

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 landings¹. 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.

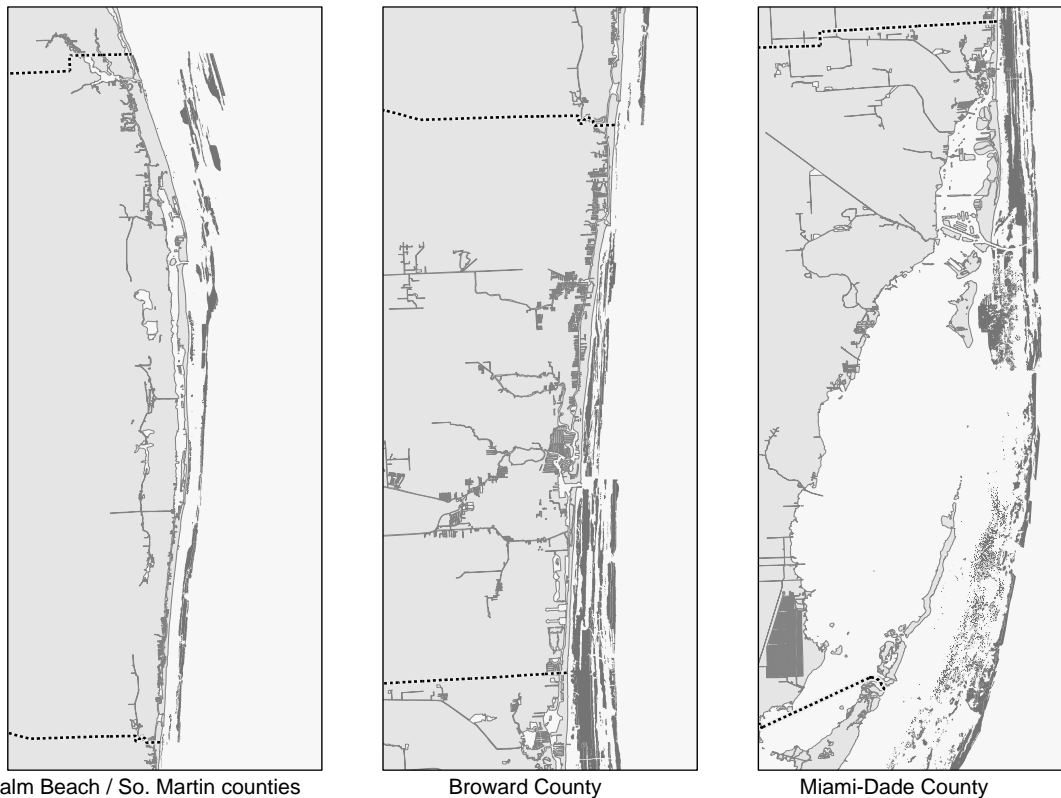


Figure 1. Map of SEFCRI region showing reef distribution. Figure source: Florida Fish and Wildlife Conservation Commission (FWC).

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, 1990-2000². 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 data³ 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 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 forms⁴. 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.

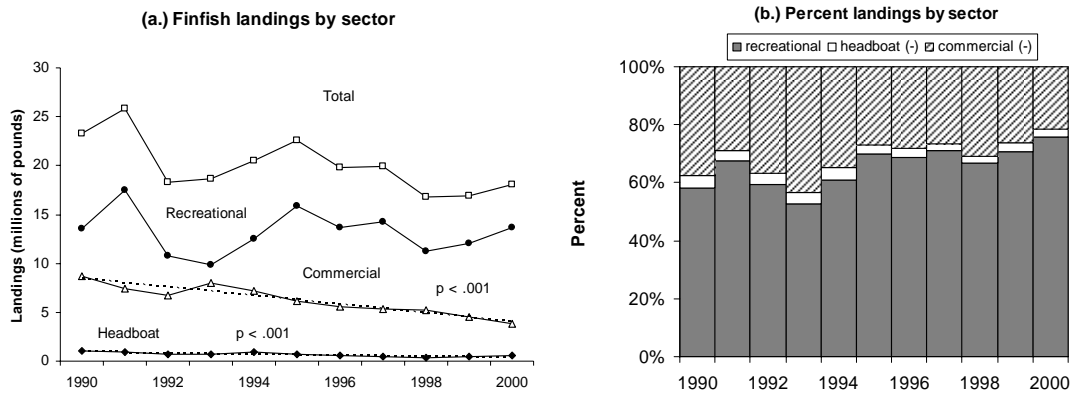


Figure 2. Total annual finfish landings (millions of pounds) in the SEFCRI region (a.) by recreational, commercial, and headboat sources, (b.) percent contribution by source. Dotted lines show significant ($p < 0.05$) linear trends.

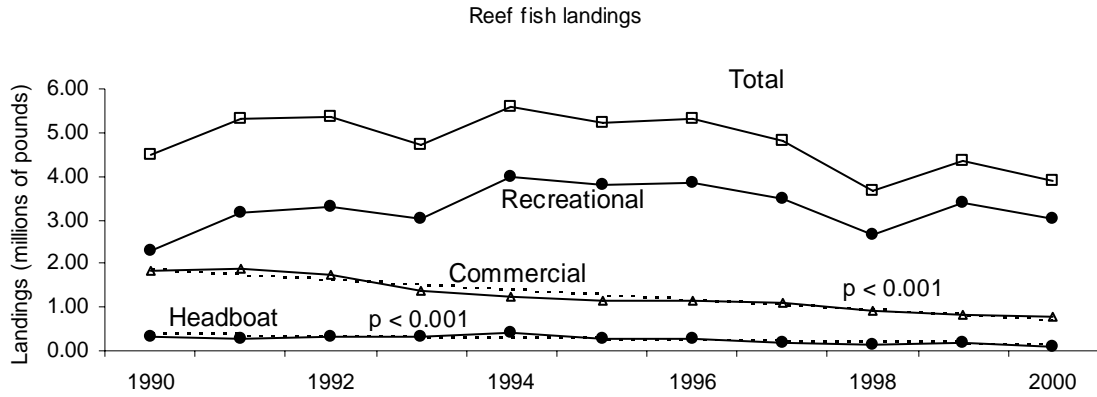


Figure 3. Reef fish landings (in millions of pounds) for the Headboat, Commercial, and Recreational sectors, and for all sectors combined (Total).

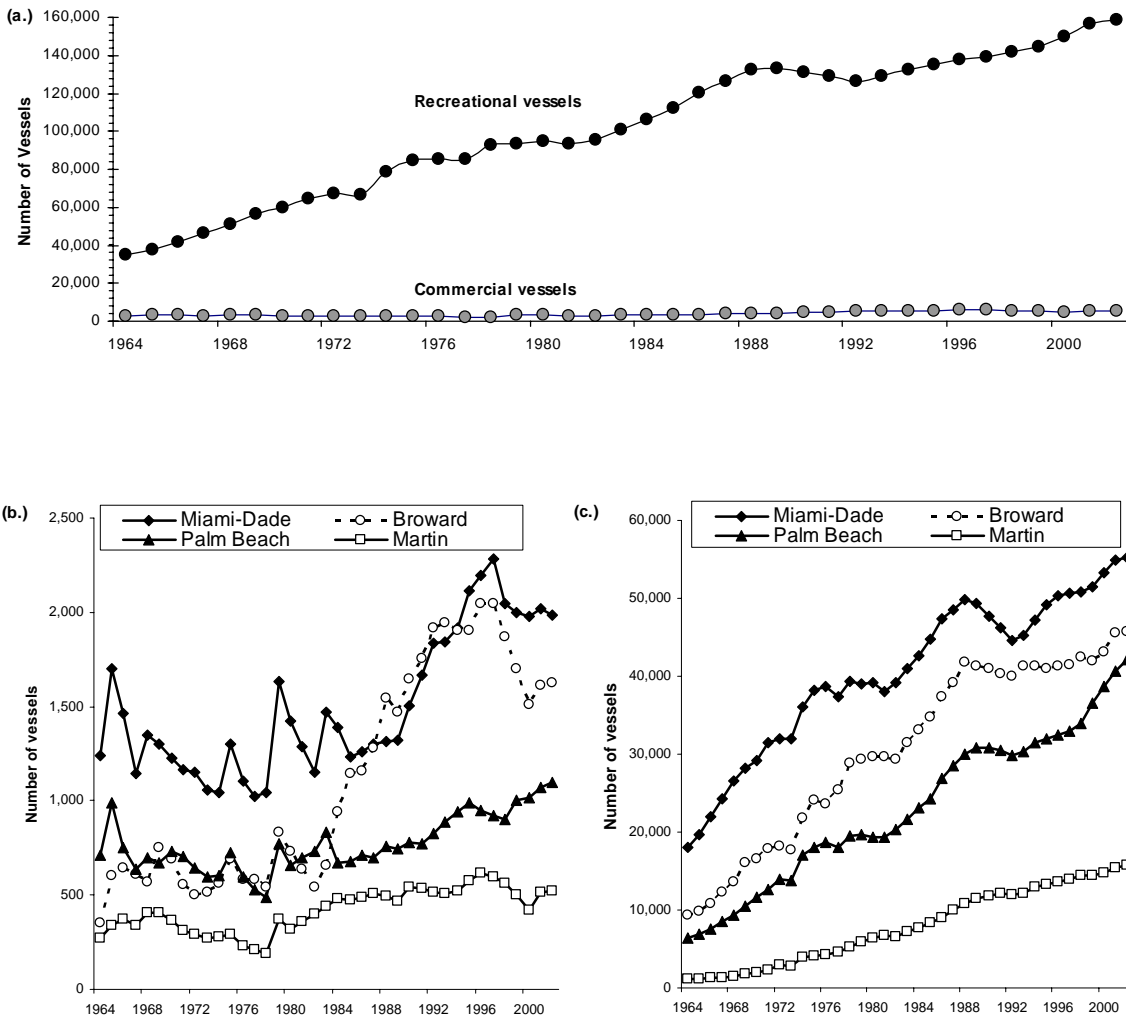


Figure 4. Trends in total registered vessels in the SEFCRI region, 1964-2001. (a.) Total number of registered recreational and commercial vessels. (b.) Number of registered commercial vessels by county. (c.) Number of registered recreational vessels by county.

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	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	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	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	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	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	972	1,726	2,517	1,439	1,143	629	540	n.s.	
Dog snapper	Reef Fish			87	123	98	47	693	594	777	131	18	n.s.	
Gag grouper	Reef Fish		23,283	72,287	84,532	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	23,217	18,393	31,225	33,376	24,442	20,488	17,763	n.s.	
Graysby	Reef Fish			1,756	628	83	289	489	64	223	11	42	neg	0.008
Greater amberjack	Reef Fish		311,359	376,533	391,561	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	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	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	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	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	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	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	75							~	
Red grouper	Reef Fish		16,525	26,156	10,694	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	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	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.

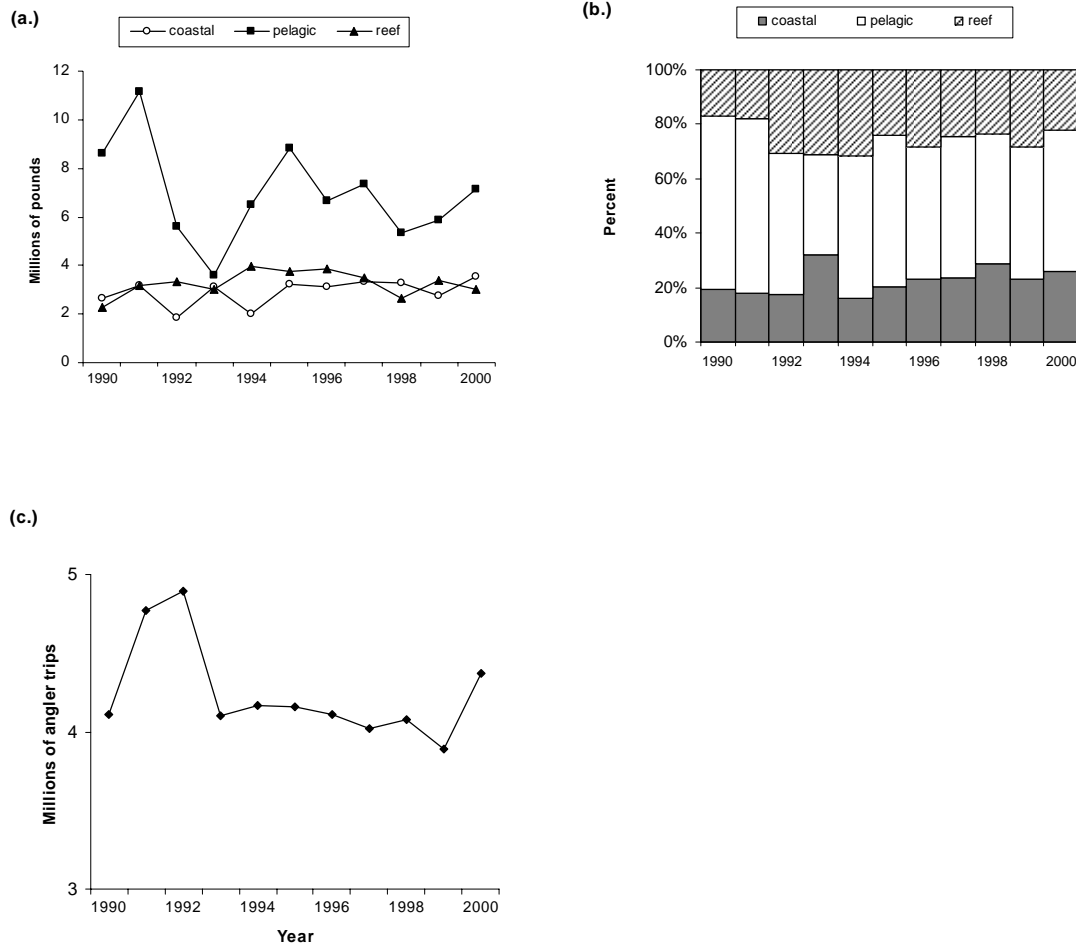


Figure 5. Marine Recreational Fishery Statistics Survey estimates for the SEFCRI area 1990-2000. (a.) recreational landings (millions of pounds) by fishery type, (b.) percent composition by type, (c.) fishing effort (angler trips).

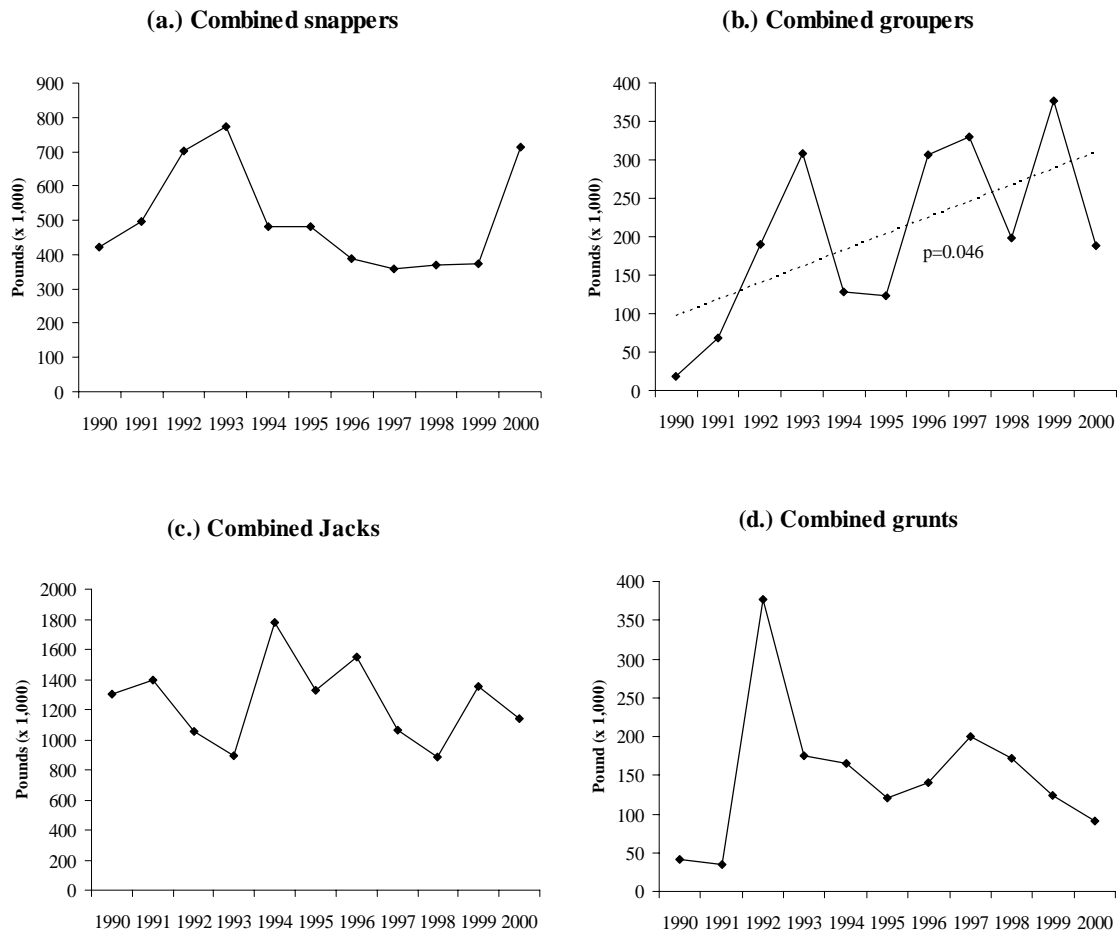


Figure 6. Marine Recreational Fishery Statistics Survey estimates by major species groups in the reef fishery for the SEFCRI area 1990-2000. (a.) combined snappers, (b.) combined groupers (c.) combined jacks (d.) combined grunts. Dotted lines show significant ($p < 0.05$) linear trends.

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 sheephead (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 sheephead 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).

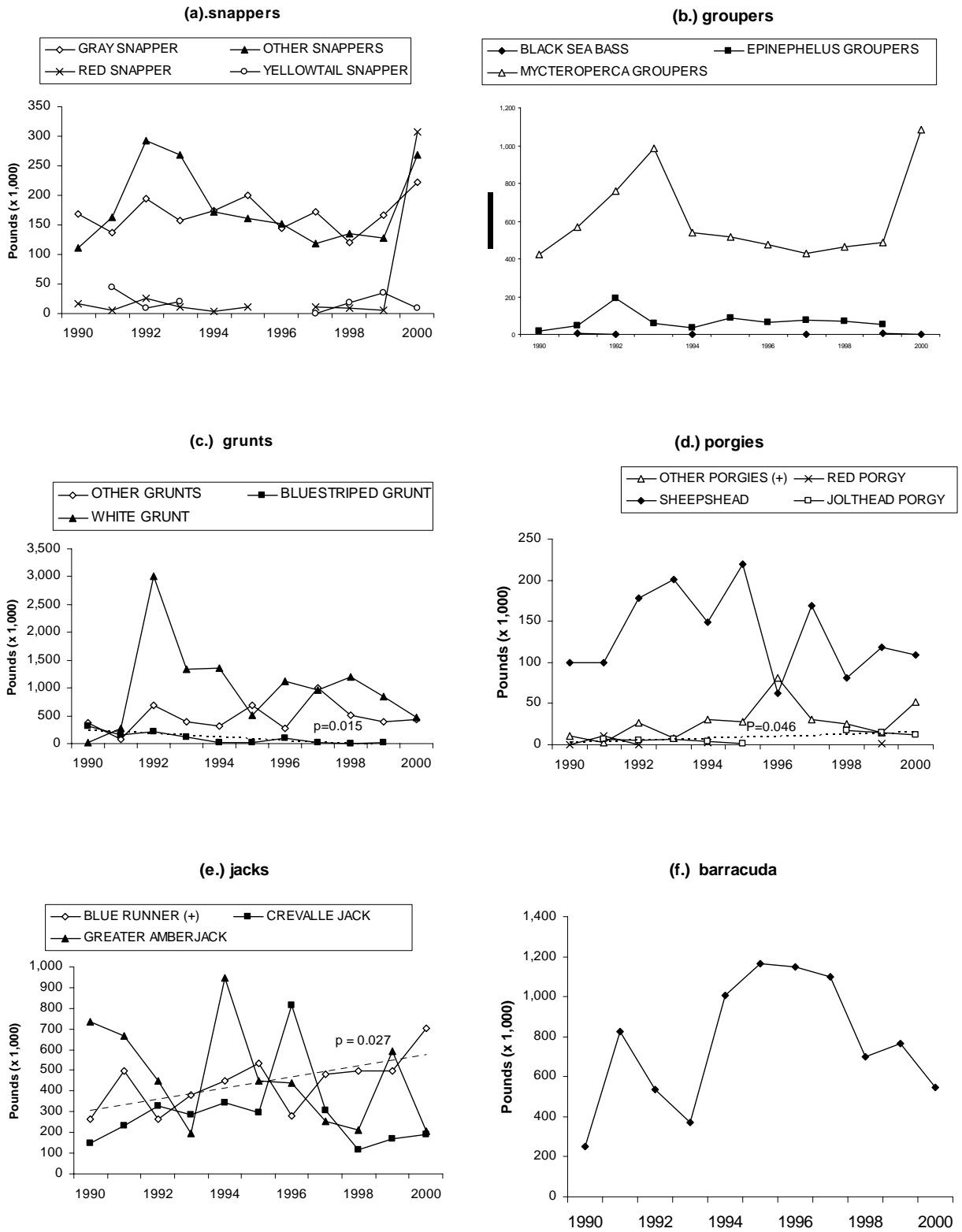


Figure 7. Recreational landings of major species in reef fishery for SEFCRI region 1990-2000. (a.) snappers, (b.) groupers, (c.) grunts, (d.) porgies, (e.) jacks (f.) barracuda. Dotted lines show significant ($p < 0.05$) linear trends.

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

Common name	Type	1990-2000												
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	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.	
Bonfish	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	490			165		~	
False pilotfish	Coastal	77,293	136,538										~	
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	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							4,930	~	
Northern kingfish	Coastal						430			627			~	
Northern sennet	Coastal										630		~	
Ocellated flounder	Coastal												~	
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	~	
Pompano dolphin	Coastal									4,534	2,096	20,827	~	0.018
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				7,430	3,808	43,612	2,949	23,901	5,552	4,610	17,333	n.s.	
Sand perch	Coastal	5,258		1,002		3,718	3,040	1,163	3,379	6,824	14,443		n.s.	

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

Common name	Type	1990-2000												trend	p-value			
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000						
Scated sardine	Coastal				1,797												~	
Scup	Coastal				1,084												~	
Sea bream	Coastal			4,989							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											468					~	
Spottin 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																~	
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										~	
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												4,841	2,889	3,990		~	
Blue marlin	Pelagic																~	
Bluefin tuna	Pelagic																~	
Bonnethead	Pelagic																~	
Bull shark	Pelagic	1,106,712		4,841	1,863	7,883	10,900	1,813	1,320	1,648	3,071	18,628				n.s.		
Cobia	Pelagic	41,452		76,243	109,109	100,811	74,223	17,409	176,852	63,576	121,872	147,017				~		
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. (pos)	0.099	
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																~	
Nurse shark	Pelagic																~	
Reef shark	Pelagic																~	
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																~	
Skipjack tuna	Pelagic			40,318	3,703	7,461	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	1990-2000												trend	p-value			
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000						
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	36,724	7,311	9,451	10,142	825						n.s.	
Bermuda chub	Reef fish			944		1,249		1,528	593	1,906	1,509						~	
Bigeye	Reef fish										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
Caeser 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.	
Cheekered 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	17,759	42,921	139,646	114,260	45,383	50,182	85,644	189,609	44,848	255,759	100,954					n.s.	
Gag	Reef fish					1,667											~	
Glasseye snapper	Reef fish																~	
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	1990-2000												trend	p-value				
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000							
Knobbed porgy	Reef fish					639												~	
Lane snapper	Reef fish	14,060	23,735	18,592	31,237	14,500	19,542	18,311	32,873	2,753	2,102	1,177						n.s.	
Least puffer	Reef fish						1,193											~	
Lesser amberjack	Reef fish			7,541	1,278		493			4,389	2,117	806						~	
Littlehead porgy	Reef fish				677		3,420	30,286		3,974	615	9,433						n.s.	
Longspine porgy	Reef fish					645												~	
Mahogany snapper	Reef fish																	~	
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	677	746	402	453	4,575	1,292	586	1,214						n.s.	
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						1,340			472							~	
Queen parrotfish	Reef fish							470			249							~	
Queen snapper	Reef fish																	~	
Queen triggerfish	Reef fish	7,379	3,214	3,254	6,337	10,029	27,420	4,060	774	5,659	3,353	4,187						n.s.	
Rainbow runner	Reef fish	25,057		4,167	3,389				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	372	888						~	
Short Bigeye	Reef fish																	~	
Shrimp eel	Reef fish																	~	
Silk snapper	Reef fish																	~	
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	1990-2000										trend	p-value		
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999			2000	
Snowy grouper	Reef fish				87,327		13,126				14,762			~	
Southern puffer	Reef fish	1,256					310				572			~	
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			786					1,258					~	
Squirrelfish	Reef fish				705	3,525	645		1,258					~	
Stoplight parrotfish	Reef fish				984	15,958			2,216					~	
Striped grunt	Reef fish										1,150			~	
Tilefish	Reef fish					107								~	
Tilefishes	Reef fish													~	n.s.
Tomtate	Reef fish			786	1,751						742			~	
Trunkfish	Reef fish										1,018			~	
Unicorn filefish	Reef fish										3,033			~	
Vermilion snapper	Reef fish		44,757	9,845	19,482	9,596					35,873			~	n.s.
Warsaw grouper	Reef fish			201							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			n.s.	
Whitebone porgy	Reef fish	5,643		786	2,243	4,413	1,598	252	13,876	2,290	217			n.s.	
Yellow chub	Reef fish		15,834	15,834	857	952	2,592	900	9,143	2,893				n.s.	
Yellow jack	Reef fish	130,154	1,155	1,155	18,466	24,397	15,365	4,830	8,215	529	2,602			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			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			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			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

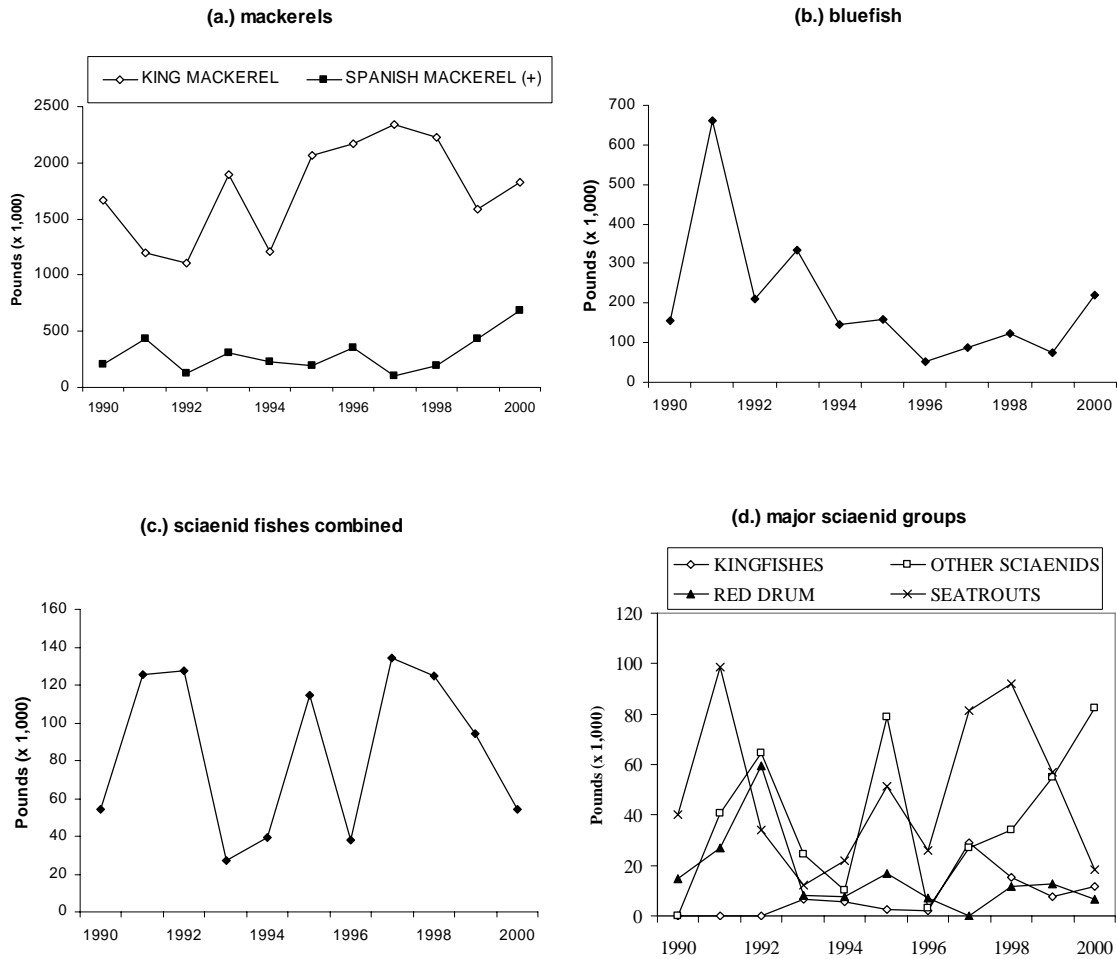


Figure 8. Recreational landings of major species/groups in coastal fishery for SEFCRI region 1990-2000. (a.) mackerels, (b.) bluefish, (c.) sciaenid fishes combined (d.) sciaenid fishes by species/groups: kingfishes, red drum, seatrouts, and other sciaenids. Dotted lines show significant ($p < 0.05$)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

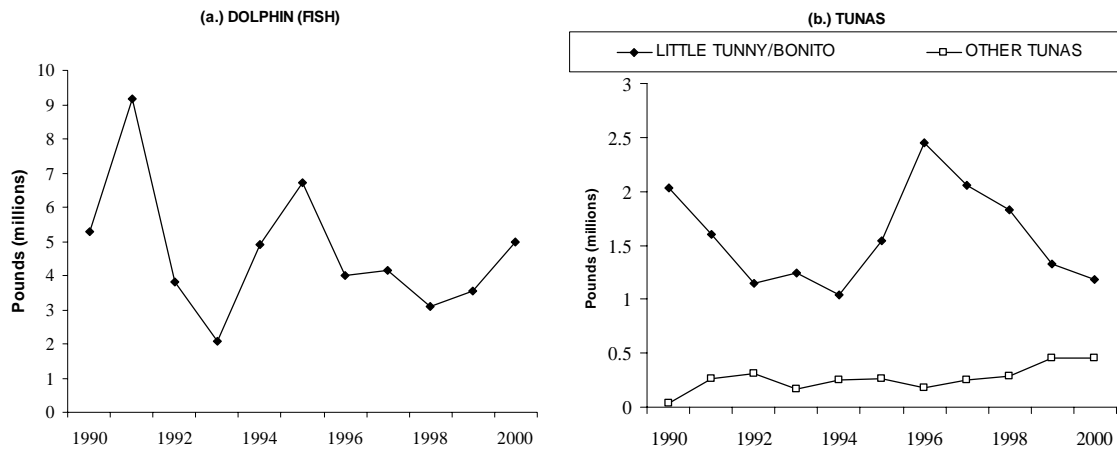


Figure 9. Recreational landings of major offshore pelagic species for SEFCRI region 1990-2000. (a.) dolphin (fish), (b.) tunas.

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). Regular season recreational landings also varied without trend (Fig. 10c). Regular season recreational effort 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.

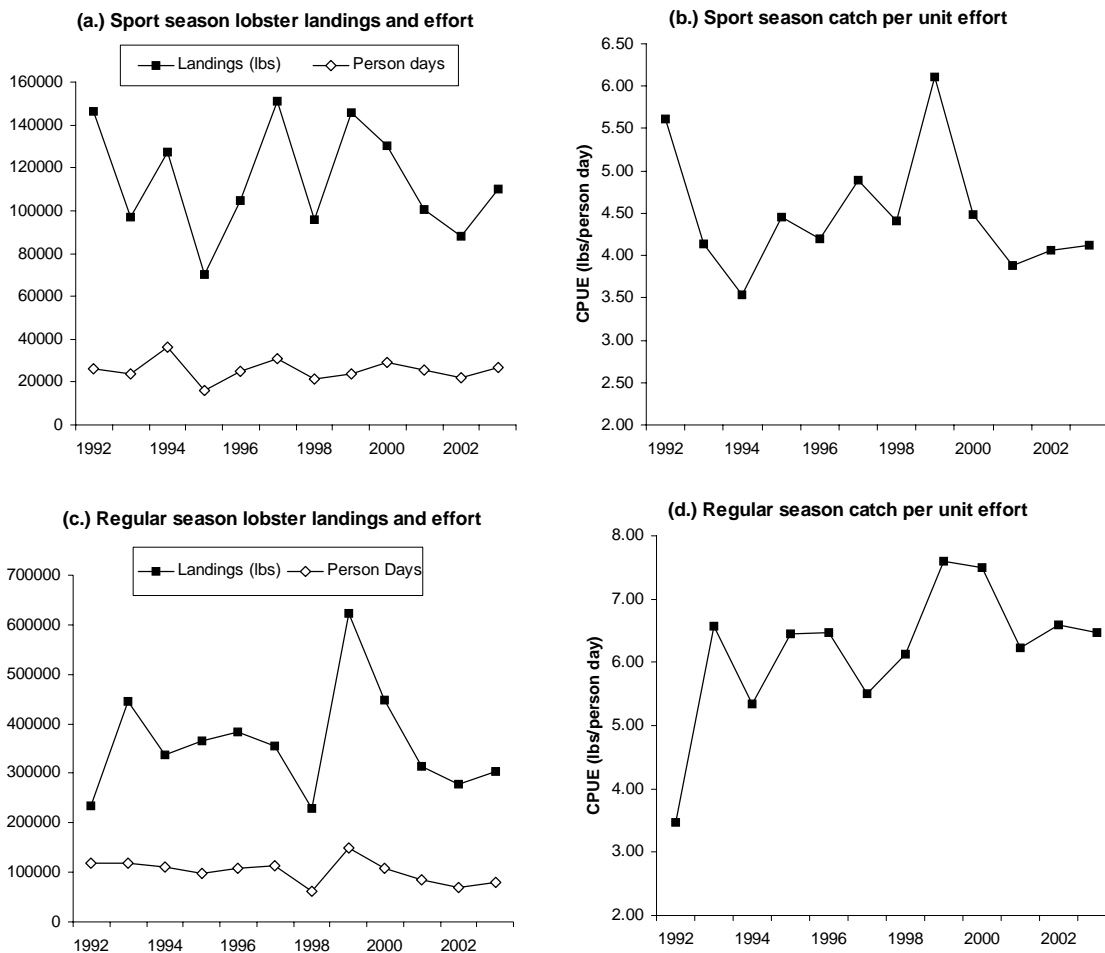


Figure 10. (a.) Recreational landings (lbs) and effort (person days) and (b.) catch per unit effort for the two-day sport season; (c.) recreational landings (lbs) and effort (person days) and (d.) catch per unit effort for the regular lobster season.

NMFS Headboat Survey Sector (1990-2000)

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%).

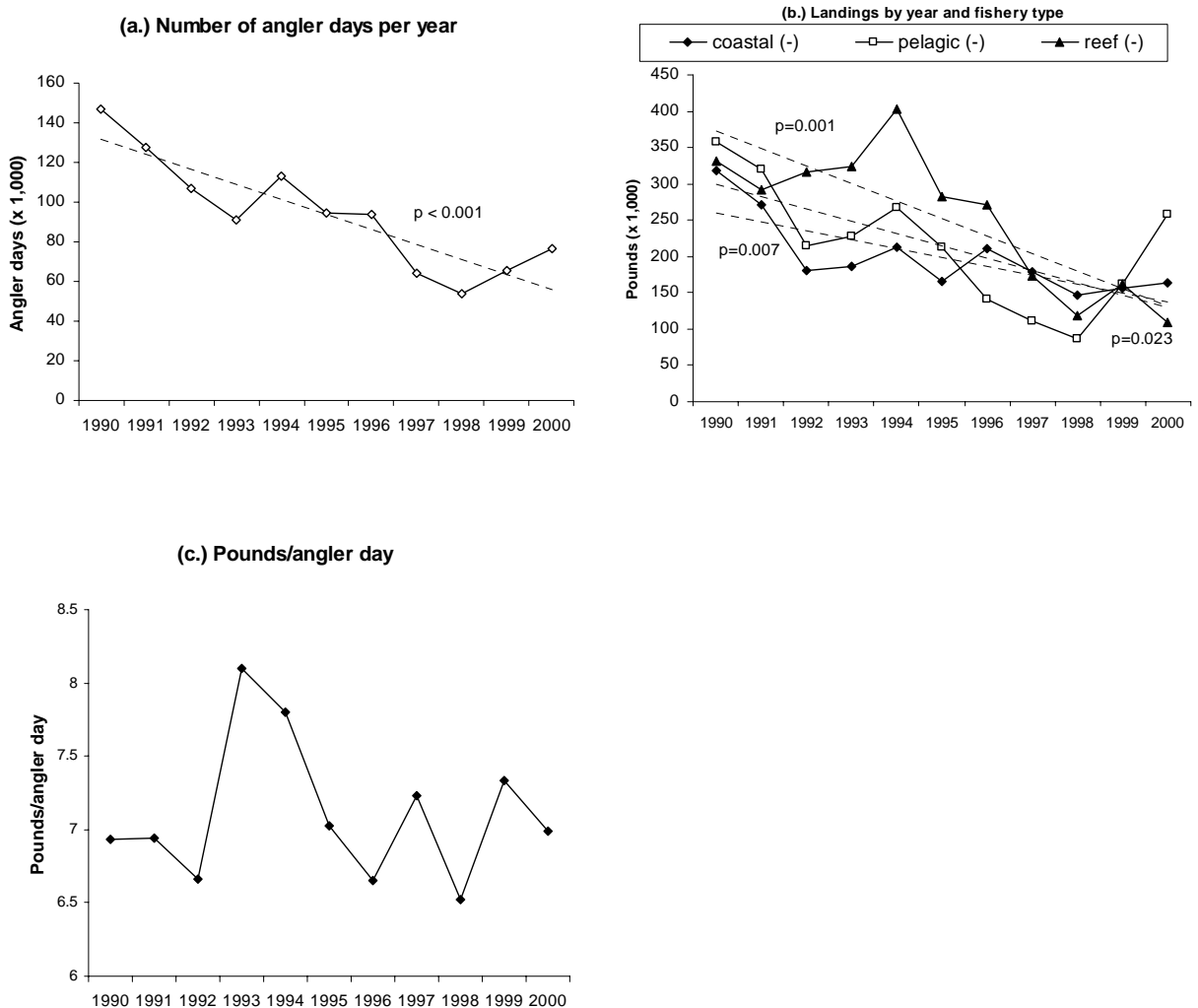


Figure 11. Headboat effort in SEFCRI region 1990-2000 (a). Number of angler days per year for headboat fishery (b.) headboat landings (in pounds) by year and fishery type (c.) Pounds/angler day. Dotted lines show significant ($p < 0.05$) linear trends.

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	1990-2000													P-value		
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Trend*				
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	1990-2000										P-value		
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999		2000	Trend*
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 shark	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	134	4			~	
Lemon shark	Pelagic	117				77							~	
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		103	116	52		102		n.s.	
Skipjack tuna	Pelagic	15	17		135	11		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	1990-2000													P-value
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Trend*		
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)		
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		
Blackfin snapper	Reef Fish	448	662	54	402	89	328	187	43	11	40		neg		
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		
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									~		
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		
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		
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	1990-2000													P-value		
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Trend*				
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	1990-2000										Trend*	P-value		
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999			2000	
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.	
Stoptlight parrotfish	Reef Fish					4								~	0.015
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	
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 resources⁵.

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%), vermilion 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, vermilion, cubera, and yellowtail), groupers (yellowfin, black, gag, red, Nassau, and goliath), red porgy, hogfish, gray triggerfish, and amberjack (Table 4).

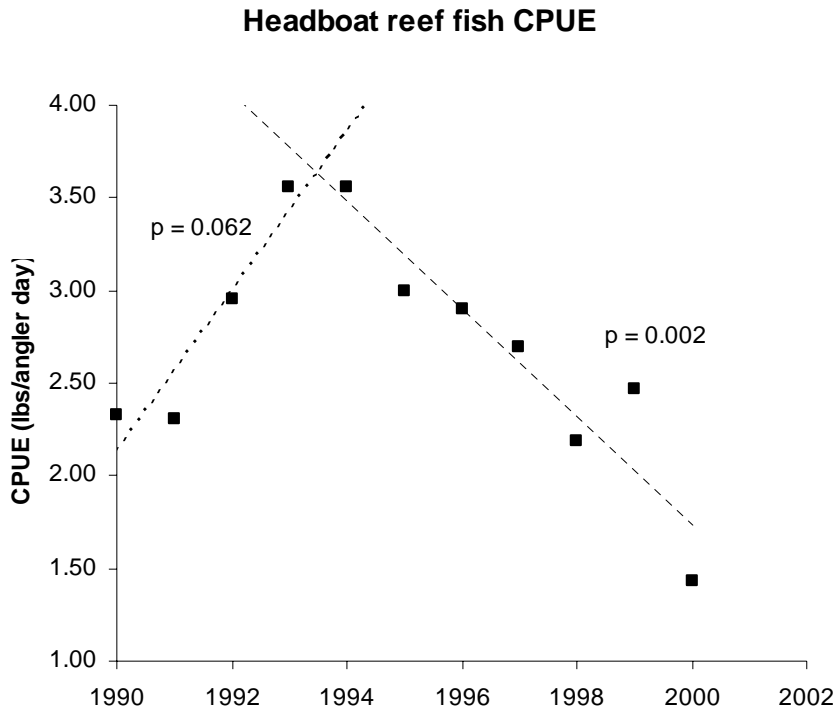


Figure 12. Catch per unit effort (lbs / angler day) for reef fish landed in the headboat fishery. Angler days are for all headboat trips combined, as reef trips could not be differentiated from other trips in the effort data.

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

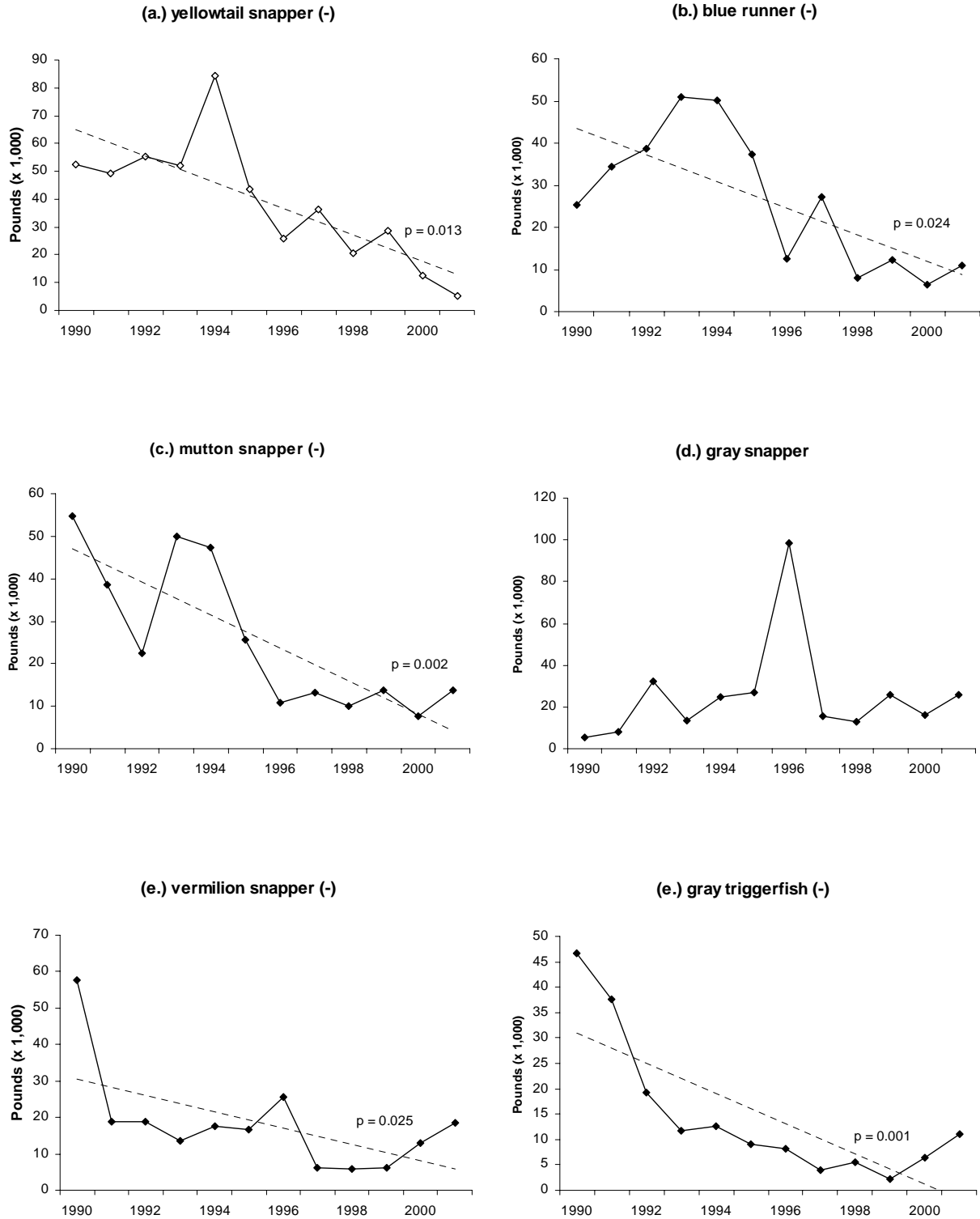


Figure 13. Landings of major reef fish species in the recreational headboat fishery in the SEFCRI region, 1990-2000. (a.) yellowtail snapper, (b.) blue runner, (c.) mutton snapper, (d.) gray snapper, (e.) vermilion snapper, (f.) gray triggerfish. Dotted lines show significant ($p < 0.05$) linear trends.

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" 10 fish daily bag limit for recreational fishermen established minimum size limit increased 12 inches fork length commercial harvesters required to adhere to statewide gear requirements 7,500 pound daily commercial vessel limit north of the Dade/Monroe county line 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 bag limit: 2 per person daily for all fishermen, commercial and recreational
Dolphin	1/1/1991	recreational daily bag limit: 10 commercial size limit: 20 inches fork length allowed gear: Hook and line, longline
Flounder	1/1/1996	12 inch minimum size limit for all harvester 10 fish daily recreational bag limit
Sheephead	1/1/1996	12 inch minimum size limit for all harvester 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 Established daily bag limit - 1 redfish per person and an off-the-water possession limit of 2 fish per person Sale of native redfish prohibited. Red drum closed to harvest and possession prohibited during months of March, April, and May
Reef Fish	7/29/1985	minimum size limits- red, mutton, yellowtail snappers - 12 inches yellowfin, black, gag, red, Nassau groupers and jewfish - 18 inches 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 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 vermilion 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 limits - mutton snapper - 16 inches red pogy, hogfish, gray triggerfish - 12 inches recreational bag daily limits - vermilion snapper 10; hogfish 5 per fisherman	
	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 limits - black and gag grouper - 24 inches black sea bass - 10 inches; red pogy 14 inches	
	12/31/1998	recreational daily bag limits - black and gag grouper 2 per person red pogy 5 per person; speckled hind and Warsaw grouper 1 per person black sea bass 20 aggregate	
	3/6/2000	red pogy 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 pogy - 14 inches daily bag limits - red pogy - 1 per person recreational; 50 pound commercial vessel closed season - red pogy - 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 commercial 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 maximum size limit - 20 inches closed season - November-December annually daily recreational bag limit - 5 per person
	7/1/2000	daily recreational 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).

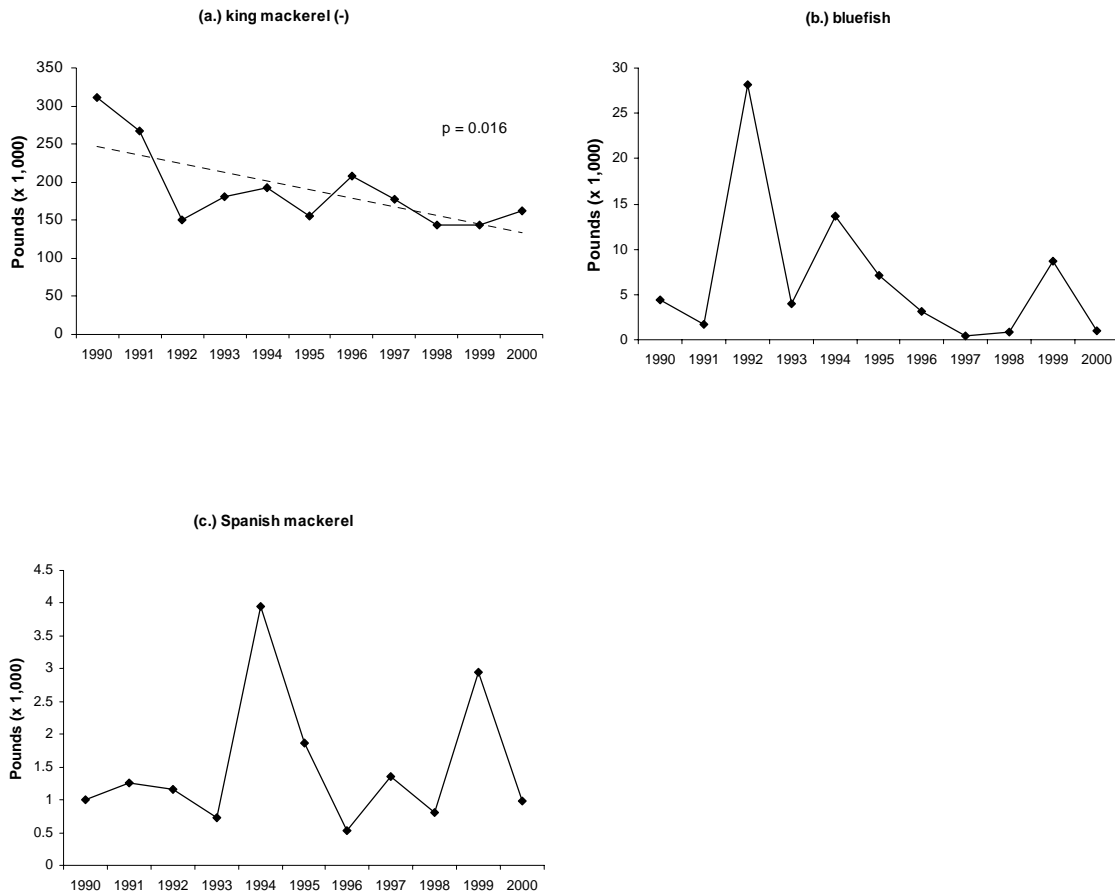


Figure 14. Landings of major coastal species taken in the recreational headboat fishery 1990-2000 in SEFCRI region. (a.) king mackerel, (b.) bluefish, (c.) Spanish mackerel. Dotted lines show significant ($p < 0.05$) linear trends.

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).

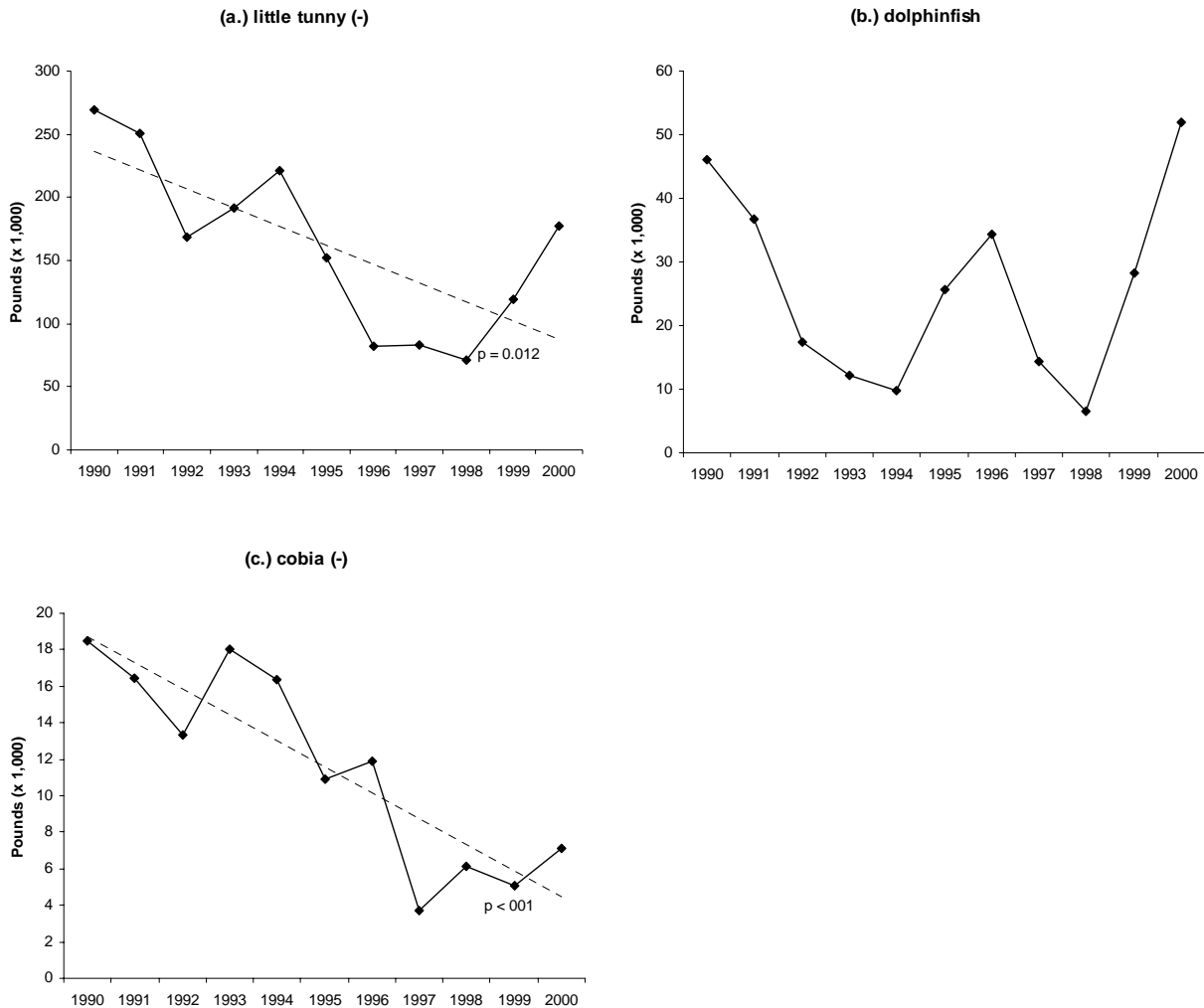


Figure 15. Landings of major offshore pelagic species taken in the headboat fishery 1990-2000 in SEFCRI region. (a.) little tunny, (b.) dolphin (fish), (c.) cobia. Dotted lines show significant ($p < 0.05$) linear trends.

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).

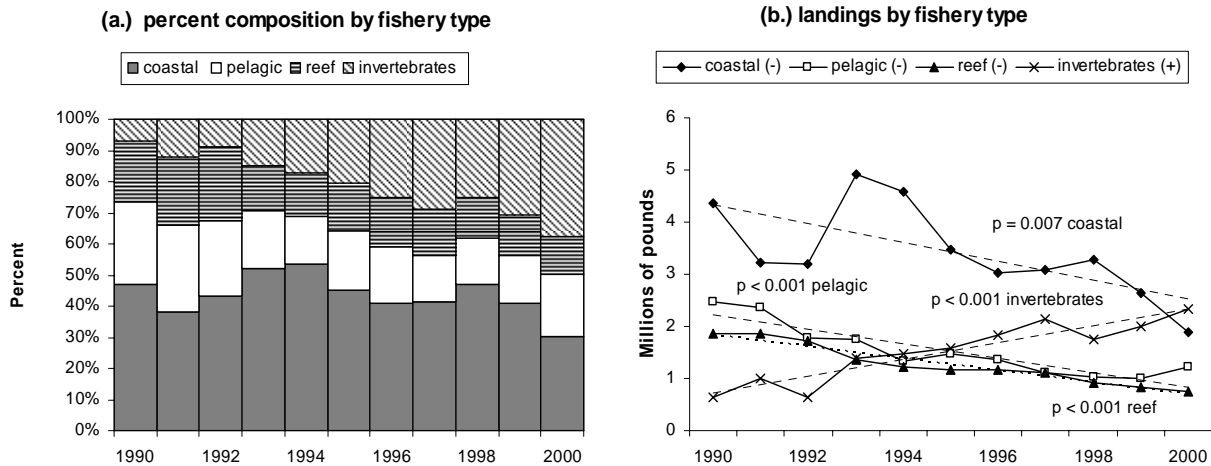


Figure 16. Commercial landings (pounds) by year for SEFCRI region, 1990-2000. Landings by (a.) percent composition, (b.) fishery type (coastal, offshore pelagic, reef, and invertebrates (no sponges)). Dotted lines show significant ($p < 0.05$) linear trends.

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).

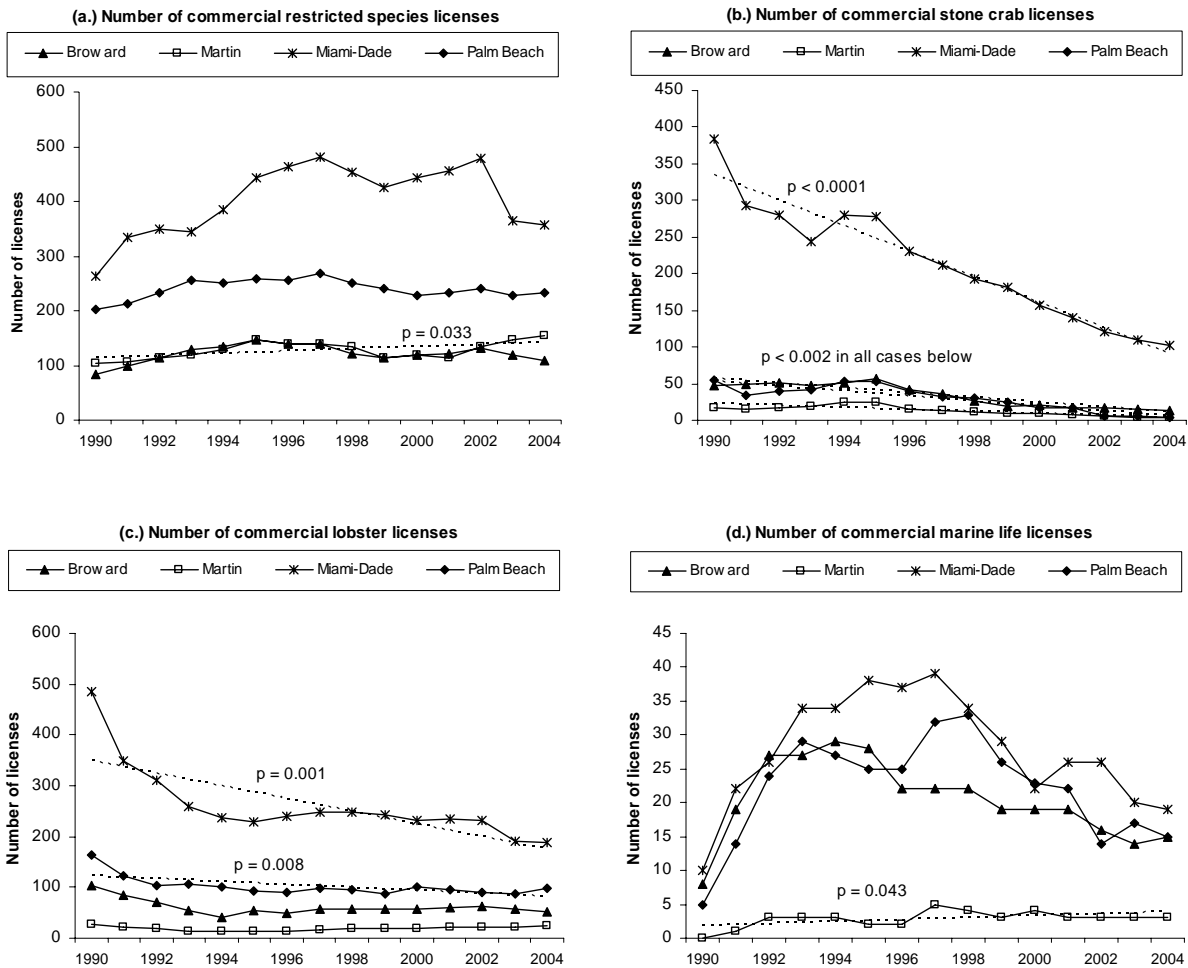


Figure 17. Number of commercial licenses for which associated landings were reported in SEFCRI region by county and year. (a.) restricted species, (b.) stone crab, (c.) spiny lobster, (d.) marine life.

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).

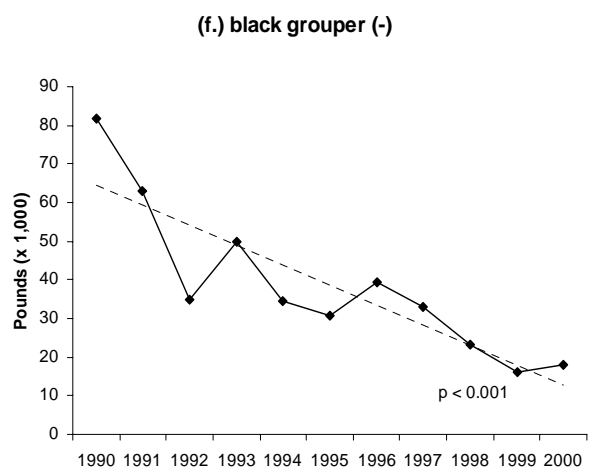
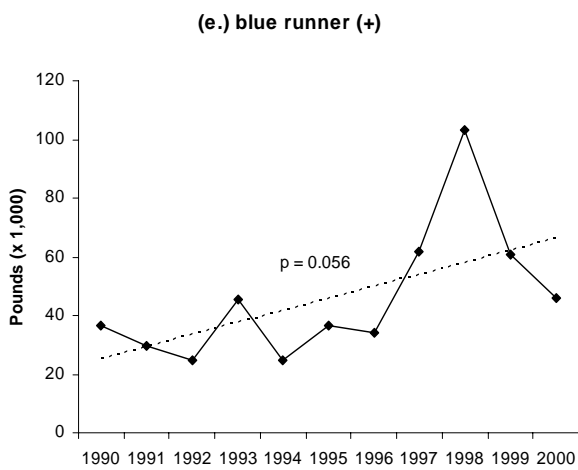
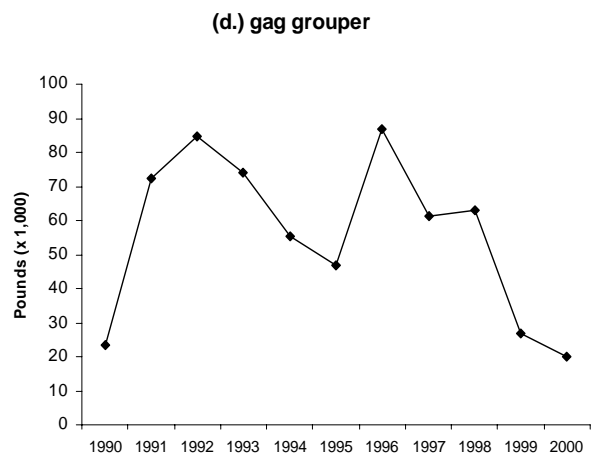
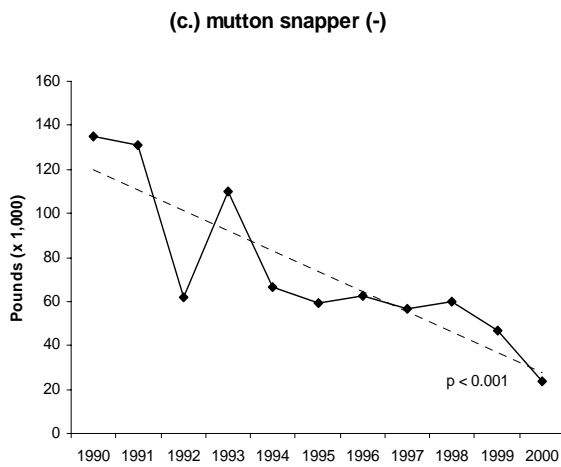
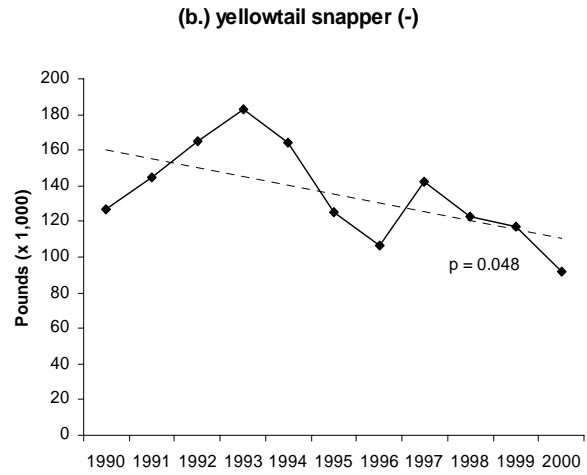
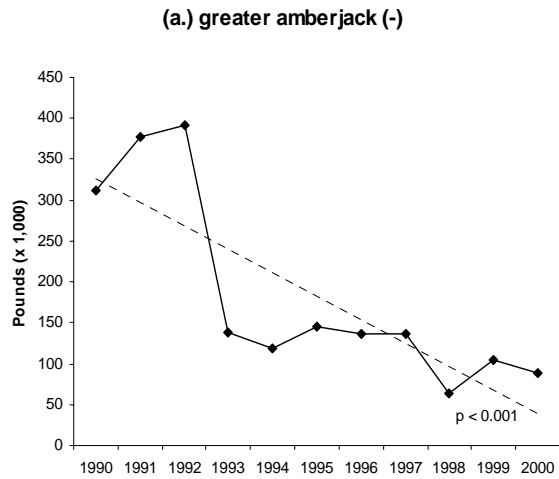


Figure 18. Commercial landings of major reef fishes in SEFCRI region 1990-2000 (a.) greater amberjack, (b.) yellowtail snapper, (c.) mutton snapper, (d.) gag grouper, (e.) blue runner, (f.) black grouper. Dotted lines show significant ($p < 0.05$) linear trends.

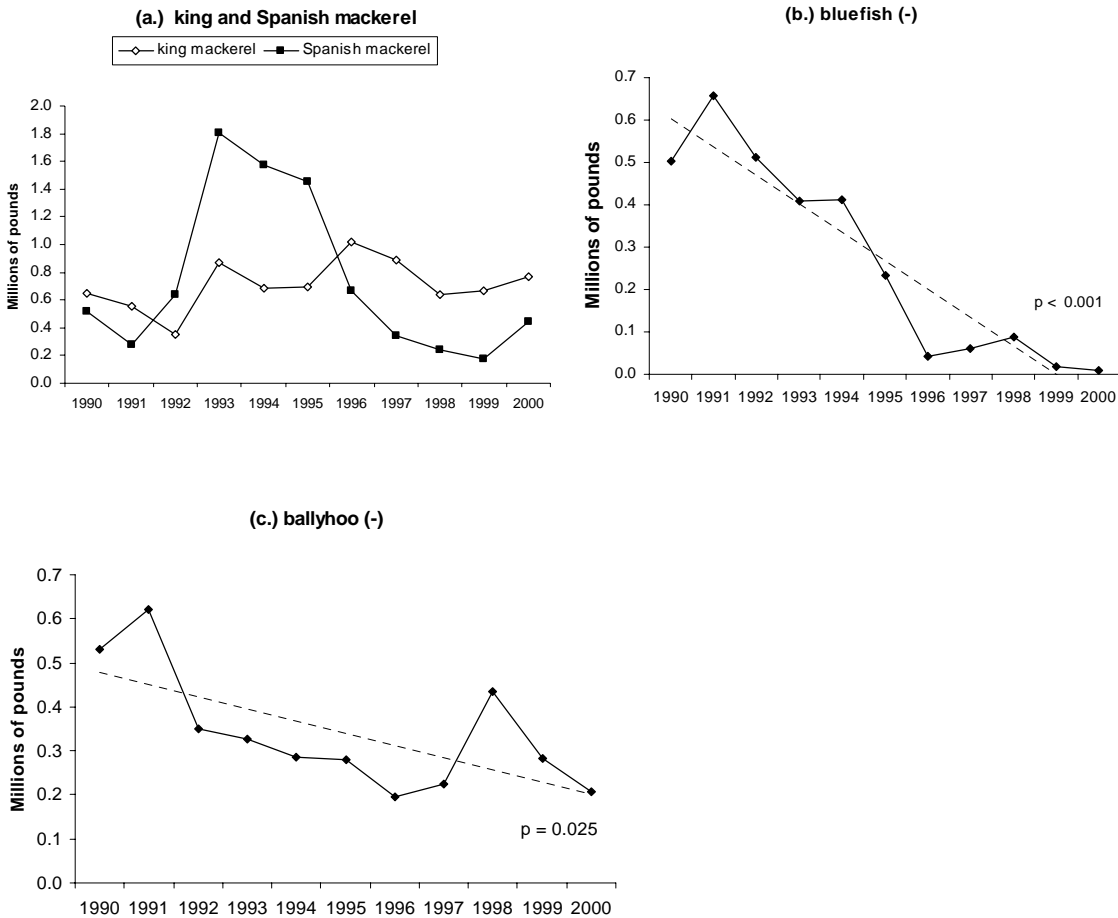


Figure 19. Commercial landings of major coastal species in the SEFCRI region (a.) king and Spanish mackerel, (b.) bluefish, (c.) ballyhoo. Dotted lines show significant ($p < 0.05$) linear trends.

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.

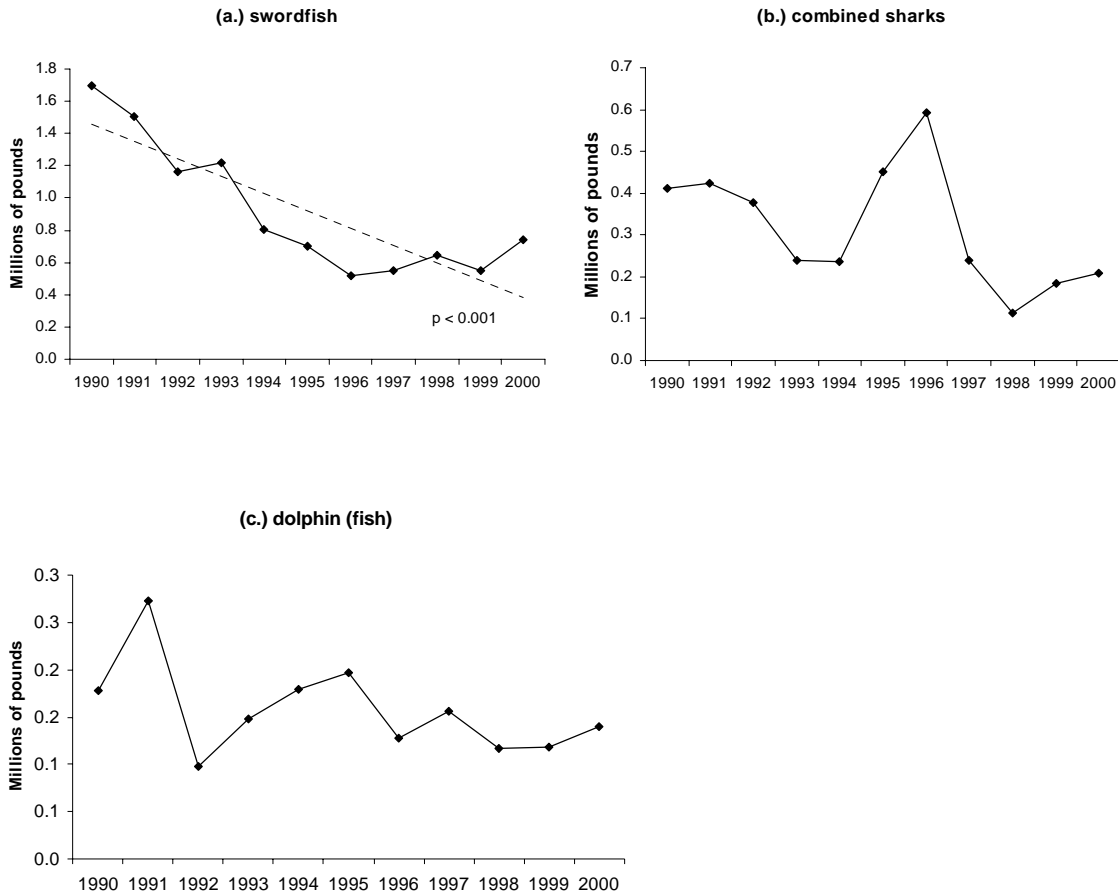


Figure 20. Commercial landings of major offshore pelagic species in the SEFCRI region (a.) swordfish, (b.) combined sharks, (c.) dolphinfish. Dotted lines show significant ($p < 0.05$) linear trends.

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.

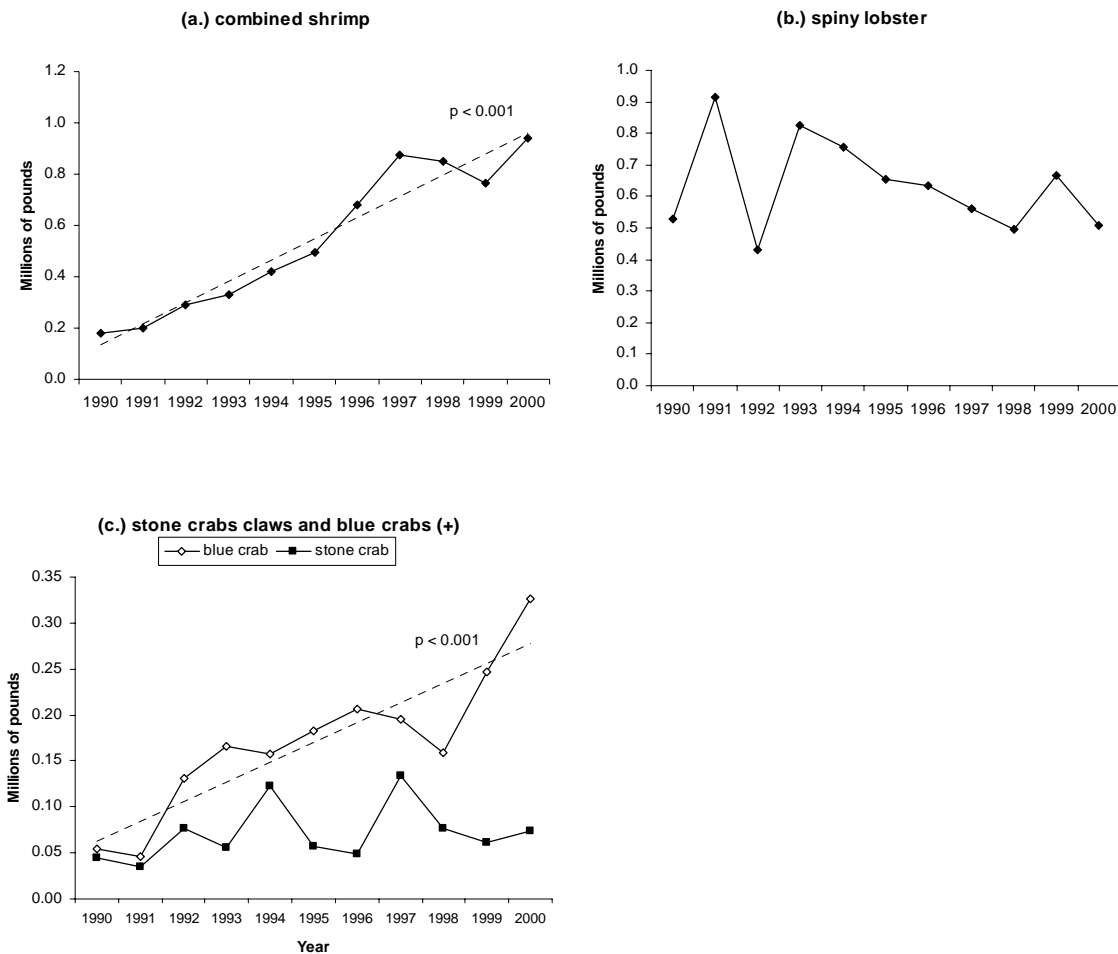


Figure 21. Commercial landings of major invertebrate species in the SEFCRI region (a.) combined shrimp, (b.) spiny lobster, (c.) stone crab claws and blue crab. Dotted lines show significant ($p < 0.05$) linear trends.

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 (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	1993-2003											Trend*	P-value
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003		
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 headline gear from the Fishery Logbook System data (1993-2003) with trends and p-value of significant trends.

Common name	Type	1993-2003											Trend*	P-value	
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003			
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 headline gear from the Fishery Logbook System data (1993-2003) with trends and p-value of significant trends.

Common name	Type	1993-2003											Trend*	P-value			
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003					
Porgy family	Reef Fish	0.2														~	
Queen snapper	Reef Fish					0.6	0.2	0.1	0.1	0.1	0.1	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						0.1		0.2			0.1		0.1		~	
Sand tilefish	Reef Fish									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	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	1993-2003											Trend*	P-value	
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003			
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

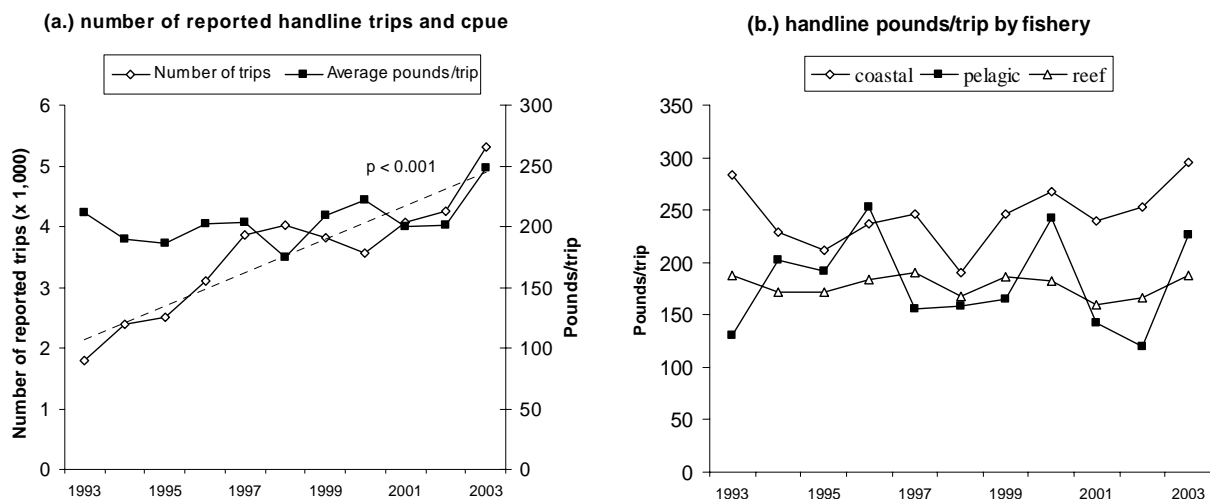


Figure 22: Commercial effort and landings/trip by handline gear for logbook data in the SEFCRI region (a.) annual number of reported handline trips and landings/trip (b.) handline landings/trip by fishery. Dotted lines show significant ($p < 0.05$) linear trends.

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.

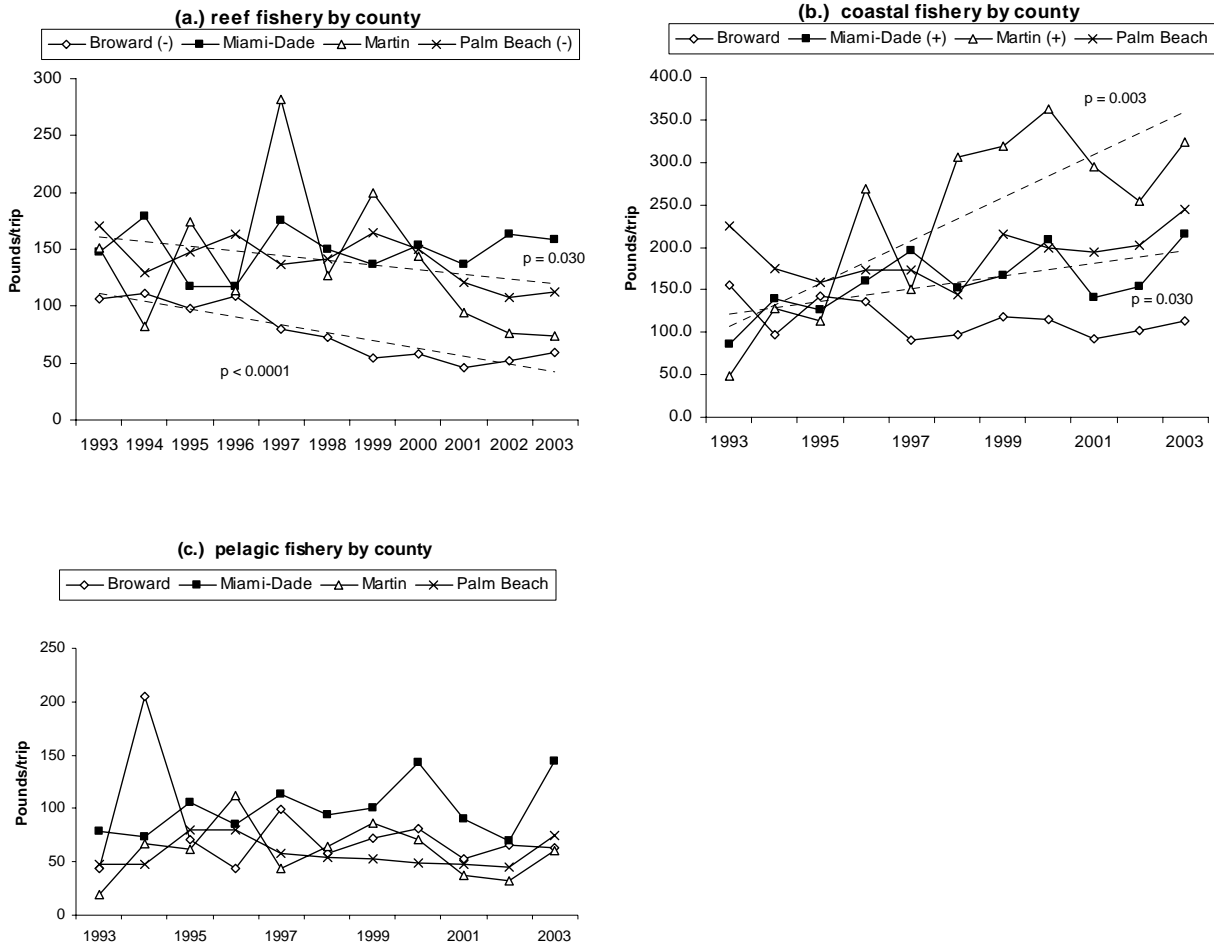


Figure 23: Commercial handline gear CPUE (pounds per trip) by county in the SEFCRI region 1993-2003 (a.) reef fishery, (b.) coastal fishery, (c.) offshore pelagic fishery. Dotted lines show significant ($p < 0.05$) linear trends.

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. Statewide collection of ornamental fish (numbers) 1994-2004
(Data source: FWRI commercial fishery landings)**

(a) Fish

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.

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

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

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

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

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

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

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

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

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

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

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

