



NOAA Technical Memorandum NMFS-SEFSC-390

# **Aerial Surveys For Sea Turtles, Marine Mammals, and Vessel Activity along the Southeast Florida Coast: 1992 - 1996.**

by  
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**July 1996**

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This report should be cited as follows:

McClellan, D. B. 1996. Aerial surveys for sea turtles, marine mammals, and vessel activity along the southeast Florida coast, 1992 - 1996. NOAA Technical Memorandum NMFS-SEFSC-390. 42 pp.

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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<sup>2</sup>. 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).

### ACKNOWLEDGMENTS

I thank the pilots and crewmen of the U. S. Coast Guard who flew and crewed the aircraft and assisted in observations during the surveys. Special thanks go to Lt. J. Bevelacqua and Lt. M. Marro for logistic assistance and scheduling of flights. J. Bohnsack, D. Harper, N. Thompson, and W. Witzell made contributions and comments. S. Bolden, C. Brown, J. Contillo, J. Javech, M. Judge, Lt.(jg) G. Konoval, A. Martinez, W. Teas, and A. Woodhead assisted in flights and data collection. N. Foy assisted in data entry.



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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		TURTLE SURVEY		GREEN TURTLES		LEATHERBACK TURTLES		LOGGERHEAD TURTLES		NO. OF UNKNOWN TURTLES		BOTTLENOSE DOLPHINS		NO. OF SPOTT'D DOLPHINS		NO. OF FISHING VESSELS	NO. OF DIVING VESSELS	NO. OF CRUISING VESSELS
			TIME (Min)	MILES (km)	TIME (Min)	MILES (km)	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED				
1	28-Sep-92	8-12	5	69	87	69	87	1	0	0	2	2	5	10	0	0	0	0	54	10	8
2	**18-Dec-92	8-10	2	50	61	50	61	0	0	0	0	0	5	0	0	0	0	0	72	17	4
3	29-Jan-93	8-13	4	67	114	67	114	0	0	0	0	1	0	0	0	0	0	423	40	14	
4	05-Mar-93	8-12	4	67	97	67	116	0	1	0	0	0	9	6	0	0	0	396	56	124	
5	**23-Apr-93	8-14	2	77	141	77	141	0	0	0	0	3	0	0	0	0	0	70	21	47	
6	17-May-93	8-13	4	66	109	66	109	1	0	2	2	57	26	0	0	0	0	71	98	37	
7	04-Jun-93	8-11	3	71	84	103	148	2	0	4	4	2	8	0	0	0	0	62	16	4	
8	01-Jul-93	8-12	3	45	51	88	183	0	0	0	1	8	7	0	0	0	0	51	29	13	
9	11-Aug-93	8-13	4	67	117	123	244	0	0	1	1	42	14	0	0	0	0	88	238	22	
10	27-Aug-93	8-13	4	61	109	118	208	0	1	0	0	30	1	25	54	66	0	0	0	0	
11	10-Sep-93	9-12	3	49	84	78	153	0	0	23	0	3	0	0	1	56	0	0	0	0	
12	24-Sep-93	9-12	3	55	86	55	86	0	0	0	0	6	10	0	0	0	0	87	49	71	
13	08-Oct-93	8-12	3	59	89	107	178	4	0	3	3	16	8	0	0	0	0	71	20	22	
14	22-Oct-93	9-13	4	39	101	78	202	0	0	0	0	5	0	0	0	0	0	89	36	81	
15	19-Nov-93	10-11	5	27	41	27	41	0	0	0	0	6	0	0	0	0	0	30	33	0	
16	10-Dec-93	8-13	3	61	104	128	213	0	0	12	15	10	10	0	0	0	0	104	41	11	
17	11-Mar-94	8-14	3	127	150	127	150	0	10	10	1	10	0	0	0	0	0	53	5	4	
18	25-Mar-94	8-13	4	78	109	151	213	2	0	19	36	32	0	0	0	0	0	136	67	14	
19	02-Apr-94	8-14	3	61	129	135	245	0	0	7	13	0	0	0	0	0	0	90	65	9	
20	06-May-94	8-12	4	58	89	77	178	1	0	3	3	4	0	0	0	0	0	99	32	23	
21	27-May-94	9-14	5	60	135	91	135	0	0	4	4	18	1	0	0	0	0	56	72	17	
22	24-Jun-94	8-13	4	65	118	105	175	1	0	7	10	9	0	0	0	0	0	31	43	21	
23	15-Jul-94	9-13	4	65	99	99	99	1	1	1	14	19	0	0	0	0	0	35	42	30	
24	27-Jul-94	8-14	3	74	150	74	150	0	0	2	4	0	0	0	0	0	0	9	123	6	
25	28-Jul-94	8-14	3	111	150	111	264	0	0	8	21	3	0	0	0	0	0	42	504	15	
26	19-Aug-94	9-14	4	60	119	123	238	0	0	5	20	16	0	0	0	0	0	44	58	13	
27	26-Aug-94	9-14	4	77	119	105	119	0	0	0	0	11	1	0	0	0	0	57	70	3	
28	16-Sep-94	9-14	3	55	130	116	130	0	0	0	0	3	8	0	0	0	0	24	56	10	
29	23-Sep-94	9-14	5	75	111	144	225	0	0	0	9	10	0	0	0	0	0	92	35	0	
30	14-Oct-94	9-14	4	88	112	88	112	1	0	0	9	116	0	0	0	0	0	136	47	29	
31	21-Oct-94	9-14	4	81	130	81	130	1	0	3	2	0	0	0	0	0	0	108	36	5	
32	27-Oct-94	8-14	4	90	140	90	155	0	0	3	4	8	0	0	0	0	0	85	38	21	
33	18-Nov-94	9-14	3	73	130	95	161	1	0	0	5	54	0	0	0	0	0	180	20	33	
34	09-Dec-94	9-14	3	87	130	87	130	3	0	4	5	0	0	0	0	0	0	124	36	43	
35	30-Dec-94	8-14	3	110	134	192	253	3	0	12	19	20	22	266	103	0	0	0	0	0	

\* = 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 (*)	NO. OF OBSERVERS	BOAT SURVEY		TURTLE SURVEY		NO. OF GREEN	NO. OF LEATHERBACK	NO. OF LOGGERHEAD	NO. OF UNKNOWN	NO. OF BOTTLENOSE	NO. OF SPOTTED	NO. OF FISHING	NO. OF DIVING	NO. OF CRUISING	
			TIME (Mn)	MILES (nm)	TIME (Mn)	MILES (nm)	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED	TURTLES SIGHTED	DOLPHINS SIGHTED	DOLPHINS SIGHTED	VESSELS	VESSELS	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	118	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	4	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	29	0	191	76	14
64	03-Nov-95	2 - 7	4	55	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	47	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.

ZONE	WINTER 1983			SPRING 1983			SUMMER 1983			FALL 1983			
	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	
1													
2													
3													
4													
5													
6													
7													
8	21	0.006	5	45	0.111	55	0.091	15	0.000	0	0.000	15	0.000
9	3	0.060	18	95	0.189	18	0.095	3	0.120	1	0.040	25	0.040
10	0	0.000	16	84	0.190	22	0.116	3	0.143	1	0.087	21	0.190
11	4	0.087	18	92	0.084	35	0.064	21	0.087	2	0.000		
12	4	0.063	10	44	0.227	26	0.191	2	0.000	0			
13	0	0.000	4	2	0.000	6	0.130	0					
14			0	12	0.000								
Total	11	0.048	71	398	0.178	112	0.108	8	0.092	5	0.092	61	0.092
ZONE	WINTER 1984			SPRING 1984			SUMMER 1984			FALL 1984			
	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	
1													
2													
3													
4													
5													
6													
7													
8	40	0.000	2	60	0.033	0	0.000	30	0.000	0	0.000	15	0.000
9	75	0.080	9	150	0.060	11	0.056	195	0.143	11	0.073	150	0.073
10	5	0.079	13	128	0.103	30	0.143	210	0.143	18	0.122	147	0.122
11	30	0.435	15	161	0.083	9	0.039	230	0.095	11	0.086	161	0.086
12	24	0.364	12	120	0.100	21	0.095	220	0.095	13	0.084	154	0.084
13	0	0.000	7	80	0.088	13	0.087	230	0.087	10	0.085	171	0.085
14	3	0.143	9	36	0.250	13	0.118	110	0.118	11	0.095	143	0.095
Total	68	0.187	67	733	0.091	97	0.079	1225	0.079	74	0.079	941	0.079
ZONE	WINTER 1985			SPRING 1985			SUMMER 1985			FALL 1985			
	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	
1													
2													
3													
4													
5													
6													
7													
8	18	0.111	6	45	0.133	40	0.889	45	0.889	0	0.000	11	0.000
9	350	0.189	19	156	0.147	14	0.132	106	0.132	7	0.056	94	0.056
10	356	0.173	71	157	0.427	34	0.283	120	0.283	6	0.058	120	0.058
11	89	0.368	42	150	0.393	11	0.100	110	0.100	5	0.042	120	0.042
12	100	0.511	16	156	0.205	7	0.058	120	0.058	1	0.008	120	0.008
13	74	0.247	23	105	0.076	6	0.067	90	0.067	0	0.000	90	0.000
14	43	0.234	14	47	0.000	5	0.000	83	0.000	2	0.000	40	0.000
Total	432	0.230	392	1979	0.193	247	0.146	1697	0.146	118	0.093	1264	0.093
ZONE	WINTER 1988			TOTAL (SEPTEMBER 1982 - MARCH 1988)									
	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE	TOTAL NUMBER OF TURTLES	ZONE	TOTAL NUMBER OF TURTLES	TURTLES PER NAUTICAL MILE							
1				1	48	0.421							
2	13	0.154		2	46	0.112							
3	56	0.054		3	108	0.228							
4	80	0.013		4	78	0.170							
5	80	0.038		5	42	0.088							
6	80	0.025		6	42	0.043							
7	1	0.017		7	15	0.049							
8	30	0.100		8	26	0.111							
9	16	0.178		9	230	0.205							
10	39	0.464		10	327	0.189							
11	21	0.228		11	322	0.138							
12	21	0.239		12	306	0.170							
13	21	0.228		13	211	0.141							
14	84	0.214		14	142	0.147							
Total	151	0.163		Total	1904	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.

ZONE	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
Total	6	0.026	34	398	0.085	35	1033	0.115	0	0.000	61	0.000

ZONE	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
Total	42	0.116	14	733	0.019	57	1225	0.047	0	0.000	18	0.028

ZONE	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
Total	134	0.071	217	1979	0.110	97	1687	0.081	0	0.000	198	0.210

ZONE	WINTER 1996			SPRING 1996			SUMMER 1996			FALL 1996		
	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
Total	105	0.114	929	1877	0.081	103	1264	0.081	4	0.044	103	0.081

ZONE	WINTER 1997			SPRING 1997			SUMMER 1997			FALL 1997		
	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE	TOTAL NUMBER OF DOLPHINS	DOLPHINS PER NAUTICAL MILE
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
Total	105	0.114	929	1877	0.081	103	1264	0.081	4	0.044	103	0.081

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.

ZONE	SUMMER 1992			FALL 1992		
	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						

ZONE	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
	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	106	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						

ZONE	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
	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	256	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	289	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

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

ZONE	WINTER 1996		
	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

ZONE	TOTAL (SEPT. 1992 - MARCH 1996)		
	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.

ZONE	SUMMER 1992			FALL 1992		
	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						

ZONE	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
	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	89	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						

ZONE	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
	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	28	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

ZONE	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
	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	95	23.3	3	58	19.3
12	8	331	41.4	4	96	24.0	4	83	15.8	3	63	21.0
13	7	598	85.4	4	58	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

ZONE	WINTER 1996		
	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	85	32.5
13	2	116	58.0
14	2	37	18.5

ZONE	TOTAL (SEPT. 1992 - MARCH 1996)		
	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	461	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	1281	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

ZONE	SUMMER 1992			FALL 1992		
	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						

ZONE	WINTER 1993			SPRING 1993			SUMMER 1993			FALL 1993		
	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						

ZONE	WINTER 1994			SPRING 1994			SUMMER 1994			FALL 1994		
	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	116	16.6	6	122	20.3
14	1	3	3.0	2	12	6.0	6	58	9.7	6	44	7.3

ZONE	WINTER 1995			SPRING 1995			SUMMER 1995			FALL 1995		
	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	58	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

ZONE	WINTER 1996		
	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

ZONE	TOTAL (SEPT. 1992 - MARCH 1996)		
	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).

WINTER TRIM	TOTAL NUMBER OF BOATS	BOATS PER SURVEY	SPRING TRIM		TOTAL NUMBER OF BOATS	BOATS PER SURVEY	SUMMER TRIM		TOTAL NUMBER OF BOATS	BOATS PER SURVEY	FALL TRIM		TOTAL NUMBER OF BOATS	BOATS PER SURVEY
			NUMBER OF SURVEYS	NUMBER OF BOATS			NUMBER OF SURVEYS	NUMBER OF BOATS			NUMBER OF SURVEYS	NUMBER OF BOATS		
1 CAYMAN POINT REEF	2	1.0	1	3	3	3.0	1	1	4	4.0	5	5.0	5	5.0
2 THE ELBOW REEF	2	1.0	1	3	3	3.0	1	1	4	4.0	5	5.0	5	5.0
3 FRENCH REEF	2	1.0	1	7	7	7.0	1	1	8	8.0	3	3.0	3	3.0
4 MOLLASSES REEF	2	1.0	1	0	0	0.0	1	1	2	2.0	3	3.0	3	3.0
5 CONCH REEF	2	1.0	1	0	0	0.0	1	1	2	2.0	1	1.0	2	2.0
6 DAVIS REEF	2	1.0	1	0	0	0.0	1	1	2	2.0	2	2.0	4	4.0
7 ALLIGATOR REEF	2	1.0	1	4	4	4.0	1	4	5	5.0	2	2.0	13	13.0
8 TENNESSEE REEF	2	1.0	1	0	0	0.0	1	0	1	1.0	2	2.0	14	14.0
9 COFFINS PATCH REEF	2	1.0	1	0	0	0.0	1	0	1	1.0	13	13.0	13	13.0
10 SOMMERO REEF	2	1.0	1	0	0	0.0	1	0	1	1.0	9	9.0	20	20.0
11 LOOSE KEY REEF	2	1.0	1	0	0	0.0	1	0	1	1.0	16	16.0	16	16.0
12 PELICAN SHOALS	2	1.0	1	0	0	0.0	1	0	1	1.0	3	3.0	3	3.0
13 SAND KEY REEF	2	1.0	1	0	0	0.0	1	0	1	1.0	2	2.0	2	2.0
14 W. SAMBOS	2	2.0	2	14	14	7.0	3	14	23	23.0	0	0.0	38	38.0
15 SAND KEY REEF	2	1.0	1	0	0	0.0	1	0	1	1.0	0	0.0	0	0.0
16 SAND KEY REEF	2	1.0	1	0	0	0.0	1	0	1	1.0	16	16.0	16	16.0
ECOLOGICAL RESERVE														
1 KEY LARDO	2	1.0	1	0	0	0.0	1	0	1	1.0	5	5.0	5	5.0
2 SAMBOS	2	2.0	2	0	0	0.0	1	0	3	3.0	19	19.0	19	19.0
WINTER TRIM TOTAL	2	2.0	2	11	11	5.5	2	11	24	24.0	4	4.0	24	24.0
SPRING TRIM TOTAL	2	2.0	2	12	12	6.0	2	12	22	22.0	6	6.0	18	18.0
SUMMER TRIM TOTAL	2	2.0	2	30	30	15.0	6	30	48	48.0	6	6.0	38	38.0
FALL TRIM TOTAL	2	2.0	2	17	17	8.5	6	17	24	24.0	5	5.0	19	19.0
WINTER TRIM	2	2.0	2	22	22	11.0	4	22	37	37.0	4	4.0	31	31.0
SPRING TRIM	2	2.0	2	28	28	14.0	6	28	48	48.0	6	6.0	39	39.0
SUMMER TRIM	2	2.0	2	72	72	36.0	18	72	118	118.0	18	18.0	94	94.0
FALL TRIM	2	2.0	2	18	18	9.0	6	18	27	27.0	5	5.0	22	22.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	22	22.0
SPRING TRIM	2	2.0	2	22	22	11.0	4	22	37	37.0	6	6.0	31	31.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	5	5.0	30	30.0
WINTER TRIM	2	2.0	2	28	28	14.0	6	28	42	42.0	6	6.0	36	36.0
SPRING TRIM	2	2.0	2	35	35	17.5	7	35	52	52.0	7	7.0	44	44.0
SUMMER TRIM	2	2.0	2	90	90	45.0	22	90	135	135.0	22	22.0	108	108.0
FALL TRIM	2	2.0	2	40	40	20.0	8	40	60	60.0	5	5.0	60	60.0
WINTER TRIM	2	2.0	2	16	16	8.0	4	16	24	24.0	4	4.0	24	24.0
SPRING TRIM	2	2.0	2	20	20	10.0	5	20	30	30.0	5	5.0	30	30.0
SUMMER TRIM	2	2.0	2	50	50	25.0	12	50	75	75.0	12	12.0	75	75.0
FALL TRIM	2	2.0	2	24	24	12.0	6	24	36	36.0	6	6.0	48	48.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0
WINTER TRIM	2	2.0	2	18	18	9.0	4	18	27	27.0	4	4.0	27	27.0
SPRING TRIM	2	2.0	2	22	22	11.0	5	22	33	33.0	5	5.0	33	33.0
SUMMER TRIM	2	2.0	2	60	60	30.0	15	60	90	90.0	15	15.0	75	75.0
FALL TRIM	2	2.0	2	30	30	15.0	6	30	45	45.0	6	6.0	45	45.0

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).

SPAREEF NAME	NUMBER OF SURVEYS	WINTER 1985		SPRING 1985		SUMMER 1985		FALL 1985	
		NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY
1 CARYSFORT REEF	1	1	2.0	1	1.0	2	3.0	1	1.0
2 DRY ROCKS	1	1	5.0	0	0.0	0	0.0	1	1.0
3 FRENCH REEF	1	1	0.0	0	0.0	0	0.0	0	0.0
4 MOULASSES REEF	1	1	0.0	0	0.0	0	0.0	0	0.0
5 CONCH REEF	1	1	3.0	1.0	1	1.0	1	1.0	
6 ALLIGATOR REEF	1	1	3.0	1.0	1	1.0	1	1.0	
7 TENNESSEE REEF	1	1	1.0	1.0	1	1.0	1	1.0	
8 COFFINS PATCH	1	1	1.0	1.0	1	1.0	1	1.0	
9 SOMBRERO REEF	1	1	1.0	1.0	1	1.0	1	1.0	
10 LOOPE KEY REEF	1	1	1.0	1.0	1	1.0	1	1.0	
11 PELICAN SHOALS	1	1	1.0	1.0	1	1.0	1	1.0	
12 W. SAMBOS	1	1	0.0	0	0.0	0	0.0	0	0.0
13 SAND KEY REEF	1	1	0.0	0	0.0	0	0.0	0	0.0
ECOLOGICAL RESERVE									
X KEY LARGO S SAMBOS	1	0	0.0	0	0.0	0	0.0	1	4.0

SPAREEF NAME	NUMBER OF SURVEYS	WINTER 1985		SPRING 1985		SUMMER 1985		FALL 1985	
		NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY
1 CARYSFORT REEF	2	2	13.0	2	0.7	15	3.0	4	4.0
2 DRY ROCKS	2	2	4.5	1	1.0	4	0.8	4	1.0
3 FRENCH REEF	2	2	1.0	2	0.7	3	0.2	4	1.0
4 MOULASSES REEF	2	2	14.0	3	1.7	5	1.2	4	0.8
5 CONCH REEF	1	1	0.0	5	6.7	5	4.2	4	4.0
6 DAVIS REEF	1	1	0.0	17	6.7	21	1.3	3	1.6
7 ALLIGATOR REEF	2	2	1.9	13	4.3	26	5.2	4	0.8
8 COFFINS PATCH	2	2	1.9	6	2.5	17	2.2	2	0.8
9 SOMBRERO REEF	2	2	2.1	8	4.0	7	2.5	3	4.5
10 LOOPE KEY REEF	1	1	1.0	2	1.0	1	1.0	2	2.5
11 PELICAN SHOALS	1	1	1.0	0	0.0	7	1.0	8	8
12 W. SAMBOS	1	1	0.0	0	0.0	0	0.0	0	0.0
13 SAND KEY REEF	1	1	0.0	0	0.0	1	1.0	2	2.5
ECOLOGICAL RESERVE									
X KEY LARGO S SAMBOS	2	0	N/A	1	1.3	0	0.0	4	8

SPAREEF NAME	NUMBER OF SURVEYS	WINTER 1985		SPRING 1985		SUMMER 1985		FALL 1985	
		NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY
1 CARYSFORT REEF	2	2	0.0	2	0.5	14	2.5	8	1.7
2 DRY ROCKS	2	2	0.5	0	0.0	1	0.2	6	2.2
3 FRENCH REEF	2	2	3.5	0	0.0	8	1.9	13	1.2
4 MOULASSES REEF	2	2	8.5	0	0.0	0	0.0	6	2.0
5 CONCH REEF	2	2	1.2	7	1.8	2	0.3	8	0.7
6 DAVIS REEF	2	2	4.0	3	0.8	13	2.2	30	5.1
7 ALLIGATOR REEF	2	2	4.0	18	4.5	19	2.0	46	8.2
8 COFFINS PATCH	2	2	5.5	9	1.0	6	0.8	24	4.0
9 SOMBRERO REEF	2	2	2.5	3	1.0	5	0.8	21	3.5
10 LOOPE KEY REEF	2	2	0.0	0	0.0	7	1.0	6	4.5
11 PELICAN SHOALS	1	1	0.0	0	0.0	2	0.0	28	6
12 W. SAMBOS	1	1	0.0	0	0.0	14	2.3	5	1.2
13 SAND KEY REEF	1	1	1.0	4	2.0	1	0.3	8	1.8
ECOLOGICAL RESERVE									
X KEY LARGO S SAMBOS	2	4	2.0	4	1.0	7	1.2	6	1.8

SPAREEF NAME	NUMBER OF SURVEYS	WINTER 1985		SPRING 1985		SUMMER 1985		FALL 1985	
		NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY
1 CARYSFORT REEF	8	8	2.4	2	0.8	11	2.8	5	1.7
2 DRY ROCKS	8	8	0.3	2	0.6	5	1.2	7	1.7
3 FRENCH REEF	8	8	1.6	0	0.0	6	1.3	15	5.0
4 MOULASSES REEF	8	8	3.5	11	2.8	6	1.5	3	1.0
5 CONCH REEF	8	8	4.1	0	0.0	17	4.3	2	0.7
6 DAVIS REEF	8	8	8.8	10	2.5	12	3.0	5	5.7
7 ALLIGATOR REEF	8	8	4.1	18	3.6	10	4.0	18	8.0
8 COFFINS PATCH	8	8	4.8	12	3.0	11	4.5	8	2.7
9 SOMBRERO REEF	8	8	7.7	13	3.5	4	1.0	10	0
10 LOOPE KEY REEF	7	7	5.8	2	0.7	4	2.0	10	3.3
11 PELICAN SHOALS	4	4	2.0	2	0.7	6	1.0	0	0.0
12 W. SAMBOS	4	4	1.9	0	0.0	1	1.0	11	1
13 SAND KEY REEF	4	4	13.3	2	0.7	1	0.5	23	7.7
ECOLOGICAL RESERVE									
X KEY LARGO S SAMBOS	8	3	0.8	4	1.3	23	5.8	12	2.0

SPAREEF NAME	NUMBER OF SURVEYS	WINTER 1985		SPRING 1985		SUMMER 1985		FALL 1985	
		NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY
1 CARYSFORT REEF	2	2	1.0	2	0.6	5	1.2	7	1.7
2 DRY ROCKS	2	2	0.0	0	0.0	6	1.3	15	5.0
3 FRENCH REEF	2	2	5.5	0	0.0	17	4.3	2	0.7
4 MOULASSES REEF	2	2	1.1	11	2.8	6	1.5	3	1.0
5 CONCH REEF	2	2	0.5	0	0.0	12	3.0	5	5.7
6 DAVIS REEF	2	2	17	10	2.5	10	4.0	18	8.0
7 ALLIGATOR REEF	2	2	8.5	12	3.6	11	4.5	8	2.7
8 COFFINS PATCH	2	2	8.5	13	3.5	4	1.0	10	0
9 SOMBRERO REEF	2	2	2.0	2	0.7	6	2.0	10	3.3
10 LOOPE KEY REEF	2	2	3.5	0	0.0	1	1.0	11	1
11 PELICAN SHOALS	2	2	0.0	2	0.7	1	0.5	23	7.7
12 W. SAMBOS	2	2	2.0	0	0.0	1	1.0	11	1
13 SAND KEY REEF	2	2	0.0	0	0.0	1	0.5	23	7.7
ECOLOGICAL RESERVE									
X KEY LARGO S SAMBOS	2	3	1.5	4	1.3	23	5.8	12	2.0

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).

SPACIAL RESERVE	REEF NAME	NUMBER OF SURVEYS	NUMBER OF BOATS PER SURVEY	SUMMER 1982		FALL 1982			
				NUMBER OF SURVEYS	BOATS PER SURVEY	NUMBER OF SURVEYS	BOATS PER SURVEY		
ECOLOGICAL RESERVE	1 CARYSFORT REEF	2	0.0	1	1.0	1	2.0		
	2 THE ELBOW	2	0.0	1	1.0	0	0.0		
	3 DRY ROCKS	2	0.0	1	1.0	0	0.0		
	4 FRENCH REEF	2	0.0	1	1.0	0	0.0		
	5 MOLASSES REEF	2	0.0	1	3.0	0	3.0		
	6 CONCH REEF	2	0.0	1	0.0	0	0.0		
	7 DAVIS REEF	2	0.0	1	1.0	1	1.0		
	8 ALLIGATOR REEF	2	0.0	1	0.0	0	0.0		
	9 TENNESSEE REEF	2	0.0	1	1	1	1		
	10 COFFINS PATCH	2	0.0	1	0.0	0	0.0		
	11 SOMBRERO REEF	2	0.0	1	10	10	10		
	12 LOOE KEY REEF	2	1.0	1.0	5.0	5.0	5.0		
	13 PELICAN SHOALS	2	0.0	0.0	18.7	18.7	18.7		
	14 W. SAMBOS	2	0.0	0.0	68	68	68		
	15 SAND KEY REEF	2	0.0	0.0	98.0	98.0	98.0		
ECOLOGICAL RESERVE				1	0.0	1	0	0	0.0
KEY LINDO				0	N/A	0	0	0	N/A
S SAMBOS				0	N/A	0	0	0	N/A
ECOLOGICAL RESERVE	1 CARYSFORT REEF	2	0.0	1	1.0	1	2.0		
	2 THE ELBOW	2	0.0	1	1.0	0	0.0		
	3 DRY ROCKS	2	0.0	1	1.0	0	0.0		
	4 FRENCH REEF	2	0.0	1	1.0	0	0.0		
	5 MOLASSES REEF	2	0.0	1	3.0	0	3.0		
	6 CONCH REEF	2	0.0	1	0.0	0	0.0		
	7 DAVIS REEF	2	0.0	1	1.0	1	1.0		
	8 ALLIGATOR REEF	2	0.0	1	0.0	0	0.0		
	9 TENNESSEE REEF	2	0.0	1	1	1	1		
	10 COFFINS PATCH	2	0.0	1	0.0	0	0.0		
	11 SOMBRERO REEF	2	0.0	1	10	10	10		
	12 LOOE KEY REEF	2	1.0	1.0	5.0	5.0	5.0		
	13 PELICAN SHOALS	2	0.0	0.0	18.7	18.7	18.7		
	14 W. SAMBOS	2	0.0	0.0	68	68	68		
	15 SAND KEY REEF	2	0.0	0.0	98.0	98.0	98.0		
ECOLOGICAL RESERVE				1	0.0	1	0	0	0.0
KEY LINDO				0	N/A	0	0	0	N/A
S SAMBOS				0	N/A	0	0	0	N/A
ECOLOGICAL RESERVE	1 CARYSFORT REEF	2	0.0	1	1.0	1	2.0		
	2 THE ELBOW	2	0.0	1	1.0	0	0.0		
	3 DRY ROCKS	2	0.0	1	1.0	0	0.0		
	4 FRENCH REEF	2	0.0	1	1.0	0	0.0		
	5 MOLASSES REEF	2	0.0	1	3.0	0	3.0		
	6 CONCH REEF	2	0.0	1	0.0	0	0.0		
	7 DAVIS REEF	2	0.0	1	1.0	1	1.0		
	8 ALLIGATOR REEF	2	0.0	1	0.0	0	0.0		
	9 TENNESSEE REEF	2	0.0	1	1	1	1		
	10 COFFINS PATCH	2	0.0	1	0.0	0	0.0		
	11 SOMBRERO REEF	2	0.0	1	10	10	10		
	12 LOOE KEY REEF	2	1.0	1.0	5.0	5.0	5.0		
	13 PELICAN SHOALS	2	0.0	0.0	18.7	18.7	18.7		
	14 W. SAMBOS	2	0.0	0.0	68	68	68		
	15 SAND KEY REEF	2	0.0	0.0	98.0	98.0	98.0		
ECOLOGICAL RESERVE				1	0.0	1	0	0	0.0
KEY LINDO				0	N/A	0	0	0	N/A
S SAMBOS				0	N/A	0	0	0	N/A

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.

SANCTUARY PROTECTED AREAS	FISHING VESSELS								DIVING VESSELS			CRUISE	TOTAL
	RECREATIONAL				COMMERCIAL				SMALL CHARTER/ <35 FEET				
	YACHT	UNKNOWN	TOTAL	LOBSTER	FISHING	UNKNOWN	TOTAL	YACHT	TOTAL				
OTHER REEF AREAS	4419	1228	222	5869	28	216	388	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)	56	18	2	76	1		13	14	21	38	59	13	162
3 DRY 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	178
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	8	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	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	483
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
<b>ECOLOGICAL RESERVES</b>													
OUTSIDE RESERVES	5539	1550	288	7357	34	237	499	770	2276	810	3086	1171	12384
KEY LARGO (54)	99	11	18	128	2	3	28	33	55	13	68	43	272
SAMBOS (30)	81	11	2	74	2		13	15	16	28	44	25	158
TOTAL	5699	1572	288	7559	38	240	540	818	2347	851	3198	1241	12816
<b>ZONES</b>													
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)	88	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	481	162	623	278	2705
12 (54)	961	238	56	1255	5	11	61	77	152	83	235	181	1728
13 (45)	1017	74	38	1129	2	41	89	132	687	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.

SURVEY NUMBER	RECREATIONAL VESSELS				NUMBER OF TRAILERS AT MARINAS			
	FISHING	DIVE	CRUISE	TOTAL	CONVOY POINT	BLACK POINT	MATHESON HAMMOCK	TOTAL TRAILERS
	SUR003	26	0	1	27	30	2	12
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.

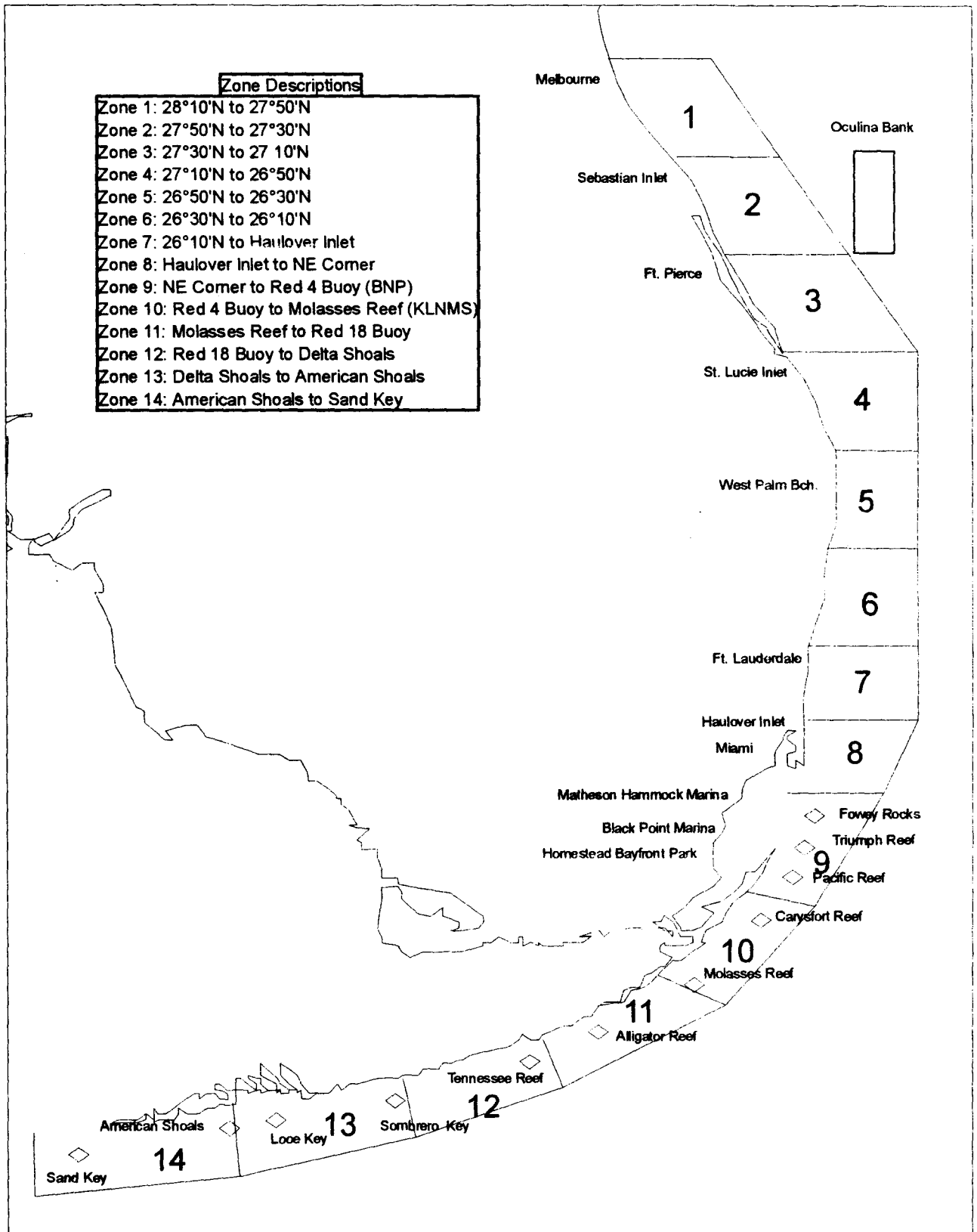
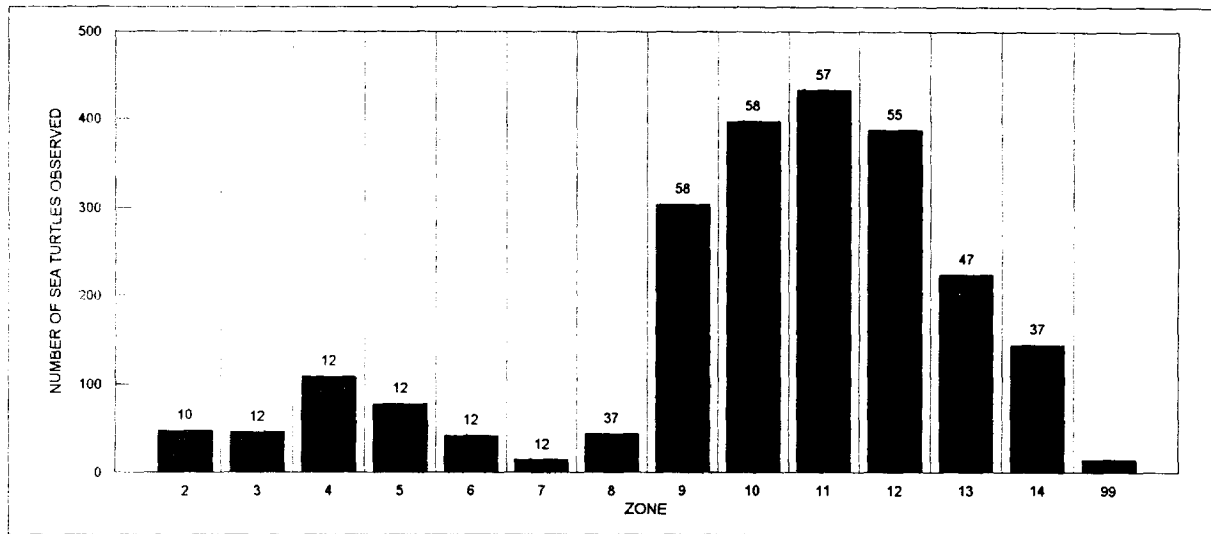
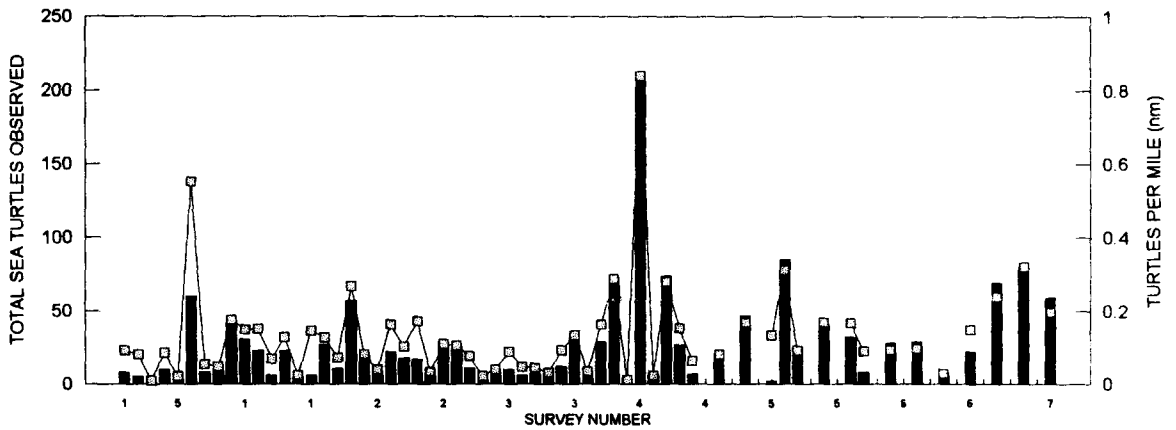


Figure 2. Total number of sea turtles observed, September 28, 1992 through March 21, 1996  
N equals the number of surveys per zone.

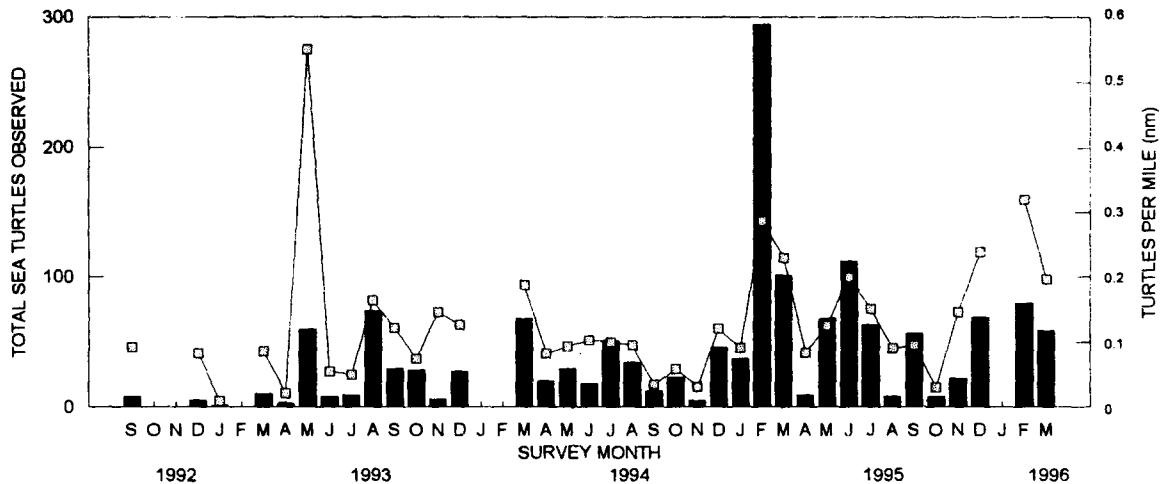


Key to zones: 1 = 28° 10' N to 27° 50' N, 2 = 27° 50' N to 27° 30' N, 3 = 27° 30' N to 27° 10' N, 4 = 27° 10' N to 26° 50' N,  
5 = 26° 50' N to 26° 30' N, 6 = 26° 30' N to 26° 10' N, 7 = 26° 10' N to Haulover Inlet,  
8 = Haulover Inlet to NE Corner, 9 = NE Corner to Red 4 buoy, 10 = Red 4 buoy to Molasses 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.**

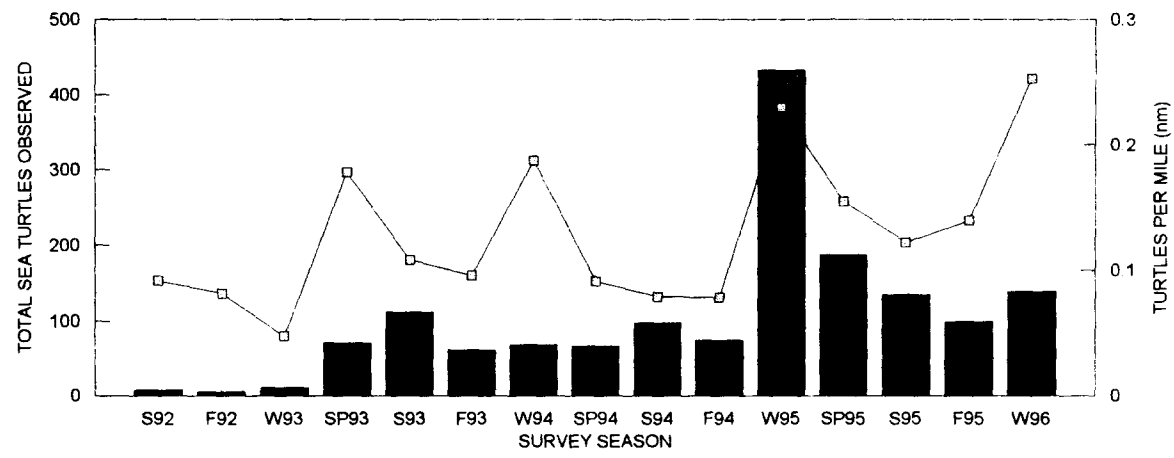




Figure 4. Total number of sea turtles observed (bars) and sea turtles per nautical mile (lines) by season for south surveys (zones 8 - 14 only).

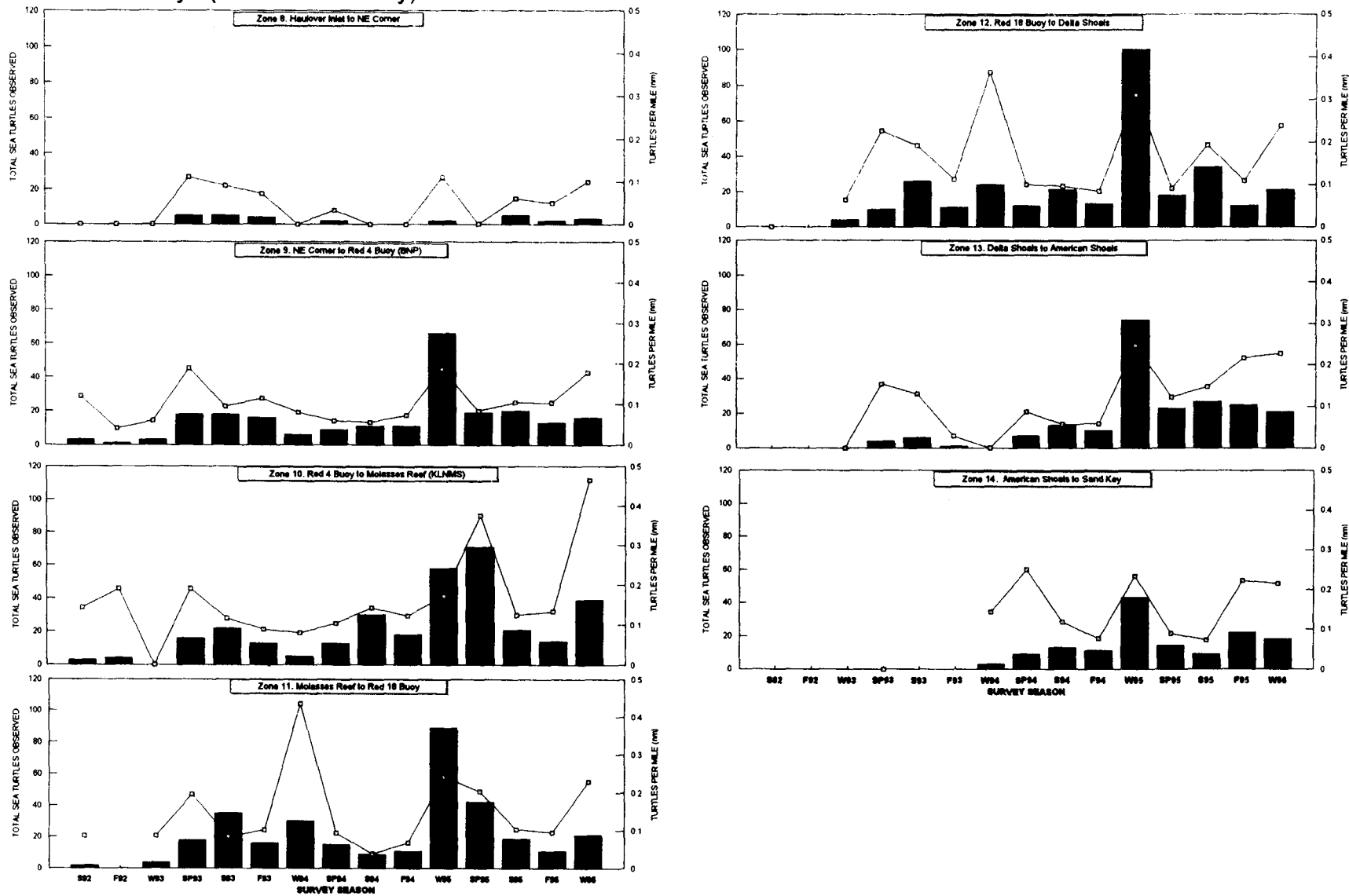


Figure 5a. Number of sea turtles observed (bars) and sea turtles per nautical mile (lines) for north surveys (zones 2 - 7) only.

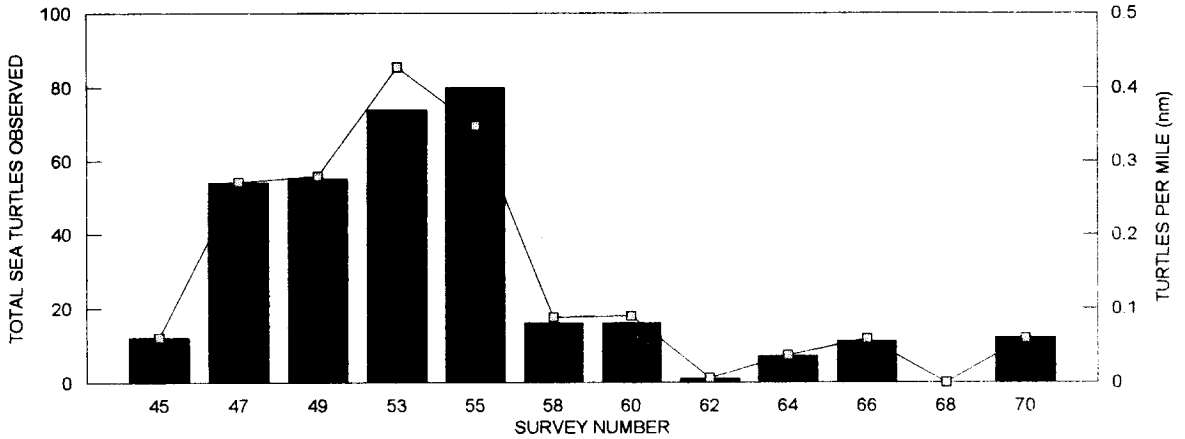


Figure 5b. Number of sea turtles seen by month (bars) and sea turtles per nautical mile (lines) for north surveys (zones 2 - 7) only. No surveys took place between September 1992 and March 1995.

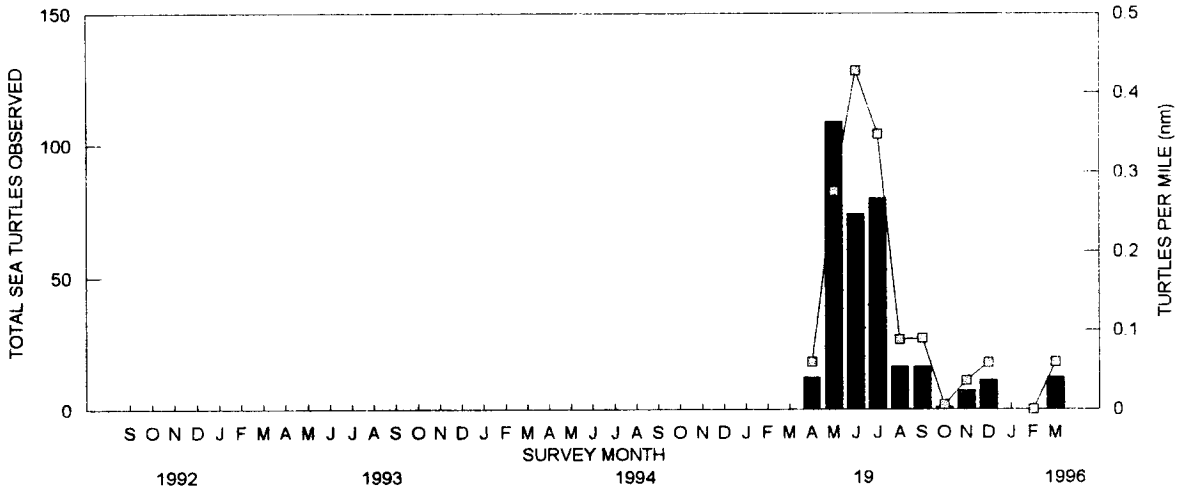


Figure 5c. Number of sea turtles seen by season (bars) and sea turtles per nautical mile (lines) for north surveys (zones 2 - 7) only. No surveys took place between summer 1992 and winter 1995.

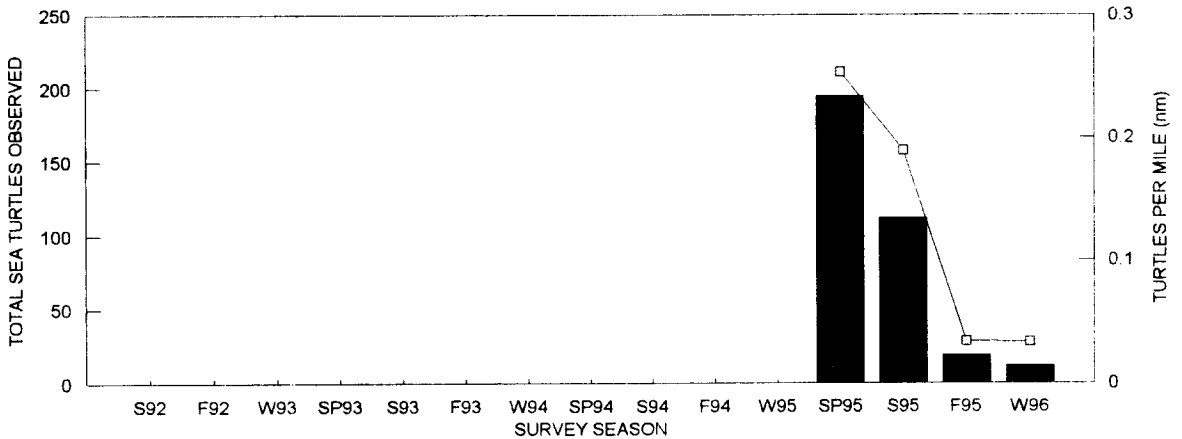


Figure 6. Total number of sea turtles observed (bars) and sea turtles per nautical mile (lines) by season for north surveys (zones 2 - 7 only). No surveys took place summer 1992 through winter 1995.

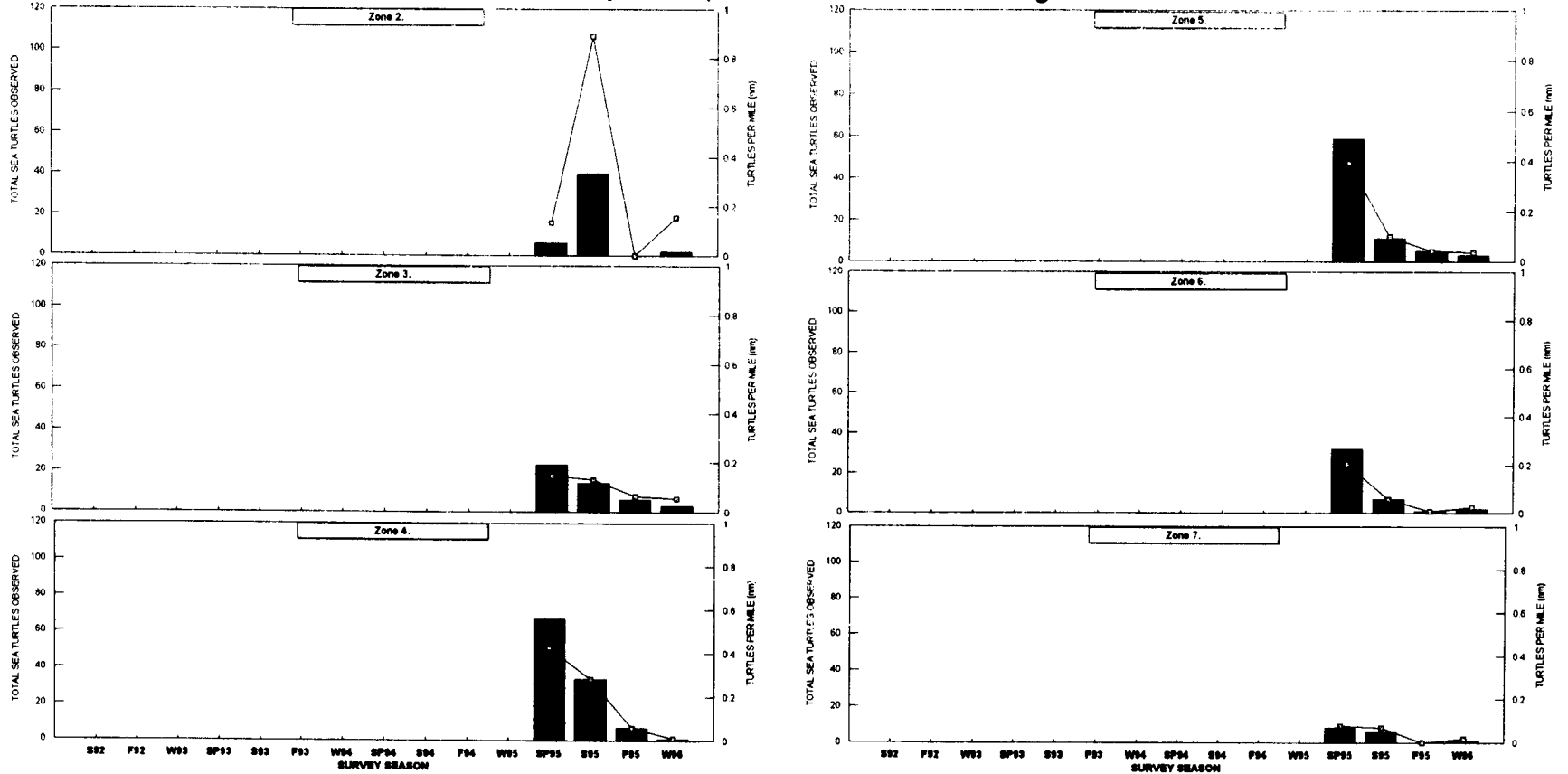


Figure 7a. Distribution of sea turtles observed in aerial surveys for the southern portion (zones 8 - 14) for 1993. The number of surveys is given in parenthesis. The number of animals are noted as x = 1, 0 = 2 to 4, and <> = >5 per sighting. See Table 1 and Figure 1 for zone information.

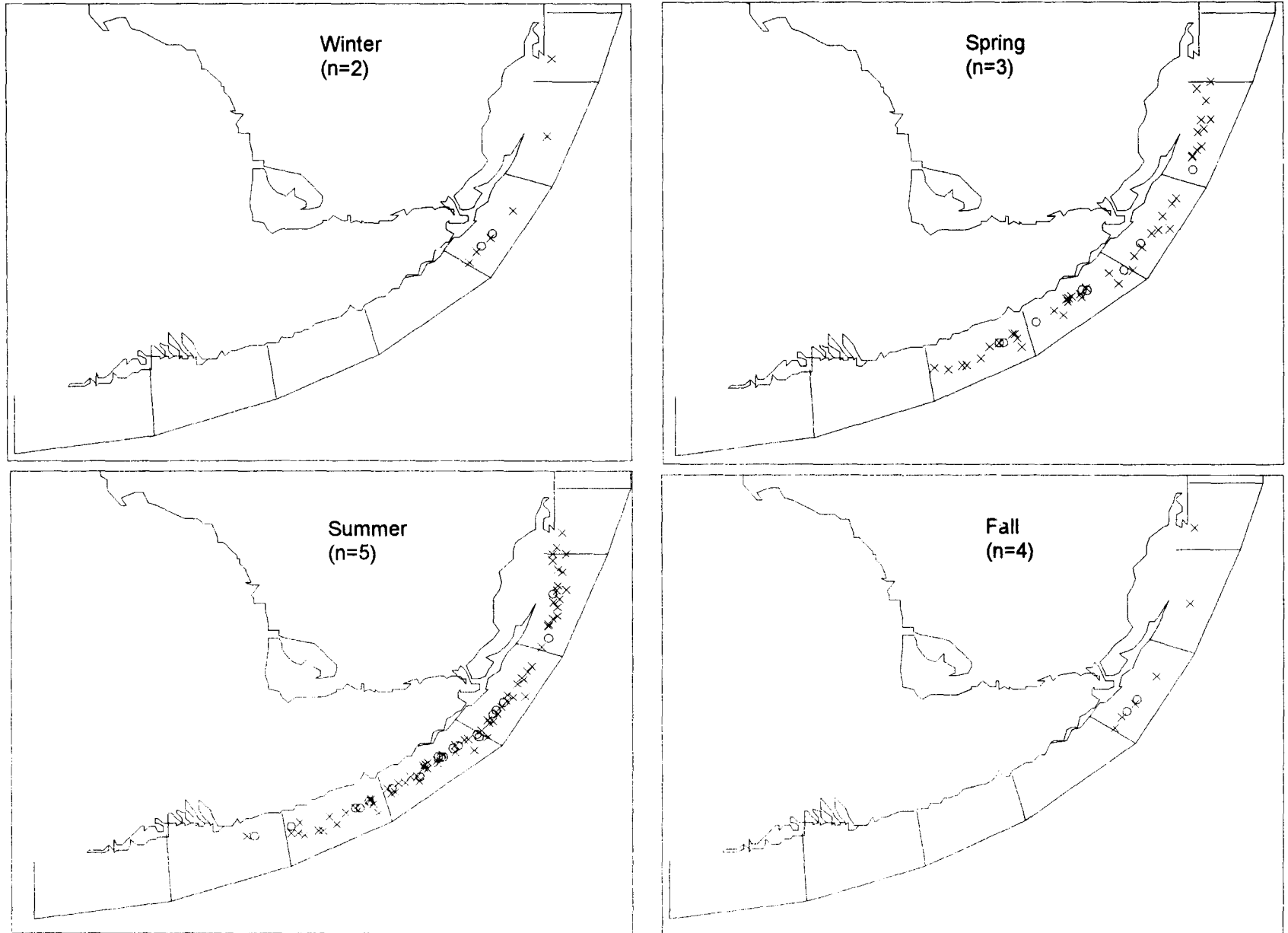


Figure 7b. Distribution of sea turtles observed in aerial surveys for the southern portion (zones 8 - 14) for 1994. The number of surveys is given in parenthesis. The number of animals are noted as x = 1, o = 2 to 4, < > = >5 per sighting. See Table 1 and Figure 1 for zone information.

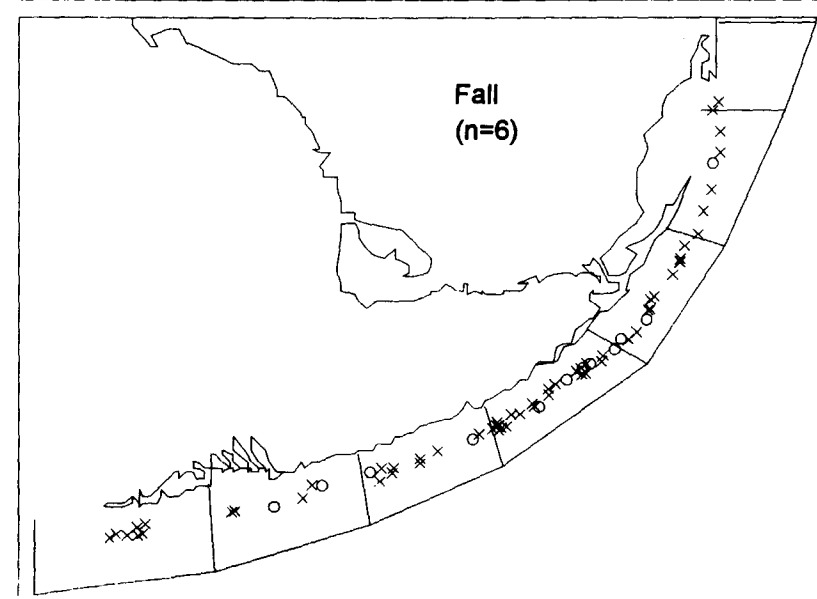
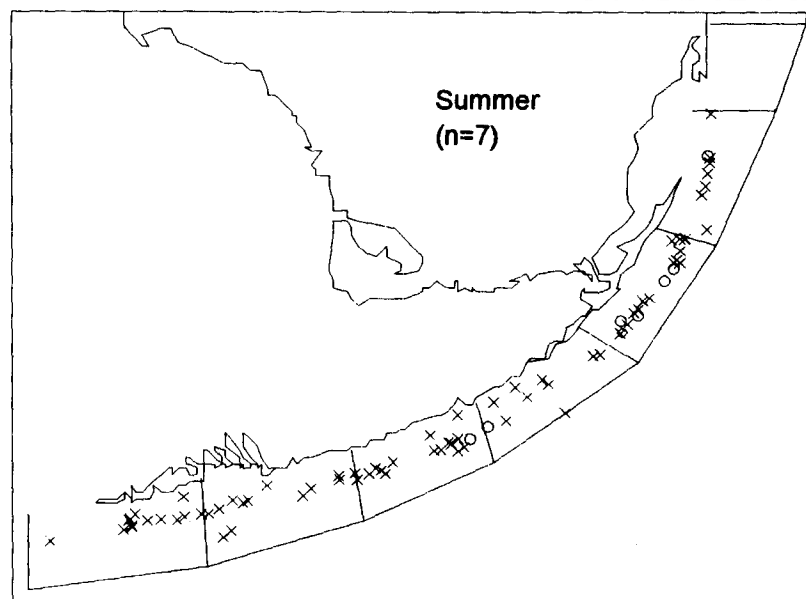
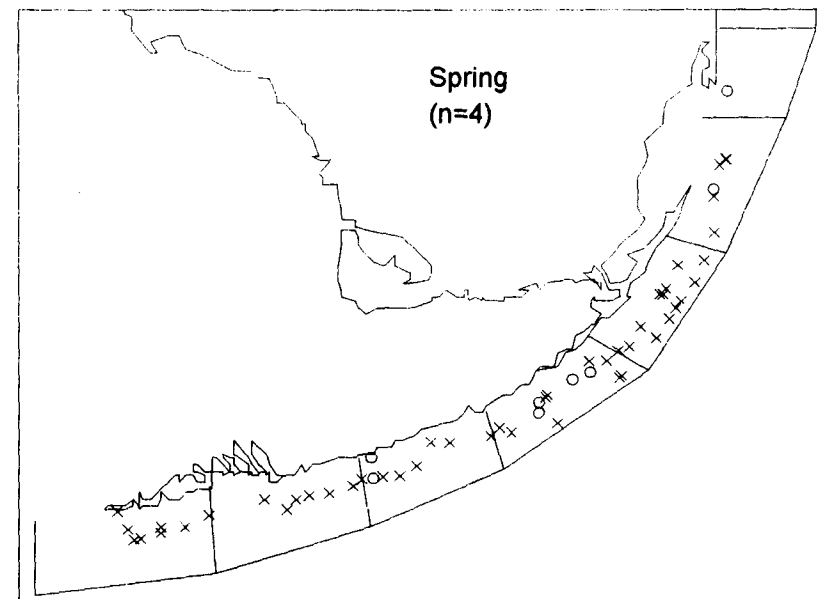
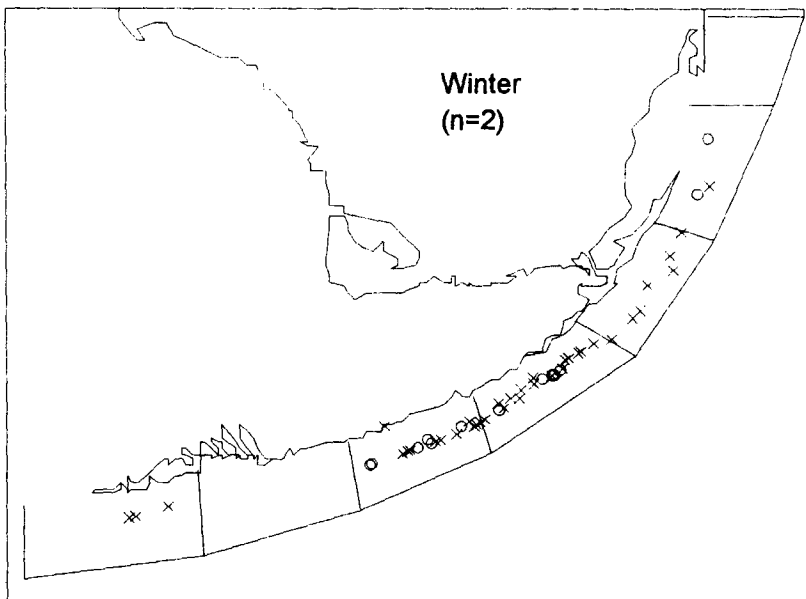


Figure 7c. Distribution of sea turtles observed in aerial surveys for the southern portion (zones 8 - 14) for 1995. The number of surveys is given in parenthesis. The number of animals are noted as x = 1, o = 2 to 4, <> = >5 per sighting. See Table 1 and Figure 1 for zone information.

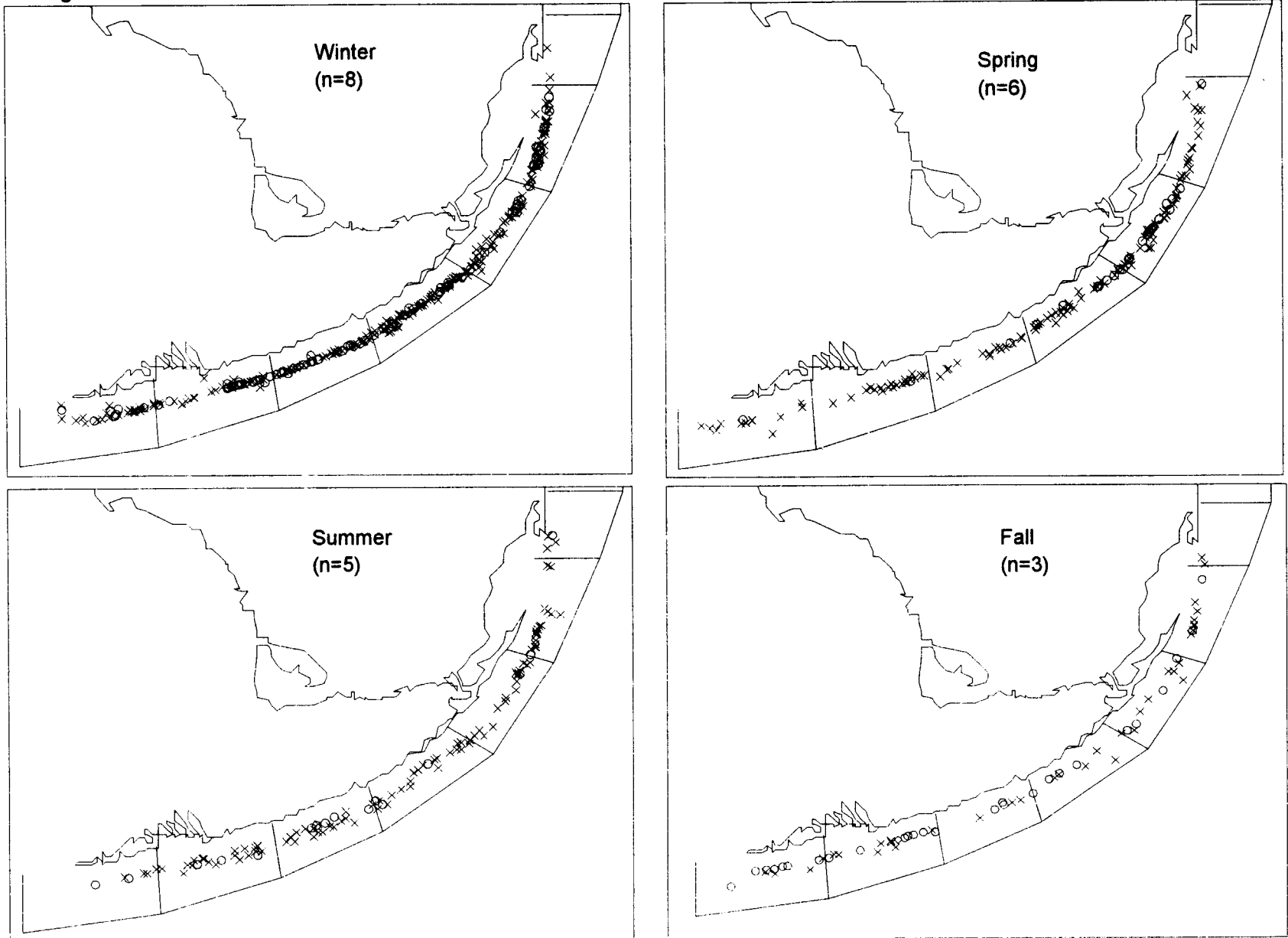


Figure 8. Distribution of sea turtles observed in aerial surveys for the northern portion (zones 2 - 7) for Spring 1995 through Winter 1996. The number of surveys is given in parenthesis. The number of animals are noted as x = 1, o = 2 to 4, < > = >5 per sighting. See Table 1 and Figure 1 for zone information.



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.

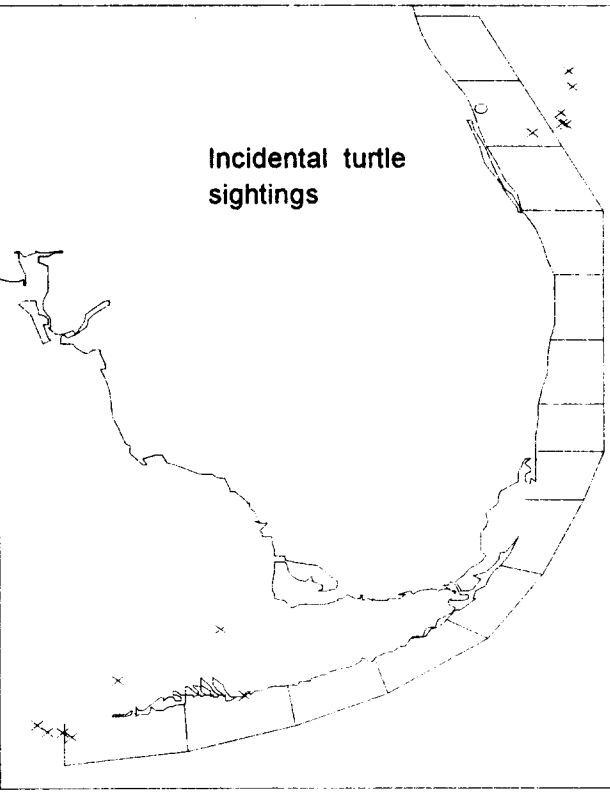
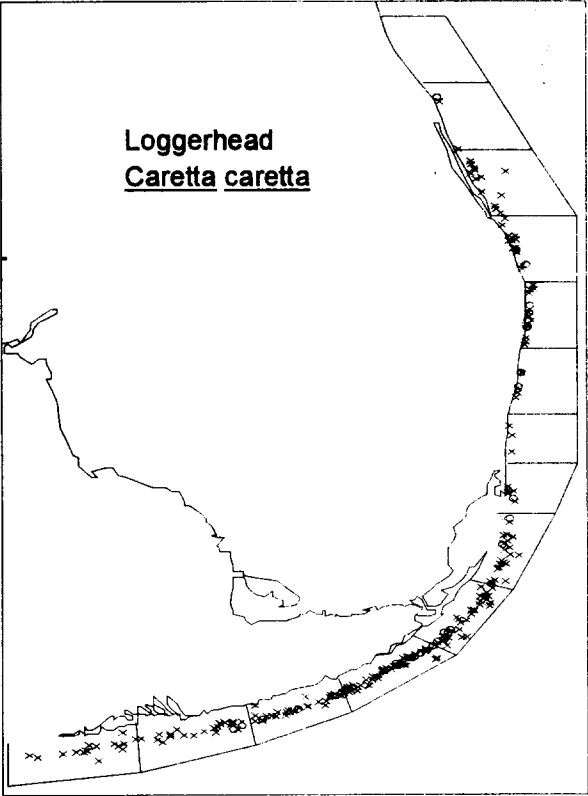
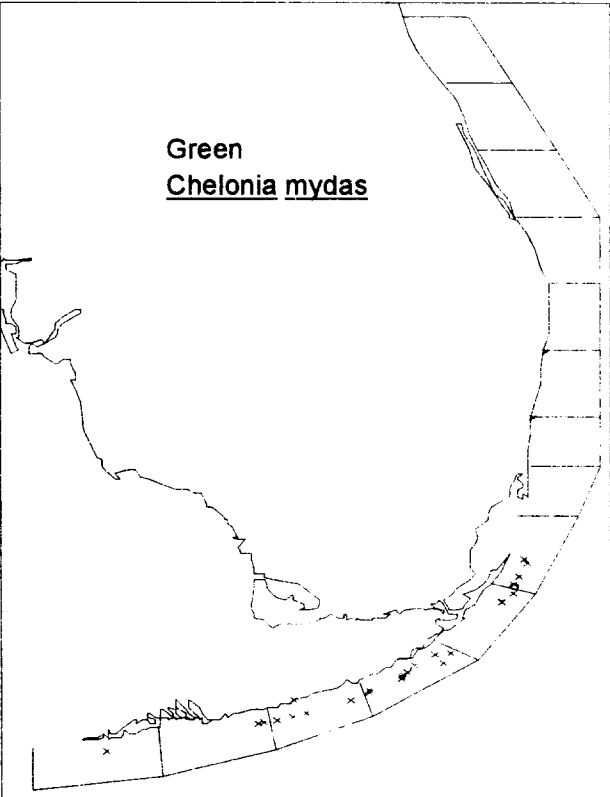
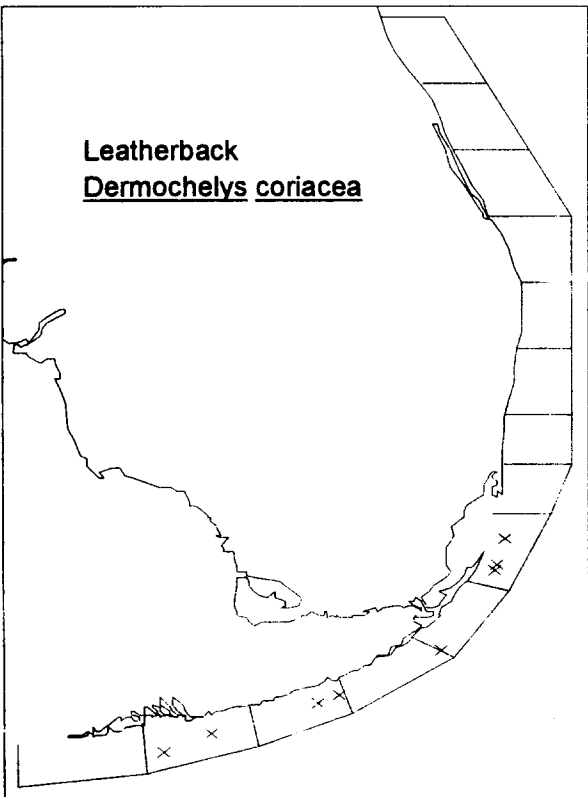




Figure 10. Distribution of bottlenose dolphin (*Tursiops truncatus*) observed during all aerial surveys for 1992-1996. The number of animals are noted as x = 1-9, □ = 10-19, and O ≥ 20 per sighting. See Table 1 and Figure 1 for zone information.

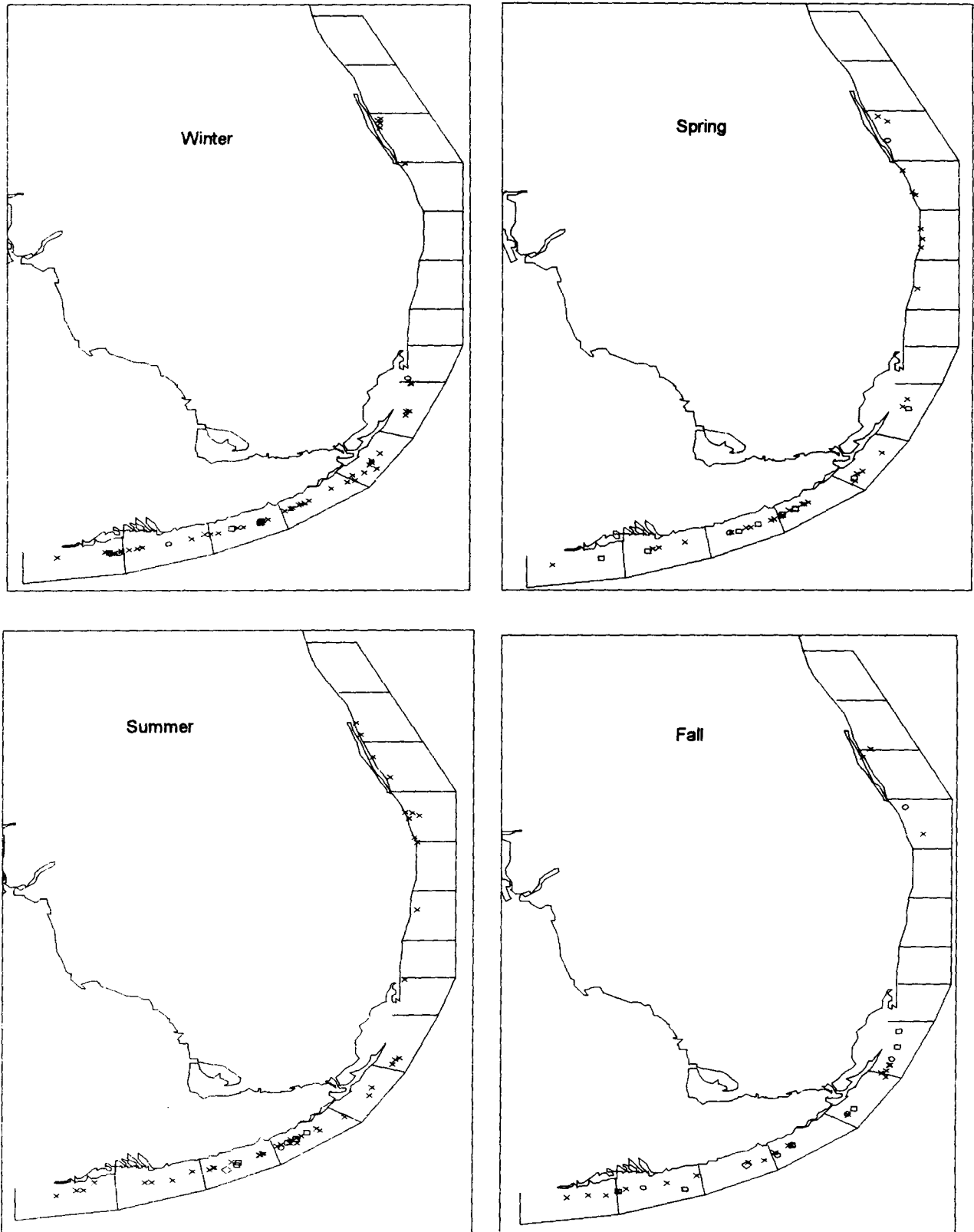


Figure 11. Comparison between the number per survey of fishing versus dive vessels by season in the south (zones 8 -14) survey area. The numbers of surveys flown per season from September 28, 1992 - March 21, 1996 are given.

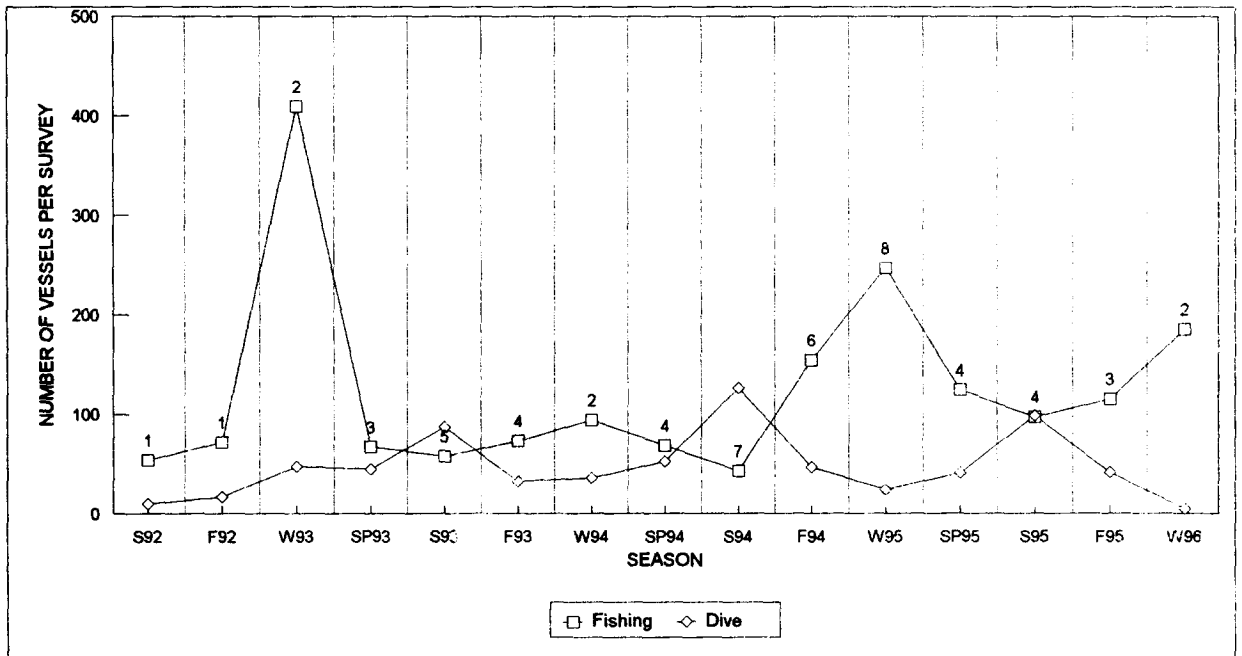


Figure 12. Comparison between the number per survey of fishing versus dive vessels by season in the north (zones 2-7) survey area. The numbers of surveys flown per season are given. No surveys were flown between the summer of 1992 and and winter of 1995.

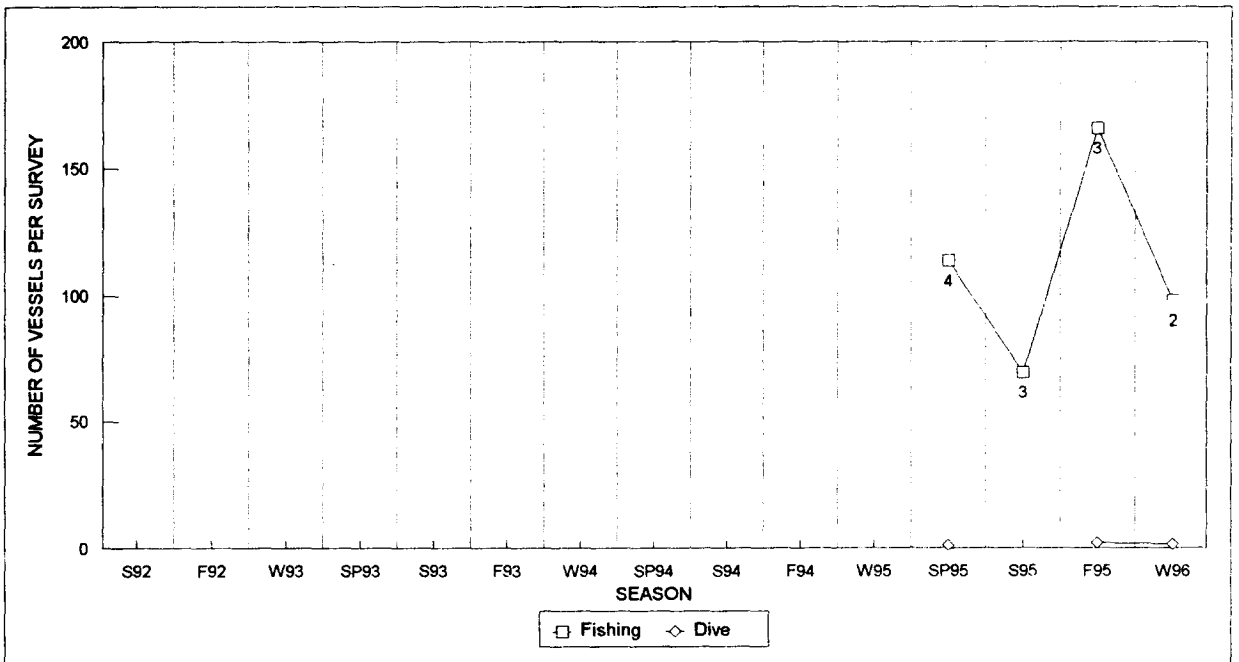


Figure 13. Different classifications of fishing vessels observed per survey for the total survey area (zones 2 - 14) from September 28, 1992 - March 21, 1996. The number of surveys flown per zone are noted.

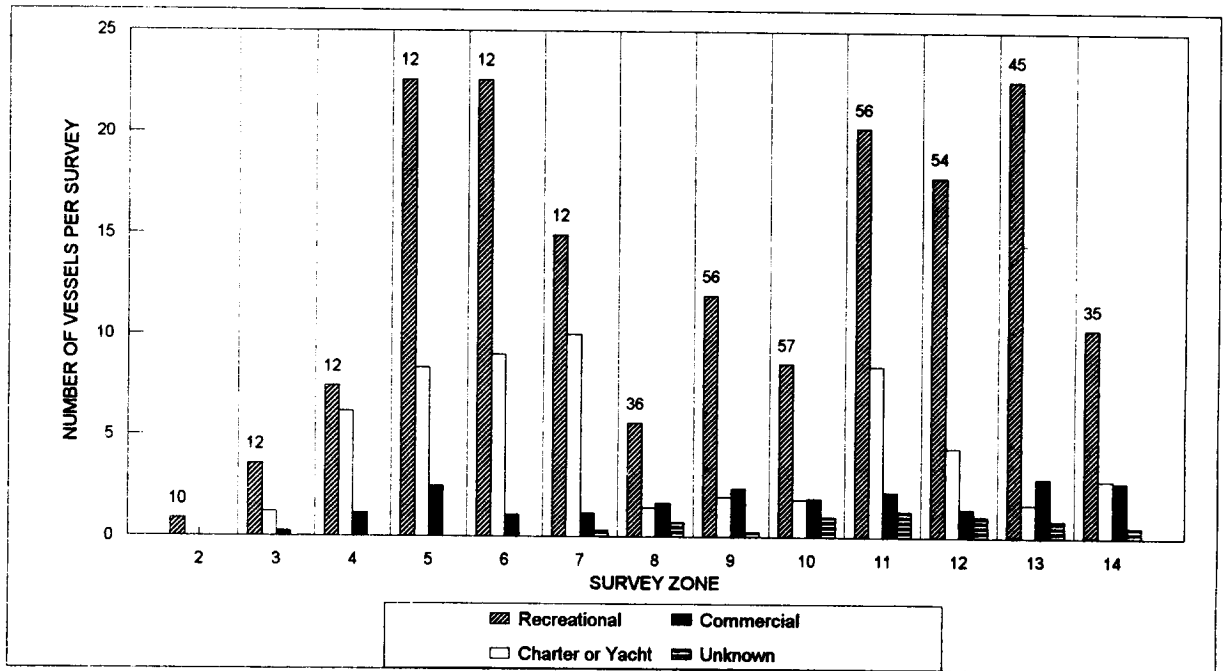


Figure 14. Different classifications of dive vessels observed per survey for the total survey area (zones 2 - 14) September 28, 1992 - March 21, 1996. The total number of surveys flown per zone are noted.

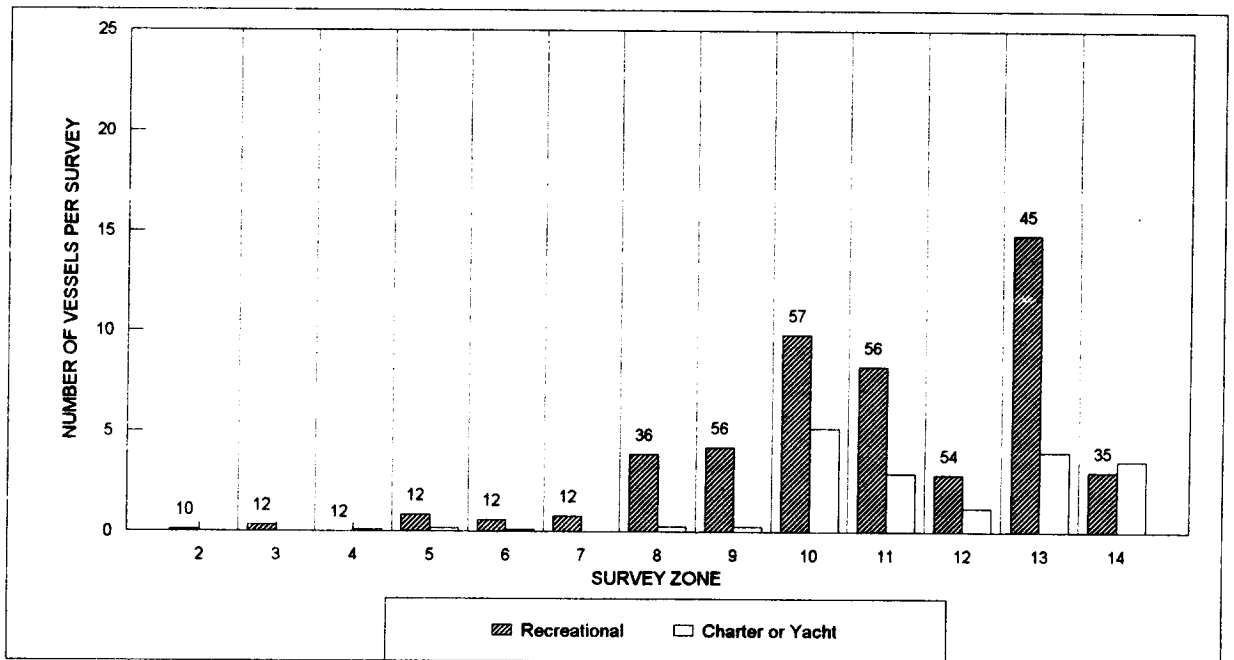


Figure 15. Number of fishing vessels for each survey and season observed in the southern zones (8 - 14 only).

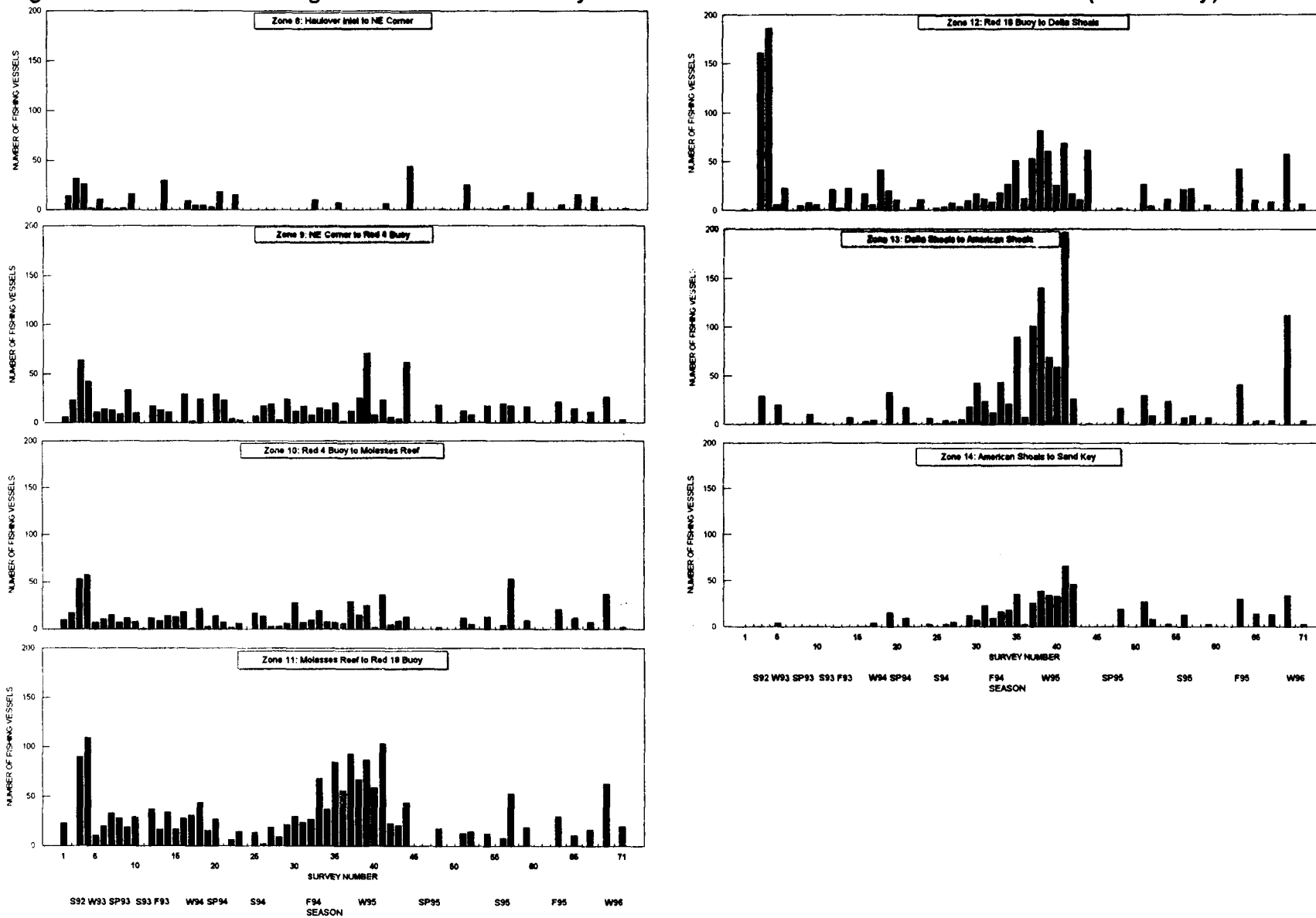


Figure 16. Number of fishing vessels for each survey and season observed in the northern zones (1 - 7 only). No surve between summer 1992 and winter 1995.

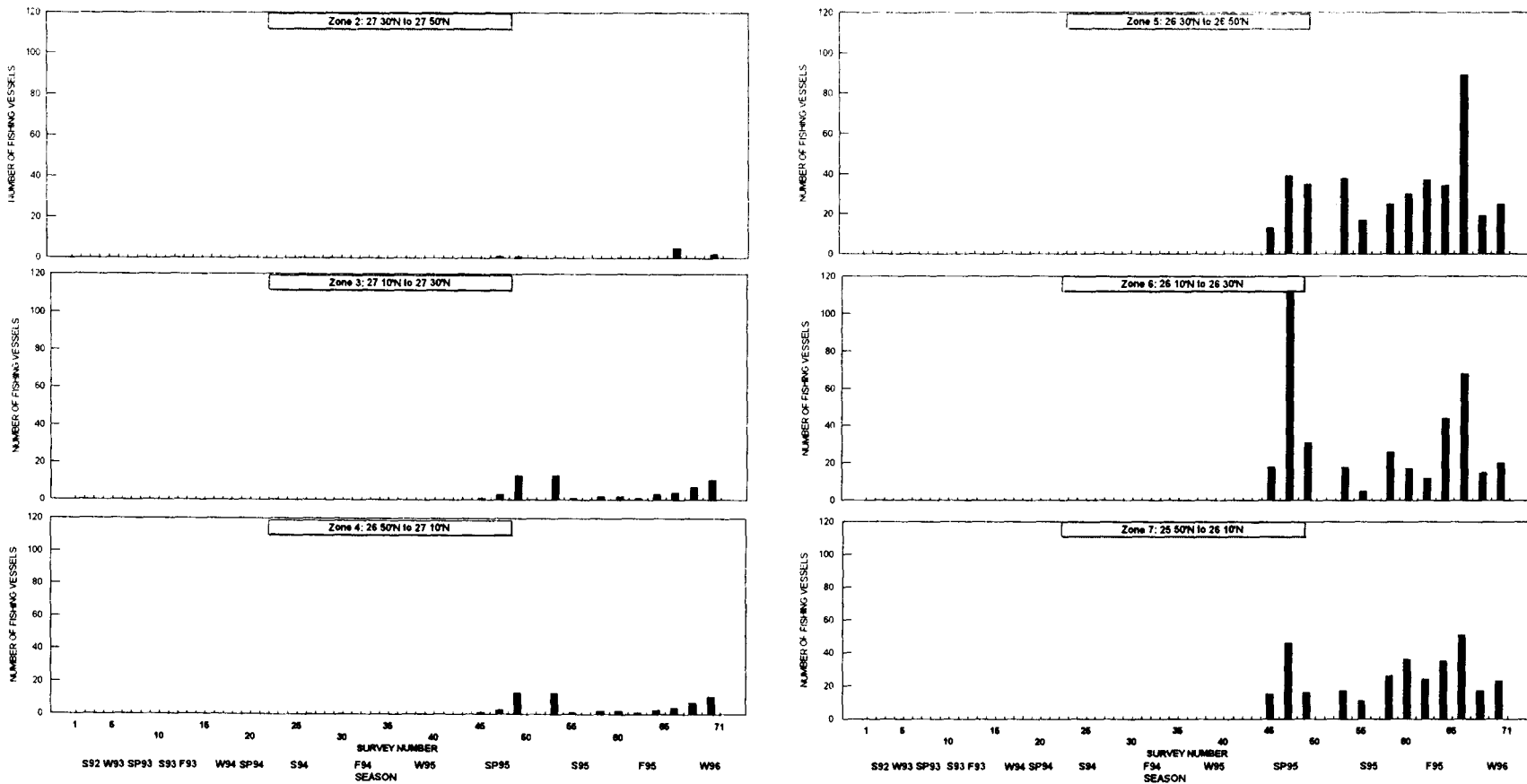


Figure 17. Number of dive vessels for each survey and season observed in the southern zones (8 - 14 only).

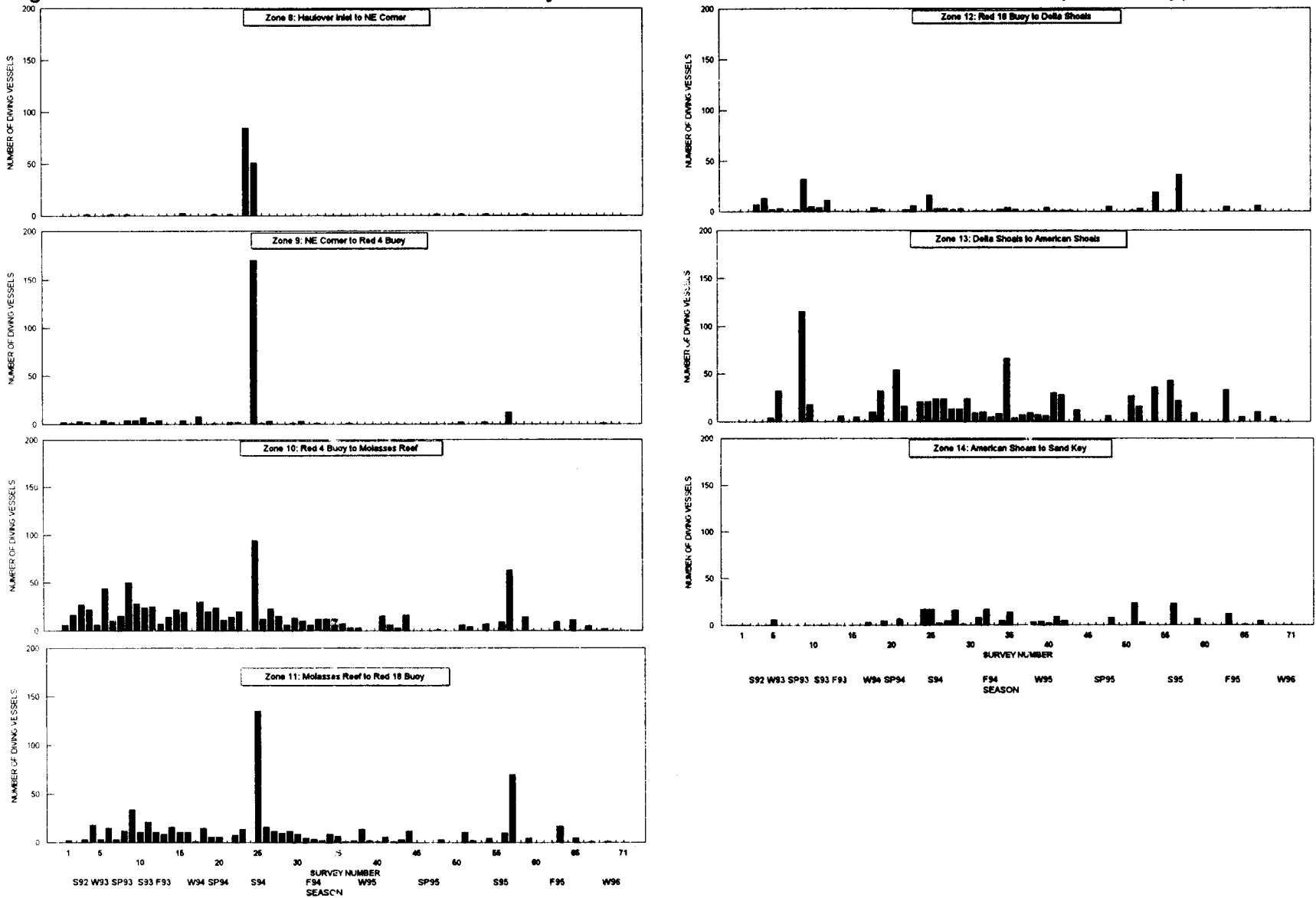


Figure 18. Number of dive vessels for each survey observed in the northern zones (1 - 7 only). No surveys took place between summer 1992 and winter 1995.

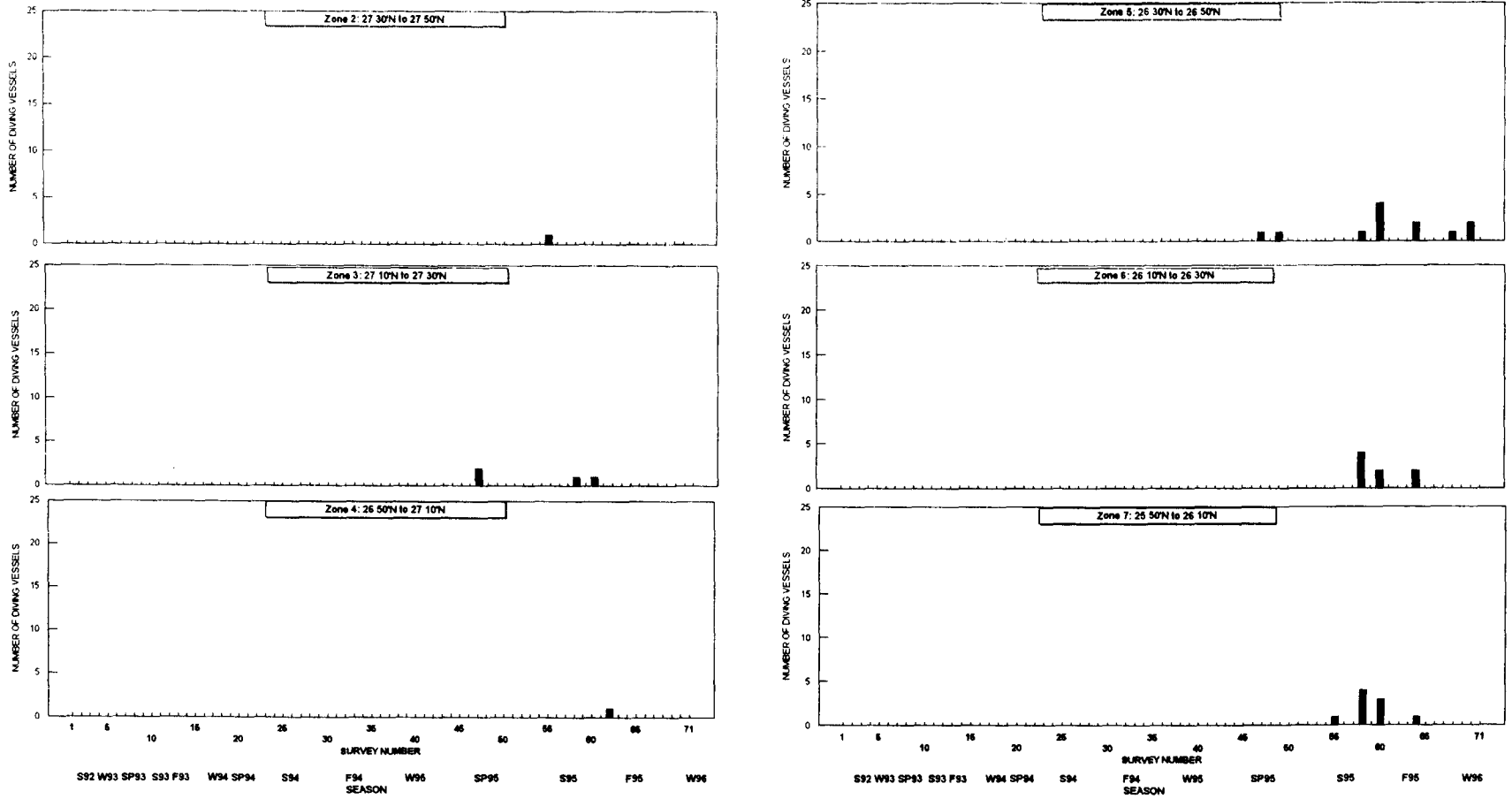
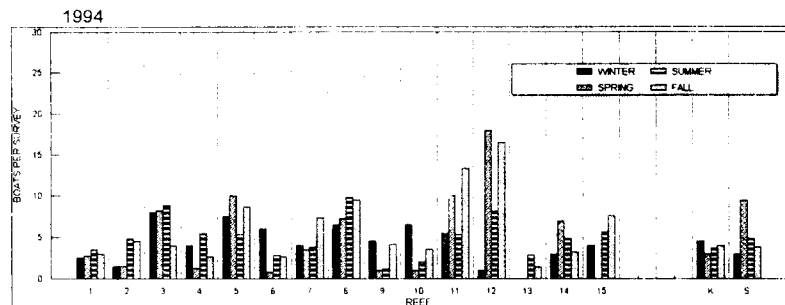
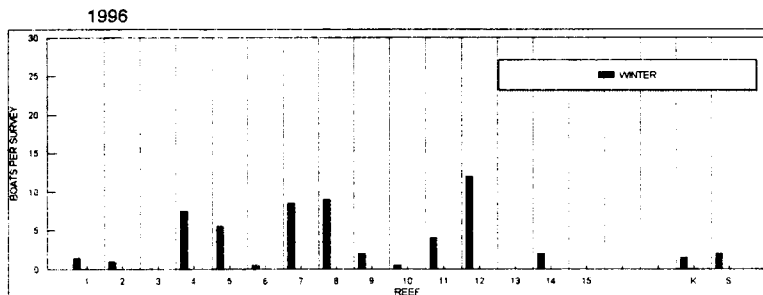
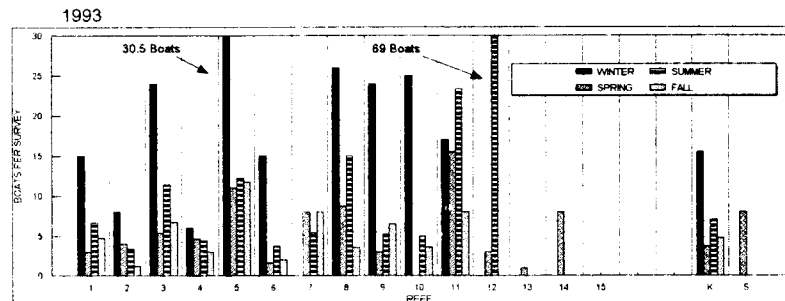
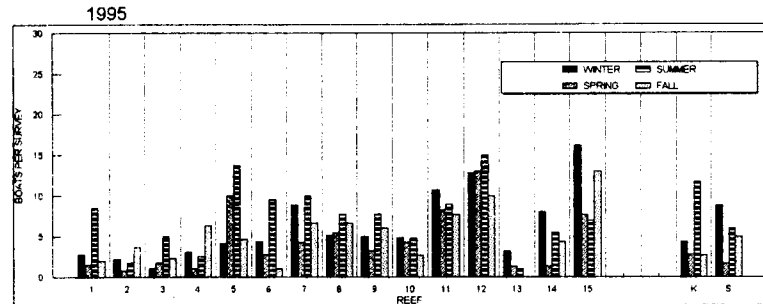
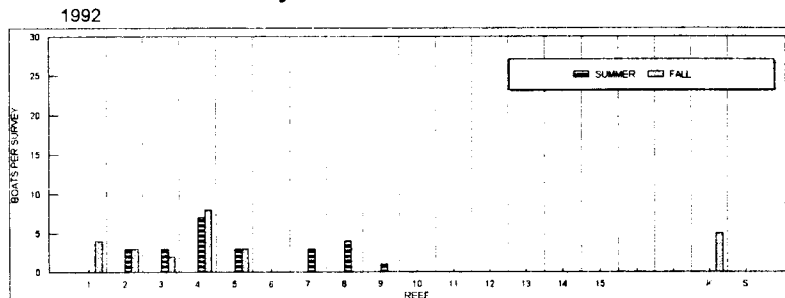


Figure 19. Total vessels (fish, dive, and cruise) per survey observed at Sanctuary Protected Areas (SPAs) and Ecological Reserves in the Florida Keys National Marine Sanctuary (FKNMS) by year and season of survey.



**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

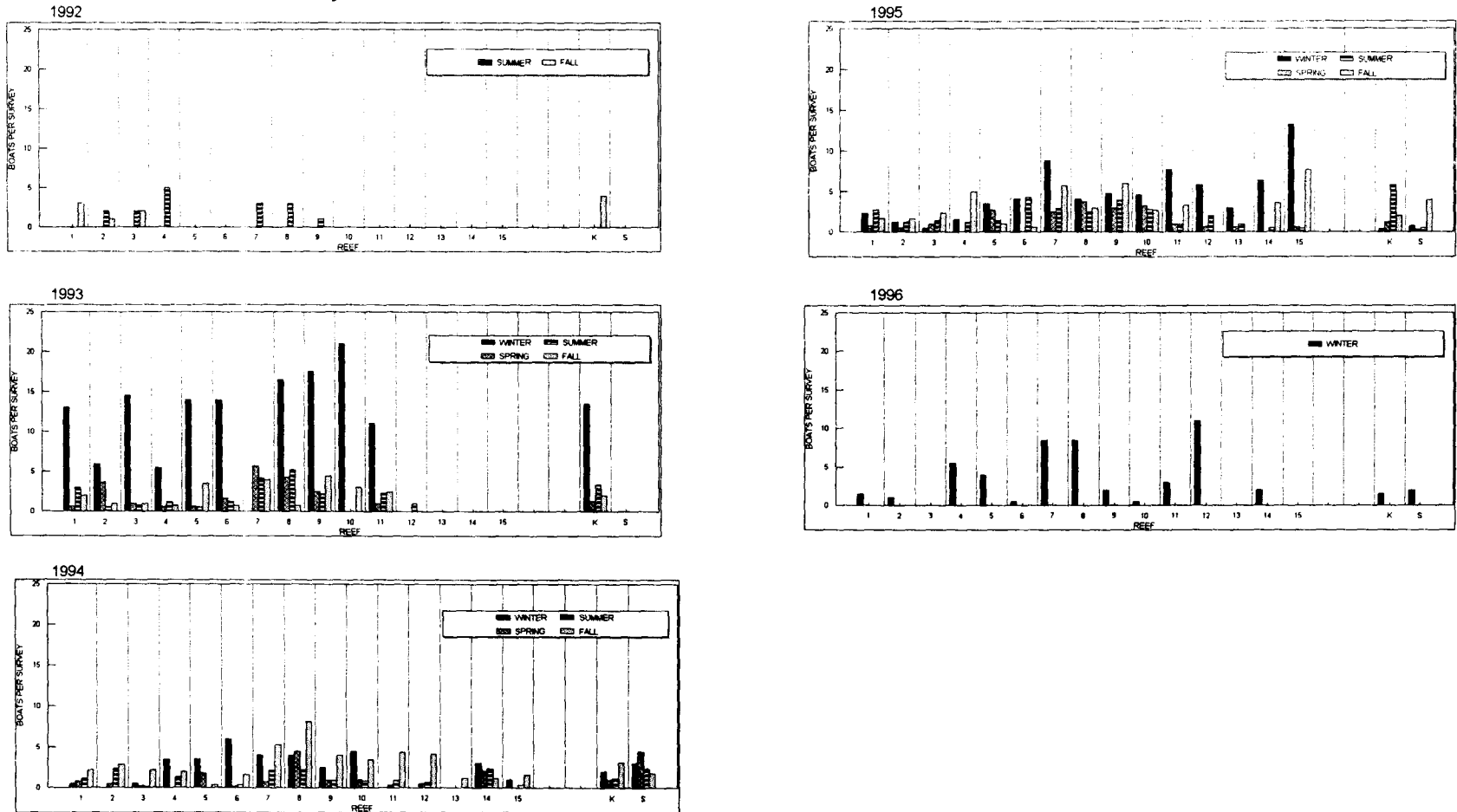
- 12 = Looe Key
- 13 = Pelican Shoals
- 14 = W. Sambos
- 15 = Sand Key

**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

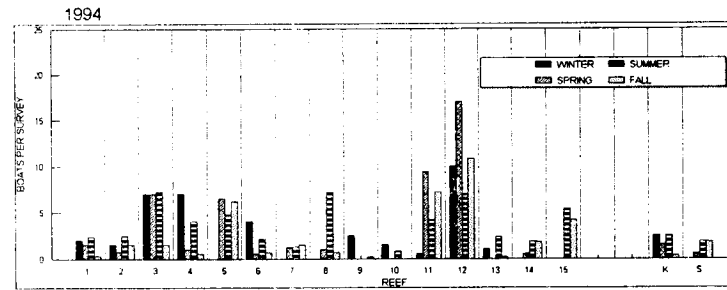
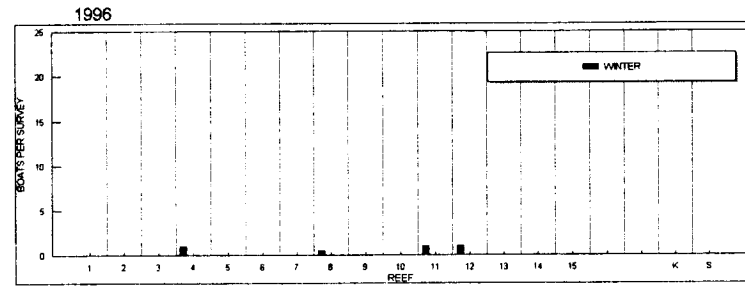
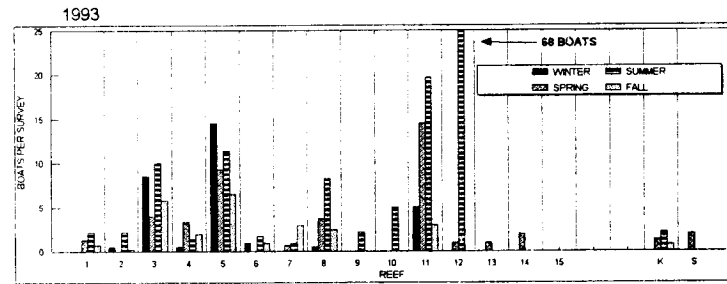
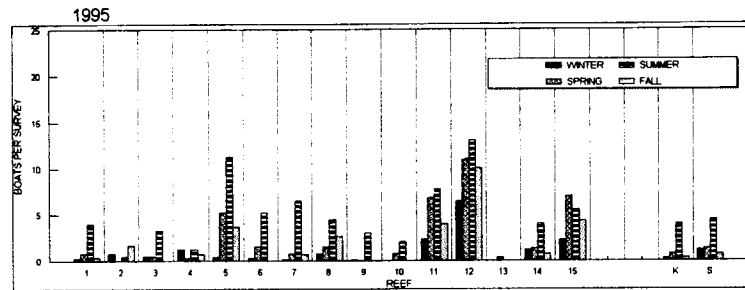
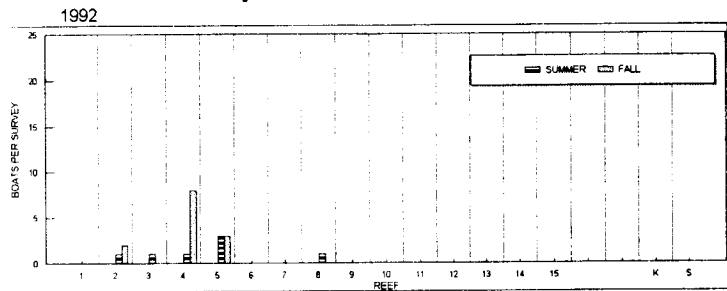
- 8 = Alligator Reef
- 9 = Tennessee Reef
- 10 = Coffins Patch
- 11 = Sombrero Reef

- 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.

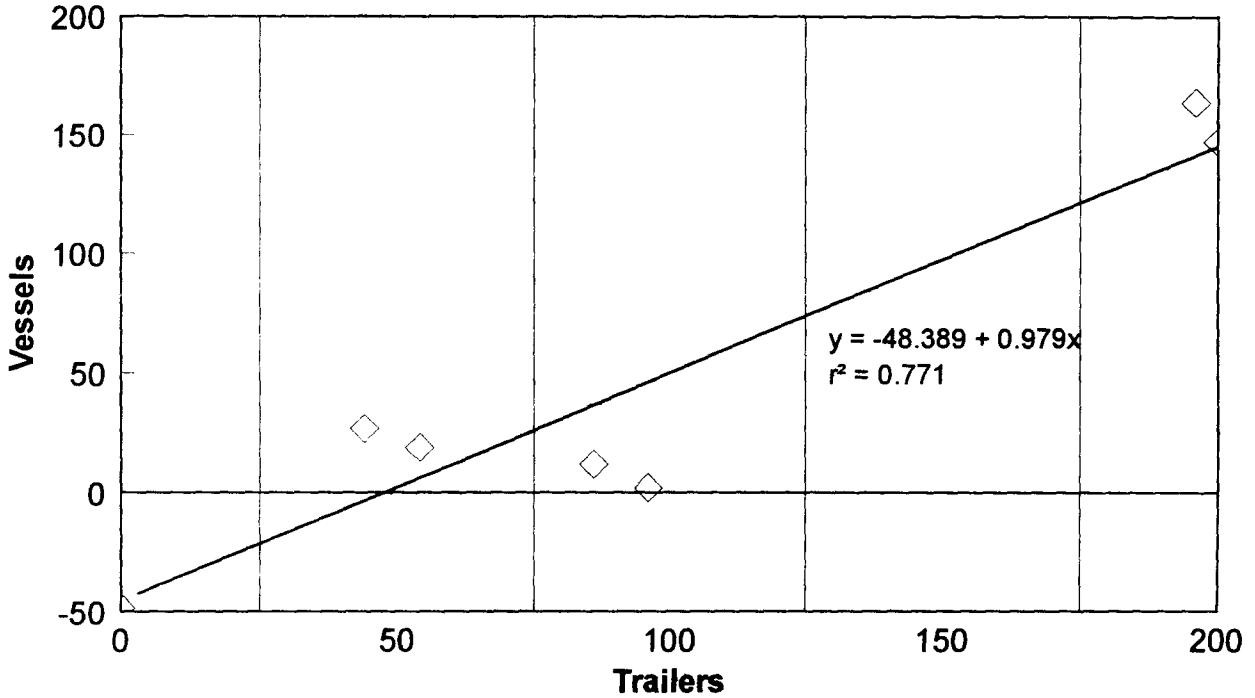
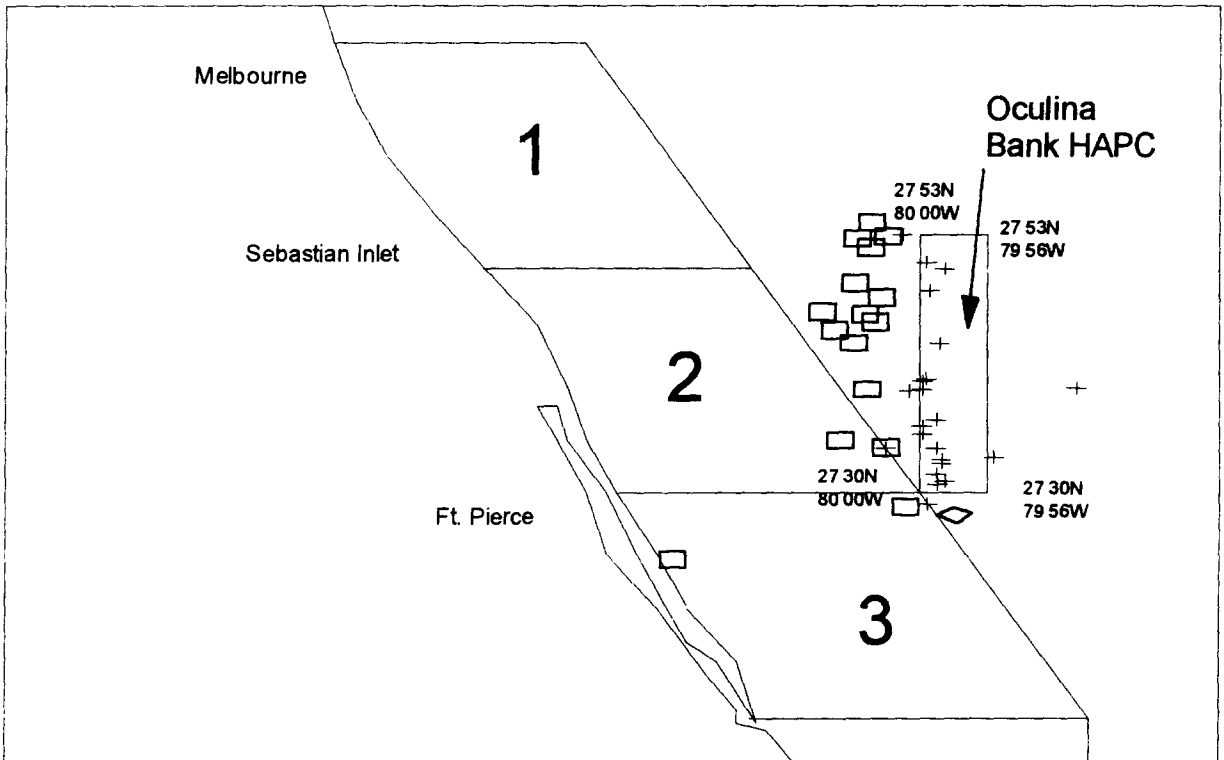


Figure 23. Vessels observed during 8 Aerial Surveys in the Oculina Bank Habitat Area of Particular Concern (HAPC), April 1995 - March 1996.



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

