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ANNUAL FISHERIES REPORT
EVERGLADES NATIONAL PARK

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National Park Service
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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 to: 1) estimate catch rates, relative abundance, age structure, 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, 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, an analysis of the fisheries database in 1985-88, provided Virtual Population Analysis (VPA) cohort stock assessments for the park's major fish species based on a 10-year collection (1974-84) of over 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 at Flamingo for NOAA's NMFS (National Marine Fisheries Service) MRFSS (Marine Recreational Fisheries Statistical Survey) regional quarterly meeting, and at the Annual Meeting of the American Fisheries Society in Tampa, FL. A status report on Florida Bay project results was completed for the Florida Bay Science Conference held in Gainesville during October. A poster on the preliminary analysis of guide data was presented at the Annual Meeting of the Ecological Society of America, Logan, UT.

Other related activities that involve the gamefish harvest project include the evaluation of fish kills. One fish kill event was reported in the Bear Lake area during March, 1995.

This report represents the first annual fisheries report produced since 1990. Due to severe personnel shortages, both the project manager and fisheries technician departed during 1991, only basic data collection activities were maintained from 1991-94 by two port samplers at Flamingo and Everglades City. The report includes a description of the fishery, and relative abundance and estimated total harvest for selected gamefish species.

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 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 (hours fished/number of anglers), 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 Everglades City interviews. Data collection activities began in Everglades City in 1980.

Estimates of total recreational catch and harvest of individual fish species 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.

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.

RESULTS

All of the recreational non-guided fishermen 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 recreational 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. This report represents the first time that Everglades City angler survey and catch data has been presented together in an annual report format.

During 1995, 3,420 boaters were interviewed at Flamingo. Ninety-eight percent of these boating trips were involved in sport fishing activity. Only 5.4% of the anglers did not catch fish.

At Everglades City only fishing boats were interviewed. A total of 2,239 fishing parties were interviewed. Only 4.4% of the fishermen did not catch fish.

Description of the Fishery

Most (86%) of the anglers fishing out of Flamingo were south Florida residents (Dade County to, and including Ft Lauderdale, excluding local); 3% local (Florida City, Flamingo, Florida Keys), and 10% Florida other than south Florida or local. Only 1% of the anglers came from out of state.

At Everglades City, most (67%) 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 15% were local (Chokoloskee/Everglades City/Ochopee) residents and 3% came from out of state.

An estimated 24,092 fishing trips, 57,584 anglers, and 24,670 boats made up the boating and fishing activity in Florida Bay. Of these fishing trips, 14% were interviewed at the Flamingo boat ramps. The average trip from these ramps lasted 5.6 hours and caught an average of 19 fish.

Most anglers interviewed at Flamingo (59%) did not try to catch any particular kind of fish. Snook was the most popular fish, sought by 19% of the fishermen. The next four species preferred were seatrout (12%), red drum (7%), tarpon (1%), and gray snapper (2%). Over 43% of the fishing parties interviewed reported catching spotted seatrout. The next three species most commonly caught were gray snapper (34%), red drum (28%), and snook (24%).

At Everglades City an estimated 14,754 fishing trips, 34,343 anglers, and 15,105 boats made up the boating and fishing activity. Of these fishing trips, 15 % were interviewed at the Everglades City boat ramps. The average trip lasted 5.4 hours and caught an average of 17 fish.

Many anglers interviewed at Everglades City (50%) did not try to catch any particular kind of fish. Snook was by far the most popular fish, sought by 36% of the fishermen. The next four species preferred were seatrout (6%), red drum (5%), tarpon (less than 1%), and gray snapper (less than 1%). Over 44% of the fishing parties interviewed reported catching snook. The next three species most commonly caught were, red drum (36%), seatrout (30%), and gray snapper (23%).

An estimated total of 38,846 fishing trips were reported in park waters during 1995. The park was closed nearly 3 weeks during the fall quarter due to government shutdowns. 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) (Fig. 2). A decline during the early 1990's, is attributed to the impacts of Hurricane Andrew. The park was closed from September through December, 1992. The recreational effort (total estimated angler-hours fishing) has followed this trend.

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 1995 average catch and harvest rates from the sampled fishermen for the major species in the park fishery are presented in Table 1. Relationships of 1995 catch to past years are presented in Figures 4 - 9.

Table 1. Catch/harvest rates (per angler-hours) of anglers in Florida Bay, Everglades National Park, 1995. (Seatrout, snook, drum and snapper = non-guided catch, tarpon and bonefish = guide catches)

Species	CPUE	HPUE	Sample Size *	
Spotted Seatrout	0.7830	0.3606	1423	1007
Snook	0.2442	0.1231	793	321
Red Drum	0.3100	0.1167	936	403
Gray Snapper	0.7182	0.3391	1143	558
Tarpon	0.2195	0.0016	460	3
Bonefish	0.3631	0.0 00	161	0

* Number of fishing parties.

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. To estimate the total harvest we need to know what portion of the total fishing activity in the park is measured by daily counts of boat trailers at the Flamingo ramps, which are in turn related to total boating activity by aerial surveys. 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 recreational harvest. Due to personnel and time constraints estimated total recreational catch and harvest were completed for the second (spring) quarter only. The total estimated recreational non-guided fishery harvest from the park for the 1995 spring quarter is shown in Table 2. The relationship of spring 1995, to previous spring quarters is shown in Figure 10.

Table 2. Total estimated fishery harvest by recreational fishermen from Everglades National Park, spring quarter (April-June), 1995

Species	Florida Bay		Florida Bay & Everglades City		EC only	
	Catch	Harvest	Catch	Harvest	Catch	Harvest
Spotted Seatrout	41595	14859	49418	17629	7823	2770
Snook	4045	972	11102	2070	7057	1098
Red Drum	3689	558	5598	892	1909	334
Gray Snapper	21028	5491	26256	6157	5228	666
Tarpon	715	0	885	0	170	0
Other species	66844	4240	97863	6168	31,019	1928
Total	137917	26119	191122	32915	53,205	6796

Recent Trends (Florida Bay)

Overall, 1995 annual sport fish catch rates for the major species were nearly as high or higher than the preceding years (1986-1990, data for the years 1991-1994 were not available for analysis). Annual harvest rates have decreased steadily over the same time period, except for snook rates which have remained relatively constant. Catch rates may be used as an index of abundance, and are directly related to environmental factors such as rainfall, and are generally not directly affected by fishing regulations, while harvest rates most certainly are.

During the 1990's, the average number of gray snapper harvested out of Flamingo has dropped as low or lower than anytime during the previous record and the trend may continue downward (Fig. 4). The lower harvest may largely be due to the regulations imposed on the fishery in 1988 when the legal minimum size was increased from 6 to 8 inches, and in Feb 1990 which established a minimum legal length of 10" and a bag limit of 5 fish per person. During 1989-90 and 1995, the increase in catch but not harvest may reflect a good stock recruitment of small juvenile fish which are being released because of size regulations. Historically, fewer numbers of sub-adult gray snapper may tend to remain in park waters during lower salinity periods.

During 1989-90, a similar general pattern can be seen for the average number of spotted seatrout harvested out of Flamingo, as that shown by harvest of gray snapper (Fig. 5). The lack of increase in harvest may be due to the regulations imposed on the fishery in 1989 which raised the legal size limit from 12 to 14". In 1995, a new high in numbers of seatrout caught and released was reached. This increase in catch is probably due in part to recent size restrictions and may reflect a good stock recruitment of small juvenile seatrout. Presumably an increase in coastal rainfall and lower salinity results in an increase in larval recruitment and/or juvenile survival (Rutherford et al. 1989a) .

Proposed changes for 1996, in state regulations for south Florida seatrout populations (15" minimum size/5 fish bag limit/Nov-Dec closure), were made to reduce harvest in order 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.

For red drum, during 1989-90 and 1995, the annual harvest rate at Flamingo has followed a pattern of stability (Fig. 6). The lack of increase in the harvest rate is probably due to the 1989 bag limits of 1 fish per person following almost two full years of prohibited harvest (1987-88). Increased size limits (12" to 18") and a closed season imposed on the fishery in September 1985 probably accounted for the large declines in average harvest in 1986, however, the sharp declines in harvest rates during 1985 suggest the possibility of overharvest or poor recruitment. Previous studies have shown that periods of generally higher rainfall may lead to increased abundance of red drum in the park. Based on the faster than anticipated state-wide recovery of this species, the FMFC has proposed to eliminate the March, April, May closed seasons, allowing year round fishing, and eliminate the 27" maximum size limit, effective January 1, 1996.

During the most recent annual periods analyzed, 1990 and 1995, snook catch rates were higher than the 1988-89, period and are suggestive of good recruitment (Fig. 7). High recruitment years probably occurred during 1986 and possibly 1991, based on the 4-year time period needed for snook to recruit to the park fishery. Recruitment may also be enhanced by increased rainfall/runoff. The increase in catch but not harvest may again reflect a stock recruitment of small juvenile snook which are released because of size restrictions Because of these regulations and possible changes in fishing behavior, as discussed in previous 1995 quarterly reports, an unknown number of fishermen are presumably releasing their catch in response to promotions in catch-and-release fishing.

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, this year represents the greatest number of fishing parties (770) catching snook over the period of record (1958-1990, 1995). Only 30 boats reported catching snook in 1982. According to the most recent MRFSS 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. 1995). By reducing the state bag limit from two to one per day the SPR for snook would come close to the FMFC's SPR target of 28%.

The professional guide fishery is largely directed at a few highly prized gamefish species within the park. Two of these species, tarpon and bonefish, are of little food value and are not sought by the majority of the of non-guided anglers. They are the trophy species of the guide fishery. In the past tarpon have accounted for 1% of the guide fishery catch. Less than 10% of all tarpon caught have been harvested since 1980. Since harvest of tarpon only occurs for the purposes of mounting the catch as a trophy, catch rate may be more

indicative of the stock than harvest rate. The catch rate rebounded in 1983, from a low in 1982, experienced a slow decline in the mid- 1980's, until reaching an apparent high value in 1995 (Fig. 8). Since 1978, tarpon catch rates have not varied throughout the park.

Like tarpon, bonefish are not harvested unless the angler desires to mount the catch. Bonefish catches show an almost cyclic trend since 1980, with a low value in 1983, steadily increasing to the late 1980's, with a slight decline in 1995 (Fig. 9). Nearly all bonefish are released when caught and, therefore, it is highly unlikely that fishing mortality has played any significant role in determining bonefish stock abundance. Although sufficient data are not available to reasonably evaluate the impacts of fishing activity on these two species, reported catch rates of tarpon and bonefish suggest that the stocks are relatively stable.

Fish Kills

Presumably low dissolved oxygen conditions were responsible for a fish kill event in the Bear Lake area during March. Several thousand fish including mostly striped mojarra, black drum and mullet were left stranded near small tidal creeks following a period of high water.

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 needed. These include: (1) current stock assessments on major game fish species using, as needed, VPA, separable Virtual Population Analysis (SVPA), SPR, & sequential population analysis (SPA), (2) new age-length keys for major species, especially resident species, snook & seatrout (seatrout otoliths/scales are being collected by the park and analyzed at Florida Marine Research Institute; collection and analyses of snook hard parts is pending), (3) work up of a 15 year recreational/guide database at Everglades City, (4) data entry and analysis of the 3 year backlog of fish length measurements; (5) incorporate the fisheries database into the park's GIS system for spatially oriented ecological applications; (6) draft a park fishery management plan. and (7) develop a new fishery data management handbook.

ACKNOWLEDGMENTS

We received assistance interviewing fishermen at Flamingo from a number of Americorp members. We wish to thank Dana Ellege, Elizabeth Marks, Trip Springer and Jolie Wanger for their invaluable help along with the Flamingo Rangers who provided boat trailer counts and assistance during fish kill events. We especially thank VIP Laurie Jackson for completing the data entry of the 3-year backlog of recreational interview sheets into Lotus 1-2-3. Also, thanks to Barry Wood for producing the fishing area map on the park GIS. We thank Computer Program Manager Dave Buker for his statistical advice and support in interpreting many of the Wang fisheries programs for conversion to ACCESS and EXCEL. And finally we thank Hydrologist Dave Sikkema for developing a fishery macro to aid in our analysis of the recreational data with ACCESS and EXCEL

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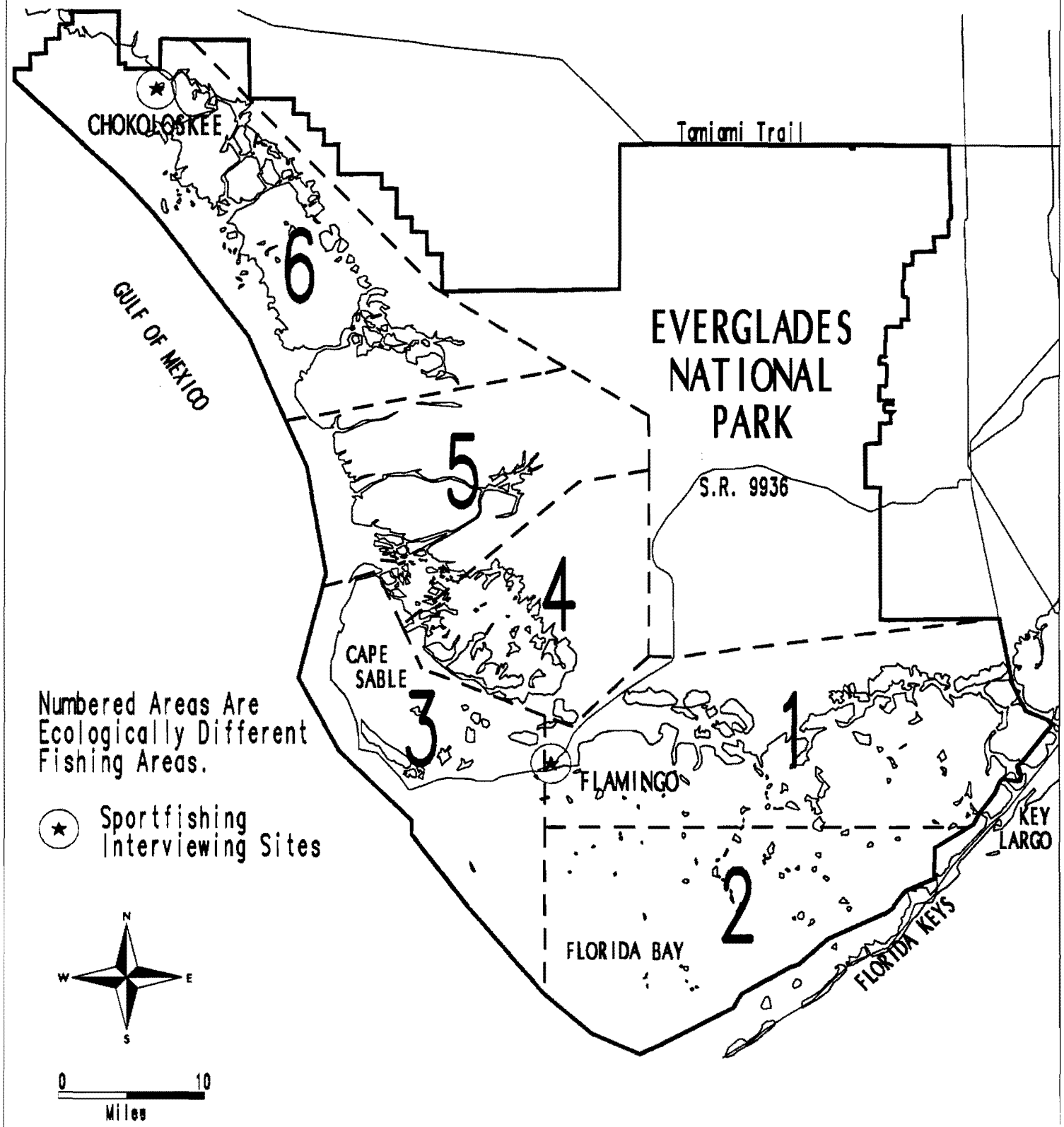
Fig. 1:

ECOLOGICALLY DIFFERENT FISHING AREAS EVERGLADES NATIONAL PARK



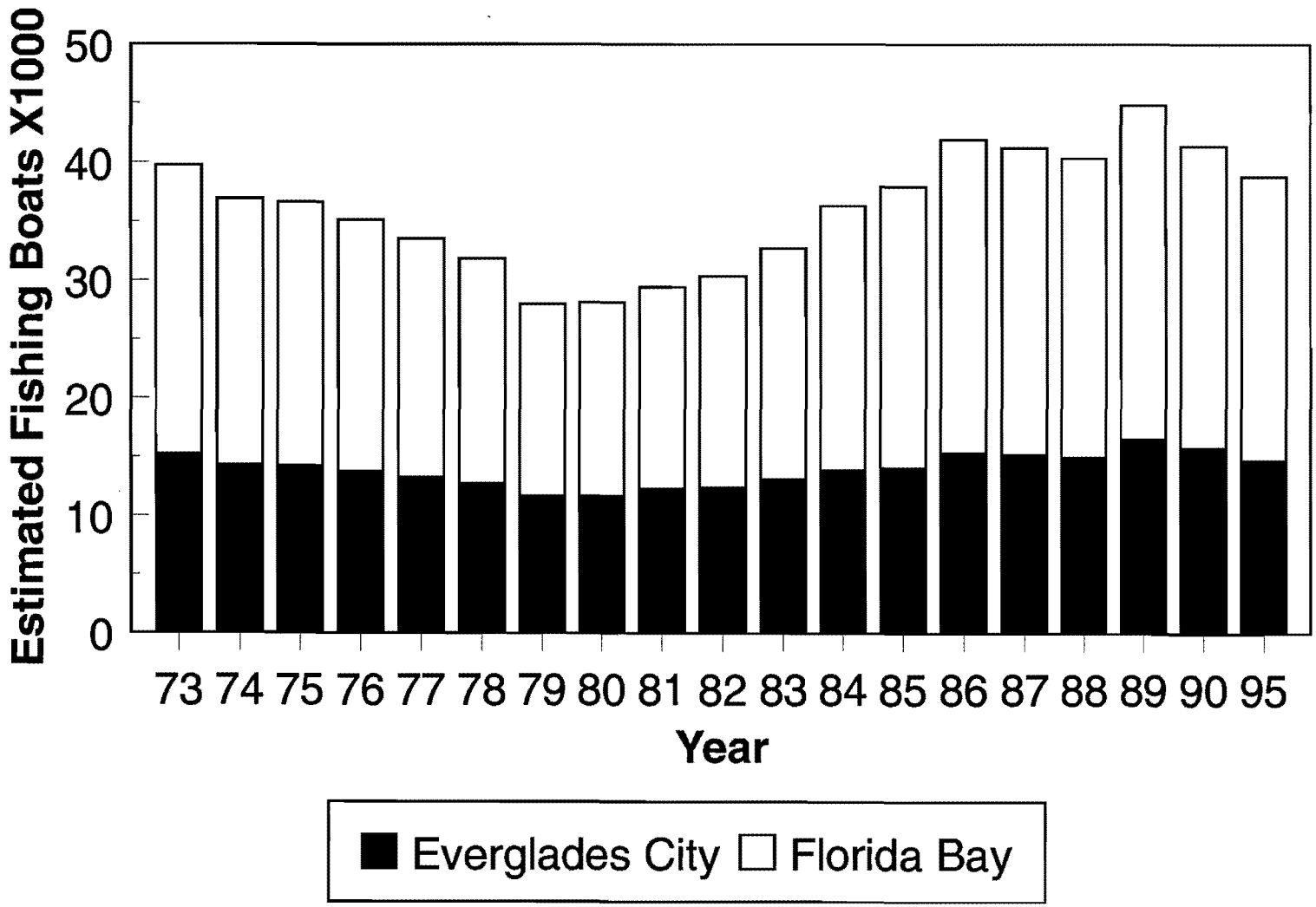


Figure 2: Estimated number of fishing boats within Everglades National Park, 1973-90, 95.

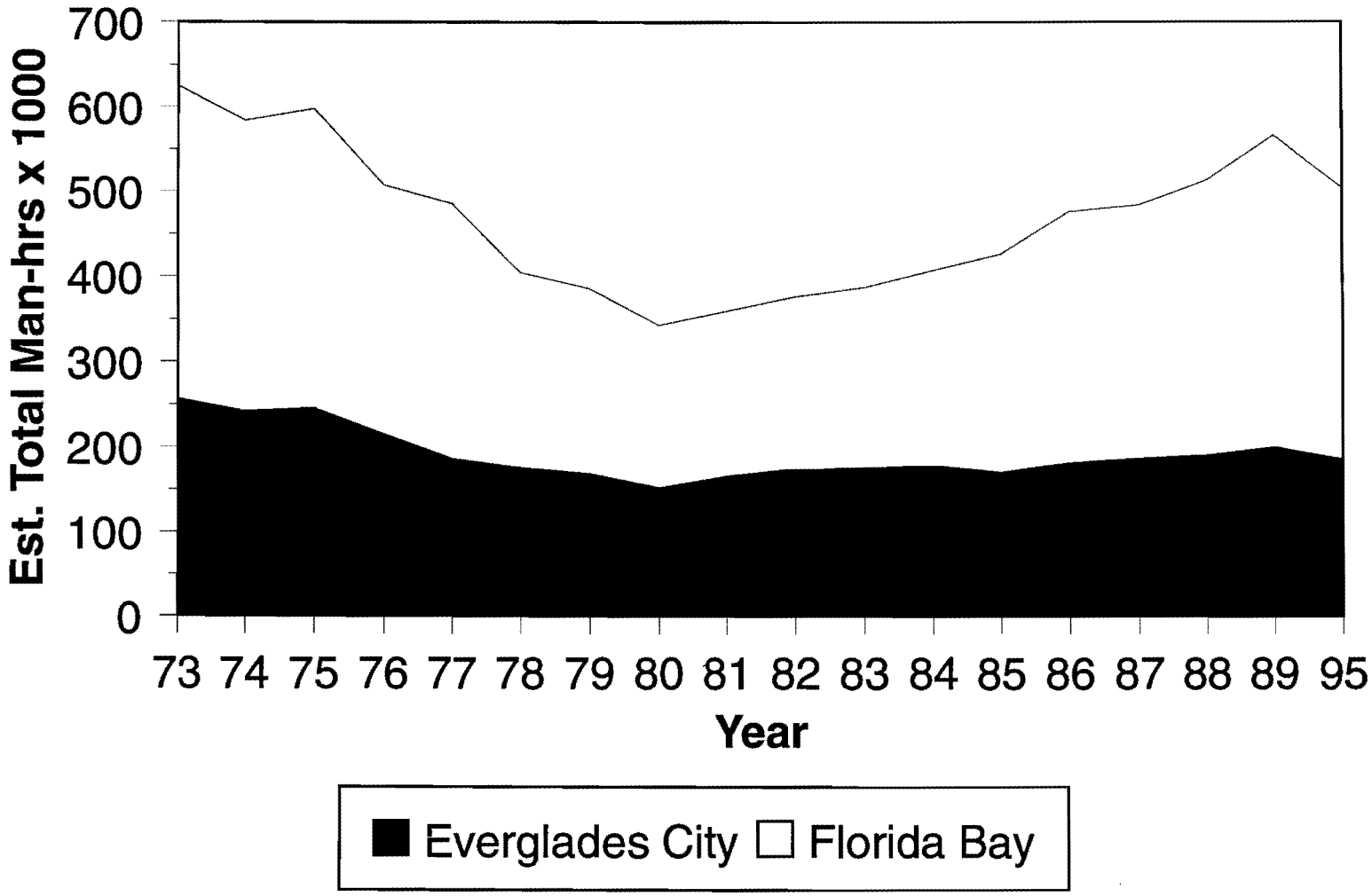


Figure 3: Estimated total effort (Man-Hours) of fishing within Everglades National Park, 1973-89, 95.

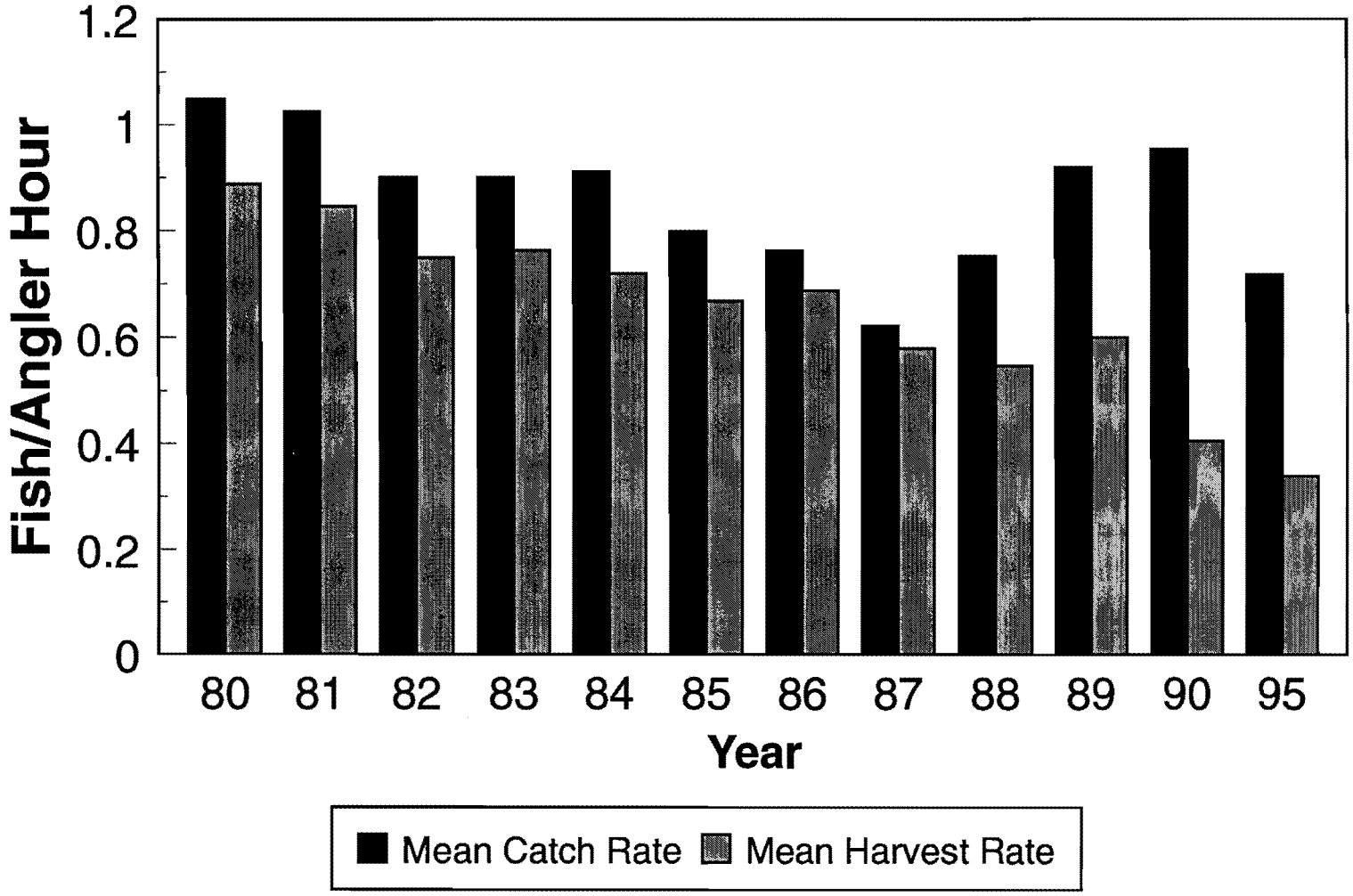


Figure 4: Recreational catch/harvest rates for gray snapper in Florida Bay (Areas 1-5), 1980-90, 95.

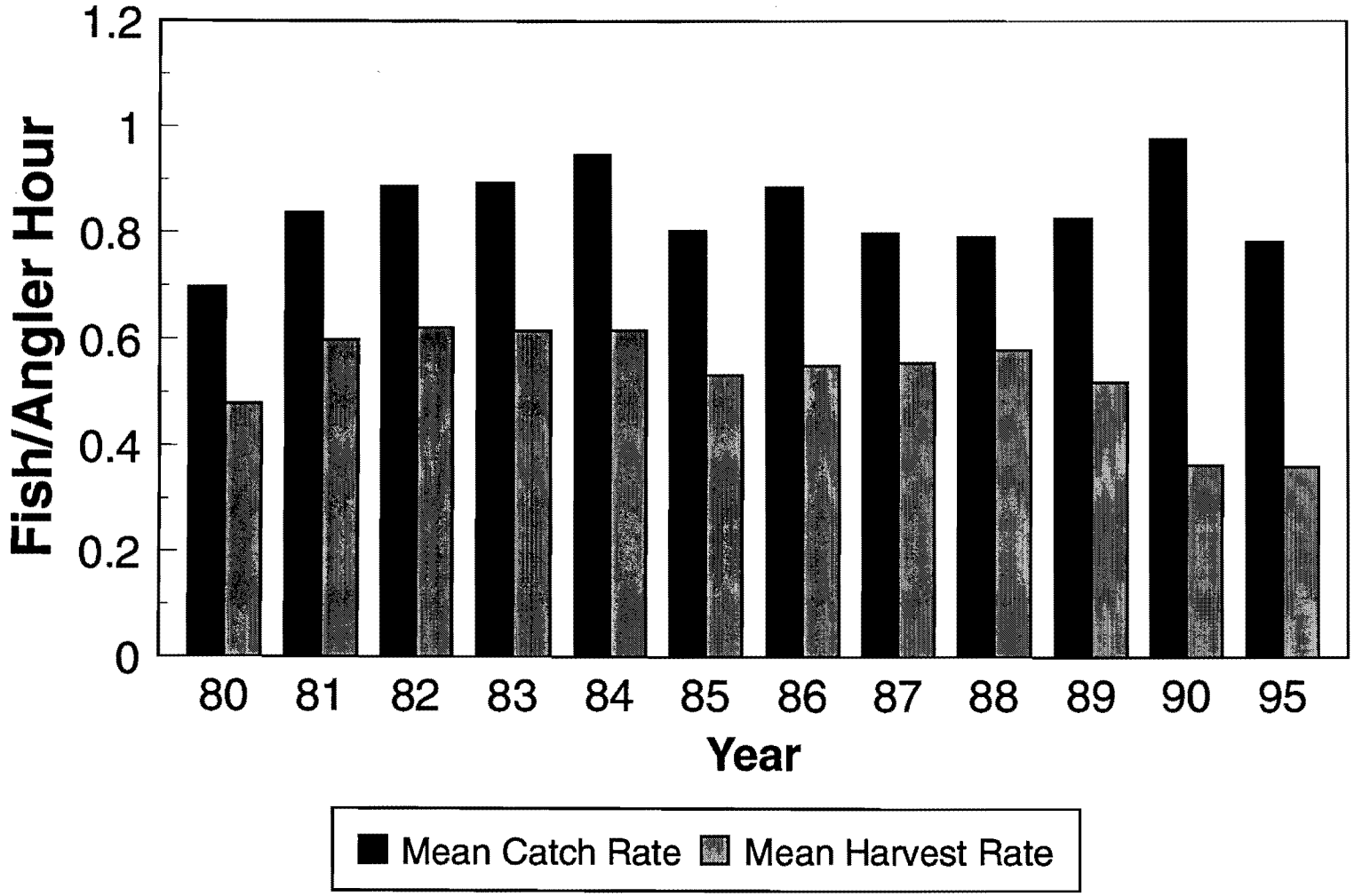


Figure 5: Recreational catch/harvest rates for spotted seatrout in Florida Bay, 1980-90, 95.

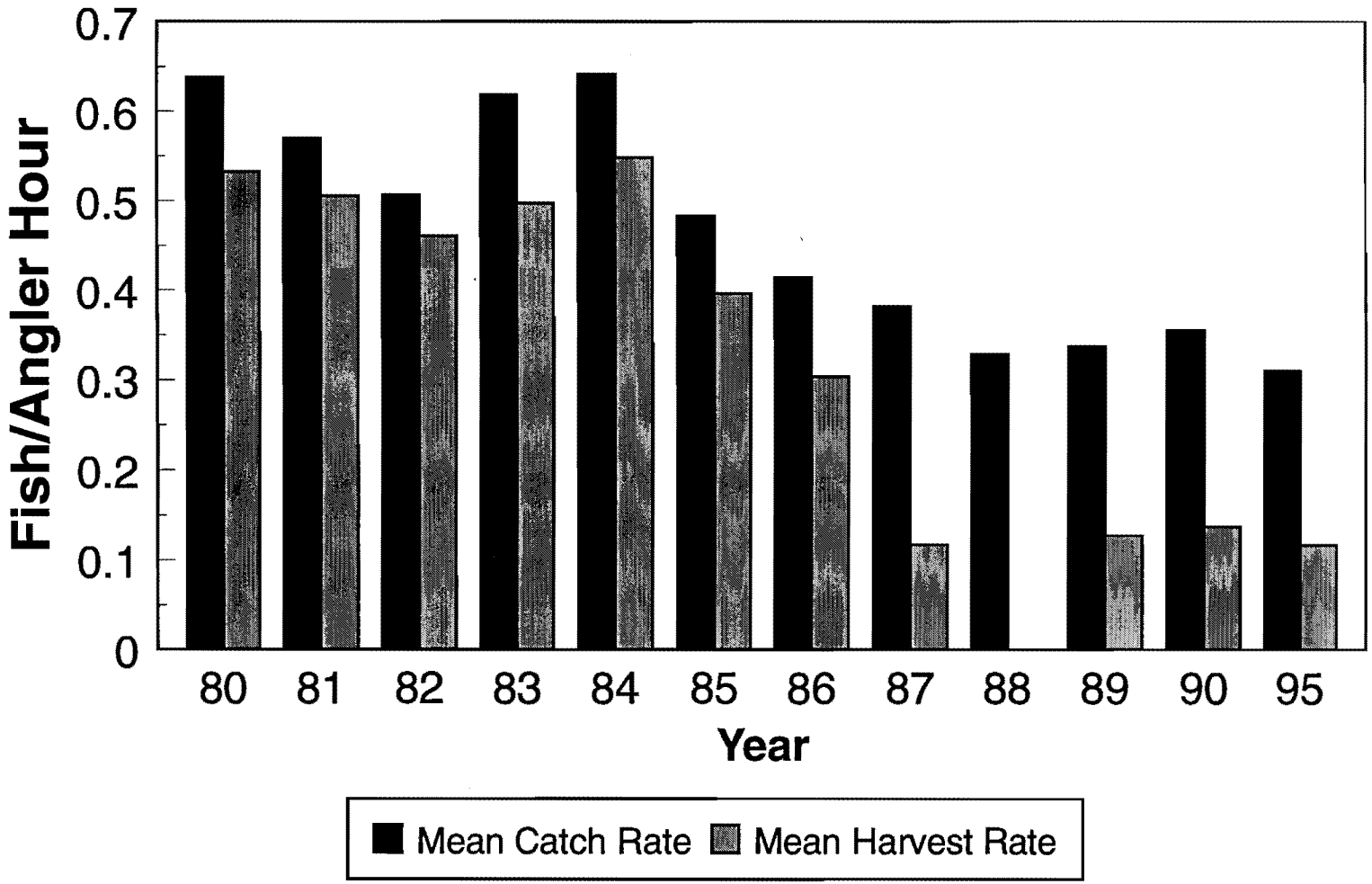


Figure 6: Recreational catch/harvest rates for red drum in Florida Bay (Areas 1-5), 1980-90, 95.

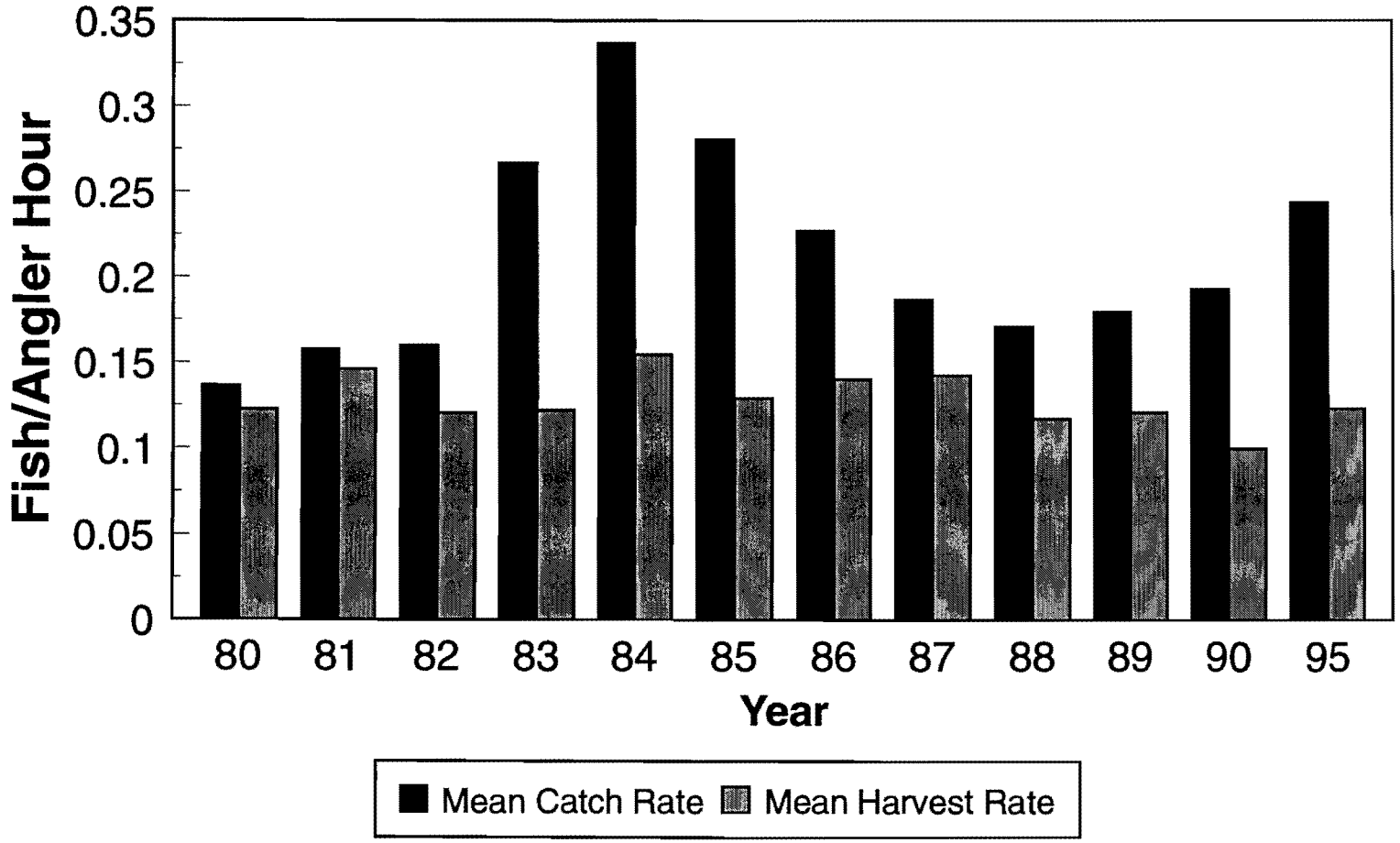


Figure 7: Recreational catch/harvest rates for snook in Florida Bay (Areas 1-5), 1980-90, 95.

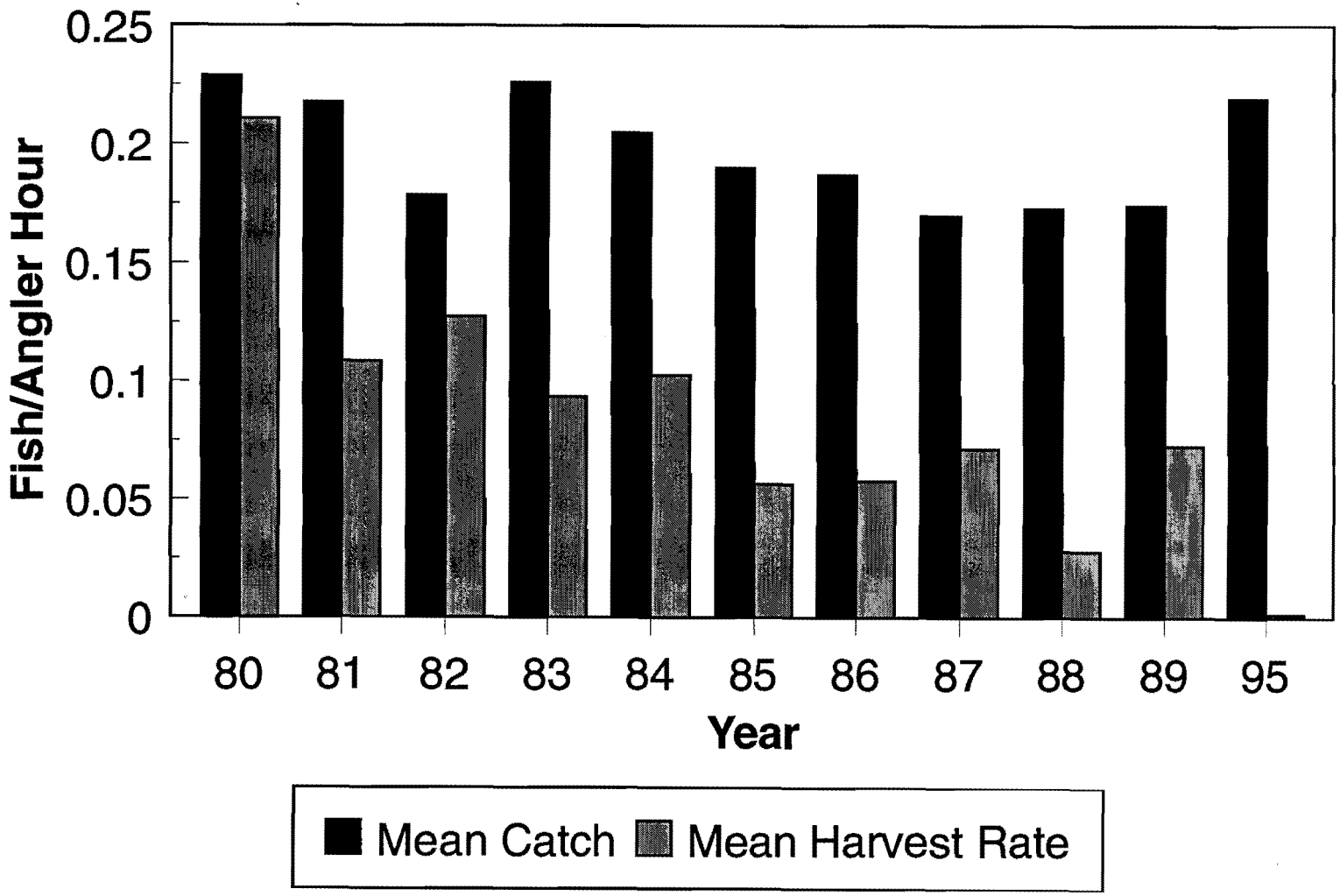


Figure 8: Guide catch/harvest rate for tarpon in Florida Bay (Areas 1-5), 1980-89, 95.

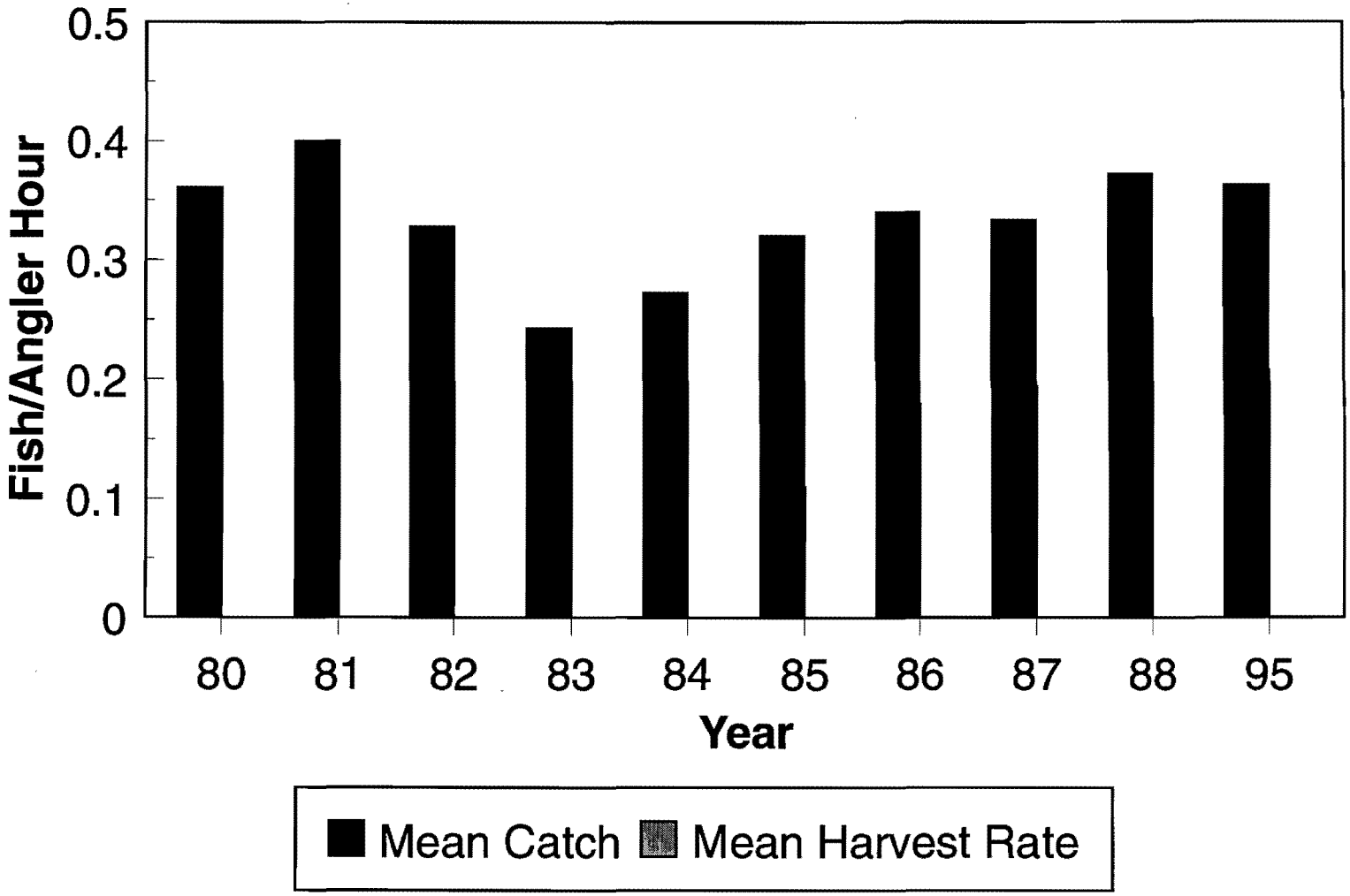


Figure 9: Guide catch/harvest rate for bonefish in Florida Bay (Areas 1-5), 1980-88, 95.

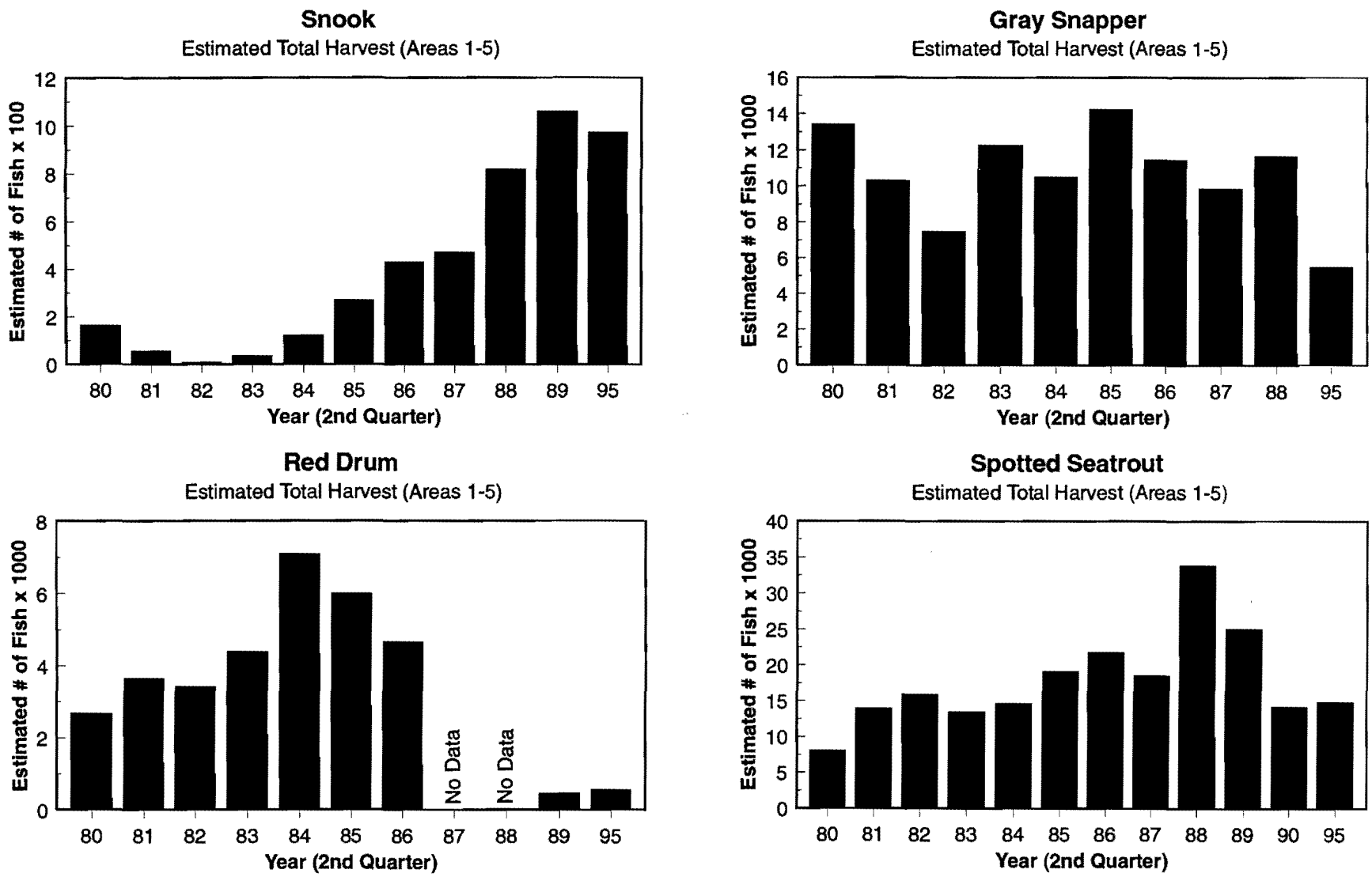


Figure 10: Estimated total quaterly harvest for snook, gray snapper, red drum and spotted seatrout in Florida Bay, 1980-89, 95.