Feeding ecology and habitat affinities of Kemp's ridley sea turtles (*Lepidochelys kempi*) in the Big Bend, Florida.

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Introduction

The Kemp's ridley (*Lepidochelys kempi*) is considered the most endangered of the seven extant marine turtle species (Ross et al. 1989). The US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) estimate the breeding population at 1,500 to 3,000 individuals. The nesting population has been reduced from approximately 40,000 on one day to no more than 700 annually (Magnuson et al. 1990, USFWS & NMFS 1992). Conservation measures for the species have focused on the protection of the nesting beach, captive rearing (head starting), and the implementation of turtle excluder devices (TEDs) on shrimp nets. Five hundred to 5,000 ridleys are still taken incidentally yearly by shrimp trawls (Magnuson et al. 1990). Lack of knowledge about early life stages of the Kemp's ridley sea turtle currently hinders recovery efforts for this federally listed species.

In the species recovery plan for the Kemp's ridley (U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS), 1992), the recovery team identified in-water, live capture studies as a Priority I Task for recovery of the species to determine seasonal use of nearshore habitat by juvenile/subadults. The U.S. Geological Survey, Biological Resources Division (USGS-BRD) has targeted marine turtles on their Biological Resource and Management Issues agenda. In addition, an independent scientific review team (Eckert et al. 1994) has recommended that research efforts for Kemp's ridley be focused on a large-scale mark and recapture program that should, in part, provide information on growth and survival rates, size-frequency distributions, sex ratios, habitat use, and movement patterns for wild and headstarted juvenile turtles.

Juvenile and subadult Kemp's ridleys are known to utilize the shallow nearshore waters of the north and central West Coast of Florida (Ogren 1989, Rudloe et al. 1991, Schmid 1998, Schmid and Ogren 1992). In the nearshore waters of Cedar Key, Florida, Schmid and Ogren (1992, Schmid 1998) have been conducting a long-term (1986-1995) study of wild subadult Kemp's ridleys. This is one of few studies that has characterized the population of Kemp's ridleys utilizing developmental habitat in the region.

The current study was undertaken as part of a collaborative effort between the NMFS, Southeast Fisheries Science Center, Panama City, Florida, and USGS-BRD, Florida Caribbean Science Center, Gainesville, Florida, to establish sampling methods for development of population indices for monitoring Kemp's ridleys in the Florida Panhandle.

Objectives

The goals of the NMFS/USGS ridley research in the Florida Big Bend area have been to define patterns of occurrence, relative abundance (vis-a-vis other sea turtle species), growth rate, sex ratio, size frequency distribution, habitat use, and movement. To better understand how Kemp's ridleys utilize benthic habitats we have also begun examining their prey selection and preference during FY 98.

Materials and Methods

Study Area

Sampling has been conducted from Apalachee Bay to Suwannee Sound within the Florida Big Bend. The specific areas targeted for sampling have included Apalachee and adjacent bays, between Dallus Creek and Big Grass Island (near Fisherman's Rest), and the vicinity of Pepperfish Keys. The majority of netting in 1995 was conducted in and around Dickerson and Levy Bays, whereas the majority of netting in 1996 and 1997 was conducted in the other two locations. Much of the Apalachee Bay area is characterized as estuarine habitat with oyster beds, seagrass, sand, and mud patches throughout. Seagrass beds with sand substrate characterize the more southern capture areas. In 1998 sampling was concentrated in Deadman Bay due to the abundance of ridleys, the previously high capture rate, and the high degree of recreational scallop harvesting. The bulk of the effort was concentrated north of the Steinhatchee River around The Bars (Figure 1). Several major paleochannels bisect the broad seagrass shelf underlying the bay. Ridleys are known to utilize these bathymetric features to move in and offshore while exploiting the abundant prey along the edge of the shallower grass flats (Carr and Caldwell 1956, Rudloe et al 1991, Schmid 1998).

Capture Methods

Several capture methods, including set-netting, strike-netting, and hand capture, have been used. All have proven successful but vary in efficacy depending on conditions.

Passive

A standard set-netting procedure was conducted. A 50m x 6m nylon net (25cm bar) was stretched across the main E/W channel. Each end was held in place by a large (@ 25kg) anchor. Floats were attached along the headline to supplement floatation and serve as aides to navigation. The net was checked for turtles hourly. Any turtle observed in the net were immediately removed. These methods are consistent with those of other in-water studies (Schmid1998, Schmid and Ogren 1992).

Strong tides and a high frequency of boat activity hinders set-netting. It is therefore best to conduct this sampling during neap tides, on weekdays, and early in the summer before scallop season commences.

Active

Two observers looked into the water with polarized glasses, one port and one starboard, while a third person piloted the boat on the predetermined course. When a turtle was spotted a marker was dropped at that spot. The turtle was either pursued for capture or the observation will be noted.

Active methods are best suited to periods of high visibility and increased boat traffic. These tactics should therefore be applied during calm weather, high sun, clear water, and high activity conditions.

Strike-netting

After marking the spot where the turtle was seen the observer watched the fleeing animal while directing the pilot into position. The second observer then released the net. The pilot encircled the turtle as the net ran off the stern. Turtles generally become entangled in the net and were easily removed from the boat. A swimmer removed individuals that were encircled but continued to avoid becoming entangled. Initially a 150 x 6 m nylon net (25cm bar) net was used for strike-netting but was later replaced by a 150 x 2.5 m monofilament net (10 cm bar) for its superior ability to contain small turtles.

Hand-capture

This method was generally reserved as a last resort if an animal escaped entanglement in a strike-net or if the water was too shallow to run the boat. After pursuing an individual for a short period a diver jumped off the boat onto the turtle while the rest of the crew returned in the boat to pick up both turtle and diver. This has been effective with animals as small as 20.7 cm SSCL and as large as 70.7 cm SSCL. Because Kemp's ridleys will attempt to hide in the seagrass after fleeing a short distance, they are well suited to capture by this method.

Biometric and Non-biometric Data

Turtles were checked for evidence of previous tagging, e.g. tag scars, living, flipper, and PIT (Passive Integrated Transponder) tags. Living tags appear as a white patch near the center of a carapacial scute. Living tags are formed by transplanting a piece of lighter colored plastral tissue into a scute on the darker carapace at different scute locations to distinguish between year classes (Fontaine et al. 1993). The NMFS Head-start Program in Galveston, Texas has performed this procedure on all head-started turtles since 1984. If flipper tags were not present, #681 inconel flipper tags (National Band and Tag Co., supplied by NMFS, Miami) were placed on the trailing proximal edge of both anterior flippers of all marine turtle species captured. If a PIT tag was not detected by scanning the anterior flippers and shoulder region then one was placed subcutaneously in the dorsal left anterior flipper of all Kemp's ridleys. Any biofoulents were removed from the tags of recaptured animals to help aid in retention of flipper tags.

Measurements including carapace and plastron lengths and widths, and overall body mass was obtained for each individual. The carapace measurements included both curved and straight-line measurements for the following: 1) standard carapace length (from the precentral scute at carapace midline to posterior margin of postcentrals, 2) minimum carapace length, 3) notched carapace length, and 4) total

carapace length. (See Pritchard et al. 1983 for full descriptions and diagrams of carapace measurements.) Curved and straight-line carapace widths were measured at the widest point of the dorsal side. Tree calipers (95 cm length or 40 cm) were used for all straight-line measurements and a 150 cm flexible tape measure was used for all curved measurements, all to the nearest mm. Using hanging Pesola spring scales, turtles weighing less than 2 kg were weighed to the nearest 0.02 kg, between 2 and 20 kg were weighed to the nearest 0.2-kg and those greater than 20 kg to the nearest 0.5 kg. Photographs were taken of the full body of each individual (carapace and plastron) and of deformities or mutilations. When possible blood was drawn from Kemp's ridleys for sex determination.

Twenty-seven ridleys captured were held for fecal samples. The standards set forth by the Florida Department of Environmental Protection (FDEP) were strictly followed. Fifty-four inch diameter molded cattle watering tanks were filled two and a half feet deep with synthetic seawater and maintained outdoors under 50% shadecloth. After being transported to the Florida-Caribbean Science Center in a climate-controlled vehicle, each animal was placed in its own tank. Tanks were isolated from one another to prevent the spread of pathogens. Fecal matter was removed from the tanks as soon as observed. To insure water quality standards each tank in use had a backup tank in case of any unforeseen events. Terry Heaton Jones and/or Elliot Jacobson were the local veterinarians on the project. All turtles will be released within 48 hours regardless of obtaining a fecal sample (see Burke et al. 1993b, 1994 for full description). Fecal samples were frozen for later examination without the loose of color, which is often important in the identification of crabs. Before analysis the samples will be rinsed, air-dried for 24 hours, and sieved through a 4 mm screen. Each fragment will be classified to the lowest taxon possible with the aid of a dissecting scope. Fragments with the same identification will be grouped and a list of components for each sample will be compiled. These data will be used to calculate the percent occurrence for each component. The grouped samples will then be dried at 60° C for 48 hours and weighed on an electronic balance. These weights will be used to calculate the relative importance (dry mass percentage) of each diet component in each turtle's fecal sample (Burke et al. 1993, 1994, Shaver 1991,). Percent occurrence (% O) and percent dry mass (% DM) will be calculated as follows:

$$\% \text{ O} = \frac{\text{Number of samples in which a particular prey species occurred}}{\text{Total number of samples}} \times 100$$

$$\% \text{ DM} = \frac{\text{Weight of a particular prey species in a sample}}{\text{Total weight of all prey species in that sample}} \times 100$$

Salinity and water temperatures were obtained at the time of capture using a YSI model 30 meter. Depth, tidal vector and velocity, and substrate and vegetative composition were also recorded. Position was recorded at each capture location using a differentially corrected Magellan NAV DLX -10 GPS with accuracy better than 10 meters. Universal Transverse Mercator (UTM) coordinates were used in lieu of latitude and longitude.

Results

Captures

A total of 43 days were spent netting or searching for turtles. Seventy-three new captures and 13 recaptures were made for a total of 86 captures. An average rate of two captures per trip was observed. The number of captures per trip ranged from zero to 10. The majority of turtles were captured in the vicinity of The Bars. Seventeen (19.8%) turtles were captured by hand and 68 (79.1%) using strike-nets. In 1998, 1.5 km/net/hrs of set-netting yielded only one loggerhead (CPUE 0.67 turtles/km/net/hr). Set-netting was only attempted early in the season and was abandoned for more productive methods. Synoptic data on individuals by capture location are presented in Appendix I.

Kemp's ridleys

The sixty-three Kemp's ridleys captured ranged in size from 20.7 to 51.8 cm straight standard carapace length (anterior notch to posterior tip; SSCL) and weighed from 1.25 to 19.75 kg (Appendix I). Kemp's ridleys were on average the smallest of the three species captured ($\bar{x}$ = 32.7 cm SSCL, standard deviation (SD) = 7.8, range = 31.1). Thirteen recaptures were made of 9 individuals. One individual, SSN948/949, was recaptured 3 times and two other individuals, XXA834 and XXA819, were recaptured twice. Hand captures accounted for 17 (22.4%) of the 76 ridley captures. Strike-netting produced the remaining 59 (77.6 %) captures. Turtles were captured over seagrass, sand, or sand/mud substrate. Blood samples were collected from 29 individuals for future RIA analysis.

Fecal Samples

Thirty fecal samples were collected from 29 individual ridleys. Two samples were obtained from turtles that defecated during field processing. All other samples were collected from animals held with the specific intention of collecting a fecal sample. Four species of prey, all crabs, have been observed in the fecal samples. Cursory examination indicates spider crab (*Libinia* sp.) to be present in all (100% O) samples collected. Blue (*Callinictes* sp., @ 20% O), stone (*Menippe* sp., @ 13% O) and purse crab (*Persephona* sp., @ 7% O) occurred in a few fecal samples, though several individuals were often present in each fecal bolus.

Green Turtles

The five green turtles captured averaged slightly larger than the Kemp's ridleys, although both were captured in the same areas ($\bar{x}$ = 37.1 cm, SD = 7.0, min = 28.6, max = 47.8, range = 28.6 - 47.8 cm). Weights ranged from 3.2 to 14.75 kg. All green turtles were captured over seagrass beds using strike-nets (Appendix I). No fibropapillomatosis was observed in 1998. This is a substantially lower figure than the last two years, with an 18.1% and 55% incidence respectively.

Loggerheads

The loggerhead was the largest species captured ($\bar{x}$ = 52.1 cm, SD = 14.2, min = 33.5, max = 66.9, range = 33.4). The largest individual was not included in the statistical analysis because its SSCL could not be measured with 95 cm calipers, therefore, the mean size of this species is slightly underestimated. Four of the five individuals captured were secured by strike-net, the last by set-net (Appendix I). The set-netted individual was the only capture in the Pepperfish Keys area and came from a paleochannel. All other loggerhead captures occurred over seagrass beds or over sand substrates. The four largest turtles appeared to be female by external characteristics and the smallest was too immature to determine gender by external anatomy.

Strandings

Four stranded marine turtles were recovered this year, 2 ridleys and 2 loggerheads. Both loggerheads and one ridley were represented by skeletal remains found near or slightly above the wrack line. The remaining ridley, a fresh carcass, was found floating. The cause of death was determined to be boat impact.

Discussion and Recommendations

The majority (86%) of marine turtles captured during this study in Deadman Bay were wild juvenile Kemp's ridleys. This suggests the shallow waters in this area are important spring, summer, fall, and possibly winter developmental habitat for the species and that this area may figure prominently in the recovery of the highly endangered Kemp's ridley.

By focusing efforts in an area previously identified as an area of concentration, the number of turtles captured and recaptured increased significantly from past years. Additionally, a specific site, The Bars, was identified as a "hot spot". By consistently revisiting this site, observations on the short-term site fidelity of individual turtles were made. Residence time at this location was as long as 5 months (XXA834) despite significant perturbation(s): tagging and fecal collection, recapture, and the storm surge of two hurricanes. The possibilities for long term monitoring at this site are great.

The presence of post-pelagic turtles in the area is not well documented. Until this year only one ridley smaller than 25 cm SSCL was captured. In 1998, 11 (17.5%) ridleys were in the 20 to 25 cm size class (Figure 2). It is possible aberrant environmental conditions contributed to this phenomenon but there is a confounding factor of reduced gear size. Beginning on 26 June 1998 a 10 cm bar monofilament strike-net was used exclusively. Until this year that net was used on only one occasion and a 23.0 cm SSCL ridley was captured. Ogren (1989) hypothesized post pelagic ridleys would recruit to the Big Bend but until 1998 insufficient observations were made to support this hypothesis. It is possible small turtles have been underrepresented in our sampling efforts prior to 1998.

The prey items observed in the fecal samples did not vary greatly from the species expected, however, the diversity of prey species was low. Four species, all crabs, were identified from 30 fecal samples. Despite catholic tendencies (Burke et al 1993, 1994, Schmid 1998, Shaver 1991), Kemp's ridleys are considered to be strictly cancivorous (Carr 1950, Ernst & Barbour 1989). Twenty-six species in 14 genera of crab have been confirmed in Kemp's diet, yet we observed only four. Prey selection appears heavily skewed toward spider crabs. A similar pattern of ridleys preying on slow moving, walking crabs was observed by Burke et al (1993, 1994) in the waters surrounding Long Island. This affirms the importance of the area as developmental habitat for immature animals that may lack the skill and dexterity of subadults and adults. Although spider crabs are not commercially harvested, they are despised by commercial crabbers, who smash them so they cannot reenter the traps and eat the bait.

Like last year, strike netting over seagrass beds (and channels depending on depth) was the most effective method of capturing ridleys. This is likely due to the refinement of the crew's skill, using the same crewmembers, as well as the addition of a spotting tower and a more effective strike net. Although strike netting is somewhat limited to use in areas of high water clarity it was also effective during less than ideal conditions (i.e. after hurricane storm surge).

The lower number of green turtle (n = 5) and loggerhead (n = 5) captures compared to ridleys (n = 76) is probably less a reflection of their true abundance in the seagrass beds of the lower Big Bend, but rather the differences in microhabitat selection and the wariness of green turtles. Efforts were concentrated on maximizing the capture of ridleys from a relatively small area, The Bars, and kept us from searching those microhabitats preferred by other species.

In summary, the shallow seagrass flats and associated channels of the Florida Big Bend are used by at least three species of marine turtles. However, this area seems to be particularly important developmental habitat for the Kemp's ridley, the most endangered marine turtle. The Deadman Bay area should be considered as an index site in a network of in-water capture studies. Continued monitoring and research efforts in this area are imperative to evaluating potential human impacts (commercial crabbing, recreational scalloping, and high speed boating activity in shallow water), population trends and defining life history patterns of Kemp's ridleys in the Gulf of Mexico.

Outlook for 99

We intend to continue sampling around The Bars and a recently identified site nearby. The protocols followed this year will continue to be the standard but may be altered slightly as a product of gear and technique refinement, and logistics. With the large number of turtles marked within a relatively small area a significant number of between year recaptures is expected. Between year recaptures will greatly improve our understanding of long-term site fidelity, annual growth, and ontogenetic shifts in habitat use and feeding ecology.

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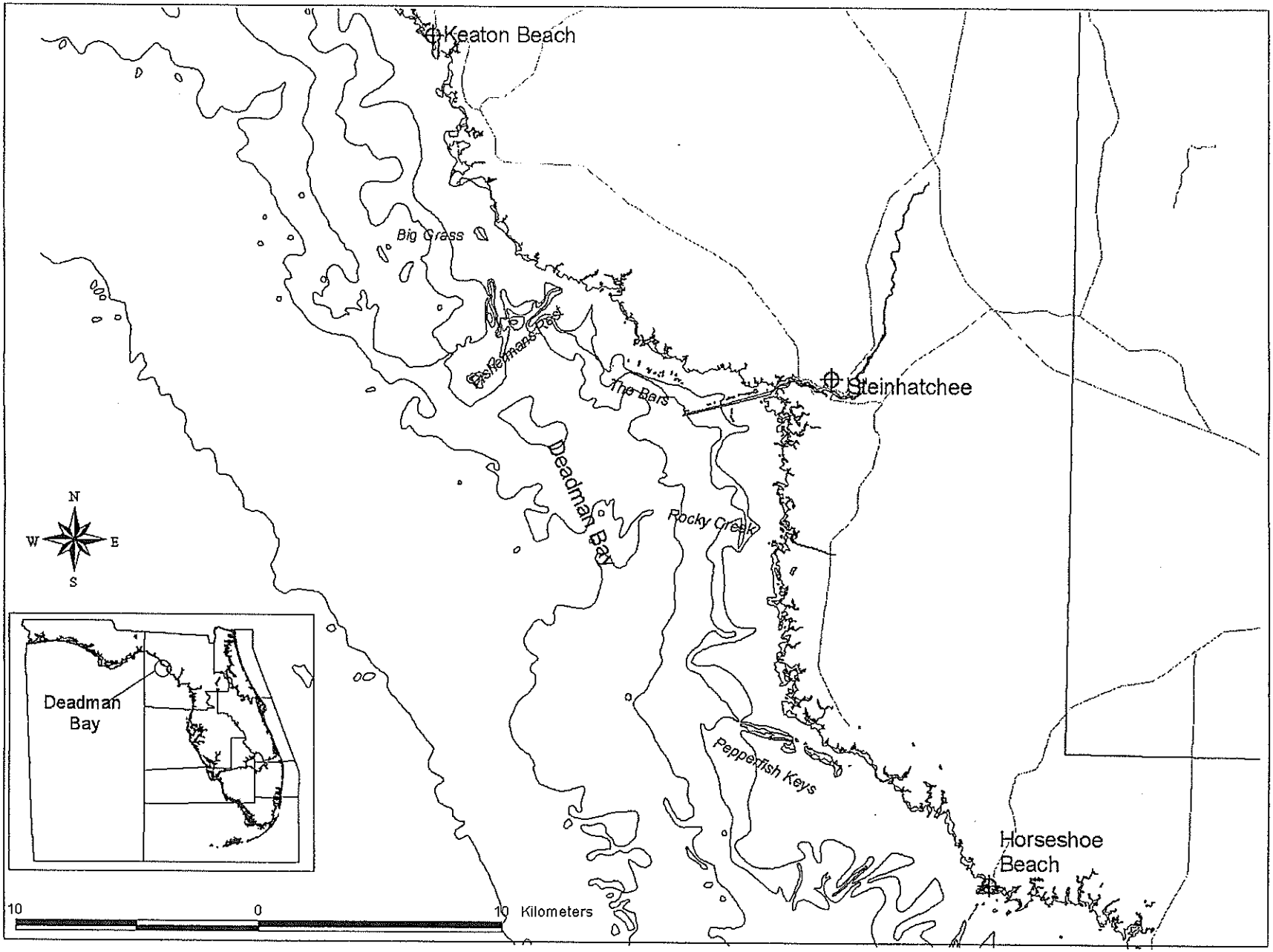

Figure 1. Detailed map of the Deadman Bay study area showing specific site localities.

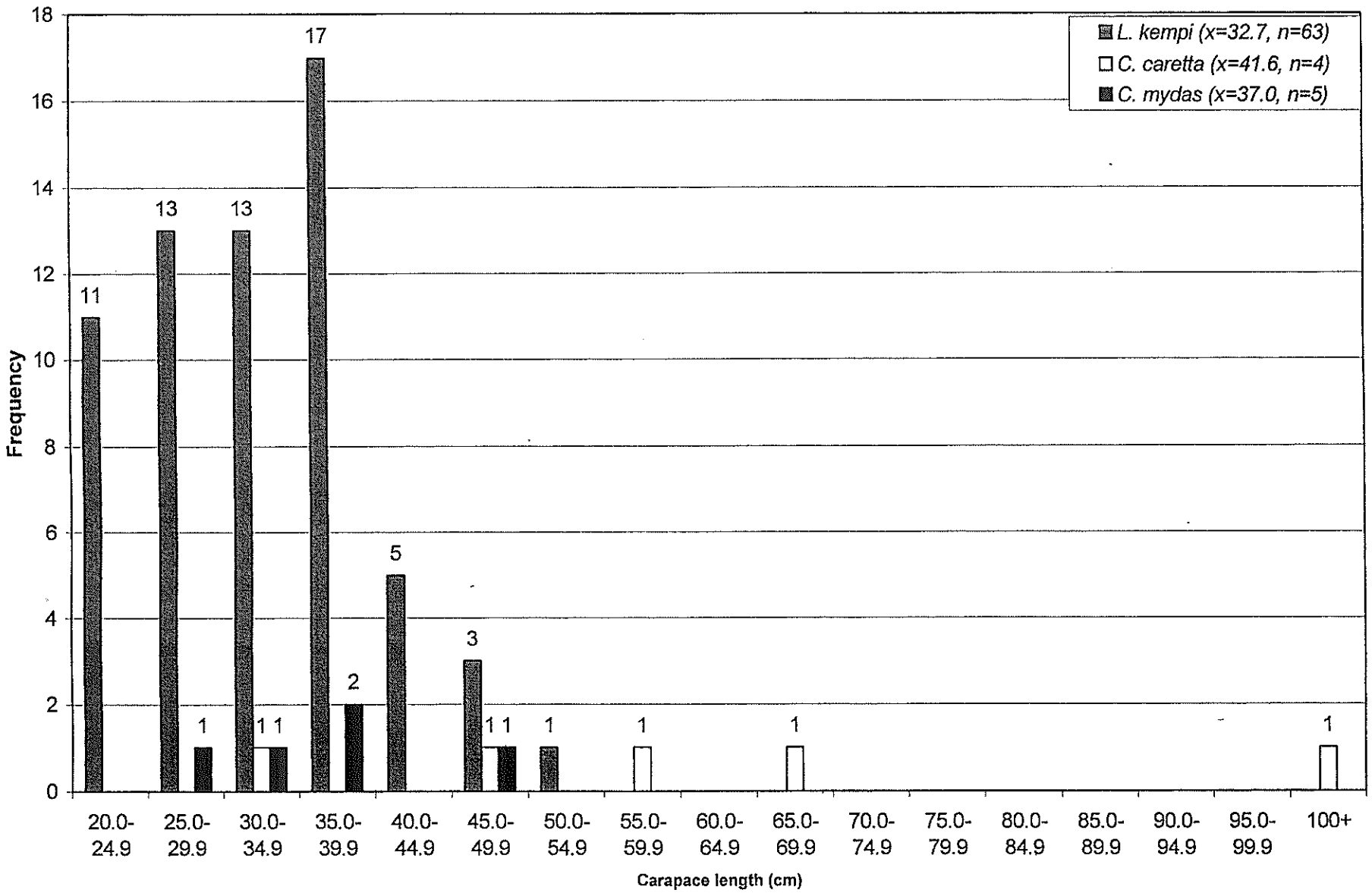

Figure 2. Standard straight carapace length (notch-to-tip) distribution by 5 cm increments of all species captured in Deadman Bay during the 1998 season. Note that one *C. caretta* (>95 cm and estimated at 100+ cm) was not used in calculating the mean.

Appendix I. Synoptic capture data for Kemp's ridley and other marine turtle species from NMFS/USGS-BRD sampling, FY 1998.

Species	Date(s) Captured	Right Tag Left Tag PIT	Locality UTM Coordinates (North & East)	Capture Method	SSCL (cm)	Weight (kg)	Comments
LK	13-May-98	SSN928 SSN929 414E7B1E78	Deadman Bay north of the Steinhatchee River 3289438 254690	Nylon-Strike	30.6	5.25	
LK	20-May-98	SSN930 SSN931 4139010629	Deadman Bay north of the Steinhatchee River 3286890 258406	Hand	38.5	7.75	
LK	20-May-98	SSN932 SSN933 414E787E71	Deadman Bay north of the Steinhatchee River 3286890 258406	Hand	41.3	10.5	
LK	20-May-98	SSN934 SSN935 413901262A	Deadman Bay north of the Steinhatchee River 3288137 256359	Nylon-Strike	36.9	7.5	
CC	04-Jun-98	SSN936 SSN937	Fisherman's Rest 32664440 267899	Nylon-Strike	58.2	30.5	
CC	09-Jun-98	SSN938 SSN939	Pepperfish Keys 3266437 267306	Nylon-Set	66.9	52.3	
LK	10-Jun-98	SSN940 SSN941 4139460403	Deadman Bay north of the Steinhatchee River 3284379 262436	Nylon-Strike	36	8	
LK	11-Jun-98	SSN942 SSN943 4138744402	Deadman Bay north of the Steinhatchee River 3284695 261846	Nylon-Strike	37.5	8.25	
LK	11-Jun-98	SSN944 SSN945 414F1C1C21	Deadman Bay north of the Steinhatchee River 3285736 257946	Nylon-Strike	40.9	10.25	
LK	11-Jun-98	SSN946 SSN947 414F1E2067	Deadman Bay north of the Steinhatchee River 3285736 257946	Nylon-Strike	37.9	8.25	
LK	11-Jun-98 30-jul-98 18-Aug-98 08-Sep-98	SSN948 SSN949 414E7A2A0B	Deadman Bay north of the Steinhatchee River 3286384 258255	Hand & (3) Mono-Strike	32	5.5	THREE RECAPTURES, marginal (L11) deeply notched, barnacles removed from tags, shark attack between 2nd and 3rd recapture
LK	11-Jun-98	SSN950 414F162B61	Deadman Bay north of the Steinhatchee River 3284801 261356	Nylon-Strike	51.8	19.75	

pecies	Date(s) Captured	Right Tag Left Tag PIT	Locality UTM Coordinates (North & East)	Capture Method	SSCL (cm)	Weight (kg)	Comments
LK	19-Jun-98	SSN951 SSN952 4139OD005C	Deadman Bay north of the Steinhatchee River 3284871 261296	Hand	35.6	6.75	
LK	19-Jun-98	SSN953 SSN954 414E786370	Deadman Bay north of the Steinhatchee River 3285981 259583	Hand	28.9	4	
LK	19-Jun-98 30-Jul-98	SSN955 SSN956 4138782039	Deadman Bay north of the Steinhatchee River 3287604 256935	Nylon-Strike	33.9	5.75	RECAPTURED
CM	19-Jun-98	SSN957 SSN958	Deadman Bay north of the Steinhatchee River 3284908 260614	Nylon-Strike	47.8	14.75	
CC	19-Jun-98	SSN958 SSN959	Deadman Bay north of the Steinhatchee River 3284908 260614	Nylon-Strike	33.5	6.75	
LK	24-Jun-98 30-Jul-98	414F005033	Deadman Bay north of the Steinhatchee River 3285765 259380	Hand	20.7	1.25	RECAPTURED, recaptured while being attacked by 2.25 m *Sphryna lewini*
LK	24-Jun-98	SSN961 SSN962 414F06581E	Deadman Bay north of the Steinhatchee River 3285558 260055	Hand	31.7	4.25	
LK	26-Jun-98	SSN963 SSN964 41387D2A53	Deadman Bay north of the Steinhatchee River 3284488 261455	Mono-Strike	35.6	6.75	
CC	26-Jun-98	SSN965 SSN966	Deadman Bay north of the Steinhatchee River 3285835 257782	Mono-Strike	100+	@120	Very large specimen
LK	26-Jun-98 18-Aug-98 01-Dec-98	XXA834 4138776B39 4139093720 414F031B68	Deadman Bay north of the Steinhatchee River 3285684 258315	Mono-Strike	21.8	1.5	RECAPTURED TWICE, lost PIT twice
LK	26-Jun-98 20-Aug-98	SSN967 SSN968 414F1C6D06	Deadman Bay north of the Steinhatchee River 3284897 258154	Hand & Mono-Strike	29.1	3.75	RECAPTURE, heavy tag fouling, barnacles removed from tags
LK	26-Jun-98	4139036B4B	Deadman Bay north of the Steinhatchee River 3287917 256046	Mono-Strike	21.6	1.5	

Species	Date(s) Captured	Right Tag Left Tag PIT	Locality UTM Coordinates (North & East)	Capture Method	SSCL (cm)	Weight (kg)	Comments
LK	26-Jun-98	SSN969 SSN970 41395F2C69	Deadman Bay north of the Steinhatchee River 3285908 260335	Mono-Strike	25.7	2.75	
LK	29-Jun-98	SSN971 SSN972 414F125O38	Deadman Bay north of the Steinhatchee River 3284578 260954	Mono-Strike	34.9	6.5	
LK	29-Jun-98	SSN973 SSN974 4138706639	Deadman Bay north of the Steinhatchee River 3285283 259852	Mono-Strike	35.6	6.3	
LK	29-Jun-98	SSN975 SSN976 414F024109	Deadman Bay north of the Steinhatchee River 3284367 262180	Mono-Strike	37.6	7.75	
LK	29-Jun-98	SSN977 SSN978 414F50674E	Deadman Bay north of the Steinhatchee River 3284735 261764	Hand	40.7	9.75	
LK	29-Jun-98	SSN979 SSN980 4138611645	Deadman Bay north of the Steinhatchee River 3284735 261764	Mono-Strike	28.4	3.75	
LK	30-Jun-98	SSN981 SSN982 414F21E58	Deadman Bay north of the Steinhatchee River 3285279 259871	Mono-Strike	33.7	5.5	Margin of carapace badly eroded
LK	30-Jun-98	SSN983 SSN984 414F29OO60	Deadman Bay north of the Steinhatchee River 3284330 261953	Mono-Strike	29.4	3.75	
LK	30-Jun-98	SSN985 SSN986 414F1O7751	Deadman Bay north of the Steinhatchee River 3284933 260947	Mono-Strike	48.7	17	
CM	02-Jul-98	SSN987	Deadman Bay north of the Steinhatchee River 3284282 263030	Mono-Strike	34.2	6	Left front flipper absent
LK	02-Jul-98	SSN988 SSN989 414FO544F	Deadman Bay north of the Steinhatchee River 3284074 263311	Mono-Strike	31.5	4.75	
LK	07-Jul-98	SSN990 SSN991 414E7D053C	Deadman Bay south of the Steinhatchee River 3281590 264844	Mono-Strike	31	4.4	
LK	09-Jul-98	SSN992 SSN993 414F12532F	Deadman Bay north of the Steinhatchee River 3285014 260898	Mono-Strike	32	4.8	

Species	Date(s) Captured	Right Tag Left Tag RIT	Locality UTM Coordinates (North & East)	Capture Method	SSCL (cm)	Weight (kg)	Comments
LK	09-Jul-98	SSN994 41386F0F62	Deadman Bay north of the Steinhatchee River 3284664 262310	Hand	24.5	2.12	
LK	28-Jul-98	SSN995 SSN996 414E7B1133	Deadman Bay north of the Steinhatchee River 3287852 255876	Mono-Strike	33.5	6	
LK	28-Jul-98	SSN997 SSN998 414F177A51	Deadman Bay north of the Steinhatchee River 3287739 255682	Mono-Strike	39.1	8.8	
LK	28-Jul-98	SSN999 SSN000 414E7E5152	Deadman Bay north of the Steinhatchee River 3286881 250336	Mono-Strike	42	9.8	
CC	11-Aug-98	XXA801 XXA802	Deadman Bay north of the Steinhatchee River 3285555 257985	Mono-Strike	49.6	22	
LK	11-Aug-98	XXA803 XXA804 414F217A1	Deadman Bay north of the Steinhatchee River 3284401 262629	Mono-Strike	48.2	15.8	Large cracks on carapace and plastron, likely dropped from trawl
LK	11-Aug-98	XXA804 XXA806 414E7C1E07	Deadman Bay north of the Steinhatchee River 3284043 262583	Mono-Strike	36.2	7.2	
LK	11-Aug-98	XXA807 414F030350	Deadman Bay north of the Steinhatchee River 3285326 259755	Mono-Strike	22.2	1.64	
LK	11-Aug-98	XXA808 XXA809 4139045B49	Deadman Bay north of the Steinhatchee River 3285355 259532	Mono-Strike	37.5	7.6	
LK	11-Aug-98	XXA810 41390D9D23	Deadman Bay north of the Steinhatchee River 3285889 258590	Mono-Strike	23.4	1.82	
LK	11-Aug-98	XXA811 XXA812 4138775E7D	Deadman Bay north of the Steinhatchee River 3286056 257730	Mono-Strike	37.9	7.6	
LK	13-Aug-98	XXA815 XXA816 4139003557	Deadman Bay north of the Steinhatchee River 3285389 259781	Mono-Strike	36.5	6.8	Captured with XXA827/XXA828
LK	13-Aug-98	XXA827 XXA828 414F215D4F	Deadman Bay north of the Steinhatchee River 3258389 259781	Mono-Strike	28	3.2	Captured with XXA815/XXA816

Species	Date(s) Captured	Right Tag Left Tag PIT	Locality UTM Coordinates (North & East)	Capture Method	SSCL (cm)	Weight (kg)	Comments
LK	13-Aug-98	XXA817 XXA818 414F067D24	Deadman Bay north of the Steinhatchee River 3285446 259501	Hand	29.4	3.6	
LK	13-Aug-98	XXA826 414E7C6148	Deadman Bay north of the Steinhatchee River 3285493 259460	Hand	25.6	2.5	
LK	13-Aug-98 18-Aug-98 03-Dec-98	XXA819 414F130F60 414F1C3C22	Deadman Bay north of the Steinhatchee River 3285324 259573	Hand (2) & Mono-Strike	22.4	1.74	RECAPTURED TWICE, Nexaband still present and holding at 1st recap, PIT tag missing at second recap, barnacles removed from fouled flipper tag, R14 still notched
LK	13-Aug-98	XXA829 XXA830 414F18146B	Deadman Bay north of the Steinhatchee River 3285378 259704	Hand	28.6	3.8	
CM	13-Aug-98	XXA813 XXA814	Deadman Bay north of the Steinhatchee River 3285615 259760	Mono-Strike	36.7	9.4	Kyphotic, captured along channel edge
LK	13-Aug-98 08-Dec-98	XXA820 XXA821 414F0A107A	Deadman Bay north of the Steinhatchee River 3285326 259827	Mono-Strike	34.7	6	RECAPTURE, Captured with XXA824/XXA825, Barnacles removed from both flipper tags
LK	13-Aug-98	XXA824 XXA825 4139OB6O4D	Deadman Bay north of the Steinhatchee River 3285326 259827	Mono-Strike	30	4.2	Captured with XXA820/XXA821
LK	13-Aug-98	XXA822 XXA823 414F183468	Deadman Bay north of the Steinhatchee River 3284419 262364	Mono-Strike	35.1	6.4	
LK	15-Aug-98	XXA831 414F4E2O6A	Deadman Bay north of the Steinhatchee River 3285432 259793	Hand	26.4	2.4	
LK	18-Aug-98	XXA832 XXA833 414F123A30	Deadman Bay north of the Steinhatchee River 3285559 259183	Mono-Strike	48	15.2	
LK	10-Sep-98	XXA835 414F155E2F	Deadman Bay north of the Steinhatchee River 3285283 260008	Mono-Strike	22.8	1.66	
LK	10-Sep-98 06-Oct-98	XXA836 XXA837 414F191823	Deadman Bay north of the Steinhatchee River 3285374 259965	Mono-Strike	30.4	4	RECAPTURE, radiated cranial scalation

pecies	Date(s) Captured	Right Tag Left Tag PIT	Locality UTM Coordinates (North & East)	Capture Method	SSCL (cm)	Weight (kg)	Comments
LK	10-Sep-98	XXA838 XXA839 413954114F	Deadman Bay north of the Steinhatchee River 3285656 259310	Mono-Strike	43.2	10.6	
LK	08-Oct-98	XXA840 XXA841 ?	Deadman Bay north of the Steinhatchee River 3285597 259649	Mono-Strike	25.4	2.4	
LK	08-Oct-98 08-Dec-98	XXA842 414E633E40	Deadman Bay north of the Steinhatchee River 3285667 259283	Mono-Strike	24.4	2.28	RECAPTURE
CM	08-Oct-98	XXA843 XXA844 414E6E4F28	Deadman Bay north of the Steinhatchee River 3291620 252685	Mono-Strike	38	7.0	Right rear flipper missing
LK	13-Nov-98	XXA845 XXA846 414F026D56	Deadman Bay north of the Steinhatchee River 3285887 259811	Mono-Strike	35.1	5.8	
LK	13-Nov-98	XXA847 414F125F73	Deadman Bay north of the Steinhatchee River 3285118 260210	Mono-Strike	23.1	1.875	
LK	01-Dec-98	XXA848 XXA849 41386F3343	Deadman Bay north of the Steinhatchee River 3285114 261243	Mono-Strike	35.1	6.5	Deeply notched marginal scutes L14, R12, notches identical to those of SSN848/849
LK	01-Dec-98	XXA850 XXA851 414F121807	Deadman Bay north of the Steinhatchee River 3285722 259694	Mono-Strike	26.9	3	Deep notch in R12 & R13
LK	01-Dec-98	XXA852 XXA853 414F027E3F	Deadman Bay north of the Steinhatchee River 3285498 260071	Mono-Strike	29.6	3.8	
CM	08-Dec-98	XXA854 XXA855 414E7E3411	Deadman Bay north of the Steinhatchee River 3285289 261055	Mono-Strike	28.6	3.2	Anal scale present
LK	08-Dec-98	XXA856 4138771EO4	Deadman Bay north of the Steinhatchee River 3286133 259692	Hand	22.6	2	Defecated while on boat