Retention of Imitation Satellite Transmitters (ISTs) Fiberglassed to the Carapace of Sea Turtles

by

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Introduction

In order to obtain long term data on sea turtles, the application of tags has improved such that they may remain on sea turtles for periods of a year or more. However, there are concerns that the tags may This paper reports on the retention of tags fiberglassed to the carapace of Kemp's ridley (Lepidochelys kempi) sea turtles.

Materials and Methods

Twelve sub-adult Kemp's ridley sea turtles, approximately 32 months of age, from the Kemp's ridley Head Start project of the National Marine Fisheries Services' (NMFS) Galveston Laboratory were fitted with imitation satellite transmitters (ISTs), (Figure 1, Table 1). In order to prevent physical conflict between individuals, turtles were individually held indoor in partitioned raceways for the duration of the experiment. They were fed Purina Trout Chow supplemented with live blue crabs (Calinectes sapidus) during the last month of their captivity.

Tag Design. ISTs fabricated with epoxy resin were scaled down in dimensions (13 x 8 x 2 cm) and weight (335 g) to accommodate the small size of turtles available for experimentation. Scaled down dimensions were based on the proportion of dimensions of a Telonics ST-3 Satellite Transmitter to straight carapace lengths and widths of four previously tagged wild Kemp's ridley sea turtles. Weight was adjusted with split shot fishing lead to achieve a density equal to that of the ST-3 transmitter. Short plastic cable ties were used to simulate a satellite transmitter antenna.

IST Fabrication. Wooden molds were constructed to conform to the above dimensions. Prior to pouring the epoxy resin, molds were coated with PAM to facilitate removal of the finished product. Split shot was poured into the resin before it hardened and a black cable tie was positioned to serve as a mock antenna. Once hardened, each IST was removed from the mold and sanded to remove rough edges. Each finished IST was weighed and measured to verify that the appropriate specifications were achieved.

IST Attachment. Given the characteristic dorsal ridge of the juvenile Kemp's ridley, IST attachment was performed in three phases. Phase one consisted of shell preparation - cleaning, sanding and drying. Phase two involved construction of a level platform on the turtle's back for the IST. Finally, the IST was

attached. A rectangular clay mold was formed on the turtle carapace surrounding the area of IST attachment. A two part epoxy mixture of HobyPoxy Quick-Fix Formula 4 was poured into the mold. Due to the exothermic reaction of the epoxy mixture, the platform was made in multiple layers to prevent excessive heat and discomfort to the turtle. Three to 5 layers were used

depending on the height of a turtle's dorsal ridge. Each layer required approximately 5 minutes to react and harden. Once the platform cured and clay removed, the turtle was ready for IST attachment. The ISTs were attached by employing techniques previously used at the NMFS Galveston Laboratory for satellite tagging wild sea turtles. Strips of fiberglass cloth were laid across the IST and allowed to overlap onto the turtle carapace. The fiberglass cloth was held in place with epoxy resin. Three separate applications of epoxy and fiberglass cloth were used on each turtle. Usually 45 minutes to 1 hour of drying was allowed before applying the next layer of epoxy and cloth. Turtles were returned to their raceways after the final coat of resin was completely dry, approximately 1 - 2 hours.

Behavioral Monitoring and ITS Maintenance. Observation of the sea turtles' swimming and feeding behavior and documentation of IST sloughing was conducted approximately every two weeks. Conditions considered to be associated with IST sloughing were peeled, chipped, or raised fiberglass cloth. Algal growth on the carapace of the turtles was periodically cleaned off with a medium bristle brush and sponge. This prevented bacterial decomposition of turtle food (trout chow pellets) caught in the algae. Removing the algae also facilitated successful assessment of any developments in the sloughing process.

Tag Removal. The fiberglass cloth was cut with a hacksaw on the front and right sides of the IST. The IST and the remaining fiberglass cloth on the left and rear sides of the carapace were pulled off by hand in one piece. The fiberglass cloth on the anterior and right side of the carapace was easily removed with a screwdriver.

Discussion

Turtles were isolated from each other and held indoors, and thus, were not afforded normal environmental contacts such as direct exposure to sun, wave action, weather disturbances, rock jetties, etc. With the lack of natural environmental influences, we felt that the ISTs would have remain attached to the turtles for another year and extending the duration of the experiment would not have lead to any new information.

There was no attempt to remove the ISTs by pulling off the entire package in one piece. In hindsight though, we should have tried this, because once cut on two sides the ISTs came off very easily.

Byles[1] and Renaud believe that transmitters applied with epoxy resin and fiberglass cloth will fall off within 12-18 months under normal environmental conditions. Renaud believes the transmitters will come off in one piece, preventing a partially detached transmitter from being pulled around by a turtle. Renaud's view is supported by an earlier tagging experience in 1990. A satellite transmitter and its fiberglass coating was accidently knocked off a turtle in one piece after the resin had already set. This hypothesis was further substantiated by the easy removal of ISTs and fiberglass cloth at the conclusion of this experiment. A few bumps or jolts on rocks or platforms in the natural environment may produce the same result. Evidence that transmitters fiberglassed to the carapace of wild sea turtles also suggests that these structures do not remain for extended periods of time. One green sea turtle (Chelonia mydas) tagged during a radio tracking experiment at South Padre Island (Renaud et al. 1992), TX was recaptured 8 months later without its radio transmitter or sonic tag. The transmitter had been attached in the same manner described in this report.

This experiment tested the longevity of packages fiberglassed to sea turtle carapaces. The design of satellite transmitters by Byles[1] did take into account swimming and related behaviors. Tags are small compared to the turtles body weight ($\leq$6% body weight) and relatively streamline producing minimal resistance to swimming, feeding and probably mating. The swimming and feeding behavior of these sea turtles was comparable to that of hundreds of captive and wild sea turtles previously observed by the authors. The ISTs did not interfere with these normal daily activities. Turtles moved swiftly through the water in their holding tanks and executed very quick, sharp turns, necessary for the capture of live prey items in the wild. These turtles captured and fed on live crabs while in captivity. Their increase in weight (5.5 to 18.1 lb/yr, mean of 11.7 lb/yr) and length (3.4 to 8.6 cm/yr, mean of 6.1 cm/yr)) during the experiment is testament to their health an normal feeding behavior.

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[1]Personal Communication, U.S. Fish and Wildlife Service, Albuquerque, NM.

If tags fall off a turtle within 12 to 18 months, then they would not interfere with breeding behavior juvenile sea turtles. We feel that a transmitter would be knocked off a female turtle during the mating process and thus, not be a problem.

It is not thought that the transmitters make the turtles more vulnerable to predation. Tags blend in with the color of the turtle carapace and are quickly overgrown with algae to reduce any visual cues of their presence. White barnacles are commonly seen on turtle shells in the wild. It would seem that the high contrast of the barnacle shell would offer more of a visual cue to a predator than a tag which has much less contrast with the turtle shell.

In a similar study, Beavers et al. (1991) have compared the use of epoxy and fiberglass cloth to various dental compounds for ease of tagging. They did not report any deleterious effects or changes in turtle behaviors during their experiments. In summary, it is not felt that transmitter packages attached to sea turtle carapaces with epoxy and fiberglass cloth do harm to the animal.

References

Beavers, S. C., E. R. Cassano and R. A. Byles. 1991. Stuck on turtles: preliminary results from adhesive studies with satellite transmitters. Proceedings of the Eleventh Annual Workshop on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFC-301, pp. 135-138.

Renaud, M., G. Gitschlag, S. Manzella, and J. Williams. 1992. Tracking of green (Chelonia mydas) and loggerhead (Caretta caretta) sea turtles using radio and sonic telemetry at South Padre Island, Texas. June - September 1991. Final Report to U. S. Army Corps of Engineers (Galveston and New Orleans District). 52 p.

Table 1. Turtle flipper tag numbers, straight length and width, growth rates, and dates of platform and IST application and removal.

Turtle ID Number*	Fiberglass Loose on IST Edges**	Initial Straight Measurements L X W (cm)	Final Straight Measurements L X W (cm)	Straight Length Growth Rate cm/yr	Initial Weight Lbs**	Final Weight Lbs**	Weight Growth Rate Lb/yr	Platform Base Applied	IST Applied	IST Removed
QQA-025	F - B	41.3 x 42.0	49.5 x 50.0	6.2	23	33	7.5	3/12/92	3/12/91	7/08/92
QQA-860	R - F - B	40.3 x 41.7	48.5 x 50.3	6.2	22	44	16.6	3/13/91	4/01/91	7/08/92
QQA-969	R - F - B	42.7 x 40.8	47.2 x 48.0	3.5	24	38	10.9	3/28/92	4/01/91	7/08/92
QQA-974	R - F - B	38.6 x 37.9	47.0 x 45.0	6.6	18	34	12.5	3/28/91	4/01/91	7/08/92
QQA-942	F	39.6 x 39.8	48.0 x 48.0	6.6	21	39	14.0	3/28/92	4/02/91	7/08/92
QQA-106	F	41.7 x 42.2	47.4 x 47.4	4.4	23	41	14.0	3/28/91	4/02/91	7/08/92
QQA-913	F	40.1 x 40.4	48.1 x 49.5	6.2	21	31	7.8	3/28/91	4/02/91	7/08/92
QQA-854	F	38.9 x 39.3	49.8 x 50.9	8.5	20	31	8.6	3/28/91	4/02/91	7/08/92
QQA-121	F	39.1 x 40.0	47.1 x 48.3	6.3	21	30	7.1	4/01/91	4/03/91	7/08/92
QQA-033	R - F - L - B	41.4 x 42.0	45.7 x 45.0	3.4	25	32	5.5	4/01/91	4/03/91	7/08/92
QQA-960	F	42.3 x 43.7	50.5 x 50.9	6.4	25	47	17.3	4/01/92	4/03/91	7/08/92
QQA-063	F	39.9 x 39.6	50.8 x 48.8	8.6	22	45	18.1	4/02/91	4/03/91	7/08/92
			MEAN ± Std Err	6.1 ± 0.5			11.7 ± 1.3			

* Hasco Type, Style 681 inconnel tags applied to the right flipper of the turtle.

** R = right, F = front, L = left and B = back

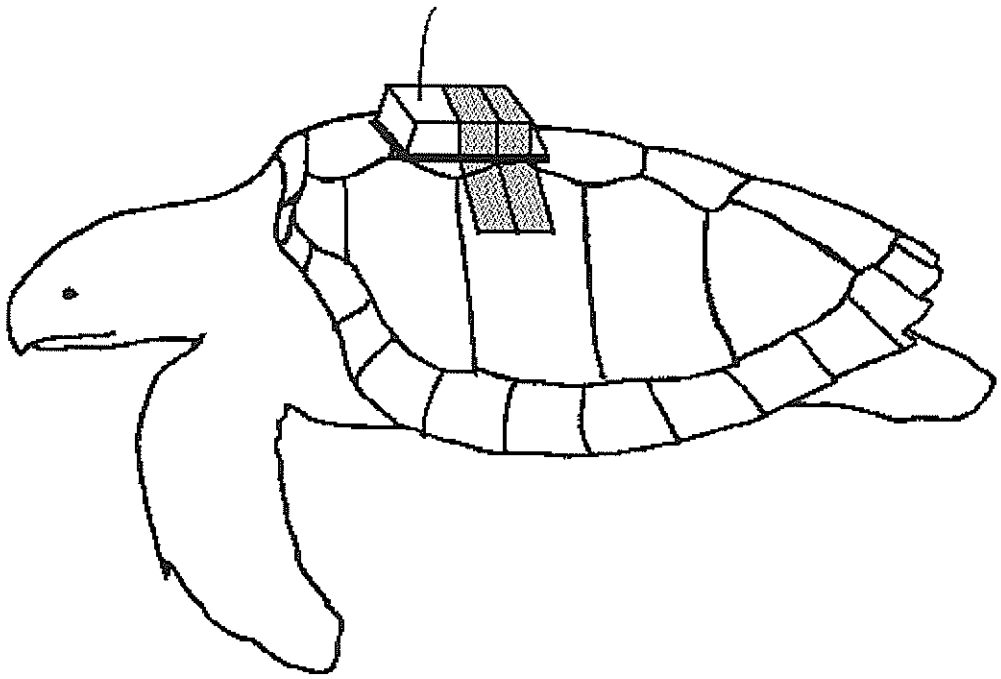

Figure 1. Schematic of Kemp's ridley sea turtle with imitation satellite transmitter.

Turtles: tagging 1501-91

INTRODUCTION

The early life history stages of sea turtles have not been as extensively studied as the reproductively active adults and their developing offspring. Moreover, the terms "juvenile" and "subadult" used to describe these early stages are not well defined. Other than possible current-mediated dispersal scenarios (Carr, 1986; Collard, 1987), nothing is known about the pelagic stage of sea turtle development. Information concerning the populations of immature turtles foraging in the coastal waters of the southeast U.S. has been slowly accumulating.

Carr and Caldwell (1956) conducted a one year tagging study on Kemp's ridley, Lepidochelys kempi, and green turtles, Chelonia mydas, purchased from Cedar Key turtle fishermen. Though scant and inconclusive, the data did provide information on seasonal occurrence, morphometrics, and estimates of abundance for immature turtles. More recently, fishery-independent capture and tagging efforts have characterized the populations of loggerhead, Caretta caretta, and green turtles foraging in the lagoonal habitat on the east coast of Florida (Ehrhart and Yoder, 1978; Mendonça, 1981; Mendonça and Ehrhart, 1982; Ehrhart, 1983; Mendonça, 1983). In addition, fishery-dependent research activities have provided data on the length frequency, seasonal occurrence, and long distance migrations of sea turtles collected along the Atlantic coast, primarily offshore of Cape Canaveral (Henwood, 1987; Henwood and Ogren, 1987).

In 1984, the NMFS Panama City Laboratory initiated long-term tagging studies of sea turtles occurring on the northwest and east-

central coasts of Florida. Efforts on the Gulf coast have been concentrated in the Apalachicola Bay-Panacea area (Rudloe et al., 1991) and near the Cedar Keys (Schmid and Ogren, 1990). The Kemp's ridley is the target species , and the species most frequently encountered.

In this paper I present results from the NMFS tagging study conducted on the east coast of Florida from 1986 to 1991. Furthermore, the term "juvenile" has been reserved for immature turtles utilizing the pelagic zone. A turtle is considered "subadult" upon recruiting to its respective coastal-benthic habitat, and then "adult" upon reaching sexual maturity.

STUDY AREA AND METHODS

A single commercial fishing vessel was contracted by National Marine Fisheries Service (NMFS), from May 1986 to December 1991, to measure, tag, and release sea turtles incidentally captured during shrimp trawling. Trawling effort extended from Amelia Island to Sebastian Inlet, Florida, with a concentration in the Cape Canaveral area defined by Henwood and Ogren (1987). During 1986 and 1987, seasonal (summer) trawling was conducted offshore of Winyah Bay, South Carolina, and adjacent coastal waters.

Captured turtles were double tagged with #681 inconel flipper tags (National Band and Tag Co., Newport, KT). Tagging information included: tag codes, species, date, location of capture, latitude/longitude, depth, gear type, standard straight-line carapace length (std SLCL), straight-line carapace width, weight (Kemp's ridley and green turtles only), and notes on the condition of the turtle. A cooperative T.E.D. testing program was started in 1988. Subsequently, effort data was available for 1989-91 which included: trawl size and type; number of tows and total tow time; and number of captured turtles.

RESULTS AND DISCUSSION

Since the implementation of this study, 864 loggerhead, 116 Kemp's ridley, and 42 green turtles have been captured, tagged, and released. In addition, a leatherback (Dermochelys coriacea) was captured and tagged 1.95 miles east of New Smyrna Beach. A total of 68 tagged turtles were recaptured or recovered by either incidental capture in commercial fisheries, sighting of nesting female, power plant intake canal, or beach stranding. A summary of the population structure of each species is given below:

Loggerhead turtle

Of the total number of loggerheads, 776 were collected off the east coast of Florida and 88 were collected offshore of Winyah Bay or adjacent South Carolina coastal waters. Loggerheads captured in Florida ranged from 38.23 to 110.01 cm standard straight-line carapace length (std SLCL). Similarly, turtles captured in South Carolina during the summer ranged from 42.29 to 105.41 cm std SLCL. Length frequency distributions for each area are shown in Figure 1 and Figure 2, respectively. The majority of the turtles, 64%, are in the late subadult size class (50-70 cm) typical of immature loggerheads in the western Atlantic (Carr, 1986; Mendonça and Ehrhart, 1982). The remaining turtles fall within the size class of Cape Canaveral nesting females. Analysis of yearly length frequencies revealed a bimodal distribution for these two groups which was slightly apparent in the total for all years. As noted by Henwood (1987), this pattern results from an influx of adult turtles during the nesting season. Loggerheads were present year round in the Cape Canaveral area (Table 1), with the highest

numbers encountered during the winter months (November, December, and January).

Forty-eight loggerheads were recaptured or recovered , 32 of which were initially tagged by the contracted vessel. Of the remaining 16 loggerhead recaptures: 7 were tagged in Georgia (awaiting response to data request); 3 were tagged at Hutchinson Island, FL; 1 was tagged in the Indian River Lagoon; 1 was tagged while nesting on Melbourne Beach; 2 were tagged in the Cape Canaveral area prior 1986; and 2 were tagged in locations yet to be identified. The amount of time between tagging and recapture ranged from 1 to 2,499 days; however, 84% were recaptured within a year of initial capture. Three loggerheads with the longest time spans (1,402 days, 1,975 days, and 2,499 days) were originally tagged with monel tags, which are highly susceptible to corrosion in the estuarine habitat within a short period of time. Though some tag corrosion was reported, the long retention times of the monel tags seem to indicate that these individuals had occupied an oceanic habitat.

Table 1. Monthly and yearly captures of loggerhead turtles in the nearshore waters of Florida and South Carolina (**boldface**).

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1986	-	-	-	-	1	5/**6**	**11**	**12**	5/**9**	37	31	44	161
1987	90	47	31	12	5	12/**14**	**8**	**16**	**10**	3/**2**	2	0	252
1988	1	0	16	1	2	0	4	3	2	6	8	16	59
1989	19	1	7	7	7	7	11	13	2	1	10	6	91
1990	3	10	8	8	8	5	29	10	10	10	16	28	145
1991	23	6	6	6	24	15	25	24	-	9	7	11	156
Total	136	64	68	34	47	44/**20**	69/**19**	50/**28**	19/**19**	66/**2**	74	105	

Table 2. Recaptures of loggerhead turtles.

Tag code	Sps	Date Tagged	Location	Date Recaptured	Location
PPF 601-602	CC	12/27/86	Port Canaveral, FL	12/31/86	Port Canaveral, FL
PPF 629-630	CC	12/31/86	Port Canaveral, FL	1/4/87	Port Canaveral, FL
PPF 663-664	CC	1/2/87	Port Canaveral, FL	1/16/87	Hutchinson Island, FL
PPF 519-520	CC	11/17/86	Cocoa Beach, FL	1/17/87	Melbourne, FL
PPF 753-755	CC	1/20/87	Melbourne, FL	2/21/87	Port Canaveral, FL
PPF 707-708	CC	1/13/87	Grant, FL	4/4/87	Port Canaveral, FL
PPH 638-639	CC	4/2/87	Port Canaveral, FL	4/5/87	Cocoa Beach, FL
PPH 602-603	CC	3/25/87	Port Canaveral, FL	4/12/87	Hillsborough Inlet, FL
PPH 600-601	CC	3/25/87	Port Canaveral, FL	6/10/87	Sapelo Island, GA
PPF 651-652	CC	1/2/87	Port Canaveral, FL	6/26/87	Hampton, VA
PPH 682-683	CC	6/13/87	Port Canaveral, FL	6/15/87	Patrick AFB, FL
PPH 664-665	CC	5/27/87	Port Canaveral, FL	7/13/87	Jensen Beach, FL
PPJ 525-526	CC	7/27/87	Winyah Bay, SC	8/3/87	Charleston Harbor, SC
PPJ 567-568	CC	9/06/87	Winyah Bay, SC	10/06/87	Winyah Bay, SC
PPF 893	CC	2/10/87	Port Canaveral, FL	10/15/87	Cedar Island, NC
PPH 668-669	CC	6/08/87	Port Canaveral, FL	1/2/88	Kennedy Space Cntr, FL
PPF 613-614	CC	12/30/86	Kennedy Space Cntr, FL	1/10/89	Kennedy Space Cntr, FL

Table 2. cont'd

Tag code	Sps	Date Tagged	Location	Date Recaptured	Location
PPS 971-972	CC	5/4/89	Port Canaveral, FL	5/10/89	Port Canaveral, FL
PPY 540-541	CC	1/4/87	Port Canaveral, FL	2/13/90	Port Canaveral, FL
QQC 345-346	CC	7/13/90	New Smyrna Beach, FL	7/18/90	Ponce Inlet, FL
X 977-978	CC	1/2/90	Cape Canaveral, FL	8/2/90	Port Canaveral, FL
QQC 379-380	CC	8/6/90	Ponce Inlet, FL	11/1/90	Volusia Co., FL
PPY 506-507	CC	12/6/89	Cocoa Beach, FL	11/6/90	Kennedy Space Cntr, FL
QQE 844-845	CC	11/2/90	Port Canaveral, FL	12/28/90	Port Canaveral, FL
X 1230-1231	CC	12/31/90	Cape Canaveral, FL	1/28/91	Port Canaveral, FL
QQH 678-679	CC	12/20/90	Port Canaveral, FL	2/4/91	Port Canaveral, FL
QQH 799-800	CC	5/17/91	Amelia Island, FL	5/18/91	Amelia Island, FL
X 999-1000	CC	1/5/90	Cape Canaveral, FL	6/10/91	Port Canaveral, FL
QQH 788-789	CC	4/13/91	Port Canaveral, FL	6/19/91	Core Sound, NC
PPY 518-519	CC	1/1/90	Kennedy Space Cntr, FL	8/3/91	Port Canaveral, FL
X 1250-1251	CC	1/2/91	Cape Canaveral, FL	8/13/91	Port Canaveral, FL
QQE 877-878	CC	11/23/90	Port Canaveral, FL	8/14/91	Kennedy Space Cntr, FL
GA 4018,6162, 5053 & 6348	CC			12/03/86	Port Canaveral, FL

Table 2. cont'd

Tag code	Sps	Date Tagged	Location	Date Recaptured	Location
PPD 047-048	CC			12/31/86	Port Canaveral, FL
NNZ 332 K 6282	CC	8/22/86	Indian River Lagoon, FL	1/16/87	Indian Harbor Beach, FL
PPD 181	CC			10/25/87	Flagler, FL
AAM 646	CC	3/9/83	Cape Canaveral, FL	8/05/88	Port Canaveral, FL
PPD 134-135	CC			12/15/88	Cocoa Beach, FL
PPW 279 AAJ 677	CC	12/28/88	Hutchinson Island, FL	3/22/89	Port Canaveral, FL
T 2761	CC	7/7/82	Melbourne Bch., FL	5/11/89	Port Canaveral, FL
AAE 414	CC	10/8/85	Port Canaveral, FL	8/10/89	Port Canaveral, FL
AAN 572	CC			7/30/89	Eau Gallie, FL
PPD 171	CC			6/25/90	Port Canaveral, FL
PPD 027-028	CC			7/28/90	Port Canaveral, FL
PPW 379	CC	7/11/89	Hutchinson Island, FL	12/6/90	Satellite Beach, FL
S 13152	CC			6/27/91	Cape Canaveral, FL
K 10096	CC			7/4/91	Port Canaveral, FL
PPW 650 BBC 362	CC	4/15/91	Hutchinson Island, FL	7/19/91 & 7/21/91	Port Canaveral, FL Port Canaveral, FL

Kemp's ridley turtle

One hundred and thirteen Kemp's ridleys were captured on the Atlantic coast of Florida, ranging from 21.46 to 60.26 cm std SLCL. Three Kemp's ridleys were captured offshore of Winyah Bay, S.C., ranging from 34.1 to 48.58 cm std SLCL. Length frequency distribution for all ridleys collected is given in Figure 3. The smallest Kemp's ridleys captured at Cape Canaveral (20-25 cm) coincide with the minimum size for post-pelagic turtles in Louisiana and the northwest Florida panhandle. With the exception of a single turtle, the Kemp's ridleys caught on the east coast can be classified as immature (< 60 cm). Most of these turtles are in the early to mid-subadult size classes. A similar size distribution has been reported for Kemp's ridleys collected in the northeastern Gulf of Mexico (Rudloe et al., 1991). Kemp's ridleys were captured year round in the Cape Canaveral area (Table 3); however, captures were highest during the winter months (December to March). Despite long term tagging efforts in southeast Florida, Kemp's ridleys tagged in the Atlantic have not been reported or recaptured in the Gulf of Mexico. It is still not certain whether the Atlantic ridleys recruit to the breeding population.

Seventeen Kemp's ridley turtles were recaptured or recovered. Two of the recaptures were headstart turtles, released offshore of Padre Island,Texas and captured on the Atlantic coast of Florida 9-10 months later. Two Kemp's ridleys originally tagged in the Cape Canaveral area during winter were recovered in Georgia and South Carolina the following summer. Two other turtles had multiple recaptures within the Cape Canaveral area, one tagged in November

was caught once in December and then again in May of the following year. Another ridley tagged in May was recaptured twice in September of that year. All Kemp's ridleys were recaptured within a year, with the exception of a single turtle captured in the area of initial tagging after 615 days at large.

Table 3. Monthly and yearly captures of Kemp's ridley turtles in the nearshore waters of Florida and South Carolina (**boldface**).

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1986	-	1*	-	-	1	0/**0**	**0**	**0**	0/**1**	1	1	4	9
1987	13	10	4	1	0	1/**0**	**0**	**1**	**0**	1/**1**	1	2	35
1988	1	0	17	0	0	0	2	1	1	1	2	2	27
1989	1	2	1	4	1	8	0	1	0	0	3	1	22
1990	0	3	1	2	4	0	0	0	4	1	1	3	19
1991	2	0	1	0	0	0	0	0	-	1	0	0	4
Total	17	16	24	7	6	9	2	2/**1**	5/**1**	5/**1**	8	12	

* Recapture of headstart Kemp's ridley

Table 4. Recaptures of Kemp's ridley turtles.

Tag code	Sps	Date Tagged	Location	Date Recaptured	Location
PPF 541-542	LK	11/29/86	Port Canaveral, FL	12/31/86 & 3/23/87	Port Canaveral, FL Port Canaveral, FL
PPF 595	LK	12/26/86	Cocoa Beach, FL	7/25/87	Bull Bay, SC
PPH 542-543	LK	2/25/87	Port Canaveral, FL	7/28/87	Glynn County, GA
PPJ 651-652	LK	3/14/88	Cape Canaveral, FL	3/16/88	Port Canaveral, FL
X 037-038	LK	3/2/88	Cape Canaveral, FL	3/16/88	Canaveral Pier, FL
PPS 858-859	LK	12/14/88	Cocoa Beach, FL	1/22/89	Grant, FL
PPS 846	LK	12/1/88	Port Canaveral, FL	3/25/89	Cape Canaveral, FL
PPS 969-970	LK	4/30/89	Cape Canaveral, FL	6/14/89	Port Canaveral, FL
PPS 841	LK	11/25/88	Port Canaveral, FL	6/24/89	Port Canaveral, FL
PPY 462	LK	8/16/91	Port Canaveral, FL	2/17/89	Port Canaveral, FL
PPY 504-505	LK	12/1/89	Cocoa Beach, FL	5/22/90	Port Canaveral, FL
QQC 308-309	LK	5/21/90	Port Canaveral, FL	9/22/90 & 9/30/90	Cape Canaveral, FL Cape Canaveral, FL
QQE 815-816	LK	9/25/90	Cape Canaveral, FL	10/2/90	Cape Canaveral, FL
PPS 935	LK	2/28/89	Port Canaveral, FL	11/05/90	Port Canaveral, FL
NNT 663	LK		Padre Island, TX	2/10/86	Cocoa Beach, FL
PPD 752-753	LK	4/3/87	Hutchinson Island, FL	10/24/87	Cocoa Beach, FL

NNY 056	LK	Padre Island, TX	3/22/88	Cocoa Beach, FL

Green turtle

Of the total number of green turtles collected along the east coast, forty-one were taken from Florida waters, ranging from 24.00 to 55.37 cm std SLCL. A single green (24.70 cm std SLCL) was captured offshore of Winyah Bay. Length frequency distribution for green turtles is presented in Figure 4. Eighty-one percent of the greens captured off the east coast of Florida were early subadults less than 40 cm and the majority of these turtles were caught within 2 miles of the coast. In addition, fishermen in the Canaveral area report small green turtles occurring within the inlet and adjacent port basins. Capture data from other studies indicate that this size class of green turtle inhabits the Sabellariid worm reef tracts off the southeast coast of Florida prior to entry into the lagoonal habitat (Ernest et al., 1989; Guseman and Ehrhart, 1990; Wershoven and Wershoven, 1989). Wershoven and Wershoven (1989) analyzed the stomach contents of stranded green turtles and determined that the smaller turtles were

Canaveral area and a third was tagged with a series distributed to Fort Lauderdale, Florida (awaiting response to data request). Of the two Cape Canaveral green turtles, one can be classified as a "within season" recapture, where the turtle was initially tagged in January and then recaptured in April, approximately 42 nautical miles to the north. The other green turtle was recaptured "between seasons", initially tagged in January and then recaptured the following October at the site of initial capture.

Table 5. Monthly and yearly captures of green turtles in the nearshore waters of Florida and South Carolina (**boldface**).

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1986	-	-	-	-	1	0/**0**	**0**	**0**	0/**0**	0	0	2	3
1987	7	1	0	1	0	0/**0**	**1**	**0**	**0**	0/**0**	0	6	16
1988	0	0	0	0	0	0	0	0	1	0	0	2	3
1989	4	0	0	0	0	3	0	0	0	0	1	0	8
1990	0	0	0	0	0	0	0	0	1	3	5	3	12
1991	0	0	0	0	0	0	0	0	-	0	0	0	0
Total	11	1	0	1	1	3/**0**	0/**1**	0/**0**	2/**0**	3	6	13	

Table 6. Recaptures of green turtles.

Tag code	Sps	Date Tagged	Location	Date Recaptured	Location
PPF 774-775	CM	1/22/87	Port Canaveral, FL	4/15/87	Ponce Inlet, FL
X 1128	CM	1/11/90	Cape Canaveral, FL	10/2/90	Cape Canaveral, FL
NNV 711	CM			9/30/88	St. Augustine, FL

CONCLUSIONS

Long distance recaptures continue to support the seasonal north-south migratory pattern suggested for east coast populations of loggerhead (Henwood, 1987) and Kemp's ridley (Henwood and Ogren, 1987). Turtles initially tagged in Cape Canaveral during the winter months were recaptured as far north as Chesapeake Bay during the summer months. Similarly, recaptures of turtles tagged in northern waters during summer demonstrate the importance of the Cape Canaveral area as a winter foraging ground.

LIST OF REFERENCES

Carr, A. 1986. New perspectives on the pelagic stage of sea turtle development. NOAA Tech. Memo. NMFS-SEFC-190:1-36.

Carr, A. F. and D. K. Caldwell. 1956. The ecology and migrations of sea turtles: 1. Results of field work in Florida, 1955. Am. Mus. Nov. 1793:1-23.

Collard, S. B. 1987. Review of oceanographic features relating to neonate sea turtle distribution and dispersal in the pelagic environment: Kemp's ridley (Lepidochelys kempi) in the Gulf of Mexico. U.S. Dept. Commerce, Nat. Mar. Fish. Serv., Final Rep. 40-GFNF-5-00193.

Erhart, L. M. 1983. Marine turtles of the Indian River Lagoon System. Florida Scientist 46:337-346.

Ehrhart, L. and M. 1978. The marine turtles of Merritt Island National Wildlife Refuge, Kennedy Space Center, Florida. In: G. E. Henderson (Editor). Proceedings of the Florida Interregional Conference on Sea Turtles. Florida Mar. Res. Publ. 33:25-30.

Ernest, R. G., et al. 1989. Population dynamics of sea turtles utilizing shallow coastal waters off Hutchinson Island, Florida. In: Eckert, S. A., K. L. Eckert, and T. H. Richardson (Compilers). Proceedings of the Ninth Annual Workshop on Sea Turtle Biology and Conservation. NOAA Tech. Memo. NMFS-SEFC-232.

Guseman, J. L. and L. M. Ehrhart. 1990. Green turtles on Sabellarid worm reefs: initial results from studies on the Florida Atlantic coast. In: Richardson, T. I., J. I. Richardson, and M. Donnelly (Compilers). Proceedings of the Tenth Annual Workshop on Sea Turtle Biology and Conservation. NOAA Tech. Memo. NMFS-SEFC-278:125-127.

Henwood, T. A. 1987. Movements and seasonal changes in loggerhead turtle, Caretta caretta, aggregations in the vicinity of Cape Canaveral, Florida (1978-84). Biol. Conserv. 40:191-202.

Henwood, T. A. and L. H. Ogren. 1987. Distribution and migrations of immature Kemp's ridley turtles (Lepidochelys kempi) and green turtles (Chelonia mydas) off Florida, Georgia, and South Carolina. Northeast Gulf Sci. 9:153-159.

Mendonça, M. T. 1981. Comparative growth rates of wild, immature Chelonia mydas and Caretta caretta in Florida. J. Herpetology 15:447-451.

Mendonça, M. T. 1983. Movements and feeding ecology of immature green turtles(Chelonia mydas) in Mosquito Lagoon, Florida.

Copeia 1983: 1013-1023.

Mendonça, M. T. and L. M. Ehrhart. 1982. Activity, population size, and structure of immature Chelonia mydas and Caretta caretta in Mosquito Lagoon, Florida. Copeia 1982:161-167.

Rudloe, A., J. Rudloe, and L. H. Ogren. 1990. Occurrence of immature Kemp's ridley turtles, Lepidochelys kempi, in coastal waters of northwest Florida. Northeast Gulf Sci. 12:49-53.

Schmid, J. R. and L. H. Ogren. 1990. Results of a tagging study at Cedar Key, Florida, with comments Kemp's ridley distribution in the southeastern U.S. In: Richardson, T. I., Richardson, J. I., and Donnelly, M. (Compilers). Proceedings of the Tenth Annual Workshop on Sea Turtle Biology and Conservation. NOAA Tech. Memo. NMFS-SEFC-278:129-130.

Wershoven, R. and J. Wershoven. 1989. Juvenile green turtles in a developmental habitat. Underwater Naturalist 18:14-17.