ANNUAL FISHERIES REPORT

EVERGLADES NATIONAL PARK

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Thomas W. Schmidt, Mario Alvarado, and John Kalafarski

South Florida Natural Resources Center
Everglades National Park
40001 State Road 9336
Homestead, FL 33034

INTRODUCTION

National Park Service (NPS) management policies state that recreational fishing is permitted in parks where it is authorized by federal law or is not specifically prohibited, and is in accordance with applicable federal/state laws and regulations. However, the NPS may restrict fishing activities whenever necessary to achieve management objectives. NPS sport fish goals and management objectives are based on the preservation and restoration of the diversity and natural ecological integrity of fish populations. When harvest is permitted, in no case should it be allowed to reduce the reproductive potential of the population or to radically alter its natural (unfished) age structure. Fishing activity and harvest of sport fish from Everglades National Park have been monitored nearly continuously since 1958. The objectives of fisheries monitoring in the park are: 1) to estimate catch rates, relative abundance, age structure, and total harvest, and 2) to estimate boating (and fishing) activity in park waters.

This monitoring program was originally initiated because of concern over greatly increased fishing pressure resulting from the construction of a highway, marina facilities and access canal to Whitewater Bay in 1958. The first ten years of the park's fishery monitoring program (1958- 69) were conducted through contract with the University of Miami, Institute of Marine Science and were directed at evaluating only the sport fishery.

Under the University of Miami program, measures of catch and catch-per-unit-of-effort (CPUE) were made only from those fishermen operating out of Flamingo. These data covered a major area of the fishery but largely missed two other major areas: eastern Florida Bay and the lower Ten Thousand Islands.

In 1965, a permitting system was established for commercial fishermen operating in the park. These fisheries included commercial hook & line (primarily spotted seatrout), netting (mullet and pompano), stone crab trapping, and professional guides. Until 1972, these catch data consisted of monthly total harvest, by species, for each fishermen. The harvest reports did not include any measure of fishing effort or specific area of harvest so it was not possible to monitor populations by ecosystem or management unit, nor to evaluate the degree to which fishermen complied with the reporting requirements of their permits.

In 1972, the NPS expanded the harvest monitoring program to include daily trip ticket reports from commercial permit holders and developed censuing techniques to evaluate total parkwide sport fishing and commercial effort. Primary emphasis of the expanded monitoring was to improve the precision of the catch rate and total fishing effort estimates for both sport and commercial fisheries (Davis 1979a). In 1974, fish size data was added to the information recorded and, in 1980, Chokoloskee-Everglades City and boat ramps along the Florida Keys were added on a routine basis.

In 1978, a second detailed account of the park's fishery database was completed in response to sport fishermen and professional fishing guide complaints of declining stocks.

Results of this assessment were incorporated into a document for public review concerning alternative fishery management options for Everglades National Park (Davis 1979b). This assessment summarized the estimated total harvest of fish from park waters by species, by area, and fishermen type for the years 1973-1977. Although recorded catch rates and annual fishing activity were analyzed for trends, no detailed analysis of catch rate response to changes in effort and harvest or to environmental factors were made. Insufficient fish length data also were available in 1979 to evaluate such important parameters as age structure of the catch, mortality rates, and mortality response to changes in fishing effort and harvest.

Recently, a 1985-88 analysis of the fisheries database, provided Virtual Population Analysis (VPA) cohort stock assessments for the park's major fish species based on a 10-year collection (1974-84) of data on 40,000 fish length measurements. VPA's are statistical models which use primarily catch (harvest) data to produce relative estimates of how many fish of a given species exist or how many species of a particular age class are surviving yearly to become spawners. Park stock assessments included total mortality estimates, age structure, and a yield-per-recruit analysis for the three most commonly caught sport fish (spotted seatrout, red drum, and gray snapper) (Tilmant et al. 1986, Rutherford et al. 1989a, 1989b). This review concluded that environmental factors may explain as much of the variability in fish abundances as does fishing pressure.

More recently, oral presentations of project results were given during April at the Estuarine Research Federation's Southeast Research Society regional spring meeting held in Islamorada, Fla. A paper on an overview of recent trends (1985-1996) in the Florida Bay fishery was submitted to the journal "Estuaries" as part of a volume dedicated to Florida Bay. Data summaries to assist in the evaluation of snook/seatrout populations in south Florida were presented at Florida Marine Fisheries Commission Meetings held in Punta Gorda and Hollywood Beach.

Other related activities that involve the sportfish monitoring project includes the participation of the senior author as the NPS Committee member of the Recreational and Commercial Fisheries Information Networks, collectively known as the Fisheries Information Network (FIN) and on the Recreational Fisheries Information Network's Biological/Environmental Work Group. These programs coordinate the development of federal-state cooperative fisheries data collection activities in the Gulf of Mexico, SE Atlantic coast and the territories of Puerto Rico and the US Virgin Islands. One semi-annual FIN meeting was attended in March in Washington, D.C and a Biological/Environmental Work Group meeting was attended in Miami during July.

A State of Florida health advisory remains in effect for six species of marine species found in northern Florida Bay. The average mercury level of spotted seatrout, crevalle jack, gafftopsail catfish, ladyfish and bluefish is in excess of the state limit for human consumption.

No major fish kills were reported in park coastal waters during the year.

This report represents the third annual fisheries report produced since 1990. Due to severe personnel shortages, only basic data collection activities were maintained from 1991-94 by two port samplers at Flamingo and Everglades City. This report includes a description of the fishery, and relative abundance for 1997, and, for the first time, effort-catch relationships, relationships with catch and environmental conditions and a long-term analysis of catch rates for the major species covering the period of 1985-96. Due to loss of personnel in December and early 1998, calculations for estimated total catch/harvest, effort, and boating activity for 1997 were not completed.

METHODS

Methods (data collection/recording format) employed to obtain sport fishing monitoring and boating activity data in Everglades National Park have been previously presented by Higman (1967), Davis and Thue (1979) and Tilmant et al. (1986), and are briefly discussed below.

Recreational fishermen are interviewed at boat launch sites (Flamingo and Chokoloskee/Everglades City) upon completion of their trip every weekend. Data recorded include area fished (Fig. 1), reported catch (fish kept and released), harvest (kept only), effort (angler hours fished), species preference, angler residence, and, since 1974, fish lengths. Commercial fishermen and professional guides were required to obtain an annual "no-fee" permit from the park and report their monthly catch and effort on a per trip basis via logbooks supplied with the permit. Prior to 1980, reporting was voluntary. Reporting compliance of the guide fishermen is determined from recorded field observations by park patrol rangers and by port samplers at the boat launch sites. Since the elimination of commercial fishing in Everglades National Park in 1985, only recreational guided and non- guided recreational anglers are permitted to fish within park estuarine and coastal marine waters.

Daily estimates of the total number of fishing boats operating in park waters were made by regressing the daily counts of empty trailers at Flamingo against a known number of boats fishing the same day. Aerial surveys were used to determine the correlation of boat trailers at the Flamingo launch ramp to the total number and distribution of boats within the park. Over 243 flights were conducted using randomly selected weekdays and weekends stratified by month for three sample periods (July 1972 to May 1975; October 1977 to October 1978; and October 1983 to October 1984). Highly significant linear relationships between the number of trailers at Flamingo and total boats observed in the park were obtained during each sampling period. The accuracy of the aerial observers was about 94% (152 known patrol boats on the water; 143 sighted). No significant differences were found among the regression statistics for the three survey periods and therefore all the data were pooled to strengthen the expansion estimates ($r = 0.84$, $N = 243$, $P < 0.01$) (Tilmant et al. 1986). There was no significant difference in the boat count-trailer count regression between weekdays ($r = 0.65$, $N = 133$) and weekends ($r = 0.70$, $N = 110$) ($P < 0.02$). The percentage of recreational boats actually fishing was determined from boater interviews. Most of the recreational fishermen catch data for Florida Bay and the

immediate vicinity has come from interviews conducted at the Flamingo boat ramp (Areas 1-5, Fig 1).

Flamingo is by far the greatest single access point to Florida Bay and has been used by 50-60% of the total anglers. During 1972-74 and 1981-84, additional interviews were obtained at ramp sites along the Florida Keys. However, no significant differences were found in the catch composition or success per unit of effort of these anglers when compared to those anglers fishing the same areas interviewed at Flamingo (Tilmant et al. 1986). Catch data from area 6 (Fig. 1) is entirely from Chokoloskee/Everglades City interviews.

Estimates of total recreational catch and harvest of individual fish species for the non-guided fishery were made quarterly during each year by applying the recorded mean catch (or harvest) of that species per successful trip to the estimated total number of fishing trips successful for that species. The estimated total number of recreational fishing trips for a species was determined by applying the proportion of recreational boats, contacted by interviewers, that were successful for the species to the estimated total recreational boats determined by the ramp boat-trailer count.

Estimates of total harvest for the guide fishery were obtained by dividing the reported harvest by the estimated percent reporting compliance of fishermen known to be fishing. Not all guides reported their catch as required and therefore a reporting compliance adjustment was necessary. Reporting compliance estimates as determined through independent field observations of fishing activities ranged from 39-64%, for 1996.

Statistical differences were found between the mean reported catch rates at Everglades City (fishing area 6) and at Flamingo (Fishing area 1-5) (Tilmant et al. 1986). Therefore, total estimated catch and harvest computations were made separately for Everglades City and the Florida Bay region and then added to obtain park-wide estimates.

The seasonal distribution of the number of fishing interviews and fishing effort have not been consistent from year to year. Therefore, all calculations of annual mean catch rates (CPUE), harvest rates (HPUE), and estimated total harvest or effort were calculated by calendar quarters and the four quarters either averaged or summed to obtain comparable annual values. In estimating the average CPUE or HPUE for a calendar quarter, rates of individual trips were calculated after Malvestuto (1983). Only those anglers successful in catching a species were used to calculate a harvest or catch rate to avoid bias in the possible change in the proportion of effort applicable to a species each year.

Catch/Effort relationships - The predictability of the numbers of species catch/harvest from an annual level of fishing effort was based on the numbers of fish kept and released. This assumption was used because the annual release rates exceeded more than three fish/boat for snook and over 8 fish/boat for gray snapper (Fig. 2). This assumption suggests that the numbers of fish kept and released reflects catch frequency more accurately than harvest frequency (Schirripa and Goodyear 1994).

During the period 1985-96, annual rainfall was compiled and averaged from five stations within or near ENP including Flamingo, Royal Palm, Everglades City, Tamiami Ranger Station, and Tavernier. Water level data were obtained from well P-37 in western Taylor Slough and salinity data were obtained from 3 stations in northern Florida Bay (Little Maderia Bay, Trout Cove, and Butternut Key).

Missing monthly rainfall values for various time periods were estimated from monthly period of record values for Royal Palm (1992,1995), Tavernier (1986,1995), Everglades City (1993-95).

RESULTS

All of the non-guided angler catch data for Florida Bay and the immediately adjacent waters,(Cape Sable, Whitewater Bay, and Shark River area, hereafter referred to as Florida Bay) has come from interviews conducted at the Flamingo boat ramps. All of the non-guided catch data for Everglades City (Lostman's River to the northwestern boundary of the park near Chokoloskee) has come from interviews conducted in the Everglades City-Chokoloskee boat ramps and marinas.

During 1997, 5,356 boaters were interviewed at Flamingo. Ninety-seven percent of these boating trips were involved in sport fishing activity. Only 5.2% of the anglers did not catch fish.

At Everglades City 3,342 boaters were interviewed. Ninety-five percent of the total boats interviewed were fishing. Only 4.2 % of the fishermen did not catch fish.

Description of the Fishery (1997)

Most (83%) of the anglers fishing out of Flamingo were south Florida residents (Dade County to, and including Ft Lauderdale, excluding local); 2% local (Florida City, Flamingo, Florida Keys), and 14% Florida other than south Florida or local. Only 1% of the anglers came from out of state.

At Everglades City, most (70%) of the anglers fishing were Florida residents other than south Florida (Collier, Dade, Monroe Counties) and local residents. South Florida accounted for 15% of the anglers, while 13% were local (Chokoloskee/Everglades City/Ochopee) residents and 2% came from out of state.

The average boating trip lasted 7.2 hours with an average fishing time of 5.9 hours and caught an average of 20 fish.

Most anglers interviewed at Flamingo (47%) did not try to catch any particular kind of fish. Snook and red drum were the most popular fish, sought by 18% and 16%, respectively, of the fishermen. The next three species preferred were seatrout (12%),

tarpon (2%), and gray snapper (2%). Over 46% of the fishing parties interviewed reported catching spotted seatrout, an increase of 7% from 1996 (Fig. 3). The next three species most commonly caught were red drum (36%), gray snapper (29%),, and snook (25%). For red drum this represent an increase of 7% and for gray snapper a decrease of 7% when compared to anglers catching these species in 1996.

The average boating trip lasted 7.3 hours with an average fishing time of 5.5 hours and caught an average of 16 fish.

Many anglers interviewed at Everglades City (55%) did not try to catch any particular kind of fish. Snook was by far the most popular fish, sought by 32% of the fishermen. The next three species preferred were seatrout (6%), red drum (4%), and tarpon (1%). Over 40% of the fishing parties interviewed reported catching snook. The next three species most commonly caught were seatrout (41%), red drum (30%), and gray snapper (22%). For spotted seatrout this represent an increase of 8% of the anglers catching seatrout in 1996.

The overall trend in recreational fishing boats since 1973 shows high values in 1973-75, with lows in 1979- 80, and a rebound to moderate values in the mid-80's, to the highest ever recorded in 1989 (44,861), followed by a dip at Flamingo during 1992 (Fig. 4). A decline during the early 1990's, is attributed to the impacts of Hurricane Andrew. The park (Flamingo) was closed from September through December, 1992, however angler interviews continued at Everglades City.. The recreational effort (total estimated angler-hours fishing) has followed this trend (Fig. 5).

Relative Abundance

Catch rate is a function of the number of fish caught for a unit of time or effort expended. The number of fish caught for each hour of fishing is used as an index of the abundance of the fish. . The 1997 average catch and harvest rates from the sampled anglers for major species in the park fishery are presented in Table 1. For the major species, relationships of 1997 catch/harvest rates to past years are presented in Figure 6.

Estimated Total Harvest

The catches of the interviewed anglers and the reported catches of the guide fishermen are only samples of the total park harvest. Catch rates calculated from interviews are multiplied by the estimated total number of fishing boats fishing for a particular species to yield estimates of total non-guided harvest. For the guide fishery, the total number of fish reported harvested is divided by the percent of total estimated harvest to yield the estimated total harvest by species. The 1985-96 estimated total non-guided catch/harvest for the major species are shown in Figure 7.

Environmental Relationships Catch rates may be used as an index of abundance, and are directly related to environmental factors such as rainfall, water level, and salinity, and

are generally not directly affected by fishing regulations, while harvest rates most certainly are. For 1985-96, guide and non-guide catch rates for the major species versus rainfall, water levels, and salinity are shown in Figures 8-11.

Effort-Catch Relationships- It is not always sufficient to know if catch rates are declining to determine if a fishery is in trouble. If both catch and catch rate are in decline then there is a need to asses the amount of effort being placed on a fishery. In figures 12-15, estimated total catch and estimated total effort of the major species are compared to determine if fishing effort impacted the stock.

Recent Trends (Florida Bay)

The annual total non-guided=sport recreational fishing effort increased from 1985 to 1989, dropped slightly from 1990-92, but increased annually after 1993 (Fig. 5). The 1992 decline may have been partly due to the closure of the main entrance to the park and Flamingo during the aftermath of Hurricane Andrew. From 1994 to 1995, there was a 30% decline in the number of reported guide fishing trips, resulting in a marked decrease in the numbers of hours fished and total numbers of people fishing. A 3-week closure of the park during the November-December federal government shut-down may have accounted for the small decline in effort reported in 1995.

Gray Snapper- The popularity of gray snapper in Florida Bay has remained relatively stable from 1985-96. During the 1980's the percentage of boats reporting catches of gray snapper increased from 31% in 1987 to 44% in 1990, then declined in 1991 to nearly 34% (Fig. 3). The variation in the proportion of boats reporting catches of gray snapper may largely be due to the state regulations imposed on the fishery in 1988 when the minimum size was increased from 6 to 8 inches and in 1990 when the minimum size was increased to 10 inches with a bag limit of 5 fish per person which apparently provided an abundance of undersized gray snapper to the fishery (Fig. 7).

Catch rates-Between 1985 and 1989 catch rates of gray snapper were lower than for catch rates reported for 1990, then increased to a high in 1992, and declined sharply in 1994 to their lowest levels since 1987.Although gray snapper catch rates increased slightly during 1995-96, they declined again in 1997 (Fig. 6). There was no significant difference between guided and non-guided gray snapper catch rates. If these fish move offshore at age 4 as suggested by Rutherford et al. (1989), it is probable that only age 3 fish are available to the fishery in Florida Bay in greatest abundance.

Environmental relationships- Overall (1985-96) a weak positive ($r = 0.49$, $N = 12$, $P < 0.1$) relationship was found between sportfish catch rates of gray snapper and mean annual salinities found in northern Florida Bay (Fig. 8), suggesting that periods of high salinity may lead to increased abundance of gray snapper. Average annual water levels recorded at P-37 were inversely related significantly to gray snapper catch rates during the same year, indicating that during periods of reduced water levels in the upper Taylor

Slough abundance of gray snapper increased. Increases in gray snapper abundance during the 1989-90 period may have also been related to low yearly rainfall in the ENP area and annual periods of high salinities in Florida Bay. A series of low rainfall years from 1985-90 resulted in increased hypersaline conditions in Florida Bay. Rutherford et al. (1983) reported larger fish in areas of higher salinity than fish in brackish areas. Thus, if during low rainfall years, sub-adult fish remain tend to remain in Florida Bay longer under high salinity conditions, then gray snapper abundance (catch rates) should increase and the fish would become increasingly available to the angler. During the 1993-95 period, water levels/rainfall, especially from Tropical Storm Gorden in November 1994 increased, resulting in salinity reductions in northern Florida Bay with a notable decrease in gray snapper catch rates (Fig. 8).

Effort-catch relationships-Annual estimated effort for the non-guided gray snapper fishery ranged from a high of 168,239 angler hours in 1994 to a low of 96,311 angler hours in 1985 (Fig. 12). The yearly catches of gray snapper were lowest in 1985 (61,859) and 1987 (58,401) and highest in 1989 (123,707) and 1990 (122,327) (Fig. 12). Increased size limits in 1988 and 1990 and imposition of bag limits in 1990 may account for the high number of gray snapper caught and released during those years. The annual estimated total catch of gray snapper was linearly correlated with estimated total fishing effort placed on the fishery between 1985-1996, suggesting that the maximum potential catch of gray snapper in Florida Bay has not been reached (Fig. 12)

Spotted seatrout- The percentage of boats catching spotted seatrout declined from 54% in 1985 to nearly 47% in 1988, but then increased steadily to over 60% in 1992 (Fig.3). After 1992 the percentage of boaters reporting spotted seatrout catches dropped rapidly to the lowest proportion (39%) over the long-term period in 1996, but rebounded in 1997 to 46%. During 1989-90, and 1995-97, a similar general pattern can be seen for the annual guide and non-guided harvest rates and estimated total harvest of spotted seatrout taken out of Flamingo, as that shown by harvest of gray snapper (Figs. 7). The lack of increase in harvest may be due to state regulations imposed on the fishery in 1989 which raised the legal size limit from 12 to 14", and then in 1996, for the south Florida populations (15" minimum size/5 fish bag limit/Nov-Dec closure), to reduce harvest to achieve the Florida Marine Fisheries Commission's (FMFC) spawning potential ratio (SPR) objective of 35%. The SPR is the ratio of the spawning stock biomass of the exploited fish population to the spawning stock biomass of the same population in an unfished condition. These regulations may have affected the strategy of anglers in both catching and harvesting seatrout as a declining trend in seatrout catch rates followed as anglers appeared to have targeted snook and red drum instead of seatrout as increased catches of snook and red drum occurred at the same time..

Greater numbers of seatrout were caught and released in 1997 than during the past 4 years (Fig. 6). This increase in catch is probably due in part to the 1996 regulatory restrictions, providing a good stock recruitment of small juvenile seatrout.

Environmental relationships-During the period 1985-96 a significant linear relationship

was found between spotted seatrout catch rates and northern Florida Bay annual mean salinities indicating that as salinity increased (26 to 43 ppt) from 1989 to 1992, seatrout catch rates increased for both guide and non-guided anglers (Fig.9). Annual mean water levels in the upper marshes were negatively correlated with annual spotted seatrout catch rates during the following year ($r = -0.73$, $N = 12$) and 3 years later ($r = -0.66$, $N = 12$) suggesting increased rainfall=water levels improve recruitment through increased growth and survival of larvae and juveniles. Recently, Thayer et al. (1998) in reporting increases in the spawning habitat and abundance of larval and small juvenile seatrout in northern Florida Bay east of Crocodile Pt., suggested that lowered salinities in this area may assist in the survival of these young-of-the-year fish. Presumably an increase in coastal rainfall and lower salinity results in an increase in larval recruitment and/or juvenile survival (Rutherford et al. 1989a) .

Effort-catch relationships-Total estimated effort of spotted seatrout ranged from a high of 202,383 angler hours in 1990 to 147,882 angler hours in 1995 (Fig. 13). The correlation of yearly effort with catch was linear and significant ($r = 0.792$, $P < 0.05$) (Fig. 13). There was no decrease in total catch with increasing effort, indicating yearly fishing effort did not severely impact the fishery.

Red Drum-The percentage of boats reporting catches of red drum decreased dramatically from 33% in 1985 to 17% in 1988, followed by a steady increase to over 36% in 1997 (Fig. 3). Our analysis indicates that based on red drum catch rates in Florida Bay, their abundance has increased, except for a dip in 1994, steadily since 1988, but remains considerably lower than during the period of 1979 to 1985 when the increase in the harvest of this species was recognized statewide by the FMFC and its concern for overexploitation or poor recruitment resulted in increased size limits of 12 to 18 inches in 1985, a closed season from March to May in 1986, followed by almost 2 full years of prohibited harvest (Fig. 7). When harvest was reinstituted in 1989 a bag limit of one fish per person was established and the percentage of anglers catching red drum greatly increased. If red drum populations were oveerexploited resulting in reduced recruitment in 1985-87, these restrictive regulations may have allowed the offshore stocks to rebuild, resulting in increased recruitment to the fishery beginning in 1989. Based on the faster than anticipated state-wide recovery of this species, the FMFC in 1996 eliminated the March, April, May closed seasons, allowing year round fishing. This probably attributed to higher catch rates observed in 1996-7, when compared to catches reported in 1995.

Environmental conditions- Fishing effort and catch rates may have affected by environmental conditions. For example, the reduced abundance of red drum during the 1985-87 period may have been due to prior intense fishing pressure or reduced annual rainfall Previous studies (Tilmant et al. 1989) have shown that periods of generally higher rainfall may lead to increased abundance of small juvenile red drum in the park. In our analysis increased abundance was significantly related to lower rainfall three years earlier (Fig. 10). Higman (1967) suggested periods of low rainfall are indicative of increased red drum abundance during the following year.

Catch/harvest- Annual estimated total catch data (Fig.14) suggests that red drum catches increased from a low of 23,853 fish in 1990 to 43,003 fish in 1996, an increase in 44% in numbers caught. Harvest increased from a low of 3,376 fish in 1992 to a high of 6,588 fish in 1996, an increase of 46% in numbers harvested (Fig.7).

Effort-catch relationships-Total estimated recreational effort of red drum for Florida Bay ranged from a low of 58,093 angler hours 1987 to 133,869 angler hours in 1996 (Fig. 14), an increase of 39% in fishing effort. A statistically significant linear relationship ($r = 0.7908$, $N = 12$, $P , 0.05$) was found between yearly effort from 1985-96 and the resultant catch, suggesting that the increase in fishing effort did not greatly impact the catch of red drum in the non-guide fishery (Fig. 14)

Snook-The popularity of snook has increased dramatically from 1985-1997. The percentage of boats reporting catches of snook increased from 9% in 1985 to nearly 27% in 1994 (Fig. 3). The snook population of Florida Bay has not been extensively studied. As recently as 1982 this species was considered a species of special concern-close to extinction. Only 130 fish were reported captured in 1982 in Florida Bay. . However after numerous regulatory activities enacted during the early- to mid- eighties (emergency closures during June-August, January-February, minimum size increased from 18 to 24 inches, reduced bag limits based on size of fish) the species recovered dramatically and is approaching the FMFC Spawning Potential Ratio (SPR) of 40% for both coats of Florida.

Snook is a relatively non-migratory, inshore species that will make localized movements between estuaries as juveniles, and move to nearby offshore areas as adults for spawning activities. Research, underway to determine which population the Florida Bay's stock belongs to, or if it represents a separate Florida Bay/Florida Keys stock, suggests that Gulf and Atlantic stocks differ genetically by size and age (Tringali and Bert 1994). Muller & Murphy (1997), Schmidt et al. (In Prep), and Thue et al. 1982 reported that fish aged three to five are the main recruits to the fishery.

Catch rates.-The long-term (12-year record) record of snook catch and harvest rates for successful sport fishing boats within Florida Bay is presented in Fig. 6. Catches and catch rates of snook in Florida Bay dropped sharply during 1986-1989, then increased. During 1984-94 there was a 148% increase in catch while harvest increased only 40% suggesting increased catches were due to a large recruitment of young fish being released due to size regulations (Schmidt et al. in prep.) Because of regulations and possible changes in fishing behavior, an unknown number of fishermen are presumably releasing their catch in response to catch-and-release fishing promotions.

Overall, (Fig. 11) the annual non-guided average CPUE of snook based on angler h reached a peak in 1992 (.326) from a low of .171 fish per angler h effort in 1988. After 1992 the annual catch rates of snook dropped to 0.24 fish/angler h in 1996. Guide mean annual catch rates of snook followed a somewhat similar pattern with a high of .478 fish per angler h effort in 1985, declining to a low of .232 fish per angler h effort in 1989, and gradually increasing to the second highest average CPUE in 1993 (.37 angler h). Muller

and Murphy (1997) presented a comparison of the mean standardized catch rates (fish per trip) and length of ENP snook from the Gulf Coast as a part of an assessment of south Florida snook populations for the period of 1982-1992. They reported catch rates of similar magnitude and similar trends as those found in the current study with higher catch rates from 1983 through 1985, decreasing until 1991 when they increased again. Schmidt et al. (in prep) reported similar increases in catches and catch rates from the early to mid-eighties based on good recruitment following several years of average and above average rainfall during 1982-1984. Sizes of snook from three data sources on the Gulf coast were similar.

Catch/harvest.-The annual total estimated catch of snook from sport fishery in Florida Bay increased from a low of 6,975 fish in 1990 to a high of 22,581 fish in 1994 (Fig. 15) representing an increase of nearly 70% in numbers of fish taken. Between 1992 and 1995 harvest increased from a low of 1,135 fish to a high of 3,433 fish kept, an increase of 67% in numbers of snook harvested (Fig.7). Despite the bag limits, minimum size limits, and closed seasons placed on this fishery to date, harvest has not been reduced. Even though there was a state-wide snook die-off due to cold weather in 1989-90 (Schmidt & Robblee 1994), and a similar but much smaller cold-snap die-off reported in SW Florida during the winter of 1996, this year represents the greatest number of non-guided fishing parties (1300) catching snook over the period of record (1958-1997). According to recent National Marine Fisheries Service MRFSS (Marine Recreational Fisheries Statistical Survey) fisheries statistics for Florida, the increase in snook catch/harvest rates over the past 5-10 years appears to be a state wide occurrence, particularly on the east-central coast (Taylor et al. 1996). By reducing the state bag limit from two to one per day for Florida (under current consideration), the SPR for snook would come close to the FMFC's SPR target of 28%.

Environmental Relationships-Declining stock size of Florida Bay snook populations observed during 1986 to 1989 may have been due to low rainfall and water levels in the upper marsh areas. A significant linear relationship ($r=0.578$, $N= 12$, $P=0.04$) was found between recorded CPUE of snook and mean annual upland water levels recorded at P-37 in western Taylor Slough and mean annual rainfall recorded at 5 stations in the ENP area ($r = 0.677$, $N = 12$, $P < 0.05$) during the same year (Fig. 11). However the long-term annual non-guided catch rates of snook were not found to be correlated with water levels when time-lagged by one- to three years nor were annual CPUE values of snook significantly correlated with mean annual salinities recorded in northern Florida Bay. Although no statistical correlation was found between annual mean salinities and snook catch rates , the relationship shown in Figure 11 suggests that a period of generally high salinity years may lead to decreased abundance of snook in Florida Bay. The overall increased abundance of snook may have been a result of increased rainfall and water levels as shown in Figure 11, and reported during the early eighties) by Schmidt et al (in prep). Mean annual rainfall and water levels were higher when catch rates were higher. Van Os et al. (1981) indicated that the catch rate of snook within the St. Lucie River estuary, was positively correlated with the length of St Lucie River control structure discharges. They concluded that snook move into the freshwater discharges to take

advantage of the increased food supply. Other field studies on snook habitat have shown that the greatest number of juvenile snook are consistently found in shallow, well protected, back-water areas of estuaries that are influenced by freshwater runoff (Fore and Schmidt 1974; McMichael et al. 1987).

Effort-Catch Relationships.- Annual fishing effort for sport anglers of snook in Florida Bay ranged from lows of 44,071 and 43,193 angler h in 1990 and 1991, respectively, to a high of 85,728 anger h in 1996, an increase of nearly 50% in fishing effort (Fig.15) The annual estimated total catch of snook for the sport fishery from was highly correlated with the total angler hours effort placed on the stock between 1985 and 1996 ($r = .0.922$, $N=12$, $p<0.01$) (Fig. 15). Total catch appeared to increase linearly over the entire range of annual effort, suggesting that current catches do not greatly impact the Florida Bay stock and that additional increases in catch are possible. This forecast is supported by Muller and Murphy (1997) who concluded that based on catch rates, harvest levels, age and size of fish, the snook stocks in south Florida are in good condition. For the Gulf stocks, the population size projected for 1997 is the highest in the time series.

Cooperative Federal-State Data Collection Programs-The National Marine Fisheries Service, Gulf States Marine Fisheries Commission, Florida's Department of Environmental Protection (DEP), and the NPS (ENP) worked cooperatively to develop the Gulf Charter Boat Survey Research Program. The Program will develop methods for more efficient data collection and more precise estimation of fishing effort by charter (guide) boat anglers. The Program consists of two pilot surveys - a pilot telephone survey of charter boat operators and a pilot logbook panel survey. We provided information on park guide boat operators to DEP to update charter boat directories for the Gulf Coast of Florida. Surveys began in September and will continue through August 1998. Survey questionnaires will serve to document/validate guide fishing activities in ENP. Weekly fishing effort activities are summed to allow direct comparison with MRFSS estimates.

A Recreational Fisheries Information Network Quality Control/Quality Assurance draft document was reviewed/completed, metadata criteria were reviewed, and duplicative marine recreational data collection activities including ENP and Biscayne NP were reviewed for recommendations at the Biological/Environmental Work Group meeting. The next meeting is scheduled in conjunction with the fall 1998 meeting of FIN (ComFIN and RecFIN (SE) in Puerto Rico.

CONCLUSIONS

While the current sport fish monitoring project is evaluating various aspects of catch/harvest rates, relative abundance, total estimated harvest, and fishing/boating activity, additional areas of work are underway or needed. These include: (1) current stock assessments on other major game fish species including black drum, sheepsheaad, barracuda, etc.using, as needed, separable virtual population analysis (SVPA), SPR, &

sequential population analysis (SPA), (DEP/NPS snook/seatrout assessments were completed for 1997), (2) new age-length keys for major species, especially resident species, snook & seatrout (seatrout otoliths/scales have collected by the park and await analysis at Florida Marine Research Institute; collection and analyses of snook hard parts is pending), (3) analysis of a 12 year non-guide/guide Gulf Coast database, cooperatively by DEP/ENP is underway), (4) analysis of fish length measurements was completed for snook from the Gulf Coast for the years 1982-92; (5) incorporate the fisheries database into the park's GIS system for spatially oriented ecological applications, (6) long-term (12 years Florida Bay CPUE/HPUE stock assessment of major species was completed, (7) develop a new fishery data management handbook, and .(8) the non-guide fishing area locator map was revised, as recommended, to reflect a finer resolution in "area fished" as in the guide logbooks.

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Table 1: Recreational catch/harvest rates (per angler-hours) in Florida Bay, Everglades National Park, 1997.

Non-Guide Anglers				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size* CPUE/HPUE**	
Snook	0.2174±0.0134	0.108±0.0070	1300	441
Red Drum	0.3402±0.0250	0.1143±0.0041	1886	1041
Spotted Seatrout	1.02114±0.0660	0.2974±0.0149	2389	1447
Gray Snapper	0.66269±0.0448	0.2526±0.0178	1513	730

* Number of Fishing Parties

RECREATIONAL/GUIDE FISHING AREAS
EVERGLADES NATIONAL PARK

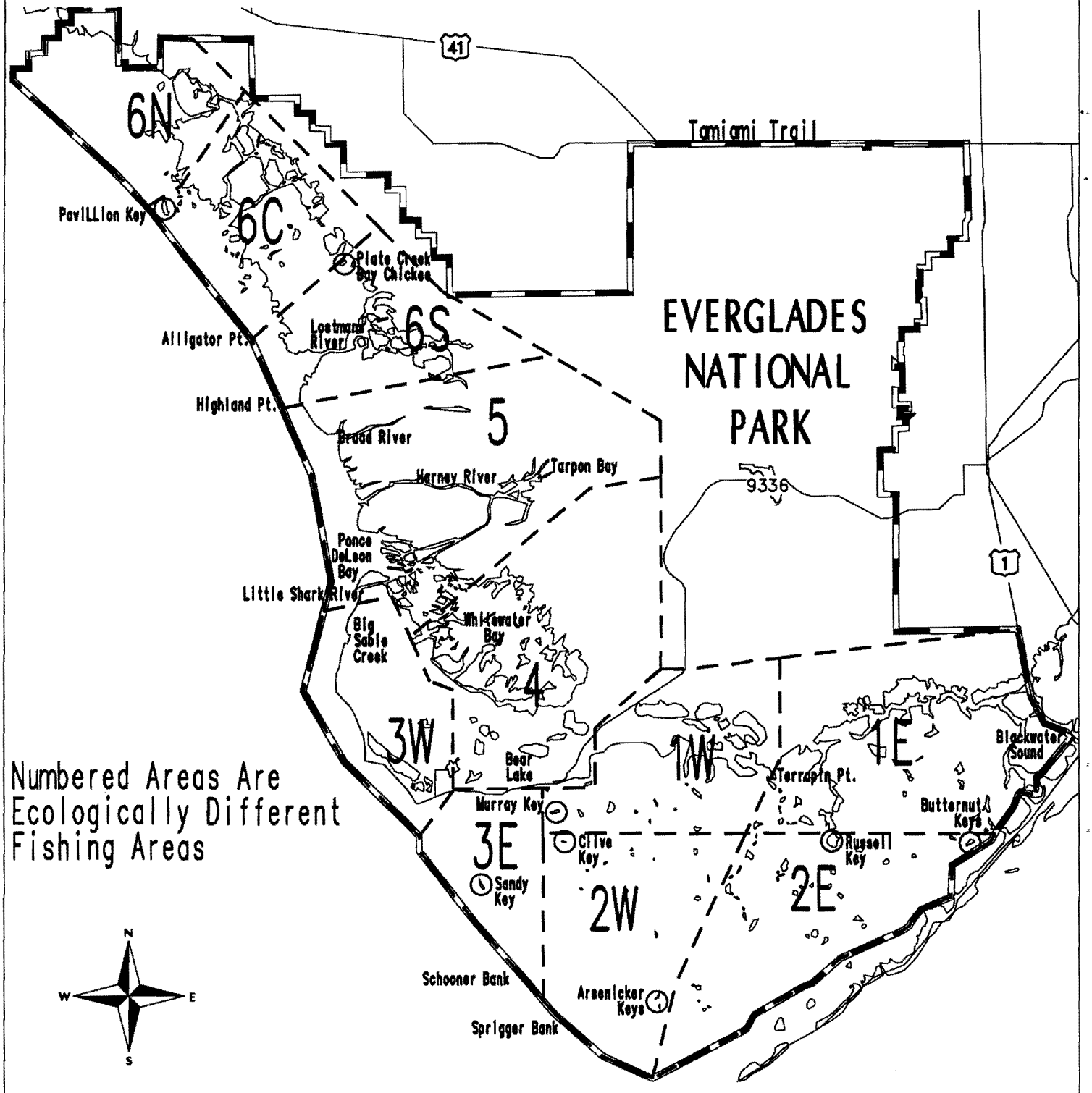

Figure 1

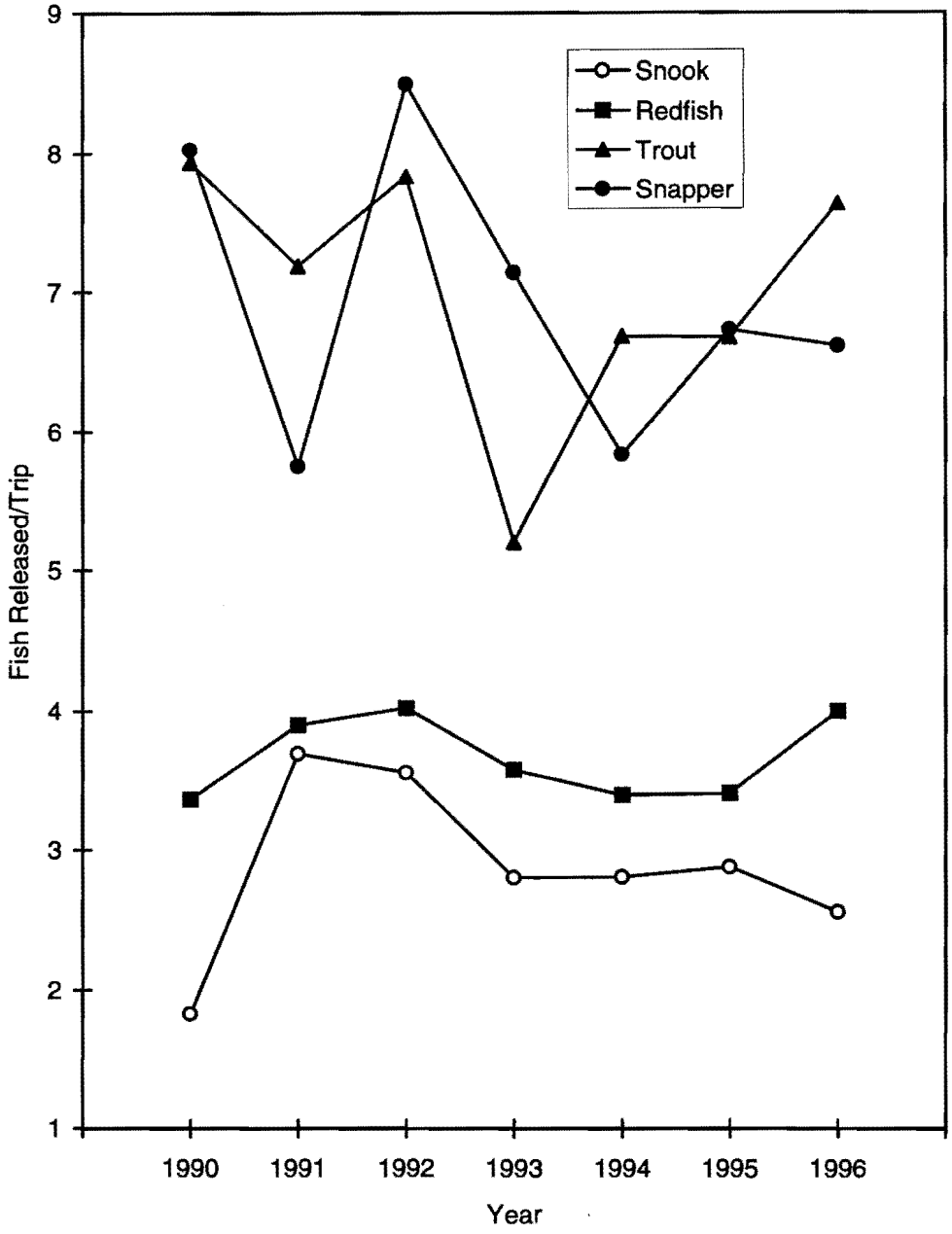

Figure 2: Mean number of fish released per successful boat by non-guide anglers in Florida Bay (Areas 1-5), 1990-96.

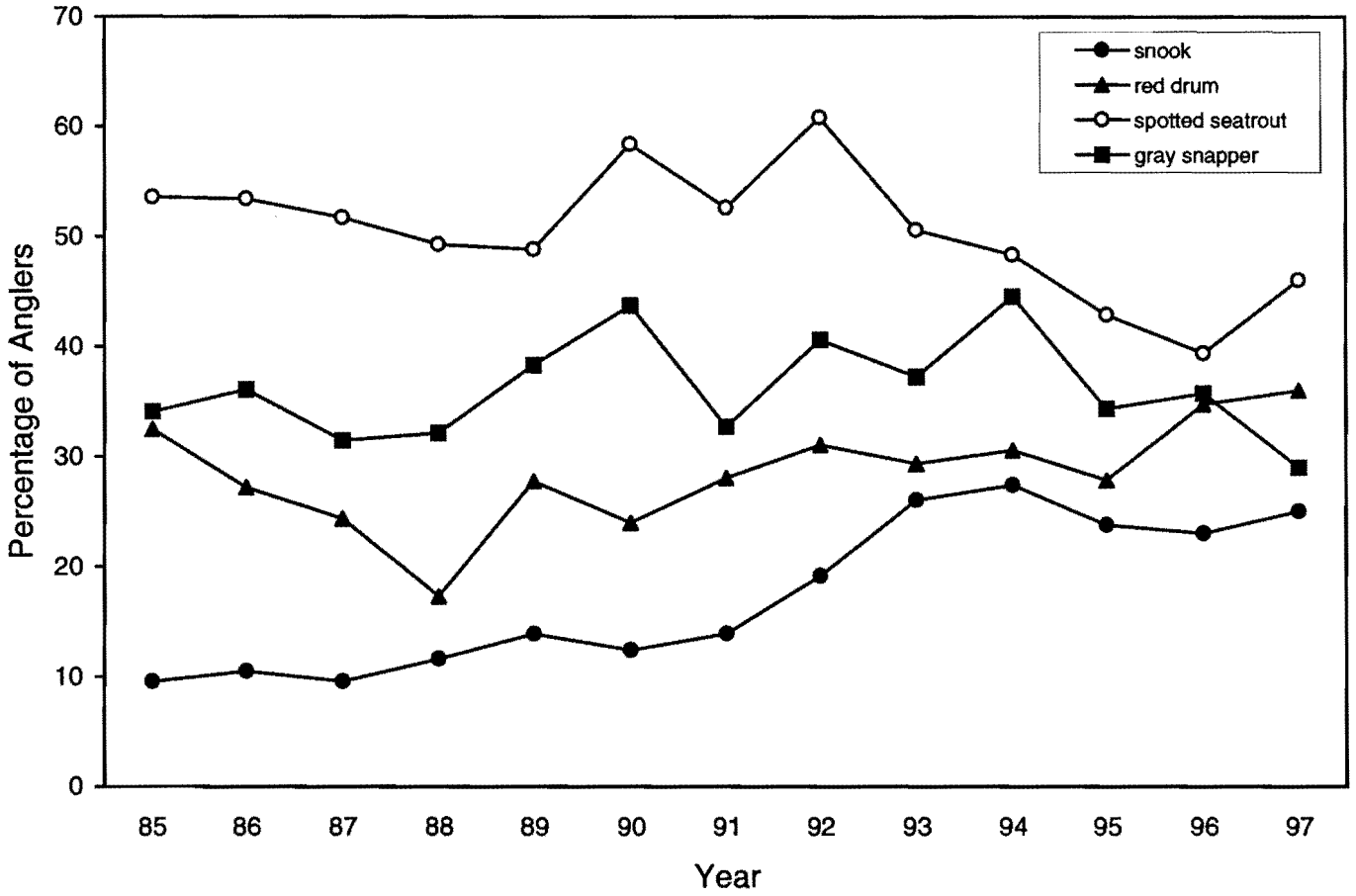

Figure 3: Percentage of anglers interviewed at Flamingo catching snook, red drum, gray snapper and spotted seatrout, 1985-1997.

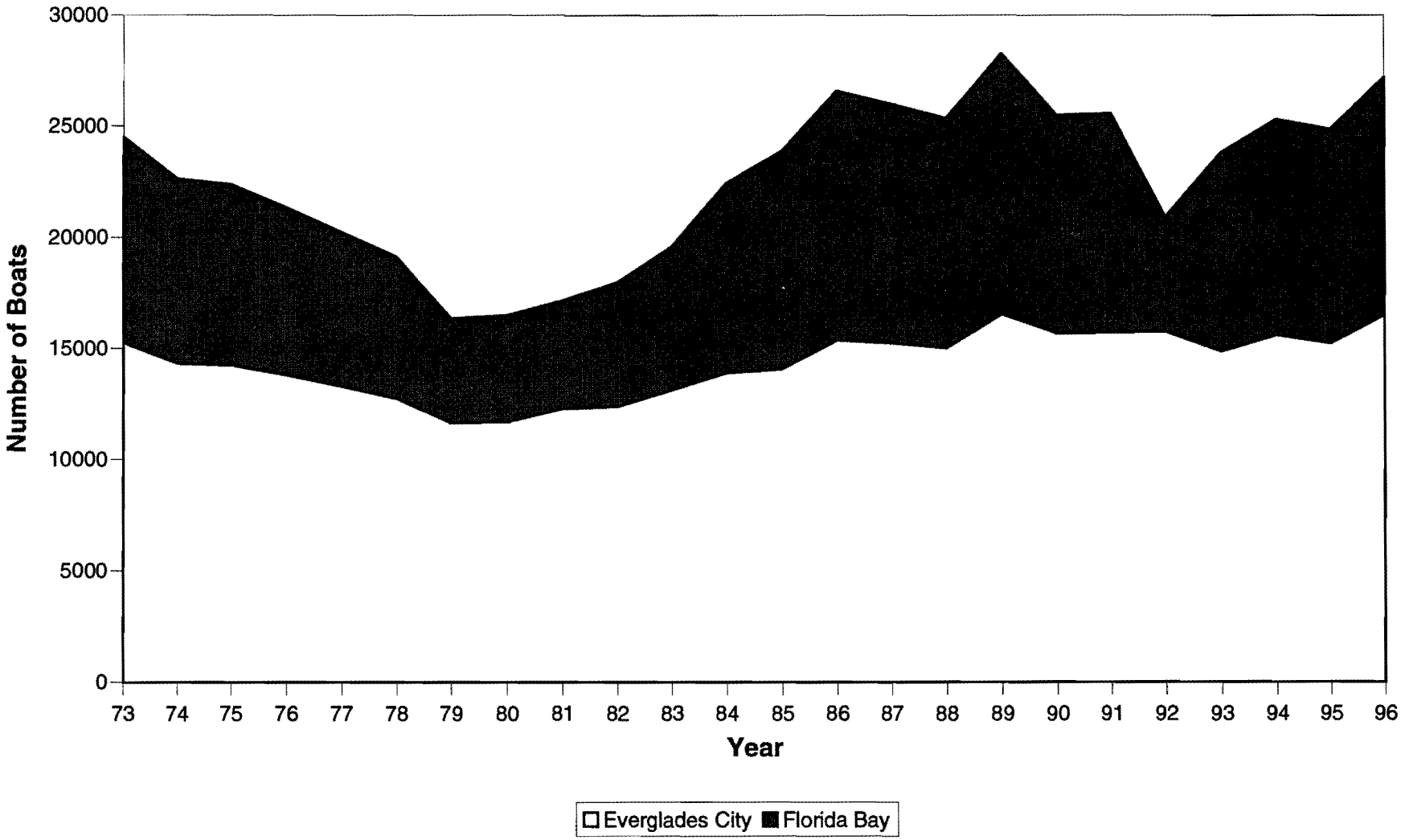

Figure 4: Estimated number of fishing boats within Everglades National Park, 1973-96.

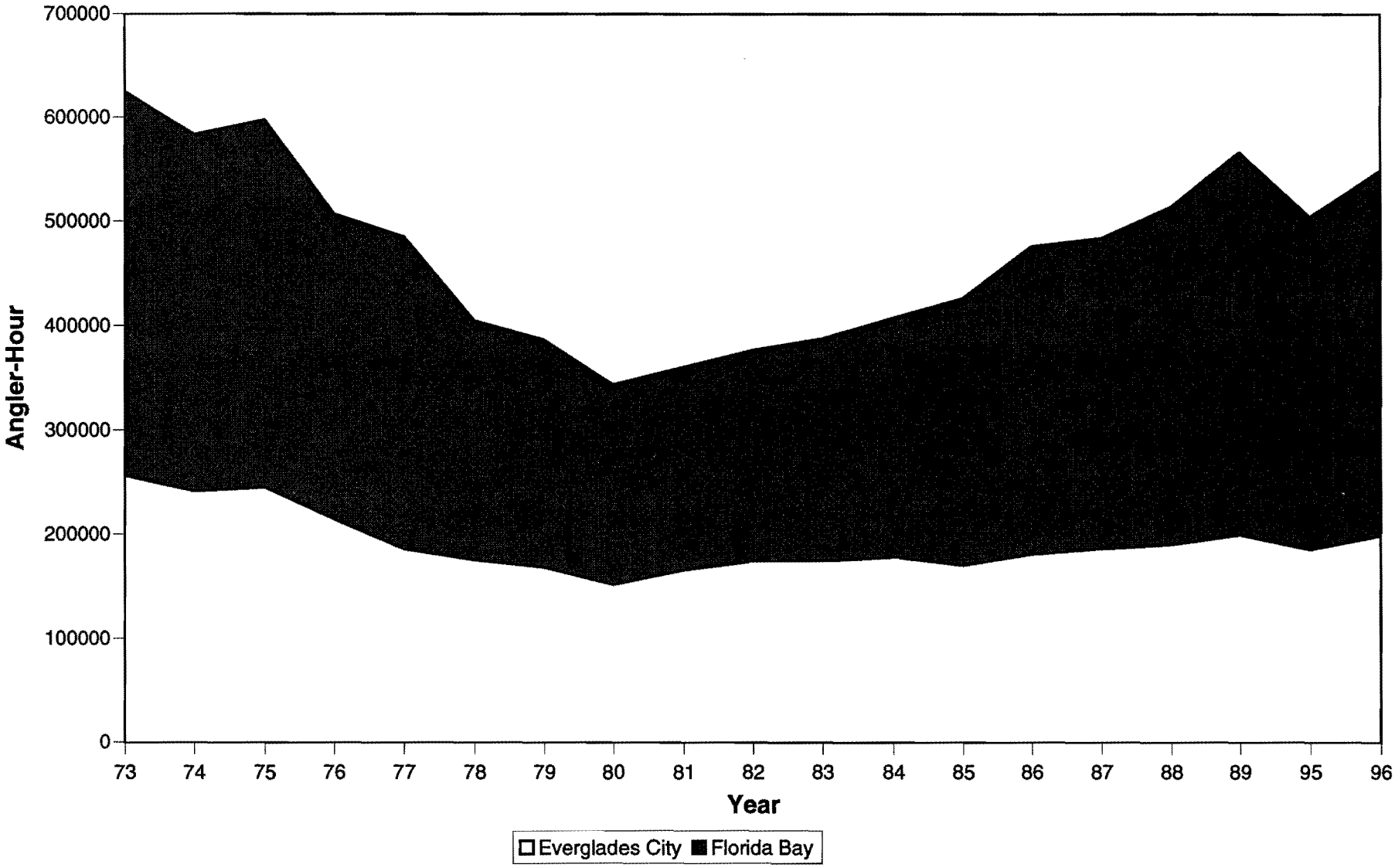

Figure 5: Estimated total effort (Angler-Hours) of fishing within Everglades National Park, 1973-89, 95-96.

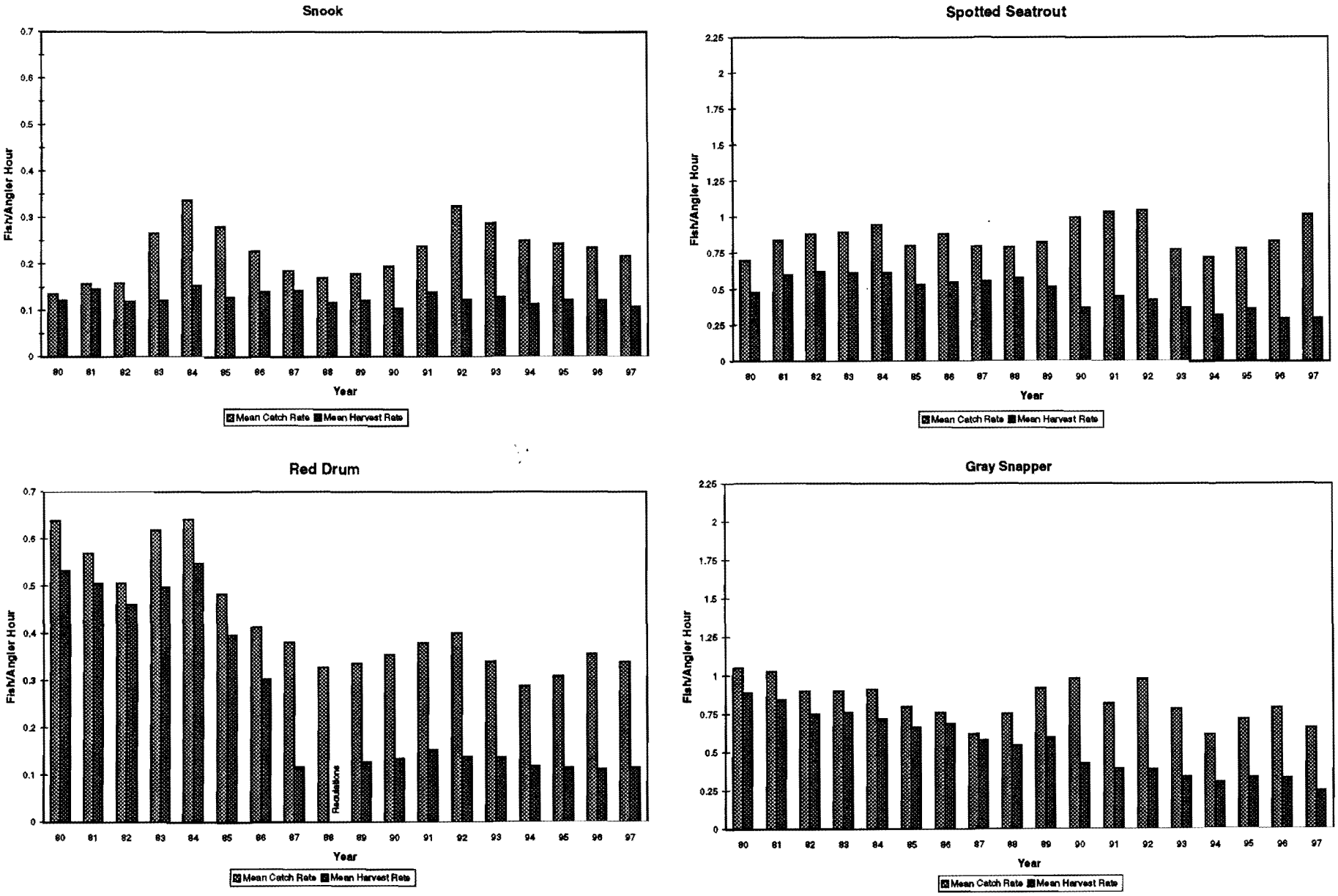

Figure 6: Recreational non-guided catch/harvest rates for the major game fish species in Florida Bay (Areas 1-5), 1980-97.

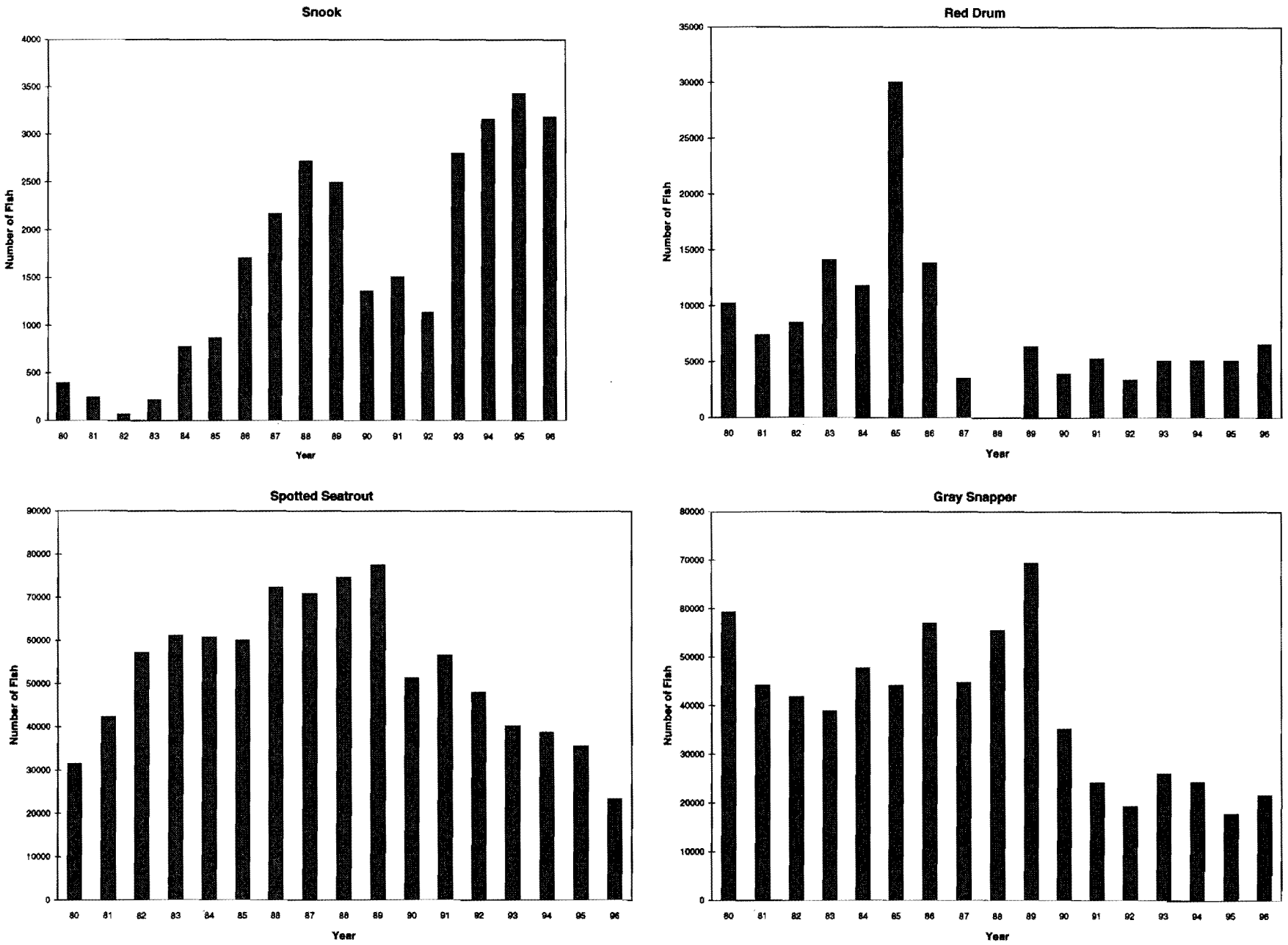

Figure 7: Estimated total harvest of snook, red drum, spotted seatrout and gray snapper by non-guided anglers in Florida Bay (Areas 1-5), 1980-96.

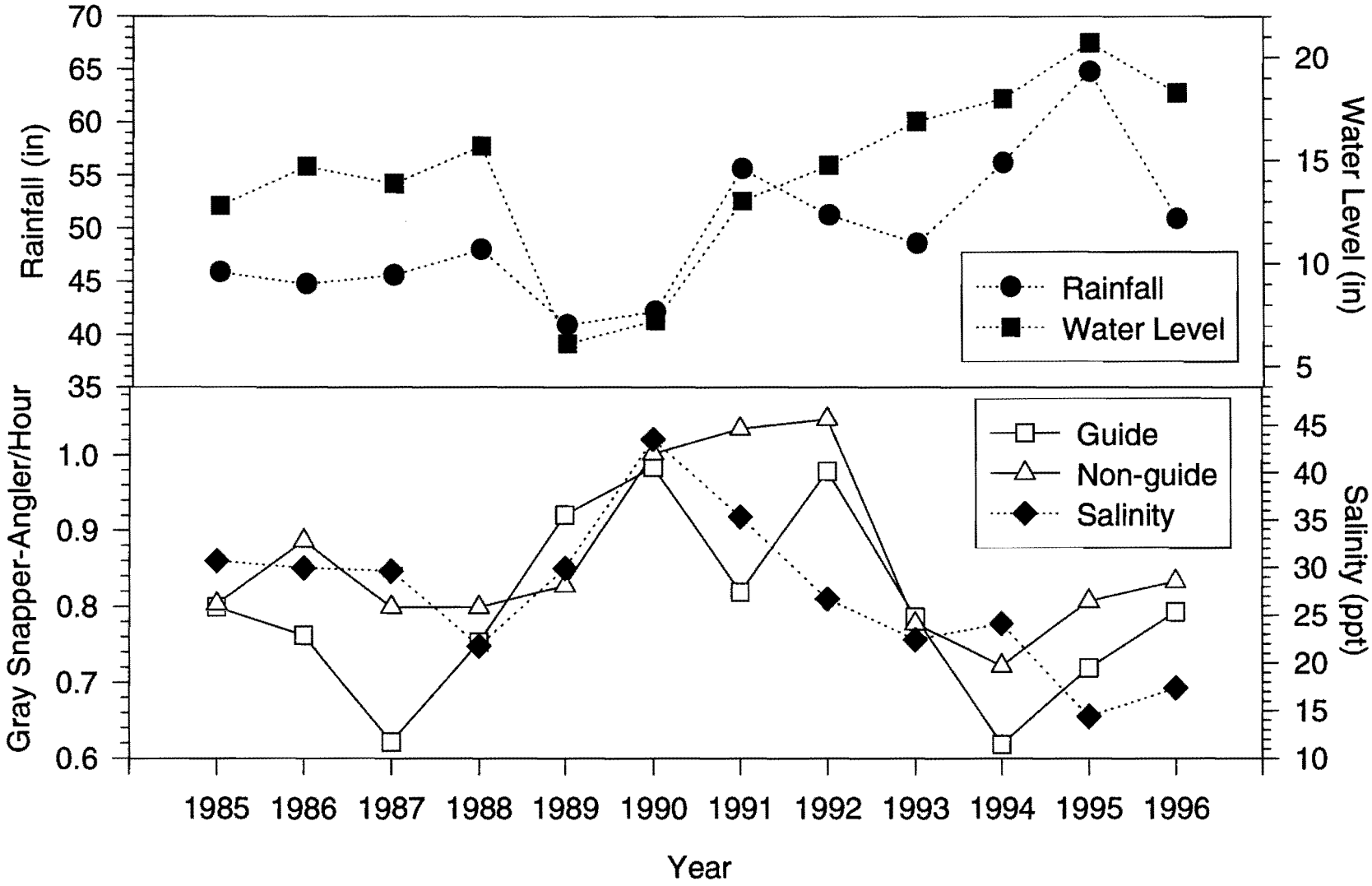

Figure 8: Average rainfall recorded at 5 stations in or near ENP, average water level at station P-37 in Taylor Slough (ENP), average salinity recorded at 3 stations in Florida Bay and, guide and non-guide catch rates of gray snapper in the Florida Bay Area, 1985-96.

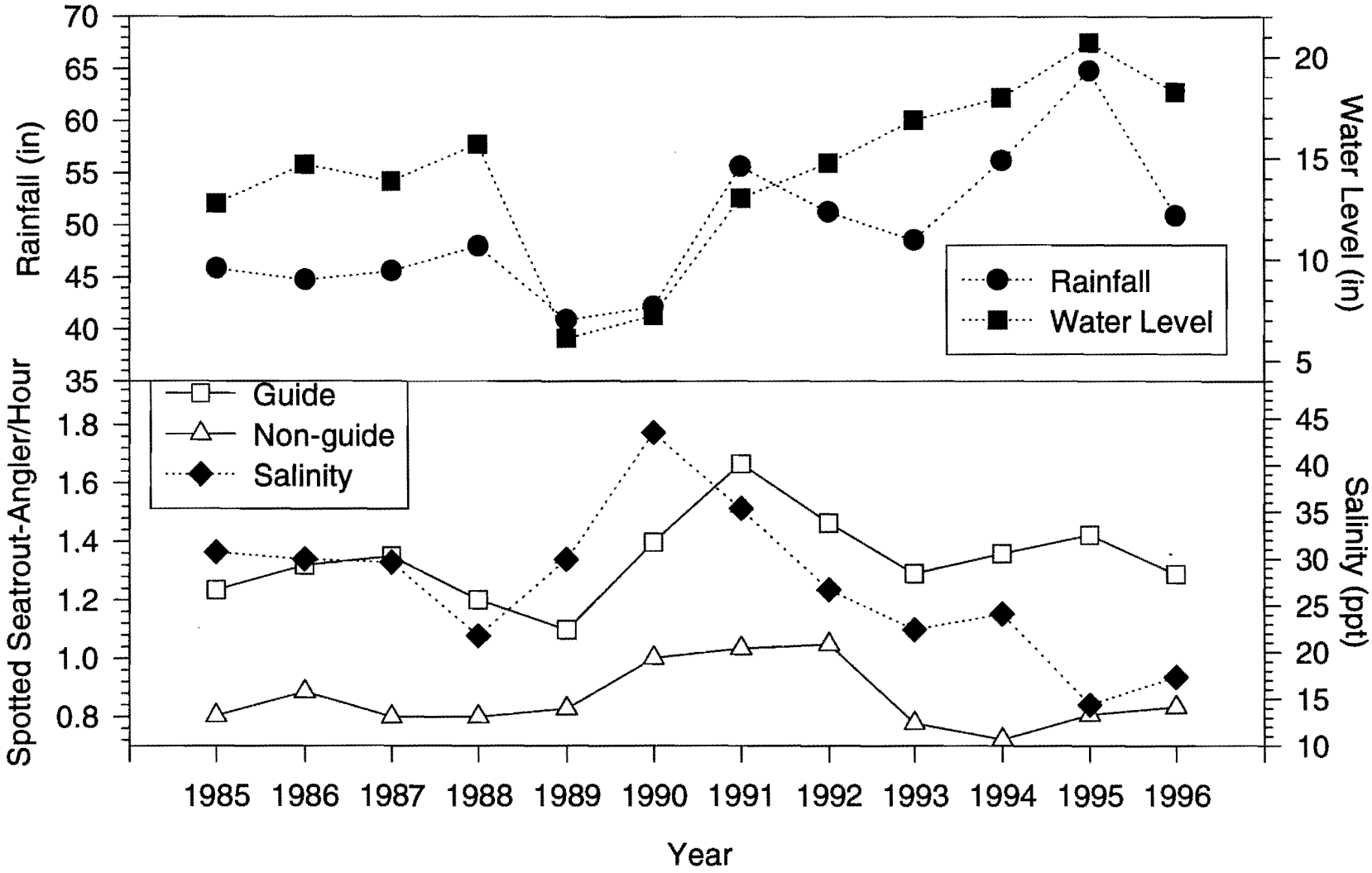

Figure 9: Average rainfall recorded at 5 stations in or near ENP, average water level at station P-37 in Taylor Slough (ENP), average salinity recorded at 3 stations in Florida Bay and, guide and non-guide catch rates of spotted seatrout in the Florida Bay Area, 1985-96.

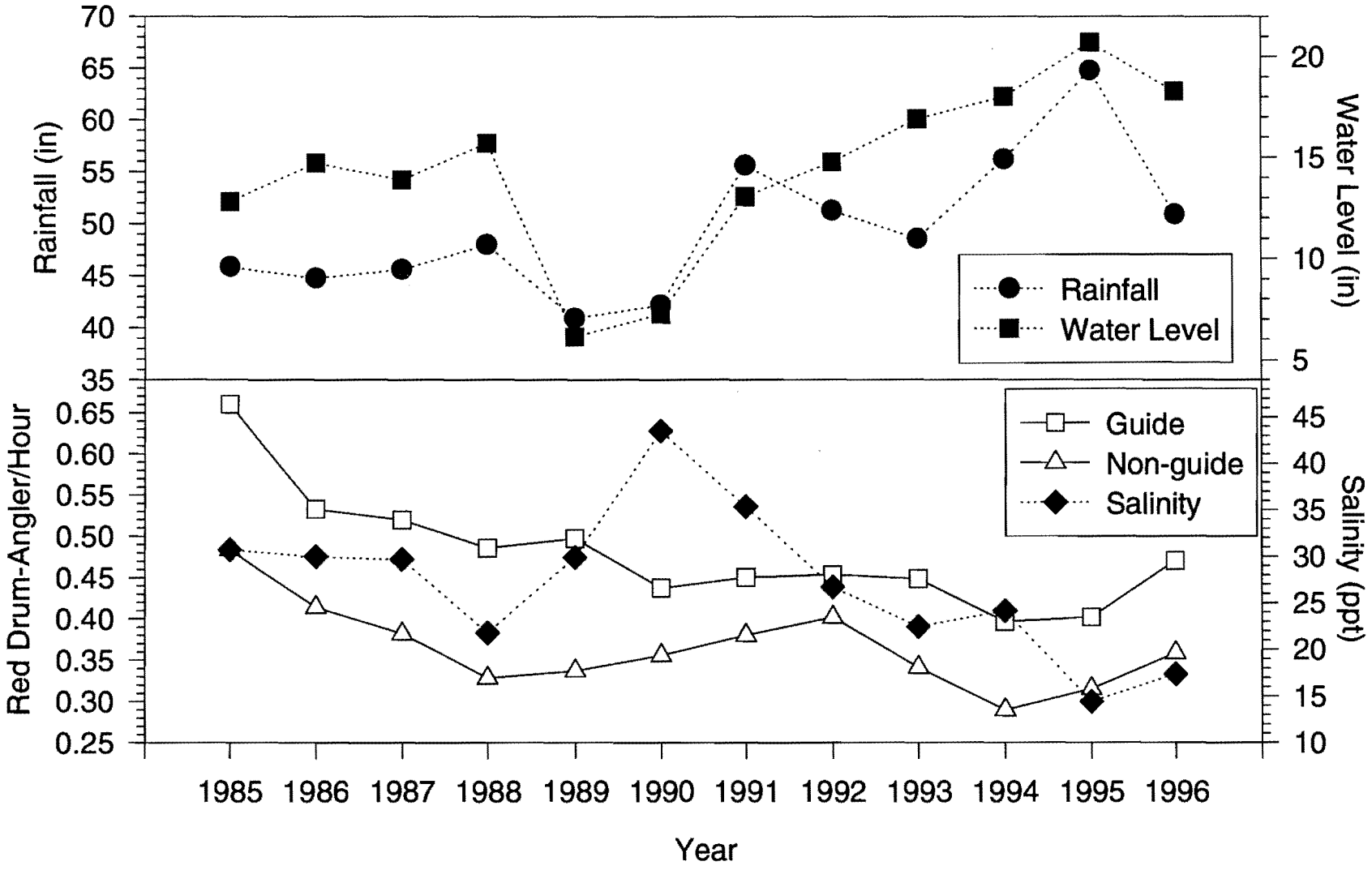

Figure 10: Average rainfall recorded at 5 stations in or near ENP, average water level at station P-37 in Taylor Slough (ENP), average salinity recorded at 3 stations in Florida Bay and, guide and non-guide catch rates of red drum in the Florida Bay Area, 1985-96.

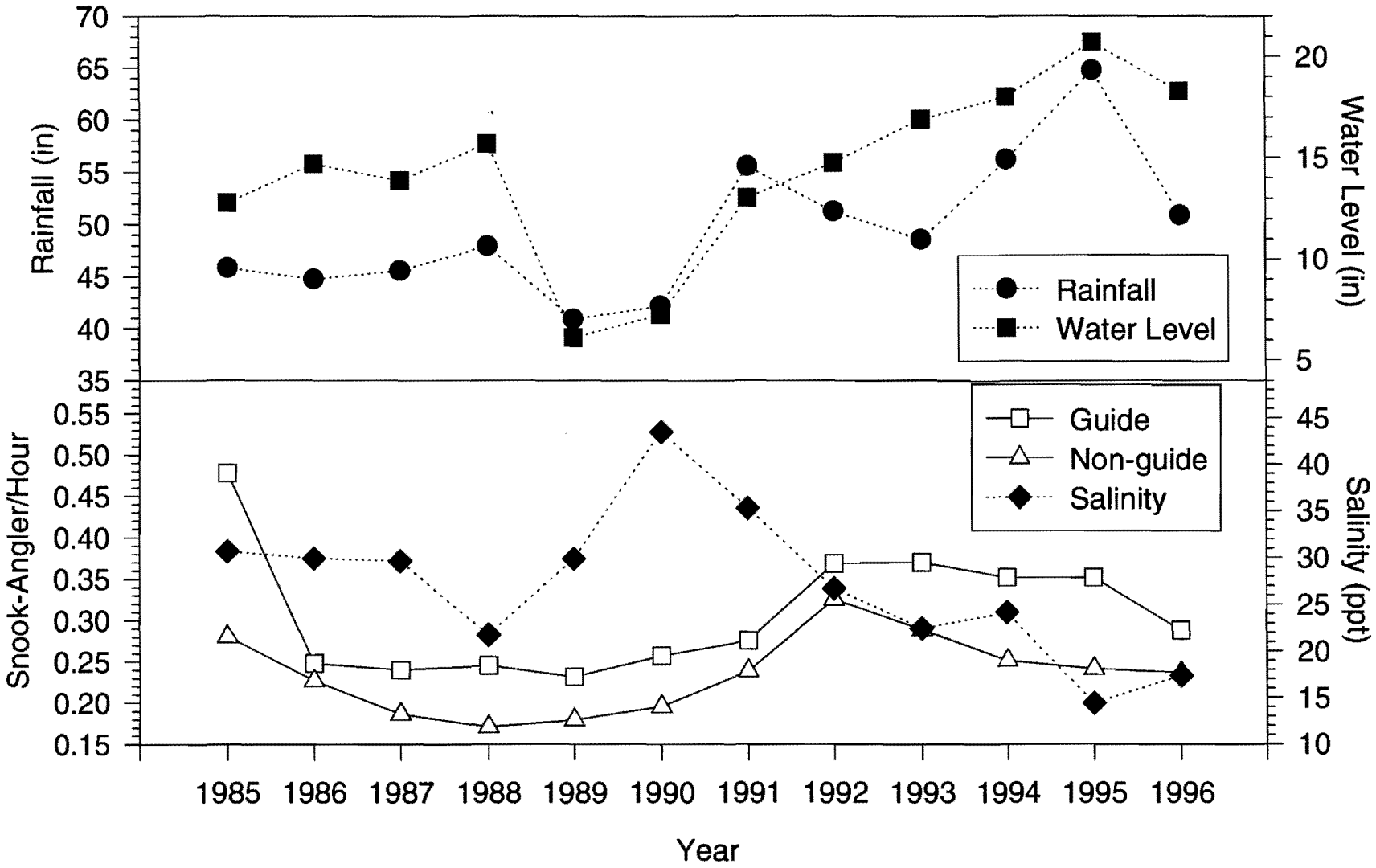

Figure 11: Average rainfall recorded at 5 stations in or near ENP, average water level at station P-37 in Taylor Slough (ENP), average salinity recorded at 3 stations in Florida Bay and, guide and non-guide catch rates of snook in the Florida Bay Area, 1985-96.

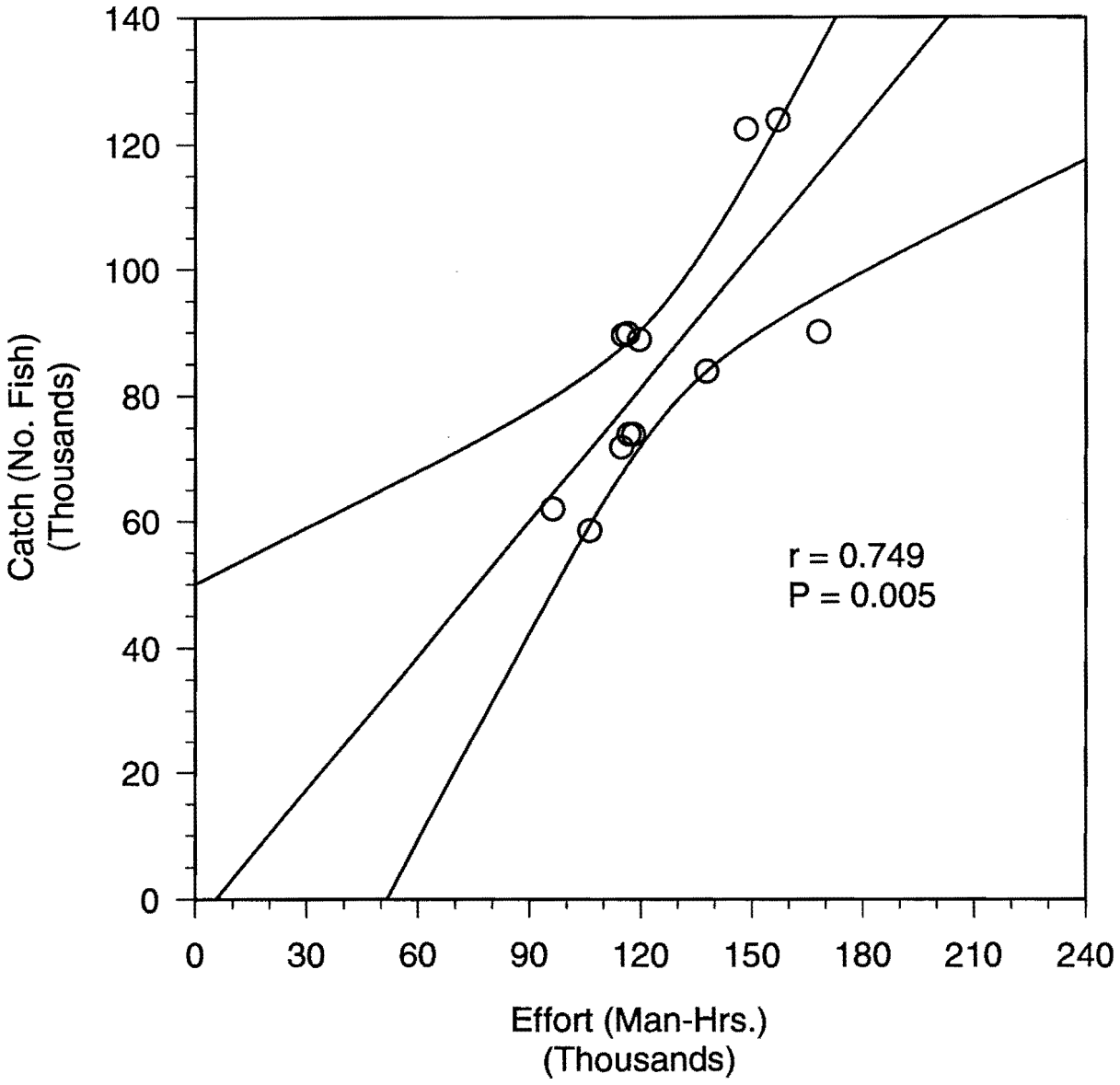

Figure 12: Correlation with 95% confidence intervals of total estimated catch and total estimated effort for gray snapper in Florida Bay (Areas 1-5), 1985-96.

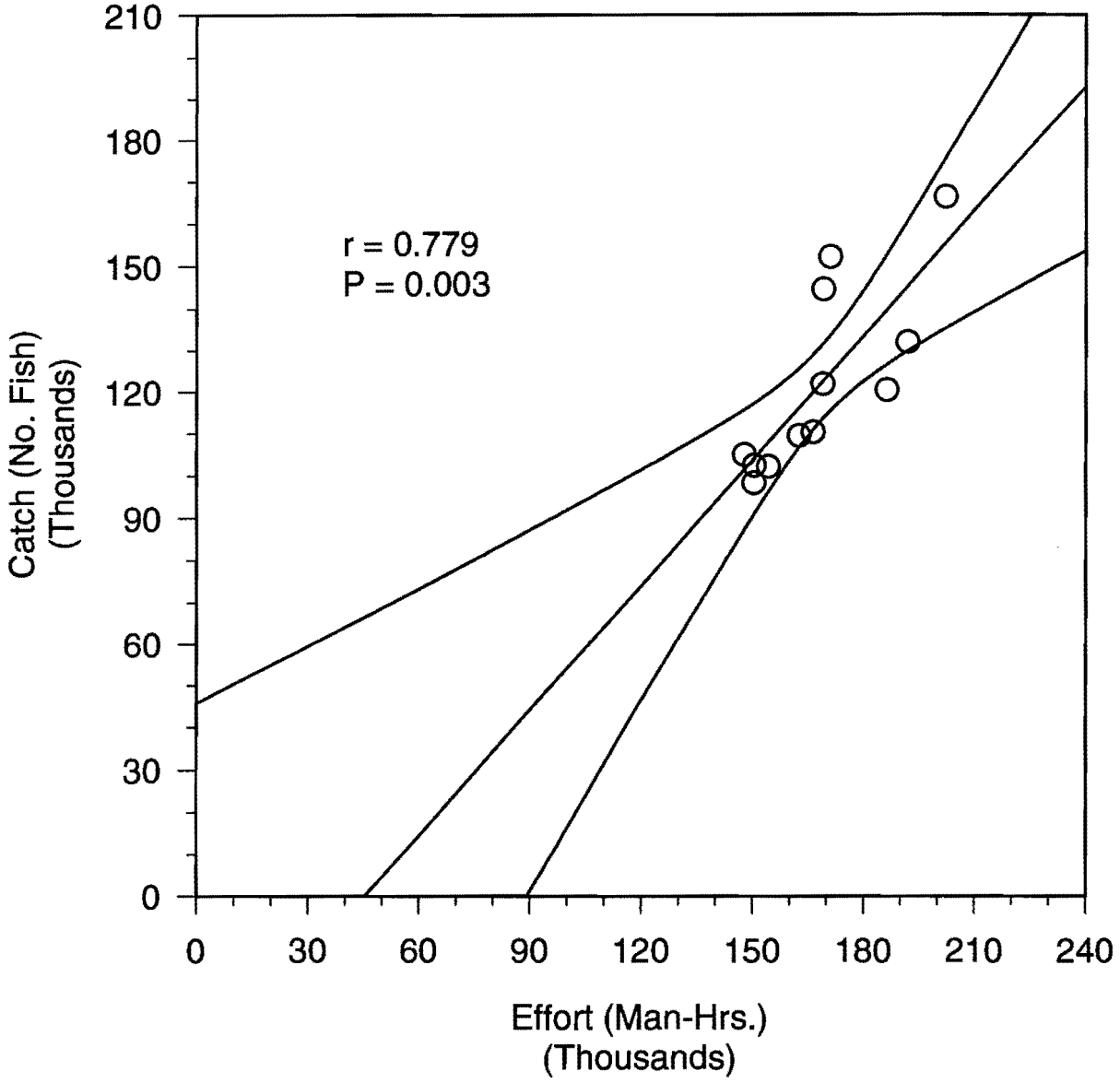

Figure 13: Correlation with 95% confidence intervals of total estimated catch and total estimated effort for spotted seatrout in Florida Bay (Areas 1-5), 1985-96.

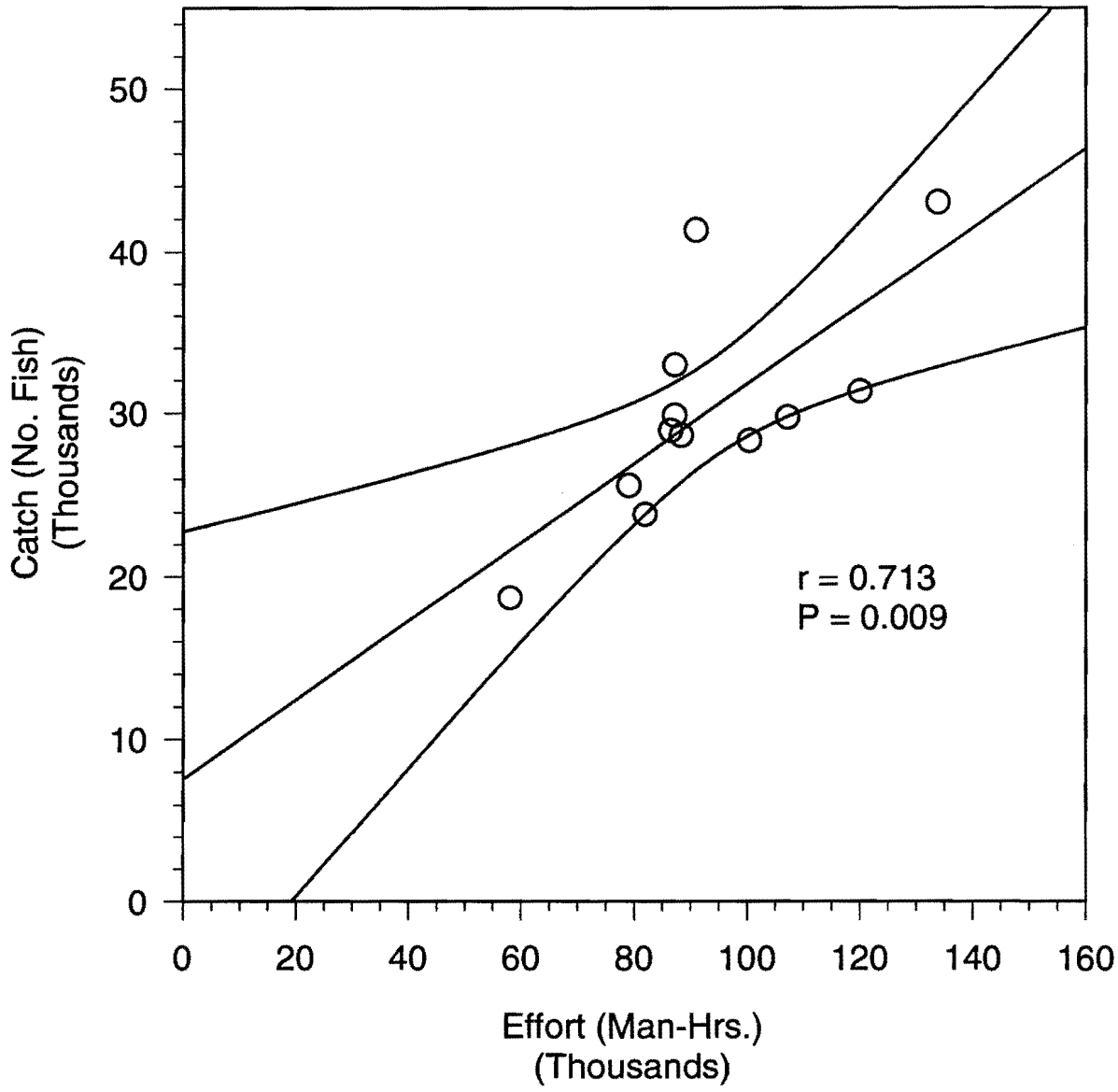

Figure 14: Correlation with 95% confidence intervals of total estimated catch and total estimated effort for red drum in Florida Bay (Areas 1-5), 1985-96.

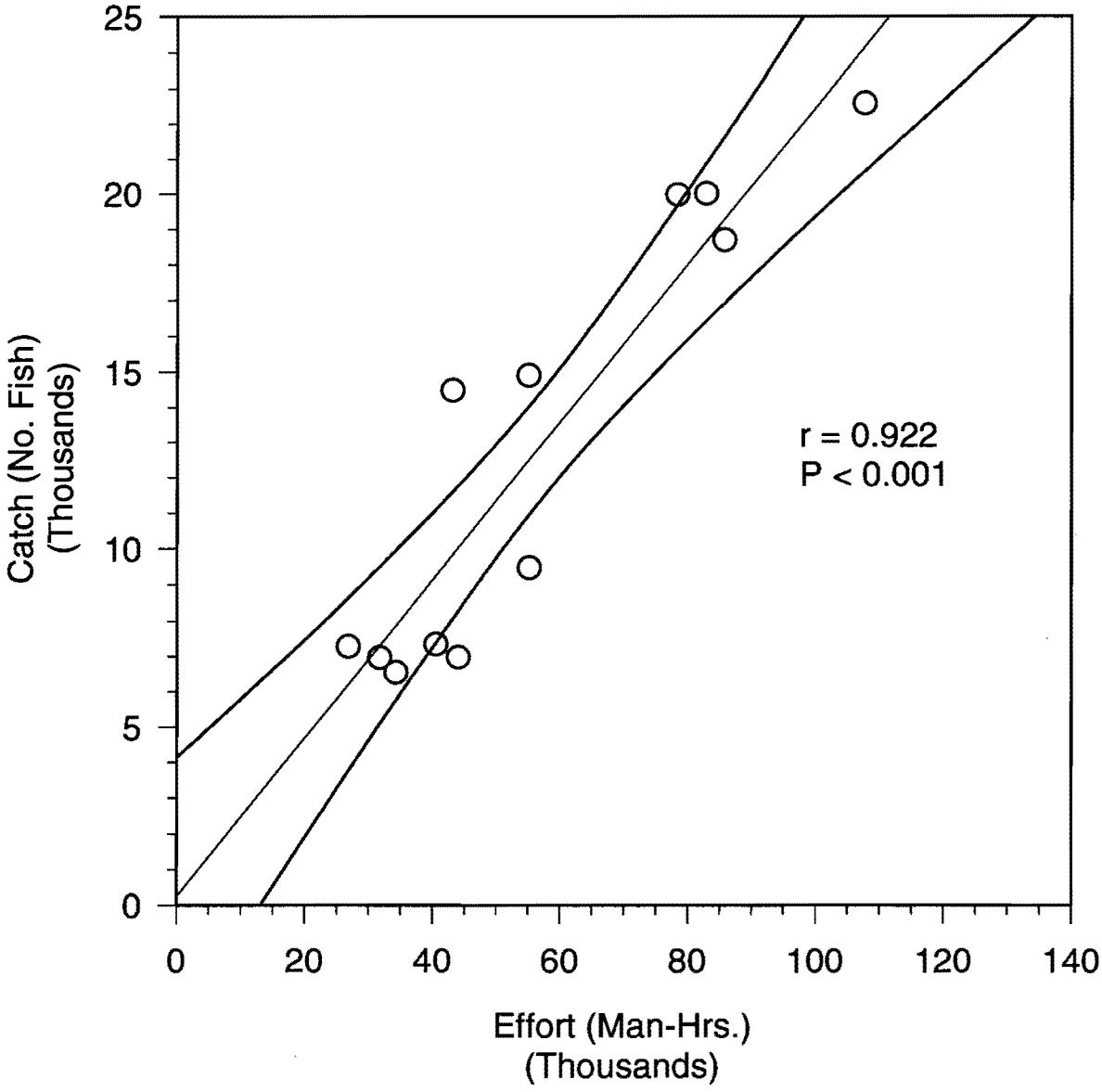

Figure 15: Correlation with 95% confidence intervals of total estimated catch and total sport fishing effort for snook in Florida Bay (Areas 1-5), 1985-96.