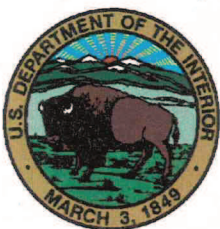


**PADRE ISLAND NATIONAL SEASHORE
KEMP'S RIDLEY SEA TURTLE PROJECT AND
TEXAS SEA TURTLE NESTING AND STRANDING
1999 REPORT**



**DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
PADRE ISLAND NATIONAL SEASHORE**



PADRE ISLAND NATIONAL SEASHORE
KEMP'S RIDLEY SEA TURTLE PROJECT
AND TEXAS SEA TURTLE NESTING
AND STRANDING 1999 REPORT

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ABSTRACT

Patrols for nesting and stranded sea turtles on North Padre Island (including Padre Island National Seashore [PAIS]), documentation of sea turtle nests and stranded sea turtles found on local beaches, public education efforts regarding sea turtles, and monitoring the movements of Kemp's ridley turtles (*Lepidochelys kempii*) that nested in south Texas using satellite telemetry continued at PAIS during 1999. Efforts to incubate sea turtle eggs laid in Texas and maintain records for all sea turtle nests and stranded sea turtles that were documented in Texas also continued.

PAIS employees and volunteers conducted patrols for nesting sea turtles and tracks on North Padre Island (including PAIS) from 21 March through 16 July. During 1999, 10,939 hours were spent patrolling a total of 153,250 km of beach front, similar to the number of patrol hours and kilometers patrolled during 1998. Additional patrols for stranded sea turtles were conducted outside the Kemp's ridley nesting season.

Eighteen confirmed sea turtle nests were detected on the Texas coast during 1999. The 18 included 16 Kemp's ridley and two loggerhead (*Caretta caretta*) nests. The 18 nests were located due to observations of either nesting turtles or tracks. Ten were found by patrollers on North Padre Island, one by a patroller on Boca Chica Beach, and seven by the public. Eleven of the Kemp's ridley nests were located at PAIS, two on Mustang Island, and three on Boca Chica Beach. The two loggerhead nests were located at PAIS. The 16 confirmed Kemp's ridley nests found on the Texas coast during 1999 were the most Kemp's ridley nests documented on the Texas coast during a single year and an increase the number of Kemp's ridley nests found on the Texas coast for the fifth consecutive year. The only other Kemp's ridley nests documented in the U.S. during 1999 were two found in Florida. The same number of loggerhead nests were found on the Texas coast during 1999 as during 1998.

Of the 16 Kemp's ridley nests found on the Texas coast during 1999, seven were from four different turtles that had been experimentally imprinted to PAIS, six were from nesting turtles that were not examined for tags, and three were from three different turtles that were examined but had no tags. The four returnees from the experimental project were from the 1984 ($n = 1$), 1986 ($n = 2$), and 1988 ($n = 1$) year-classes. Three of these four individuals were documented nesting on the Texas coast twice during 1999. To date, nine turtles from this experimental project have been documented nesting on the Texas coast. Satellite transmitters were applied to six of the nesting Kemp's ridley turtles. Three of the six moved northward and eastward along the Gulf of Mexico shoreline after nesting, two remained off the south Texas coast after nesting, and one moved extensively both northward and southward after nesting. As of March 1999, transmissions continued to be received from only one of the six.

Eggs from all 18 confirmed nests found on the Texas coast were packed into Styrofoam boxes and transported to the PAIS incubation facility for protected incubation. Overall, 81.5% of the 1,681 Kemp's ridley turtle eggs and 94.2% of the 226 loggerhead turtle eggs incubated at the PAIS facility hatched. From these, 1,364 Kemp's ridley and 212 loggerhead hatchlings were released on the beach at PAIS and entered the Gulf of Mexico. Two deformed Kemp's ridley hatchlings succumbed prior to release and four deformed Kemp's ridley hatchlings and one small loggerhead hatchling were too weak to enter the surf and were transported to the University of Texas Marine Sciences institute for prolonged care.

From 1 January through 31 December 1999, 450 sea turtles were located stranded along the Texas coast. Among the 450 were 95 Kemp's ridley, 212 loggerhead, 83 green (*Chelonia mydas*), 18 leatherback (*Dermochelys coriacea*), 32 hawksbill (*Eretmochelys imbricata*), and 10 unknown species turtles. The 450 found during 1999 was the fourth largest annual total number of turtles located

stranded along the Texas coast since 1980 (when the Sea Turtle Stranding and Salvage Network [STSSN] was established). However, the 212 loggerhead turtles found stranded on the Texas coast during 1999 was the largest annual total. Eighteen adult Kemp's ridley turtles (> 60.0 cm straight-line carapace length) were located stranded on the Texas coast during 1999, down from the record number of adult Kemp's ridleys found stranded on the Texas coast during 1998. Additionally, more stranded turtles were found offshore in zones 20 and 21 (aggregated) than found in those zones during any other year in STSSN history.

Twenty-three sea turtle hatchlings and post-hatchlings (hereafter termed hatchlings) were found stranded along the Texas coast during 1999, between 14 June and 25 September. All 23 were found in south Texas and among the 23 were seven Kemp's ridley, one green, one loggerhead, 13 hawksbill, and one unknown species. Additionally, two Kemp's ridley hatchlings were reported as incidental captures. One stranded Kemp's ridley may have emerged from an undetected south Texas nest. One stranded Kemp's ridley and one stranded loggerhead may have originated from clutches that were laid in south Texas, incubated at PAIS, and released at PAIS. It is unlikely that any of the other stranded hatchlings emerged from south Texas nests. A large percentage of the stranded hatchlings likely washed ashore as a result of Hurricane Bret.

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BACKGROUND

During each summer from 1978 to 1988, approximately 2,000 Kemp's ridley turtle (*Lepidochelys kempii*) eggs were shipped to Padre Island National Seashore (PAIS) from Rancho Nuevo, Mexico in an experimental attempt to establish a secondary breeding colony of this species through imprinting. Of the 22,507 eggs received, 17,358 (77.1%) hatched and 15,875 hatchlings were shipped to the National Marine Fisheries Service Laboratory in Galveston, Texas for head starting (Fontaine et al., 1989; Shaver, 1989c; 1992a). Overall, 13,275 yearlings were released into the Gulf of Mexico (and elsewhere) after 9 to 11 months of head starting (Caillouet et al., 1995). Several others were released after longer periods of head starting and captive rearing.

Transfer of Kemp's ridley eggs to PAIS from Rancho Nuevo, Mexico was terminated after the 1988 incubation season. Now the primary objective of the PAIS Kemp's ridley project is to identify whether Kemp's ridleys return to nest in south Texas (Shaver, 1989b). Also significant in our efforts is the location, investigation, and protection of nesting sea turtles and sea turtle nests; satellite tracking of adult Kemp's ridleys that nested in south Texas; and, tabulation of sea turtle nesting in Texas. The majority of Kemp's ridley nests located on the Texas coast and in the U.S. during the last two decades have been found at PAIS. Additionally, in 1996, two turtles experimentally imprinted to PAIS were documented nesting there (Shaver, 1996a; 1996b; 1997a; 1997b; 1998a; 1999a). These two turtles were the first from this project confirmed to have nested outside of captivity.

Since 1980, stranded sea turtles found on the Texas coast have been documented in conjunction with the national Sea Turtle Stranding and Salvage Network (STSSN). I serve as the Texas Coordinator of the STSSN, tabulate sea turtle strandings for Texas, and maintain records of all sea turtles found stranded in Texas since 1980. PAIS personnel participate in the STSSN.

This report summarizes PAIS patrols for nesting and stranded sea turtles, public education efforts regarding sea turtles, incubation of sea turtle eggs, and satellite tracking of adult Kemp's ridley turtles during 1999. Also, sea turtle nests and stranded sea turtles that were documented on the Texas coast during 1999 are summarized.

BEACH PATROLS FOR NESTING TURTLES

Management of the Padre Island National Seashore nesting beach, including beach patrols of the area, is listed as a priority 2 recovery task item in the Kemp's Ridley Sea Turtle Recovery Plan (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1992). As a result, seasonal beach patrols for nesting sea turtles, tracks, and nests began at PAIS in 1986 and continued through 1999.

From 21 March through 16 July 1999, U.S. Geological Survey and National Park Service employees and volunteers conducted patrols along North Padre Island. The 125 km long target patrol area extended from the Nueces County/Kleberg County line (20 km north of PAIS) to the Mansfield Channel. The target patrol area was divided into sections that varied slightly in length and were repeatedly traversed during daylight hours.

Patrols began as early as 0600 hours (h) and terminated as late as 1830 h. Paid staff members that conducted patrols were placed on four, 10 hour shifts per week to allow maximum coverage during daylight hours. Volunteers conducting patrols worked either half days (5-6.5 hours/day) or complete days (10 hours/day). Patrols of the central and southern sections of the target patrol area were conducted primarily by paid staff members and patrols of the northern sections were conducted primarily by volunteers.

Patrols originated from the northern end of PAIS (at Ranger Road) or the southern end of PAIS (at the base camps established at the PAIS 48 and 81 km markers).

Campers alternated on a three day schedule and they repeatedly patrolled the areas adjacent to the base camps. This is the first year that two base camps were maintained for the entire patrol season.

A total of 153,250 km of patrol distance was logged during 1999, nearly identical to the patrol distance recorded in 1998 (Fig. 1). Since 1993, all-terrain four-wheel cycles (ATVs) have been the primary patrol vehicle and during 1999 ATVs were used to conduct all patrols. ATVs are considered the preferred vehicles for patrols because they 1) have excellent vantage for sighting nesting sea turtles, sea turtle tracks, and stranded sea turtles; 2) can be operated by one individual; and, 3) can be operated at varying speeds and for varying distances, depending upon conditions.

During 1999, four-wheel drive trucks, sport utility vehicles, and HUMMERS were not used to conduct patrols but were used as support vehicles for the patrol program. These vehicles were used to 1) transport gear to and from the base camp site; 2) transport broken ATVs from the beach and replace broken ATVs with functional ATVs; 3) transport personnel to investigate nesting emergencies; 4) transport sea turtle eggs to the incubation facility; 5) transport adult female Kemp's ridley turtles to the PAIS Turtle Laboratory for application of satellite transmitters; and, 6) transport large stranded sea turtles to the PAIS Turtle Laboratory. During patrol seasons from 1986-1992, before sufficient funding was available to purchase ATVs, four-wheel drive trucks were the main vehicles available and used for patrols. However, trucks, sport utility vehicles, and HUMMERS are unsuitable for patrols because they 1) have a reduced field of observation and are ineffective for sighting small turtles and faint sea turtle tracks; 2) are subject to relatively high levels of mechanical failure; and, 3) require two people to be present in order to conduct patrols (one driver and one observer).

During the 1999 nesting patrol season, 10,939 hours were spent patrolling. In

comparison, 9,478 hours were spent patrolling during 1998 (Fig. 2). Numerous individuals were needed to conduct patrols because of the extensive area (125 km linear distance) and lengthy season (4 months). Because of the extremely rigorous beach conditions, each individual was generally limited to no more than four patrol days/week. Patrol hours were split between employees (8,471 hours) and volunteers (2,468 hours) conducting these patrols (Fig. 2).

Although Maintenance Division and Visitor Protection Division employees traversed long distances of beach front during the course of their duties, their vehicle types (large sedans, sport utility vehicles, and four-wheel drive trucks) and high speeds (often in excess of 40 km/hour) typically prohibited them from being able to observe nesting sea turtles or tracks. Thus, no beach driving conducted by these employees qualified for inclusion in distance and time totals for PAIS beach patrol efforts during 1999.

For the first time in recent years, systematic patrols to detect nesting on other beaches in south Texas were conducted. Patrols were conducted on Boca Chica Beach throughout the majority of the Kemp's ridley nesting season (Smith, 1999). Although the Boca Chica Beach patrol effort is not reported in the patrol totals and protocols described in this report, nests found on Boca Chica Beach are reported.

STAFF AND VISITOR EDUCATION

The Kemp's Ridley Sea Turtle Recovery Plan lists addressing education/awareness and long-term education needs as a priority 2 recovery task item, with the National Park Service being one of the responsible agencies (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1992). Accordingly, efforts to educate the park staff and public about the Kemp's ridley project continued during 1999. It is imperative that park employees, other local beach officials, and visitors receive information to enable them to assist with detection and reporting of turtle sightings, since these individuals report several sea turtles each year. Therefore,

great emphasis was placed on alerting them about the potential for observing nesting Kemp's ridleys and urging them to look for nesting turtles, tracks, and stranded turtles.

A variety of methods were used to educate park visitors about the possibility of sighting nesting and stranded turtles. Posters, detailing the need to report nesting sea turtles and tracks, were displayed at PAIS and other local parks and establishments. Beach signs, alerting visitors to report live sea turtle sightings immediately, were posted at the park. A display and video tape about the Kemp's ridley project were available at the PAIS Visitor Center. Patrollers made educational contacts with numerous beach visitors, informed them about the need to report sightings immediately, and provided them with brochures listing procedures that they should follow if they observe nesting. These brochures were also given to all visitors that stopped at the PAIS Entrance Station during the nesting season. I was interviewed by the media on several occasions throughout the patrol and hatchling release seasons and I wrote a bi-weekly column for a local newspaper.

The public was invited to attend the majority of hatchling releases. A Hatchling Hotline was established to provide the public with current information about anticipated releases. The hotline format was a recorded message that was regularly updated. Over 1,000 visitors attended hatchling releases at PAIS during 1999. Educational programs about sea turtles and PAIS efforts were given at the hatchling releases attended by the public. Additionally, throughout the year, numerous educational programs were given to school children, community organizations, and park visitors. An Adopt-A-Turtle program was continued for a second year and was also effective at educating the public about the turtle project.

INVESTIGATION OF NESTING TURTLES, TRACKS, AND NESTS

When nesting sea turtles or sea turtle tracks were detected by the public or PAIS beach patrollers on North Padre or Mustang Islands, PAIS staff immediately traveled to the area to investigate and document the sightings more fully. Also, when information was received about nesting on Boca Chica Beach, PAIS staff either directly investigated these sites or assisted with investigation of them.

When nesting turtles were located, each was examined for tags (metal, magnetic, PIT, living) and tag scars and each was measured for straight-line carapace length (SLCL), straight-line carapace width (SLCW), curved carapace length (CCL), and curved carapace width (CCW). Each was tagged with PIT and metal tags when those tags were not present. A blood sample was removed from each and sent to Texas A&M University to determine the serum testosterone level (used to indicate the number of remaining clutches that would be laid during that season by that individual). Five of the six individuals that would be tracked using satellite transmitters were transported to the PAIS Turtle Laboratory for application of the transmitter and the sixth was transported to the base camp at the 48 km marker for transmitter attachment (see Movements of Nesting Kemp's Ridley Turtles).

Each emergence site was investigated to determine if eggs were laid and to protect eggs from a variety of threats. Sea turtle emergences at which eggs were found were considered confirmed nestings and sea turtle emergences at which eggs were not found were considered to be confirmed tracks. Eggs were removed from the nest sites for all confirmed nests located on the Texas coast during 1999. Eggs found were shaded, counted, and packed into Styrofoam incubation boxes containing sand from the nest sites. Large Kemp's ridley clutches and all clutches laid by other species were split into two incubation boxes. The two boxes for divided clutches were designated as A and B. Collected eggs were transported to the PAIS incubation facility in shaded conditions within a truck, sport utility vehicle, or HUMMER. Information is presented on incubation, hatching, and

release of clutches located in 1999 (see Sea Turtle Egg Incubation Techniques and Sea Turtle Egg Incubation Results).

CONFIRMED NESTS AND TRACKS

Confirmed nests

Eighteen sea turtle nests were detected on the Texas coast during 1999, from 8 April through 23 June (Table 1). The 18 included 16 Kemp's ridley and two loggerhead nests. Thirteen of the 18 confirmed sea turtle nests located on the Texas coast during 1999 (including 11 Kemp's ridley and two loggerhead) were found on PAIS (Table 1). The other five included two Kemp's ridley nests found on Mustang Island and three Kemp's ridley nests found on Boca Chica Beach.

Patrollers on North Padre Island located eight of the Kemp's ridley nest sites (seven through observations of nesting turtles and one through observations of tracks), patrollers on Boca Chica Beach located one of the confirmed nest sites (through an observation of tracks) and beach visitors located seven of the Kemp's ridley nest sites (six through observations of nesting turtles and one through an observation of tracks) (Table 1). North Padre Island patrollers located both of the confirmed loggerhead nest sites by observing the tracks (Table 1).

The 16 Kemp's ridley nests were located between 8 April and 27 May and the two loggerhead nests on 24 May and 23 June (Table 1). The 13 nesting Kemp's ridleys seen by patrollers or beach visitors at confirmed nest sites were detected between 0830 and 1500 h. The three Kemp's ridley tracks found at confirmed nest sites were located between 0700 and 0830 h and hence the turtles may have nested the day before the tracks were seen or earlier on the day that the tracks were seen. The two loggerhead tracks were located between 0745 and 0800 h (Table 1).

The 16 confirmed Kemp's ridley nests found on the Texas coast during 1999 were

the most Kemp's ridley nests documented on the Texas coast during a single year and an increase the number of Kemp's ridley nests found on the Texas coast for the fifth consecutive year. The recent increase in detected Kemp's ridley nesting on the Texas coast may reflect increased nesting, improved detection efforts, increased awareness and reporting by the public, or a combination of all of these factors. Thirty-nine confirmed Kemp's ridley nests were located on the Texas coast from 1979-1998 (Shaver, 1995a; 1996a; 1996c; 1998b; 1999b). During the last 20 years, other possible nests could not be fully documented while others could have easily gone unnoticed or unreported. Patrols of North Padre Island were not comprehensive until 1996. During 1999, nests could have easily been missed on North Padre Island, especially during the first half of the Kemp's ridley nesting season, since a mat of *Sargassum sp.* covered the beach and made track detection almost impossible.

The 16 confirmed Kemp's ridley nests found on the Texas coast in 1999 were not the only confirmed Kemp's ridley nests found in the U.S. that year. Two nests were located in Sarasota County, on the central Gulf coast of Florida; the two were found on 7 June and 27 June and were likely from the same turtle (Foote and Mueller, in press).

Two confirmed loggerhead turtle nests were located on the Texas coast during 1999, in comparison to five found in 1996, four found in 1997, and two found in 1998. Seventeen confirmed loggerhead nests were located on the Texas coast from 1979-1998 (Shaver, 1999b).

I saw and examined Kemp's ridley turtles from eight of the 16 confirmed Kemp's ridley nests found in south Texas during 1999 (Table 2). Two individuals were documented nesting twice and four individuals were documented nesting once. Serum testosterone levels for samples obtained the first time that these six individuals were observed ranged from 1.50 to 50.4 pg/ml (Table 3). The highest

testosterone level (50.4 pg/ml) was for the sample obtained from the mother of the first nest found during 1999. This level of testosterone indicated that the turtle should have nested one more time during the 1999 nesting season (Dr. David Owens, personal communication) and she was observed nesting once more. The low testosterone levels from the other samples should have indicated that each of the five turtles just laid their only or last clutch of the 1999 nesting season. However, one of the five definitely nested again during 1999.

SLCL for the six individuals examined ranged from 59.9 to 64.1 cm (Table 2). Three of the nesting Kemp's ridley turtles examined had no tags or tag scars and were found nesting once (Table 2). Three of the six individuals had tags linking them to the experimental imprinting project (Table 2). The three included 1) a 15 year old from the 1984 year-class found nesting twice in 1999; 2) a 13 year old from the 1986 year-class found nesting twice; and, 3) a 13 year old from the 1986 year-class found nesting once (Table 3). This 13 year old was found with living, magnetic, metal, and PIT tags and had been held in captivity until two years of age and then was released by the National Marine Fisheries Service. An 11 year old turtle from the 1988 year-class was found nesting twice during 1999. Although this turtle was not examined by trained biologists, she was photographed at both nest sites. Comparison of photographs, nest dates, and nest locations supported the assertion that this was one individual. All four of these turtles had been "imprinted" to PAIS as part of this project. The first two confirmed returnees from this project were located nesting at PAIS in 1996 and included a 13 year old from the 1983 year-class and a 10 year old from the 1986 year-class (Shaver, 1996a; 1996b; 1997a; 1997b; 1998a; 1999a). To date, nine returnees from this project have been detected nesting in south Texas.

The nesting Kemp's ridley turtles were not examined by trained biologists at the remainder of Kemp's ridley nestings documented on the Texas coast during 1999. During these observations, the nesting Kemp's ridley turtles re-entered the water

before trained biologists arrived. The nesting turtles were not observed by biologists at the two loggerhead nests documented on the Texas coast during 1999.

The nesting turtle was not examined for tags by trained biologists at both of the Kemp's ridley nest sites in Sarasota County, Florida, but photographs were taken. Comparison of the photographs, nest dates, and nest locations supported the assertion that this was one individual (Foote and Mueller, in press). This turtle had no living or metal tags and no tag scars and thus had no tags linking it to the experimental project.

Unfortunately, since the nesting turtles were not examined at all nest sites in Texas, it was impossible to calculate the number of turtles that nested during 1999. The minimum and maximum numbers of individual females of each species that laid the confirmed clutches found on the Texas coast during 1999 were estimated based on lay dates, typical inter-nesting intervals, typical number of clutches laid per nesting season, nest locations, and movements of individuals that were satellite tracked. The typical inter-nesting interval for *L. kempii* is 18-22 days and inter-nesting intervals under 10-15 days are not possible for this species (Dr. David Owens, personal communication). The number of individual Kemp's ridley turtles that might have laid the 16 confirmed Kemp's ridley clutches on the Texas coast during 1999 ranges from a minimum of 11 to a maximum of 13. The minimum estimate is probably more accurate than the maximum estimate, since Kemp's ridley turtles lay an average of 2.5 clutches/nesting season. Two of the clutches laid on Boca Chica Beach (on 8 April and 1-2 May) were most likely from the same turtle since they were located within a few hundred meters of each other and were found on the same days that an individual was documented nesting at PAIS. Since the two loggerhead clutches could have been laid by the same individual, as few as one loggerhead turtle nested in Texas in 1999.

Confirmed Tracks

Two confirmed tracks, at which eggs were not located, were documented on the Texas coast during 1999 (Table 4). Both were Kemp's ridley tracks found at PAIS. One was at a site where visitors saw the turtle re-enter the water and the other was at a site where patrollers found tracks but no turtle.

ADDITIONAL NESTING-RELATED REPORTS

Three other nesting-related observations on the Texas coast during 1999 were relayed to me. These three observations were likely credible, but a lack of photographic documentation and details about the reports prohibited categorizing them as confirmed reports.

Mr. Lionel LaForce, a National Marine Fisheries Service Gear Specialist, observed a pair of mating leatherback turtles on 24 April 1999. The pair was seen off PAIS, approximately 64 km south of the Aransas Pass Ship Channel and just south of the Ranger Station, in Gulf of Mexico waters approximately 1 km off the beach.

Mr. Jeff Llewellyn, a Texas Natural Resource Conservation Commission (TNRCC) employee conducting hazardous materials surveys, reported observing possible tracks and a circular disturbed area 4 km north of Cedar Bayou at the beginning of May 1999. I did not receive the report until mid-May and details of the report were too sketchy to allow investigation of the site.

A visitor reported observing a 61 cm long turtle crossing the beach vehicular roadway and re-entering the water at about the PAIS 4 km marker at 0700 h on 25 May 1999. The area was searched within two hours of the observation, but no tracks were found. However, an extensive covering of *Sargassum sp.* covered the beach, making it impossible to see tracks low on the beach. It is possible that the observation was of a Kemp's ridley making an aborted nesting attempt; the next day two nesting Kemp's ridleys were observed a few km south of this site.

PAIS patrollers immediately responded to numerous other reports from the public of sea turtle nesting activity that, after investigation, were disproved. Several reports of nesting sea turtles turned out to be live swimming sea turtles, live and dead stranded sea turtles, live red-eared sliders (*Trachemys scripta*), and coconuts. Most reports of sea turtle tracks turned out to be tracks from red-eared sliders and ghost crabs (*Ocypode quadrata*) and dragged lawn chairs, ice chests, trash bags, and logs. Materials reported as sea turtle eggs were actually chicken eggs, paint balls, partially buried rubber gloves, and roller balls from roll-on deodorants.

MOVEMENTS OF NESTING KEMP'S RIDLEY TURTLES

Platform Transmitter Terminals (PTTs) were used to study the inter-nesting and post-nesting movements of two Kemp's ridley turtles that nested in south Texas during 1997, four that nested in 1998, and six that nested in 1999. The turtles selected for this study were the first individuals encountered during the nesting season that were deemed suitable for tracking; turtles with obvious injuries or unsuitable carapace characteristics were excluded.

In 1999, five of the selected turtles were placed on cushions, in the back of sport utility vehicles, and transported at moderate temperatures to the PAIS Turtle Laboratory for attachment of satellite transmitters. The sixth turtle was transported in the same manner to the base camp at the 48 km marker. A Telonics, ST-6, backpack style, satellite transmitter was attached to the anterior of each turtle's carapace using fiberglass cloth and resin. Three transmitters (18281, 18160, 18277) were attached with the antenna located anteriorly and three (18308, 18299, 18301) were attached with the antenna located posteriorly. After transmitter attachment, five of the six turtles were released on Closed Beach at PAIS and one was released at the 48 km marker. One turtle (18281) was released on the day after nesting and the other five were released on the same day that they nested. Data were received from individual transmitters from a minimum of 18 days to a maximum of 10 months. As of 4 March 2000, data continue to be

received from one transmitter (18160).

After release, four of the turtles tracked in 1999 eventually moved northward and eastward and all traveled along the coastline. The final locations for three (18277, 18299, 18301) of these four were off the coasts of Texas (upper Texas coast), Louisiana, and Alabama. However, one of those four (18160) eventually moved back southward and entered waters off Rancho Nuevo, subsequently moved northward and returned to waters off PAIS, and continues to reside there. The other two turtles (18281, 18308) remained in south Texas after their first nestings, re-nested, and remained in south Texas after the second nestings and until the transmitters ceased functioning.

Location data within Gulf waters of zones 20 and 21 were gathered for all six of the PTTs deployed during 1999. Combining records for these six PTTs and the four PTTs deployed during 1997 and 1998 for which location data within Gulf waters of zones 20 and 21 were gathered, 37.6% of their identified positions in offshore waters of zones 20 and 21 were in 10 fathoms depth or less, within about 4.6 nautical miles from shore, and 80.5% of their identified positions in offshore waters of zones 20 and 21 were in 20 fathoms depth or less, within about 17.0 nautical miles from shore.

SEA TURTLE EGG INCUBATION TECHNIQUES

Eggs from all 18 sea turtle clutches documented on the Texas coast during 1999 were retrieved for incubation, to protect them from a variety of threats. Eggs were packed into Styrofoam boxes with sand from the nest site and transported to the PAIS incubation facility. Eggs were collected and transported to the PAIS incubation facility as soon as possible after detection. PAIS staff collected all clutches that were laid on Mustang Island and PAIS (Table 5). All Kemp's ridley clutches laid on Mustang Island and PAIS arrived at the PAIS incubation facility on the same day that they were laid.

The collection and transport of eggs from three Kemp's ridley clutches laid on Boca Chica Beach were more variable. Clutch 2 was laid by a female that was observed by a visitor at 1500 h on 8 April 1999. The visitor reported the observation to the the University of Texas at Pan American Coastal Studies Laboratory (CSL) the next morning and the CSL subsequently notified me. Cynthia Rubio, U.S. Geological Survey Biological Technician, immediately traveled to the site, retrieved the eggs at 1630 h on 9 April, and returned the eggs to the incubation facility at PAIS on the morning of 10 April.

Clutch 7 was the second Kemp's ridley clutch located on Boca Chica Beach during 1999. Tracks were located at the nest site at 0830 h on 2 May 1999 and the eggs were laid either the previous day or earlier that morning. Beach resident Bobby Hessling excavated the eggs at approximately 1330 h that day and transported them to the Gladys Porter Zoo. A PAIS staff member retrieved the eggs and placed them into the PAIS incubation facility at 1600 h on 3 May.

Clutch 11 was the third Kemp's ridley clutch laid on Boca Chica Beach during 1999. Tracks were located at the nest site at 0700 h on 11 May 1999 and the eggs were laid either the previous day or earlier that morning. Cynthia Rubio immediately traveled to the site, excavated the eggs at approximately 1300 h on 11 May, and placed the eggs into the PAIS incubation facility at about 2000 h on 11 May.

The two loggerhead clutches laid at PAIS were retrieved immediately after detection. These eggs must have been laid sometime after patrols ceased the previous day (1800 h) and before the tracks were found that day (0745 and 0800 h). Thus, the eggs were placed in the incubation facility fewer than 18 hours after they were laid.

At the PAIS incubation facility, each of the smaller Styrofoam boxes containing the

eggs was placed into a larger Styrofoam box. New smaller and larger Styrofoam incubation boxes were purchased, prepared, and used during 1999. Incubation procedures for Kemp's ridley eggs were similar to those used since 1986 and for eggs of other sea turtle species were similar to those used since 1988 (Shaver et al., 1986; 1988a; Shaver, 1990; 1992b; 1996c; 1997b; 1998b; 1999b). All sea turtle clutches were held in the incubation facility throughout the incubation period.

However, incubation protocols differed for clutch 7 because the eggs from this clutch were packed differently than all other clutches incubated at PAIS. The eggs from this clutch were interspersed within the incubation box with sand between, above, and below each egg, rather than the eggs having air spaces between them and the egg mass being surrounded by sand (as occurs under natural conditions). Also, the incubation box that the eggs were placed into did not have holes to allow ventilation and drainage. To compensate for the reduced respiratory capabilities of the eggs due to these conditions, incubation practices were altered for this clutch. The box lids were left slightly ajar throughout the entire incubation period. This protocol lowered incubation temperatures and necessitated much more frequent monitoring and addition of water to the clutch than typically occurs.

Air temperatures and control box temperatures were monitored at the three shelf heights in the incubation facility throughout the entire time that eggs were held for incubation at PAIS. Air, control box, and incubation box temperatures were recorded at hourly intervals using a Data Acquisition System and entered directly into a computerized database. Attempts were made to elevate incubation temperatures during the middle third of the incubation period in order to avoid the potentially masculinizing effects of incubating sea turtle eggs in Styrofoam boxes (Dutton et al., 1985). Procedures were employed to produce mean middle third of incubation period temperatures that slightly exceeded pivotal temperatures. Such modifications proved successful in producing primarily female Kemp's ridley sea

turtles at Padre Island National Seashore from 1985-1988 (Shaver et al., 1988b; Shaver, 1989c).

Attempts were also made to prevent incubation temperatures from becoming too hot, too cold, or too unstable, all of which could stress the developing embryos and reduce their viability (Shaver et al., 1987; 1988b; Shaver, 1989c; Shaver and Chaney, 1989). Plastic sheeting, plastic shades, and black draperies were placed over the shed walls to reduce temperature fluctuations, light, and noise within the facility.

Eggs incubated at PAIS from 8 April through 10 August 1999. During that time, a few prolonged episodes of cold temperatures threatened to decrease incubation temperatures to dangerously low levels. A heater was installed on an automatic thermostat to ameliorate the cold temperatures.

During the last third of the incubation period, incubation temperatures could exceed lethal limits due to metabolic heat and high ambient temperatures (Shaver et al., 1987; Shaver, 1989c; Shaver and Chaney, 1989). Several means were utilized to reduce incubation temperatures of the clutches during the latter portion of the incubation period. An exhaust fan activated by an automatic thermostat was used to reduce high ambient temperatures in the incubation facility. Air cooled by an air conditioner was blown into the incubation facility during periods of hot diurnal temperatures. Clutches were moved to cooler, lower shelves immediately after the middle third of the incubation period was completed. Incubation box lids were removed to reduce incubation temperatures after they exceeded 33.5 C (for *L. kempii*) and 31.5 C (for other species). Generally, lids were removed between 2200 and 0800 h and replaced by 1000 h. This pattern of lid removal decreased temperatures in accordance with thermal cycles that would be experienced by eggs incubated *in situ* (Shaver et al., 1988a; 1988b). For incubation boxes that produced a large amount of metabolic heat, lids were

removed and kept off continually for a few days at the end of the incubation period; this protocol was used for the first time in 1999.

Styrofoam incubation boxes were opened approximately once every week throughout incubation to check for insects and sand moisture. Moisture content of the sand above the eggs was monitored by the "pie-crust" pinch technique. When decreased sand moisture was detected in the clutches (typically during the last several days of incubation) small amounts of distilled water were added to the top sand layers.

Incubation boxes were checked for hatching twice daily beginning on the 44th day of incubation. Hatching was typically detected prior to the hatchlings fully emerging from their eggs and reaching the sand surface. The progress of hatching and activity levels of the hatchlings were monitored 24 hours a day after hatching was detected, to determine the appropriate release time for the hatchlings. Some turtles entered their infantile frenzy while in Styrofoam boxes, but others did not. Hatchlings that entered their infantile frenzy were immediately readied for release. Turtles that did not enter their frenzy in the boxes were evaluated to determine when they were ready for release. All emerged hatchlings were transferred to other double Styrofoam boxes containing moist sand from PAIS, most on the morning that they were released, and these boxes were covered with thin, black, cloth covers to eliminate extraneous light from entering the boxes. All hatchlings were measured for SLCL and weighed prior to release.

In 1995, the U.S. Fish and Wildlife Service's National Sea Turtle Coordinator determined that hatchlings incubated at the PAIS facility should be released on Closed Beach, PAIS. The Coordinator concluded that releases there would decrease stress to the hatchlings from transportation to other areas, would eliminate disorientation due to condominium and vehicle lights, and might facilitate the return of these turtles to this less-developed area after adulthood is attained.

Hatchlings from all clutches were released on the northern end of Closed Beach during early morning hours. The hatchlings were guarded from beach predators during release. For the third year, actions were employed to lure laughing gulls (*Larus atricilla*) away from the release site, to prevent them from harming any hatchlings. The releases were attended by PAIS staff and volunteers, visitors, and media personnel.

Unhatched eggs were allowed to incubate for up to five days after the remainder of the clutch had hatched. After that time, all unhatched eggs were either examined immediately or preserved for later analysis. Unhatched eggs that were preserved were injected with, and stored in, F.A.A. solution. Large embryos were injected with 10% buffered formalin to preserve internal tissues. Eggs were examined and embryos classified according to procedures and guidelines used at PAIS since 1982 (Shaver et al., 1988a; Shaver and Chaney, 1989). Cratz (1982) was used to classify Kemp's ridley embryos and Miller (1985) to classify loggerhead embryos.

INCUBATION OF EGGS LAID ON SOUTH TEXAS BEACHES

Incubation facility temperatures

Comparisons were made between air temperatures recorded from the three shelf heights in the incubation facility during the time when eggs were incubating at PAIS (Table 6). Since temperatures were not normally distributed, non-parametric procedures were used to make comparisons. Median air temperatures on top (30.7 C), middle (30.2 C), and bottom (29.4 C) shelves in 1999 were significantly different (Kruskal-Wallis One Way Analysis of Variance on Ranks, $H = 721.016$, $df = 2$, $P < 0.001$). The median air temperatures on the top, middle, and bottom shelves were all significantly different from one another (Student-Newman-Keuls All Pairwise Multiple Comparison Procedures, $P < 0.05$).

Comparisons were made between control box temperatures recorded from the

three shelf heights in the incubation facility during the time when eggs were incubating at PAIS (Table 6). Since temperatures were not normally distributed, non-parametric procedures were used to make comparisons. Median temperatures of control boxes located on top (30.2 C), middle (29.4 C), and bottom (28.7 C) shelves in 1999 were significantly different (Kruskal-Wallis One Way Analysis of Variance on Ranks, $H=3204.071$, $df=2$, $P<0.001$). The median temperatures of the control boxes on the top, middle, and bottom shelves were all significantly different from one another (Student-Newman-Keuls All Pairwise Multiple Comparison Procedures, $P<0.05$).

Incubation temperatures and hatching results

Incubation temperatures for the entire incubation periods of the 18 incubated sea turtle clutches were recorded (Table 6) but not compared due to differences in the dates of egg incubation, numbers of eggs, and various other parameters.

Attempts were made to maintain middle third of the incubation period temperatures slightly above the pivotal temperature for Kemp's ridley (30.2 C) (Shaver et al., 1988b) and loggerhead turtles. These manipulations were apparently successful since the mean middle third of incubation period temperatures for virtually all clutches (Table 6) exceeded the pivotal temperatures for these species.

The incubation period for the Kemp's ridley clutches ranged from 47-52 days and for the loggerhead clutches ranged from 48-50 days (Table 5). Incubation period was measured as the number of days from egg laying until hatching was detected; generally hatching was detected at pipping but occasionally it was not detected until complete hatchling emergence and frenzy.

Two Kemp's ridley clutches (clutches 9, 16) never hatched. The lack of visible embryos in the unhatched eggs (Table 8) is consistent with movement induced

mortality (Limpus, 1979). However, these two clutches were laid on Mustang Island and the eggs were transferred to the PAIS incubation facility within fewer than 4 hours after they were laid. Additionally, transport conditions were even more careful than for the other eggs, since beach driving conditions on Mustang Island were excellent and most of the transport was via a smooth highway. It is most likely that the lack of hatching in these clutches is related to the nesting female and/or her mate(s). The turtle was a returnee from the 1988 year-class. She is among the youngest of turtles from this project detected nesting in the wild. It is likely that she was a neophyte nester and that the poor success of her clutches could have been related to her young age. Alternatively, she and/or her mate(s) could have had physical or physiological difficulties, possibly brought about stress from in-water capture and release by fisheries operations. It is also possible that she never found mates and laid eggs that were not fertilized.

Slight delays in egg collection and transport for Kemp's ridley eggs located at the southern end of PAIS and on Boca Chica Beach and for loggerhead eggs located at PAIS did not result in reduced hatching success. Kemp's ridley eggs carefully collected several hours to a few days after egg laying can be successfully hatched, as also evidenced by a clutch collected by Cynthia Rubio on Boca Chica Beach on 3 June 1996 (laid on 1 June) that had a 92.4% hatch (Shaver, 1997b) and a clutch collected by Cynthia Rubio on South Padre Island on 28 May 1997 (laid on 25 May) that had an 88.8% hatch (Shaver, 1998b). However, highly experienced personnel and extremely careful collection and transport protocols must be employed to assure high hatching success.

Overall, 81.5% of the 1,681 Kemp's ridley eggs that were incubated at PAIS hatched (Table 5). Of the 1,370 Kemp's ridley hatchlings produced, 1,364 were released on the beach and entered the Gulf of Mexico (Table 5). Two deformed Kemp's ridley hatchlings (clutch 8) succumbed prior to release and four deformed Kemp's ridley hatchlings (clutch 8) that were too weak to enter the surf when

placed on the beach was transferred to the University of Texas Marine Sciences Institute (UTMSI) for prolonged care. All four of those hatchlings succumbed within 24 hours of transfer to UTMSI and were transferred back to PAIS for necropsy. Excluding the two Kemp's ridley clutches that did not hatch (clutches 9, 16), 92.2% of the 1,486 Kemp's ridley eggs that were incubated at PAIS hatched (Table 5).

Overall, 94.2% of the 226 loggerhead eggs incubated at PAIS hatched (Table 5). Of the 213 loggerhead hatchlings produced, 212 were released on the beach and entered the Gulf of Mexico (Table 5). One loggerhead hatchling (clutch 13) that was too weak to enter the surf when placed on the beach was transferred to UTMSI for prolonged care.

SLCLs and weights of live hatchlings from the 14 Kemp's ridley clutches that hatched and from the two loggerhead clutches were recorded and summarized (Table 7). SLCLs and weights of the five hatchlings that were sent to UTMSI were included in the descriptive statistics for their two clutches of origin.

After 50 days of incubation no metabolic heat and hatching were detected in clutches 9 and 16. The eggs were examined, deemed non-viable, and preserved at that time. The unhatched eggs from all other clutches were examined after full-term clutch incubation and were determined to have ceased development at various times during the incubation period (Tables 8, 9).

Obvious external deformities were observed in eight deformed Kemp's ridley hatchlings; all eight of those were from clutch 8 (Table 10). Two of the eight died before release, two were successfully released, and four were too weak to enter the surf upon release and were transferred to UTMSI for prolonged care. One deformed loggerhead and 11 deformed Kemp's ridley embryos were found in unhatched eggs (Table 10). Six of the 11 deformed Kemp's ridley embryos were

from clutch 8.

Gonads were removed for histological sex determination from dead hatchlings and late-staged embryos (Tables 8, 9). Gonads were shipped to Texas A&M University, Veterinary Diagnostic Laboratory, where histology was used to determine gender of the embryos and dead hatchlings. Some gonad samples were available and analyzed for six Kemp's ridley and two loggerhead clutches. The percent females of the samples analyzed for the six Kemp's ridley clutches ranged from 33.3-100.0, with an overall mean percent females for these clutches of 80.7% (Table 11). The percent females of the samples analyzed for the two loggerhead clutches were both 100.0% (Table 11).

Kemp's ridley clutch sex ratio estimates were also made based upon the mean middle third of incubation period temperature and incubation period, both of which have been correlated with clutch sex ratio (Shaver et al., 1988b; Shaver, 1989b). Values for the mean middle third of incubation period temperature and incubation period were inserted into equations previously derived correlating these variables with percent females. Using the equation correlating percent female with the mean middle third of incubation period temperature [$Y = -1297.8747 + 44.7152X$ (Shaver et al, 1988b)], the percent females estimated for each of the 14 clutches that hatched ranged from 25.0-100.0%, with a mean for those 14 clutches of 73.1% (Table 11). Using the equation correlating percent female with the incubation period [$Y = 772.343 - 14.634X$ (Shaver, 1989b)], the percent females estimated for each of the 12 clutches that hatched ranged from 11.4-84.5%, with a mean for those 14 clutches of 45.9% (Table 11). To estimate the overall percent females produced from the 14 Kemp's ridley clutches that hatched during 1999, mean percent females derived for the 14 clutches based on results from histological sex determination and both equations were compared. The three means varied considerably and ranged from 45.9-80.7% females. However, the estimates based on histology (80.7%) and mean middle third of incubation

temperatures (73.1%) were likely more reliable than the estimate based on incubation periods. The incubation periods were extended during 1999 due to the new protocol of leaving lids off for longer time periods.

SEA TURTLE STRANDINGS

General

Stranded sea turtles are those individuals located washed ashore or floating, either alive or dead. Sea turtles known to have been captured incidentally (such as in active fisheries operations, on power plant intake grids, etc.) are not included in stranding totals. Stranded sea turtles found on the Texas coast are documented in conjunction with the STSSN. I serve as the Texas Coordinator of the STSSN and tabulate stranding tallies for Texas. Stranded sea turtles are located during systematic surveys and in response to information provided by the public, law enforcement officials, and beach workers. In Texas, outside PAIS, systematic surveys for stranded turtles are conducted from one to three times per week. At PAIS, systematic surveys for nestings and strandings are conducted repeatedly each day during the nesting patrol season and systematic surveys for strandings are conducted at least once a week outside the nesting patrol season.

Each turtle found stranded in Texas is documented on a standardized form and photographed. Locations are classified as either offshore (Gulf of Mexico and associated beaches) or inshore (bays, inlets, and channels and associated beaches). Locations are also categorized according to statistical zones that were designated by the National Marine Fisheries Service. Zones 17-21 are located from north to south along the Texas coast, with the majority of zone 17 located in adjacent Louisiana and PAIS located in roughly the southern half of zone 20 and northern half of zone 21.

Live stranded turtles are taken to rehabilitation facilities and dead turtles are often salvaged for specimen collection and/or necropsy. Most of stranded turtles

documented in Texas are found dead. However, the numbers of dead turtles reported by the network underestimate mortality, since only a portion of dead turtles actually wash ashore and then can be documented.

Four hundred and fifty wild turtles (Table 12), but no head started Kemp's ridley turtles (Table 13), were located stranded along the Texas coast from 1 January through 31 December 1999. Sixty-five were located in inshore areas and 385 in offshore areas. Among the 450 wild turtles that were located stranded were 95 Kemp's ridley, 212 loggerhead, 83 green, 18 leatherback, 32 hawksbill, and 10 unknown species turtles.

The total number of turtles found stranded in Texas during 1999 was the fourth highest annual total since the STSSN was established. However, the number of loggerhead strandings on the Texas coast during 1999 was the largest in network history.

The 385 turtles found offshore in Texas during 1999 included none found in statistical zone 17, 94 in zone 18, 53 in zone 19, 170 in zone 20, and 68 in zone 21. Overall, 62% of Texas offshore strandings were located in zones 20 and 21. The total number of sea turtles found stranded offshore in zones 20 and 21 during 1999 (238) exceeded the total numbers found stranded in zones 20 and 21 during all other years.

Strandings were more numerous in March, April, May, July, August, and September than during any other months in 1999 (Table 12, Fig. 3). Strandings in March-April were concentrated in zone 20 and strandings from mid-July through September were distributed throughout the state.

Of the 450 stranded turtles, 91 were found alive and 359 were found dead. The 359 dead individuals included 40 that were fresh dead (code 1), 114 that

were moderately decomposed (code 2), 161 that were severely decomposed (code 3), 17 that were a dried carcass (code 4), 21 that were only a skeleton (code 5), and 6 that were unknown (code 9). Part or all of 103 dead individuals were salvaged for specimen collection or necropsy (final disposition = 3). Specimen collections and necropsies were also conducted on several turtles that died during rehabilitation efforts.

From January 1 through 31 December 1999, 50 of the 385 turtles found stranded offshore were linked to likely stranding causes (three hypothermic stunned; 22 hatchlings and post-hatchlings that drifted onto shore with currents; two wedged in jetty rocks; one with a rope tied around its flippers and/or neck; four entangled in non-fishing gear medium; two with tar on the body; five in an emaciated condition; three entangled in fishing line; three entangled in fishing net; one with a hook in the flipper or other soft body part; one with monofilament or steel line protruding from the cloaca; and, three with monofilament line found in the digestive tract). Twenty-seven of the 65 turtles found stranded inshore were linked to likely stranding causes (13 hypothermic stunned; four entangled in fishing line; one with possible mutilation; two in an emaciated condition; three wedged in jetty rocks; one with a hook in the mouth; one post-hatchling that drifted onto shore with currents; one entangled in fishing net; and, one entangled in non-fishing gear medium). Additionally, 16 stranded turtles (11 offshore, five inshore) were found with boat propeller injuries, but these injuries could have been inflicted either pre- or post-mortem. Some stranded turtles found during 1999 had signs of interactions with sharks and other animals, but these injuries could have been the result of post-mortem scavenging.

As during many previous years (Shaver, 1994b; 1995b; 1996d; 1998c; 1999b), strandings increased in offshore areas during the spring (Shaver, 1995b), decreased when Gulf of Mexico waters off the Texas coast were closed to shrimp trawling during the Texas Closure (15 May through 15 July 1999), and increased

after shrimp trawling resumed in the Gulf (Table 12, Fig. 3). During 1999, offshore strandings were less numerous during the Texas Closure than before and after the Closure, as typically occurs. The total number of stranded turtles located on offshore beaches during the eight complete weeks before the Texas Closure was 109, number during the eight complete weeks of the Texas Closure was 38, and number during the eight complete weeks after the Texas Closure was 105. The worst spike in the number of stranded turtles found on the Texas coast during 1999 occurred in the first full week after the Texas Closure ended and the Gulf shrimping season opened. In fact, the 33 stranded turtles located on offshore beaches of the Texas coast during that week was the largest weekly total for offshore strandings on the Texas coast since the week of 10-16 July 1994. However, strandings decreased after this spike in 1999. Beginning immediately after the Texas Closure, Texas Parks and Wildlife Department employees assisted with turtle excluder device enforcement (TED) activities for the first time.

Strandings of adult Kemp's ridley turtles

Eighteen adult Kemp's ridleys (> 60.0 cm SLCL) were located stranded on the Texas coast during 1999, down from the record 37 found there in 1998. These 18 stranded adults found during 1999 were documented between 3 February and 11 December. Seventeen of the 18 were located dead; the single individual located alive was transported to a rehabilitation facility but died within 24 hours.

The 18 included 10 females, 4 males, and 4 undetermined sex. Four of the 18 had tags that had been placed on them previously while nesting at or near Rancho Nuevo, Mexico. Some of the other 14 were missing flippers and scutes and hence could not be thoroughly examined to determine if they were from the experimental project or had been tagged previously.

Unfortunately, more adult Kemp's ridleys are typically found stranded in Texas than in any other U.S. state, even though adult Kemp's ridleys forage in, and

migrate through, near shore waters of several other U.S. states. Thirty-seven adult Kemp's ridleys were found stranded in the U.S. during 1999; including 18 found in Texas, seven in Louisiana, nine in Florida, two in South Carolina, and one in Virginia. Nine of the 18 were found stranded in zone 21 and more adult Kemp's ridleys were found stranded in zone 21 during 1999 than in any other U.S. zone that year. Of the 18 found in Texas, 14 were found offshore in zones 20 and 21. Five of the 18 stranded adult Kemp's ridleys found in Texas were located at PAIS, where 11 of the 18 confirmed Kemp's ridley nests in the U.S. were found during 1999.

About half of the adult Kemp's ridleys found stranded on the Texas coast during recent years were females and the loss of each female represents a loss of up to three clutches/nesting season, potentially for many years of nesting. The success of efforts to increase nesting by Kemp's ridleys in south Texas could be threatened by continued mortality of adults in waters offshore from south Texas nesting beaches (Shaver, 1999a).

Strandings of hatchlings

The number of hatchlings and post-hatchlings (hereafter referred to as hatchlings) found stranded on south Texas beaches during each year since 1980 has varied greatly. A considerable increase in these strandings occurred during 1990, when 53 were found on North Padre and Mustang Islands (Shaver, 1990). Since that time PAIS and UTMSI have expended considerable effort to detect and rehabilitate these small stranded turtles.

Twenty-three hatchlings were found stranded along the Texas coast during 1999. All were found in south Texas, including 8 on Mustang Island, 10 on North Padre Island (including PAIS), four on South Padre Island, and one in Mexiquita Flats (Table 14). Among the 23 hatchlings were seven Kemp's ridley, one green, one loggerhead, 13 hawksbill, and one unknown species. As during 1990-1998, most

of the hatchlings were located by pedestrians in heavily visited beach areas (Shaver, 1990; 1991; 1992b; 1993; 1994a; 1996c; 1997b; 1998b; 1999b). Additionally, two hatchlings were found within dolphin fish (*Coryphaena hippurus*). These two were considered to be incidentally captured and hence were not included in stranding totals, but were listed in Table 14.

Stranding locations and dates were noted for each hatchling and most were measured for SLCL, SLCW, CCL, CCW, and weight (Table 14). To assess possible age and origin of the hatchlings, most were examined for the presence of an umbilical scar, egg tooth, internal yolk (if dead), gut contents (if dead), wounds, and epizoans (Table 14). Additionally, most that were found dead or died during rehabilitation were necropsied in an attempt to determine cause of death and remove gonads for histological sex determination. Gonads were shipped to Texas A&M University, Veterinary Diagnostic Laboratory, where histology was used to determine the gender of the dead hatchlings (Table 14).

One Kemp's ridley hatchling found washed ashore on 8 June 1999 was almost certainly from clutch 3 that was released earlier that day; this turtle was not included in any of the stranding totals. One stranded Kemp's ridley hatchling (LK-99-31) was found washed ashore on 18 July and may have been from either clutch 12, 14, 15, or 17 that were released at PAIS between 3 July and 17 July. The loggerhead hatchling found stranded on 21 July may have been from clutch 13, which was released on 13-14 July. Additionally, the live Kemp's ridley hatchling found stranded on 14 June may have emerged from an undetected south Texas nest. These four hatchlings were the size of newly hatched turtles and possessed an umbilical scar and/or an egg tooth (Table 14). It is unlikely that they had been in the water for several days prior to stranding since each was without epizoans and the dead individuals examined had a relatively large quantity of internal yolk and no gut contents.

Based on the size and various attributes of the other 20 stranded hatchlings, it is unlikely that any of them originated from nests deposited along the Texas coast that were either incubated at PAIS or were not detected. A large percentage of the stranded hatchlings were located after the passage of Hurricane Bret and may have washed ashore as a result of this major storm.

FUTURE PLANS

Public education programs, beach patrols, investigation and protection of nesting sea turtles and nests, satellite tracking of nesting Kemp's ridley turtles, and tallying and reporting of nesting in Texas will be continued during 2000. At least one base camp will be operated during the patrol season, to increase the effectiveness of the patrol program. ATVs will continue to be the vehicle type used to conduct most patrols. Operation of the PAIS sea turtle egg incubation facility, the only such facility on the Texas coast, will continue. PAIS participation in the Sea Turtle Stranding and Salvage Network will continue and I will continue to serve as the Texas Coordinator for the STSSN.

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Table 1. Locations and dates of the 18 confirmed sea turtle nests detected along the Texas coast during 1999.

Clutch Number	Species	Nest Site ¹	How Located	Lay Date	Time Tracks or Turtle Detected (h)
1	LK	PAIS-62.8 km marker	Turtle-patroller	8 April	1300
2	LK	BCB-1.3 km S. of BSP	Turtle-public	8 April	1500
3	LK	PAIS-11.3 km marker	Turtle-patroller	20 April	1330
4	LK	PAIS-12.1 km marker	Turtle-public	30 April	1200
5	LK	PAIS-64.2 km marker	Turtle-patroller	1 May	1035
6	LK	PAIS-35.7 km marker	Turtle-public	1 May	1140
7	LK	BCB-0.8 km S. of BSP	Tracks-patroller	2 May	0830
8	LK	PAIS-0.8 km S. of NB/CB	Turtle-patroller	6 May	0930
9	LK	MI-between markers 55 and 56	Turtle-public	6 May	1045
10	LK	PAIS-70.0 km marker	Turtle-patroller	10 May	0830
11	LK	BCB-0.8 km N. of H.W. 4	Tracks-public	11 May	0700
12	LK	PAIS-5.6 km marker	Turtle-public	16 May	1300
13	CC	PAIS-60.3 km marker	Tracks-patroller	24 May	0800
14	LK	PAIS-8.0 km marker	Turtle-patroller	26 May	0830
15	LK	PAIS-6.4 km marker	Turtle-patroller	26 May	1000
16	LK	MI-just S. of Access Rd. 1	Turtle-public	26 May	1030
17	LK	PAIS-86.9 marker	Tracks-patroller	27 May	0730
18	CC	PAIS-Ranger Road	Tracks-patroller	23 June	0745

¹ PAIS = Padre Island National Seashore; MI = Mustang Island; BCB = Boca Chica Beach, BSP = Brazos Santiago Pass, NB/CB = North Beach/Closed Beach barricade.

Table 2. Measurements and tags^{1,2} on the six Kemp's ridley sea turtles that nested along the Texas coast and were examined by biologists from Padre Island National Seashore during 1999.

Clutch Number	SLCL (cm)	SLCW (cm)	CCL (cm)	CCW (cm)	Tags present				Tags applied		
					PIT	Magnetic	Living	Metal	Tag Scar	Metal	PIT
1	64.1	63.6	66.9	70.2	-	RF	LC5	-	RF	LF:SSQ939 LR:SSQ940	LF:4077004A00
3	59.9	59.7	64.3	69.2	-	LF	V4	-	RF	LF:SSQ941 LF:SSQ942	LF:4130294E38
8	62.3	60.6	66.2	68.6	-	-	-	-	-	LF:SSQ973 LR:SSQ974	LF:41307E2442
10	62.2	62.8	64.5	70.0	7F7E1B4139	LF	V4	PPK968	RF	-	-
14	62.2	62.2	66.0	67.5	-	-	-	-	-	LR:SSQ988 LF:SSQ108	LF:413044482F
15	61.6	59.6	65.5	67.6	-	-	-	-	-	LR:SSQ109 LF:SSQ110 LR:SSQ111	LF:4130354649

¹ PIT, magnetic, and metal tags and metal tag scars that were present or applied to the left front flipper (LF) or right front flipper(RF).

² Living tags that were present on scutes left costal 5 (LC5) and neural 4 (V4).

Table 3. Comments regarding six Kemp's ridley sea turtles that nested along the Texas coast and were examined by biologists from Padre Island National Seashore during 1999.

Clutch Number (if Returnee)	Year-Class	Serum Testosterone (pg/ml)	Satellite Transmitter (if Applied)	Comments
1	1984	50.4	18281	Nested again on 1 May 1999 (see clutch 5)
3	1986	12.3	18308	Nested again on 16 May 1999 (see clutch 12)
8	-	3.11	18160	-
10	1986	2.59	18277	-
14	-	2.10	18299	Missing left edge of right rear flipper
15		1.50	18301	-

Table 4. Locations and dates of the two confirmed sea turtle tracks found on the Texas coast during 1999. Note that no eggs were located at these sites.

Suspected Species	Location ¹	How Located	Time		Comments
			Date	Detected (h)	
LK	PAIS-57.1 km marker	Turtle-public	1 May	1130	visible low beach
LK	PAIS-78.1 km marker	Tracks-patroller	14 July	0845	visible low beach

¹ PAIS = Padre Island National Seashore.

Table 5. Incubation and hatching information for the 18 confirmed sea turtle nests detected along the Texas coast during 1999.

Clutch Number	Number of Eggs Incubated ¹	Hatch Date	Incubation Period (Days)	Percent of Eggs Hatched ²	Number Hatchlings Died Prior to Release	Number Hatchlings Released ³	Hatchling Release Dates	Number Hatchlings Retained ⁴
1	101	27 May	50	100.0	0	101	28 May	0
2	105	27 May	50	98.1	0	103	29 May	0
3	103	7 June	49	95.1	0	98	8 June	0
4	121	17-18 June	49-50	97.5	0	118	18-20 June	0
5	97	17 June	48	94.8	0	92	20 June	0
6	113	18-21 June	49-52	91.2	0	103	20-23 June	0
7	85	22 June	52	98.8	0	84	23-24 June	0
8	127	25-26 June	51-52	78.7	2	94	27-28 June	4
9	94	-	-	0.0	0	0	-	0
10	98	26 June	48	96.9	0	95	27 June	0
11	113	1 July	52	98.2	0	111	3 July	0
12	97	1 July	47	99.0	0	96	3 July	0
13	128	10-12 July	48-50	97.7	0	124	13-14 July	1
14	109	11 July	47	60.6	0	66	14-16 July	0
15	122	12-13 July	48-49	91.0	0	111	15-16 July	0
16	101	-	-	0.0	0	0	-	0
17	95	12-15 July	47-50	96.8	0	92	17 July	0
18	98	10 Aug.	49	89.8	0	88	13-15 Aug.	0

¹ Does not include one additional egg from clutches 5, 8, 13, and 15 that were broken and not incubated.

Total number of eggs incubated: 1,681 LK and 226 CC = 1,907 eggs all species.

² Calculated based on the number of eggs incubated.

Total hatched: LK = 81.5% (1,370/1,681); CC = 94.2% (213/226); Total = 82.9% (1,581/1,907).

³ Hatchlings that successfully entered the surf.

Total number of hatchlings released: 1,364 LK and 212 CC.

⁴ Hatchlings measured but too weak to enter the surf and were transferred to UTMSI for prolonged care.

Table 6. Temperatures (Celsius) recorded at Padre Island National Seashore for clutch incubation boxes, air temperature probes, and control boxes during 1999¹.

Temperature Measured	Entire Incubation Period				Middle Third of Incubation Period			
	N	Range	Mean(S.E.)	Median	N	Range	Mean(S.E.)	Median
Clutch 1	1,154	25.8-35.0	30.6(0.1)	30.7	379	29.0-33.8	30.8(0.0)	30.8
Clutch 2	1,113	26.4-35.2	31.0(0.1)	30.9	379	29.1-33.6	30.9(0.0)	30.8
Clutch 3	1,133	25.0-34.7	31.0(0.1)	30.6	378	28.8-32.9	30.8(0.0)	30.7
Clutch 4A	1,138	26.4-33.8	30.5(0.0)	30.5	382	28.4-33.8	30.8(0.1)	30.7
Clutch 4B	1,159	25.7-33.6	30.2(0.0)	30.1	382	28.1-33.0	30.5(0.0)	30.4
Clutch 5	1,119	24.3-33.7	30.8(0.0)	30.7	382	28.6-33.7	30.9(0.1)	30.7
Clutch 6A	1,206	24.3-32.3	29.9(0.0)	30.0	382	28.3-32.1	30.1(0.0)	30.1
Clutch 6B	1,142	24.4-33.6	30.4(0.0)	30.3	407	29.3-33.0	31.1(0.0)	30.8
Clutch 7	1,184	27.2-33.4	29.5(0.0)	29.3	407	28.1-31.5	29.6(0.0)	29.6
Clutch 8A	1,212	23.7-32.9	29.9(0.0)	29.8	407	28.1-32.9	30.5(0.0)	30.4
Clutch 8B	1,188	23.4-33.3	30.3(0.0)	30.2	407	28.8-33.3	30.8(0.0)	30.5
Clutch 9	1,217	24.5-31.6	29.5(0.0)	29.5	N/A	N/A	N/A	N/A
Clutch 10	1,113	25.4-33.8	31.2(0.0)	31.4	383	30.0-33.8	31.7(0.1)	31.8
Clutch 11A	1,209	27.5-32.0	30.0(0.0)	30.0	407	28.8-31.3	30.1(0.0)	30.1
Clutch 11B	1,209	27.3-32.9	30.1(0.0)	30.0	407	28.6-31.6	30.1(0.0)	30.0
Clutch 12	1,095	28.6-33.6	31.2(0.0)	31.3	360	28.9-33.5	31.6(0.0)	31.6
Clutch 13A	1,122	28.7-32.8	30.4(0.0)	30.2	384	29.1-31.6	30.2(0.0)	30.1
Clutch 13B	1,161	28.6-32.9	30.4(0.0)	30.2	384	29.0-31.3	30.1(0.0)	30.1
Clutch 14A	1,101	27.3-32.5	30.7(0.0)	30.7	360	29.6-32.5	30.8(0.0)	30.8
Clutch 14B	1,457	27.1-32.1	29.9(0.0)	29.9	N/A	N/A	N/A	N/A
Clutch 15A	1,117	27.8-32.4	30.5(0.0)	30.6	384	29.3-32.4	30.6(0.0)	30.6
Clutch 15B	1,137	27.7-32.2	30.3(0.0)	30.3	384	29.1-32.1	30.4(0.0)	30.4
Clutch 16	1,189	27.0-31.2	29.5(0.0)	29.4	N/A	N/A	N/A	N/A
Clutch 17A	1,167	27.2-31.5	29.8(0.0)	29.8	384	28.7-31.5	30.0(0.0)	30.0
Clutch 17B	1,055	28.4-31.8	30.1(0.0)	30.1	360	29.1-31.6	30.3(0.0)	30.3
Clutch 18A	1,145	27.2-32.3	30.3(0.0)	30.3	385	28.5-32.3	30.5(0.0)	30.6
Clutch 18B	1,145	27.2-32.2	30.1(0.0)	30.2	385	27.9-32.2	30.3(0.0)	30.4
Air 1	2,950	23.7-35.5	30.7(0.0)	30.7				
Air 2	2,950	23.8-35.7	30.2(0.0)	30.2				
Air 3	2,950	23.0-34.8	29.5(0.0)	29.4				
Control 1	2,950	25.8-33.1	30.1(0.0)	30.2				
Control 2	2,950	25.4-31.0	29.3(0.0)	29.4				
Control 3	2,950	24.7-30.2	28.6(0.0)	28.7				

¹ Air 1 = air probe on top shelf of PAIS incubation facility.
 Air 2 = air probe on middle shelf of PAIS incubation facility.
 Air 3 = air probe on bottom shelf of PAIS incubation facility.
 Control 1 = control box on top shelf of PAIS incubation facility.
 Control 2 = control box on middle shelf of PAIS incubation facility.
 Control 3 = control box on bottom shelf of PAIS incubation facility.

Table 7. Lengths and weights of live hatchlings from clutches detected along the Texas coast during 1999.

Clutch Number	N ¹	Straight-line Carapace Length (mm)			Weight (g)		
		Range	Mean(S.E.)	Median	Range	Mean(S.E.)	Median
1	101	40.02-44.71	42.20(0.08)	42.19	15.68-18.22	16.65(0.05)	16.64
2	103	40.60-45.61	43.69(0.10)	43.70	16.72-19.44	18.22(0.06)	18.24
3	98	38.21-45.29	41.73(0.14)	41.80	14.44-18.59	16.25(0.09)	16.18
4	118	40.00-46.41	43.42(0.12)	43.59	16.01-19.77	17.97(0.07)	18.00
5	92	37.91-45.23	42.23(0.14)	42.26	12.98-18.25	15.86(0.10)	15.83
6	103	40.60-45.21	43.30(0.08)	43.35	14.59-17.18	15.66(0.06)	15.65
7	84	41.22-47.70	44.24(0.14)	44.23	14.49-20.05	18.07(0.13)	18.28
8	98	38.14-44.08	41.14(0.10)	41.06	13.05-16.34	14.92(0.07)	14.94
9	-	-	-	-	-	-	-
10	95	38.87-44.54	42.49(0.10)	42.70	14.05-17.99	16.16(0.10)	16.14
11	111	44.13-48.83	46.93(0.07)	46.97	18.37-21.44	19.91(0.07)	19.95
12	96	39.52-43.67	41.67(0.10)	41.73	13.42-16.70	15.25(0.08)	15.27
13	125	43.26-47.45	45.54(0.08)	45.48	17.92-24.20	20.42(0.08)	20.40
14	66	37.18-46.17	42.36(0.23)	42.45	14.11-20.39	18.30(0.14)	18.46
15	111	41.12-44.92	43.03(0.07)	43.05	13.54-17.73	15.42(0.07)	15.42
16	-	-	-	-	-	-	-
17	92	40.51-45.80	43.49(0.10)	43.61	14.08-19.09	16.57(0.12)	16.42
18	88	41.77-46.80	44.76(0.09)	44.81	16.82-19.85	18.45(0.07)	18.49

¹ N = number measured.

Table 8. Results of analyses of unhatched Kemp's ridley eggs^{1,2,3} and histological sex determination for Kemp's ridley clutches detected along the Texas coast during 1999.

Parameter	Clutch Number																
	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	
<u>Analyses of unhatched eggs</u>																	
no. unhatched	0	2	5	3	5	10	1	27	94	3	2	1	43	11	101	3	
no. decomposed	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	
no. infertile	0	1	1	1	1	2	0	9	86	2	0	1	1	9	101	1	
no. fertile w/o embryos	0	1	1	1	0	5	1	8	8	0	0	0	20	2	0	0	
no. decomposed embryos	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	
no. stage 3 embryos	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
no. stage 10 embryos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
no. stage 11 embryos	0	0	1	0	0	1	0	2	0	0	1	0	0	0	0	0	
no. stage 12 embryos	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	
no. stage 13 embryos	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	
no. stage 18 embryos	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
no. stage 22 embryos	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
no. stage 25 embryos	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	
no. stage 27 embryos	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	
no. stage 28 embryos	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	
no. stage 28-29 embryos	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	
no. stage 29 embryos	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	
no. stage 29-30 embryos	0	0	1	1	2	1	0	0	0	0	0	0	2	0	0	0	
no. stage 30 embryos	0	0	0	0	2	0	0	7	0	0	0	0	0	0	0	0	
<u>Histological sex determination for late-staged embryos and dead hatchlings³</u>																	
no. analyzed	0	0	2	1	3	0	0	11	0	0	0	2	3	0	0	0	
no. males	0	0	0	0	1	0	0	6	0	0	0	0	2	0	0	0	
no. females	0	0	2	1	2	0	0	5	0	0	0	2	1	0	0	0	

¹ Cratz (1982) was used to categorize embryological stage of development at death.

² No twins were found.

³ Included in sex determination analyses were two deformed hatchlings from clutch 8 that died, four deformed hatchlings from clutch 8 that were transferred to UTMSI for rehabilitation but succumbed, and a stranded hatchling found on North Padre Island on 8 June 1999 was likely from clutch 3 that was released that day.

Table 9. Results of analyses of unhatched loggerhead eggs¹ and histological sex determination for loggerhead clutches detected along the Texas coast during 1999.

Parameter	Clutch Number	
	13	18
<u>Analyses unhatched eggs</u>		
no. unhatched	3	10
no. infertile	0	4
no. fertile w/o embryos	1	3
no. decomposed embryos	0	0
no. stage 18 embryos	0	1
no. stage 23 embryos	1	0
no. stage 27 embryos	0	1
no. stage 28 embryos	0	1
no. stage 30 embryos	1	0
<u>Histological sex determination for late-staged embryos and dead hatchlings</u>		
no. analyzed	1	1
no. males	0	0
no. females	1	1

¹ Miller (1985) was used to categorize embryological stage of development at death.

Table 10. Deformed embryos found within unhatched eggs and deformed hatchlings from the 18 clutches detected along the Texas coast during 1999.

Clutch Number	Species	Stage	Deformity Observed and Comments
3	LK	29-30	Cleft palette; dead embryo
5	LK	29-30	Cleft palette; dead embryo
5	LK	29-30	Left front flipper split; dead embryo
5	LK	30	Body contorted; dead embryo
6	LK	29-30	No eyes, no jaws, no right front or right rear flippers, partial albino; dead embryo
8	LK	hatchling	No left eye, snout twisted to the left; live hatchling too weak for release, transferred to UTMSI and died there
8	LK	hatchling	No left eye, crossed jaws; live hatchling too weak for release, transferred to UTMSI and died there
8	LK	hatchling	No right eye, left eye small, upper jaw twisted to the right; live hatchling too weak for release, transferred to UTMSI and died there
8	LK	hatchling	No eyes, lower jaw longer than upper jaw; too weak for release, transferred to UTMSI and died there
8	LK	hatchling	No eyes, bump on head, severe indentation on left side of carapace; dead hatchling found in incubation box
8	LK	hatchling	No eyes, bump on head, lower jaw longer than upper; dead hatchling found in incubation box
8	LK	hatchling	No right eye; live hatchling successfully released
8	LK	hatchling	No right eye; live hatchling successfully released
8	LK	30	Rear of body inverted; dead embryo
8	LK	30	No eyes, bump on head; dead embryo
8	LK	30	No eyes, bump on head, lower jaw longer than upper; dead embryo
8	LK	30	No eyes, bump on head, lower jaw longer than upper; dead embryo
8	LK	30	No eyes, lower jaw curves to left; dead embryo
8	LK	30	No eyes, bump on head, upper jaw short and flattened, rear of body inverted; dead embryo
18	CC	27	Lower jaw longer, saddleback; dead embryo

Table 11. Estimated and identified sex ratios for sea turtle clutches detected along the Texas coast during 1999.

Clutch Number	Estimated % Female Based on Temperature ¹	Estimated % Female Based on Incubation Period ²	Identified % Female Based on Histology ³
1	78.1	40.6	-
2	81.9	40.6	-
3	78.5	55.3	100.0
4	81.5&64.4	40.6&55.3	100.0
5	81.9	69.9	66.6
6	47.2&94.1	11.4&55.3	-
7	25.0	11.4	-
8	66.6&78.8	11.4&26.0	45.5
9	-	-	-
10	100.0	69.9	-
11	45.9&46.0	11.4	-
12	100.0	84.5	100.0
13	-	-	100.0
14	80.8	84.5	33.3
15	61.4&70.2	55.3&69.9	-
16	-	-	-
17	45.1-57.4	40.6&84.5	-
18	-	-	100.0
Overall ⁴			
<i>L. kempii</i>	73.1	45.9	80.7
<i>C. caretta</i>			100.0

¹ Calculated using equation relating % female and mean middle third of incubation period temperature for Kemp's ridley ($Y = -1297.8747 + 44.7152X$) (Shaver et al., 1988b).

² Calculated using equation relating % female and incubation period for Kemp's ridley ($Y = 772.343 - 14.634X$) (Shaver, 1989b).

³ Calculated based on results of histological analyses of gonads from dead hatchlings and late-staged embryos (see Tables 8 and 9 for sample sizes analyzed).

⁴ Mean for the six Kemp's ridley and two loggerhead clutches from which samples were analyzed.

Table 12. Wild sea turtles found stranded along the Texas coast during 1999.

Species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
CC	5	17	16	35	22	10	43	21	23	6	9	5	212
LK	2	6	11	24	8	2	16	5	4	8	4	5	95
CM	13	5	9	5	3	7	2	5	4	6	12	12	83
DC	0	0	5	10	2	0	0	0	0	1	0	0	18
EI	2	1	2	1	4	4	4	2	11	1	0	0	32
UN	0	0	0	1	2	0	0	4	1	1	0	1	10
Total	22	29	43	76	41	23	65	37	43	23	25	23	450

CC = Loggerhead (*Caretta caretta*)
 LK = Kemp's ridley (*Lepidochelys kempii*)
 CM = Green (*Chelonia mydas*)
 DC = Leatherback (*Dermochelys coriacea*)
 EI = Hawksbill (*Eretmochelys imbricata*)
 UN = Unknown

Table 13. Head started Kemp's ridley sea turtles found stranded along the Texas coast during 1999.

Species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
LK	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 14. Sea turtle hatchlings and post-hatchlings (<10.0cm SLCL) found stranded (S) or incidentally captured (IC) on the Texas coast during 1999.

I.D.	Species	SLCL (cm)	SLCW (cm)	CCL (cm)	CCW (g)	Weight (g)	Location ¹	Date	Type	Condition Facility ²	Fate ³	Sex ⁴	Comments ⁵
LK	LK	4.1	-	-	-	14.7	SPI, 6.4 km S. of Mansfield Channel	14 June	S	live GPZ	U	U	wu, et
LK-99-25	LK	5.4	5.2	5.5	6.0	28.1	NPI, 1.6 km N. of J.P. Luby Surf Pier	27 June	S	live UTRF	D	M	ep, wf
LK-99-31	LK	4.3	3.6	4.5	4.6	16.4	MI, Port Aransas County Park	18 July	S	live UTRF	1 July	M	wf, et, us, y
LK-99-32	LK	5.1	5.0	5.5	5.9	24.6	Gulf of Mexico, in dolphin fish	18 July	I	dead	19 July	F	g
LK-99-33	LK	5.9	5.4	6.7	6.2	38.9	Gulf of Mexico, in dolphin fish	18 July	I	dead	-	F	g
CC	CC	4.7	3.6	4.9	4.7	19.0	MI, Mayan Princess Condo	21 July	S	live UTRF	U	U	wf, us
LK	LK	5.4	5.2	5.4	6.0	24.1	MI, Port Aransas	22 July	S	live UTRF	U	U	wu
LK	LK	4.7	4.5	4.8	5.0	21.8	PAIS, 0.4 km S. of N. Park boundary	23 July	S	live UTRF	U	U	ep, us, et, wh
LK	LK	5.2	4.8	5.5	5.7	24.2	NPI, 8 km S. of Nu./Kl. Co. line	23 July	S	live UTRF	U	U	ep
EI-99-08	EI	6.3	4.9	7.0	6.7	32.3	NPI, Bob Hall Pier	27 July	S	live UTRF	D	F	ep, wh, wf
LK	LK	5.2	4.9	5.5	5.8	26.2	MI, south jetty of Aransas Pass	24 Aug.	S	live UTRF	U	U	-
EI	EI	5.3	4.1	5.8	5.2	27.1	NPI, Padre Balli Park	24 Aug.	S	live UTRF	U	U	wf
EI	EI	5.5	4.5	5.1	5.6	26.1	MI, 6.3 km S. of Access Rd. 1	29 Aug.	S	live UTRF	U	U	wf
EI	EI	8.1	6.4	9.0	8.3	69.2	PAIS, 16.1 km marker	4 Sept.	S	live UTRF	U	U	ep
EI	EI	5.6	4.3	6.0	5.0	-	SPI	4 Sept.	S	live GPZ	U	U	wu
EI	EI	6.0	4.9	6.2	6.0	27.7	PAIS, 4.8 km S. of Malaquite Beach	5 Sept.	S	live UTRF	U	U	ep
EI	EI	7.4	6.3	7.7	7.6	53.0	NPI, 4.8 km S. of Bob Hall Pier	6 Sept.	S	live UTRF	U	U	ep, wu
UN	UN	-	-	-	-	-	MI, Mayan Princess	7 Sept.	S	live	-	U	-

Table 14. Continued.

I.D.	Species	SICL (cm)	SLCW (cm)	CCL (cm)	CCW (cm)	Weight (g)	Location ¹	Date	Type	Condition Facility ²	Fate ³	Sex ⁴	Comments ⁵
CM	CM	7.2	6.0	7.4	6.3	36.5	MI, Nueces County Park	8 Sept.	S	live	U	U	wu
EI	EI	5.7	5.0	6.1	6.0	36.0	NPI, J.P. Luby Surf Pier	11 Sept.	S	live	U	U	wf, ep
EI	EI	7.9	6.3	8.3	7.6	-	SPI, Isla Blanca State Park	11 Sept.	S	live	U	U	wu
EI	EI	6.9	5.7	7.3	7.2	46.1	MI, Executive Keys Condo	12 Sept.	S	live	U	U	wu
EI	EI	4.8	4.2	5.4	5.2	-	SPI, 16.8 km N. of Brazos Sant. Pass	12 Sept.	U	live	U	U	-
EI	EI	6.9	5.6	7.9	7.2	50.1	PAIS, 0.8 km marker	19 Sept.	S	live	U	U	ep
EI	EI	7.8	6.3	8.1	7.6	-	Mexiquita Flats	25 Sept.	S	live	U	U	wf
										GPZ			

¹ NPI = North Padre Island, PAIS = Padre Island National Seashore, MI = Mustang Island, BCB = Boca Chica Beach, SPI = South Padre Island

² UTRF = University of Texas Marine Sciences Institute rehabilitation facility, GPZ = Gladys Porter Zoo

³ D = died, H = still being held for rehabilitation

⁴ M = male, F = female, U = unknown

⁵ y = internal yolk, et = egg tooth, us = umbilical scar, ep = epizoan, wf = fresh external wounds, wh = healed external wounds, wu = wounds (unknown fresh or healed), g = gut contents present

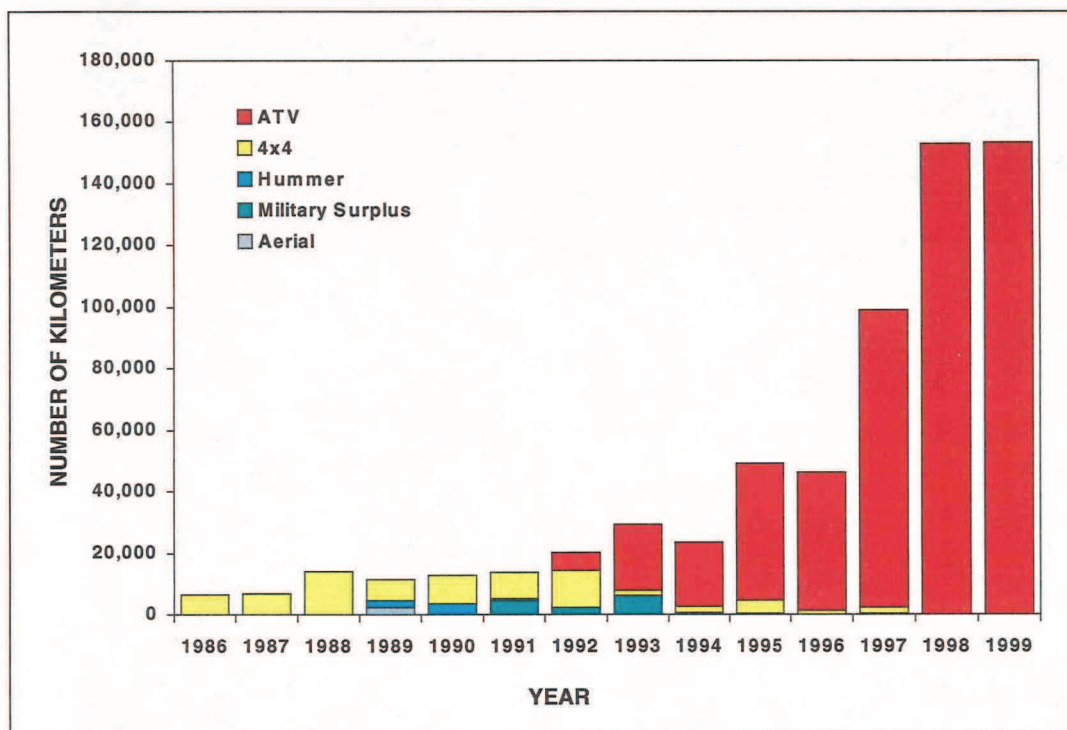


Figure 1. Number of kilometers patrolled on North Padre Island, Texas from 1986-1999.

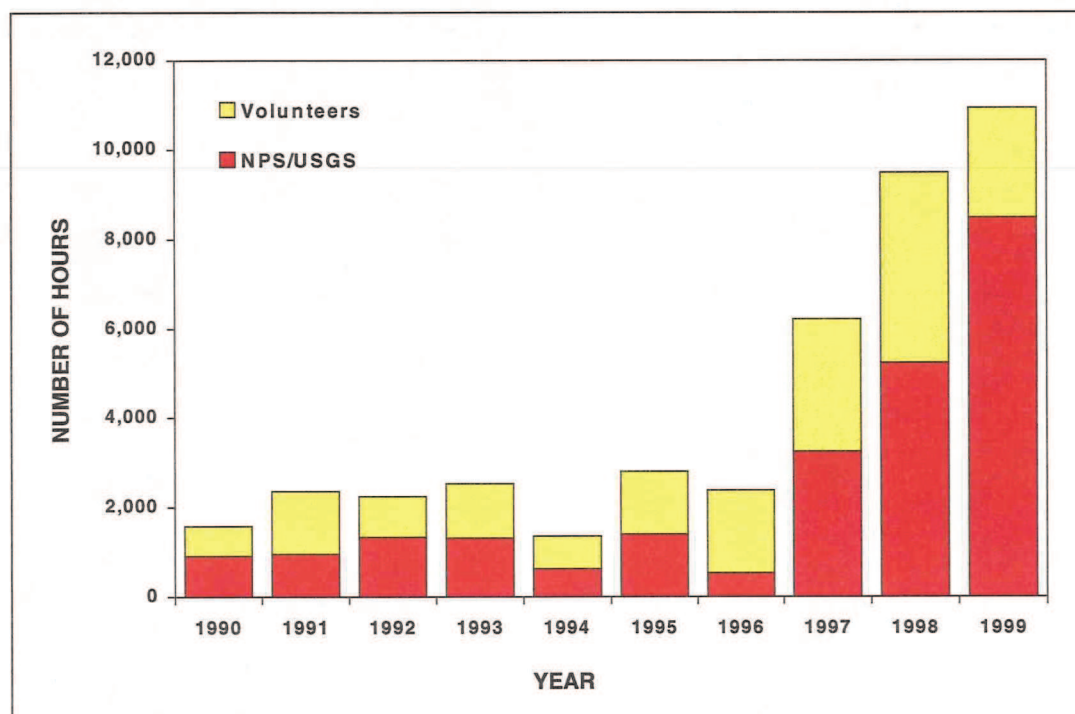


Figure 2. Number of hours various groups spent conducting patrols on North Padre Island, Texas from 1990-1999.

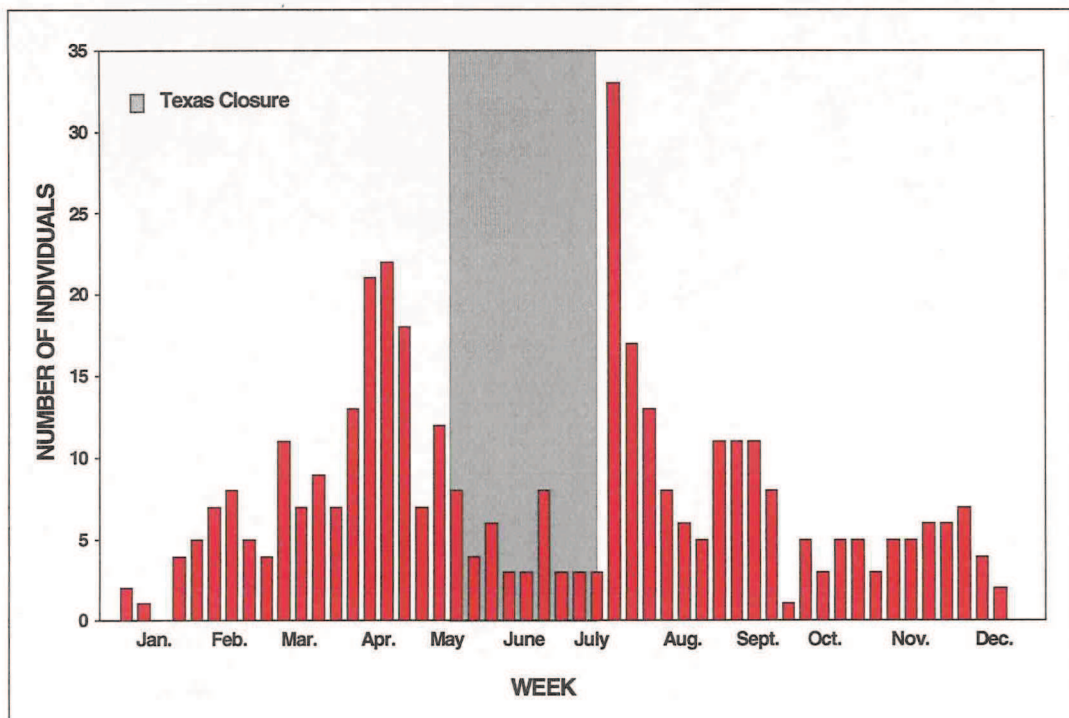


Figure 3. Number of non-headstarted sea turtles located stranded on offshore beaches along the Texas coast during each week in 1999.

