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NOAA Technical Memorandum NMFS-SEFSC-390

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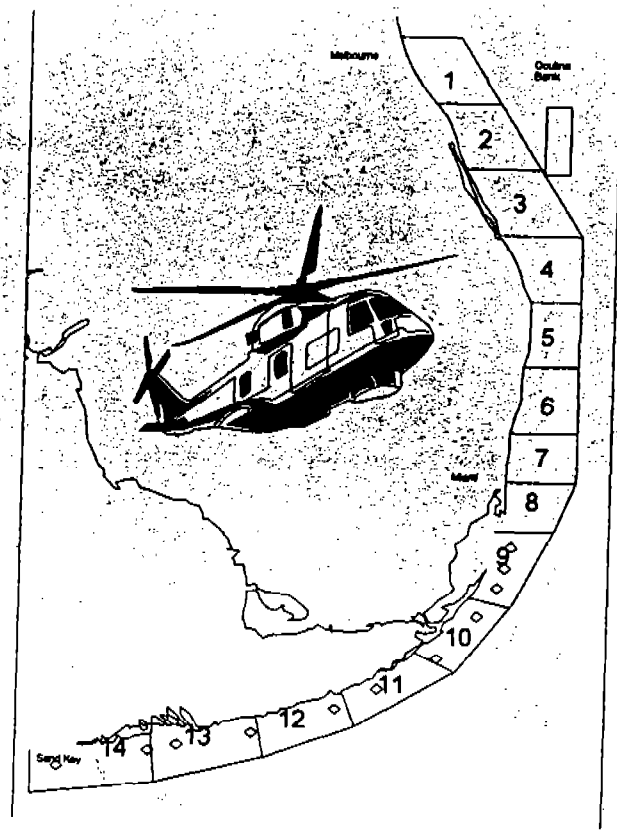

by

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Introduction

A cooperative agreement was established in September 1992 between the National Marine Fisheries Service (NMFS) Miami Laboratory and the United States Coast Guard Miami Air Station to monitor marine animals and vessel activity in the Florida Keys. The primary objectives of this study were to document sea turtle and marine mammal occurrence, seasonality, and distribution along the southeast Florida coast and to describe vessel usage patterns in Biscayne National Park (BNP) and the Florida Keys National Marine Sanctuary (FKNMS). The area surveyed was extended north to Melbourne, Florida in April 1995, and vessel activity was also documented in the Oculina Bank Habitat Area of Particular Concern (HAPC) occurring off Ft. Pierce, Florida .

Results for surveys conducted between September 28, 1992 and December 31, 1995 have been summarized in annual reports (McClellan et al. 1994; McClellan 1995, 1996). Through March 21, 1996 a total of 71 surveys were completed and 1,919 sea turtles (unknown; loggerhead, Caretta caretta; green, Chelonia mydas; and leatherback, Dermochelys coriacea), 1,118 dolphins (bottlenose, Tursiops truncatus and pantropical spotted, Stella attenuata), and 12,816 vessels (fishing, dive and cruising) have been documented. Sea turtle and dolphin distribution and frequency of occurrence from Melbourne, Florida to Sand Key, located offshore Key West, Florida are presented. Information on vessel usage throughout the survey area, in the proposed Sanctuary Protected Areas (SPAS) and Ecological Reserves of the FKNMS, and within Oculina Bank (HAPC) located offshore of Ft. Pierce, Florida, is reported. Vessel activity in BNP related to the number of boat trailers at marinas adjacent to the park was computed.

Materials and Methods

Aerial surveys were attempted on a random basis during the first year of the study (September 28, 1992 through December 10, 1993), up to two surveys per month, along the southeast Florida coast between Haulover Inlet (N. Miami Beach, Florida) and Sombrero Light offshore Marathon, Florida. Beginning in January 1994, surveys were attempted once a week, depending on weather and availability. In April 1995 the survey area was extended north to Melbourne, Florida. All flights were aboard United States Coast Guard aircraft based at the Miami Air Station, Opalocka, Florida. An RG-8 fixed wing single engine airplane (2 flights) and a Dolphin HH-65 helicopter (69 flights) were the two survey platforms used. The helicopter was preferred because it could carry more observers and hover as required for species identification. The number of observers and crew ranged from two on the airplane up to a maximum of five on the helicopter (Table 1). Flights were conducted at an altitude of 50-85 meters and a speed of approximately 100 knots. Flights were not attempted when weather was unfavorable, e.g., greater than Beaufort 4/5 (4-6 ft. seas, 20 knot winds). Seasons were defined as winter (January through March), spring (April through June), summer (July through September), and fall (October through December). The study area was arbitrarily divided into 14 approximately equal (20 nm) zones corresponding to major reef areas to the south and 20 minute latitude lines to the north (Figure 1). The south survey area is defined as zone 8-14 that occurs from Haulover Inlet (N. Miami Beach to Sand Key (Key West). The north survey area is defined as zone 1-7 that occurs from Haulover Inlet to Melbourne.

One observer/recorder used a standardized data sheet (Appendix 1) to document vessels, while all observers, including the pilots and crew chief, assisted in sighting sea turtles and

marine mammals. The time and latitude and longitude to the nearest 1/10 degrees were recorded for each sighting using a Global Positioning System (GPS) unit located on the aircraft control panel. Diving and fishing vessels were listed as recreational, commercial/lobster, charter/yacht, or unknown. Dive boats were identified when a dive flag was displayed or divers were present in the water. Commercial/lobster vessels generally had a large identification number on the roof or side and possibly traps on deck. Vessels larger than 35 feet were considered charter/yacht, recreational vessels those smaller than 35 feet. Cruising/sailing vessels were also recorded. Boat trailers were counted at three marinas (Homestead Bayfront Park, Black Point Marina, and Matheson Hammock Marina) located adjacent to BNP boundaries. Counts were made at the marinas on the return leg of random southern surveys. Only trailers in the main parking lots were listed.

Initially, surveys began at Haulover Inlet, continued southwesterly along the reef tract counting sea turtles, marine mammals, and vessels as far as possible (usually to Sombrero Light) in the allotted flight time, and returned to the airport in a straight line over Florida Bay and the Everglades. This flight plan was chosen to maximize the survey distance in two hours (fuel capacity restraints) of flight time. After the third survey, the flight plan was changed to return to base approximately one-half mile offshore of the reef line. This new return flight path maximized survey time over the reef tract in the two hours, and sea turtles and marine mammals could be counted on the return trip. Friday afternoon flights from noon to 3 PM were chosen to maximize vessel counts and to minimize surface glare. In January 1994, the plan was amended to leave Miami Air Station, Opalocka, FL, between 8 AM to 9 AM and fly the entire reef tract to Sand Key. Vessels, located up to approximately one mile on each side of the flight path, were counted only on the southbound portion of each survey to avoid duplication of data. Sea turtles and marine mammals, located directly below and up to approximately one quarter mile on each side of the flight path, were counted on both the southbound leg and then approximately one-half mile seaward of the reef tract during the return trip.

After the survey area was expanded north to Melbourne, Florida, additional marine animal observations, recreational and commercial vessel activity, and vessel usage in the Oculina Bank HAPC were documented. Vessels, located up to one mile on either side of the flight path, were counted only on the northbound leg from Haulover Inlet, and followed the greatest concentration of vessels. Sea turtles and marine mammals, located directly below and up to one quarter mile on either side of the flight path, were counted on both north (offshore) and south (inshore) legs of the survey. Vessel activity in the HAPC was determined by radar images obtained by the aircraft flying along the 79°58'W longitude line (Figure 1). When an image was returned, the aircraft flew to the vessel to see if it was inside the boundaries and to identify its activity.

Results and Discussion

Sea Turtles

Numerous aerial surveys for sea turtles have occurred off the southeastern U.S. coast and provide information on sea turtle distribution and abundance (Hoffman and Fritts 1982, Fritts et al. 1983a;b, Thompson and Shoop 1983, Schroeder and Thompson 1987, Thompson et al. 1991, Shoop and Kenney 1992, Epperly et al. 1995, Witzell and Azarovitz 1996). Information has also been reported for incidental sightings for adjacent

area waters (Browder et al. 1995, Witzell and McCoy 1995).

Aerial surveys for sea turtles are difficult due to numerous factors, such as observer experience and fatigue, water turbidity, wind and sea conditions, time of day, and sea turtle size and avoidance behavior. Difference in sea and weather clearly mean fewer are seen in rough and turbid waters and the numbers at the surface represent only a fraction of those underwater. Flight altitudes, air speeds, and time of day (sun glare from the surface) all effect sightings. In addition, the lack of observer experience could possibly have biased the number of sightings due to the learning curve involved in developing appropriate search images and identification. These factors have been discussed in detail by Marsh and Saalfeld 1989, Marsh and Sinclair 1989, Shoop and Kenny 1992, and Epperly et al. 1995, among others.

Species identification was not always possible and sea turtles are frequently indistinguishable from the air because of their small size (Epperly et al. 1995). Five sea turtle species occur in the western north Atlantic: loggerhead, green, leatherback, hawksbill (Eretmochelys imbricata), and Kemp's ridley (Lepidochelys kempi) (Witzell and Azarovitz 1996). Of the 1,919 sea turtles counted in this study, those positively identified to species (Table 1) included 323 (16.8%) loggerhead, 30 (1.6%) green, and 9 (0.5%) leatherback . Unknown species were recorded for 1,557 (80.8%) of all sightings. Thompson and Shoop (1983) identified 87 (78.4%) loggerhead, 4 (3.6%) green, and 20 (18.0%) unknown sea turtles in a previous aerial survey near the same area. Schroeder and Thompson (1987) stated 95% were loggerheads and 5% were leatherbacks off Cape Canaveral, Florida. Hoffman and Fritts (1982) reported 255 (85.5%), 18 (6.0%) leatherback, 6 green (2.0%), and 19 (6.4%) unknown sea turtles in a survey off eastern Florida. Epperly et al. (1995) reported 80% loggerhead and 15% green turtles in a survey in North Carolina. For discussion and analysis purposes in this report, all sea turtles are combined.

Sea turtles were observed all year from shallow hard-bottom areas in Hawks Channel shoreward of the reef out to open waters offshore of the reef in the Florida Keys (zones 8-14) and waters close to shore to offshore in the northern part of the survey area (zones 1-7). Sea turtles are predominantly distributed within the 0 to 37 meter isobath (Witzell and Azarovitz 1996) and the flight plan follows this contour in this study. Overall, more were sighted in zone 11 in the middle Keys, possibly due to the greater number of surveys that included the zone (Figure 2). Observations were made on all but one survey (Figures 3-6), with an average number per survey of 28.0 (range 0 to 213, Table 1). The survey that recorded zero sightings had a Beaufort sea state of 4, while the other surveys had sea states of Beaufort 1 to 2.

An average of 0.133 sea turtle sightings per nautical mile (range 0.009 to 0.839) [0.072 sea turtle sightings per kilometer (range 0.005 to 0.453)] occurred for the southern sector (n = 59 surveys, Figure 3a). Thompson et al. (1991) reported a range of 0.0083 to 0.0111 turtles/km for the northeastern Gulf of Mexico, which included the Florida Keys. Fritts et al. (1983a,b) estimated density off the southwest coast of Florida between 0.061 and 0.220 turtles/km^2. Witzell and Mccoy (1994) reported 0.034 turtles/nm (range 0.003 to 0.091) [0.042 turtles/km (range 0.002 to 0.049)] for incidental sightings in Florida Bay. There was an average of 0.149 turtles\nm (range 0 to 0.428) [0.080 turtles/km (range 0 to 0.231), Figure 5a] for surveys in the northern sector (n = 12 surveys). Witzell and Azarovitz (1996) reported 0.038 turtles/km (range 0.007 to 0.130) for their southern zones

that corresponds with the northern areas in this study. Overall, zone 2 has the highest incidence of sightings at 0.421 turtles/nm (Table 2), ranging from 0.043 - 0.421 turtles/nm along the entire survey area.

Monthly and survey frequency of sea turtle occurrences appeared to be random, but an apparent seasonal trend occurs in the southern sector (zones 8 - 14), the winter months showing the highest frequency (Figure 3c). This seasonality is also apparent when a zonal breakdown is shown (Figure 4). Results from previous aerial surveys also show an aggregation of sea turtles off southwest Florida in the winter (Fritts et al. 1983a;b, Thompson et al. 1991). A greater occurrence seemed to appear in the spring for the northern portion (zones 2-7), but inadequate sampling has occurred to show any real trends (Figures 5c and 6). The greatest number of sea turtles observed off Cape Canaveral, which is slightly north of our area, occurred during spring and summer surveys because of peak nesting activity (Fritts et al. 1983a,b; Schroeder and Thompson, 1987). Witzell and Azarovitz (1996) reported the highest average for summer in their southern zones that corresponds to the northern sector here.

Distributions of sea turtle sightings along the central and southeast Florida coasts are shown in Figures 7a-c and 8. Most turtles are distributed along the reef tract since this was the transect flown. Seasonality of occurrence is difficult to determine since the flights were dependent on weather and aircraft availability. Distribution of identified species is shown in Figure 9. Most green and leatherback turtles were seen in the southern zones. Loggerhead turtles were scattered all along the coast.

Marine mammals

The bottlenose dolphin is managed by the NMFS under the authority of the Marine Mammal Protection Act of 1972 as amended and is the most common cetacean in this region (Hansen 1986). To begin determining the status of stocks, aerial surveys for bottlenose dolphin were conducted in the southeastern United States from 1979-1983 (Hansen and Scott 1989). Little population data exists for the southeast Florida area before 1972, though marine mammal observations were recorded during the 1969-1971 Portuguese man-of-war survey by the Florida Department of Natural Resources (Hansen 1986). Bottlenose dolphin occurrences have been documented by a photo-identification project in Biscayne Bay, Florida since 1990 (Litz et al. 1996).

The only marine mammals observed during the surveys were the bottlenose and pantropical spotted dolphins, both common off the southeast Florida coast (Fritts et al. 1983a). Dolphin observations were dependent on the same factors as discussed with sea turtles. Herds of the spotted dolphins occurred twice in deeper offshore waters, with 22 and 25 animals seen. Sightings of bottlenose dolphins occurred 183 times with a total of 1,071 animals (Table 1). Estimated bottlenose dolphin herd sizes for the central and southeast Florida coasts from Melbourne to Key West averaged 5.85 (range 1 to 40) and is similar to that of other surveys of Florida waters. Hansen (1986) reported the mean herd size from 28 sightings off the Florida Keys at 6.43 animals, eastern seaboard groups have been reported at 4.15 to 5.18 animals (Blaylock and Haggard 1994), mean herd sizes ranged from 2.3 (summer) to 5.4 (winter) off Key West, Florida (Hansen and Scott 1989), and a mean was recorded at 5.15 (1 to 21 individuals) for Biscayne Bay, Florida (Litz et al. 1996).

Seasonal distribution of bottlenose dolphin showed occurrences during all months off the southeast Florida coast (Figure 10) and were located throughout the area from the reef tract

to offshore deeper waters. Overall, bottlenose dolphin averaged 0.08 dolphins/nm for the whole study area. They occurred most often in zone 3 (0.153 dolphins/nm) in the northern sector and zone 12 (0.146 dolphins/nm) in the southern sector (Table 3).

Vessels

Vessels in the southern portion (zones 8 - 14) of the study area were counted and classified to determine patterns of usage in the FKNMS (Figure 1). Counts were later made from April 1995 - March 1996 in the northern portion (zones 1 - 7) of the survey. Fishing vessels were located farther offshore so sightings follow vessel patterns to the north. The number of boats observed was dependent upon the weather, sea conditions, time of day, and day of week. Matthews et al. (1986) presented a hypothetical daily boat abundance curve that depicts boat abundance on the reef greatest between noon and 2 PM. They also stated weekends had higher recreationally boat usage. Weekend flights were not possible, so Fridays were selected since people might take the day off to go boating. Commercial vessels in southeast Florida do not routinely fish on weekends and holidays because of the high recreational pressure during these periods.

Fishing vessels represented 65.4% of all boat counts (n = 12,816) during the surveys, followed by dive (25.0%) and cruising vessels (9.7%, Table 1). Overall total boat usage (Table 4) in the southern survey areas was led by zone 13 in the lower Keys (includes Looe Key and Sombrero reef) with 49.2 boats of all types counted per survey. Zones 5 and 6 (Ft. Lauderdale to W. Palm Beach.) in the north had the highest overall boat usage with 37.3 and 36.8 boats/survey respectively.

The most abundant activity in the southern areas (zones 8 - 14) during the fall and winter was fishing while diving was more prevalent in the spring and summer (Figure 11). Zone 11, which includes Alligator reef, had the highest fishing usage with 32.2 boats/survey; the least activity took place off Miami in zone 8 (Table 5). Fishing was dominant in zones 5 and 6 in the north between Ft. Lauderdale and W. Palm Beach. Fishing greatly outnumbered dive boats to the north in zones 2 - 7 (Figure 12).

Recreational usage was the predominant classification of both fishing and dive boats for all zones, except more charter dive boats were sighted in zone 14 (Figures 13 and 14). The number of private recreational vessels registered in the Keys has increased dramatically from 1965 to 1991 (Bohnsack et al. 1994). A fall to winter trend in fishing vessel usage in the Middle Keys can be seen in Figure 15, but not enough data has been collected for the northern portion of the survey for any trends to be noticed (Figure 16).

Diving activity was centered in the Middle Keys (zones 10 and 11), which includes French and Molasses reefs, and the Lower Keys (zone 13) which includes Looe Key (Figure 17). Matthews et al. (1986) showed diving activity at Looe Key peaked during the summer (1988-1991). Zone 13, which includes Looe Key, had the highest overall diving activity (18.8 boats/survey) than anywhere along the southeast Florida coast (Table 6). The survey on July 28, 1994 reported the highest number of vessels (mainly dive) because it occurred during the 1994 mini-lobster season (Figure 17). Very little diving activity was observed in zones 2-7 (Figure 18).

Sanctuary Protected Areas (SPAS) and Ecological Reserves proposed by the FKNMS Management Plan (U.S. Department of Commerce 1995) were compared for vessel usage. Map areas for the SPAS and Ecological Reserves were slightly expanded to take into effect of the speed of the aircraft and delay in reading GPS coordinates. Looe Key, with 13.7 boats/survey, was the most popular SPA

overall, followed by Sombrero reef, Molasses reef, and Sand Key (10.2, 9.1, and 8.7 boats/survey respectively) (Table 7 and Figure 19). Fishing activity was almost even between SPAs; Alligator reef, Davis reef, and Sand Key the most popular (4.6, 4.5 and 3.9 boats/survey respectively, Table 8 and Figure 20). SPAs with the greatest diving activity were Looe Key, Sombrero reef, Molasses reef, and Sand Key (10.2, 6.5, 5.9, 4.1 boats/survey respectively, Table 9 and Figure 21).

Commercial fishing activity by zones, SPAs and reserves is shown in Table 10. Only 12.1% (33 of 272) and 9.5% (15 of 158) of the total vessels observed in Key Largo and Sambos Reserves, respectively, were commercial in nature. Most vessels were not identified to activity, either lobster or fishing, in the Reserves; though commercial fishing vessels greatly outnumbered lobster boats throughout the surveys.

Boat Trailers

The number of vessels observed in BNP (zone 9) during five surveys were compared with the number of boat trailers parked at Homestead Bayfront Park (Convoy Point), Black Point Marina, and Matheson Hammock Marina. These marinas are located adjacent to BNP boundaries and are the most common launching points for recreational fishing and diving vessels in and near BNP waters. Since the surveys are flown down the reef line, boaters may be offshore fishing for pelagic fishes such as dolphin, or diving inshore near Hawk's Channel , and could not be counted. A regression analysis ($y = -48.389 + 0.979x$) was computed with an $r^2=0.771$ (Figure 22), suggesting it might be possible to estimate the number of boats using BNP at any time by counting boat trailers.

Oculina Bank (HAPC)

The HAPC was established in 1994 as a closed area to harvest of species in the snapper-grouper management unit (SAFMC 1994). Anchoring while fishing for snapper-grouper fishes was also prohibited. Management regulations in 1995 expanded the anchoring ban to prohibit the anchoring of all fishing vessels to protect Oculina varicosa (ivory tree coral) and live/hard bottom habitat (SAFMC 1995). The only activity allowed inside the area is fishing for coastal migratory pelagics (mackerels), pelagic sharks, and oceanic pelagics (sailfish, marlin, swordfish, and dolphin) by commercial, and charter and recreational vessels.

Vessels were counted during ten northern sector surveys (April 1995 to March 1996) in the Oculina Bank HAPC to see what fishing activity took place. The only activity observed inside the closed area was trolling by recreational and charter vessels, presumably for non-restricted species. During surveys on September 15 and October 13, 1995, and February 2, 1996, 17 shrimp boats, with outriggers extended, were anchored west of the closed area (Figure 23).

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LITERATURE CITED

Blaylock, R.A. and W. Haggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. NOAA Tech. Memo. NMFS-SEFSC-356. 10 p.

Bohnsack, J.A., D.E. Harper, and D.B. McClellan. 1994. Fisheries trends from Monroe county, Florida. Bull. Mar. Sci. 54(3):982-1017.

Browder, J.A., O. Bass, J. Gebelein, and H. Huang. 1995. Spatial analysis of Florida Bay. (Abstract). Conference of Florida Bay Investigators, 17-18 October 1995.

Epperly, S.P., J. Braun, and A.J. Chester. 1995. Aerial surveys for sea turtles in North Carolina inshore waters. Fish. Bull. 93:254-261(1995).

Fritts, T.H., A.B. Irvine, R.D. Jennings, L.A. Collum, W. Hoffman, and M.A. McGehee.. 1983a. Turtles, birds, and mammals in the northern Gulf of Mexico and nearby Atlantic waters. U.S. Fish. Wildl. Serv. FWS/OBS-82/65, 445 p.

Fritts, T.H., W. Hoffman, and M.A. McGehee. 1983b. The distribution and abundance of marine turtles in the Gulf of Mexico and nearby Atlantic waters. J. Herpetol. 17:327-344.

Hansen. L.J. 1986. Dolphin aerial survey data from Florida waters April 1969-February 1971. NOAA/NMFS/SEFC/Miami Lab, CRD ML-86-52. 28 p.

Hansen, L.J. and G.P. Scott. 1989. Bottlenose dolphin densities in five selected southeastern United States areas during 1981-1983. NMFS/SEFC, Miami Laboratory, Coastal Resources Division, Contribution ML-CRD-88/89-08. 20 p.

Hoffman, W. and T.H. Fritts. 1982. Sea turtle distribution along the boundary of the Gulf Stream off eastern Florida. Herpetologica 38(3):405-409.

Litz, J., J. Contillo, J. Tobias, and B. Mase. Low-level monitoring of bottlenose dolphins (Tursiops truncatus) in Biscayne Bay, Florida. April, 26, 1996. Unpubl. report. 26 p.

Marsh, H. and W.K. Saalfeld. 1989. Aerial surveys of sea turtles in the northern Great Barrier Reef Marine Park. Aust. Wildl. Res. 16:239-249.

Marsh, H. and D.F. Sinclair. 1989. An experimental evaluation of duong and sea turtle aerial survey techniques. Aust. Wildl. Res. 16:639-650.

Matthews, T., P. Donovan-Potts, and M. Enstrom. 1986. Estimating utilization of Florida Keys National Marine Sanctuary using aerial surveys. Proposal to FKNMS. 9 p.

McClellan, D.B., Lt. J. Bevelaqua, S. Bolden, W. Teas, N. Thompson, and A. Martinez. 1994. Aerial survey for sea turtles, marine mammals, and vessel counts along the southeast Florida coast from Haulover Inlet to Key West: a progress report. NOAA/NMFS/SEFC/Miami Lab Contr. MIA-93/94-29. 16 p.

McClellan, D.B. 1995. Aerial survey of sea turtles, marine mammals, and vessel usage along the southeast Florida coast, Haulover Inlet to Sand Key: Phase 2. NOAA/NMFS/SEFC/Miami Lab Contr. MIA-94/95-29. 22 p.

McClellan, D.B. 1996. An aerial survey for sea turtles, marine mammals, and vessel usage along the southeast Florida coast, Melbourne to Sand Key: September 1992 through December 1995. NOAA/NMFS/SEFC/Miami Lab Contr. MIA-95/96-26. 39 p.

SAFMC. 1994. Amendment Number 6, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Environmental Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Circle, Ste. 306, Charleston, S.C. 29407-4699. 237 p.

SAFMC. 1995. Amendment Number 3 to the Fishery Management Plan for Coral, Coral Reefs, and Live/Hard Bottom Habitats of the South Atlantic Region (Including an Environmental Assessment, Regulatory Impact Review, and Social Impact Assessment). South Atlantic Fishery Management Council, 1 Southpark Circle, Ste. 306, Charleston, S.C. 29407-4699. 73 p. and appendices.

Schroeder, B.A. and N.B. Thompson. 1987. Distribution of the loggerhead turtle, Caretta caretta, and the leatherback turtle, Dermochelys coriacea, in the Cape Canaveral, Florida area: results of aerial surveys. Pages 45-53 in: W.N. Witzell (ed.) Ecology of east Florida sea turtles: proceedings of the Cape Canaveral, Florida sea turtle workshop Miami, Florida February 26-27, 1985. U.S. Dep. Commer. NOAA Tech. Rep. NMFS 53, 80 p.

Shoop, C.R. and R.D. Kenny. 1992. Seasonal distributions and abundance's of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43-67.

Thompson, N.B. and C.R. Shoop. 1983. Southeast turtle survey (SETS), pelagic surveys. Final report to the National Marine Fisheries Service. Aero-Marine Surveys, Inc., Groton, CT. 76 p.

Thompson, N.B., E.S. Denton, D.B. Koi, A. Martinez, and K. Mullin. 1991. Turtles in the Gulf of Mexico: Pelagic distributions and commercial shrimp trawling. NOAA Tech. Memo. NMFS-SEFSC-286, 12 p.

U.S. Department of Commerce. 1995. Florida Keys National Marine Sanctuary draft management plan/environmental impact statement. Vol 1. The management plan, March 1995. Sanctuaries and Reserves Division, National Oceanic and Atmospheric Administration. 323 p.

Witzell, W.N. and A.J. McCoy. 1995. Incidental aerial sightings of sea turtles in Florida Bay, Florida 1984-1985. NOAA Tech. Memo. NMFS-SEFSC-372, 8 p.

Witzell, W.N. and T. Azarovitz. 1996. Relative abundance and thermal and geographic distribution of sea turtles off the U.S. Atlantic coast based on aerial surveys (1963-1969). NOAA Tech. Memo. NMFS-SEFSC-381, 10p.

Table 1. Summary of southeast Florida aerial surveys, Sept. 28, 1992 to March 21, 1996. See Fig. 1 for zone descriptions.

	DATE	ZONES (*) SURVEYED	NO. OF OBSERVERS	BOAT SURVEY TIME (Min)	BOAT SURVEY MILES(nm)	TURTLE SURVEY TIME (Min)	TURTLE SURVEY MILES (nm)	NO. OF GREEN TURTLES SIGHTED	NO. OF LEATHERBACK TURTLES SIGHTED	NO. OF LOGGERHEAD TURTLES SIGHTED	NO. OF UNKNOWN TURTLES SIGHTED	NO. OF BOTTLENOSE DOLPHINS SIGHTED	NO. OF SPOTTED DOLPHINS SIGHTED	NO. OF FISHING VESSELS	NO. OF DIVING VESSELS	NO. OF CRUISING VESSELS
1	28-Sep-92	8 - 12	5	69	87	69	87	1	0	2	5	10	0	54	10	8
2	* * *18-Dec-92	8 - 10	2	50	61	50	61	0	0	0	5	0	0	72	17	4
3	29-Jan-93	8 - 13	4	67	114	67	114	0	0	0	1	0	0	423	40	14
4	05-Mar-93	8 - 12	4	67	97	67	116	0	1	0	9	6	0	396	56	124
5	* * *23-Apr-93	8 - 14	2	77	141	77	141	0	0	0	3	0	0	70	21	47
6	17-May-93	8 - 13	4	66	109	66	109	1	0	2	57	26	0	71	98	37
7	04-Jun-93	8 - 11	3	71	84	103	148	2	0	4	2	8	0	62	18	4
8	01-Jul-93	8 - 12	3	45	51	88	183	0	0	1	8	7	0	51	29	13
9	11-Aug-93	8 - 13	4	67	117	123	244	0	0	1	42	14	0	98	236	22
10	27-Aug-93	8 - 13	4	61	109	118	208	0	1	0	30	1	25	54	66	0
11	10-Sep-93	9 - 12	3	49	84	78	153	0	0	23	0	3	0	1	56	0
12	24-Sep-93	9 - 12	3	55	86	55	86	0	0	0	6	10	0	87	49	71
13	08-Oct-93	8 - 12	3	59	89	107	178	4	0	3	16	8	0	71	20	22
14	22-Oct-93	9 - 13	4	39	101	78	202	0	0	0	5	0	0	89	36	81
15	19-Nov-93	10 - 11	5	27	41	27	41	0	0	0	6	0	0	30	33	0
16	10-Dec-93	8 - 13	3	61	104	128	213	0	0	12	15	10	0	104	41	11
17	11-Mar-94	8 - 14	3	127	150	127	150	0	0	10	1	10	0	53	5	4
18	25-Mar-94	8 - 13	4	78	109	151	213	2	0	19	36	32	0	136	67	14
19	02-Apr-94	8 - 14	3	61	129	135	245	0	0	7	13	0	0	90	65	9
20	06-May-94	8 - 12	4	58	89	77	178	1	0	3	3	4	0	99	32	23
21	27-May-94	9 - 14	5	60	135	91	135	0	0	4	18	1	0	56	72	17
22	24-Jun-94	8 - 13	4	65	118	105	175	1	0	7	10	9	0	31	43	21
23	15-Jul-94	9 - 13	4	65	99	99	99	1	1	1	14	19	0	35	42	30
24	27-Jul-94	8 - 14	3	74	150	74	150	0	0	2	4	0	0	9	123	6
25	28-Jul-94	8 - 14	3	111	150	111	264	0	0	8	21	3	0	42	504	15
26	19-Aug-94	9 - 14	4	60	119	123	238	0	0	5	20	16	0	44	58	13
27	26-Aug-94	9 - 14	4	77	119	105	119	0	0	0	11	1	0	57	70	3
28	16-Sep-94	9 - 14	3	55	130	116	130	0	0	0	3	8	0	24	56	10
29	23-Sep-94	9 - 14	5	75	111	144	225	0	0	0	9	10	0	92	35	0
30	14-Oct-94	9 - 14	4	88	112	88	112	1	0	0	9	116	0	136	47	29
31	21-Oct-94	9 - 14	4	81	130	81	130	1	0	3	2	0	0	108	36	5
32	27-Oct-94	8 - 14	4	90	140	90	155	0	0	3	4	8	0	85	38	21
33	18-Nov-94	9 - 14	3	73	130	95	161	1	0	0	5	54	0	180	20	33
34	09-Dec-94	9 - 14	3	87	130	87	130	3	0	4	5	0	0	124	36	43
35	30-Dec-94	8 - 14	3	110	134	192	253	3	0	12	19	20	22	295	103	33

* = Some zones were not completely surveyed

** = Turtles only recorded

*** = RG-8 airplane is the platform.

Table 1 (cont.) . Summary of southeast Florida aerial surveys, Sept. 28, 1992 to March 21, 1996. See Fig. 1 for zone descriptions.

	DATE	ZONES (*) SURVEYED	NO. OF OBSERVERS	BOAT SURVEY TIME (Min)	BOAT SURVEY MILES(nm)	TURTLE SURVEY TIME (Min)	TURTLE SURVEY MILES (nm)	NO. OF GREEN TURTLES SIGHTED	NO. OF LEATHERBACK TURTLES SIGHTED	NO. OF LOGGERHEAD TURTLES SIGHTED	NO. OF UNKNOWN TURTLES SIGHTED	NO. OF BOTTLENOSE DOLPHINS SIGHTED	NO. OF SPOTTED DOLPHINS SIGHTED	NO. OF FISHING VESSELS	NO. OF DIVING VESSELS	NO. OF CRUISING VESSELS
36	20-Jan-95	9 - 14	3	80	116	163	232	0	0	1	7	15	0	86	14	13
37	27-Jan-95	9 - 14	4	69	113	103	177	0	1	0	28	0	0	314	13	3
38	03-Feb-95	9 - 14	3	70	124	131	248	0	0	0	71	34	0	368	30	12
39	10-Feb-95	9 - 14	4	66	130	112	239	0	0	3	0	0	0	347	13	3
40	17-Feb-95	8 - 14	5	80	130	165	254	0	1	0	212	14	0	187	13	2
41	24-Feb-95	8 - 14	3	100	150	190	285	0	0	4	3	37	0	499	61	30
42	03-Mar-95	9 - 14	3	64	130	132	265	0	0	0	74	34	0	123	41	23
43	17-Mar-95	8 - 12	4	46	90	90	177	0	0	3	24	0	0	45	7	7
44	07-Apr-95	8 - 13	4	79	109	79	109	0	0	1	6	25	0	226	40	22
45	21-Apr-95	2 - 7	4	53	95	143	200	1	0	4	9	2	0	47	0	6
46	* *05-May-95	9 - 14	3	0	0	111	260	0	0	0	21	46	0	0	0	0
47	12-May-95	2 - 7	4	72	108	140	199	1	0	25	28	43	0	218	3	26
48	19-May-95	8 - 14	3	120	150	201	280	1	0	13	33	39	0	76	24	21
49	26-May-95	2 - 7	3	67	115	149	197	0	0	0	58	3	0	101	1	1
50	* *02-Jun-95	9	3	0	0	47	15	0	0	0	2	0	0	0	0	0
51	09-Jun-95	8 - 14	4	108	150	176	274	0	0	15	70	47	0	146	72	22
52	16-Jun-95	8 - 14	3	71	136	146	272	0	0	9	16	5	0	50	28	23
53	30-Jun-95	2 - 7	3	67	96	116	173	0	0	18	56	7	0	88	0	21
54	07-Jul-95	8 - 14	3	80	128	154	243	1	1	17	22	23	0	83	70	0
55	14-Jul-95	2 - 7	3	73	115	149	230	0	0	13	67	11	0	35	2	14
56	21-Jul-95	8 - 14	3	101	150	127	174	0	0	8	24	22	0	91	87	26
57	11-Aug-95	9 - 13	3	52	89	52	89	0	0	0	8	10	0	155	203	11
58	18-Aug-95	3 - 7	3	65	91	130	182	0	0	1	12	11	0	84	10	9
59	01-Sep-95	8 - 14	3	118	150	231	300	0	0	4	24	8	0	77	36	34
60	15-Sep-95	2 - 7	3	128	79	188	179	0	0	0	16	7	0	90	10	8
61	* *29-Sep-95	8 - 14	4	0	0	158	300	1	0	5	23	5	0	0	0	0
62	13-Oct-95	2 - 7	3	55	77	207	172	0	0	2	0	0	0	80	1	0
63	27-Oct-95	8 - 14	3	96	140	198	269	0	1	2	5	20	0	191	76	14
64	03-Nov-95	2 - 7	4	56	90	131	195	0	0	4	4	2	0	158	5	27
65	17-Nov-95	8 - 14	3	90	150	90	150	2	0	2	18	0	0	81	23	11
66	01-Dec-95	2 - 7	3	70	96	154	188	0	0	4	8	26	0	260	0	27
67	15-Dec-95	8 - 14	3	111	150	175	290	0	1	5	63	46	0	75	27	14
68	02-Feb-96	3 - 7	3	37	80	79	155	0	0	0	0	0	0	89	1	4
69	23-Feb-96	9 - 14	3	83	125	147	250	0	1	0	79	65	0	330	9	9
70	07-Mar-96	2 - 7	3	48	95	120	202	0	0	6	6	17	0	107	2	7
71	21-Mar-96	8 - 14	3	86	150	181	300	1	0	15	43	24	0	41	0	4
	TOTAL							30	9	323	1557	1071	4	8377	3198	1241

* = Some zones were not completely surveyed

** = Turtles only recorded

*** = RG-8 airplane is the platform.

Table 2. Summary of the total number of sea turtles and turtles per nautical mile observed in individual zones (1 - 14). See Figure 1 for zone descriptions.

	SUMMER 1992			FALL 1992		
ZONE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE
1						
2						
3						
4						
5						
6						
7						
8	0	15	0.000	0	15	0.000
9	3	25	0.120	1	25	0.040
10	3	21	0.143	4	21	0.190
11	2	23	0.087			
12	0	3	0.000			
13						
14						
Total	8	87	0.092	5	61	0.082

	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
ZONE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE
1												
2												
3												
4												
5												
6												
7												
8	0	21	0.000	5	45	0.111	6	55	0.091	4	55	0.073
9	3	50	0.060	16	95	0.169	16	190	0.095	16	140	0.114
10	0	42	0.000	16	84	0.190	22	189	0.116	13	147	0.088
11	4	46	0.087	18	92	0.196	35	417	0.084	16	158	0.101
12	4	63	0.063	10	44	0.227	26	136	0.191	11	98	0.112
13	0	8	0.000	4	26	0.154	6	46	0.130	1	36	0.028
14				0	12	0.000						
Total	11	230	0.048	71	398	0.178	112	1033	0.108	61	634	0.096

	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
Zone	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE
1												
2												
3												
4												
5												
6												
7												
8	0	40	0.000	2	60	0.033	0	30	0.000	0	15	0.000
9	6	75	0.080	9	150	0.060	11	195	0.056	11	150	0.073
10	5	63	0.079	13	126	0.103	30	210	0.143	18	147	0.122
11	30	69	0.435	15	161	0.093	9	230	0.039	11	161	0.068
12	24	66	0.364	12	120	0.100	21	220	0.095	13	154	0.084
13	0	29	0.000	7	80	0.088	13	230	0.057	10	171	0.058
14	3	21	0.143	9	36	0.250	13	110	0.118	11	143	0.077
Total	68	363	0.187	67	733	0.091	97	1225	0.079	74	941	0.079

	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
ZONE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE
1												
2				6	45	0.133	40	45	0.889	0	11	0.000
3				23	156	0.147	14	106	0.132	6	94	0.064
4				67	157	0.427	34	120	0.283	7	120	0.058
5				59	150	0.393	11	110	0.100	5	120	0.042
6				32	156	0.205	7	120	0.058	1	120	0.008
7				8	105	0.076	6	90	0.067	0	90	0.000
8	2	18	0.111	0	47	0.000	5	83	0.060	2	40	0.050
9	66	350	0.189	19	225	0.084	20	190	0.105	13	125	0.104
10	58	336	0.173	71	189	0.376	21	168	0.125	14	105	0.133
11	89	368	0.242	42	207	0.203	19	184	0.103	11	115	0.096
12	100	322	0.311	18	198	0.091	34	176	0.193	12	110	0.109
13	74	299	0.247	23	187	0.123	27	182	0.148	25	115	0.217
14	43	184	0.234	14	157	0.089	9	123	0.073	22	99	0.222
Total	432	1877	0.230	382	1979	0.193	247	1697	0.146	118	1264	0.093

	WINTER 1996		
ZONE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE
1			
2	2	13	0.154
3	3	56	0.054
4	1	80	0.013
5	3	80	0.038
6	2	80	0.025
7	1	60	0.017
8	3	30	0.100
9	16	90	0.178
10	39	84	0.464
11	21	92	0.228
12	21	88	0.239
13	21	92	0.228
14	18	84	0.214
Total	151	929	0.163

	TOTAL (SEPTEMBER 1992 - MARCH 1996)		
ZONE	TOTAL NUMBER OF TURTLES	NUMBER OF NAUTICAL MILES	TURTLES PER NAUTICAL MILE
1			
2	48	114	0.421
3	46	412	0.112
4	108	477	0.229
5	78	460	0.170
6	42	478	0.088
7	15	345	0.043
8	28	569	0.049
9	230	2075	0.111
10	327	1932	0.169
11	322	2323	0.139
12	306	1798	0.170
13	211	1501	0.141
14	142	969	0.147
Total	1904	13451	0.142

Table 3. Summary of the total number of bottlenose dolphin and dolphins per nautical mile observed in individual zones (1 - 14). See Figure 1 for zone descriptions.

	SUMMER 1992			FALL 1992		
ZONE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE
1						
2						
3						
4						
5						
6						
7						
8	0	15	0.000	0	15	0.000
9	0	25	0.000	0	25	0.000
10	0	21	0.000	0	21	0.000
11	10	23	0.435			
12	0	3	0.000			
13						
14						
Total	10	87	0.115	0	61	0.000

	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
ZONE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE
1												
2												
3												
4												
5												
6												
7												
8	0	21	0.000	0	45	0.000	0	55	0.000	0	55	0.000
9	2	50	0.040	1	95	0.011	0	190	0.000	18	140	0.129
10	0	42	0.000	11	84	0.131	8	189	0.042	0	147	0.000
11	0	46	0.000	15	92	0.163	12	417	0.029	0	158	0.000
12	4	63	0.063	7	44	0.159	13	136	0.096	0	98	0.000
13	0	8	0.000	0	26	0.000	2	46	0.043	0	36	0.000
14				0	12	0.000						
Total	6	230	0.026	34	398	0.085	35	1033	0.034	18	634	0.028

	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
Zone	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE
1												
2												
3												
4												
5												
6												
7												
8	0	40	0.000	0	60	0.000	0	30	0.000	0	15	0.000
9	6	75	0.080	0	150	0.000	2	195	0.010	13	150	0.087
10	1	63	0.016	0	126	0.000	0	210	0.000	37	147	0.252
11	13	69	0.188	12	161	0.075	18	230	0.078	14	161	0.087
12	19	66	0.288	1	120	0.008	20	220	0.091	8	154	0.052
13	0	29	0.000	1	80	0.013	4	230	0.017	97	171	0.567
14	3	21	0.143	0	36	0.000	13	110	0.118	29	143	0.203
Total	42	363	0.116	14	733	0.019	57	1225	0.047	198	941	0.210

	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
ZONE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE
1												
2				0	45	0.000	2	45	0.044	4	11	0.364
3				43	156	0.276	2	108	0.019	2	94	0.021
4				3	157	0.019	14	120	0.117	22	120	0.183
5				6	150	0.040	2	110	0.018	0	120	0.000
6				3	156	0.019	1	120	0.008	0	120	0.000
7				0	105	0.000	8	90	0.089	0	90	0.000
8	20	18	1.111	0	47	0.000	0	83	0.000	0	40	0.000
9	6	350	0.017	19	225	0.084	11	190	0.058	38	125	0.304
10	13	336	0.039	22	189	0.116	0	168	0.000	0	105	0.000
11	20	368	0.054	11	207	0.053	24	184	0.130	2	115	0.017
12	45	322	0.140	78	1[illegible]8	0.334	30	1[illegible]5	0.179	27	110	0.245
13	12	299	0.040	17	187	0.091	1	182	0.005	2	115	0.017
14	18	184	0.098	15	157	0.096	2	123	0.016	6	99	0.061
Total	134	1877	0.071	217	1979	0.110	97	1697	0.057	103	1264	0.081

	WINTER 1996		
ZONE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE
1			
2	0	13	0.000
3	16	56	0.286
4	1	80	0.013
5	0	80	0.000
6	0	80	0.000
7	0	60	0.000
8	0	30	0.000
9	5	90	0.056
10	0	84	0.000
11	11	92	0.120
12	10	88	0.114
13	43	92	0.467
14	20	84	0.238
Total	106	929	0.114

	TOTAL (SEPTEMBER 1992 - MARCH 1996)		
ZONE	TOTAL NUMBER OF DOLPHINS	NUMBER OF NAUTICAL MILES	DOLPHINS PER NAUTICAL MILE
1			
2	6	114	0.053
3	63	412	0.153
4	40	477	0.084
5	8	460	0.017
6	4	476	0.008
7	8	345	0.023
8	20	569	0.035
9	121	2075	0.058
10	92	1932	0.048
11	162	2323	0.070
12	262	1798	0.146
13	179	1501	0.119
14	106	969	0.109
Total	1071	13451	0.080

Table 4. Summary of the total number of vessels (fish, dive, and cruise) and vessels per survey observed in individual zones (1 - 14). See Figure 1 for zone descriptions.

	SUMMER 1992			FALL 1992		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1						
2						
3						
4						
5						
6						
7						
8	1	16	16.0	1	32	32.0
9	1	11	11.0	1	27	27.0
10	1	17	17.0	1	34	34.0
11	1	27	27.0			
12	1	1	1.0			
13						
14						

	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1												
2												
3												
4												
5												
6												
7												
8	2	38	19.0	3	28	9.3	4	23	5.8	2	54	27.0
9	2	125	62.5	3	57	19.0	6	107	17.8	3	84	28.0
10	2	177	88.5	3	105	35.0	6	208	34.7	4	147	36.8
11	2	270	135.0	3	105	35.0	6	229	38.2	4	169	42.3
12	2	414	207.0	3	46	15.3	5	119	23.8	3	58	19.3
13	1	29	29.0	2	61	30.5	2	147	73.5	2	26	13.0
14				1	25	25.0						

	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1												
2												
3												
4												
5												
6												
7												
8	2	11	5.5	3	47	15.7	2	136	68.0	2	20	10.0
9	2	35	17.5	4	61	15.3	7	258	36.6	6	102	17.0
10	2	56	28.0	4	114	28.5	7	237	33.9	6	171	28.5
11	2	97	48.5	4	91	22.8	7	299	42.7	6	356	59.3
12	2	57	28.5	4	39	9.8	7	85	12.1	6	154	25.7
13	2	16	8.0	3	160	53.3	7	165	23.6	6	388	64.7
14	1	7	7.0	2	46	23.0	6	89	14.8	6	180	30.0

	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1				4	2	0.5	2	1	0.5	3	5	1.7
2				4	38	9.5	3	13	4.3	3	13	4.3
3				4	24	6.0	3	14	4.7	3	93	31.0
4				4	134	33.5	3	89	29.7	3	174	58.0
5				4	200	50.0	3	61	20.3	3	142	47.3
6				4	114	28.5	3	84	28.0	3	131	43.7
7				4	82	20.5	3	40	13.3	3	39	13.0
8	3	12	4.0	4	115	28.8	4	90	22.5	3	47	15.7
9	8	166	20.8	4	76	19.0	4	187	46.8	3	73	24.3
10	8	175	21.9	4	138	34.5	4	197	49.3	3	91	30.3
11	8	549	68.6	4	119	29.8	4	130	32.5	3	79	26.3
12	8	360	45.0	4	130	32.5	4	160	40.0	3	103	34.3
13	7	706	100.9	4	90	22.5	3	54	18.0	3	80	26.7
14	7	284	40.6									

	WINTER 1996		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1			
2	1	2	2.0
3	2	18	9.0
4	2	59	29.5
5	2	51	25.5
6	2	38	19.0
7	2	42	21.0
8	1	1	1.0
9	2	32	16.0
10	2	46	23.0
11	2	87	43.5
12	2	67	33.5
13	2	122	61.0
14	2	37	18.5

	TOTAL SEPT. 1992 - MARCH 1996		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1			
2	10	10	1.0
3	12	82	6.8
4	12	190	15.8
5	12	448	37.3
6	12	441	36.8
7	12	371	30.9
8	36	579	16.1
9	56	1315	23.5
10	57	1823	32.0
11	56	2705	48.3
12	54	1728	32.0
13	45	2213	49.2
14	35	892	25.5

Table 5. Summary of the number of fishing vessels (recreational and commercial) and vessels per survey observed in individual zones (1 - 14). See Figure 1 for zone descriptions.

	SUMMER 1992			FALL 1992		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1						
2						
3						
4						
5						
6						
7						
8	1	14	14.0	1	32	32.0
9	1	6	6.0	1	23	23.0
10	1	10	10.0	1	17	17.0
11	1	23	23.0			
12	1	1	1.0			
13						
14						

	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1												
2												
3												
4												
5												
6												
7												
8	2	28	14.0	3	14	4.7	4	18	4.5	2	39	19.5
9	2	106	53.0	3	36	12.0	6	69	11.5	3	53	17.7
10	2	110	55.0	3	33	11.0	6	40	6.7	4	54	13.5
11	2	199	99.5	3	64	21.3	6	113	18.8	4	96	24.0
12	2	347	173.5	3	29	9.7	5	40	8.0	3	42	14.0
13	1	29	29.0	2	21	10.5	2	11	5.5	2	10	5.0
14				1	4	4.0						

	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1												
2												
3												
4												
5												
6												
7												
8	2	10	5.0	3	36	12.0	2	0	0.0	2	17	8.5
9	2	26	13.0	4	56	14.0	7	73	10.4	6	85	14.2
10	2	23	11.5	4	26	6.5	7	49	7.0	6	80	13.3
11	2	75	37.5	4	49	12.3	7	81	11.6	6	271	45.2
12	2	47	23.5	4	34	8.5	7	40	5.7	6	134	22.3
13	2	4	2.0	3	51	17.0	7	37	5.3	6	232	38.7
14	1	4	4.0	2	24	12.0	6	23	3.8	6	108	18.0

	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1												
2				4	2	0.5	2	0	0.0	3	5	1.7
3				4	30	7.5	3	5	1.7	3	8	2.7
4				4	18	4.5	3	11	3.7	3	91	30.3
5				4	125	31.3	3	72	24.0	3	160	53.3
6				4	185	46.3	3	48	16.0	3	124	41.3
7				4	94	23.5	3	73	24.3	3	110	36.7
8	3	6	2.0	4	70	17.5	3	22	7.3	3	33	11.0
9	8	151	18.9	4	100	25.0	4	69	17.3	3	46	15.3
10	8	127	15.9	4	32	8.0	4	79	19.8	3	41	13.7
11	8	509	63.6	4	90	22.5	4	93	23.3	3	58	19.3
12	8	331	41.4	4	96	24.0	4	63	15.8	3	63	21.0
13	7	598	85.4	4	56	14.0	4	47	11.8	3	49	16.3
14	7	246	35.1	4	54	13.5	3	19	6.3	3	57	19.0

	WINTER 1996		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1			
2	1	2	2.0
3	2	18	9.0
4	2	57	28.5
5	2	44	22.0
6	2	35	17.5
7	2	40	20.0
8	1	1	1.0
9	2	29	14.5
10	2	39	19.5
11	2	83	41.5
12	2	65	32.5
13	2	116	58.0
14	2	37	18.5

	TOTAL (SEPT. 1992 - MARCH 1996)		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1			
2	10	9	0.9
3	12	61	5.1
4	12	177	14.8
5	12	401	33.4
6	12	392	32.7
7	12	317	26.4
8	36	340	9.4
9	56	928	16.6
10	57	760	13.3
11	56	1804	32.2
12	54	1332	24.7
13	45	1261	28.0
14	35	576	16.5

Table 6. Summary of the number of dive vessels (recreational and charter/yacht) and vessels per survey observed in individual zones (1 - 14). See Figure 1 for zone descriptions

	SUMMER 1992			FALL 1992		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1						
2						
3						
4						
5						
6						
7						
8	1	0	0.0	1	0	0.0
9	1	2	2.0	1	1	1.0
10	1	6	6.0	1	16	16.0
11	1	2	2.0			
12	1	0	0.0			
13						
14						

	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1												
2												
3												
4												
5												
6												
7												
8	2	1	0.5	3	1	0.3	4	1	0.3	2	2	1.0
9	2	5	2.5	3	6	2.0	6	17	2.8	3	8	2.7
10	2	49	24.5	3	60	20.0	6	142	23.7	4	62	15.5
11	2	21	10.5	3	21	7.0	6	89	14.8	4	47	11.8
12	2	20	10.0	3	5	1.7	5	54	10.8	3	0	0.0
13	1	0	0.0	2	36	18.0	2	133	66.5	2	11	5.5
14				1	6	6.0						

	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1												
2												
3												
4												
5												
6												
7												
8	2	0	0.0	3	2	0.7	2	136	68.0	2	0	0.0
9	2	8	4.0	4	3	0.8	7	176	25.1	6	5	0.8
10	2	30	15.0	4	69	17.3	7	170	24.3	6	65	10.8
11	2	16	8.0	4	20	5.0	7	199	28.4	6	36	6.0
12	2	4	2.0	4	4	1.0	7	33	4.7	6	8	1.3
13	2	11	5.5	3	102	34.0	7	118	16.6	6	122	20.3
14	1	3	3.0	2	12	6.0	6	58	9.7	6	44	7.3

	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1												
2				4	0	0.0	2	1	0.5	3	0	0.0
3				4	2	0.5	3	2	0.7	3	0	0.0
4				4	0	0.0	3	0	0.0	3	1	0.3
5				4	2	0.5	3	5	1.7	3	2	0.7
6				4	0	0.0	3	6	2.0	3	2	0.7
7				4	0	0.0	3	8	2.7	3	1	0.3
8	3	0	0.0	4	2	0.5	3	2	0.7	3	0	0.0
9	8	1	0.1	4	2	0.5	4	14	3.5	3	0	0.0
10	8	37	4.6	4	27	6.8	4	93	23.3	3	25	8.3
11	8	30	3.8	4	28	7.0	4	90	22.5	3	23	7.7
12	8	10	1.3	4	9	2.3	4	56	14.0	3	12	4.0
13	7	91	13.0	4	61	15.3	4	110	27.5	3	48	16.0
14	7	23	3.3	4	35	8.8	3	30	10.0	3	18	6.0

	WINTER 1996		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1			
2	1	0	0.0
3	2	0	0.0
4	2	0	0.0
5	2	3	1.5
6	2	0	0.0
7	2	0	0.0
8	1	0	0.0
9	2	1	0.5
10	2	2	1.0
11	2	1	0.5
12	2	0	0.0
13	2	5	2.5
14	2	0	0.0

	TOTAL (SEPT. 1992 - MARCH 1996)		
ZONE	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1			
2	10	1	0.1
3	12	4	0.3
4	12	1	0.1
5	12	12	1.0
6	12	8	0.7
7	12	9	0.8
8	36	147	4.1
9	56	249	4.4
10	57	853	15.0
11	56	623	11.1
12	54	215	4.0
13	45	846	18.8
14	35	229	6.5

Table 7. Summary of the total number of vessels (fish, dive, and cruise) and vessels per survey observed at proposed Sanctuary Protected Areas (SPAS) and Ecological Reserves in zones 10-14 of the Florida Keys National Marine Sanctuary (FKNMS).

	SUMMER 1992			FALL 1992		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF				1	4	4.0
2 THE ELBOW	1	3	3.0	1	3	3.0
3 DRY ROCKS	1	3	3.0	1	2	2.0
4 FRENCH REEF	1	7	7.0	1	8	8.0
5 MOLASSES REEF	1	3	3.0	1	3	3.0
6 CONCH REEF	1	0	0.0			
7 DAVIS REEF	1	3	3.0			
8 ALLIGATOR REEF	1	4	4.0			
9 TENNESSEE REEF	1	1	1.0			
10 COFFINS PATCH						
11 SOMBRERO REEF						
12 LOOE KEY REEF						
13 PELICAN SHOALS						
14 W. SAMBOS						
15 SAND KEY REEF						
ECOLOGICAL RESERVE						
K KEY LARGO	1	0	0.0	1	5	5.0
S SAMBOS	0		N/A	0		N/A

	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	2	30	15.0	3	9	3.0	6	33	6.6	4	19	4.8
2 THE ELBOW	2	16	8.0	3	12	4.0	6	17	3.4	4	5	1.3
3 DRY ROCKS	2	48	24.0	3	16	5.3	6	67	11.4	4	27	6.8
4 FRENCH REEF	2	12	6.0	3	14	4.7	6	22	4.4	4	12	3.0
5 MOLASSES REEF	2	61	30.5	3	33	11.0	6	61	12.2	4	47	11.8
6 CONCH REEF	1	15	15.0	3	5	1.7	4	16	3.9	4	8	2.0
7 DAVIS REEF	1	0	0.0	3	24	8.0	5	27	5.4	4	32	8.0
8 ALLIGATOR REEF	2	52	26.0	3	26	8.7	6	75	15.0	4	14	3.5
9 TENNESSEE REEF	2	48	24.0	2	6	3.0	6	26	5.2	2	13	6.5
10 COFFINS PATCH	2	50	25.0	2	0	0.0	2	10	5.0	2	7	3.5
11 SOMBRERO REEF	1	17	17.0	2	31	15.5	3	70	23.3	2	18	9.0
12 LOOE KEY REEF				1	3	3.0	1	69	69.0			
13 PELICAN SHOALS				1	1	1.0						
14 W. SAMBOS				1	8	8.0						
15 SAND KEY REEF												
ECOLOGICAL RESERVE												
K KEY LARGO	2	31	15.5	3	11	3.7	5	35	7.0	4	19	4.8
S SAMBOS	0		N/A	1	8	8.0	0		N/A	0		N/A

	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	2	5	2.5	4	11	2.8	6	21	3.5	6	18	3.0
2 THE ELBOW	2	3	1.5	4	6	1.5	6	29	4.8	6	27	4.5
3 DRY ROCKS	2	16	8.0	4	33	8.3	6	53	8.8	6	24	4.0
4 FRENCH REEF	2	8	4.0	4	5	1.3	6	33	5.5	6	16	2.7
5 MOLASSES REEF	2	15	7.5	4	40	10.0	6	32	5.3	6	62	10.3
6 CONCH REEF	2	12	6.0	4	3	0.8	6	17	2.8	6	16	2.7
7 DAVIS REEF	2	8	4.0	4	14	3.5	6	23	3.8	6	44	7.3
8 ALLIGATOR REEF	2	13	6.5	4	29	7.3	6	59	9.8	6	57	9.5
9 TENNESSEE REEF	2	9	4.5	4	4	1.0	6	7	1.2	6	25	4.2
10 COFFINS PATCH	2	13	6.5	3	3	1.0	6	12	2.0	6	21	3.5
11 SOMBRERO REEF	2	11	5.5	3	30	10.0	7	37	5.3	6	80	13.3
12 LOOE KEY REEF	1	1	1.0	2	36	18.0	7	57	8.1	6	99	16.5
13 PELICAN SHOALS	1	0	0.0	2	0	0.0	6	17	2.8	5	7	1.4
14 W. SAMBOS	1	3	3.0	2	14	7.0	6	29	4.8	5	16	3.2
15 SAND KEY REEF	1	4	4.0				3	17	5.7	5	36	7.8
ECOLOGICAL RESERVE												
K KEY LARGO	2	9	4.5	4	12	3.0	6	22	3.7	6	24	4.0
S SAMBOS	1	3	3.0	2	19	9.5	6	29	4.8	5	19	3.8

	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	8	22	2.8	4	6	1.5	4	34	8.5	3	6	2.0
2 THE ELBOW	8	18	2.3	4	3	0.8	4	7	1.8	3	11	3.7
3 DRY ROCKS	8	9	1.1	4	7	1.8	4	20	5.0	3	7	2.3
4 FRENCH REEF	8	25	3.1	4	4	1.0	4	10	2.5	3	19	6.3
5 MOLASSES REEF	8	33	4.1	4	40	10.0	4	55	13.8	3	14	4.7
6 CONCH REEF	8	35	4.4	4	11	2.8	4	38	9.5	3	3	1.0
7 DAVIS REEF	8	71	8.9	4	17	4.3	4	40	10.0	3	20	6.7
8 ALLIGATOR REEF	8	41	5.1	4	22	5.5	4	31	7.8	3	20	6.7
9 TENNESSEE REEF	8	40	5.0	4	13	3.3	4	31	7.8	3	18	6.0
10 COFFINS PATCH	8	39	4.9	4	17	4.3	4	18	4.5	3	8	2.7
11 SOMBRERO REEF	7	75	10.7	4	33	8.3	4	36	9.0	3	23	7.7
12 LOOE KEY REEF	7	90	12.9	3	39	13.0	3	46	15.3	3	30	10.0
13 PELICAN SHOALS	6	19	3.2	3	4	1.3	3	9	3.0	2	0	0.0
14 W. SAMBOS	6	40	6.0	3	4	1.3	2	11	5.5	3	13	4.3
15 SAND KEY REEF	4	66	16.5	3	23	7.7	2	14	7.0	3	39	13.0
ECOLOGICAL RESERVE												
K KEY LARGO	8	35	4.4	4	11	2.8	4	47	11.8	3	8	2.7
S SAMBOS	6	44	8.8	3	6	1.7	2	12	6.0	3	15	5.0

	WINTER 1996		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	2	3	1.5
2 THE ELBOW	2	2	1.0
3 DRY ROCKS	2	0	0.0
4 FRENCH REEF	2	15	7.5
5 MOLASSES REEF	2	11	5.5
6 CONCH REEF	2	1	0.5
7 DAVIS REEF	2	17	8.5
8 ALLIGATOR REEF	2	18	9.0
9 TENNESSEE REEF	2	4	2.0
10 COFFINS PATCH	2	1	0.5
11 SOMBRERO REEF	2	8	4.0
12 LOOE KEY REEF	2	24	12.0
13 PELICAN SHOALS	2	0	0.0
14 W. SAMBOS	2	4	2.0
15 SAND KEY REEF	2		0.0
ECOLOGICAL RESERVE			
K KEY LARGO	2	3	1.5
S SAMBOS	2	4	2.0

	TOTAL (SEPTEMBER 1992 - MARCH 1996)		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	54	221	4.1
2 THE ELBOW	55	162	2.9
3 DRY ROCKS	55	322	5.9
4 FRENCH REEF	56	210	3.8
5 MOLASSES REEF	56	500	9.1
6 CONCH REEF	52	178	3.4
7 DAVIS REEF	53	340	6.4
8 ALLIGATOR REEF	54	461	8.5
9 TENNESSEE REEF	51	245	4.8
10 COFFINS PATCH	46	200	4.3
11 SOMBRERO REEF	44	457	10.2
12 LOOE KEY REEF	36	493	13.7
13 PELICAN SHOALS	31	61	1.8
14 W. SAMBOS	30	142	4.7
15 SAND KEY REEF	23	200	8.7
ECOLOGICAL RESERVE			
K KEY LARGO	54	272	5.0
S SAMBOS	30	158	5.3

Table 8. Summary of the total number of fishing vessels (recreational and commercial) and vessels per survey observed at proposed Sanctuary Protected Areas (SPAS) and Ecological Reserves in zones 10-14 of the Florida Keys National Marine Sanctuary (FKNMS).

	SUMMER 1992			FALL 1992		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF				1	3	3.0
2 THE ELBOW	1	2	2.0	1	1	1.0
3 DRY ROCKS	1	2	2.0	1	2	2.0
4 FRENCH REEF	1	5	5.0	1	0	0.0
5 MOLASSES REEF	1	0	0.0	1	0	0.0
6 CONCH REEF	1	0	0.0			
7 DAVIS REEF	1	3	3.0			
8 ALLIGATOR REEF	1	3	3.0			
9 TENNESSEE REEF	1	1	1.0			
10 COFFINS PATCH						
11 SOMBRERO REEF						
12 LOOE KEY REEF						
13 PELICAN SHOALS						
14 W. SAMBOS						
15 SAND KEY REEF						
ECOLOGICAL RESERVE						
K KEY LARGO	1	0	0.0	1	4	4.0
S SAMBOS	0		N/A	0		N/A

	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	2	26	13.0	3	2	0.7	6	15	3.0	4	8	2.0
2 THE ELBOW	2	12	6.0	3	11	3.7	5	3	0.8	4	4	1.0
3 DRY ROCKS	2	29	14.5	3	3	1.0	6	4	0.8	4	4	1.0
4 FRENCH REEF	2	11	5.5	3	2	0.7	5	6	1.2	4	3	0.8
5 MOLASSES REEF	2	28	14.0	3	2	0.7	5	3	0.8	4	14	3.5
6 CONCH REEF	1	14	14.0	3	5	1.7	4	5	1.3	4	3	0.8
7 DAVIS REEF	1	0	0.0	3	17	5.7	6	21	4.2	4	16	4.0
8 ALLIGATOR REEF	2	33	16.5	3	13	4.3	5	26	5.2	4	3	0.8
9 TENNESSEE REEF	2	35	17.5	2	5	2.5	5	11	2.2	2	9	4.5
10 COFFINS PATCH	2	42	21.0	2	0	0.0	2	0	0.0	2	6	3.0
11 SOMBRERO REEF	1	11	11.0	2	2	1.0	3	7	2.3	2	5	2.5
12 LOOE KEY REEF				1	0	0.0	1	1	1.0			
13 PELICAN SHOALS				1	0	0.0						
14 W. SAMBOS				1	0	0.0						
15 SAND KEY REEF												
ECOLOGICAL RESERVE												
K KEY LARGO	2	27	13.5	3	4	1.3	5	17	3.4	4	8	2.0
S SAMBOS	0		N/A	1	0	0.0	0		N/A	0		N/A

	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	2	1	0.5	4	3	0.8	6	7	1.2	6	13	2.2
2 THE ELBOW	2	0	0.0	4	2	0.5	6	14	2.3	6	17	2.8
3 DRY ROCKS	2	1	0.5	4	1	0.3	6	1	0.2	6	13	2.2
4 FRENCH REEF	2	7	3.5	4	0	0.0	6	8	1.3	6	12	2.0
5 MOLASSES REEF	2	7	3.5	4	7	1.8	6	0	0.0	6	2	0.3
6 CONCH REEF	2	12	6.0	4	1	0.3	6	2	0.3	6	10	1.7
7 DAVIS REEF	2	8	4.0	4	3	0.8	6	13	2.2	6	32	5.3
8 ALLIGATOR REEF	2	8	4.0	4	18	4.5	6	13	2.2	6	49	8.2
9 TENNESSEE REEF	2	5	2.5	4	4	1.0	6	6	1.0	6	24	4.0
10 COFFINS PATCH	2	9	4.5	3	3	1.0	6	5	0.8	6	21	3.5
11 SOMBRERO REEF	2	0	0.0	3	1	0.3	7	7	1.0	6	26	4.3
12 LOOE KEY REEF	1	0	0.0	2	1	0.5	7	5	0.7	6	25	4.2
13 PELICAN SHOALS	1	0	0.0	2	0	0.0	6	0	0.0	5	6	1.2
14 W. SAMBOS	1	3	3.0	2	4	2.0	6	14	2.3	5	6	1.2
15 SAND KEY REEF	1	1	1.0				3	1	0.3	5	8	1.6
ECOLOGICAL RESERVE												
K KEY LARGO	2	4	2.0	4	4	1.0	6	7	1.2	6	19	3.2
S SAMBOS	1	3	3.0	2	9	4.5	6	14	2.3	5	9	1.8

	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	8	19	2.4	4	3	0.8	4	11	2.8	3	5	1.7
2 THE ELBOW	8	10	1.3	4	2	0.5	4	5	1.3	3	6	1.7
3 DRY ROCKS	8	4	0.5	4	4	1.0	4	6	1.5	3	7	2.3
4 FRENCH REEF	8	13	1.6	4	0	0.0	4	5	1.3	3	15	5.0
5 MOLASSES REEF	8	28	3.5	4	11	2.8	4	6	1.5	3	3	1.0
6 CONCH REEF	8	33	4.1	4	0	0.0	4	17	4.3	3	2	0.7
7 DAVIS REEF	8	70	8.8	4	10	2.5	4	12	3.0	3	17	5.7
8 ALLIGATOR REEF	8	33	4.1	4	15	3.8	4	10	2.5	3	9	3.0
9 TENNESSEE REEF	8	38	4.8	4	12	3.0	4	16	4.0	3	18	6.0
10 COFFINS PATCH	8	37	4.6	4	13	3.3	4	11	2.8	3	8	2.7
11 SOMBRERO REEF	7	54	7.7	4	4	1.0	4	4	1.0	3	10	3.3
12 LOOE KEY REEF	7	41	5.9	3	2	0.7	3	8	2.0	3	0	0.0
13 PELICAN SHOALS	6	18	3.0	3	2	0.7	3	3	1.0	2	0	0.0
14 W. SAMBOS	5	32	6.4	3	0	0.0	2	1	0.5	3	11	3.7
15 SAND KEY REEF	4	53	13.3	3	2	0.7	2	1	0.5	3	23	7.7
ECOLOGICAL RESERVE												
K KEY LARGO	8	3	0.4	4	5	1.3	4	23	5.8	3	6	2.0
S SAMBOS	5	4	0.8	3	1	0.3	2	1	0.5	3	12	4.0

	WINTER 1996		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	2	3	1.5
2 THE ELBOW	2	2	1.0
3 DRY ROCKS	2	0	0.0
4 FRENCH REEF	2	11	5.5
5 MOLASSES REEF	2	8	4.0
6 CONCH REEF	2	1	0.5
7 DAVIS REEF	2	17	8.5
8 ALLIGATOR REEF	2	17	8.5
9 TENNESSEE REEF	2	4	2.0
10 COFFINS PATCH	2	1	0.5
11 SOMBRERO REEF	2	6	3.0
12 LOOE KEY REEF	2	22	11.0
13 PELICAN SHOALS	2	0	0.0
14 W. SAMBOS	2	4	2.0
15 SAND KEY REEF	2	0	0.0
ECOLOGICAL RESERVE			
K KEY LARGO	2	3	1.5
S SAMBOS	2	4	2.0

	TOTAL (SEPTEMBER 1992 - MARCH 1996)		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	54	119	2.2
2 THE ELBOW	56	90	1.6
3 DRY ROCKS	56	91	1.5
4 FRENCH REEF	56	99	1.8
5 MOLASSES REEF	56	119	2.2
6 CONCH REEF	52	105	2.0
7 DAVIS REEF	53	239	4.5
8 ALLIGATOR REEF	54	250	4.6
9 TENNESSEE REEF	51	189	3.7
10 COFFINS PATCH	46	156	3.4
11 SOMBRERO REEF	46	137	3.0
12 LOOE KEY REEF	36	103	2.9
13 PELICAN SHOALS	31	29	0.9
14 W. SAMBOS	30	75	2.5
15 SAND KEY REEF	23	89	3.9
ECOLOGICAL RESERVE			
K KEY LARGO	54	181	3.0
S SAMBOS	30	89	3.0

Table 9. Summary of the number of total diving vessels and vessels per survey observed at proposed Sanctuary Protected Areas (SPAS) and Ecological Reserves in zones 10 - 14 of the Florida Keys National Marine Sanctuary (FKNMS).

	SUMMER 1992			FALL 1992		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF				1	0	0.0
2 THE ELBOW	1	1	1.0	1	2	2.0
3 DRY ROCKS	1	1	1.0	1	0	0.0
4 FRENCH REEF	1	1	1.0	1	8	8.0
5 MOLASSES REEF	1	3	3.0	1	3	3.0
6 CONCH REEF	1	0	0.0			
7 DAVIS REEF	1	0	0.0			
8 ALLIGATOR REEF	1	1	1.0			
9 TENNESSEE REEF	1	0	0.0			
10 COFFINS PATCH						
11 SOMBRERO REEF						
12 LOOE KEY REEF						
13 PELICAN SHOALS						
14 W. SAMBOS						
15 SAND KEY REEF						
ECOLOGICAL RESERVE						
K KEY LARGO	1	0	0.0	1	0	0.0
S SAMBOS	0		N/A	0		N/A

	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	2	0	0.0	3	4	1.3	5	11	2.2	4	3	0.8
2 THE ELBOW	2	1	0.5	3	0	0.0	5	11	2.2	4	1	0.3
3 DRY ROCKS	2	17	8.5	3	12	4.0	5	50	10.0	4	23	5.8
4 FRENCH REEF	2	1	0.5	3	10	3.3	5	7	1.4	4	8	2.0
5 MOLASSES REEF	2	29	14.5	3	28	9.3	5	57	11.4	4	26	6.5
6 CONCH REEF	1	1	1.0	3	0	0.0	4	7	1.8	4	4	1.0
7 DAVIS REEF	1	0	0.0	3	2	0.7	5	5	1.0	4	12	3.0
8 ALLIGATOR REEF	2	1	0.5	3	11	3.7	5	41	8.2	4	10	2.5
9 TENNESSEE REEF	2	0	0.0	2	0	0.0	5	11	2.2	2	0	0.0
10 COFFINS PATCH	2	0	0.0	2	0	0.0	2	10	5.0	2	0	0.0
11 SOMBRERO REEF	1	6	6.0	2	29	14.5	3	59	19.7	2	6	3.0
12 LOOE KEY REEF				1	1	1.0	1	69	69.0			
13 PELICAN SHOALS				1	1	1.0						
14 W. SAMBOS				1	2	2.0						
15 SAND KEY REEF												
ECOLOGICAL RESERVE												
K KEY LARGO	2	0	0.0	3	4	1.3	5	11	2.2	4	3	0.8
S SAMBOS	0		N/A	1	2	2.0	0		N/A	0		N/A

	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	2	4	2.0	4	6	1.5	6	14	2.3	6	2	0.3
2 THE ELBOW	2	3	1.5	4	3	0.8	6	15	2.5	6	9	1.5
3 DRY ROCKS	2	14	7.0	4	28	7.0	6	43	7.2	6	9	1.5
4 FRENCH REEF	2	0	7.0	4	4	1.0	6	24	4.0	6	3	0.5
5 MOLASSES REEF	2	0	0.0	4	26	6.5	6	29	4.8	6	37	6.2
6 CONCH REEF	2	0	4.0	4	2	0.5	6	13	2.2	6	4	0.7
7 DAVIS REEF	2	0	0.0	4	5	1.3	6	8	1.3	6	9	1.5
8 ALLIGATOR REEF	2	5	0.0	4	4	1.0	6	43	7.2	6	4	0.7
9 TENNESSEE REEF	2	3	2.5	4	0	0.0	6	0	0.0	6	1	0.2
10 COFFINS PATCH	2	1	1.5	3	0	0.0	6	5	0.8	6	0	0.0
11 SOMBRERO REEF	2	10	0.5	3	28	9.3	7	29	4.1	6	43	7.2
12 LOOE KEY REEF	1	1	10.0	2	34	17.0	7	49	7.0	6	66	10.8
13 PELICAN SHOALS	1	0	1.0	2	0	0.0	6	14	2.3	6	1	0.2
14 W. SAMBOS	1	0	0.0	2	1	0.5	6	11	1.8	5	9	1.8
15 SAND KEY REEF	1	3	0.0				3	16	5.3	5	21	4.2
ECOLOGICAL RESERVE												
K KEY LARGO	2	5	2.5	4	6	1.5	6	15	2.5	6	2	0.3
S SAMBOS	1	0	0.0	2	1	0.5	6	11	1.8	5	9	1.8

	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	6	2	0.3	4	3	0.8	4	16	4.0	3	1	0.3
2 THE ELBOW	6	6	0.8	4	0	0.0	4	2	0.5	3	5	1.7
3 DRY ROCKS	6	4	0.5	4	2	0.5	4	13	3.3	3	0	0.0
4 FRENCH REEF	6	10	1.3	4	1	0.3	4	5	1.3	3	2	0.7
5 MOLASSES REEF	6	3	0.4	4	21	5.3	4	45	11.3	3	11	3.7
6 CONCH REEF	6	2	0.3	4	6	1.5	4	21	5.3	3	0	0.0
7 DAVIS REEF	6	1	0.1	4	3	0.8	4	26	6.5	3	2	0.7
8 ALLIGATOR REEF	6	6	0.8	4	6	1.5	4	18	4.5	3	8	2.7
9 TENNESSEE REEF	6	1	0.1	4	0	0.0	4	12	3.0	3	0	0.0
10 COFFINS PATCH	6	0	0.0	4	3	0.8	4	8	2.0	3	0	0.0
11 SOMBRERO REEF	7	16	2.3	4	27	6.8	4	31	7.8	3	12	4.0
12 LOOE KEY REEF	7	46	6.4	3	33	11.0	3	39	13.0	3	30	10.0
13 PELICAN SHOALS	6	0	0.0	3	1	0.3	3	0	0.0	2	0	0.0
14 W. SAMBOS	5	6	1.2	3	4	1.3	2	8	4.0	3	2	0.7
15 SAND KEY REEF	4	9	2.3	3	21	7.0	2	11	6.5	3	13	4.3
ECOLOGICAL RESERVE												
K KEY LARGO	6	2	0.3	4	3	0.8	4	16	4.0	3	1	0.3
S SAMBOS	5	6	1.2	3	4	1.3	2	9	4.5	3	2	0.7

	WINTER 1996		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	2	0	0.0
2 THE ELBOW	2	0	0.0
3 DRY ROCKS	2	0	0.0
4 FRENCH REEF	2	2	1.0
5 MOLASSES REEF	2	0	0.0
6 CONCH REEF	2	0	0.0
7 DAVIS REEF	2	0	0.0
8 ALLIGATOR REEF	2	1	0.5
9 TENNESSEE REEF	2	0	0.0
10 COFFINS PATCH	2	0	0.0
11 SOMBRERO REEF	2	2	1.0
12 LOOE KEY REEF	2	2	1.0
13 PELICAN SHOALS	2	0	0.0
14 W. SAMBOS	2	0	0.0
15 SAND KEY REEF	2	0	0.0
ECOLOGICAL RESERVE			
K KEY LARGO	2	0	0.0
S SAMBOS	2	0	0.0

	TOTAL (SEPTEMBER 1992 - MARCH 1996)		
SPA REEF NAME	NUMBER OF SURVEYS	TOTAL NUMBER OF BOATS	BOATS PER SURVEY
1 CARYSFORT REEF	54	68	1.2
2 THE ELBOW	55	59	1.1
3 DRY ROCKS	55	218	3.9
4 FRENCH REEF	55	88	1.6
5 MOLASSES REEF	56	326	5.9
6 CONCH REEF	52	60	1.2
7 DAVIS REEF	53	73	1.4
8 ALLIGATOR REEF	54	159	2.9
9 TENNESSEE REEF	51	28	0.5
10 COFFINS PATCH	46	27	0.6
11 SOMBRERO REEF	46	287	6.5
12 LOOE KEY REEF	36	367	10.2
13 PELICAN SHOALS	31	17	0.5
14 W. SAMBOS	30	43	1.4
15 SAND KEY REEF	23	94	4.1
ECOLOGICAL RESERVE			
K KEY LARGO	54	69	1.3
S SAMBOS	30	44	1.5

Table 10. Summary of total vessels by activity for Sanctuary Protected Areas, Ecological Reserves, and zones from Melbourne to Key West, 1992-1996. See Figure 1 for zone descriptions. The number of surveys are noted in parenthesis.

	FISHING VESSELS								DIVING VESSELS				
	RECREATIONAL				COMMERCIAL								
SANCTUARY PROTECTED AREAS	SMALL (<35 FEET	CHARTER/ YACHT	UNKNOWN	TOTAL	LOBSTER	FISHING	UNKNOWN	TOTAL	SMALL (<35 FEET	CHARTER/ YACHT	TOTAL	CRUISE	TOTAL
OTHER REEF AREAS	4419	1228	222	5869	28	216	386	630	1008	272	1280	844	8623
1 CARYSFORT REEF (54)	77	8	8	93	1	2	23	26	54	12	66	36	221
2 THE ELBOW (55)	58	18	2	78	1		13	14	21	38	59	13	162
3 ORY ROCKS (55)	57	7	8	72	1	2	6	9	130	86	216	25	322
4 FRENCH REEF (55)	67	16	5	88	1	2	7	10	83	23	86	26	210
5 MOLASSES REEF (55)	78	24	3	105	1	3	10	14	226	100	326	55	500
6 CONCH REEF (52)	83	16	15	94	1	1	9	11	34	26	60	14	179
7 DAVIS REEF (53)	157	73	1	231	1	1	6	8	47	26	73	28	340
8 ALLIGATOR REEF (54)	170	54	6	230		2	18	20	138	21	159	52	481
9 TENNESSEE REEF (51)	124	38	9	171	1	2	14	17	18	10	28	29	245
10 COFFINS PATCH (46)	119	29	2	150		2	4	6	21	6	27	17	200
11 SOMBRERO REEF (46)	108	17		125		2	10	12	251	46	297	33	467
12 LOOE KEY REEF (36)	90	3	2	95		3	5	8	272	95	367	23	493
13 PELICAN SHOALS (31)	21	2		23		2	4	6	14	3	17	5	51
14 W. SAMBOS (30)	53	8		61	2		12	14	16	27	43	24	142
15 SAND KEY REEF (23)	40	31	5	76			13	13	34	60	94	17	200
TOTAL	5699	1572	288	7559	38	240	540	818	2347	851	3198	1241	12816
ECOLOGICAL RESERVES													
OUTSIDE RESERVES	5539	1550	268	7357	34	237	499	770	2276	810	3086	1171	12384
KEY LARGO (54)	99	11	16	126	2	3	28	33	55	13	68	43	272
SAMBOS (30)	61	11	2	74	2		13	15	18	28	44	25	158
TOTAL	5699	1572	288	7559	38	240	540	818	2347	851	3198	1241	12816
ZONES													
OUTSIDE ZONES	4	2		6		11		11		1	1	1	19
2 (10)	9			9					1		1		10
3 (12)	43	15		58		3		3	4		4	17	82
4 (12)	89	74		163		14		14		1	1	12	190
5 (12)	271	100		371		30		30	10	2	12	35	448
6 (12)	271	108		379		13		13	7	1	8	41	441
7 (12)	179	120	4	303		14		14	9		9	45	371
8 (36)	202	52	26	280	1	32	27	60	138	9	147	92	579
9 (56)	670	111	15	796	9	13	112	134	234	15	249	136	1315
10 (57)	488	106	57	651	11	14	84	109	559	294	853	210	1823
11 (56)	1133	473	73	1679	7	22	96	125	461	162	623	278	2705
12 (54)	961	238	56	1255	5	11	61	77	152	63	215	191	1728
13 (45)	1017	74	38	1129	2	41	89	132	667	179	846	106	2213
14 (35)	362	99	19	480	3	22	71	96	105	124	229	87	892
TOTAL	5699	1572	288	7559	38	240	540	818	2347	851	3198	1241	12816

Table 11. Comparison between the number of trailers at selected marinas adjacent to Biscayne National Park and recreational vessels using the park.

	RECREATIONAL VESSELS				NUMBER OF TRAILERS AT MARINAS			
SURVEY NUMBER	FISHING	DIVE	CRUISE	TOTAL	CONVOY POINT	BLACK POINT	MATHESON HAMMOCK	TOTAL TRAILERS
SUR003	26	0	1	27	30	2	12	44
SUR012	8	2	9	19	13	22	19	54
SUR020	10	1	1	12	32	24	30	86
SUR022	2	0	0	2	27	34	35	96
SUR025	7	155	2	164	50	74	72	196

Figure 1. Zones identified in the southeast Florida aerial survey, September 28, 1992 through March 21, 1996.

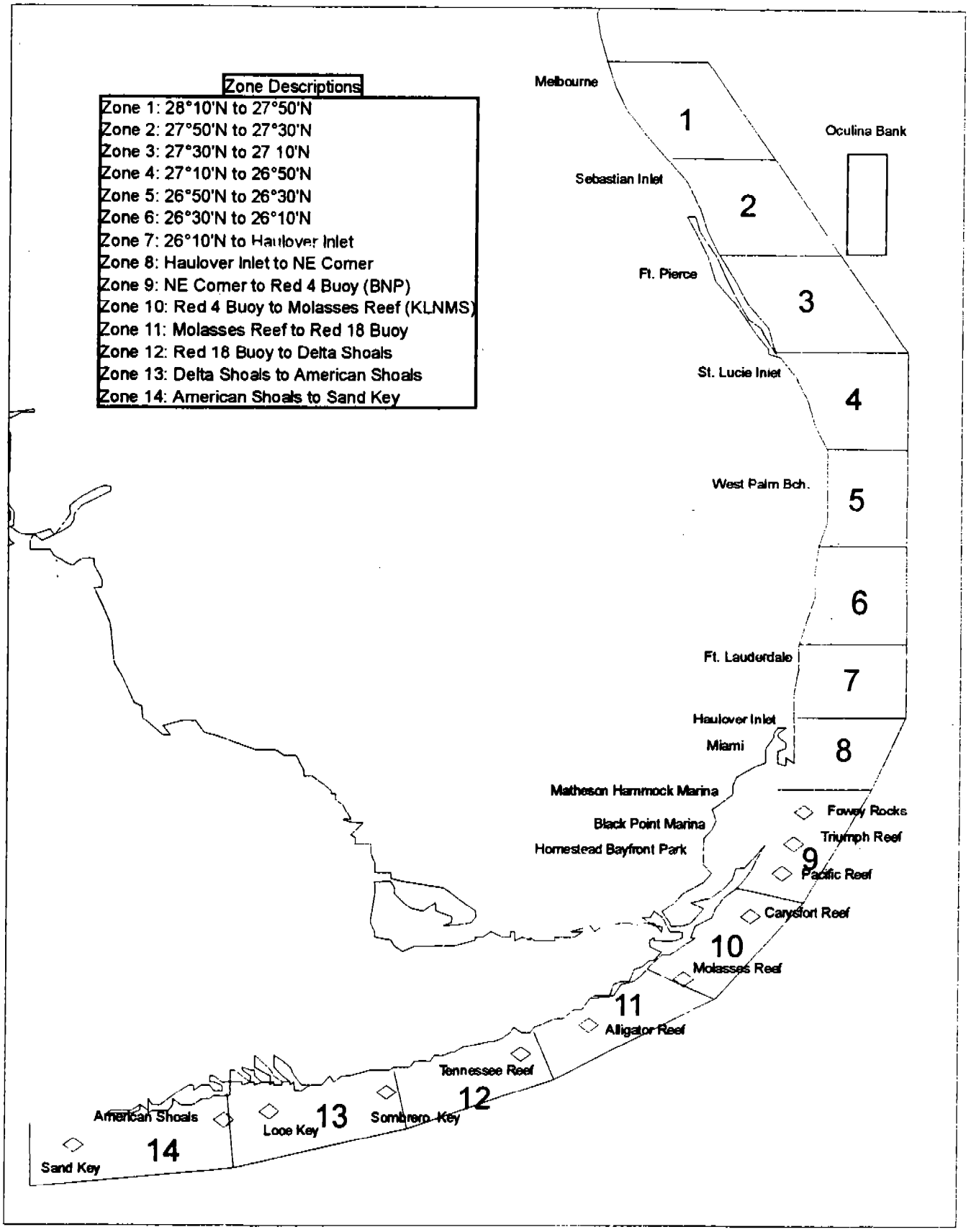
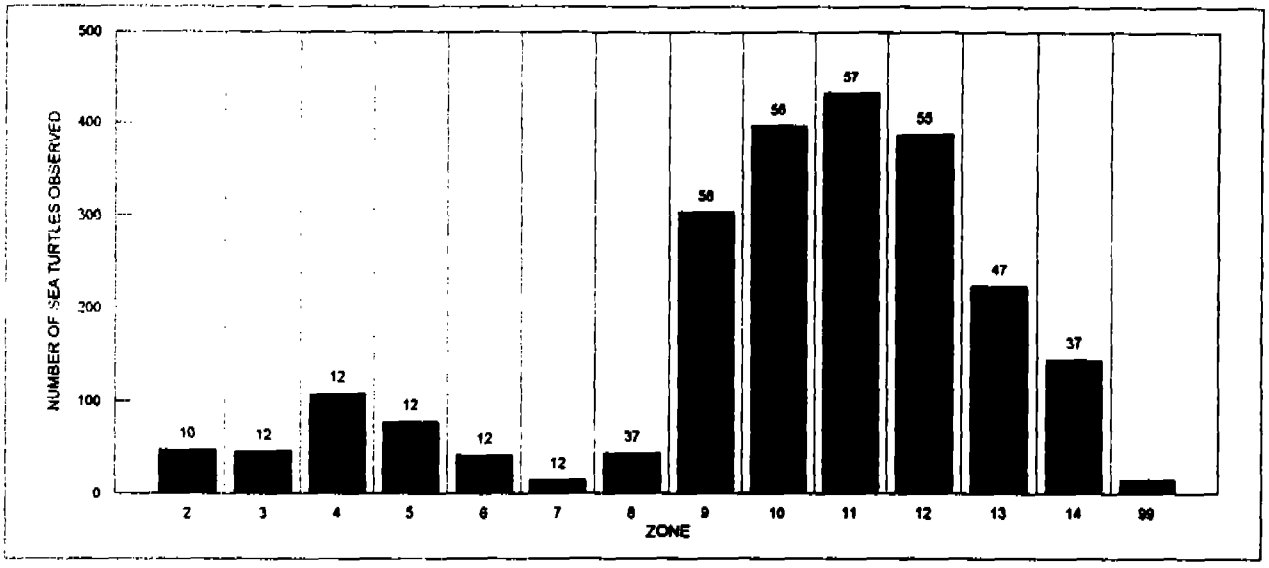


Figure 2. Total number of sea turtles observed, September 28, 1992 through March 21, 1996
N equals the number of surveys per zone.



Key to zones: 1 =28° 10' N to 27° 50' N, 2 = 27° 50' N to 27° 30' N, 3 = 27° 30' N to 27° 10' N, 4 = 27° 10'N to 26° 50' N,
5 = 26° 50' N to 26° 30' N, 6 = 26° 30' N to 26° 10' N, 7 = 26° 10' N to Haulover Inlet,
8 = Haulover Inlet to NE Corner, 9 = NE Corner to Red 4 buoy, 10 = Red 4 buoy to Molasses Reef,
11 = Molasses Reef to Red 18 buoy, 12 = Red 18 buoy to Delta Shoals, 13 = Delta Shoals to American Shoals,
14 = American Shoals to Sand Key, 99 = other areas.

Figure 3a. Number of sea turtles observed (bars) and sea turtles per nautical mile (lines) for south surveys (zones 8 - 14) only.

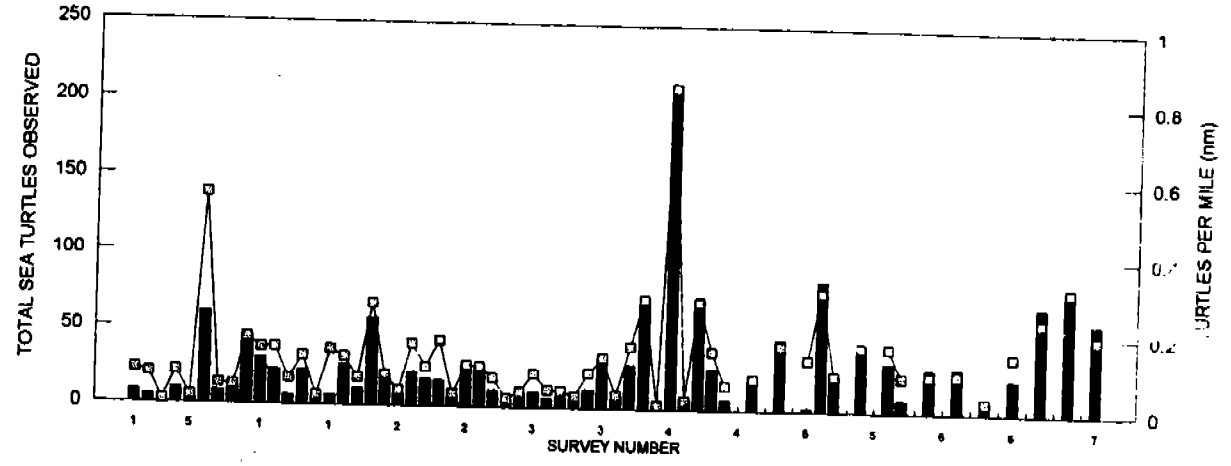


Figure 3b. Number of sea turtles seen by month (bars) and sea turtles per nautical mile (lines) for south surveys (zones 8 - 14) only.

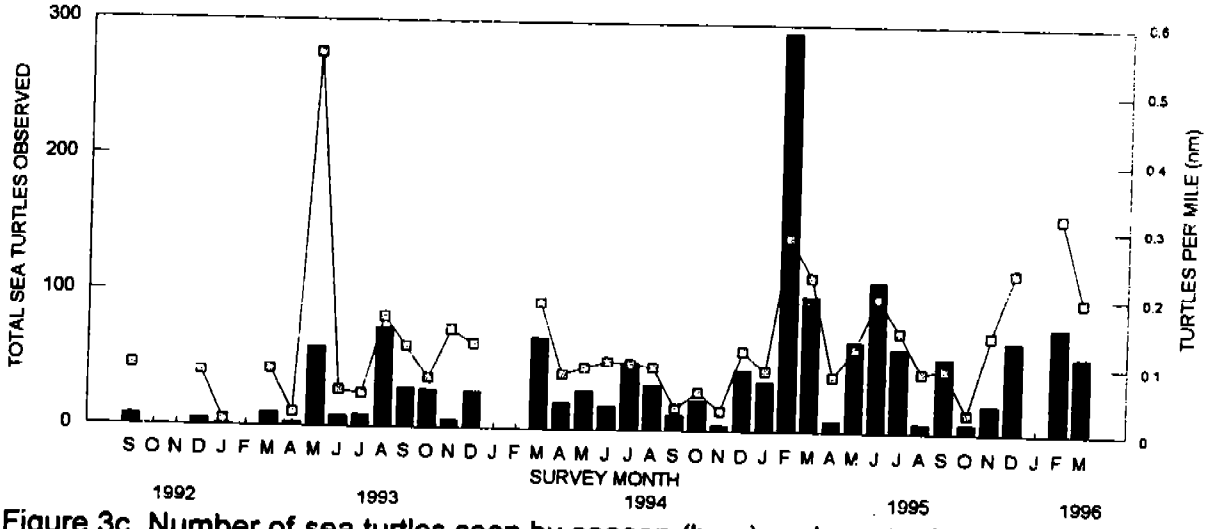


Figure 3c. Number of sea turtles seen by season (bars) and sea turtles per nautical mile (lines) for south surveys (zones 8 - 14) only.

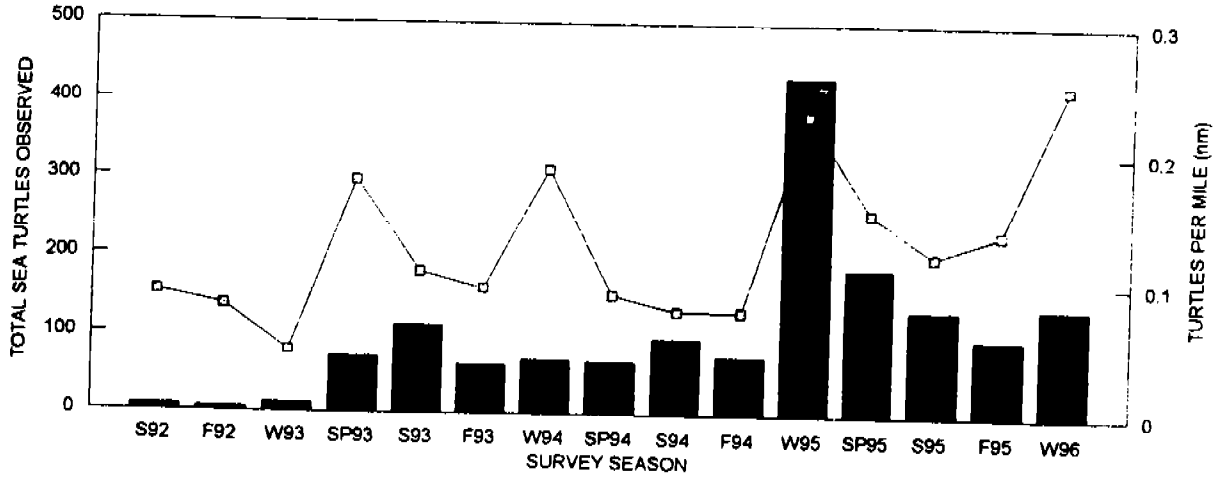


Figure 4. Total number of sea turtles observed (bars) and sea turtles per nautical mile (lines) by season for south surveys (zones 8 - 14 only).

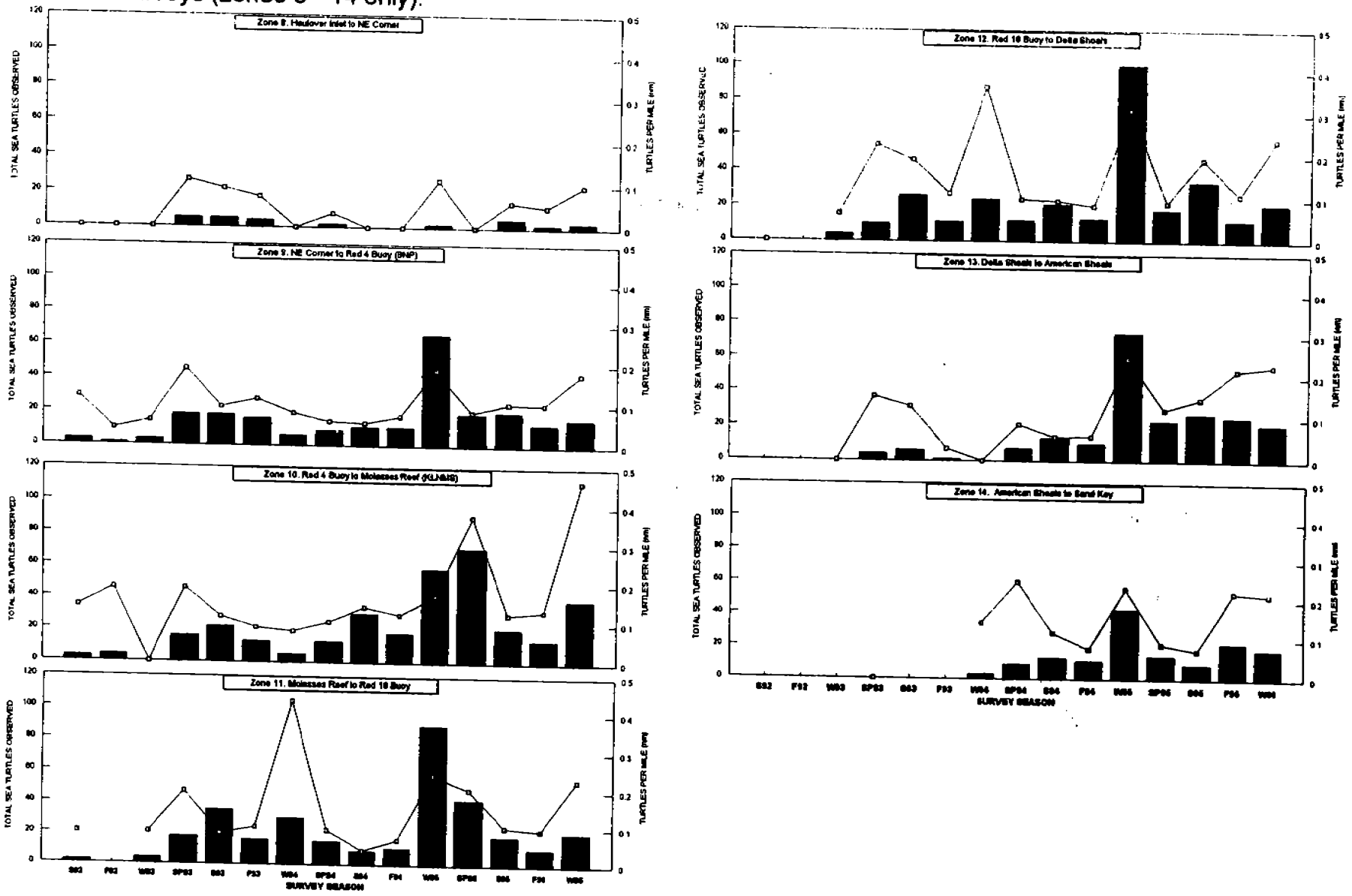


Figure 5a. Number of sea turtles observed (bars) and sea turtles per nautical mile (lines) for north surveys (zones 2 - 7) only.

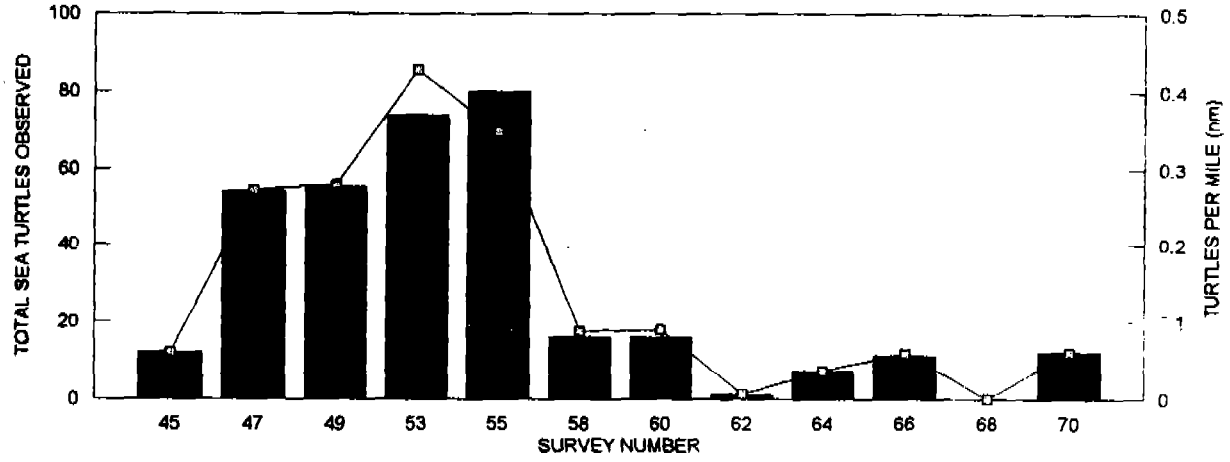


Figure 5b. Number of sea turtles seen by month (bars) and sea turtles per nautical mile (lines) for north surveys (zones 2 - 7) only. No surveys took place between September 1992 and March 1995.

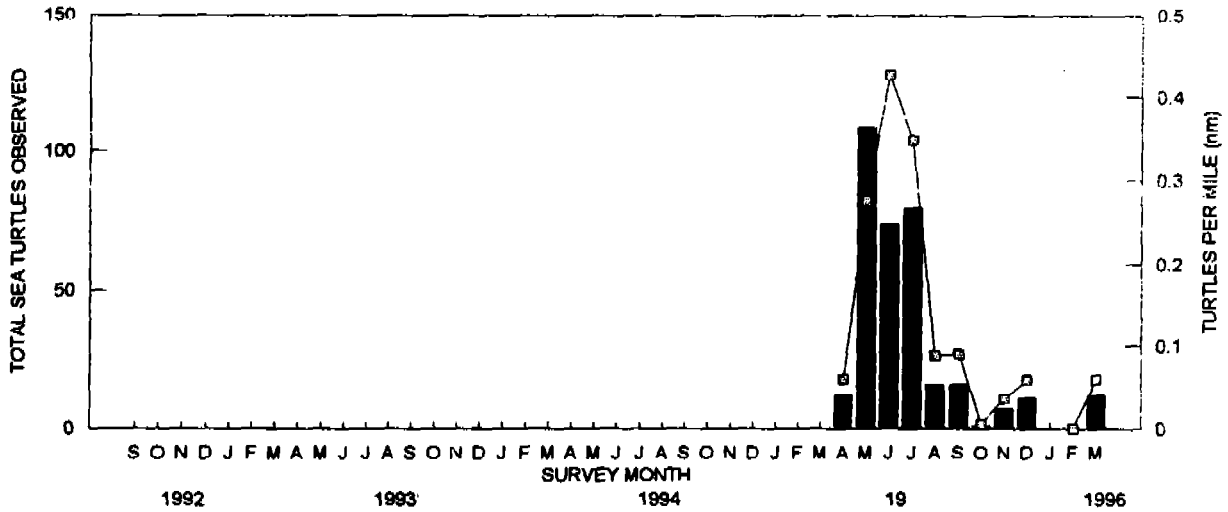


Figure 5c. Number of sea turtles seen by season (bars) and sea turtles per nautical mile (lines) for north surveys (zones 2 - 7) only. No surveys took place between summer 1992 and winter 1995.

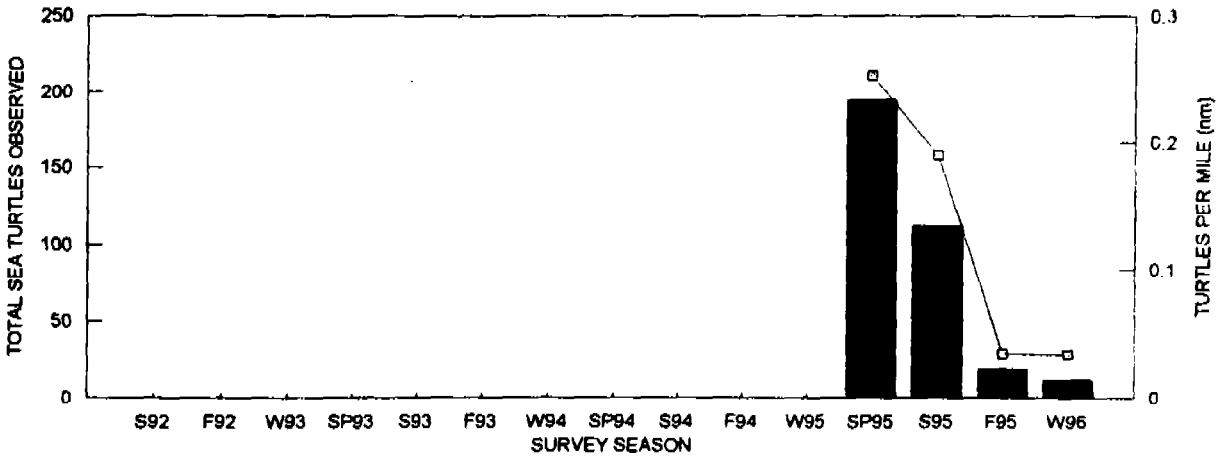


Figure 6. Total number of sea turtles observed (bars) and sea turtles per nautical mile (lines) by season for north surveys (zones 2 - 7 only). No surveys took place summer 1992 through winter 1995.

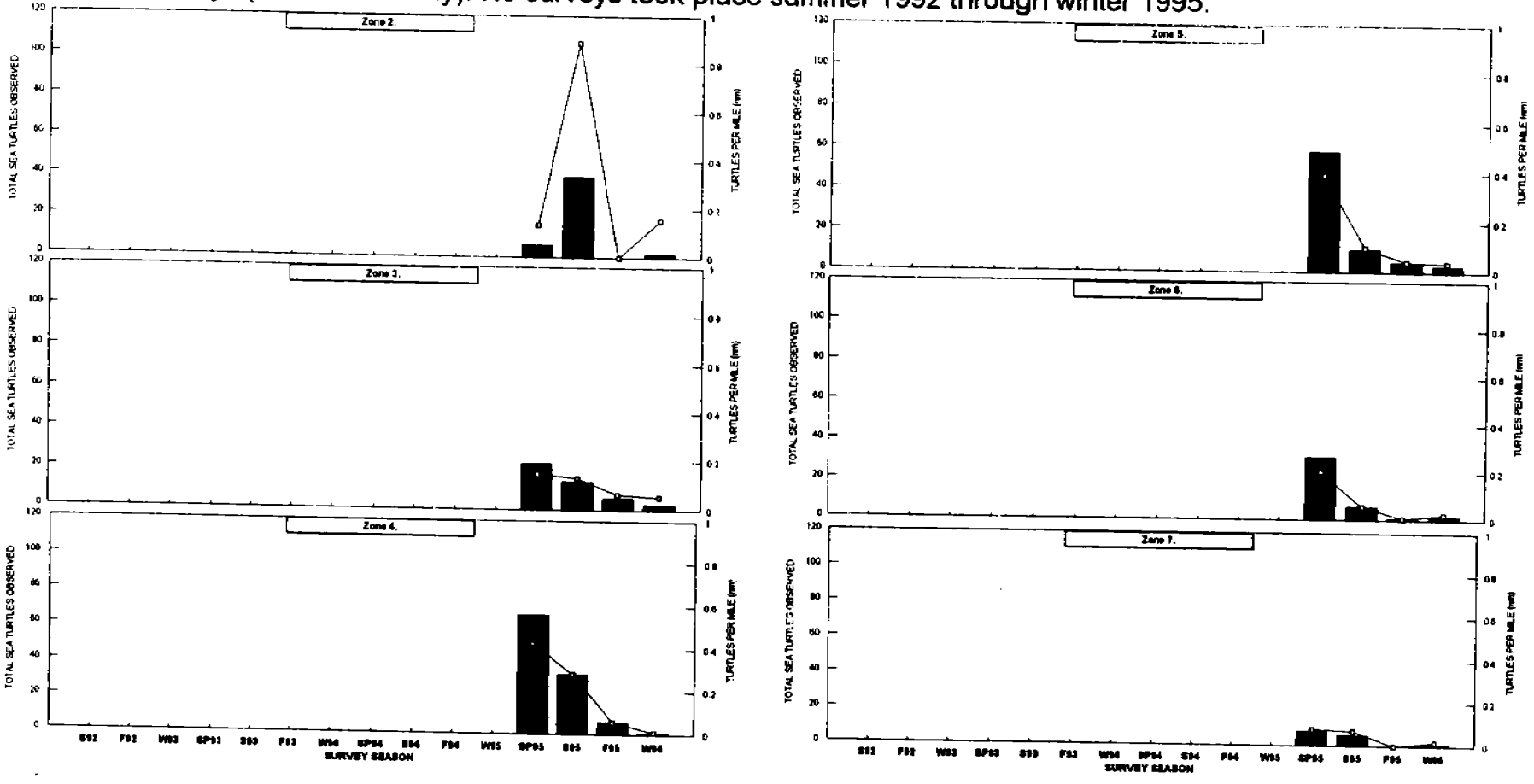


Figure 7a. Distribution of sea turtles observed in aerial surveys for the southern portion (zones 8 - 14) for 1993. The number of surveys is given in parenthesis. The number of animals are noted as x = 1, 0 = 2 to 4, and <> = >5 per sighting. See Table 1 and Figure 1 for zone information.

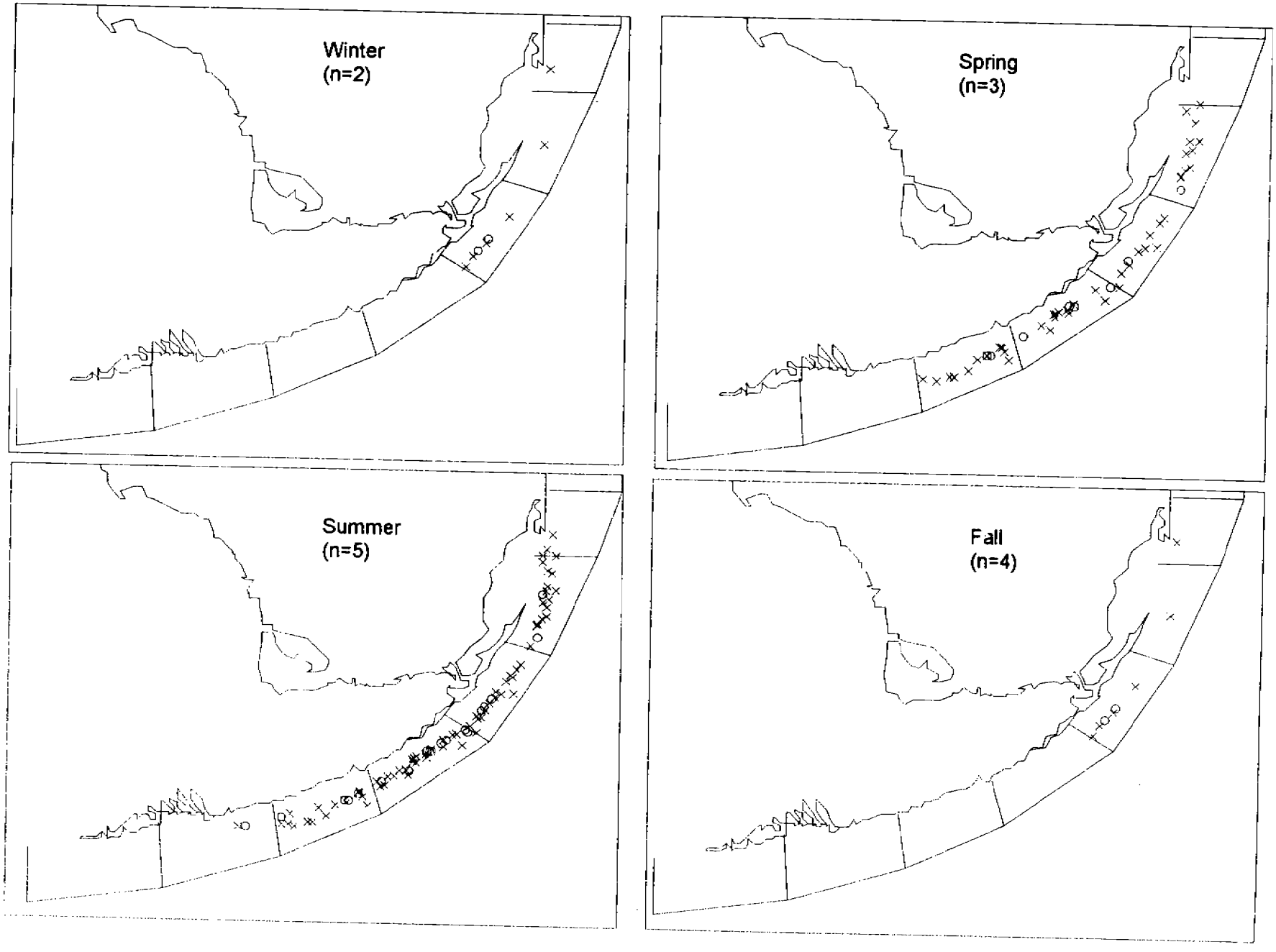


Figure7b. Distribution of sea turtles observed in aerial surveys for the southern portion (zones 8 - 14) for 1994. The number of surveys is given in parenthesis. The number of animals are noted as x = 1, o = 2 to 4, <> = >5 per sighting. See Table 1 and Figure 1 for zone information.

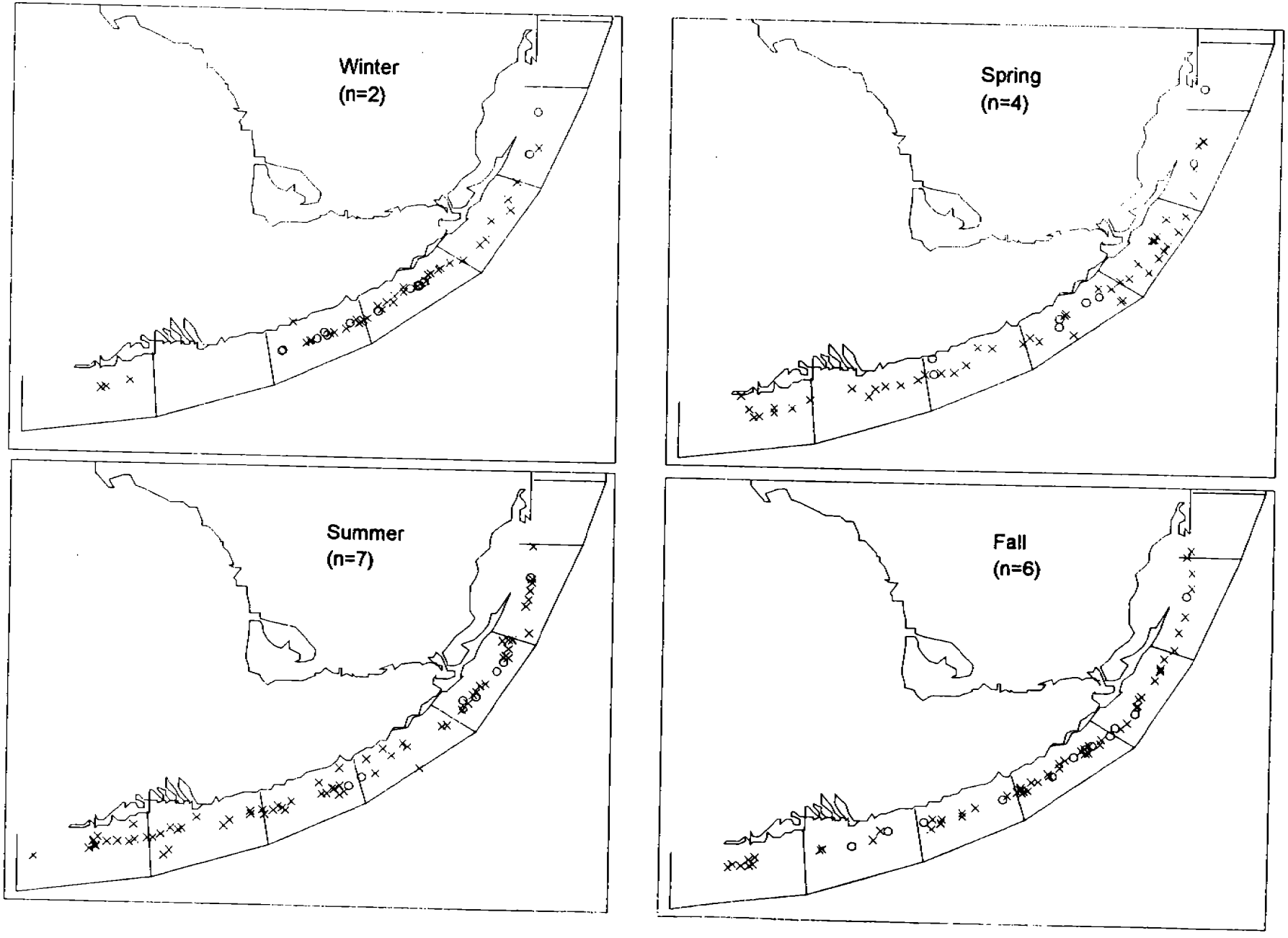
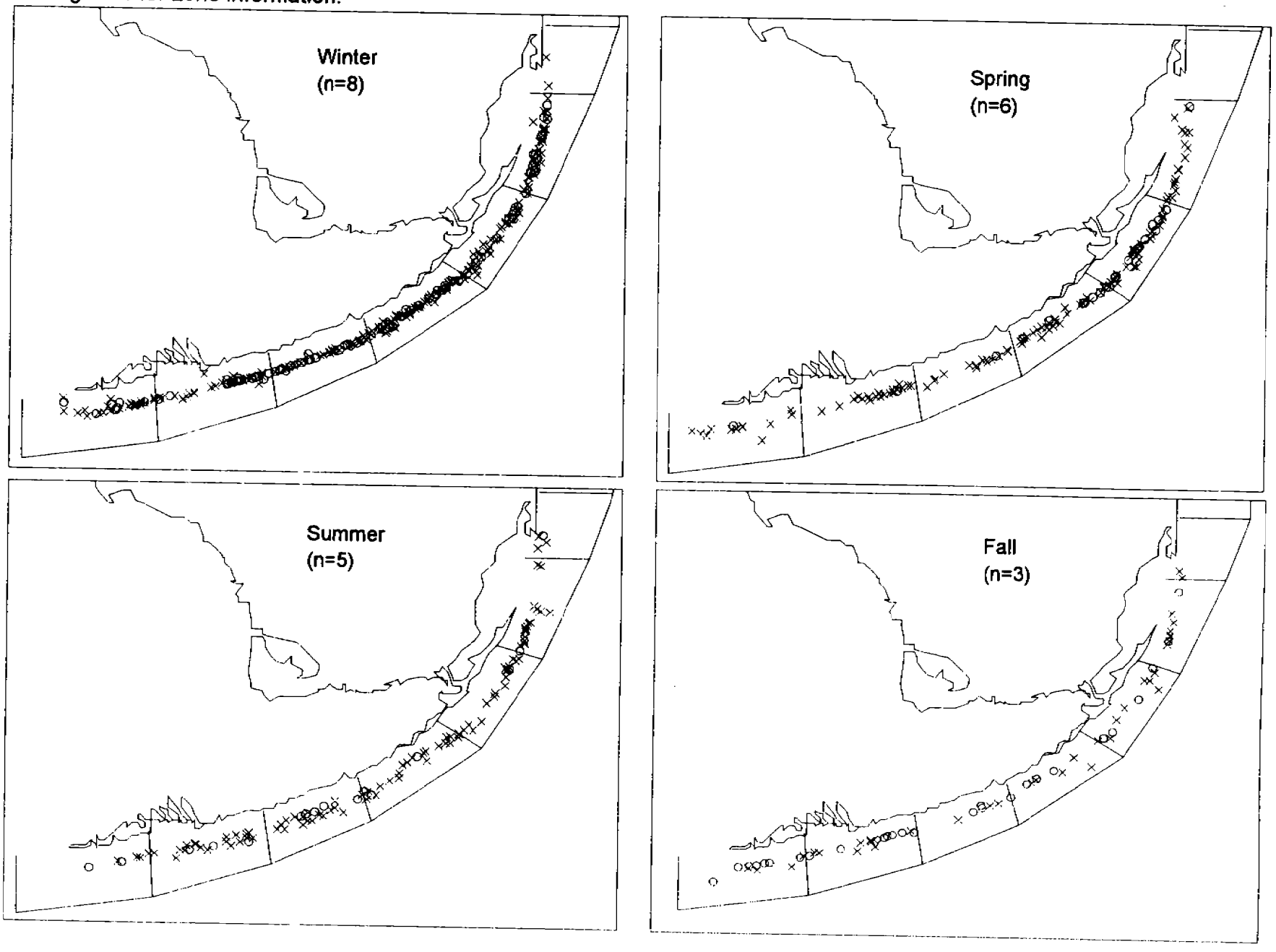


Figure7c. Distribution of sea turtles observed in aerial surveys for the southern portion (zones 8 - 14) for 1995. The number of surveys is given in parenthesis. The number of animals are noted as x = 1, o = 2 to 4, <> = >5 per sighting. See Table 1 and Figure 1 for zone information.



109d

Figure 8. Distribution of sea turtles observed in aerial surveys for the northern portion (zones 2 - 7) for Spring 1995 through Winter 1996. The number of surveys is given in parenthesis. The number of animals are noted as x = 1, o = 2 to 4, <> = >5 per sighting. See Table 1 and Figure 1 for zone information.

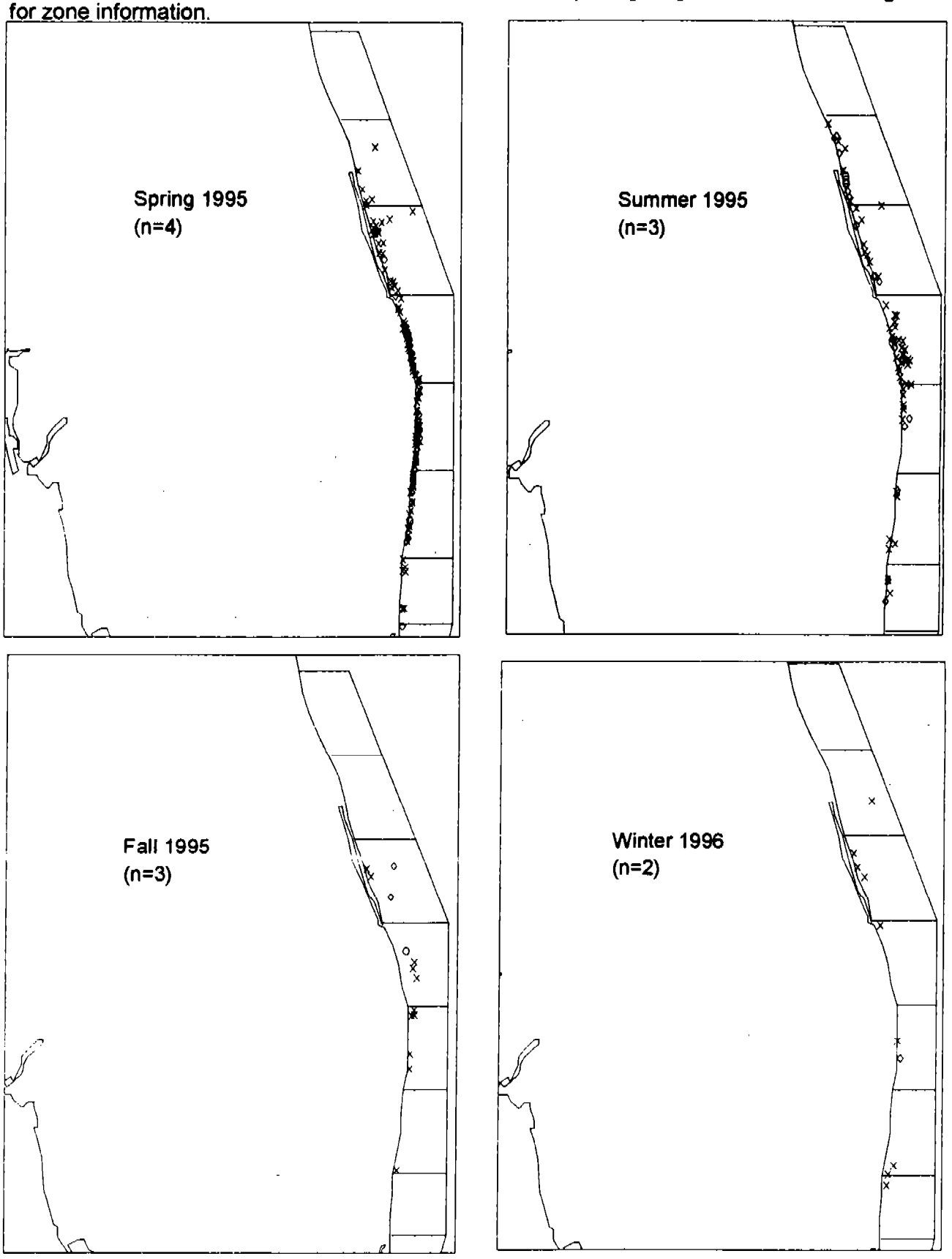


Figure 9. Distribution of identified species of sea turtles observed in all (n = 71) aerial surveys (zones 2-14) for September 1992 - March 1996. The number of animals are noted as x = 1, o = 2 to 4, <> = >5 per sighting. See Table 1 and Figure 1 for zone information.

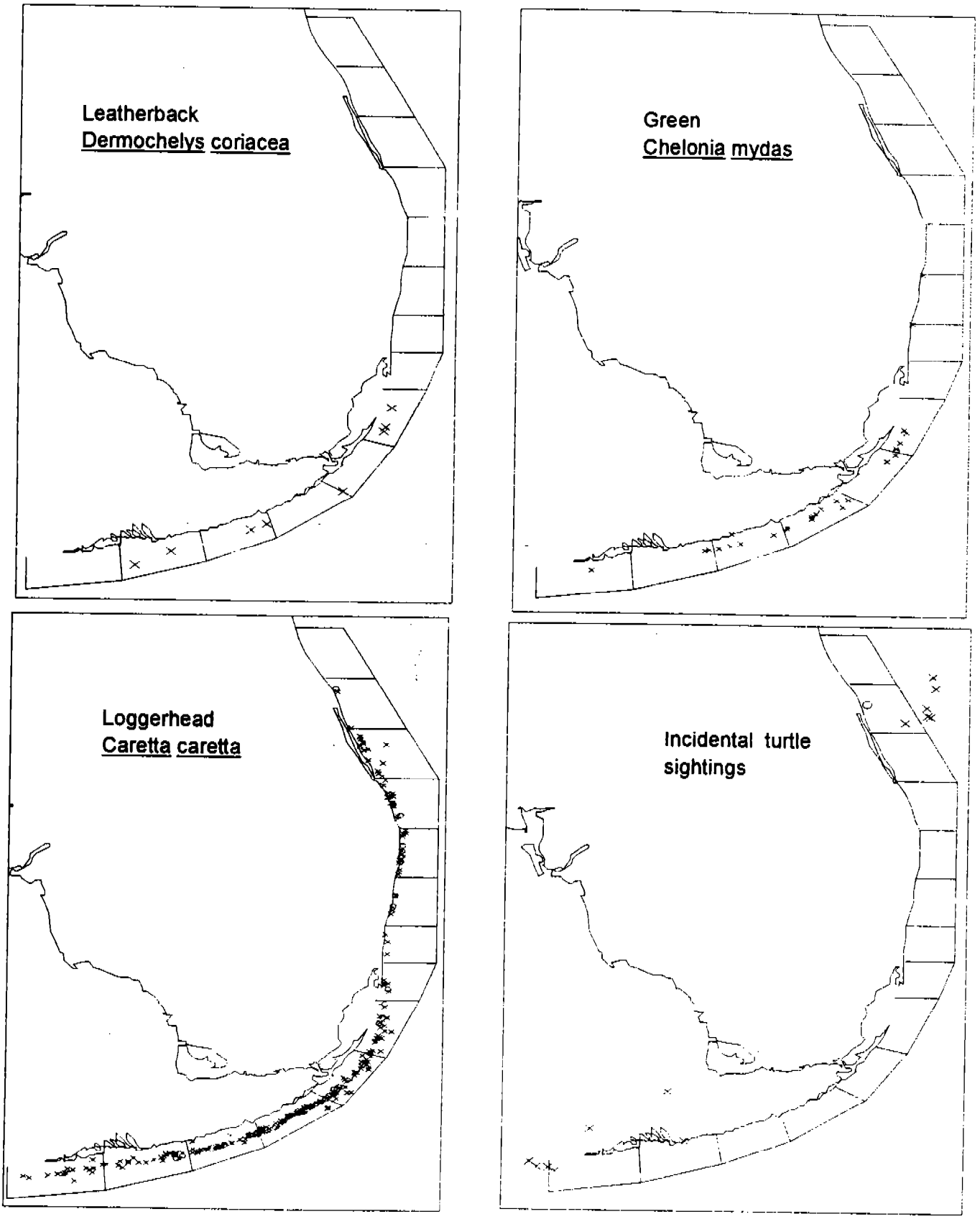


Figure 10. Distribution of bottlenose dolphin (Tursiops truncatus) observed during all aerial surveys for 1992-1996. The number of animals are noted as x = 1-9, []=10-19,and O>=20 per sighting. See Table 1 and Figure 1 for zone information.

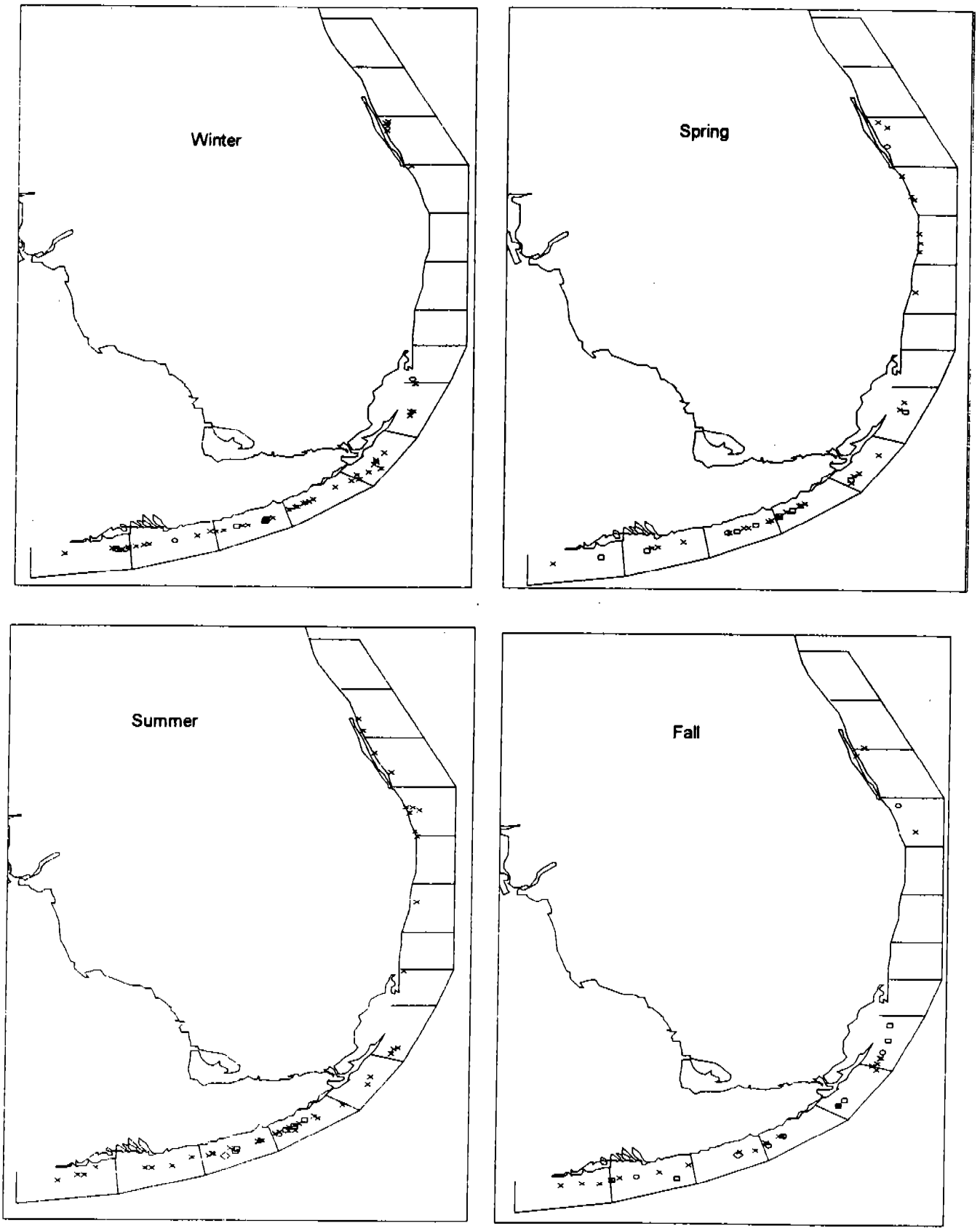


Figure 11. Comparison between the number per survey of fishing versus dive vessels by season in the south (zones 8 -14) survey area. The numbers of surveys flown flown per season from September 28, 1992 - March 21,1996 are given.

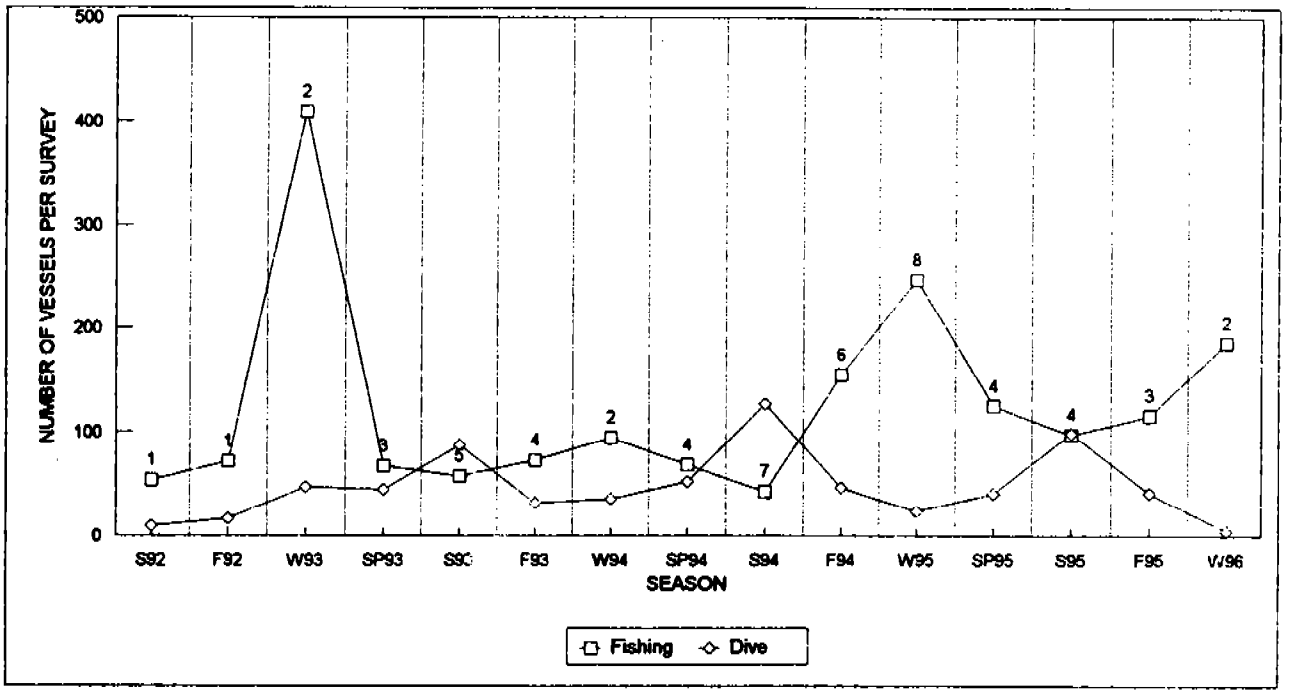


Figure 12. Comparison between the number per survey of fishing versus dive vessels by season in the north (zones 2 -7) survey area. The numbers of surveys flown per season are given. No surveys were flown between the summer of 1992 and and winter of 1995.

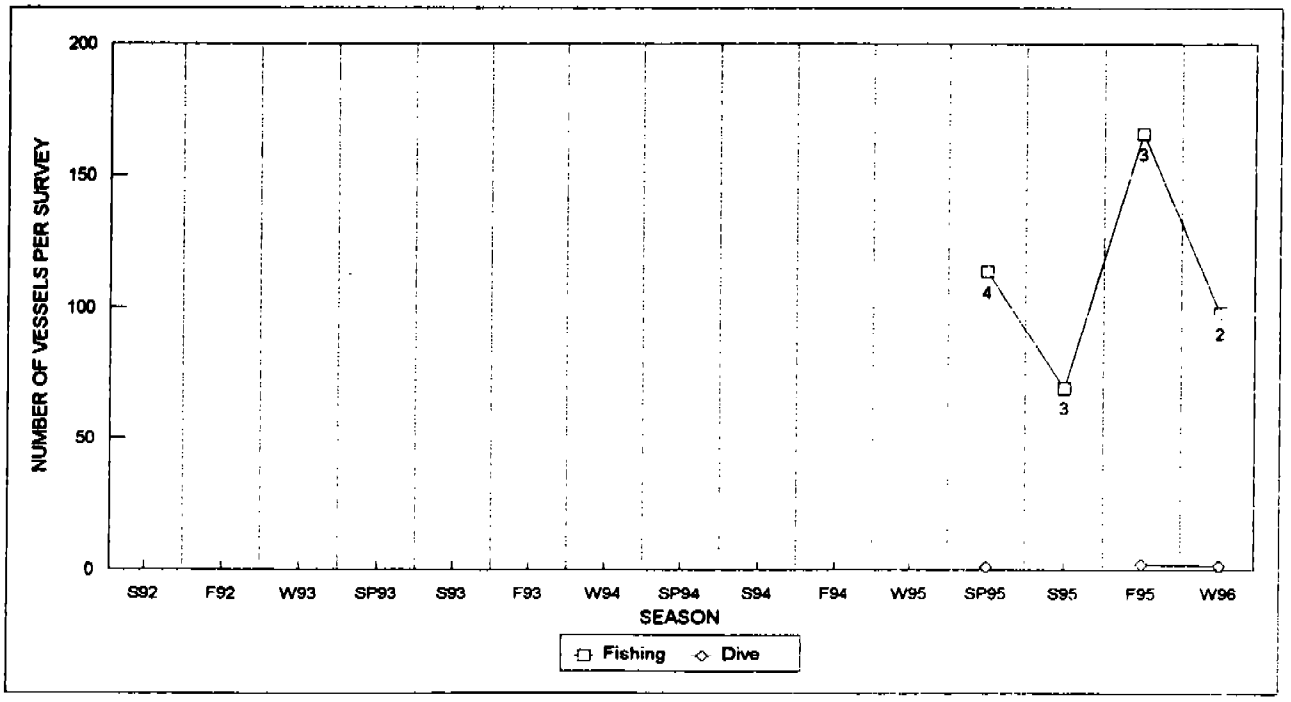


Figure 13. Different classifications of fishing vessels observed per survey for the total survey area (zones 2 - 14) from September 28, 1992 - March 21, 1996. The number of surveys flown per zone are noted.

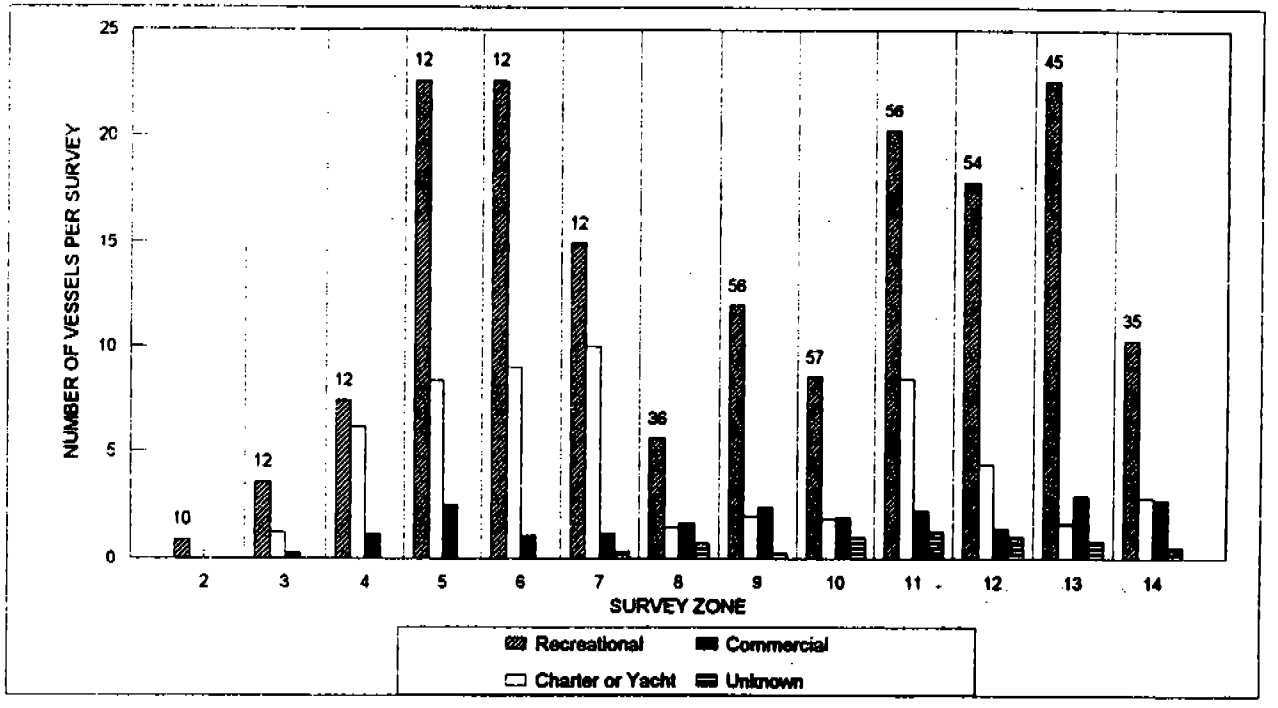


Figure 14. Different classifications of dive vessels observed per survey for the total survey area (zones 2 - 14) September 28, 1992 - March 21, 1996. The total number of surveys flown per zone are noted.

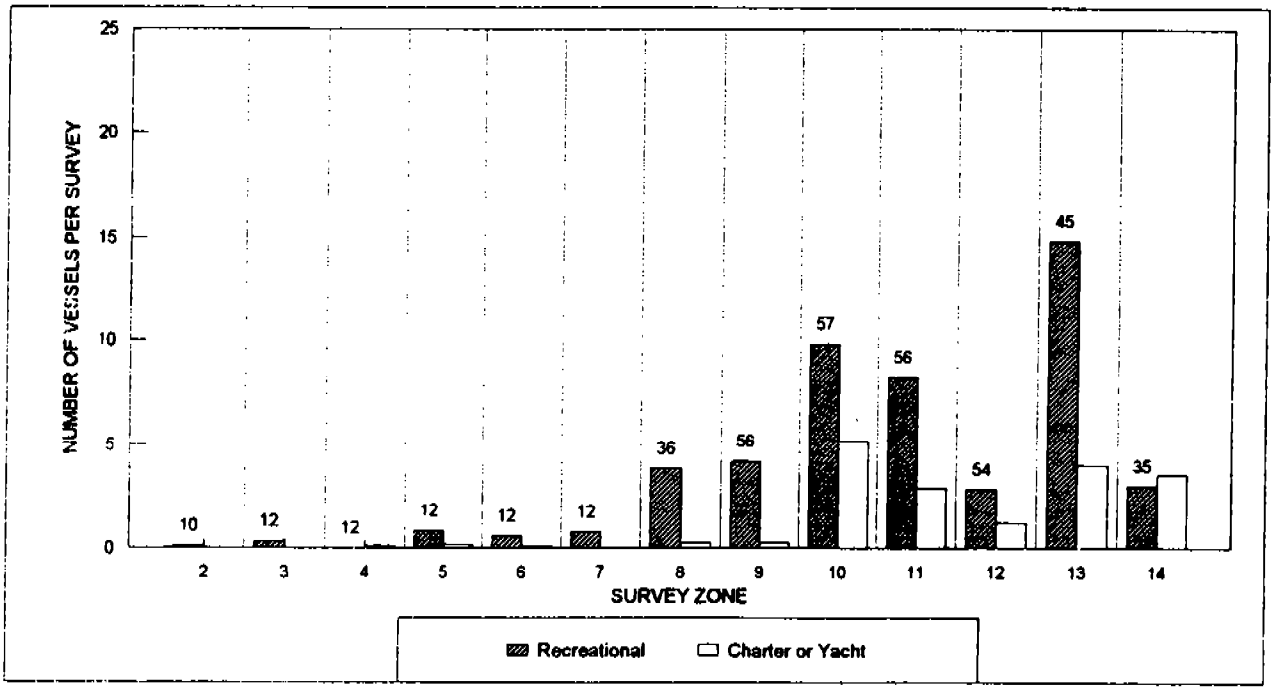


Figure 15. Number of fishing vessels for each survey and season observed in the southern zones (8 - 14 only).

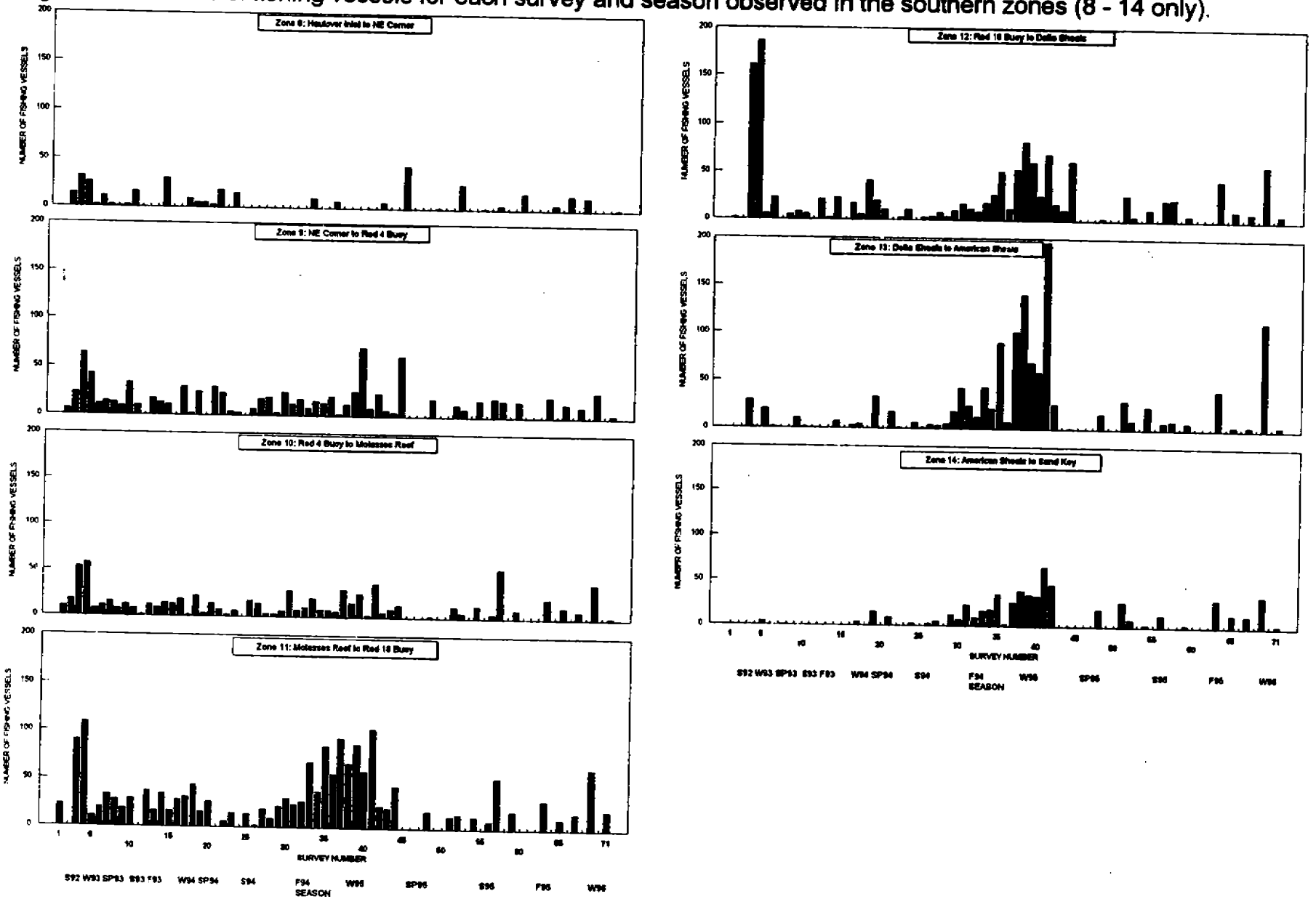


Figure 16. Number of fishing vessels for each survey and season observed in the northern zones (1 - 7 only). No surve between summer 1992 and winter 1995.

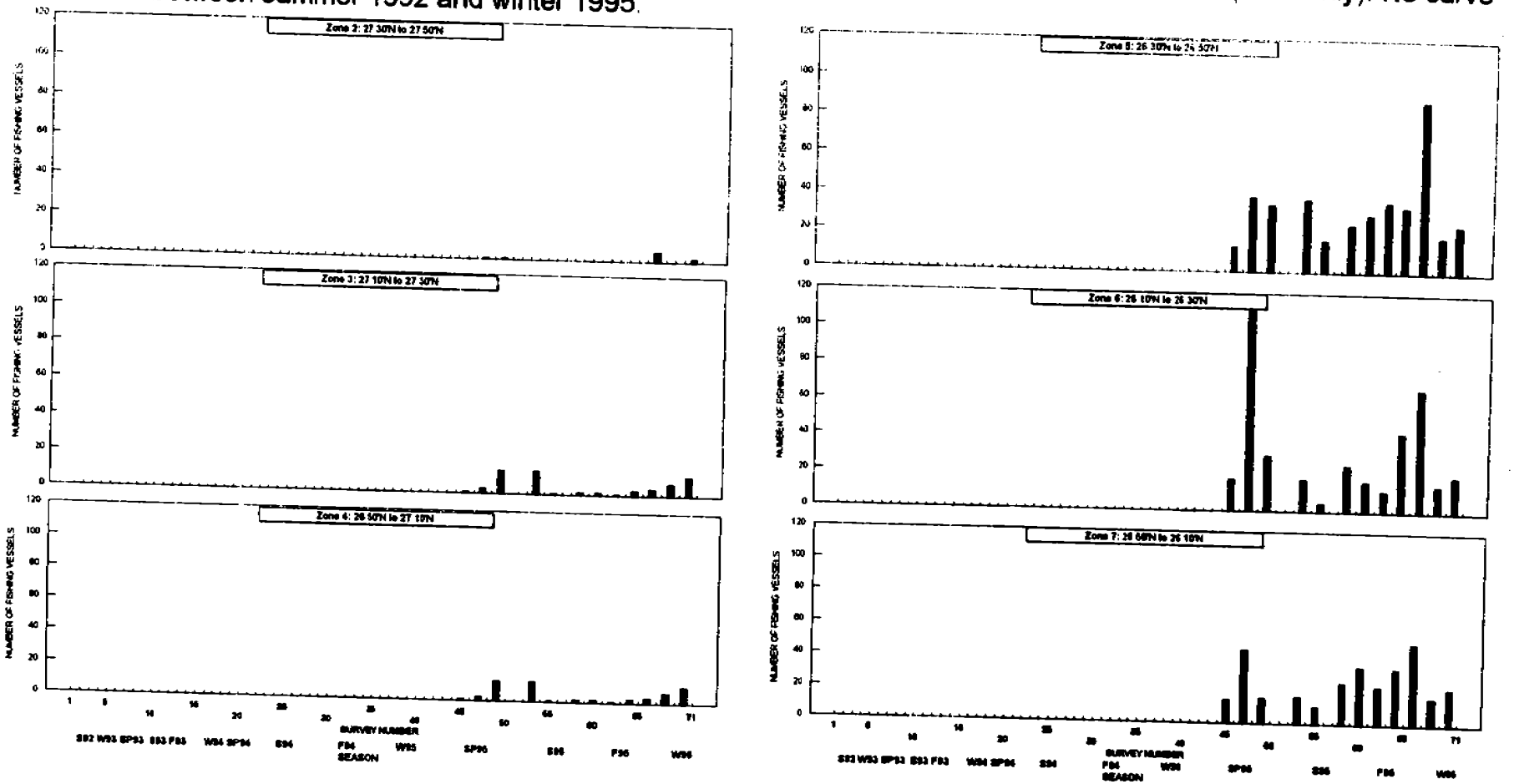


Figure 17. Number of dive vessels for each survey and season observed in the southern zones (8 - 14 only).

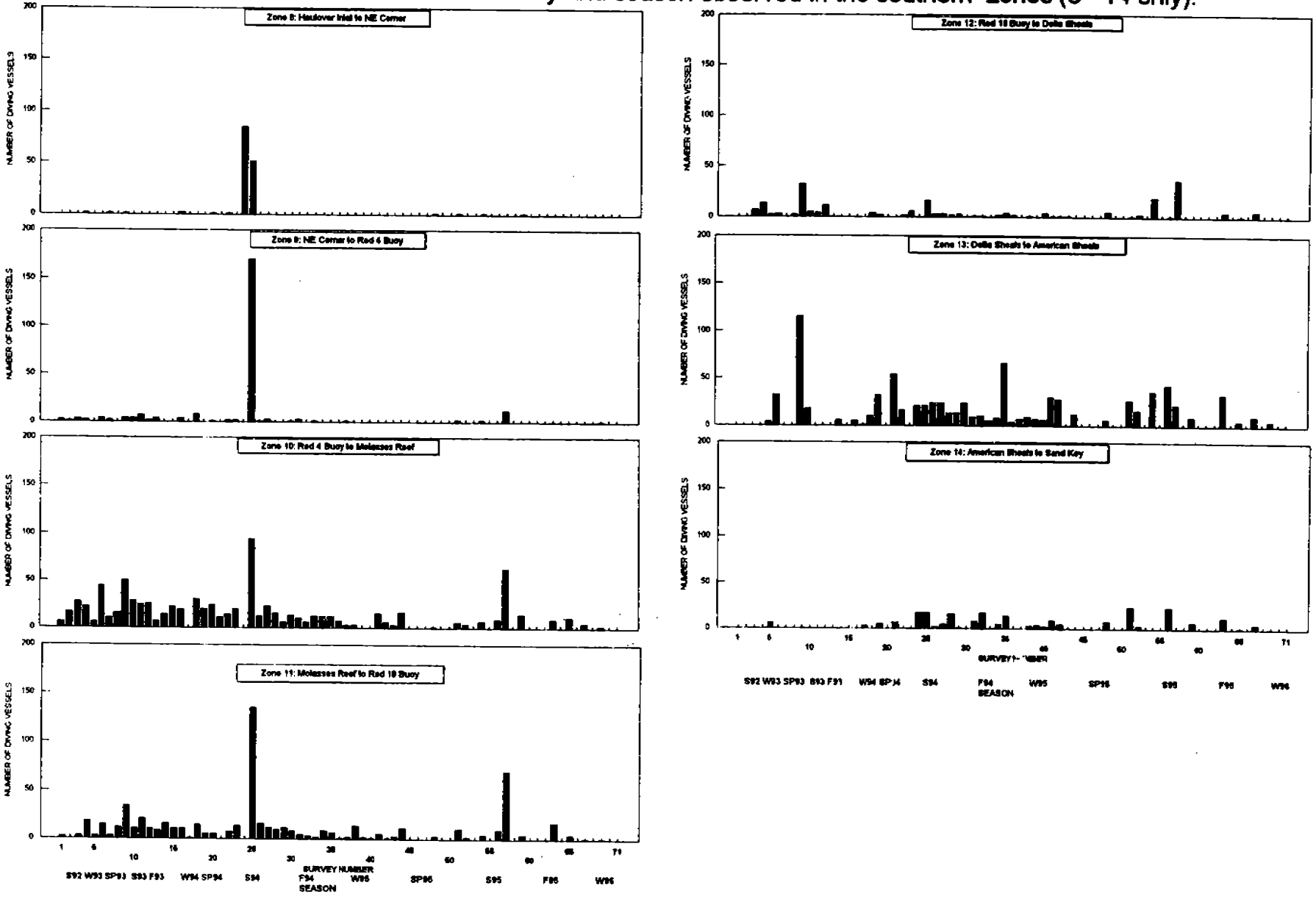


Figure 18. Number of dive vessels for each survey observed in the northern zones (1 - 7 only). No surveys took place between summer 1992 and winter 1995.

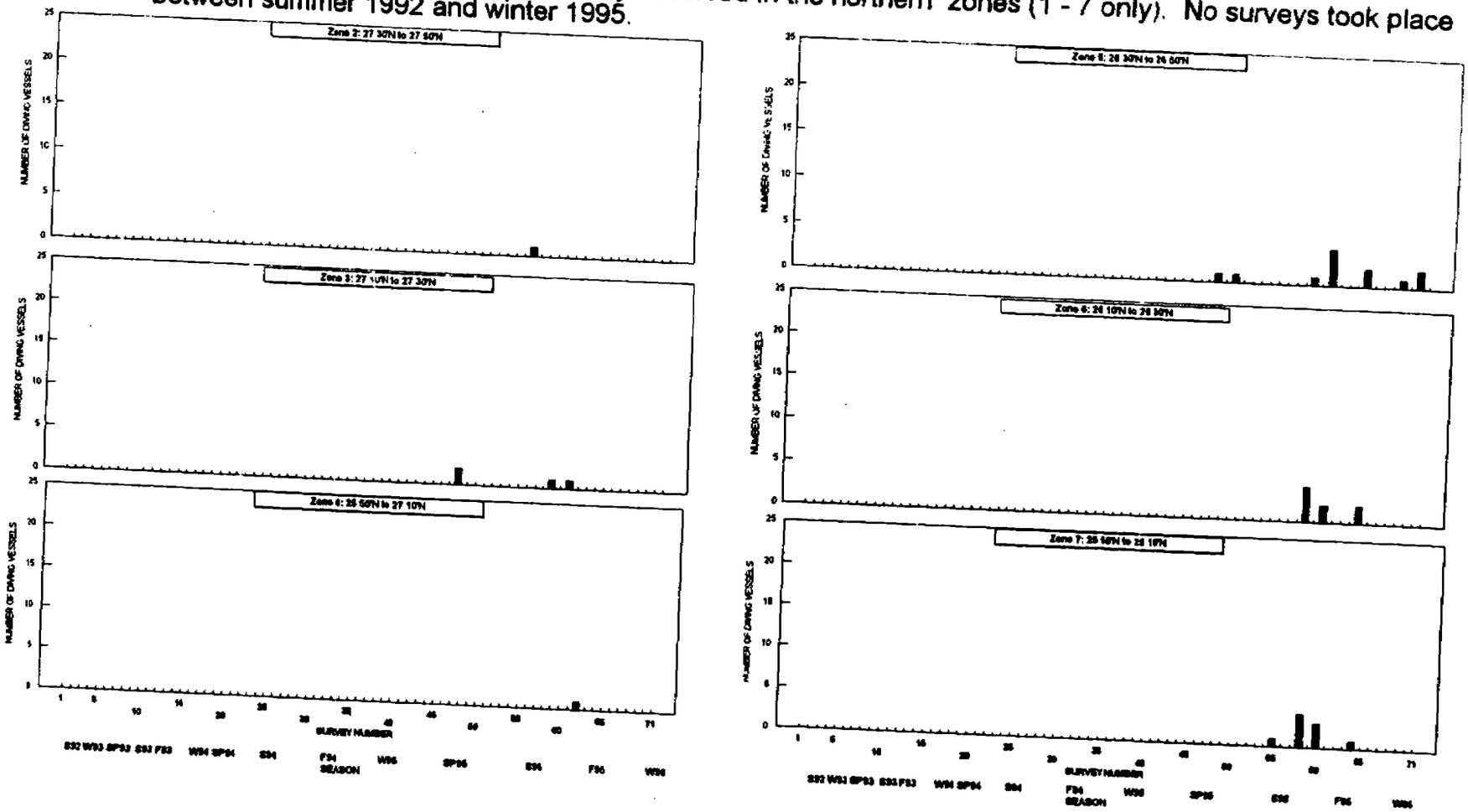
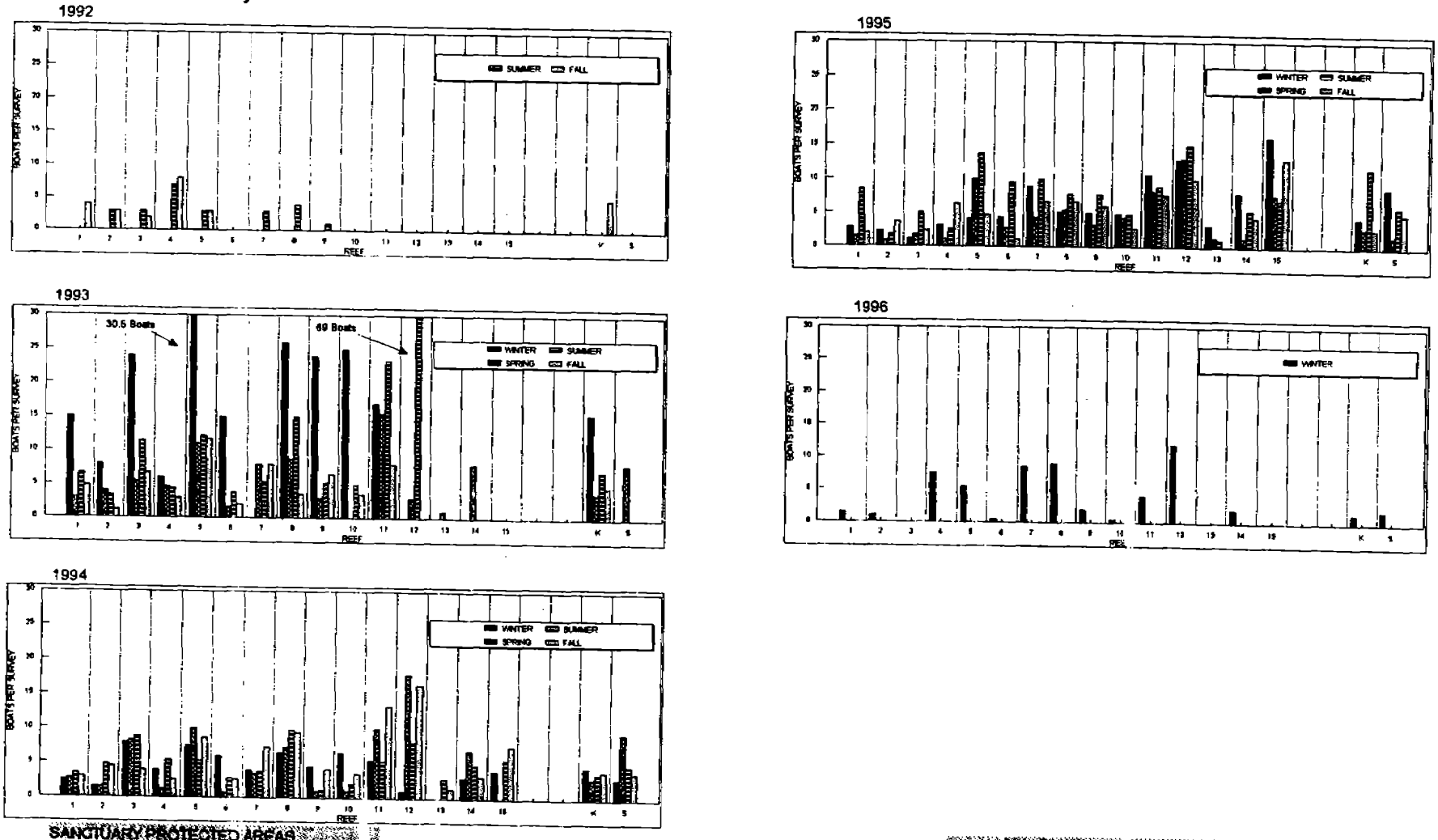


Figure 19. Total vessels (fish, dive, and cruise) per survey observed at Sanctuary Protected Areas (SPAS) and Ecological Reserves in the Florida Keys National Marine Sanctuary (FKNMS) by year and season of survey.



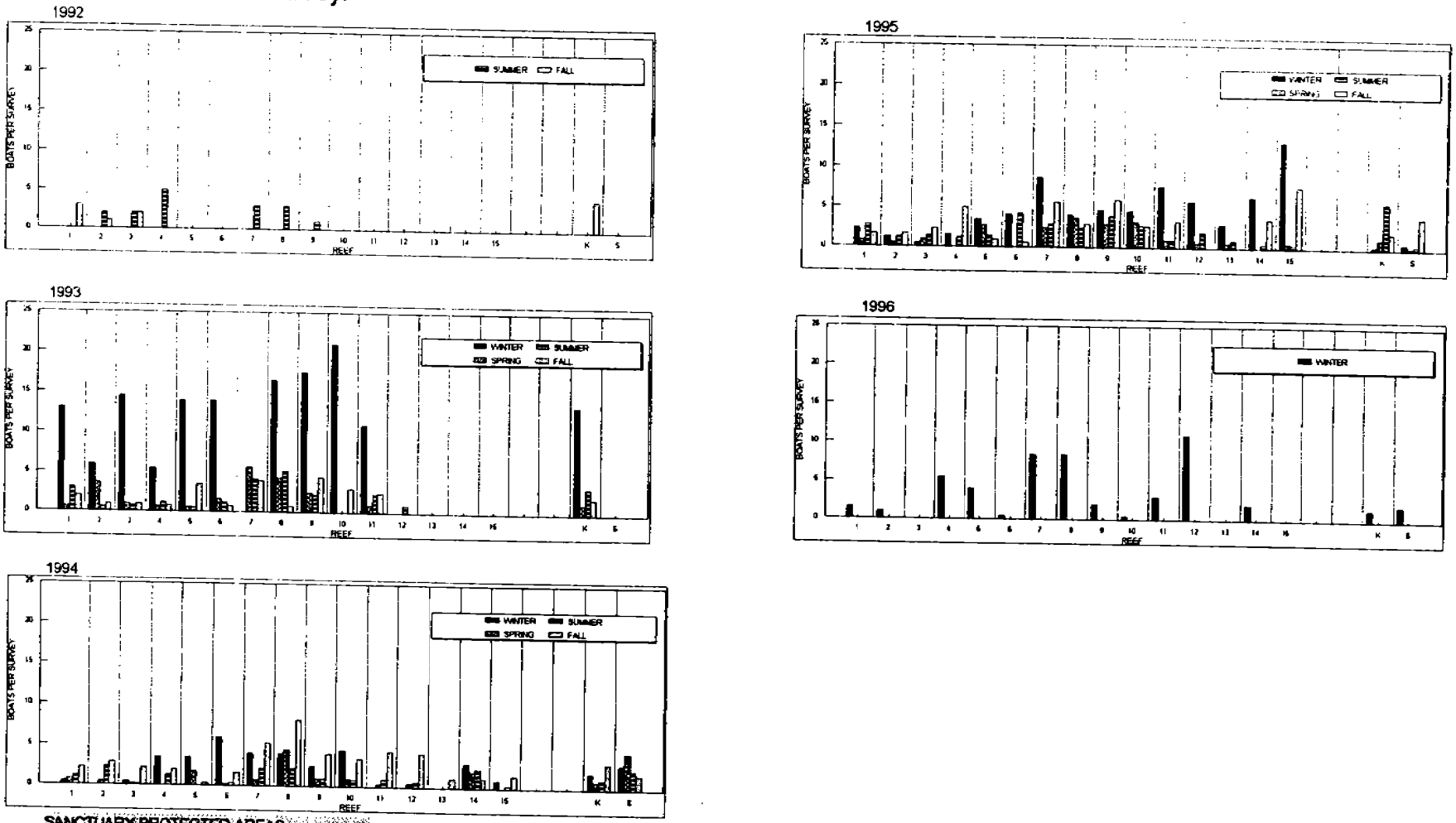
SANCTUARY PROTECTED AREAS

1 = Carysfort Reef
2 = The Elbow
3 = Grecian Dry Rocks & Key Largo Dry Rocks
4 = French Reef
5 = Molasses Reef
6 = Conch Reef
7 = Davis Reef
8 = Alligator Reef
9 = Tennessee Reef
10 = Coffins Patch
11 = Sombrero Reef
12 = Looe Key
13 = Pelican Shoals
14 = W. Sambos
15 = Sand Key

ECOLOGICAL RESERVES

K = Key Largo Reserve
S = Sambos Reserve

Figure 20. Total fishing vessels (recreational and commercial) per survey observed at Sanctuary Protected Areas (SPAS) and Ecological Reserves in the Florida Keys National Marine Sanctuary (FKNMS) by year and season of survey.



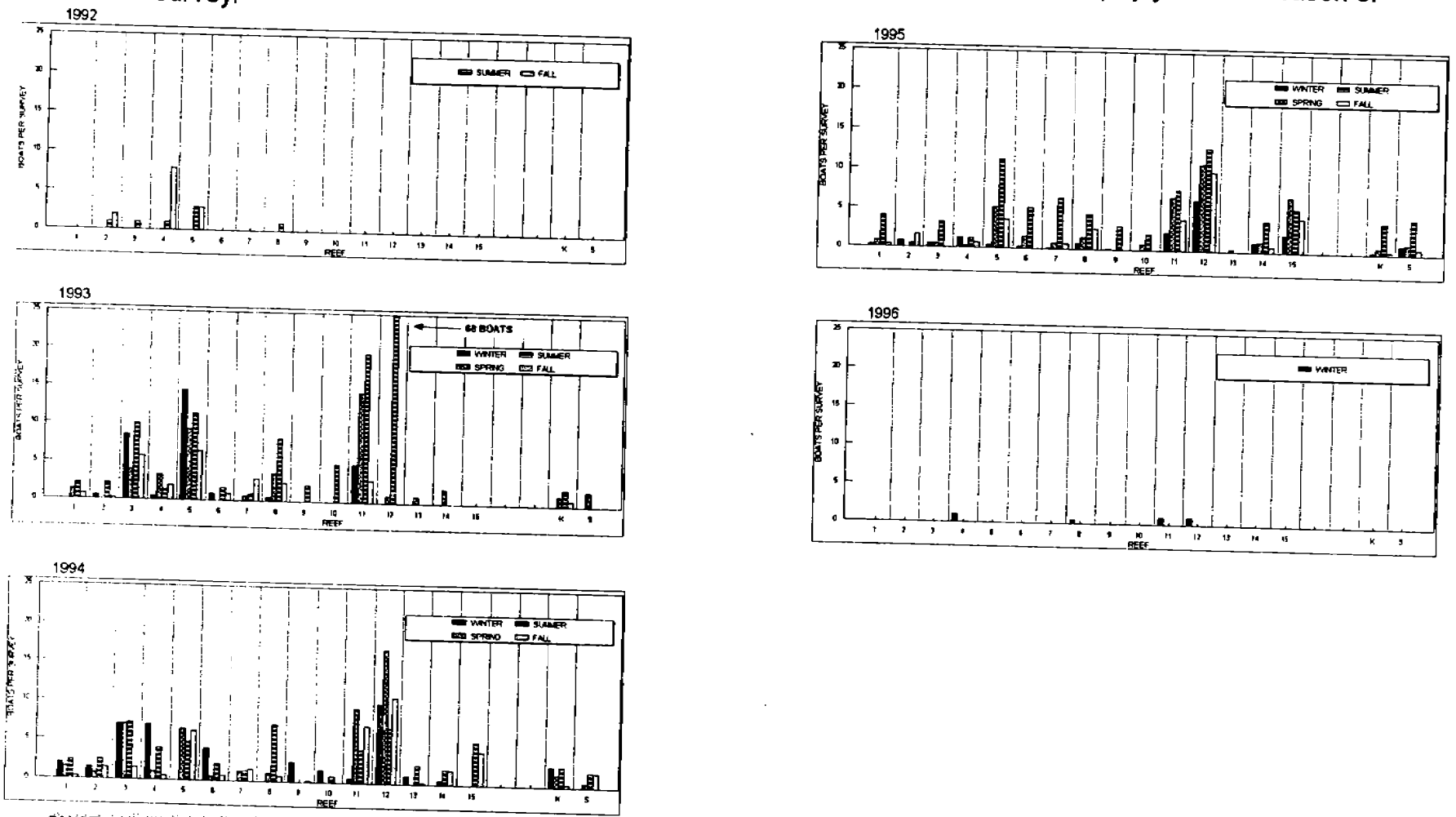
SANCTUARY PROTECTED AREAS

1 = Carysfort Reef
2 = The Elbow
3 = Grecian Dry Rocks & Key Largo Dry Rocks
4 = French Reef
5 = Molasses Reef
6 = Conch Reef
7 = Davis Reef
8 = Alligator Reef
9 = Tennessee Reef
10 = Coffins Patch
11 = Sombrero Reef
12 = Looe Key
13 = Pelican Shoals
14 = W. Sambos
15 = Sand Key

ECOLOGICAL RESERVES

K = Key Largo Reserve
S = Sambos Reserve

Figure 21. Total diving vessels (recreational and charter/yacht) per survey observed at Sanctuary Protected Areas (SPAS and Ecological Reserves in the Florida Keys National Marine Sanctuary (FKNMS) by year and season of survey.



SANCTUARY PROTECTED AREAS

1 = Carysfort Reef
2 = The Elbow
3 = Grecian Dry Rocks & Key Largo Dry Rocks
4 = French Reef
5 = Molasses Reef
6 = Conch Reef
7 = Davis Reef
8 = Alligator Reef
9 = Tennessee Reef
10 = Coffins Patch
11 = Sombrero Reef
12 = Looe Key
13 = Pelican Shoals
14 = W. Sambos
15 = Sand Key

ECOLOGICAL RESERVES

K = Key Largo Reserve
S = Sambos Reserve

Figure 22. Regression analysis for vessels observed during five aerial surveys in Biscayne National Park versus the number of trailers observed at Homestead Bayfront Park, Black Point and Matheson Hammock marinas. Counts of trailers were made from the air during the surveys.

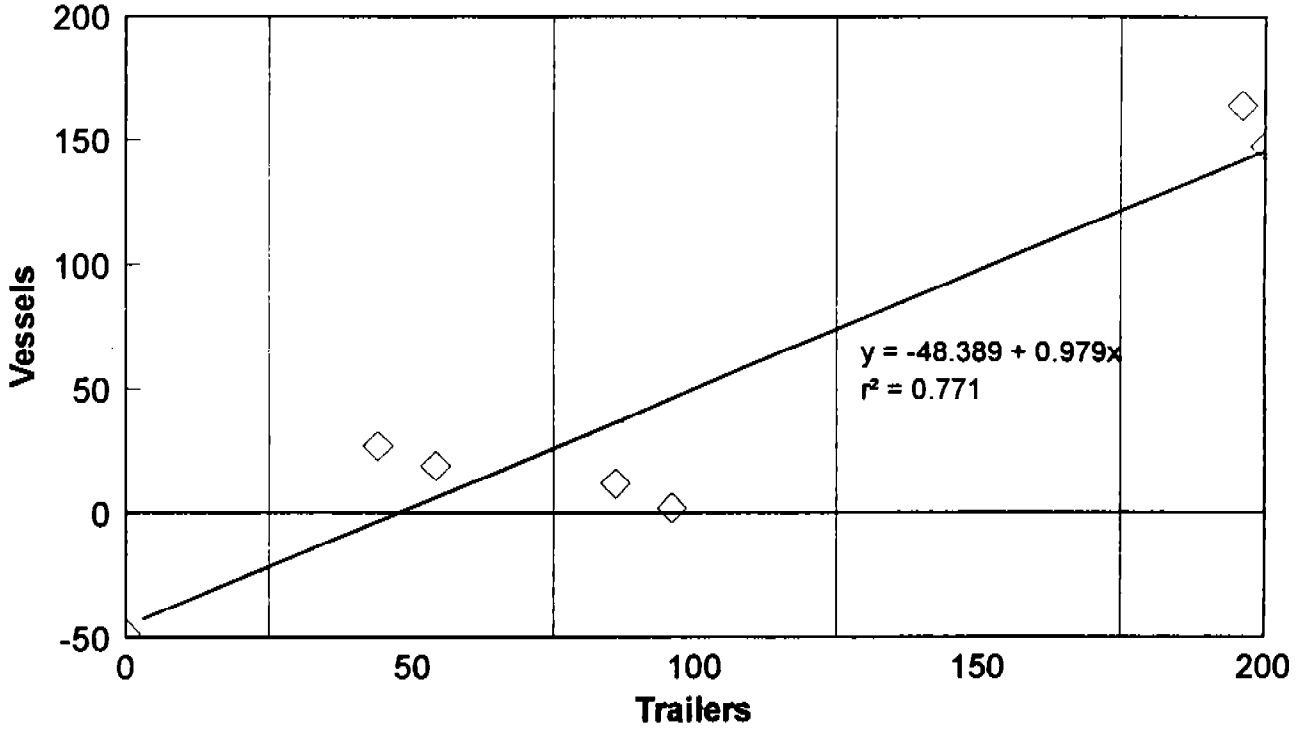
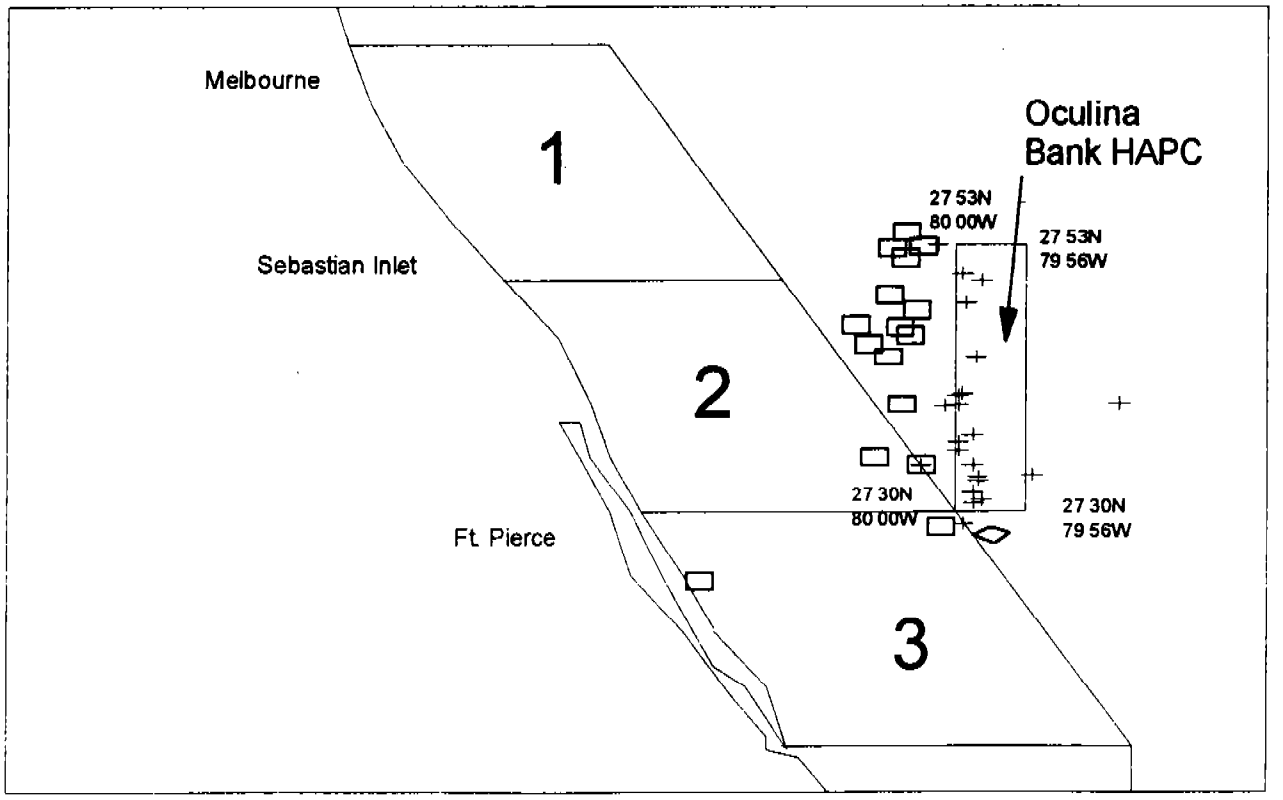


Figure 23. Vessels observed during 8 Aerial Surveys in the Oculina Bank Habitat Area of Particular Concern (HAPC), April 1995 - March 1996.



Fishing vessels (n=55) = +; Anchored shrimpers (n=17) = squares; Research vessel (n=1)= triangle.

APPENDIX 1: Data sheet used in Aerial surveys.

Samp # :		Weather :		Pilot :	Comments :
Date :		Sea Cond. :		Crewchief :	
Area :		Airspeed :		Other :	
Observer :		Altitude :			
Platform :					

						VESSELS							
						FISHING			DIVING		OTHER		
Time	Latitude	Longitude	Geog. Location	Dolphin Number	Turtle Number	Small Private	Comm or Lobster	Charter or Yacht	Small Private	Charter or Yacht	Unknown	Cruise	Total Vessels

CODES
Turtles: Green = G, Loggerhead = CC, Leatherback = L, Unknown = Unk.
Dolphin : Bottlenose = BD, Spinner = SP, Unknown = Unk.