 6,596 | 28,276 | 51,971 | n.s. | |
| Dusky shark | Pelagic | 362 | | | 35 | | | | 19 | 132 | | | ~ | |
| Frigate mackerel | Pelagic | | 30 | 2 | 4 | 39 | | | | | | | ~ | |
| Great hammerhead | Pelagic | | | 33 | | | | | | 72 | | | ~ | |
| Houndfish | Pelagic | | 18 | 78 | | 1 | 4 | 81 | | 4 | | | ~ | |
| Lemon shark | Pelagic | 117 | | | | 77 | | | 134 | | | | ~ | |
| Little tunny | Pelagic | 269,735 | 250,704 | 168,710 | 191,302 | 220,706 | 151,665 | 81,889 | 82,776 | 71,038 | 119,602 | 176,978 | **neg** | 0.012 |
| Mako shark,uncl. | Pelagic | | | | | | | | 142 | | | | ~ | |
| Nurse shark | Pelagic | 4,551 | | 531 | 346 | 1,412 | 4,279 | | 5,092 | 431 | | 9,784 | n.s. | |
| Reef shark | Pelagic | | | | 55 | 298 | 30 | | | | | | ~ | |
| Sailfish | Pelagic | 8,517 | 4,890 | 4,063 | 1,347 | 5,072 | 3,997 | 5,686 | 940 | 1,118 | 2,570 | | **neg** | 0.046 |
| Sandbar shark | Pelagic | | 120 | 25 | | | 9 | | | | | | ~ | |
| Shark, uncl. | Pelagic | 325 | 1,996 | 1,062 | 426 | 804 | | | 178 | | | | n.s. | |
| Silky shark | Pelagic | 64 | | 420 | 110 | | | 116 | 52 | | 102 | | n.s. | |
| Skipjack tuna | Pelagic | 15 | 17 | | 135 | 11 | 103 | 263 | | | | | n.s. | |
| Spinner shark | Pelagic | | | | 220 | | | | | 22 | | | ~ | |
| Wahoo | Pelagic | 1,904 | 646 | 1,697 | 947 | 1,760 | 3,039 | 1,502 | 1,107 | 1,021 | 2,625 | 1,732 | n.s. | |
| Yellowfin tuna | Pelagic | 108 | 103 | | 29 | | | 148 | | | | | ~ | |
| TOTAL PELAGIC | | 358,689 | 320,836 | 215,875 | 227,882 | 267,794 | 213,347 | 140,749 | 112,041 | 87,687 | 161,654 | 255,657 | **neg** | 0.023 |
| | | | | | | | | | | | | | | |
| African pompano | Reef Fish | 2,560 | 1,920 | 3,374 | 4,519 | 3,903 | 1,628 | 1,796 | 1,824 | 143 | 61 | 833 | **neg** | 0.018 |
| Almaco jack | Reef Fish | 392 | 3,590 | 5,227 | 779 | 1,995 | 3,520 | 2,007 | 1,597 | 1,125 | 3,957 | 3,296 | n.s. | |
| Atlantic spadefish | Reef Fish | 88 | 28 | 27 | | | 124 | | | | | | ~ | |
| Banded rudderfish | Reef Fish | 59 | 79 | 1,733 | 2,799 | 5,205 | 1,314 | 1,097 | 5,478 | 903 | 8,653 | 955 | n.s. | |
| Bank sea bass | Reef Fish | 5 | 5 | | | | 2 | 5 | 6 | 6 | | | n.s. | |

**Table 3 (cont). Annual Southeast Florida estimated headboat landings in pounds (Miami to Ft.Pierce) with decadal trend and p-value of significant trends.**

| Species | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 Trend* | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bar jack | Reef Fish | 240 | 195 | 2,132 | 2,723 | 1,473 | 173 | 117 | 404 | 1,023 | 124 | 11 | n.s. | |
| Bermuda chub | Reef Fish | 11 | 8 | 29 | 44 | 31 | 18 | | 19 | | | | n.s. | |
| Bigeye | Reef Fish | 2,608 | 2,082 | 1,196 | 1,606 | 4,977 | 5,074 | 2,879 | 2,810 | 2,702 | 3,455 | 542 | n.s. | |
| Black durgon | Reef Fish | 10 | 2 | | | | | | | | | | ~ | |
| Black grouper | Reef Fish | 569 | 643 | 1,155 | 1,959 | 1,549 | 1,112 | 2,678 | 1,113 | 1,438 | 1,438 | 2,155 | n.s. (pos) | 0.085 |
| Black jack | Reef Fish | | | 4 | | | | | | | | | ~ | |
| Black margate | Reef Fish | 246 | 104 | 598 | 241 | 912 | 841 | 374 | 285 | 168 | 1,022 | 137 | n.s. | |
| Black sea bass | Reef Fish | 6,036 | 2,588 | 2,169 | 1,901 | 1,239 | 2,301 | 14 | 911 | 1,447 | 185 | 2,178 | **neg** | 0.034 |
| Blackfin snapper | Reef Fish | 448 | 662 | 54 | 402 | 89 | 328 | 187 | 43 | 11 | 40 | | **neg** | 0.020 |
| Blue hamlet | Reef Fish | | 1 | | | | | | | | | | ~ | |
| Blue runner | Reef Fish | 25,350 | 34,361 | 38,587 | 51,034 | 50,084 | 37,381 | 12,506 | 27,151 | 7,985 | 12,153 | 6,273 | **neg** | 0.024 |
| Blue tang | Reef Fish | 8 | | | | | | | | | | | ~ | |
| Bluehead | Reef Fish | | | | 1 | | | | | | | | ~ | |
| Blueline tilefish | Reef Fish | 72 | 189 | 2,456 | 230 | 100 | 571 | 11,573 | 103 | 51 | 15 | | n.s. | |
| Bluespotted cornetfish | Reef Fish | | | | | | 6 | | | | | | ~ | |
| Bluestriped grunt | Reef Fish | 538 | 629 | 3,135 | 3,808 | 2,863 | 1,841 | 696 | 1,606 | 4,009 | 3,712 | 244 | n.s. | |
| Burro grunt | Reef Fish | | | 79 | | | | | | | | | ~ | |
| Caesar grunt | Reef Fish | | | 17 | | | 7 | | | | | | ~ | |
| Cero | Reef Fish | 650 | 810 | 585 | 1,049 | 885 | 550 | 1,553 | 751 | 331 | 392 | 80 | n.s. | |
| Coney | Reef Fish | 70 | 317 | 566 | 378 | 147 | 52 | 366 | 226 | 153 | 16 | | n.s. | |
| Cottonwick | Reef Fish | | | 570 | 40 | 72 | 374 | 191 | 44 | 32 | 1 | | n.s. | |
| Crevalle jack | Reef Fish | 35 | 131 | 258 | 435 | 68 | 330 | 833 | 275 | 395 | 9 | 23 | n.s. | |
| Cubera snapper | Reef Fish | 181 | | 54 | | 322 | 740 | 13 | 4 | 44 | | | n.s. | |
| Doctorfish | Reef Fish | 584 | 320 | 767 | 567 | 864 | 2,156 | 319 | 294 | 469 | 196 | 344 | n.s. | |
| Dog snapper | Reef Fish | 5 | 453 | 391 | 146 | 293 | 250 | | 89 | 273 | 28 | | n.s. | |
| French grunt | Reef Fish | 316 | 874 | 2,624 | | 1,653 | 1,212 | 850 | 432 | 922 | 958 | 77 | n.s. | |
| Gag | Reef Fish | 3,060 | 2,062 | 4,078 | 11,856 | 6,756 | 11,959 | 3,865 | 2,105 | 2,219 | 4,905 | 5,592 | n.s. | |
| Goldface tilefish | Reef Fish | 19 | 3 | 94 | | | 6 | 11 | 15 | | | | n.s. | |
| Goliath grouper | Reef Fish | | | | 1 | | | | | | | | ~ | |
| Grass porgy | Reef Fish | | | | | | | 16 | 3 | | | | ~ | |
| Gray snapper | Reef Fish | 5,634 | 8,194 | 32,312 | 13,640 | 24,889 | 26,765 | 98,595 | 15,490 | 12,717 | 25,868 | 16,309 | n.s. | |
| Gray triggerfish | Reef Fish | 46,749 | 37,625 | 19,158 | 11,667 | 12,642 | 9,057 | 8,101 | 4,043 | 5,548 | 2,119 | 6,338 | **neg** | 0.001 |
| Graysby | Reef Fish | 198 | 259 | 648 | 474 | 514 | 371 | 1,090 | 714 | 118 | 32 | | n.s. | |
| Great barracuda | Reef Fish | 5,718 | 8,620 | 10,583 | 11,519 | 32,318 | 10,169 | 19,054 | 6,194 | 3,823 | 2,354 | 3,740 | n.s. | |
| Greater amberjack | Reef Fish | 8,083 | 6,708 | 11,747 | 13,128 | 7,774 | 4,747 | 4,874 | 1,478 | 3,025 | 4,239 | 626 | **neg** | 0.007 |
| Green moray | Reef Fish | | | | | 45 | | | | | | | ~ | |

**Table 3 (cont). Annual Southeast Florida estimated headboat landings in pounds (Miami to Ft.Pierce) with decadal trend and p-value of significant trends.**

| Species | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 Trend* | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Harlequin bass | Reef Fish | | 16 | | | | | | | | | | ~ | |
| Hogfish | Reef Fish | 56 | 269 | 495 | 190 | 159 | 1,237 | 355 | 166 | 300 | 5 | 14 | n.s. | |
| Horse-eye jack | Reef Fish | 30 | 68 | 72 | 73 | 787 | 266 | 300 | 19 | 12 | 30 | | n.s. | |
| Jacks, uncl. | Reef Fish | 7,331 | 1,767 | 108 | | | | | | | | | ~ | |
| Jolthead porgy | Reef Fish | 1,249 | 1,805 | 1,479 | 2,460 | 1,592 | 1,906 | 964 | 1,284 | 1,568 | 94 | 153 | **neg** | 0.034 |
| Knobbed porgy | Reef Fish | 1,769 | 2,672 | 1,093 | 226 | 1,065 | 849 | 945 | 292 | 96 | 9 | 29 | **neg** | 0.003 |
| Lane snapper | Reef Fish | 9,838 | 16,224 | 10,713 | 11,564 | 25,467 | 11,982 | 8,003 | 9,662 | 6,866 | 4,142 | 3,610 | n.s (neg) | 0.074 |
| Lantern bass | Reef Fish | | | | 1 | | | | | | | | ~ | |
| Lesser amberjack | Reef Fish | | 2 | 307 | | 8 | | | | | | | ~ | |
| Littlehead porgy | Reef Fish | 150 | 32 | 944 | 53 | 560 | 1,800 | 315 | 126 | 162 | 6 | | n.s. | |
| Longspine porgy | Reef Fish | 3 | 21 | | 1 | 1 | | | 1 | | | | ~ | |
| Mahogany snapper | Reef Fish | 6 | 24 | 8 | 12 | 5 | 33 | 124 | 76 | | 1,188 | | **pos** | 0.044 |
| Margate | Reef Fish | 936 | 256 | 831 | 964 | 851 | 1,250 | 264 | 346 | 208 | 274 | 146 | n.s (neg) | 0.060 |
| Misty grouper | Reef Fish | | | | 6 | | | 4 | | 8 | | | ~ | |
| Mutton snapper | Reef Fish | 54,753 | 38,600 | 22,412 | 49,929 | 47,391 | 25,572 | 10,819 | 13,150 | 9,933 | 13,632 | 7,662 | **neg** | 0.002 |
| Nassau grouper | Reef Fish | 4,124 | 7 | | 12 | | | | | | | | ~ | |
| Northern puffer | Reef Fish | | 13 | | | | | | | | | | ~ | |
| Ocean triggerfish | Reef Fish | 4,198 | 3,699 | 694 | 1,888 | 864 | 1,915 | 398 | 803 | 107 | | 160 | **neg** | 0.005 |
| Ocellated moray | Reef Fish | | | | | 24 | | | | | | | ~ | |
| Parrotfishes | Reef Fish | 34 | 6 | 27 | 31 | 10 | 6 | 10 | 9 | | | | n.s. | |
| Pigfish | Reef fish | 769 | 2,026 | 2,656 | 1,156 | 217 | 764 | 2 | 76 | 22 | | 34 | **neg** | 0.022 |
| Porkfish | Reef Fish | 405 | 328 | 460 | 353 | 376 | 570 | 79 | 211 | 81 | 381 | 116 | n.s (neg) | 0.081 |
| Puffers | Reef Fish | 3 | 1 | 3 | 2 | | | 175 | 1 | | | | n.s. | |
| Queen triggerfish | Reef Fish | 1,545 | 1,331 | 1,478 | 1,304 | 1,511 | 831 | 1,039 | 1,228 | 448 | 191 | 503 | **neg** | 0.001 |
| Rainbow runner | Reef Fish | 652 | 1,449 | 3,315 | 1,752 | 2,667 | 1,145 | 780 | 4,378 | 982 | 684 | 473 | n.s. | |
| Red grouper | Reef Fish | 2,238 | 3,070 | 6,295 | 5,552 | 6,401 | 5,631 | 2,547 | 1,779 | 5,875 | 2,968 | 4,012 | n.s. | |
| Red hind | Reef Fish | 115 | 74 | 134 | 149 | 129 | 115 | 58 | 49 | 54 | 3 | 2 | **neg** | 0.004 |
| Red porgy | Reef Fish | 3,059 | 3,133 | 1,192 | 1,904 | 1,059 | 1,283 | 592 | 459 | 779 | 447 | 131 | **neg** | <0.001 |
| Red snapper | Reef Fish | 305 | 68 | 684 | 809 | 5,168 | 1,093 | 23 | 1,866 | 131 | 2,149 | 487 | n.s. | |
| Rock hind | Reef Fish | 623 | 557 | 1,050 | 953 | 402 | 698 | 412 | 443 | 563 | 1,123 | 62 | **neg** | <0.001 |
| Rough triggerfish | Reef Fish | | | | 15 | | | | 2 | | | | ~ | |
| Sailor's choice | Reef Fish | | | | | | 49 | 52 | 39 | | | | ~ | |
| Sand tilefish | Reef Fish | 1,799 | 1,959 | 1,350 | 1,087 | 1,737 | 3,754 | 1,616 | 1,430 | 746 | 377 | 720 | n.s. | |
| Saucereye porgy | Reef Fish | | 807 | 801 | 599 | 232 | 364 | 309 | 221 | 2 | | 5 | **neg** | <0.001 |
| Scamp | Reef Fish | 154 | 283 | 241 | 188 | 639 | 607 | 212 | 169 | 179 | 326 | 413 | n.s. | |
| Schoolmaster | Reef Fish | 618 | 174 | 836 | 500 | 657 | 218 | 67 | 145 | 57 | 603 | 21 | n.s. | |

**Table 3 (cont). Annual Southeast Florida estimated headboat landings in pounds (Miami to Ft.Pierce) with decadal trend and p-value of significant trends.**

| Species | Type | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 1990-2000 Trend* | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scrawled filefish | Reef Fish | | | 28 | 37 | 13 | 23 | 140 | 137 | | | | n.s. | |
| Scorpionfishes | Reef Fish | 18 | | 47 | 49 | 3 | 135 | | | 10 | | | n.s. | |
| Scrawled cowfish | Reef Fish | | | | | | | 224 | 70 | | | | ~ | |
| Sheepshead | Reef Fish | 17 | 5 | 33 | | | | | | | | | ~ | |
| Sheepshead porgy | Reef Fish | 95 | 101 | 338 | 58 | 447 | 368 | 358 | 58 | 133 | 24 | | n.s. | |
| Short Bigeye | Reef Fish | 2 | 7 | 9 | | | 19 | 12 | | | | | ~ | |
| Silk snapper | Reef Fish | 1,200 | 407 | 2,068 | 1,325 | 1,479 | 3,076 | 562 | 194 | 296 | 651 | 1,226 | n.s. | |
| Smooth puffer | Reef Fish | | | | | 6 | | | | | | | ~ | |
| Snowy grouper | Reef Fish | 717 | 843 | 131 | 230 | 109 | 174 | 730 | 595 | 483 | 343 | 417 | n.s. | |
| Spanish hogfish | Reef Fish | 2 | 5 | 1 | | 2 | | | | | | | ~ | |
| Speckled hind | Reef Fish | 24 | 65 | 34 | 18 | 9 | 11 | 100 | 9 | 26 | 48 | 18 | n.s. | |
| Spotted goatfish | Reef Fish | | | 2 | 5 | | | | | | | | ~ | |
| Spotted moray | Reef Fish | | | | | | | | | 176 | | | ~ | |
| Spotted soapfish | Reef Fish | | | | 10 | | | | | | | | ~ | |
| Squirrelfish | Reef Fish | 717 | 1,088 | 1,375 | 1,585 | 4,643 | 2,758 | 2,494 | 1,581 | 762 | 2,822 | 766 | n.s. | |
| Stoplight parrotfish | Reef Fish | | | | | 4 | | | | | | | ~ | |
| Tomtate | Reef Fish | 12,779 | 14,633 | 14,524 | 17,953 | 17,184 | 14,682 | 1,703 | 5,051 | 1,408 | 5,370 | 7,266 | **neg** | 0.015 |
| Trunkfish | Reef Fish | | | | | | | 27 | | 96 | | | ~ | |
| Vermilion snapper | Reef Fish | 57,672 | 18,916 | 18,825 | 13,633 | 17,608 | 16,544 | 25,503 | 6,179 | 5,842 | 6,144 | 12,811 | **neg** | 0.025 |
| Warsaw grouper | Reef Fish | 12 | | 33 | 173 | 96 | 362 | 903 | 30 | 316 | | 71 | n.s. | |
| White grunt | Reef Fish | 6,580 | 6,274 | 11,600 | 7,049 | 10,176 | 8,685 | 4,489 | 7,149 | 7,161 | 10,931 | 3,715 | n.s. | |
| Whitebone porgy | Reef Fish | 2,510 | 8,365 | 5,347 | 8,185 | 3,060 | 3,313 | 2,471 | 2,070 | 333 | 1,283 | 1,777 | **neg** | 0.022 |
| Yellow jack | Reef Fish | 37 | 61 | 73 | 92 | 161 | 105 | 79 | 206 | 14 | 340 | | n.s. | |
| Yellowedge grouper | Reef Fish | 41 | 4 | 31 | 15 | 140 | 183 | 164 | 14 | 67 | | 163 | n.s. | |
| Yellowfin grouper | Reef Fish | 36 | | 67 | 22 | 91 | 119 | 16 | 57 | | | | n.s. | |
| Yellowmouth grouper | Reef Fish | | 18 | | | | 59 | | 9 | 78 | | | ~ | |
| Yellowtail snapper | Reef Fish | 52,661 | 49,299 | 55,413 | 52,205 | 84,503 | 43,434 | 25,804 | 36,500 | 20,677 | 28,688 | 12,627 | **neg** | 0.013 |
| TOTAL REEF FISH | | 342,424 | 294,294 | 316,064 | 323,323 | 403,375 | 282,967 | 271,903 | 173,846 | 118,137 | 161,208 | 109,363 | **neg** | 0.001 |
| GRAND TOTAL | | 1,018,392 | 886,904 | 712,659 | 737,015 | 883,405 | 661,840 | 623,737 | 465,192 | 351,845 | 478,583 | 529,335 | **neg** | <0.001 |

*1990-2000 Trends

**pos** increasing landings trend; trendline slope > 0 ($p<0.05$)
**neg** decreasing landings trend; trendline slope < 0 ($p<0.05$)
**n.s.** non-significant or non-existent landings trend; trendline slope = 0 ($p>0.05$)
~ insufficient annual data (5 or fewer reporting years) for trend analysis

*Reef fish species*

There was a marginally significant (p = 0.062) increasing trend in CPUE (pounds/angler day) of reef fish from 1990-1993, followed by a statistically significant (p = 0.002) decreasing trend from 1994-2000 (Fig. 12). Because the data for Fig. 12 were calculated using total headboat trips (and not reef-specific trips, which could not be derived), it is unclear whether the recent decreasing trend in CPUE represents a true decline in CPUE for headboats fishing for reef species (which would indicate a decline in reef fishery resources), or a change of headboat effort from reef species to coastal migratory or offshore pelagic species, which could also indicate a decline in reef fishery resources[5].

The most important reef fish species landed in the headboat fishery during the study period were yellowtail snapper (17%), blue runner (11%), mutton snapper (11%), gray snapper (10%), vermillion snapper (7%), and gray triggerfish (6%). Except for gray snapper, landings declined significantly ($p < 0.05$) for these important headboat fishes (Fig. 13a-e). Gray snapper annual landings fluctuated without trend averaging 25.5 thousand pounds from 1990 through 2000. Extensive changes in regulations occurred since 1985 for reef fish species targeted by headboats, including the establishment of size and bag limits for snappers (red, mutton, vermillion, cubera, and yellowtail), groupers (yellowfin, black, gag, red, Nassau, and goliath), red porgy, hogfish, gray triggerfish, and amberjack (Table 4).

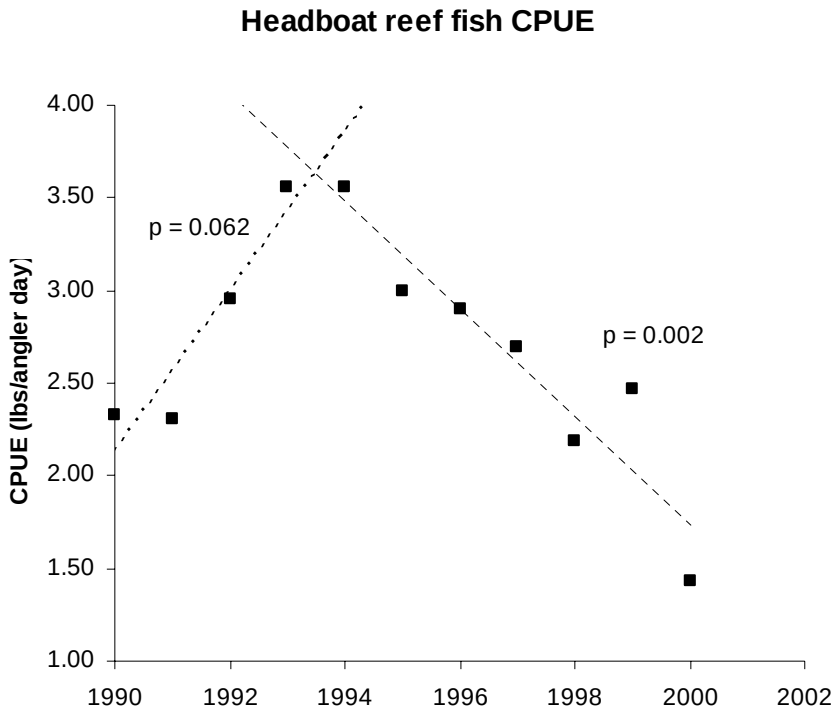



Figure 12. Catch per unit effort (lbs / angler day) for reef fish landed in the headboat fishery. Angler days are for all headboat trips combined, as reef trips could not be differentiated from other trips in the effort data.

[5] Note: a shift of effort from the reef environment to other environments would be likely to occur if reef fish CPUE declined.

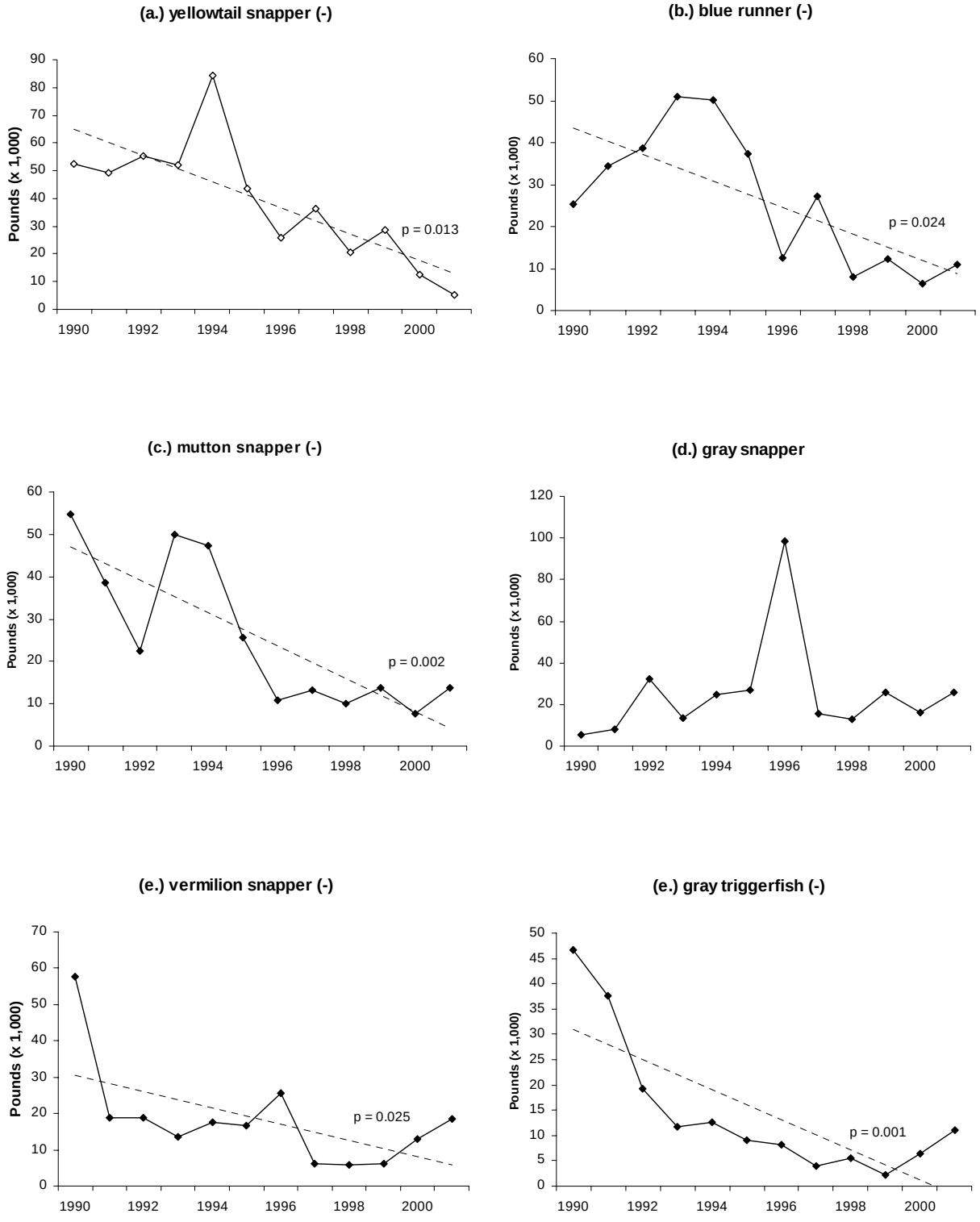



Figure 13. Landings of major reef fish species in the recreational headboat fishery in the SEFCRI region, 1990-2000. (a.) yellowtail snapper, (b.) blue runner, (c.) mutton snapper, (d.) gray snapper, (e.) vermilion snapper, (f.) gray triggerfish. Dotted lines show significant ($p < 0.05$) linear trends.

**Table 4. Summary of major Florida regulations impacting southeast Florida marine fisheries and landings; 1990-2004.**
**(State of Florida - Marine Fisheries Commission - regulations applicable to state territorial waters)**

| SPECIES/GEAR | EFFECTIVE DATE | RULES AND REGULATIONS DESCRIPTION |
|---|---|---|
| Bluefish | 7/1/1993 | designated as a "restricted species"<br>10 fish daily bag limit for recreational fishermen established<br>minimum size limit increased 12 inches fork length<br>commercial harvesters required to adhere to statewide gear requirements<br>7,500 pound daily commercial vessel limit north of the Dade/Monroe county line<br>required to be landed in a whole condition |
| | 10/4/1995 | annual commercial quota established = 877,000 pounds on the Florida east coast. |
| | 8/31/1998 | sale of undersize bluefish prohibited. |
| Cobia | 1/1/1990 | minimum size limit: 33 inches fork length<br>bag limit: 2 per person daily for all fishermen, commercial and recreational |
| Dolphin | 1/1/1991 | recreational daily bag limit: 10<br>commercial size limit: 20 inches fork length<br>allowed gear: Hook and line, longline |
| Flounder | 1/1/1996 | 12 inch minimum size limit for all harvester<br>10 fish daily recreational bag limit |
| Sheephead | 1/1/1996 | 12 inch minimum size limit for all harvester<br>10 fish daily recreational bag limit |
| | 1/1/1997 | daily recreational bag limit increased to 15 fish per person and commercial spearfishing allowed. |
| Nets | 3/20/1991 | use of gill nets in state waters with mesh size greater than 6 inches prohibited. |
| | 7/4/1991 | use of any gill or trammel net with a total length greater than 600 yards prohibited in all waters of Brevard Indian River, St. Lucie, Martin, and Palm Beach counties |
| | 7/1/1995 | use of gill nets or other entangling nets prohibited for the purpose of catching or taking any saltwater finfish, shellfish or other marine animals in Florida waters (Florida constitution Article X, Section 16 - Limiting marine net fishing). |
| King mackerel | 11/1/1988 | designated as a "restricted species" |
| | 11/29/1993 | daily vessel limit of 50 fish established until half the regional subquota is reached, and then 25 fish until the full regional subquota is reached, from Volusia County to Dade County |
| | 11/29/1993 | minimum size limit of 20 inches fork length established for all harvest of king mackerel |
| | 1/1/1997 | 750 pounds commercial trip limit established on Florida's east coast unless 75% of the subquota is reached by February 15 |
| | 1/1/1998 | daily 50 fish per vessel trip limit established for Atlantic group commercial king mackerel fishermen in state waters from Brevard through Dade counties from April 1 through October 31 each year. |
| | 1/1/2000 | minimum size limit increased to 24 inches fork length |
| Red Drum | 1/1/1989 | Established 18 inches minimum and 27 inches maximum size limits for redfish harvested in state waters<br>Established daily bag limit - 1 redfish per person and an off-the-water possession limit of 2 fish per person<br>Sale of native redfish prohibited.<br>Red drum closed to harvest and possesion prohibited during months of March, April, and May |
| Reef Fish | 7/29/1985 | minimum size limits- red, mutton, yellowtail snappers - 12 inches<br>yellowfin, black, gag, red, Nassau groupers and jewfish - 18 inches<br>black and southern sea bass - 8 inches |
| | 12/11/1986 | snapper bag limit: 10 per recreational fisherman daily for any combination of snapper, excluding lane, vermillion, and yelloweye<br>grouper bag limit: 5 per recreational fisherman daily for any combination of groupers, excluding rock hind and red hind |

**Table 4 (cont). Summary of major Florida regulations impacting southeast Florida marine fisheries and landings; 1990-2004.**
**(State of Florida - Marine Fisheries Commission - regulations applicable to state territorial waters)**

| SPECIES/GEAR | EFFECTIVE DATE | RULES AND REGULATIONS DESCRIPTION |
|---|---|---|
| Reef Fish (cont.) | 2/1/1990 | Prohibits all harvest, possession, and sale of jewfish from Florida waters |
| | | minimum size limits - red snapper - 13 inches |
| | | mutton, blackfin, cubera, dog, mahogany, silk, yellowtail snapper - 12 inches |
| | | gray and schoolmaster snapper - 10 inches |
| | | lane and vermillion snapper - 8 inches |
| | | yellowfin, black, gag, red, yellowmouth,scamp, Nassau grouper - 20 inches |
| | | amberjack - 28 inches fork length |
| | | amberjack bag limit - 3 daily per recreational fisherman |
| | 12/31/1992 | minimum size limit red snapper - 20 inches on the state's Atlantic coast |
| | | Nassau grouper harvest prohibited from state waters |
| | | minimum size limits-vermilion snapper-10 inches recreational;12 inches commercial |
| | | amberjack harvest limit restricted in April and May to the bag limit for this species |
| | 3/1/1994 | minimum size limts - mutton snapper - 16 inches |
| | | red porgy, hogfish, gray triggerfish - 12 inches |
| | | recreational bag daily limits - vermilion snapper 10; hogfish 5 per fisheman |
| | 1/1/1998 | minimum size limit - vermilion snapper 10 inches |
| | | recreational daily bag limit - greater amberjack 1 fish per fisherman |
| | 8/17/1998 | recreational bag limit - red snapper 4 fish per day (including captain and crew on for-hire vessels) |
| | 12/31/1998 | minimum size limts - black and gag grouper - 24 inches |
| | | black sea bass - 10 inches; red porgy 14 inches |
| | 12/31/1998 | recreational daily bag limits - black and gag grouper 2 per person |
| | | red porgy 5 per person; speckled hind and Warsaw grouper 1 per person |
| | | black sea bass 20 aggregate |
| | 3/6/2000 | red porgy prohibited from harvest in state waters |
| | 1/1/2001 | minimum size limits - gag and black grouper - 22 inches |
| | 3/1/2001 | minimum size limits - red porgy - 14 inches |
| | | daily bag limits - red porgy - 1 per person recreatioal; 50 pound commercial vessel |
| | | closed season - red porgy - commercial harvest January through April |
| | | commercial vessel limit - greater amberjack - 1,000 pounds per vessel |
| Sharks and Rays | 4/8/1992 | daily bag limit - 1 shark per person; maximum 2 per vessel harvested from state waters |
| | 1/1/1998 | sand tiger, bigeye sand tiger, white sharks, and manta ray prohibited from harvest |
| Shrimp | 1/1/1996 | trawl use in inshore state waters with more than 500 square feet of mesh area prohibited |
| | 1/26/1999 | food shrimp minimum size limit (47/70 count law) in Miami-Dade county eliminated |
| | 12/2/1999 | establishes Oct. 15 - May 15 allowable harvesting season for food shrimp in Biscayne Bay (with a 6 a.m. Saturday to 6 a.m. Sunday closed period to food shrimp harvest each week during this open season) |
| | | prohibits frame net use by recreational fishermen in Miami-Dade county |
| | 12/21/2000 | changes the Biscayne Bay food shrimp season to Nov. 1 - May 31. |
| Snook | 12/31/1998 | minimum size limit increased from 24 to 26 inches total length |
| | | harvest larger than 34 inches total length prohibited |
| Spanish mackerel | 10/1/1990 | Florida east coast seasonal commerial catch limit set to 1,500 pound daily per vessel April 1 - November |
| | 11/26/1992 | recreational bag limit increased from 5 to 10 per person daily in state waters |
| | 6/1/1999 | minimum size limit reestablished - 12 inches |
| | 1/1/2001 | establishes a 3,500-pound daily commercial vessel trip limit on weekdays in Atlantic state waters during the unlimited harvest phase in adjacent Atlantic federal waters. |
| Spiny lobster | 7/1/1992 | established the following rules for the special two-day recreational season: change the season to occur the last consecutive Wednesday and Thursday in July each year; during this two-day period, harvest methods will be limited to diving and to the use of bully nets or hoop nets; no more than 12 lobster may be harvested or possessed per person per day |
| | 8/6/1993 | maximum number of spiny lobster traps allowed in commercial sector each season set at 10% fewer than were allowed the previous season |

**Table 4 (cont). Summary of major Florida regulations impacting southeast Florida marine fisheries and landings; 1990-2004.**
**(State of Florida - Marine Fisheries Commission - regulations applicable to state territorial waters)**

| SPECIES/GEAR | EFFECTIVE DATE | RULES AND REGULATIONS DESCRIPTION |
|---|---|---|
| Spiny lobster (cont. | 8/1/1994 | established a daily bag limit of 50 spiny lobster per vessel for special recreational crawfish license holders (or per person for such license holders who are not harvesting lobsters from a vessel) |
| Sponges | 12/1/1991 | harvest, possession, and landing prohibited from the waters of Biscayne National Park |
| Spotted seatrout | 1/1/1996 | minimum size limit - increased to 15 inches<br>maximum size limit - 20 inches<br>closed season - November-December annually<br>daily receational bag limit - 5 per person |
| | 7/1/2000 | daily receational bag limit - reduced to 4 per person |

*Coastal species*

Total landings of coastal species taken in the headboat fishery were dominated by king mackerel (96%), followed by bluefish (3%) and Spanish mackerel (1%). Headboat landings of king mackerel decreased significantly ($p = 0.016$) from 311 thousand pounds in 1990 to 162 thousand pounds in 2000 (Fig. 14a). There were no significant trends for bluefish or Spanish mackerel landings (Fig.14b,c).

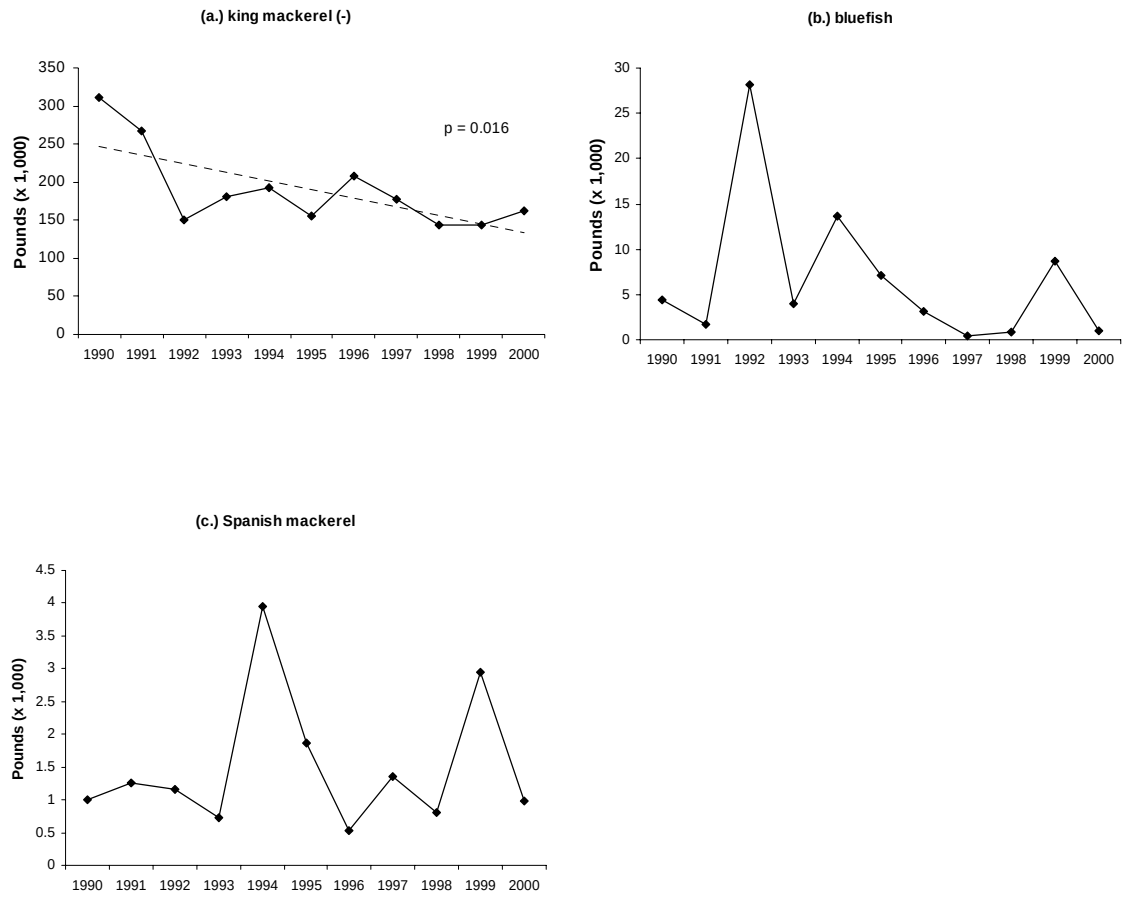



Figure 14. Landings of major coastal species taken in the recreational headboat fishery 1990-2000 in SEFCRI region. (a.) king mackerel, (b.) bluefish, (c.) Spanish mackerel. Dotted lines show significant ($p < 0.05$) linear trends.

*Offshore pelagic species*

The most important offshore pelagic species in terms of total headboat landings were little tunny (76%), dolphinfish (12%), and cobia (5%). Landings declined significantly for little tunny ($p = 0.012$) and cobia ($p < 0.001$) over the last decade (Fig. 15a,c). Landings of dolphinfish fluctuated without trend, but increased considerably from 1998 to 2000 (Fig. 15b). Significant declines in landings were found for blacktip sharks ($p = 0.010$) and sailfish ($p = 0.046$) (Table 3).

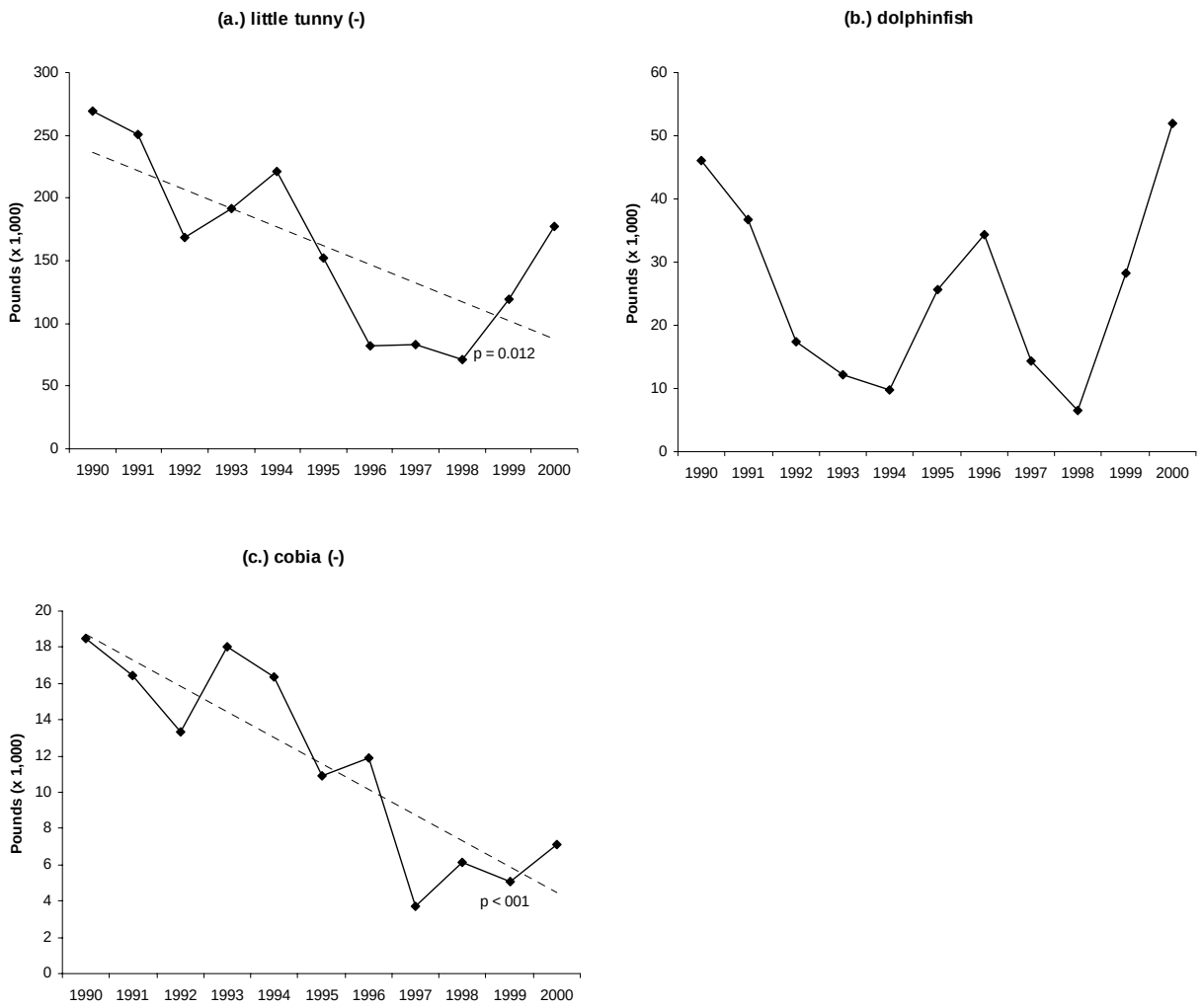



Figure 15. Landings of major offshore pelagic species taken in the headboat fishery 1990-2000 in SEFCRI region. (a.) little tunny, (b.) dolphin (fish), (c.) cobia. Dotted lines show significant ($p < 0.05$) linear trends.

## Commercial Sector

### Accumulative Landings System (1990-2000)

Total commercial landings (including invertebrates) declined 33% from 9.3 million pounds in 1990 to 6.2 million pounds in 2000 (Table 1). Total commercial finfish landings declined 55% from 8.7 million pounds in 1990 to 3.9 million pounds in 2000 (Table 1; Fig. 2a). The commercial proportion of total finfish landings also declined over time (Fig. 2b). Composition of total commercial landings over the study period includes coastal fishes (43%), offshore pelagic fishes (20%), reef fishes (17%), and invertebrates (20%) (Fig. 16a). Total landings declined significantly for reef ($p < 0.001$), coastal ($p = 0.007$) and offshore pelagic ($p < 0.001$) species, while invertebrate landings increased significantly ($p < 0.001$) (Fig. 16b). The total number of commercial restricted species licenses was highest in Miami-Dade County and increased over the study period for all counties, although the trend was only statistically significant for Martin County ($p = 0.033$; Fig. 17a). The number of commercial stone crab fishing licenses issued was highest in Miami-Dade County and declined significantly over the

study period for all counties ($p < 0.002$ in all cases; Fig. 17b). The number of spiny lobster licenses in was greatest in Miami-Dade County, and declined significantly over the study period for both Miami-Dade ($p = 0.001$) and Palm Beach ($p = 0.008$) counties, but varied without trend in Broward and Martin counties (Fig. 17c). The number of marine life licenses was similar in Miami-Dade, Broward and Palm Beach counties, and considerably less in Martin County (Fig. 17d). The number of marine life licenses increased over the study period in Martin County ($p = 0.043$), and exhibited a parabolic trend (increasing, peaking, and then decreasing over the study period) in Miami-Dade, Broward and Palm Beach counties (Fig. 17d).

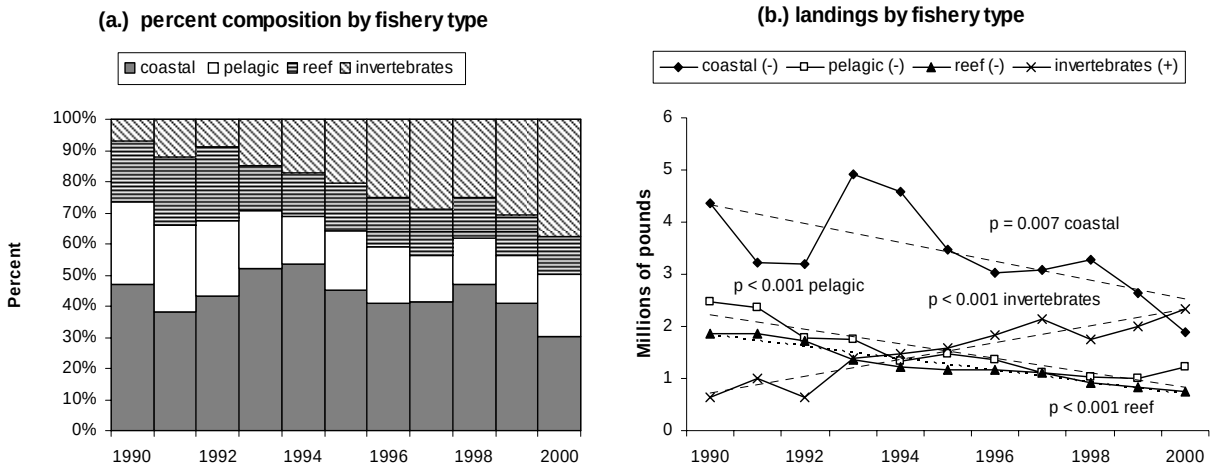



Figure 16. Commercial landings (pounds) by year for SEFCRI region, 1990-2000. Landings by (a.) percent composition, (b.) fishery type (coastal, offshore pelagic, reef, and invertebrates (no sponges). Dotted lines show significant ($p < 0.05$) linear trends.

The reduction in overall commercial landings and, in some cases, effort (based on licenses) may be partially due to increased regulation and reduced fish stocks, both of which may make fishing less profitable, or to effort-reduction programs. For example, commercial quotas have been established for certain fisheries (i.e. king and Spanish mackerels, tilefish, and bluefish) that result in closing a fishery when landings reach a certain level (Table 4). From an effort standpoint, it should be noted that decreases in numbers of licenses may reflect departure from the fishery by license-holders who historically have had minimal landings. For example, both the stone crab and spiny lobster fisheries have undergone state-mandated effort management programs in which license-holders with minimal annual landings were excluded from the fishery. In such cases, a decrease in the number of license-holders over time would be expected to occur with little impact on annual landings. The decline over time in stone crab licenses (Fig. 17b) for each of the SEFCRI counties was likely partially due to a moratorium (initiated in 1995) prohibiting new licenses and requiring annual permit renewal, followed by the establishment of an annual license fee in 2002. Similarly, a trap reduction program enacted in 1993 likely contributed to the decline in lobster licenses (Fig. 17c) . The marine life license was initiated in 1990. The number of marine life license-holders increased until 1998, when the state established a moratorium on new licenses. The moratorium likely contributed to the observed post-1998 decline in Miami-Dade, Broward and Palm Beach counties (Fig. 17d).

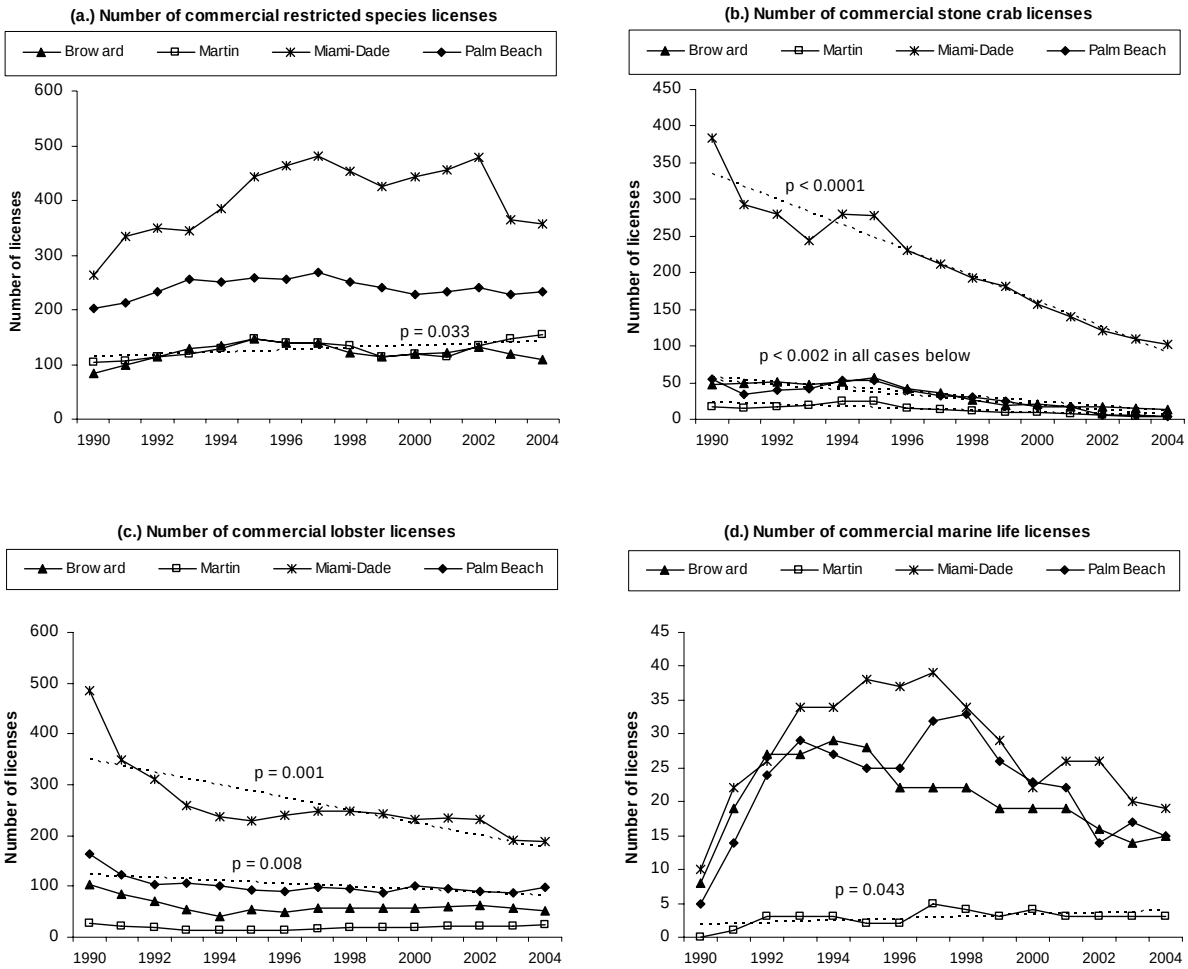



Figure 17. Number of commercial licenses for which associated landings were reported in SEFCRI region by county and year. (a.) restricted species, (b.) stone crab, (c.) spiny lobster, (d.) marine life.

*Reef fish species*

Combined commercial landings over the study period show that the most frequently landed reef species were mojarra (17%), greater amberjack (14%), crevalle jack (13%), miscellaneous reef fish (12%), yellowtail snapper (11%), mutton snapper (6%), gag grouper (4%), blue runner (4%), and black grouper (3%) (Table 1). For species groups, the snapper complex comprised 22% of commercial reef fisheries landings and the grouper complex comprised 11%. Annual commercial landings declined significantly ($p < 0.05$) for greater amberjack, yellowtail snapper, mutton snapper, and black grouper (Fig.18a,b,c,f). Landings of blue runner (Fig.18e) were higher during the second half of the decade, peaking in 1998, although this increase was not significant at 95% ($p = 0.056$). Annual landings for gag grouper were highly variable and without trend (Fig.18d).

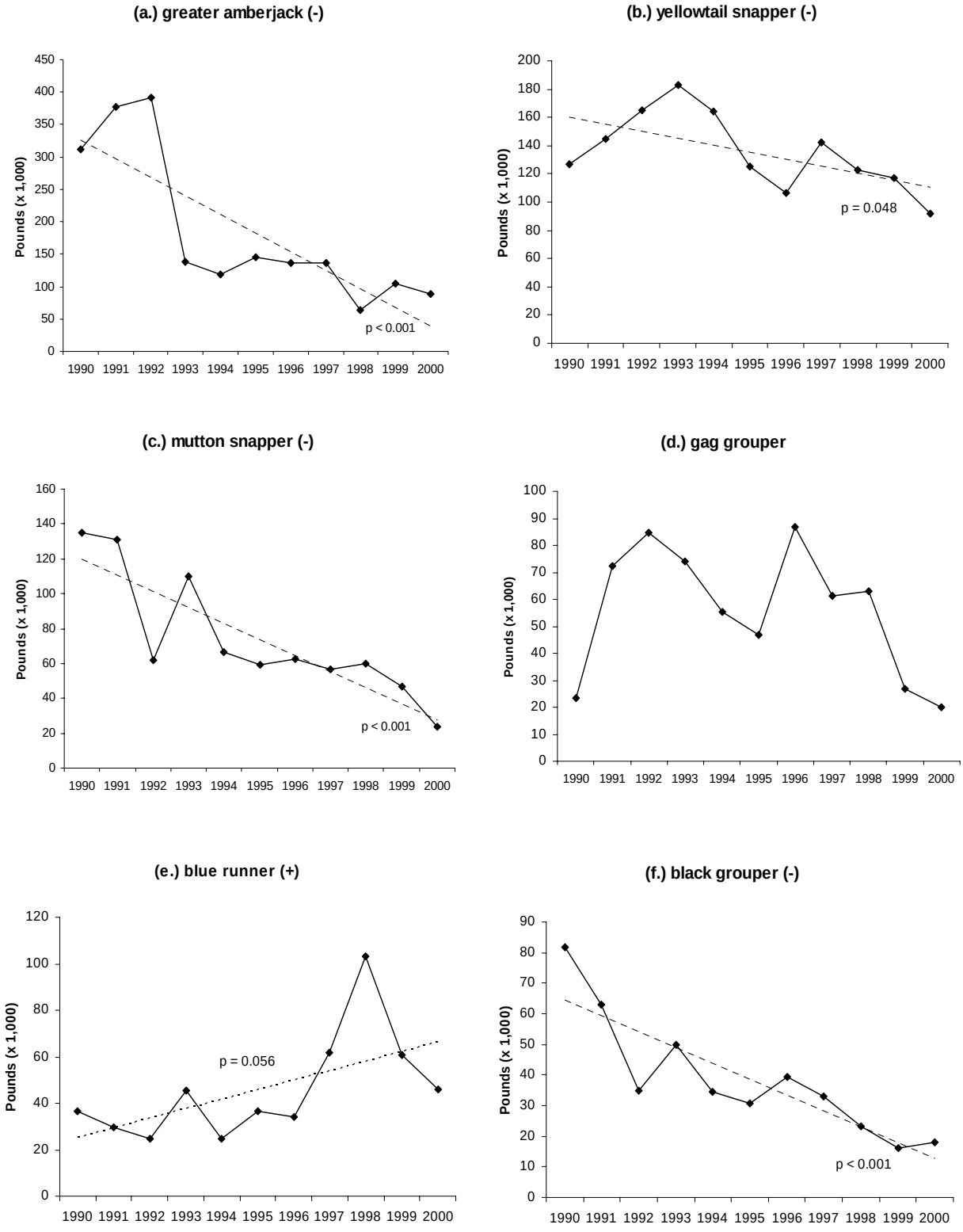



Figure 18. Commercial landings of major reef fishes in SEFCRI region 1990-2000 (a.) greater amberjack, (b.) yellowtail snapper, (c.) mutton snapper, (d.) gag grouper, (e.) blue runner, (f.) black grouper. Dotted lines show significant ($p < 0.05$) linear trends.

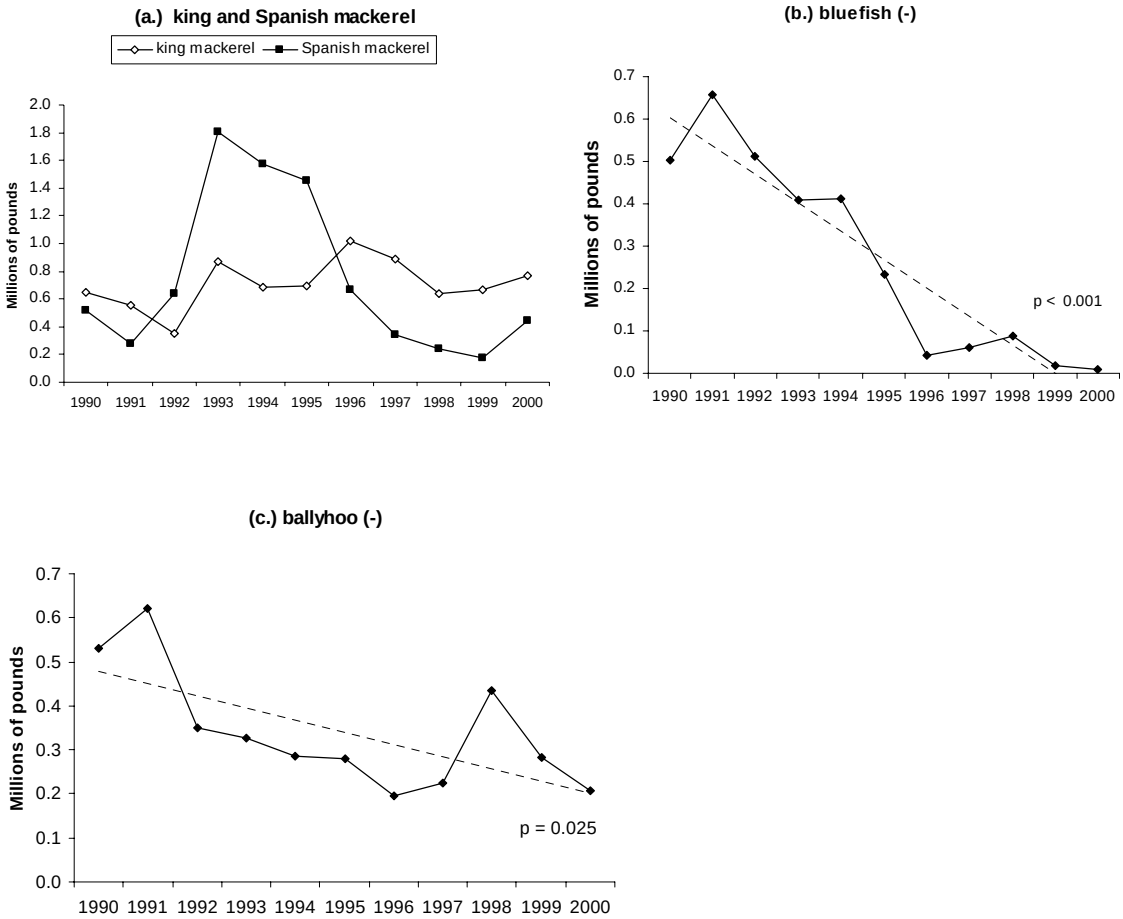



Figure 19. Commercial landings of major coastal species in the SEFCRI region (a.) king and Spanish mackerel, (b.) bluefish, (c.) ballyhoo. Dotted lines show significant ($p < 0.05$) linear trends.

*Coastal species*

The dominant species by total landings in the commercial coastal fishery were Spanish mackerel (22%), king mackerel (21%), bluefish (8%), and a baitfish, ballyhoo (10%) (Table 1). Landings of coastal fisheries peaked in 1993 principally due to high Spanish mackerel landings. Spanish and king mackerel landings fluctuated without trend over time, averaging 0.74 and 0.71 million pounds annually (Fig.19a). Bluefish (Fig.19b) and ballyhoo (Fig.19c) landings declined significantly ($p < 0.001$ and $p = 0.025$, respectively). Coastal fishes, including bluefish, ballyhoo, striped mullet, spotted sea trout, and Florida pompano, were historically targeted by commercial fishers using entangling nets (e.g., gill and trammel nets). Because these fishes occupy shallow-water habitats and exhibit schooling behavior, the use of entanglement nets is a very efficient fishing method. The State of FL regulatory net ban, effective July 1, 1995, prohibited the use of entanglement nets in Florida waters and was intended to reduce fishing pressure on targeted, shallow-water species. In the SEFCRI region significant declines in landings are evident after 1995 for a several coastal species (e.g., bluefish, striped mullet, and spotted seatrout) which were previously targeted by commercial net fishers (Table 1). Thus, Florida's net ban appears to have directly reduced landings for these species. However, specific

impacts of the net ban on coastal fishes are difficult to determine, since other fishery management, economic, and environmental influences occurred after the net ban implementation.

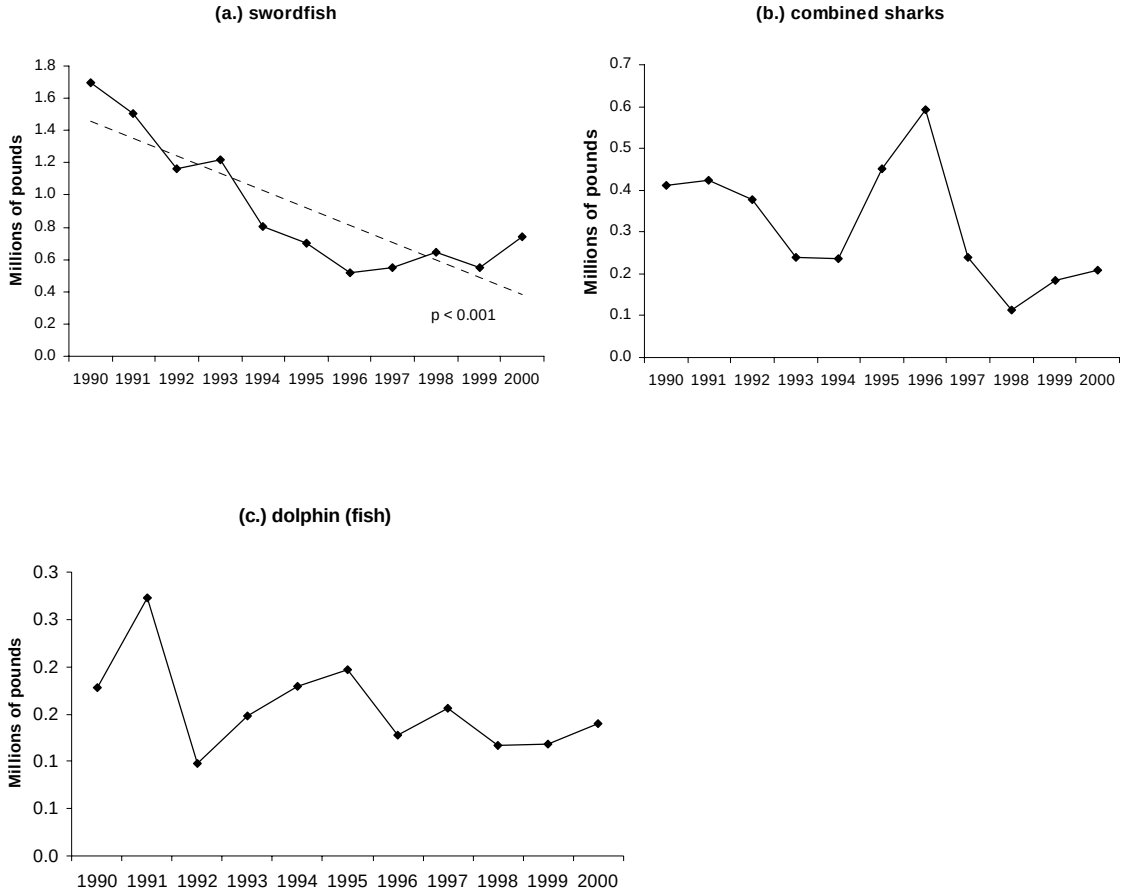



Figure 20. Commercial landings of major offshore pelagic species in the SEFCRI region (a.) swordfish, (b.) combined sharks, (c.) dolphinfish. Dotted lines show significant ($p < 0.05$) linear trends.

*Offshore pelagic species*

The major commercial offshore pelagic species landed by weight over the 11-year period were swordfish (60%), combined sharks (21%), and dolphinfish (10%). Commercial landings of swordfish decreased significantly ($p < 0.001$; Fig. 20a), while landings of combined sharks (Fig. 20b) and dolphinfish (Fig. 20c) exhibited no significant trends. Landings may have been affected by management regulations. Commercial landing of billfishes, sharks, and tunas requires specific permits, and numerous regulations exist (i.e. gear restrictions, limits on pounds landed, minimum size requirements, limited access to entering the fishery). Swordfish are highly regulated using a quota system. In 2004, regulatory changes resulted in the protection of nineteen shark species. The incidental catch limits were changed to five large coastal sharks per trip and 16 combined offshore pelagic or small coastal sharks per trip.

*Invertebrates*

Total commercial invertebrate landings increased significantly ($p < 0.001$) from 0.6 million pounds in 1990 to 2.3 million pounds in 2000 (Fig. 16b), principally due to increased landings of shrimp and blue crab (Table 1). Shrimp, principally pink shrimp, comprised 31% of the invertebrate catches. Commercial shrimp landings in 2000 were ~5 times that in 1990, and increased significantly ($p < 0.001$) over the study period (Fig. 21a). Approximately half of the shrimp landed in Miami-Dade County was for bait. There was no significant trend in spiny lobster landings, which comprised 41% of invertebrate catches (Fig. 21b), although landings in recent years have trended downward. Blue crabs, which comprised 11% of the 1990-2000 landings, increased significantly ($p < 0.001$) over the study period and in 2000 were six times 1990 landings (Fig. 21c). There was no significant trend in landings of stone crab claws which comprised 5% of the total invertebrate landings (Fig. 21c). Increased invertebrate landings may be the result of fishers in the SEFCRI region being displaced from other fisheries (e.g., related to Florida's net ban, or loss of access to certain fisheries due to management restrictions) and a subsequent re-targeting of fishing effort on invertebrates.

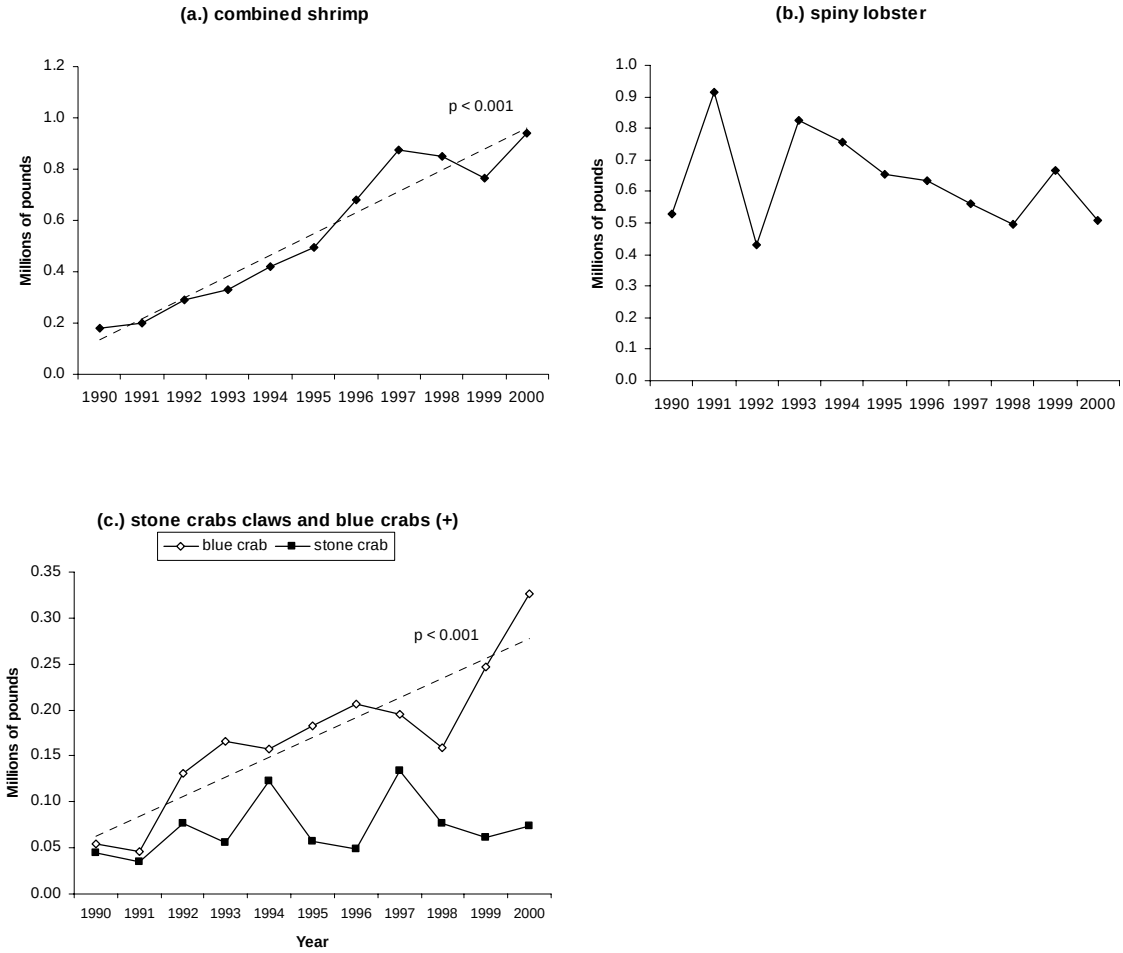



Figure 21. Commercial landings of major invertebrate species in the SEFCRI region (a.) combined shrimp, (b.) spiny lobster, (c.) stone crab claws and blue crab. Dotted lines show significant ($p < 0.05$) linear trends.

**Fisheries Logbook Data (1993-2003)**

Fisheries Logbook System (FLS) commercial logbook data were used to examine changes in catch per unit effort for various fisheries in the SEFCRI region. This reporting system began in 1993. In order to examine a similar time frame as the other data bases (11 years), data from 1993-2003 were utilized. Approximately half (50.1%) of data were for handline (hook and line) gear, a gear used in reef, coastal, and offshore pelagic fisheries (Table 5). For hand line gear, the number of reported trips increased significantly ($p < 0.001$) from 1993-2003, while the landings/trip remained fairly stable, averaging 204 pounds, during the eleven years (Fig. 22a). Analysis of annual catch-per-unit-effort (pounds/trip) trends in SEFCRI logbook handline gear data by species or higher taxonomic group indicated 3 statistically significant increasing trends, 6 statistically significant decreasing trends, 52 non-significant or non-existent trends, and 63 species for which landings data were insufficient to determine trends (Table 6).

**Table 5 . SEFCRI area total pounds reported by gear in the Fisheries Logbook System (FLS) data; 1993-2003.**

| Gear | Pounds | % total | Major species landed |
|---|---|---|---|
| Handline | 7,989,698 | 50.1 | mackerels, snappers, amberjack, snappers, tilefish, dolphin, blue runner |
| Troll line | 3,414,131 | 21.4 | mackerels, dolphin, barracuda, tuna, amberjack |
| Trap | 42,615 | 0.3 | lobster, snappers, margate, groupers, gray triggerfish |
| Spear | 243,351 | 1.5 | groupers, snappers, lobster, hogfish, african pompano, cobia, margate, amberjack |
| Powerstick | 164,684 | 1.0 | groupers, snappers, cobia, amberjack, hogfish, lobster |
| Gillnet | 1,677,784 | 10.5 | shark, mackerels, bluefish, little tunny, barracuda, blue runner, crevalle |
| Castnet | 91,570 | 0.6 | mackerels, sand perch, mullets, grunts, goatfish, moonfish, finfish bait, sheepshead, tenpounder |
| Longline | 891,537 | 5.6 | shark, dolphin, tilefish |
| Other | 1,429,899 | 9.0 | spanish mackerel, shrimp, lobster |
| **Total** | **15,945,269** | **100** | |

**Table 6. Average pounds/trip for SEFCRI area handline gear from the Fishery Logbook System data (1993-2003) with trends and p-value of significant trends.**

| Common name | Type | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 1993-2003 Trend* | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlantic croaker | Coastal | | | | | | | 0.1 | | | | | ~ | |
| Atlantic moonfish | Coastal | | 0.1 | | | | | | | | | | ~ | |
| Bigeye scad | Coastal | | | | | 0.3 | 0.1 | | 1.0 | | 0.1 | | ~ | |
| Bluefish | Coastal | 0.2 | 0.2 | 0.8 | 0.4 | 0.8 | 1.4 | 2.2 | 1.0 | 2.8 | 2.9 | 3.5 | **pos** | <0.001 |
| Finfish, uncl. | Coastal | 1.0 | 2.0 | 0.5 | 0.6 | 0.8 | 0.9 | | 0.4 | 0.1 | 0.1 | 0.1 | n.s. | |
| Finfishes, food | Coastal | | | | | 0.5 | | | | | | | ~ | |
| Florida pompano | Coastal | | | | | 0.2 | | 0.1 | 0.2 | 0.2 | 0.9 | 0.6 | n.s. | |
| Gray seatrout | Coastal | | 0.1 | | | | | | | | | | ~ | |
| Hakes | Coastal | 0.1 | 0.1 | 0.1 | | | | | | | | | ~ | |
| King mackerel | Coastal | 261.7 | 221.1 | 170.6 | 212.6 | 213.5 | 158.9 | 195.9 | 163.4 | 153.7 | 146.2 | 215.4 | n.s. | |
| Kingfishes, uncl. | Coastal | | | | | | | | | 0.4 | | | ~ | |
| Mullets | Coastal | | | 0.1 | | | | | | 1.3 | | 0.1 | ~ | |
| Ocean perch | Coastal | | | 0.1 | | | | 0.1 | | | | | ~ | |
| Sand perch | Coastal | 0.1 | | | 0.1 | 0.2 | | | | | | | ~ | |
| Spanish mackerel | Coastal | 10.1 | 2.5 | 33.9 | 19.2 | 22.9 | 26.6 | 44.6 | 96.4 | 75.3 | 95.4 | 67.9 | **pos** | <0.001 |
| Spottail pinfish | Coastal | | | 0.1 | 0.1 | | | | | | | | ~ | |
| Tripletail | Coastal | | | | | 0.1 | | 0.0 | | 0.0 | | | ~ | |
| White seatrout | Coastal | | | | | | | 0.1 | | 0.1 | | | ~ | |
| Albacore | Pelagic | | | | | | 0.2 | 0.2 | | | | | ~ | |
| Atlantic bonito | Pelagic | 32.5 | 10.5 | 21.9 | 46.7 | 22.6 | 8.6 | 15.3 | 6.5 | 9.7 | 1.9 | 2.3 | **neg** | 0.022 |
| Atlantic sharpnose shark | Pelagic | | 0.3 | | 5.3 | 0.1 | 0.3 | 0.4 | 0.7 | 1.1 | 3.1 | 0.5 | n.s. | |
| Bigeye tuna | Pelagic | | | | | | | | | | 0.3 | | ~ | |
| Blackfin tuna | Pelagic | 4.2 | 1.9 | 2.8 | 3.1 | 2.8 | 1.3 | 3.5 | 1.5 | 0.8 | 1.7 | 4.4 | n.s. | |
| Blacknose shark | Pelagic | | | | | | | | 0.2 | | 0.2 | 0.0 | ~ | |
| Blacktip shark | Pelagic | 5.3 | | | 39.3 | 0.3 | 5.8 | 1.9 | 0.3 | 2.5 | 3.3 | 19.5 | n.s. | |
| Bluefin tuna | Pelagic | | | | | | 0.3 | 0.2 | | | | | ~ | |
| Bonnethead | Pelagic | | | | | | | | | | | 1.0 | ~ | |
| Bull shark | Pelagic | | | 2.7 | 6.9 | | | | 6.9 | 1.7 | 10.2 | 11.7 | n.s. | |
| Cobia | Pelagic | 65.1 | 44.7 | 41.3 | 75.9 | 18.8 | 25.3 | 17.6 | 27.6 | 15.4 | 34.6 | 23.5 | **neg** | 0.033 |
| Dogfish sharks, uncl. | Pelagic | 1.1 | | | | | | | | | | | ~ | |

**Table 6 (cont). Average pounds/trip for SEFCRI area handline gear from the Fishery Logbook System data (1993-2003) with trends and p-value of significant trends.**

| Common name | Type | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 1993-2003 Trend* | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dolphinfish | Pelagic | 191.7 | 173.5 | 118.8 | 95.7 | 129.7 | 108.4 | 155.6 | 220.6 | 134.8 | 69.9 | 153.6 | n.s. | |
| Dusky shark | Pelagic | | | | 0.2 | | | | | | | | ~ | |
| Finetooth shark | Pelagic | | | | | | | | | | 0.4 | | ~ | |
| Great hammerhead | Pelagic | | | | 6.7 | 2.0 | | | | | | | ~ | |
| Lemon shark | Pelagic | | | | 0.6 | | | | | 3.9 | 1.0 | 3.4 | ~ | |
| Little tunny | Pelagic | | | 0.4 | 10.5 | 0.6 | 8.8 | 0.5 | 6.1 | 3.1 | 13.8 | 51.2 | n.s. | |
| Mako shark,uncl. | Pelagic | 7.1 | 3.6 | 0.9 | | | | | | 0.1 | | | ~ | |
| Sailfish | Pelagic | | | | | | 1.1 | 0.1 | | | | | ~ | |
| Sand shark | Pelagic | | | 1.1 | 17.0 | 11.4 | 6.7 | 1.6 | 13.4 | 3.7 | 0.8 | 5.0 | n.s. | |
| Sand tiger shark | Pelagic | | | | 3.4 | 0.3 | | | | | | | ~ | |
| Shark fins | Pelagic | | | | | | | | | | | 0.1 | ~ | |
| Shark, uncl. | Pelagic | 9.9 | 6.0 | 51.0 | | | 0.2 | | | 0.6 | 0.5 | | n.s. | |
| Silky shark | Pelagic | | 0.5 | 0.5 | | | 7.9 | | | 0.1 | | 0.1 | ~ | |
| Skipjack tuna | Pelagic | | | | | 2.2 | 8.6 | | | | 2.1 | | ~ | |
| Swordfish | Pelagic | | | | | | | | | 0.9 | 11.8 | | ~ | |
| Tiger shark | Pelagic | | | | 5.5 | | 0.2 | | | | | | ~ | |
| Tunas, uncl. | Pelagic | 0.6 | | | 1.0 | | 0.1 | 2.5 | 1.8 | 0.1 | 0.4 | | n.s. | |
| Wahoo | Pelagic | 6.2 | 3.0 | 8.3 | 2.1 | 3.2 | 5.3 | 4.8 | 5.3 | 10.8 | 14.8 | 6.0 | n.s. | |
| Yellowfin tuna | Pelagic | | | | | | | | | | 1.6 | | ~ | |
| African pompano | Reef Fish | 0.6 | 0.5 | 0.2 | 0.1 | 0.1 | 0.1 | | | 0.1 | | | **neg** | 0.031 |
| Almaco jack | Reef Fish | 0.8 | 3.4 | 1.1 | 1.0 | 1.4 | 1.9 | 3.7 | 3.2 | 2.0 | 1.2 | 1.6 | n.s. | |
| Amberjacks, uncl. | Reef Fish | 2.5 | | | | | | | | | | | ~ | |
| Banded rudderfish | Reef Fish | 3.7 | 0.8 | | 2.2 | 3.8 | 2.4 | 5.9 | 5.6 | 1.9 | 1.6 | 2.2 | n.s. | |
| Bar jack | Reef Fish | | 0.1 | 0.1 | 0.2 | | | | | | | | ~ | |
| Barracuda | Reef Fish | 1.0 | 2.2 | 4.3 | 4.4 | 2.6 | 1.5 | 1.8 | 2.6 | 4.8 | 5.8 | 4.3 | n.s. | |
| Bigeye | Reef Fish | 0.1 | 0.1 | 0.5 | 0.4 | 0.5 | 0.4 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | n.s. | |
| Black grouper | Reef Fish | 3.7 | 3.6 | 2.7 | 3.6 | 4.0 | 4.0 | 2.6 | 1.7 | 2.2 | 2.6 | 4.3 | n.s. | |
| Black margate | Reef Fish | 0.1 | 0.3 | 0.1 | 0.1 | 0.2 | 0.0 | 0.1 | 0.1 | 0.2 | 0.1 | 0.0 | n.s. | |
| Black sea bass | Reef Fish | 1.2 | 1.3 | 1.3 | 0.9 | 1.6 | 0.1 | 0.2 | 0.2 | 0.0 | 0.1 | 0.1 | **neg** | 0.002 |
| Blackbelly rosefish | Reef Fish | | | | 0.1 | 0.3 | | | 0.2 | 0.2 | 0.1 | 0.2 | n.s. | |

**Table 6 (cont). Average pounds/trip for SEFCRI area handline gear from the Fishery Logbook System data (1993-2003) with trends and p-value of significant trends.**

| Common name | Type | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 1993-2003 Trend* | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blackfin snapper | Reef Fish | 0.1 | 0.1 | | 0.2 | | | | | 0.1 | 0.1 | | ~ | |
| Blue runner | Reef Fish | 3.4 | 3.7 | 4.3 | 4.2 | 4.8 | 5.3 | 7.2 | 9.7 | 15.6 | 11.1 | 13.3 | **pos** | <0.001 |
| Blueline tilefish | Reef Fish | 1.0 | 0.5 | 1.2 | 1.6 | 0.6 | 0.2 | 0.2 | 1.3 | 0.9 | 1.8 | 0.3 | n.s. | |
| Bluestriped grunt | Reef Fish | 0.8 | 1.5 | 1.7 | 2.0 | 2.4 | 1.2 | 1.6 | 0.5 | 0.7 | 0.5 | 0.5 | n.s. | |
| Cero | Reef Fish | | | | | 0.1 | 0.2 | 0.3 | 0.5 | 0.1 | 0.1 | 0.1 | n.s. | |
| Cottonwick grunt | Reef Fish | | | | | | | 0.0 | | | | | ~ | |
| Crevalle jack | Reef Fish | 3.0 | 0.4 | 1.5 | 4.2 | 1.5 | 1.7 | 3.7 | 7.8 | 2.3 | 2.6 | 7.4 | n.s. | |
| Cubera snapper | Reef Fish | 0.2 | | 0.1 | 0.6 | 0.2 | 0.1 | 0.1 | | 0.1 | | | n.s. | |
| Dog snapper | Reef Fish | | | | | 0.0 | | | | | | | ~ | |
| French grunt | Reef Fish | 1.3 | 0.6 | 0.5 | 0.8 | 1.4 | 2.2 | 0.6 | 1.2 | 0.4 | 0.5 | 0.3 | n.s. | |
| Gag grouper | Reef Fish | 20.2 | 12.0 | 11.3 | 18.2 | 6.1 | 7.7 | 6.1 | 9.9 | 14.4 | 6.2 | 7.0 | n.s. | |
| Goatfishes | Reef Fish | | | | | | | | | | 0.2 | | ~ | |
| Gray snapper | Reef Fish | 4.6 | 4.9 | 5.7 | 11.8 | 11.5 | 11.1 | 8.5 | 7.0 | 6.2 | 5.8 | 6.1 | n.s. | |
| Gray triggerfish | Reef Fish | 0.6 | 0.3 | 0.3 | 0.3 | 1.2 | 1.5 | 1.2 | 0.4 | 0.5 | 1.1 | 1.2 | n.s. | |
| Graysby | Reef Fish | | | | | | | | | 0.0 | | | ~ | |
| Greater amberjack | Reef Fish | 54.5 | 50.2 | 47.9 | 53.4 | 50.6 | 42.4 | 58.9 | 38.5 | 38.7 | 37.0 | 60.1 | n.s. | |
| Groupers, uncl. | Reef Fish | 0.1 | | | | | | | | | | | ~ | |
| Grunts, uncl. | Reef Fish | 1.1 | 0.3 | 0.1 | 0.0 | 0.2 | 0.3 | 0.1 | 1.1 | 1.9 | 1.5 | 1.9 | n.s. | |
| Hogfish | Reef Fish | 0.1 | 0.3 | 0.2 | 0.1 | | | 0.0 | | | 0.2 | 0.2 | n.s. | |
| Horse-eye jack | Reef Fish | | | | | | | 0.0 | | | | | ~ | |
| Jacks, uncl. | Reef Fish | | | | 0.1 | 0.5 | 0.2 | 0.1 | 0.1 | 0.3 | | 0.1 | n.s. | |
| Jolthead porgy | Reef Fish | 0.6 | 0.4 | 0.2 | 0.1 | 0.2 | 0.1 | 0.2 | 0.1 | | 0.2 | 0.2 | n.s. | |
| Knobbed porgy | Reef Fish | | | | 0.3 | 0.4 | 0.6 | 0.1 | 0.2 | 0.1 | | | n.s. | |
| Lane snapper | Reef Fish | 0.9 | 0.9 | 1.5 | 0.8 | 1.0 | 1.4 | 1.6 | 1.6 | 0.9 | 1.4 | 1.1 | n.s. | |
| Lesser amberjack | Reef Fish | 0.1 | 1.7 | 0.2 | 0.8 | 0.3 | 1.2 | 1.5 | 0.6 | 2.2 | 0.7 | 2.1 | n.s. | |
| Margate | Reef Fish | 0.2 | 0.4 | 0.1 | 0.2 | 0.2 | 0.8 | 0.4 | 0.2 | 0.3 | 0.2 | 0.2 | n.s. | |
| Misty grouper | Reef Fish | | | | 0.1 | | 0.1 | 0.4 | 0.4 | 0.3 | 0.1 | 0.1 | n.s. | |
| Mutton snapper | Reef Fish | 16.9 | 15.2 | 9.1 | 13.0 | 14.4 | 13.1 | 8.0 | 16.0 | 9.5 | 16.5 | 10.2 | n.s. | |
| Ocean triggerfish | Reef Fish | 0.3 | | 0.1 | | 0.1 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | n.s. | |
| Parrotfishes | Reef Fish | | | | | | | | | 0.1 | | | ~ | |

**Table 6 (cont). Average pounds/trip for SEFCRI area handline gear from the Fishery Logbook System data (1993-2003) with trends and p-value of significant trends.**

| Common name | Type | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 1993-2003 Trend* | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Porgy family | Reef Fish | 0.2 | | | | | | | | | | | ~ | |
| Queen snapper | Reef Fish | | | | | 0.6 | 0.2 | 0.1 | 0.1 | 0.1 | | 0.8 | n.s. | |
| Queen triggerfish | Reef Fish | 0.1 | 0.2 | | | | 0.1 | 0.1 | | | | 0.1 | ~ | |
| Rainbow runner | Reef Fish | | | | | | | | | | | 0.1 | ~ | |
| Red grouper | Reef Fish | 0.8 | 1.0 | 1.6 | 1.6 | 0.8 | 1.6 | 2.9 | 4.1 | 0.5 | 0.9 | 1.8 | n.s. | |
| Red hind | Reef Fish | 0.1 | | | | 0.1 | | | | | | | ~ | |
| Red porgy | Reef Fish | 3.3 | 1.4 | 5.6 | 1.5 | 4.6 | 1.7 | 1.1 | 0.2 | 0.3 | 0.6 | 0.3 | **neg** | 0.027 |
| Red snapper | Reef Fish | 0.3 | 1.0 | 4.1 | 2.0 | 3.1 | 1.1 | 0.5 | 0.6 | 0.8 | 0.5 | 0.1 | n.s. | |
| Rock hind | Reef Fish | | 0.2 | | 0.1 | | | 0.1 | 0.1 | | | | ~ | |
| Rudderfish (sea chubs) | Reef Fish | | | | | | | | 0.2 | | | 0.1 | ~ | |
| Sand tilefish | Reef Fish | | | | | | 0.1 | | | 0.1 | 0.1 | 0.1 | ~ | |
| Scamp | Reef Fish | 0.1 | 0.1 | 0.8 | 0.3 | 0.7 | 0.3 | 0.9 | 0.2 | 0.1 | 0.1 | | n.s. | |
| Schoolmaster | Reef Fish | | | | 0.1 | | | | | | | | ~ | |
| Scorpionfishes | Reef Fish | | | | | 0.0 | | | | | | | ~ | |
| Sheepshead | Reef Fish | | | | | 0.2 | | | | | | | ~ | |
| Silk snapper | Reef Fish | 0.1 | | 0.2 | 0.3 | 2.2 | 0.7 | | 1.2 | 2.1 | 1.2 | 0.6 | n.s. | |
| Snappers | Reef Fish | 1.4 | 0.9 | 0.4 | 0.1 | | | | | | | | ~ | |
| Snowy grouper | Reef Fish | 6.7 | 4.9 | 9.2 | 8.8 | 8.4 | 5.5 | 7.9 | 4.4 | 7.4 | 5.9 | 5.8 | n.s. | |
| Spadefishes | Reef Fish | | | | | | | | 0.3 | | | | ~ | |
| Speckled hind | Reef Fish | | | | | | | 0.2 | 0.8 | | 0.1 | | ~ | |
| Squirrelfishes | Reef Fish | 0.3 | | 0.1 | 0.1 | 0.2 | 0.1 | | | 0.1 | 0.1 | 0.1 | **neg** | 0.038 |
| Tilefish | Reef Fish | 4.3 | 7.8 | 8.4 | 5.9 | 8.3 | 8.2 | 13.5 | 19.5 | 5.4 | 9.8 | 4.6 | n.s. | |
| Tomtate grunt | Reef Fish | | | | | | | 0.1 | | | | | ~ | |
| Triggerfishes | Reef Fish | 0.1 | | | | | | | | | | | ~ | |
| Vermilion snapper | Reef Fish | 3.6 | 1.6 | 8.3 | 2.0 | 5.5 | 1.8 | 3.9 | 6.0 | 8.3 | 7.8 | 4.8 | n.s. | |
| Warsaw grouper | Reef Fish | 0.9 | 0.1 | 0.4 | | 0.1 | 0.2 | | | | | | ~ | |
| Wenchman | Reef Fish | | | | | 0.0 | | | | | | | ~ | |
| White grunt | Reef Fish | 1.4 | 1.4 | 1.4 | 0.7 | 1.9 | 1.5 | 1.7 | 0.9 | 0.9 | 0.5 | 1.7 | n.s. | |
| Whitebone porgy | Reef Fish | | | | | | | 0.1 | 0.1 | | 0.1 | 0.1 | ~ | |
| Wreckfish | Reef Fish | 0.2 | | | | | | | | | | | ~ | |

**Table 6. (cont) Average pounds/trip for SEFCRI area handline gear from the Fishery Logbook System data (1993-2003) with trends and p-value of significant trends.**

| Common name | Type | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 1993-2003 Trend* | P-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Yellow jack | Reef Fish | | | | | | 0.1 | 0.3 | | | | | ~ | |
| Yellowedge grouper | Reef Fish | 0.1 | 0.1 | | 0.1 | | 0.1 | 0.3 | 1.6 | 0.6 | 0.4 | | n.s. | |
| Yellowfin grouper | Reef Fish | 0.1 | | 0.7 | 0.1 | | 0.2 | | | | | | ~ | |
| Yellowtail snapper | Reef Fish | 37.9 | 44.1 | 32.1 | 31.7 | 41.1 | 42.2 | 37.5 | 31.7 | 28.9 | 42.3 | 48.3 | n.s. | |

*1993-2003 Trends

**pos** increasing landings trend; trendline slope > 0 ($p<0.05$)

**neg** decreasing landings trend; trendline slope < 0 ($p<0.05$)

n.s. non-significant or non-existent landings trend; trendline slope = 0 ($p>0.05$)

~ insufficient annual data (5 or fewer reporting years) for trend analysis

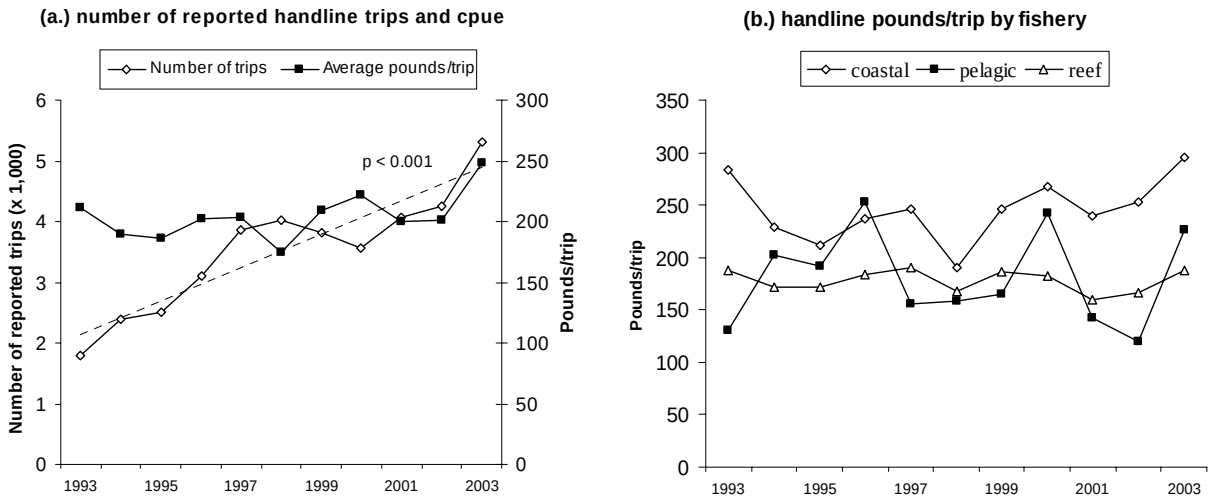



Figure 22: Commercial effort and landings/trip by handline gear for logbook data in the SEFCRI region (a.) annual number of reported handline trips and landings/trip (b.) handline landings/trip by fishery. Dotted lines show significant ($p < 0.05$) linear trends.

*Reef fish species*

Landings/trip in the commercial reef handline fishery averaged 178 pounds between 1993 and 2003 (Fig. 22b). For species with reported data for six or more years during this period, commercial handline landings/trip trends declined significantly for African pompano, black sea bass, red porgy, and squirrelfishes, while blue runner landings/trip increased significantly (Table 6). Broward County had the lowest average landings/trip (Fig. 23a). By county, there were declining trends in catch/trip over time for Broward ($p < 0.001$) and Palm Beach ($p = 0.030$) counties, and no significant changes over time for Miami-Dade and Martin counties (Fig. 23a). The highest annual landings/trip occurred in Martin County in 1997. Miami-Dade landings/trip was relatively constant throughout the time period.

*Coastal species*

Landings (lbs) /trip for coastal fishes by handline gear averaged 245 over the study period (Fig. 22b). For fishes which had data for all years, commercial handline landings/trip trends increased for Spanish mackerel ($p < 0.001$) and bluefish ($p < 0.001$), while no trends were noted for other coastal fishes (Table 6). Pounds/trip increased significantly for Miami-Dade ($p = 0.030$) and Martin ($p = 0.003$) counties (Fig. 23b). Martin County had the highest average landings/trip in the commercial coastal handline fishery (Fig. 23b). Landings/trip was lowest and relatively constant over time in Broward County.

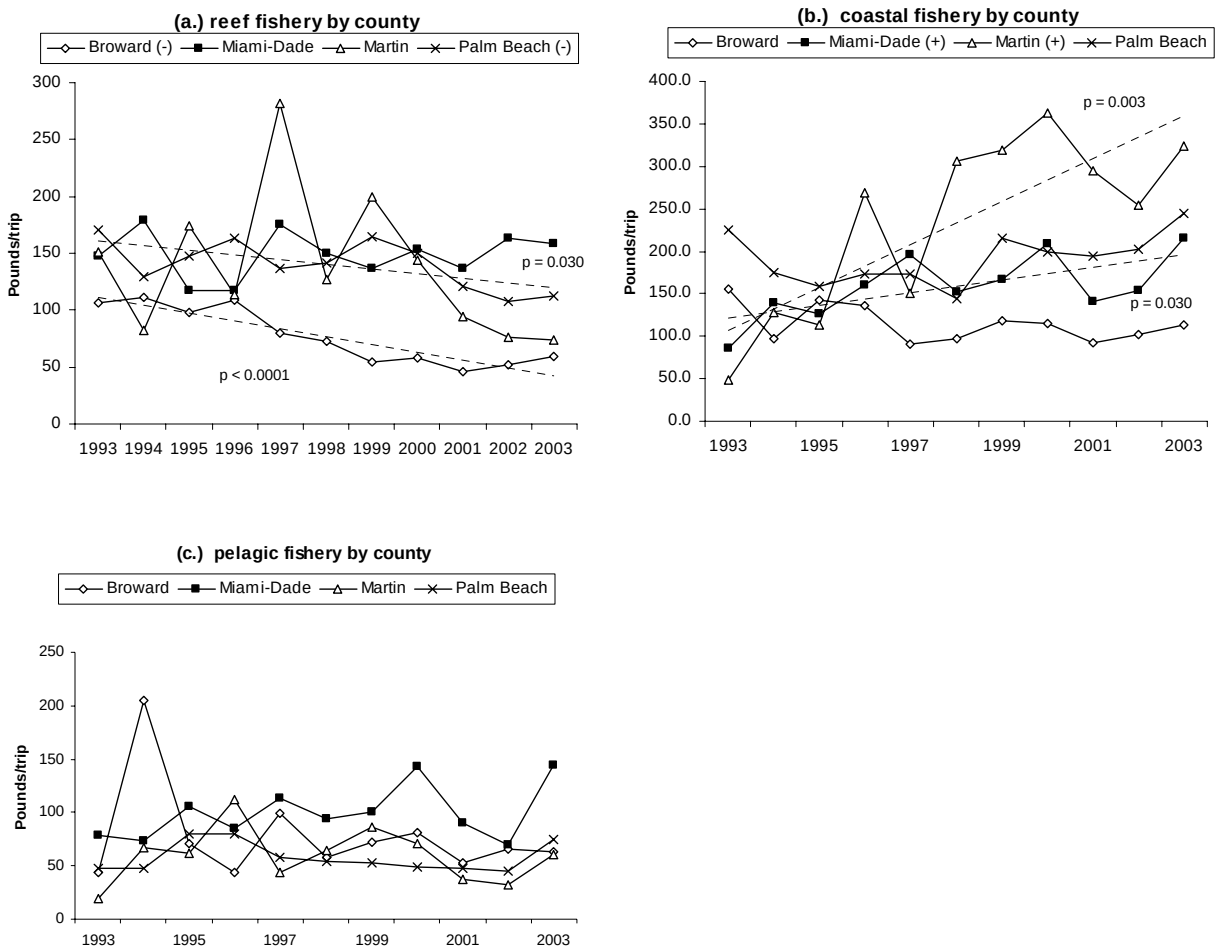



Figure 23: Commercial handline gear CPUE (pounds per trip) by county in the SEFCRI region 1993-2003 (a.) reef fishery, (b.) coastal fishery, (c.) offshore pelagic fishery. Dotted lines show significant ($p < 0.05$) linear trends.

*Offshore pelagic species*

The commercial offshore pelagic handline landings/trip averaged 180 pounds annually from 1993 through 2003 (Fig. 22b). Miami-Dade County generally had the highest overall landings/trip (Fig. 23c). Offshore pelagic handline catch/trip during the decade declined significantly for Atlantic bonito and for cobia ($p = 0.022$ and $p = 0.033$ respectively; Table 6).

## Marine Life Fishery (1994-2004)

The commercial marine life fishery provides live saltwater fishes, invertebrates, and plants primarily for use as ornamentals for the aquarium trade (Larkin and Adams, 2003). Regulations include daily bag limits, annual permitting requirements, and minimum and maximum size limits for fishes, such as butterfly fishes, angelfishes, gobies, jawfish, Spanish hogfish, and spotfin hogfish. There are prohibitions on the collection of longspine sea urchins, Bahamian starfish, sea fans, all hard, stony corals, and fire corals. Gear restrictions regulate the use of nets, trawls, and slurp guns. The use of chemicals, such as quinaldine, requires special licenses. Licensed wholesale dealers (i.e. buyers) are required to report license numbers, location of collection, the species and quantity purchased, and their value. A trip ticket

accompanies these transactions and reflects the total revenue received by collectors for specimens that survive to the first point of sale.

Information on numbers of organisms collected, fishing effort, catch per unit effort, and value of total harvest for the SEFCRI area (1990-2004) is shown in Table 7 for fish (Table 7a) and invertebrates (Table 7b). For fish, landings and effort declined significantly during the study period ($p < .003$ in both cases), leading to relatively stable catch per unit effort. For invertebrates, landings increased ($p = 0.046$) while effort decreased ($p = .001$), leading to an increase ($p = 0.003$) in catch per unit effort over time. For both fish and invertebrates, the decrease in effort (number of trips per year) over time was likely due to a moratorium issued in 1998 that restricts the number of permitted collectors.

**Table 7. SEFCRI area collection of marine life organisms (numbers) 1990-2004. (a.) fishes (b.) invertebrates (Data source: FWRI commercial fishery landings)**

(a.) Fishes

| Year | Number | Value ($) | Number Trips | Number/trip |
|---|---|---|---|---|
| 1990 | 61,716 | 222,494 | 5,213 | 11.84 |
| 1991 | 89,034 | 380,200 | 7,553 | 11.79 |
| 1992 | 122,275 | 390,073 | 9,940 | 12.30 |
| 1993 | 132,273 | 616,259 | 10,504 | 12.59 |
| 1994 | 140,321 | 688,227 | 10,611 | 13.22 |
| 1995 | 119,047 | 448,746 | 8,462 | 14.07 |
| 1996 | 89,837 | 413,780 | 5,560 | 16.16 |
| 1997 | 87,412 | 419,655 | 5,929 | 14.74 |
| 1998 | 52,803 | 257,543 | 5,097 | 10.36 |
| 1999 | 45,592 | 219,997 | 4,588 | 9.94 |
| 2000 | 57,310 | 271,994 | 4,199 | 13.65 |
| 2001 | 56,730 | 248,012 | 3,709 | 15.30 |
| 2002 | 44,625 | 185,772 | 3,260 | 13.69 |
| 2003 | 34,949 | 151,554 | 2,850 | 12.26 |
| 2004 | 38,240 | 165,739 | 2,814 | 13.59 |

(b.) Invertebrates

| Year | Number | Value ($) | Number Trips | Number/trip |
|---|---|---|---|---|
| 1990 | 525,332 | 298,038 | 2,997 | 175.29 |
| 1991 | 425,796 | 323,305 | 4,264 | 99.86 |
| 1992 | 408,943 | 270,690 | 5,204 | 78.58 |
| 1993 | 477,730 | 433,385 | 4,746 | 100.66 |
| 1994 | 361,409 | 317,141 | 4,667 | 77.44 |
| 1995 | 376,947 | 248,792 | 4,087 | 92.23 |
| 1996 | 380,465 | 190,778 | 2,949 | 129.01 |
| 1997 | 374,474 | 193,757 | 3,321 | 112.76 |
| 1998 | 520,593 | 187,229 | 3,063 | 169.96 |
| 1999 | 723,367 | 171,393 | 2,713 | 266.63 |
| 2000 | 673,685 | 193,984 | 2,384 | 282.59 |
| 2001 | 622,100 | 188,432 | 2,208 | 281.75 |
| 2002 | 622,594 | 179,585 | 2,376 | 262.03 |
| 2003 | 501,593 | 165,700 | 2,595 | 193.29 |
| 2004 | 517,223 | 175,832 | 2,572 | 201.10 |

**Considerations for Data Interpretation**

Trends in landings and effort can reflect many, often opposing, factors including changes in fishing regulations, resource productivity, and total fishing effort. Changes in landings can result from changes in abundance of targeted species, fishing effort, reporting, or combinations of the three. Changes in fishing effort can reflect changes in the number of participants, reporting, fishing technology, resource availability, economic factors such as fuel prices and market conditions, and weather. For example, we noted several times that hurricane Andrew, which hit Miami-Dade County in 1992, had apparent impacts on various fisheries in 1992 and 1993. Over the study period, fishery landings in the SEFCRI region were likely influenced by increased coastal urbanization and human population growth, as well as by the establishment of new regulations designed to reduce fishing mortality. Because of the multiple factors affecting landings and fishing effort, the results presented in this manuscript cannot be used as a sole indicator of the health of fishery stocks.

Additionally, this manuscript reports on fishery landings and effort, but does not address unreported landings, catch consumed at sea, or bycatch (dead discards and live releases either voluntary or mandatory). Also not addressed are questions concerning fishery interactions or ecological impacts of fishing on habitat, trophic cascades (Mumby et al., 2006), or ecosystem structure and function. Even if a stock is not overfished from a fishery perspective, it may be overfished from an ecosystem perspective (Pikitch et al., 2004).

## SUMMARY

In this study we profile fisheries in the SEFCRI region by sector (recreational, commercial, and headboat fisheries) and by species composition (offshore pelagic, coastal, reef, or invertebrate species) from 1990 through 2000. We used a spatially based, sub-ecosystem approach to profile marine fisheries in the SEFCRI region, recognizing that all types of fishing are part of the human dimension of the coastal ecosystem.

On average, 21.4 million pounds of fish and invertebrates per year were harvested from SEFCRI waters. Total annual finfish landings averaged 20.7 million pounds, and declined significantly over time.

The recreational sector was responsible for 66% of total reported annual landings, followed by the commercial (31%) and headboat (3%) sectors. Total annual landings for the recreational sector varied without trend during the study period, but declined significantly for both commercial and headboat sectors. Thus, the proportion of total landings (recreational, commercial and headboat sectors combined) attributed to the recreational sector increased significantly over time.

For reef fishes alone, total annual landings from all sectors over the 11-yr study period averaged 4.79 million lbs and were composed of 68% recreational, 27% commercial, and 5% headboat landings. No significant trend was detected in total annual reef fish landings for the recreational sector, while significant declines were detected for both headboat and commercial sectors.

## Acknowledgments

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## Literature Cited

Ault, J.S., S.G. Smith, G.A. Meester, J. Luo, and J.A. Bohnsack. 2001. Site characterization for Biscayne National Park: assessment of fisheries resources and habitats. NOAA Technical Memorandum NMFS-SEFSC-468: 156 p.

Ault, J.S., Bohnsack, J.A. and S.G. Smith. 2005. Towards sustainable multispecies fisheries in the Florida USA coral reef ecosystem. Bulletin of Marine Science 76(2): 592-622.

Bannerot, S.P. 1990. Fish communities and fisheries biology. Pages 231-265 in Continental Shelf Associates, Inc. Synthesis of available biological, geological, socioeconomic, and cultural resources for the south Florida area. U.S. Department of Interior Minerals and Management Services OCS Study MMS 90-0019. 745 p.

Blair, S.M., and B.S. Flynn. 1989. Biological monitoring of hard bottom reef communities off Dade County Florida: Community description. Diving for Science 1989: 9-24.

Bohnsack, J.A., D.L. Sutherland, D.E. Harper, D.B. McClellan, M.W. Hulsbeck, and C.M. Holt. 1989. The effects of fish trap mesh size on reef fish catch off southeastern Florida. Marine Fisheries Review 51(2): 36-46.

Bohnsack, J.A., Ault, J.S. and B. Causey. 2004. Why have no-take marine protected areas? American Fisheries Society Symposium 42: 185-193.

Chester, A. J., G.R. Huntsman, P.A. Tester, and C.S. Manooch, III. 1984. South Atlantic Bight reef fish communities as represented in hook-and-line catches. Bulletin of Marine Science 34: 267-279.

Department of Commerce. 2002. Fisheries of the United States 2001. National Marine Fisheries Service, National Oceanic and Atmospheric Administration. Silver Spring, MD. 126 p.

Fleur, F., L.K. Jordan, and R.E. Spieler. 2005. The marine fishes of Broward county, Florida. Final report of 1998-2002 survey results. NOAA Technical Memorandum NMFS-SEFSC-532: 73 p.

FFWCC. 2005. Florida Fish and Wildlife Conservation Commission, Fish & Wildlife Research Institute and the National Coral Reef Institute, Nova Southeastern University Oceanographic Center. Southeast Florida Coral Reef Evaluation and Monitoring Project. 2004 Year 2 Final Report for FDEP contract # G0099. 18 p.

Harper, D. E., J. A. Bohnsack, and B.R. Lockwood. 2000. Recreational fisheries in Biscayne National Park, Florida, 1976-1991. Marine Fisheries Review. 62(1): 8-26.

Huntsman, G.R. 1976. Offshore headboat fishing in North Carolina and South Carolina. Marine Fisheries Review. 38: 13-33.

Huntsman, G.R. and P.W. Willis. 1989. Status of reef fish stocks off North Carolina and South Carolina as reviewed by headboat catch statistics. North Carolina Coastal Oceanography Symposium. NOAA NURP Rept. 89-2: 387-454.

Johns, G. M., V. R. Leeworthy, F. W. Bell, and M. A. Bonn. 2001. Socioeconomic study of reefs in southeast Florida: Final Report. Hazen and Sawyer Environmental Engineers and Scientists, New York. 349 p.

D.R. Johnson, J. A. Browder, M. B. Robblee, J. Hall, D. Hazra, and P. Brown-Eyo. 2006. The Biscayne Bay Commercial Shrimp Fisheries 1986-2005 and Relationship with Salinity and Freshwater Flow. SEFRC Protected Resources and Biodiversity Division Report. SEFRC Protected Resources and Biodiversity Division Report to the South Florida Water Management District. Agreement C13401-A02. Biscayne Bay Partnership Initiative. 63 p.

Larkin, S. L. and C. M. Adams. 2003. The marine life fishery in Florida, 1990-98. Marine Fisheries Review 65(1): 21-31.

McKenna, J.E. Jr. 1997. Structure and dynamics of the fishery harvest in Broward county, Florida, during 1989. Fishery Bulletin 95: 114-125.

Mumby, P.J. C.P. Dahlgren, A.R. Harborne, C.V. Kappel, F. Micheli, D.R. Brumbaugh, K.E. Holmes, J.M. Mendes, K. Broad, J.N. Sanchirico, K. Buch, S. Box, R.W. Stoffle, A.B. Gill. 2006. Fishing, trophic cascades, and the process of grazing on coral reefs. Science 311: 90-101.

NRC (Committee on the Review of Recreational Fisheries Survey Methods, National Research Council). 2006. Review of Recreational Fisheries Survey Methods. National Academies Press. 202 p.

Pikitch, E.K., C. Santora, E.A. Babcock, A. Bakun, R. Bonfil, D.O. Conover, P. Dayton, P. Doukakis, D. Fluharty, B. Heneman, E.D. Houde, J. Link, P.A. Livingston, M. Mangel, M.K. McAllister, J. Pope, K.J. Sainsbury. 2004. Ecosystem-based fishery Management. Science 305: 346-7.

SEFCRI Team. 2004. Southeast Florida coral reef initiative: a local action strategy. Florida Dept. of Environmental Protection, Office of Coastal and Aquatic Managed Areas. 29 p.

Sharp, WC, RD Bertelsen, and VR Leeworthy. 2005. Long-term trends in the recreational lobster fishery of Florida, United States: landings, effort, and implications for management. New Zealand Journal of Marine and Freshwater Research 39 (3): 733-747.

Sluka, R.D., M. Chiappone, and K.M. Sullivan. 2001 Influence of habitat on grouper abundance in the Florida Keys, U.S.A. Journal of Fisheries Biology 58(3): 682-700.

Sutherland, D.L. and D.E. Harper. 1983. The wire fish-trap fishery of Dade and Broward counties, Florida December 1979–September 1980. Florida. Marine Research Publication Number 40. 21 p.

Thompson, T.E., D.G. Lindquist, I.E. Clavijo, S.K. Bolden, S.W. Burk, and N.C. Drayton. 1990. Assessment of reef fishes at Sombrero Key, Florida. Proceedings of the American Academy of Underwater Sciences 10th Symposium: 375-381.

Tilmant, J. 1979. Observations on the impact of shrimp roller frame trawls operated over hard-bottom communities, Biscayne Bay, Florida. National Park Service/Biscayne National Monument Report Series No. P-553. 23 p.

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**Appendix A. Common and scientific names, fishing category, and data source(s) reporting the species/group.**

| | | | DATA SOURCES | | | |
|---|---|---|---|---|---|---|
| **Common name** | **Scientific name** | **Fishing category** | **Commercial** | **Recreational** | **Headboat** | **Commercial Logbook** |
| Atlantic croaker | *Micropogonias undulatus* | Coastal | | x | | x |
| Atlantic cutlassfish | *Trichiurus lepturus* | Coastal | | x | | |
| Atlantic moonfish | *Selene setapinnis* | Coastal | | x | | x |
| Atlantic needlefish | *Strongylura marina* | Coastal | | x | | |
| Atlantic stingray | *Dasyatis sabina* | Coastal | | x | | |
| Atlantic thread herring | *Opisthonema oglinum* | Coastal | x | x | | |
| Atlantic threadfin | *Polydactylus octonemus* | Coastal | | x | | |
| Ballyhoo | *Hemiramphus brasiliensis* | Coastal | x | x | | |
| Banded drum | *Larimus fasciatus* | Coastal | | x | | |
| Barbfish | *Scorpaena brasiliensis* | Coastal | | | x | |
| Bigeye scad | *Selar crumenophthalmus* | Coastal | | x | x | x |
| Black drum | *Pogonias cromis* | Coastal | x | | | |
| Blueback herring | *Alosa aestivalis* | Coastal | | x | | |
| Bluefish | *Pomatomus saltatrix* | Coastal | x | x | x | x |
| Bonefish | *Albula vulpes* | Coastal | | x | | |
| Bullet mackerel | *Auxis rochei* | Coastal | | x | | |
| Butterfish | *Peprilus triacanthus* | Coastal | | | x | |
| Chub mackerel | *Scomber japonicus* | Coastal | | | x | |
| Coastal fishes | | Coastal | x | | | |
| Common snook | *Centropomus undecimalis* | Coastal | | x | | |
| Dwarf sand perch | *Diplectrum bivittatum* | Coastal | | x | | |
| False pilchard | *Harengula clupeola* | Coastal | | x | | |
| Finfish, uncl. | | Coastal | x | | | x |
| Finfishes, food | | Coastal | x | | | x |
| Flat needlefish | *Ablennes hians* | Coastal | | x | | |
| Florida pompano | *Trachinotus carolinus* | Coastal | x | x | | x |
| Flounders | Pleuronectiformes | Coastal | x | | | |
| Flying gurnard | *Dactylopterus volitans* | Coastal | | | x | |
| Gafftopsail catfish | *Bagre marinus* | Coastal | | x | x | |
| Gray seatrout | *Cynoscion regalis* | Coastal | | | | x |
| Guaguanche | *Sphyraena guachancho* | Coastal | | x | | |
| Gulf flounder | *Paralichthys albigutta* | Coastal | | x | | |
| Gulf kingfish | *Menticirrhus littoralis* | Coastal | | x | | |
| Gulf toadfish | *Opsanus beta* | Coastal | | x | | |
| Hakes | *Urophycis* spp. | Coastal | | | | x |
| Hardhead catfish | *Arius felis* | Coastal | | x | | |
| Houndfish | *Tylosaurus crocodiles* | Coastal | | x | | |
| Inshore lizardfish | *Synodus foetens* | Coastal | | x | x | |
| Irish pompano | *Diapterus auratus* | Coastal | | x | | |
| King mackerel | *Scomberomorus cavalla* | Coastal | x | x | x | x |
| Kingfishes, uncl. | *Menticirrhus* spp. | Coastal | | | x | x |
| Ladyfish | *Elops saurus* | Coastal | | x | x | |
| Leatherjacket | *Oligoplites saurus* | Coastal | | x | x | |
| Lefteye flounders | Bothidae | Coastal | | | x | |
| Lookdown | *Selene vomer* | Coastal | | x | x | |
| Mackerel scad | *Decapterus macarellus* | Coastal | | x | x | |
| Menhadens | *Brevoortia* spp. | Coastal | x | | | |
| Mullets | Mugilidae | Coastal | | | | x |
| Northern kingfish | *Menticirrhus saxatilis* | Coastal | | x | | |
| Northern sennet | *Sphyraena borealis* | Coastal | | x | x | |
| Ocean perch | *Sebastes marinus* | Coastal | | | | x |
| Ocellated flounder | *Ancylopsetta quadrocellata* | Coastal | | x | | |

**Appendix A (cont). Common and scientific names, fishing category, and data source(s) reporting the species/group.**

| | | | DATA SOURCES | | | |
|---|---|---|---|---|---|---|
| **Common name** | **Scientific name** | **Fishing category** | **Commercial** | **Recreational** | **Headboat** | **Commercial Logbook** |
| Offshore lizardfish | *Synodus poeyi* | Coastal | | | x | |
| Palometa | *Trachinotus goodei* | Coastal | | x | | |
| Peacock flounder | *Bothus lunatus* | Coastal | | | x | |
| Pearly razorfish | *Xyrichtys novacula* | Coastal | | | x | |
| Permit | *Trachinotus falcatus* | Coastal | x | x | x | |
| Pinfish | *Lagodon rhomboides* | Coastal | | x | | |
| Pompano dolphin | *Coryphaena equiselis* | Coastal | | x | | |
| Red drum | *Sciaenops ocellatus* | Coastal | | x | x | |
| Redeye mullet | *Mugil gaimardianus* | Coastal | | x | | |
| Remora | *Remora remora* | Coastal | | x | x | |
| Round scad | *Decapterus punctatus* | Coastal | | x | | |
| Sand diver | *Synodus intermedius* | Coastal | | x | | |
| Sand drum | *Umbrina coroides* | Coastal | | x | | |
| Sand perch | *Diplectrum formosum* | Coastal | | x | x | x |
| Scaled sardine | *Harengula jaguana* | Coastal | | x | | |
| Scup | *Stenotomus chrysops* | Coastal | | x | x | |
| Sea bream | *Archosargus rhomboidalis* | Coastal | | x | | |
| Silver perch | *Bairdiella chrysoura* | Coastal | | x | | |
| Silver seatrout | *Cynoscion nothus* | Coastal | | x | x | |
| Smooth skate | *Raja senta* | Coastal | | x | | |
| Snook, unidentified | *Centropomus* spp. | Coastal | | | x | |
| Southern flounder | *Paralichthys lethostigma* | Coastal | | x | | |
| Southern hake | *Urophycis floridana* | Coastal | | | x | |
| Southern kingfish | *Menticirrhus americanus* | Coastal | | x | | |
| Southern sennet | *Sphyraena picudilla* | Coastal | | | x | |
| Southern stingray | *Dasyatis americana* | Coastal | | x | | |
| Spanish mackerel | *Scomberomorus maculatus* | Coastal | x | x | x | x |
| Spanish sardine | *Sardinella aurita* | Coastal | x | | | |
| Spot | *Leiostomus xanthurus* | Coastal | | x | x | |
| Spotfin mojarra | *Eucinostomus argenteus* | Coastal | | x | | |
| Spottail pinfish | *Diplodus holbrooki* | Coastal | | x | x | x |
| Spotted seatrout | *Cynoscion nebulosus* | Coastal | x | x | | |
| Stingray family | Dasyatidae | Coastal | | | x | |
| Striped mojarra | *Diapterus plumieri* | Coastal | | x | | |
| Striped mullet | *Mugil cephalus* | Coastal | x | x | | |
| Summer flounder | *Paralichthys dentatus* | Coastal | | x | x | |
| Tarpon snook | *Centropomus pectinatus* | Coastal | | x | | |
| Timucu | *Strongylura timucu* | Coastal | | x | | |
| Tripletail | *Lobotes surinamensis* | Coastal | | x | x | x |
| Unicornfish | *Alutera scripta* | Coastal | | | x | |
| Weakfishes | *Cynoscion* spp. | Coastal | | x | x | |
| White mullet | *Mugil curema* | Coastal | x | x | | |
| White seatrout | *Cynoscion arenarius* | Coastal | x | | | x |
| Yellowfin mojarra | *Gerres cinereus* | Coastal | | x | | |
| Albacore | *Thunnus alalunga* | Pelagic | | x | | x |
| Atlantic bonito | *Sarda sarda* | Pelagic | x | x | x | x |
| Atlantic sharpnose shark | *Rhizoprionodon terraenovae* | Pelagic | | x | x | x |
| Bigeye tuna | *Thunnus obesus* | Pelagic | | x | | x |
| Blackfin tuna | *Thunnus atlanticus* | Pelagic | x | x | x | x |
| Blacknose shark | *Carcharhinus acronotus* | Pelagic | | x | x | x |
| Blacktip shark | *Carcharhinus limbatus* | Pelagic | | x | x | x |
| Blue marlin | *Makaira nigricans* | Pelagic | | x | | |

**Appendix A (cont). Common and scientific names, fishing category, and data source(s) reporting the species/group.**

| | | | DATA SOURCES | | | |
|---|---|---|---|---|---|---|
| **Common name** | **Scientific name** | **Fishing category** | **Commercial** | **Recreational** | **Headboat** | **Commercial Logbook** |
| Bluefin tuna | *Thunnus thynnus* | Pelagic | x | x | x | |
| Bonnethead | *Sphyrna tiburo* | Pelagic | | x | x | x |
| Bull shark | *Carcharhinus leucas* | Pelagic | | x | x | x |
| Cobia | *Rachycentron canadum* | Pelagic | x | x | x | x |
| Dogfish sharks, uncl. | Squalidae | Pelagic | | | | x |
| Dolphinfish | *Coryphaena hippurus* | Pelagic | x | x | x | x |
| Dusky shark | *Carcharhinus obscurus* | Pelagic | | | x | x |
| Finetooth shark | *Carcharhinus isodon* | Pelagic | | | | x |
| Frigate mackerel | *Auxis thazard* | Pelagic | | | x | |
| Great hammerhead | *Sphyrna mokarran* | Pelagic | | x | x | x |
| Houndfish | *Tylosaurus crocodiles* | Pelagic | | x | x | |
| Lemon shark | *Negaprion brevirostris* | Pelagic | | | x | x |
| Little tunny | *Euthynnus alletteratus* | Pelagic | | x | x | x |
| Mako shark,uncl. | *Isurus* spp. | Pelagic | | | x | x |
| Marlinsucker | *Remora osteochir* | Pelagic | | x | | |
| Nurse shark | *Ginglymostoma cirratum* | Pelagic | | x | x | |
| Pelagic fishes | | Pelagic | x | | | |
| Reef shark | *Carcharhinus perezi* | Pelagic | | x | x | |
| Sailfish | *Istiophorus platypterus* | Pelagic | | x | x | x |
| Sand shark | *Carcharias taurus* | Pelagic | | | | x |
| Sand tiger shark | *Odontaspis taurus* | Pelagic | | | | x |
| Sandbar shark | *Carcharhinus plumbeus* | Pelagic | | | x | |
| Scalloped hammerhead | *Sphyrna lewini* | Pelagic | | x | | |
| Shark fins | Squaliformes | Pelagic | | | | x |
| Shark, uncl. | Chondrichthyes | Pelagic | x | | x | x |
| Silky shark | *Carcharhinus falciformis* | Pelagic | | x | x | x |
| Skipjack tuna | *Euthynnus pelamis* | Pelagic | | x | x | x |
| Smooth hammerhead | *Sphyrna zygaena* | Pelagic | | x | | |
| Spinner shark | *Carcharhinus brevipinna* | Pelagic | | x | x | |
| Swordfish | *Xiphias gladius* | Pelagic | x | | | x |
| Tiger shark | *Galeocerdo cuvier* | Pelagic | | | | x |
| Tunas, uncl. | *Thunnus* spp. | Pelagic | x | | | x |
| Wahoo | *Acanthocybium solandri* | Pelagic | x | x | x | x |
| Yellowfin tuna | *Thunnus albacares* | Pelagic | x | x | x | x |
| African pompano | *Alectis ciliaris* | Reef fish | | x | x | x |
| Almaco jack | *Seriola rivoliana* | Reef fish | x | x | x | x |
| Amberjacks, uncl. | *Seriola* spp. | Reef fish | | | | x |
| Atlantic spadefish | *Chaetodipterus faber* | Reef fish | | x | x | |
| Balloonfish | *Diodon holocanthus* | Reef fish | | x | | |
| Banded rudderfish | *Seriola zonata* | Reef fish | x | x | x | x |
| Bandtail puffer | *Sphoeroides spengleri* | Reef fish | | x | | |
| Bank sea bass | *Centropristis ocyurus* | Reef fish | | | x | |
| Bar jack | *Caranx ruber* | Reef fish | x | x | x | x |
| Barracuda | Sphyraenidae | Reef fish | x | | | x |
| Bermuda chub | *Kyphosus sectatrix* | Reef fish | | x | x | |
| Bigeye | *Priacanthus arenatus* | Reef fish | | x | x | x |
| Bigeye soldierfish | *Ostichthys trachypoma* | Reef fish | | x | | |
| Black durgon | *Melichthys niger* | Reef fish | | | x | |
| Black grouper | *Mycteroperca bonaci* | Reef fish | x | x | x | x |
| Black jack | *Caranx lugubris* | Reef fish | | | x | |
| Black margate | *Anisotremus surinamensis* | Reef fish | | x | x | x |
| Black sea bass | *Centropristis striata* | Reef fish | | x | x | x |

**Appendix A (cont). Common and scientific names, fishing category, and data source(s) reporting the species/group.**

| | | | DATA SOURCES | | | |
|---|---|---|---|---|---|---|
| **Common name** | **Scientific name** | **Fishing category** | **Commercial** | **Recreational** | **Headboat** | **Commercial Logbook** |
| Black snapper | *Apsilus dentatus* | Reef fish | | | x | |
| Blackbelly rosefish | *Helicolenus dactylopterus* | Reef fish | | x | | x |
| Blackfin snapper | *Lutjanus buccanella* | Reef fish | x | x | x | x |
| Blackline tilefish | *Caulolatilus cyanops* | Reef fish | | x | | |
| Blue hamlet | *Hypoplectrus gemma* | Reef fish | | | x | |
| Blue runner | *Caranx crysos* | Reef fish | x | x | x | x |
| Blue tang | *Acanthurus coeruleus* | Reef fish | | | x | |
| Bluehead | *Thalassoma bifasciatum* | Reef fish | | | x | |
| Blueline tilefish | *Caulolatilus microps* | Reef fish | | x | x | x |
| Bluespotted cornetfish | *Fistularia commersonii* | Reef fish | | | x | |
| Bluestriped grunt | *Haemulon sciurus* | Reef fish | | x | x | x |
| Burro grunt | *Pomadasys crocro* | Reef fish | | | x | |
| Caesar grunt | *Haemulon carbonarium* | Reef fish | | x | x | |
| Cero | *Scomberomorus regalis* | Reef fish | | x | x | x |
| Checkered puffer | *Sphoeroides testudineus* | Reef fish | | x | | |
| Coney | *Epinephelus fulvus* | Reef fish | x | x | x | |
| Cottonwick grunt | *Haemulon melanurum* | Reef fish | | | x | x |
| Crevalle jack | *Caranx hippos* | Reef fish | x | x | x | |
| Cubera snapper | *Lutjanus cyanopterus* | Reef fish | x | x | x | x |
| Doctorfish | *Acanthurus chirurgus* | Reef fish | | | x | |
| Dog snapper | *Lutjanus jocu* | Reef fish | x | x | x | x |
| French grunt | *Haemulon flavolineatum* | Reef fish | | x | x | x |
| Gag grouper | *Mycteroperca microlepis* | Reef fish | x | x | x | x |
| Glasseye snapper | *Priacanthus cruentatus* | Reef fish | | x | | |
| Goatfishes | Mullidae | Reef fish | | | | x |
| Goldface tilefish | *Caulolatilus chrysops* | Reef fish | | | x | |
| Goliath grouper | *Epinephelus itajara* | Reef fish | x | | x | |
| Grass porgy | *Calamus arctifrons* | Reef fish | | x | x | |
| Gray angelfish | *Pomacanthus arcuatus* | Reef fish | | x | | |
| Gray snapper | *Lutjanus griseus* | Reef fish | x | x | x | x |
| Gray triggerfish | *Balistes capriscus* | Reef fish | | x | x | x |
| Graysby | *Epinephelus cruentatus* | Reef fish | x | x | x | x |
| Great barracuda | *Sphyraena barracuda* | Reef fish | | x | x | |
| Greater amberjack | *Seriola dumerili* | Reef fish | x | x | x | x |
| Green moray | *Gymnothorax funebris* | Reef fish | | | x | |
| Groupers, uncl. | Serranidae | Reef fish | x | | | x |
| Grunts, uncl. | Haemulidae | Reef fish | x | x | | x |
| Harlequin bass | *Serranus tigrinus* | Reef fish | | | x | |
| Hogfish | *Lachnolaimus maximus* | Reef fish | x | x | x | x |
| Honeycomb cowfish | *Acanthostracion polygonus* | Reef fish | | x | | |
| Horse-eye jack | *Caranx latus* | Reef fish | | x | x | x |
| Jacks, uncl. | Carangidae | Reef fish | | | x | x |
| Jolthead porgy | *Calamus bajonado* | Reef fish | | x | x | x |
| Knobbed porgy | *Calamus nodosus* | Reef fish | | x | x | x |
| Lane snapper | *Lutjanus synagris* | Reef fish | x | x | x | x |
| Lantern bass | *Serranus baldwini* | Reef fish | | | x | |
| Least puffer | *Sphoeroides parvus* | Reef fish | | x | | |
| Lesser amberjack | *Seriola fasciata* | Reef fish | | x | x | x |
| Littlehead porgy | *Calamus proridens* | Reef fish | | x | x | |
| Longspine porgy | *Stenotomus caprinus* | Reef fish | | x | x | |
| Mahogany snapper | *Lutjanus mahogoni* | Reef fish | x | x | x | |
| Margate | *Haemulon album* | Reef fish | | x | x | x |

**Appendix A (cont). Common and scientific names, fishing category, and data source(s) reporting the species/group.**

| | | | DATA SOURCES | | | |
|---|---|---|---|---|---|---|
| **Common name** | **Scientific name** | **Fishing category** | **Commercial** | **Recreational** | **Headboat** | **Commercial Logbook** |
| Misty grouper | *Epinephelus mystacinus* | Reef fish | | | x | x |
| Mutton snapper | *Lutjanus analis* | Reef fish | x | x | x | x |
| Nassau grouper | *Epinephelus striatus* | Reef fish | x | x | x | |
| Northern puffer | *Sphoeroides maculatus* | Reef fish | | x | | |
| Ocean surgeon | *Acanthurus bahianus* | Reef fish | | x | x | |
| Ocean triggerfish | *Canthidermis sufflamen* | Reef fish | | x | x | x |
| Ocellated moray | *Gymnothorax ocellatus* | Reef fish | | | x | |
| Painted wrasse | *Halichoeres caudalis* | Reef fish | | x | | |
| Parrotfishes | Scaridae | Reef fish | | | x | x |
| Pigfish | *Orthopristis chrysoptera* | Reef fish | | x | x | |
| Porgy family | Sparidae | Reef fish | | x | | x |
| Porkfish | *Anisotremus virginicus* | Reef fish | | x | x | |
| Puddingwife | *Halichoeres radiatus* | Reef fish | | x | | |
| Puffers | Tetraodontidae | Reef fish | | | x | |
| Pygmy moray | *Anarchias similis* | Reef fish | | x | | |
| Queen parrotfish | *Scarus vetula* | Reef fish | | x | | |
| Queen snapper | *Etelis oculatus* | Reef fish | | x | | x |
| Queen triggerfish | *Balistes vetula* | Reef fish | | x | x | x |
| Rainbow runner | *Elagatis bipinnulata* | Reef fish | | x | x | x |
| Rainbow wrasse | *Halichoeres pictus* | Reef fish | | x | | |
| Red grouper | *Epinephelus morio* | Reef fish | x | x | x | x |
| Red hind | *Epinephelus guttatus* | Reef fish | | x | x | x |
| Red hogfish | *Decodon puellaris* | Reef fish | | x | | |
| Red porgy | *Pagrus pagrus* | Reef fish | | x | x | x |
| Red snapper | *Lutjanus campechanus* | Reef fish | x | x | x | x |
| Redband parrotfish | *Sparisoma aurofrenatum* | Reef fish | | x | | |
| Redfin parrotfish | *Sparisoma rubripinne* | Reef fish | | x | | |
| Redtail parrotfish | *Sparisoma chrysopterum* | Reef fish | | x | | |
| Reef fishes | | Reef fish | x | | | |
| Rock hind | *Epinephelus adscensionis* | Reef fish | | x | x | x |
| Rough triggerfish | *Canthidermis maculata* | Reef fish | | | x | |
| Rudderfish (sea chubs) | Kyphosidae | Reef fish | | | | x |
| Sailor's choice | *Haemulon parrai* | Reef fish | | x | x | |
| Sand tilefish | *Malacanthus plumieri* | Reef fish | | x | x | x |
| Saucereye porgy | *Calamus calamus* | Reef fish | | x | x | |
| Scamp | *Mycteroperca phenax* | Reef fish | x | x | x | x |
| Schoolmaster | *Lutjanus apodus* | Reef fish | x | x | x | x |
| Scorpionfishes | Scorpaenidae | Reef fish | | | x | x |
| Scrawled cowfish | *Lactophrys quadricornis* | Reef fish | | x | x | |
| Scrawled filefish | *Aluterus scriptus* | Reef fish | | x | x | |
| Sergeant major | *Abudefduf saxatilis* | Reef fish | | x | | |
| Sheepshead | *Archosargus probatocephalus* | Reef fish | | x | x | x |
| Sheepshead porgy | *Calamus penna* | Reef fish | | x | x | |
| Short Bigeye | *Pristigenys alta* | Reef fish | | x | x | |
| Shrimp eel | *Ophichthus gomesi* | Reef fish | | x | | |
| Silk snapper | *Lutjanus vivanus* | Reef fish | x | x | x | x |
| Silver porgy | *Diplodus argenteus* | Reef fish | | x | | |
| Smooth puffer | *Lagocephalus laevigatus* | Reef fish | | | x | |
| Snappers | Lutjanidae | Reef fish | x | | | x |
| Snowy grouper | *Epinephelus niveatus* | Reef fish | x | x | x | x |
| Southern puffer | *Sphoeroides nephelus* | Reef fish | | x | | |
| Spadefishes | Ephippidae | Reef fish | | | | x |

**Appendix A (cont). Common and scientific names, fishing category, and data source(s) reporting the species/group.**

| | | | DATA SOURCES | | | |
|---|---|---|---|---|---|---|
| **Common name** | **Scientific name** | **Fishing category** | **Commercial** | **Recreational** | **Headboat** | **Commercial Logbook** |
| Spanish grunt | *Haemulon macrostomum* | Reef fish | | x | | |
| Spanish hogfish | *Bodianus rufus* | Reef fish | | x | x | |
| Speckled hind | *Epinephelus drummondhayi* | Reef fish | | x | x | x |
| Spinycheek scorpionfish | *Neomerinthe hemingwayi* | Reef fish | | x | | |
| Spotted burrfish | *Chilomycterus atringa* | Reef fish | | x | | |
| Spotted goatfish | *Pseudupeneus maculatus* | Reef fish | | | x | |
| Spotted moray | *Gymnothorax moringa* | Reef fish | | | x | |
| Spotted soapfish | *Rypticus saponaceus* | Reef fish | | | x | |
| Squirrelfish | *Holocentrus adscensionis* | Reef fish | | x | x | |
| Squirrelfishes | Holocentridae | Reef fish | | | | x |
| Stoplight parrotfish | *Sparisoma viride* | Reef fish | | x | x | |
| Striped grunt | *Haemulon striatum* | Reef fish | | x | | |
| Tilefish | *Lopholatilus chamaeleonticeps* | Reef fish | | x | | x |
| Tilefishes | Malacanthidae | Reef fish | | x | | |
| Tomtate grunt | *Haemulon aurolineatum* | Reef fish | | x | x | x |
| Triggerfishes | Balistidae | Reef fish | | | | x |
| Trunkfish | *Lactophrys trigonus* | Reef fish | | x | x | |
| Unicorn filefish | *Aluterus monoceros* | Reef fish | | x | | |
| Vermilion snapper | *Rhomboplites aurorubens* | Reef fish | x | x | x | x |
| Warsaw grouper | *Epinephelus nigritus* | Reef fish | x | x | x | x |
| Wenchman | *Pristipomoides aquilonaris* | Reef fish | | | | x |
| White grunt | *Haemulon plumieri* | Reef fish | | x | x | x |
| Whitebone porgy | *Calamus leucosteus* | Reef fish | | x | x | x |
| Wreckfish | *Polyprion americanus* | Reef fish | | | | x |
| Yellow chub | *Kyphosus incisor* | Reef fish | | x | | |
| Yellow jack | *Caranx bartholomaei* | Reef fish | | x | x | x |
| Yellowedge grouper | *Epinephelus flavolimbatus* | Reef fish | x | | x | x |
| Yellowfin grouper | *Mycteroperca venenosa* | Reef fish | x | x | x | x |
| Yellowmouth grouper | *Mycteroperca interstitialis* | Reef fish | | | x | x |
| Yellowtail snapper | *Ocyurus chrysurus* | Reef fish | x | x | x | x |
| Blue crab | *Callinectes sapidus* | Invertebrates | x | | | |
| Stone crab (claws) | *Menippe mercenaria* | Invertebrates | x | | | |
| Spiny lobster | *Panulirus argus* | Invertebrates | x | | | |
| Invertebrates | | Invertebrates | x | | | |
| Brown shrimp | *Penaeus aztecus* | Invertebrates | x | | | |
| White shrimp | *Penaeus setiferus* | Invertebrates | x | | | |
| Pink shrimp | *Farfantepenaeus duorarum* | Invertebrates | x | | | |
| Shrimp, unidentified | Penaeidae | Invertebrates | x | | | |
| Sponge, grass ** | *Spongia* spp. | Sponges | x | | | |
| Sponge, sheepswool ** | *Hippospongia* spp. | Sponges | x | | | |
| Sponge, yellow ** | *Spongia* spp. | Sponges | x | | | |