

Padre Island National Seashore Kemp's Ridley Sea Turtle Project and Texas Sea Turtle Nesting and Stranding

2000 Report



**U.S. Department of the Interior
U.S. Geological Survey
Padre Island Field Research Station**

**PADRE ISLAND NATIONAL SEASHORE
KEMP'S RIDLEY SEA TURTLE PROJECT AND
TEXAS SEA TURTLE NESTING AND STRANDING
2000 REPORT**

BY:

**Donna J. Shaver, Ph.D.
Department of the Interior
U.S. Geological Survey
Biological Resources Division
Columbia Environmental Research Center
Padre Island Field Research Station
Padre Island National Seashore
P.O. Box 181300
Corpus Christi, Texas 78480-1300**

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ABSTRACT

U.S. Geological Survey and National Park Service employees and volunteers conducted patrols to detect sea turtle nesting on North Padre Island [including Padre Island National Seashore (PAIS)] from 19 March through 13 August. During 2000, 11,518 hours were spent patrolling a total of 156,886 km of North Padre Island beachfront, slightly larger than the number of patrol hours and distance patrolled during 1999. The U.S. Fish and Wildlife Service, Gladys Porter Zoo, and cooperators spent roughly 1,536 hours patrolling approximately 22,794 km to detect nesting on South Padre Island and Boca Chica Beach, the only other areas on the Texas coast systematically patrolled for nesting. Sea Turtle Stranding and Salvage Network (STSSN) participants patrolled year-round to detect sea turtles stranded on Texas Gulf beaches. Several entities conducted public education efforts to alert beach visitors to report nesting and stranded sea turtles on the Texas coast and responded to these reports.

Eighteen sea turtle nests were confirmed on the Texas coast during 2000. The 18 included 12 Kemp's ridley (*Lepidochelys kempii*), one green (*Chelonia mydas*), and five loggerhead (*Caretta caretta*) nests. The 18 nests were located due to observations of either nesting turtles or their tracks. Ten were found by patrollers on North Padre Island (all at PAIS), one by a fishing guide on North Padre Island (at PAIS), one by a visitor on North Padre Island, two by patrollers on South Padre Island, two by visitors on South Padre Island, one by a STSSN participant on South Padre Island, and one by a patroller on Boca Chica Beach. Six of the Kemp's ridley nests were located on North Padre Island (including five at PAIS), five on South Padre Island, and one on Boca Chica Beach. The green and loggerhead nests were located on North Padre Island, at PAIS. The 12 confirmed Kemp's ridley nests found on the Texas coast during 2000 were less than the 16 Kemp's ridley nests documented there during 1999 and the 13 nests documented there during 1998. No other Kemp's ridley nests were confirmed in the U.S.

during 2000. The five loggerhead nests recorded on the Texas coast during 2000 matched the number found there during 1996, when a record five were documented.

Of the 12 Kemp's ridley nests found on the Texas coast during 2000, one was from a turtle that had been experimentally imprinted to PAIS and documented nesting on the Texas coast in 1998, one was from a turtle that had been tagged while nesting on the Texas coast in 1997, one was from a turtle with a metal tag that was not closely examined, six were from six different turtles that were examined but had no tags, and three were from nesting turtles that were not examined for tags. No individuals were documented nesting more than once on the Texas coast during 2000. The returnee from the experimental project was from the 1987 year-class. To date, nine turtles from this experimental project have been documented nesting on the Texas coast.

Satellite transmitters were applied to three of the Kemp's ridley turtles that nested on North Padre Island in April 2000. By the end of May 2000, all had moved northward and then eastward within Gulf of Mexico waters. The turtles were last located in the northern Gulf of Mexico, primarily off Louisiana, 3-7 months after transmitter deployment.

Eggs from 17 of the 18 confirmed nests found on the Texas coast were packed into Styrofoam boxes and transported to the incubation facility at PAIS for protected incubation. The Kemp's ridley clutch laid on Boca Chica Beach was transferred to a protective corral located there. Overall, 86.8% of the 1,086 Kemp's ridley turtle eggs, 97.1% of the 174 green turtle eggs, and 69.9% of the 499 loggerhead turtle eggs held at the incubation facility hatched. From these, 942 Kemp's ridley, 169 green, and 348 loggerhead hatchlings were released on the beach at PAIS and entered the Gulf of Mexico. One deformed Kemp's ridley

hatchling 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, but died within a few weeks. From the 74 Kemp's ridley eggs incubated in the corral on Boca Chica Beach, 78.3% hatched and 58 hatchlings were released.

During 2000, 412 sea turtles were located stranded along the Texas coast. Among the 412 were 100 Kemp's ridley, 163 loggerhead, 90 green, 14 leatherback (*Dermochelys coriacea*), 28 hawksbill (*Eretmochelys imbricata*), and 17 unknown species turtles. Twenty-three adult Kemp's ridley turtles (> 60.0 cm straight-line carapace length) were located stranded on the Texas coast during 2000.

Twenty-five sea turtle hatchlings and post-hatchlings (< 10.0 cm straight-line carapace length; hereafter termed hatchlings) were found washed ashore along the Texas coast during 2000, between 18 June and 5 October. The 25 included 19 Kemp's ridley and six hawksbill turtles. Two of the Kemp's ridley turtles likely originated from clutches that were laid in south Texas, incubated under protected conditions, and released by biologists. The remaining 23 turtles were categorized as true strandings since they could not be linked to any known releases. One stranded Kemp's ridley may have emerged from an undetected south Texas nest. It is unlikely that any of the other stranded hatchlings were from south Texas nests.

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BACKGROUND

Most Kemp's ridley turtles (*Lepidochelys kempii*) nest on the Gulf of Mexico coast in Mexico, particularly in the vicinity of the village of Rancho Nuevo, Tamaulipas, Mexico (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1992; Burchfield et al., 1999). During each summer from 1978 to 1988, approximately 2,000 Kemp's ridley turtle 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 native 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 this project is to identify whether Kemp's ridleys return to nest in south Texas (Shaver, 1989b). Also significant are the location, investigation, and protection of nesting sea turtles and sea turtle nests. Beach patrols and public education efforts are critical components of the detection efforts and a variety of entities are cooperating to conduct these activities in south Texas. During the last two decades, most Kemp's ridley nests located in the U.S. have been found in south Texas, with more Kemp's ridley nests confirmed at PAIS than at any other single location in the U.S. (Shaver and Caillouet, 1998). In 1996, the first two turtles from the experimental project confirmed to have nested outside of captivity were documented nesting at PAIS and since that time turtles from the project and other Kemp's ridley turtles have been documented nesting in south Texas (Shaver, 1996a; 1996b; 1997a; 1997b; 1998a; 1999a; 1999b; 2000).

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). STSSN participants in Texas include staff members and volunteers from a variety of federal and state agencies, universities, and other entities. Stranded sea turtles are documented on standardized forms using standardized protocols (Shaver, 1998c; Shaver and Teas, 1999). As the Texas Coordinator of the STSSN, I tabulate and maintain records of stranded sea turtles and sea turtle nests documented in Texas.

This report summarizes sea turtle nests and stranded sea turtles that were documented in Texas during 2000. Also summarized are efforts conducted on North Padre Island (including PAIS) to patrol for nesting sea turtles, educate the public about sea turtles, incubate sea turtle eggs, and satellite track nesting Kemp's ridley turtles during 2000.

BEACH PATROLS FOR NESTING TURTLES

The Kemp's Ridley Sea Turtle Recovery Plan (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1992) emphasizes that study and protection efforts at the primary nesting beach near Rancho Nuevo, Mexico are critical to the survival of this species. Management of other beaches where Kemp's ridley turtles nest is listed as a priority 2 recovery task item in the Kemp's Ridley Sea Turtle Recovery Plan and one of the other beaches mentioned is Padre Island. The recovery plan recommends patrolling for nesting Kemp's ridley turtles on Padre Island "in view of the large number of turtles that were experimentally imprinted there" and further states that "it would be a terrible waste if the imprinting experiment had worked but we did not know it because of a lack of observations". As a result, seasonal beach patrols for nesting sea turtles, tracks, and nests began on North Padre Island in 1986 and continued through 2000.

From 19 March through 13 August 2000, U.S. Geological Survey (USGS) and National Park Service (NPS) 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. During 2000, 77 volunteers participated in the patrol and hatchling release efforts. Volunteers conducting patrols worked either half days (5-6.5 hours/day) or complete days (10 hours/day). Volunteers patrolled primarily in the northern part of the patrol area and paid staff members primarily in the central and southern sections of the patrol area.

Patrols originated from the northern end of PAIS (at Ranger Road) or the southern end of PAIS (at the base camp established at the PAIS 65 km marker). Campers alternated on a three day schedule and they repeatedly patrolled the areas adjacent to the base camp.

A total of 156,886 km of patrol distance was logged on North Padre Island during 2000, nearly identical to the patrol distance recorded there in 1999 (Fig. 1). Since 1993, all-terrain four-wheel cycles (ATVs) have been the primary patrol vehicle and ATVs were used to conduct all patrols during 2000. 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 2000, four-wheel drive trucks and sport utility vehicles 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; 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 Turtle Laboratory at PAIS for application of satellite transmitters; and, 6) transport large stranded sea turtles to the Turtle Laboratory. During patrol seasons from 1986-1992, before sufficient funding was available to purchase ATVs, four-wheel drive trucks were the primary vehicles available and used for patrols. However, trucks and sport utility vehicles are unsuitable for patrols because they 1) have a reduced field of observation and are usually 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 to conduct patrols (one driver and one observer).

During the 2000 nesting patrol season, 11,518 hours were spent patrolling on North Padre Island. In comparison, 10,939 hours were spent patrolling there during 1999 (Fig. 2). Numerous individuals were needed to conduct patrols because of the extensive area (125 km linear distance) and lengthy season (5 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 (7,294 hours) and volunteers (4,224 hours) conducting these patrols (Fig. 2).

Although PAIS Maintenance Division and Visitor Protection Division employees traversed long distances of beach-front during the course of their duties, their vehicle types (sedans, sport utility vehicles, four-wheel drive trucks, etc.) 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 beach patrol efforts during 2000.

Systematic patrols to detect nesting were also conducted on South Padre Island and Boca Chica Beach throughout the majority of the nesting season during 2000; these were the only other areas on the Texas coast systematically patrolled for nesting that year. The U.S. Fish and Wildlife Service (USFWS), Gladys Porter Zoo (GPZ), and other cooperators conducted these patrols. A NPS biological technician was stationed on South Padre Island to assist with the patrol program there and the NPS and USGS provided some of the equipment used for this effort in 2000. The South Padre Island patrols were conducted every few days during the last three weeks of April and every day from 30 April through 4 August. The Boca Chica patrols were conducted every few days during early and mid-April and daily from 25 April through 30 July. Roughly 1,536 hours were spent patrolling approximately 22,794 km of beachfront on South Padre Island and Boca Chica Beach. This was the first time in recent years for nesting patrols on South Padre Island and the second time in recent years for nesting patrols on Boca Chica Beach (Smith, 1999). The South Padre Island and Boca Chica Beach patrol and public education efforts are not further reported in the patrol totals and protocols described in this report. However, nests and non-nesting emergences found there are reported, for a complete tally of nests found on the Texas coast during 2000.

The USGS provided training regarding detection, investigation, and documentation protocols to NPS, USGS, USFWS, and GPZ staff members and many volunteers conducting patrols. This training was necessary to ensure usage of standardized procedures throughout south Texas to gather comparable data for long-term studies regarding stranded sea turtles, nesting sea turtles, and sea turtle nests.

EDUCATION EFFORTS

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 people that use the beach for work or recreation continued during 2000. It is imperative that these individuals receive information to enable them to assist with detection and reporting of turtle sightings, since beach users 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 sea turtles, sea turtle tracks, and stranded sea turtles.

A variety of methods were used to educate beach users about the possibility of sighting nesting and stranded turtles. Training sessions were given to many PAIS employees, commercial fishing guides, and other beach workers, to aid in them in being able to provide information to the public and to let them know what to do if they observe a sea turtle. 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 PAIS. 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. Numerous media interviews were conducted during the patrol and hatchling release seasons and I wrote a bi-weekly column for a local newspaper detailing the sea turtle work.

The public was invited to attend 13 of the 27 hatchling releases at PAIS during

2000 and, cumulatively, over 1,000 visitors attended. A Hatchling Hotline was established to provide the public with current information about anticipated releases. Posters listing the telephone number for the Hatchling Hotline were distributed throughout PAIS and the local community. Additionally, this telephone number and anticipated release dates were published in my bi-weekly newspaper column and on various web-sites. The Hatchling Hotline format was a recorded message that was regularly updated. Educational programs about sea turtles 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 PAIS visitors. An Adopt-A-Turtle program was continued for a third year and was also effective at educating the public about the turtle project.

INVESTIGATION OF NESTING TURTLES, TRACKS, AND NESTS

The USGS led investigations of nesting sea turtles and sea turtle tracks detected by turtle patrollers and the public on North Padre Island and aided with investigations on South Padre Island. The NPS assisted with these efforts.

Complete data collection, sample collection, and tagging were performed for the four nesting Kemp's ridley turtles located on North Padre Island and one of the nesting Kemp's ridley turtles located on South Padre Island. Each of these five turtles was thoroughly 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). Length measurements were from the center of the nuchal notch to the posterior tip of the post-central scute. Each was tagged with one PIT tag and two metal tags when those tags were not present. A blood sample was removed from each and sent to The University of Charleston to determine their serum testosterone level. The serum testosterone level was used to indicate the number

of remaining clutches that would be laid during that season by that individual. Only partial data collection, sample collection, or tagging were performed for the other three nesting Kemp's ridleys found on South Padre Island and the one nesting Kemp's ridley found on Boca Chica Beach.

All three of the individuals that would be tracked using satellite transmitters were transported to the Turtle Laboratory at PAIS for application of the transmitter (see Movements of Nesting Kemp's Ridley Turtles).

Each emergence site was investigated to determine whether 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 confirmed non-nesting emergences or tracks. Confirmed non-nesting emergences were those emergences that were investigated and documented to such a degree that biologists were certain that no eggs were laid at the site. Confirmed tracks were those emergences that were investigated by biologists or documented by visitors, but it was uncertain whether eggs were laid at the site.

Eggs were removed from the nest sites for all confirmed nests located on the Texas coast during 2000. Eggs found on North and South Padre Islands were shaded, counted, packed into Styrofoam incubation boxes containing sand from the nest sites, and transported to the incubation facility at PAIS. However, eggs found on Boca Chica Beach were transferred to a protective corral there. Large Kemp's ridley clutches and all clutches laid by other species were split into two incubation boxes, with the two boxes containing roughly equal number of eggs. The two boxes for divided clutches were designated as A and B. Collected eggs were transported to the incubation facility at PAIS in shaded conditions within a truck or sport utility vehicle. Information is presented on incubation, hatching, and

release of clutches located in 2000 (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 2000, from 12 April through 18 July (Table 1). The 18 included 12 Kemp's ridley, one green (*Chelonia mydas*), and five loggerhead (*Caretta caretta*) nests. Eleven of the 18 sea turtle nests (including five Kemp's ridley, one green, and five loggerhead) were found on PAIS (Table 1). Five Kemp's ridley nests were located on South Padre Island, one Kemp's ridley nest on North Padre Island north of PAIS, and one Kemp's ridley nest on Boca Chica Beach.

Ten of the 18 nest sites were found by patrollers on North Padre Island (all at PAIS), one by a fishing guide on North Padre Island (at PAIS), one by a visitor on North Padre Island, two by patrollers on South Padre Island, two by visitors on South Padre Island, one by a STSSN participant on South Padre Island, and one by a patroller on Boca Chica Beach (Table 1).

The 12 Kemp's ridley nests were located between 12 April and 4 June, the green turtle nest on 12 July, and the five loggerhead nests between 9 June and 18 July (Table 1). The nine nesting Kemp's ridleys seen by patrollers or beach visitors at confirmed nest sites were detected between 0910 and 1545 h. The three Kemp's ridley tracks found at confirmed nest sites were located at 1010, 1130, and 1630 h. Patrols had already passed by these locations prior to discovery of the tracks and hence the turtles likely nested between patrols. The green and loggerhead nests were discovered through the observations of tracks that were found between 0730 and 0915 h (Table 1).

The 12 confirmed Kemp's ridley nests found on the Texas coast during 2000 was fewer than the 16 documented during 1999. Those 16 for 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 (Shaver, 2000). The increase in the number of Kemp's ridley nests detected on the Texas coast from 1995 through 1999 may have reflected increased nesting, improved detection efforts, increased awareness and reporting by the public, or a combination of all of these factors. Fifty-five confirmed Kemp's ridley nests were located on the Texas coast from 1979-1999 (Shaver, 1995a; 1996a; 1996c; 1998b; 1999b; 2000). 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 and patrols were not conducted on South Padre Island and Boca Chica Beach until 2000 and 1999, respectively. During 2000, nests could have been missed on the south Texas coast because large amounts of *Sargassum sp.* covered the beach and made track detection extremely difficult. Additionally, some Kemp's ridley nests could have been missed because signs of nesting were obliterated before patrollers arrived. Severe thunderstorms, heavy rainfall, high tides, and high winds were noted on many of the days when Kemp's ridley nesting was documented on the Texas coast during 2000.

The 12 confirmed Kemp's ridley nests found on the Texas coast in 2000 were the only confirmed Kemp's ridley nests found in the U.S. that year.

Five confirmed loggerhead turtle nests were located on the Texas coast during 2000, in comparison to five found in 1996, four in 1997, two in 1998, and two in 1999. Nineteen confirmed loggerhead nests were located on the Texas coast from 1979-1999 (Shaver, 1999b; 2000). The one green turtle nest located on the Texas coast was fewer than the five found in 1998, but more than the zero found

found in 1999.

Biologists examined nesting Kemp's ridley turtles for tags at nine of the 12 confirmed Kemp's ridley nests found in Texas during 2000 (Tables 2, 3). Of the nine examined, six were different turtles and had no tags or tag scars, one had been tagged while nesting on the Texas coast in 1997, one had a metal tag but was not otherwise closely examined, and one had tags indicating that it had been experimentally imprinted to PAIS and documented nesting on the Texas coast in 1998. This 13 year old returnee was from the 1987 year-class and was one of the nine turtles from the experimental project that have been documented laying a total of 14 clutches of eggs on the Texas coast to date (Shaver, 1996a; 1996b; 1997a; 1997b; 1998a; 1999a, 2000). The two turtles that were documented nesting on the Texas coast in 2000 that had been recorded previously (Table 3) were the first individuals confirmed to have nested on the Texas coast during two different years.

SLCL for the six individuals measured ranged from 60.8 to 65.1 cm (Table 2). None of the nine individuals examined were documented nesting more than once on the Texas coast during 2000, although one of these nine was only partially examined and could have been one documented nesting earlier in the nesting season. Serum testosterone levels for the five individuals sampled ranged from 10.7 to 73.3 pg/ml (Table 3). The highest testosterone levels were for the samples obtained from the mothers of clutches 2, 3, 4, and 6 found during 2000. These levels of testosterone indicated that the turtles should have nested one more time during the 2000 nesting season (Dr. David Owens, personal communication), but none were observed nesting again. The low testosterone level from the other sample (mother of clutch 1) should have indicated that this turtle just laid her only or last clutch of the 2000 nesting season and she was not observed nesting again during 2000.

The nesting Kemp's ridley turtles were not examined by trained biologists at the remaining three Kemp's ridley nests documented on the Texas coast during 2000.

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 loggerhead and green turtle nests documented on the Texas coast during 2000.

Unfortunately, since the nesting turtles were not thoroughly examined at all nest sites in Texas, it was impossible to calculate the exact number of turtles that nested during 2000. The minimum and maximum numbers of individual females of each species that laid the confirmed clutches found on the Texas coast during 2000 were estimated based on tag observations, 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 less than 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 12 confirmed Kemp's ridley clutches on the Texas coast during 2000 ranges from a minimum of eight to a maximum of 12. 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. Based on serum testosterone levels, typical inter-nesting intervals, nest locations, and movements of satellite tracked individuals it is possible that the mother of clutch 2 was also the mother of clutch 5 or 8, the mother of clutch 3 was also the mother of clutch 5 or 7, the mother of clutch 4 was also the mother of clutch 8, and the mother of clutch 6 was also the mother of clutch 11. The five loggerhead clutches located on the Texas coast in 2000 could have been laid by the same individual, so from one to five loggerhead turtles laid these five clutches.

A Kemp's ridley turtle documented nesting at PAIS on 31 May 1998 was documented nesting twice in Mexico during 2000. This turtle was not linked to the experimental imprinting project and had been tagged with metal tags SSQ103 and SSQ104 and PIT tag 41307E4022 when it nested at the PAIS 44.2 km marker in 1998. On 24 April 2000, it laid 109 eggs at Tepehuajes, Mexico and on 14 May 2000 it laid 105 eggs at Rancho Nuevo, Mexico. This is the first turtle that had initially been documented nesting in Texas that had subsequently been documented nesting in Mexico. Kemp's ridley turtles initially tagged while nesting in Mexico had already been documented making subsequent nesting and non-nesting emergences on the Texas coast (Shaver, 1998b; 1999b).

Confirmed non-nesting emergences and tracks

Five confirmed non-nesting emergences were documented on the Texas coast during 2000 (Table 4). One was a site where a patroller on Boca Chica Beach saw an adult Kemp's ridley turtle crawl on the beach and re-enter the water without nesting. The other four were located where tracks, but no turtles, were found. Three were on North Padre Island (at PAIS) and one on South Padre Island; three were from loggerhead turtles and one was from a green turtle.

ADDITIONAL NESTING-RELATED REPORTS

I was informed about one other nesting-related observation on the Texas coast during 2000. A beach visitor notified South Padre Island patrollers that he saw a second nesting turtle on 13 May 2000, at about 1800 h. However, the patrollers were unable to find a nesting turtle, tracks, or signs of a nest when they examined the area 30 minutes later. A dead, stranded loggerhead turtle was located in the general vicinity of the area described by the visitor. The visitor said that the turtle that he observed was alive and moving and was not the dead loggerhead. However, the loggerhead was located close to the surf and wave action could have made it appear to be moving. Due to lack of evidence and photographic

documentation, this report cannot be categorized as a confirmed emergence.

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, six that nested in 1999, and three that nested in 2000. 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.

The three turtles selected for tracking during 2000 were placed on cushions in the back of sport utility vehicles and transported at moderate temperatures to the Turtle Laboratory at PAIS for attachment of satellite transmitters. A Telonics, ST-6, backpack style, satellite transmitter was attached to the anterior of each turtle's carapace using fiberglass cloth and resin. All three transmitters (21811A, 18277A, 24857) were attached with the antenna positioned to the anterior. After transmitter attachment, all three of the turtles were released on Closed Beach at PAIS. One turtle (18277A) was released on the same day that it nested and the other two were released on the next day.

Turtle movements were monitored via satellite until transmissions ceased due to transmitter detachment or failure. PTTs were programmed with a transmission (duty) cycle of 6 h on/6 h off to extend the battery life. All data were extensively screened using location rejection criteria described by Plotkin (1998) to eliminate land locations, duplicate points, points where the rate of movement of a turtle between two consecutive locations exceeded 6 km/h, and locations that were obviously inaccurate. After data screening, remaining locations from ARGOS class codes 3, 2, 1, 0, A, and B were mapped for each transmitter (Figs. 3, 4, 5).

Although data were received from individual transmitters for 9-10 months, accepted locations were only received for 3-7 months. Based on these accepted locations, all three of the turtles tracked in 2000 eventually moved northward and eastward and generally traveled parallel to the coastline (Figs. 3, 4, 5). The final locations identified for the three turtles were in the northern Gulf of Mexico, primarily off Louisiana.

Transmitter 21811A was attached to the mother of clutch 1 on 12-13 April 2000. This turtle moved northward of 28° latitude and left south Texas waters on 18 April 2000 (Fig. 3). Based on this nearly immediate departure and serum testosterone data, it appears that this turtle did not nest again in south Texas during 2000. The last accepted location was received on 13 October 2000 and the last message was received on 11 February 2001.

Transmitter 18277A was attached to the mother of clutch 2 on 19 April 2000. Based on movements and serum testosterone data, it appears that this turtle may have nested again in south Texas during 2000. It is possible that she was the mother of either clutch 5 or clutch 8; clutches 5 and 8 were laid on 2 May 2000 and 13 May 2000 respectively and the nesting females were not thoroughly examined at either site. This turtle left south Texas waters on 18 May 2000 (Fig. 4). The last accepted location was received on 29 July 2000 and the last message was received on 15 January 2001.

Transmitter 24857 was attached to the mother of clutch 4 on 21-22 April 2000. Based on movements and serum testosterone data, it appears that this turtle may have nested again in south Texas during 2000. It is possible that she was the mother of clutch 8; she was located offshore from South Padre Island on 13 May, the same day that clutch 8 was laid there. She left south Texas waters on 24 May 2000 (Fig. 5). The last accepted location was received on 14 November

2000 and the last message was received on 22 January 2001.

Location data within Gulf waters of zones 20 and 21 were gathered for all three of the PTTs deployed during 2000. Combining records for these three PTTs and the 10 PTTs deployed during 1997, 1998, and 1999 for which location data within Gulf waters of zones 20 and 21 were gathered, 42.9% 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 82.9% 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 17 of the 18 sea turtle clutches documented on the Texas coast during 2000 were transported to the incubation facility at PAIS, to protect them from a variety of threats. The Kemp's ridley clutch laid on Boca Chica Beach was transported to a protective corral located there and incubation techniques for this clutch will not be detailed further.

Eggs from the 17 sea turtle clutches that were transported to the incubation facility at PAIS were packed into Styrofoam boxes with sand from the nest site prior to transport. Eggs were collected and transported to the incubation facility as soon as possible after detection. I collected eight of the clutches laid on North Padre Island (clutches 2, 3, 4, 5, 15, 16, 17, 18) and USGS biological technician Cynthia Rubio collected four of them (clutches 1, 7, 13, 14). These 12 clutches arrived at the incubation facility on the same day that the eggs were laid (Table 5).

The collection and transport of eggs from the five Kemp's ridley clutches laid on South Padre Island during 2000 were more variable. Clutch 6 was laid at about 1459 h on 8 May. Cynthia Rubio retrieved the eggs at 1930 h on 8 May and

placed them into the incubation facility at PAIS at 0945 h on 9 May. Clutch 8 was laid on 13 May, sometime before 1010 h. Volunteer Brigitte Goza collected the eggs at 1245 h that day and the eggs were placed in the incubation facility at mid-day on 14 May. Clutch 9 was laid at 1204 h on 20 May, U.S. Fish and Wildlife Service biological technician Jody Mays collected the eggs at 1400 h, and the eggs were placed in the incubation facility at PAIS later that evening. Clutch 10 was laid at 1430 h on 20 May, Jody Mays collected of the eggs at 1630 h that day, and the eggs were placed in the incubation facility at PAIS late that evening. Clutch 11 was laid at 1505 h on 4 June. Brigitte Goza collected the eggs at 1710 h on 4 June and the eggs were placed into the incubation facility at 1710 h on 5 June.

The one green and five loggerhead turtle 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 (0730-0915 h). Thus, the eggs were placed in the incubation facility fewer than 18 hours after they were laid.

At the incubation facility, each of the smaller Styrofoam boxes containing the eggs was placed into a larger Styrofoam box. Smaller incubation boxes used to hold eggs during 2000 had never been used to hold eggs previously; most were purchased and prepared for use during 2000, but some were purchased and prepared in 1999 and not used until 2000.

The USGS oversaw incubation of the 17 sea turtle clutches that were held in the incubation facility during 2000. 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; 2000). Incubating eggs remained in the

facility throughout incubation since there was no need to move them to the laboratory due to space or temperature constraints in 2000.

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. 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 PAIS 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 were held at the incubation facility from 12 April through 12 September 2000. 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 very 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 32.5 C (for *L. kempii*) and 31.0 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 (Shaver, 2000).

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 the eggshells 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. Emerged hatchlings that were ready for release were transferred to small 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 incubation facility at PAIS 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 17 clutches incubated in the facility during 2000 were released on the northern end of Closed Beach.

Most hatchlings were released during the early morning hours, but some were released at night. Hatchling releases afforded the opportunity for final verification of species and assessment of health, vigor, and deformities of the hatchlings. The hatchlings were guarded from beach predators during release. For the fourth year, when necessary, actions were employed to lure laughing gulls (*Larus atricilla*) away from the release site, to prevent them from harming any hatchlings. USGS and NPS staff and volunteers, visitors, representatives from other agencies, and media personnel attended the releases.

Unhatched eggs were allowed to incubate for up to five days after the remainder

of the clutch had hatched. After that time, eggs were examined and embryos were 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. Embryos were preserved with 10% buffered formalin.

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 there (Table 6). Since temperatures were not normally distributed, non-parametric procedures were used to make comparisons. Median air temperatures on top (30.8 C), middle (30.4 C), and bottom (29.6 C) shelves in 2000 were significantly different (Kruskal-Wallis One Way Analysis of Variance on Ranks, $H = 1160.980$, $df = 2$, $P < 0.001$). 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 there (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 (28.8 C) shelves in 2000 were significantly different (Kruskal-Wallis One Way Analysis of Variance on Ranks, $H = 4409.419$, $df = 2$, $P < 0.001$). 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 of the 17 sea turtle clutches held in the incubation facility 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), green, 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 45-52 days and for the loggerhead clutches ranged from 51-57 days (Table 5). The incubation period for the green turtle clutch was 51 days. 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.

Overall, 86.3% of the 1,160 Kemp's ridley eggs that were incubated on the Texas coast hatched (Table 5). Of the 1,001 Kemp's ridley hatchlings produced, 1,000 were released on the beach and entered the Gulf of Mexico (Table 5). Of the 1,086 Kemp's ridley eggs held in the incubation facility, 943 (86.8%) hatched and 942 hatchlings were released. One deformed Kemp's ridley hatchling (clutch 3) that was 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, but it succumbed five weeks and was transferred back to PAIS for necropsy. Of the 74 Kemp's ridley eggs incubated in the corral at Boca Chica Beach, 58 (78.3%) hatched and 58 hatchlings were released.

Overall, 69.9% of the 499 loggerhead eggs held in the incubation facility during 2000 hatched (Table 5). Of the 349 loggerhead hatchlings produced, 348 were released on the beach and entered the Gulf of Mexico (Table 5). One loggerhead hatchling (clutch 14) that was too weak to enter the surf when placed on the beach was transferred to UTMSI for prolonged care, but later died there and was transferred to PAIS for necropsy. Of the 174 green turtle eggs held in the incubation facility from clutch 17, 169 (97.1%) hatched and all 169 hatchlings were released.

The hatching success for the 11 Kemp's ridley clutches held at the incubation facility (86.8%) was slightly higher than the hatching success for the single Kemp's ridley clutch incubated in the corral on Boca Chica Beach (78.3%). During the last two decades, the hatching success of Kemp's ridley eggs held in the incubation facility has been considerably higher than the hatching success of eggs incubated in corrals in Mexico (Burchfield et al., 1999). The yearly mean hatching success of Kemp's ridley eggs retrieved from south Texas beaches and incubated at the incubation facility from 1978-2000 was 82%. In comparison, the yearly mean hatching success for the Kemp's ridley eggs incubated in corrals in Mexico from 1978-1999 was 63% (Burchfield et al., 1999).

Slight delays in the collection and transport of Kemp's ridley eggs on the south Texas coast have not resulted in reduced hatching success during past years. Additionally, Kemp's ridley eggs carefully collected a few days after egg laying can be successfully hatched, as 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, especially

of older eggs and eggs laid by other sea turtle species. Cynthia Rubio and I collected eggs from 47 sea turtle clutches located on the Texas coast from 1998-2000 and these eggs had a mean hatching success of 83.1%. Seven other people (all of whom had some sea turtle experience) collected eggs from nine other sea turtle clutches that were located on the Texas coast and transported to the incubation facility from 1998-2000, but only 54.7% of these eggs hatched. Very slight differences in egg handling protocol may have profound impacts on hatching success. These impacts not only reduce hatchling production, but also greatly confound the ability to compare fecundity of wild and head-started turtles, an important criterion required to assess the results of the experimental imprinting and head-starting procedures used in this project (U.S. Fish and Wildlife and National Marine Fisheries Service, 1992).

To achieve high hatching success of eggs held in the incubation facility, strict care must be taken during egg collection, transport, and incubation. Eggs should be individually removed from the nest, gently lifted, maintained upright, and placed into the incubation box. Incubation boxes, gloves used to touch eggs and sand, and water used during incubation should be clean and sterile. Eggs should not be jarred, tilted, or subjected to extreme temperature or moisture regimes at any time during incubation.

SLCLs and weights of live hatchlings from the 11 Kemp's ridley, one green, and five loggerhead clutches held at the incubation facility were recorded and summarized (Table 7). SLCLs and weights of the two hatchlings that were sent to UTMSI were included in the descriptive statistics for their two clutches of origin. The unhatched eggs from all clutches held at the incubation facility were examined after full-term clutch incubation and were determined to have ceased development at various times during the incubation period (Tables 8, 9). The unhatched eggs contained four deformed Kemp's ridley embryos, one set of loggerhead twins, and

one set of green turtle twins (Tables 9, 10). Two deformed live hatchlings were produced on the Texas coast during 2000, including the Kemp's ridley that was hatched in the incubation facility and transferred to UTMSI and a Kemp's ridley that was hatched at the corral on Boca Chica Beach and released there (Table 10).

Gonads were removed for histological sex determination from dead hatchlings and late-staged embryos (Tables 8, 9). Gonads were shipped to the 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 eight Kemp's ridley and three loggerhead clutches. The percent females of the samples analyzed for the eight Kemp's ridley clutches ranged from 0.0-80.0%, with an overall mean percent females for these clutches of 47.8% (Table 11). The percent females of the samples analyzed for the three loggerhead clutches ranged from 50.0-100.0, with an overall mean percent females for these clutches of 74.2% (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 11 clutches that were held at the incubated facility ranged from 64.0-99.6%, with a mean for those 11 clutches of 87.1% (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 those 11 clutches ranged from 26.0-100.0%, with a mean for those 11 clutches of 58.7% (Table 11). To estimate the

overall percent females produced from the 11 Kemp's ridley clutches that were held at the incubation facility during 2000, mean percent females derived for the 11 clutches based on results from histological sex determination and both equations were compared. The three means varied considerably and ranged from 47.8-87.1% females. However, the estimate based on mean middle third of incubation temperatures (87.1%) may have been more reliable than the other estimates. Few samples were available to derive the estimate based on histology. Incubation periods were extended during 2000 due to the protocol of leaving lids off for longer time periods; this lid protocol was established in 1999, years after the equation relating incubation period and percent female was derived (Shaver, 1989b).

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 fishing or 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 and nesting 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. Systematic surveys for stranded turtles are conducted along Texas Gulf beaches at least once per week throughout the year. However, in Texas Gulf beach areas where nesting patrols are conducted, systematic surveys for nestings and strandings are conducted repeatedly each day during 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 twelve sea turtles were located stranded along the Texas coast during 2000 (Table 12). One head-started sea turtle was also located stranded during this time (Table 13), but is not included in any further totals or discussion. Among the 412 turtles that were located stranded were 100 Kemp's ridley, 163 loggerhead, 90 green, 14 leatherback, 28 hawksbill, and 17 unknown species turtles. The total number of turtles found stranded in Texas during 2000 (412) was the fifth highest annual total since the STSSN was established.

Of the 412 stranded turtles, 54 were located in inshore areas and 358 in offshore areas. The 358 turtles found offshore in Texas during 2000 included none found in statistical zone 17, 71 in zone 18, 30 in zone 19, 177 in zone 20, and 80 in zone 21. Overall, 72% 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 2000 (257) exceeded the total numbers found stranded in zones 20 and 21 during all other years.

Strandings were more numerous in February, March, April, May, and October than during any other months in 2000 (Table 12, Fig. 6). Strandings of sea turtles measuring more than 10.0 cm SLCL decreased slightly when Gulf of Mexico waters off the Texas coast were closed to shrimp trawling during the Texas Closure (11 May through 9 July 2000) (Fig. 6).

Of the 412 stranded turtles, 89 were found alive and 323 were found dead. The 323 dead individuals included 36 that were fresh dead (code 1), 92 that were moderately decomposed (code 2), 148 that were severely decomposed (code 3), 37 that were a dried carcass (code 4), and 10 that were only a skeleton (code 5). Part or all of 117 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.

During 2000, 45 of the 358 turtles found stranded offshore were linked to likely stranding causes (one hypothermic stunned; 22 hatchlings and post-hatchlings that drifted onto shore with currents; one wedged in jetty rocks; one with a rope tied around it; five entangled in non-fishing gear medium; five entangled in fishing line; five entangled in fishing net; four with possible mutilation; and, one with a hook in the mouth). Eighteen of the 54 turtles found stranded inshore were linked to likely stranding causes (five hypothermic stunned; four entangled in fishing line; one with possible mutilation; three wedged in jetty rocks; two with a hook in the mouth or other body part; one post-hatchling that drifted onto shore with currents; one entangled in fishing net; and, one entangled in a rope). Additionally, 10 stranded turtles (five offshore, five inshore) were found with likely boat propeller injuries and/or likely boat collision injuries, but these wounds could have been inflicted either pre- or post-mortem. Some stranded turtles found during 2000 had signs of interactions with sharks and other animals, but these injuries could have been the result of post-mortem scavenging.

Strandings of adult Kemp's ridley turtles

Twenty-three adult Kemp's ridleys (> 60.0 cm SLCL) were located stranded on the Texas coast during 2000. This is more than the 18 found during the entire year in 1999, but fewer than the record 37 found during the entire year in 1998. These 23 stranded adults found during 2000 were documented between 7 January and 18 October. Twenty-one of the 23 were located dead; the two individuals located alive were transported to a rehabilitation facility but died within 24 hours.

The 23 included 10 females, six males, and seven undetermined sex. None of the 23 had any evidence of living, magnetic, PIT, or metal tags. However, many of them were missing flippers and/or 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-four adult Kemp's ridleys were found stranded in the U.S. during 2000; including 23 found in Texas, nine in Florida, one in Louisiana, and one in Georgia. Twelve of the 23 were found stranded in zone 20 and more adult Kemp's ridleys were found stranded in zone 20 during 2000 than in any other U.S. zone that year. Of the 23 found in Texas, 16 were found offshore in zones 20 and 21.

Deaths of adult Kemp's ridleys could have reduced nesting on the Texas coast during 2000. Eleven of the adult Kemp's ridleys found during 2000 were located at PAIS, including seven that were located before the 2000 Kemp's ridley mating and nesting seasons were over. Five confirmed Kemp's ridley nests were located at PAIS during 2000, in comparison to the 11 found there in 1999. In contrast,

no dead adult Kemp's ridleys were found on South Padre Island or Boca Chica Beach during 2000 until after the Kemp's ridley mating and nesting season was completed; the single individual found in these areas was located on July 24. Six nests were located on South Padre Island and Boca Chica Beach during 2000, in comparison to three located there 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 considerable effort has been expended to detect and rehabilitate these small stranded turtles.

Twenty-five hatchlings were found washed ashore along the Texas coast during 2000 and these were located between 18 June and 5 October (Table 14). Among the 25 hatchlings were 19 Kemp's ridleys and six hawksbills. As during 1990-1999, pedestrians located most of the hatchlings (Shaver, 1990; 1991; 1992b; 1993; 1994a; 1996c; 1997b; 1998b; 1999b; 2000).

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 the Texas A&M University, Veterinary Diagnostic Laboratory, where histology was used to determine the gender of the dead hatchlings (Table 14).

Two of the Kemp's ridley hatchlings likely originated from clutches that were laid in south Texas, incubated under protected conditions, and released by biologists; both were excluded from stranding totals due to their likely origin. The Kemp's ridley hatchling found washed ashore on 10 July 2000 was almost certainly from clutches 9 or 10 that were released from 7-10 June. The Kemp's ridley hatchling found washed ashore on 22 July 2000 was almost certainly from clutch 12 that was released earlier that day. These two hatchlings were the size of newly hatched turtles and possessed an umbilical scar and/or an egg tooth (Table 14). Both were found a relatively short distance north of the release sites; the prevailing currents would have taken released hatchlings northward. It is unlikely that they had been in the water for several days prior to stranding since each was without epizoans and wounds.

The remaining 23 hatchlings were categorized as true strandings since they could not be linked to any known releases. Based on size and various attributes (egg tooth, umbilical scar, a relatively large quantity of internal yolk, and no gut contents), one stranded Kemp's ridley (LK-00-30) may have emerged from an undetected south Texas nest. However, it is unlikely that any of the other 22 stranded hatchlings originated from south Texas nests.

FUTURE PLANS

During 2001, the USGS, NPS, and our cooperators will continue public education programs, beach patrols, investigation and protection of nesting sea turtles and nests, and satellite tracking of nesting Kemp's ridley turtles on North Padre Island. We will also provide technical assistance to others working elsewhere in the state. One base camp will be operated on North Padre Island during the 2001 patrol season, to increase the effectiveness of the patrol program there. Operation of the sea turtle egg incubation facility at PAIS, the only such facility on the Texas coast, will continue. The USFWS, GPZ, and their cooperators will continue efforts on South Padre Island and Boca Chica Beach and nests found there during 2001 will be transported to a protective corral located on Boca Chica Beach. ATVs will continue to be the vehicle type used to conduct most patrols to detect nesting in south Texas. Participation in the Sea Turtle Stranding and Salvage Network will continue. I will continue to serve as the Texas Coordinator for the STSSN and will continue to tally stranded sea turtles and sea turtle nests found in Texas.

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Table 1. Locations and dates of the 18 confirmed sea turtle nests detected along the Texas coast during 2000.

Clutch Number	Species	Nest Site ¹	How Located	Lay Date	Time Tracks or Turtle Detected (h)
1	LK	NPI, PAIS, 77.6 km marker	Turtle-patroller	12 April	0910
2	LK	NPI, PAIS, 40.2 km marker	Turtle-patroller	19 April	1120
3	LK	NPI, 3.2 km S. of Bob Hall Pier	Turtle-public	19 April	1545
4	LK	NPI, PAIS, 31.7 km marker	Turtle-patroller	21 April	1450
5	LK	NPI, PAIS, 42.2 km marker	Tracks-patroller	2 May	1130
6	LK	SPI, 8.0 km N. of Acc. Rd. 5	Turtle-STSSN	8 May	1459
7	LK	NPI, PAIS, 53.1 km marker	Tracks-patroller	11 May	1630
8	LK	SPI, 18.7 km N. of last Acc. Rd.	Tracks-patroller	13 May	1010
9	LK	SPI, 22.9 km N. County Park Acc.	Turtle-patroller	20 May	1204
10	LK	SPI, Seabreeze Hotel, Acc. Rd. 15	Turtle-public	20 May	1430
11	LK	SPI, 8.0 km N. of last Acc. Rd.	Turtle-public	4 June	1505
12	LK	BCB	Turtle-patroller	4 June	1215
13	CC	NPI, PAIS, 47.5 km marker	Tracks-patroller	9 June	0800
14	CC	NPI, PAIS, 49.9 km marker	Tracks-patroller	13 June	0915
15	CC	NPI, PAIS, 8.0 km marker	Tracks-patroller	30 June	0800
16	CC	NPI, PAIS, 26.1 km marker	Tracks-patroller	12 July	0845
17	CM	NPI, PAIS, 71.0 km marker	Tracks-patroller	12 July	0745
18	CC	NPI, PAIS, 40.2 km marker	Tracks-guide	18 July	0730

¹ NPI = North Padre Island; PAIS = Padre Island National Seashore; SPI = South Padre Island; BCB = Boca Chica Beach.

² STSSN = Participant in the Sea Turtle Stranding and Salvage Network.

Table 2. Measurements and tags^{1,2} on the nine Kemp's ridley sea turtles that nested along the Texas coast and were examined or partially examined by biologists during 2000.

Clutch Number	SLCL (cm)	SLCW (cm)	CCL (cm)	CCW (cm)	Tags present				Tags applied	
					PIT	Magnetic	Living	Tag	Metal	PIT
1	63.1	59.1	66.0	65.0	-	-	-	-	LF:SSQ112 LR:SSQ113	LF:40771B6039
2	60.8	59.7	64.5	67.3	-	-	-	-	LF:SSQ101 LR:SSQ102	LF:4077164833
3	60.5	59.8	64.0	69.0	4130764833	LF	RC1	LR:SSQ099 RF, LF	LF:SSQ189	-
4	63.5	60.6	66.7	68.2	-	-	-	-	LF:SSQ114 LR:SSQ115	LF:4077050013
6	63.0	60.6	65.5	66.8	-	-	-	-	LF:SSQ807 LR:SSQ808	LF:413066113D
9	-	-	68.2	68.3	-	-	-	-	LF:SSN578	-
10	65.1	61.2	-	-	41306A5208	-	-	LF	RF:SSN579	-
11 ³	-	-	-	-	NE	NE	NE	LF NE	-	-
12 ⁴	62.4	-	67.3	-	-	-	-	-	LF:KA047	LF:413606003D

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

² Living tag that was present on scute right costal 1 (RC1).

³ Not thoroughly examined (NE) for tags and tag scars; a metal tag was seen on LF, but the tag numbers were not read.

⁴ CCL for this turtle was TCCL (curved carapace length as measured in Mexico, from nuchal notch tip to post-central tip). TCCL was converted to SLCL using SLCL=4.0554+0.8662*TCCL (Schmid and Witzell, 1997).

Table 3. Comments regarding nine Kemp's ridley sea turtles that nested along the Texas coast and were examined or partially examined by biologists during 2000.

Clutch Number (if Returnee)	Year-Class	Serum Testosterone (pg/ml)	Satellite Transmitter (if Applied)	Comments ¹
1	-	10.7	21811A	antenna forward
2	-	46.4	18277A	antenna forward, missing tip of carapace
3	1987	73.3	-	wound on vertebral scute 2, previously documented nesting at PAIS on 2 June 1998
4	-	54.3	24857	antenna forward, two small gouges on vertebral scute 2
6	-	65.0	-	-
9	-	-	-	-
10	-	-	-	previously documented nesting at PAIS on 12 June 1997
11	-	-	-	returned to sea before close examination
12	-	-	-	-

¹ PAIS = Padre Island National Seashore.

Table 4. Locations and dates of the five confirmed non-nesting emergences found on the Texas coast during 2000. Note that no eggs were located at these sites.

Suspected Species	Location ¹	How Located	Date	Time Detected (h)	Comments
LK	BCB	Turtle-patroller	21 April	?	observed crawling ²
CC	NPI, PAIS, 15.4 km marker	Tracks-patroller	31 May	0930	ended at mid-beach
CC	NPI, PAIS, 30.3 km marker	Tracks-patroller	2 June	1030	ended at mid-beach
CM	NPI, PAIS, 65.2 km marker	Tracks-patroller	6 June	0750	ended at mid-beach
CC	SPI, 3.2 km S. of MC	Tracks-patroller	24 June	1300	ended at mid-beach

¹ BCB = Boca Chica Beach, NPI = North Padre Island, PAIS = Padre Island National Seashore, SPI = South Padre Island, MC = Mansfield Channel.

² Turtle was observed crawling on the beach, but did not lay eggs during this emergence.

Table 5. Incubation and hatching information for the 18 confirmed sea turtle nests detected along the Texas coast during 2000.

Clutch Number	Number of Eggs Incubated ¹	Hatch Date ²	Incubation Period (Days)	Percent of Eggs Hatched ³	Number Hatchlings Died Prior to Release	Number Hatchlings Released ⁴	Hatchling Release Dates	Number Hatchlings Retained ⁵
1	113	1 June	51	98.2	0	111	3 June	0
2	113	5-6 June	48-49	99.1	0	112	8-12 June	0
3	85	7 June	50	82.4	0	69	10-12 June	1
4	88	4 June	45	79.5	0	70	10-12 June	0
5	88	20 June	50	95.5	0	84	22 June	0
6	110	23-25 June	47-49	100.0	0	110	26-27 June	0
7	107	29 June-1 July	50-52	86.0	0	92	2-3 July	0
8	93	1 July	50	59.1	0	55	3 July	0
9	101	4 July	46	84.2	0	85	8-10 July	0
10	104	4 July	46	92.3	0	96	7-8 July	0
11	84	23 July	50	69.0	0	58	26 July	0
12	74	22 July	49	78.3	0	58	22 July	0
13	122	3-4 Aug.	56-57	19.7	0	24	3-4 Aug.	0
14	101	2-3 Aug.	51-52	97.0	0	97	4 Aug.	1
15	98	19 Aug.	51	93.9	0	92	21 Aug.	0
16	96	1 Sept.	52	97.9	0	94	2-4 Sept.	0
17	174	31 Aug.	51	97.1	0	169	1-5 Sept.	0
18	82	10 Sept.	55	50.0	0	41	10-12 Sept.	0

¹ Total number of eggs incubated: 1,160 LK, 499 CC, and 174 CM = 1,833 eggs all species.

² Hatch date is the date that hatching was detected for eggs incubated in boxes and is the date that emergence from the nest was detected for eggs incubated in a corral.

³ Calculated based on the number of eggs incubated divided by the number of live hatchlings.

Total hatched: LK = 86.3% (1,001/1,160); CC = 69.9% (349/499); CM = 97.1% (169/174);

Total all species = 82.9% (1,519/1,833).

⁴ Hatchlings that successfully entered the surf.

Total number of hatchlings released: 1,000 LK, 348 CC, and 169 CM.

⁵ Two hatchlings were measured, but too weak to enter the surf and were transferred to UTMSI for prolonged care and later died there.

Table 6. Temperatures (Celsius) recorded in the incubation facility at Padre Island National Seashore for egg incubation boxes, air temperature probes, and control boxes during 2000¹.

Temperature Measured	Entire Incubation Period				Middle Third of Incubation Period			
	N	Range	Mean(S.E.)	Median	N	Range	Mean(S.E.)	Median
Clutch 1A	1,111	24.3-33.1	30.4(0.0)	30.7	387	29.2-32.4	31.0(0.0)	31.1
Clutch 1B	1,111	24.5-32.3	30.1(0.0)	30.5	387	29.0-32.0	30.8(0.0)	30.8
Clutch 2A	1,071	25.2-31.3	29.8(0.0)	30.0	355	27.5-31.3	30.3(0.0)	30.5
Clutch 2B	1,055	25.4-32.0	30.4(0.0)	30.7	369	28.2-31.9	30.8(0.0)	30.9
Clutch 3	1,094	27.0-32.4	30.7(0.0)	30.8	355	28.6-32.1	30.9(0.0)	30.9
Clutch 4	974	24.2-32.4	30.5(0.0)	30.8	345	28.3-32.2	30.9(0.0)	31.0
Clutch 5	1,098	23.9-33.6	30.3(0.0)	30.3	333	29.0-32.7	30.8(0.0)	30.9
Clutch 6A	1,019	26.8-32.4	30.6(0.0)	30.6	360	29.5-31.5	30.5(0.0)	30.5
Clutch 6B	1,059	26.8-32.5	30.7(0.0)	30.8	384	29.6-32.2	30.8(0.0)	30.7
Clutch 7A	1,139	26.2-33.2	31.1(0.0)	31.2	408	29.7-32.6	31.3(0.0)	31.3
Clutch 7B	1,091	26.8-33.3	30.8(0.0)	31.0	384	29.9-32.4	31.0(0.0)	31.1
Clutch 8	1,098	24.2-33.4	30.5(0.0)	30.6	384	28.2-31.4	30.5(0.0)	30.7
Clutch 9	1,000	28.1-33.5	31.0(0.0)	30.8	360	29.4-32.0	30.9(0.0)	30.8
Clutch 10	1,000	28.7-33.9	31.3(0.0)	31.0	360	30.5-32.6	31.3(0.0)	31.1
Clutch 11	1,139	25.9-32.3	30.6(0.0)	30.6	380	29.5-31.5	30.6(0.0)	30.6
Clutch 13A	1,308	28.3-32.0	30.5(0.0)	30.5	428	29.8-31.5	30.5(0.0)	30.5
Clutch 13B	1,330	28.8-31.3	30.3(0.0)	30.4	452	29.6-31.3	30.3(0.0)	30.3
Clutch 14A	1,192	26.7-32.7	30.6(0.0)	30.6	404	29.6-31.6	30.6(0.0)	30.6
Clutch 14B	1,211	26.0-32.5	30.5(0.0)	30.5	404	29.5-31.4	30.4(0.0)	30.4
Clutch 15A	1,196	28.8-32.3	30.4(0.0)	30.3	408	29.2-31.4	30.2(0.0)	30.2
Clutch 15B	1,196	29.0-32.5	30.4(0.0)	30.3	408	29.2-31.6	30.2(0.0)	30.2
Clutch 16A	1,214	28.3-32.8	30.1(0.0)	30.0	408	29.1-32.3	30.5(0.0)	30.4
Clutch 16B	1,214	27.9-32.2	29.9(0.0)	29.8	408	29.1-31.8	30.3(0.0)	30.2
Clutch 17A	1,192	27.9-33.5	30.4(0.0)	30.2	408	29.7-32.4	30.7(0.0)	30.6
Clutch 17B	1,197	27.8-33.1	30.3(0.0)	30.2	408	29.8-32.6	30.7(0.0)	30.6
Clutch 18A	1,287	28.5-31.3	30.0(0.0)	30.0	430	29.3-31.3	30.3(0.0)	30.3
Clutch 18B	1,287	28.8-31.6	30.1(0.0)	30.1	430	29.4-31.2	30.3(0.0)	30.3
Air 1	3,555	13.8-34.0	30.7(0.0)	30.8				
Air 2	3,555	12.9-33.7	30.3(0.0)	30.4				
Air 3	3,555	13.4-32.5	29.6(0.0)	29.6				
Control 1	3,555	25.2-32.1	30.1(0.0)	30.2				
Control 2	3,555	25.0-30.9	29.2(0.0)	29.4				
Control 3	3,555	24.0-29.9	28.6(0.0)	28.8				

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 and incubated in the incubation facility at Padre Island National Seashore during 2000.

Clutch Number	N ¹	Straight-line Carapace Length (mm)			Weight (g)		
		Range	Mean(S.E.)	Median	Range	Mean(S.E.)	Median
1	111	38.02-43.25	41.21(0.08)	41.20	10.98-16.25	14.77(0.06)	14.78
2	112	42.02-47.42	44.45(0.11)	44.39	15.72-20.14	18.05(0.09)	18.02
3	70	41.16-46.99	44.60(0.11)	44.59	15.56-18.95	17.15(0.07)	17.19
4	70	36.41-44.98	41.73(0.21)	41.82	12.06-16.24	14.56(0.11)	14.52
5	84	40.25-45.37	42.92(0.11)	43.05	14.08-20.08	17.52(0.13)	17.73
6	110	41.05-46.04	44.32(0.08)	44.38	16.92-20.03	18.48(0.05)	18.48
7	92	36.75-49.60	43.01(0.17)	43.13	13.40-19.90	17.56(0.12)	17.72
8	55	40.62-46.64	44.94(0.16)	45.11	15.70-20.48	18.79(0.13)	18.91
9	85	37.25-49.91	42.33(0.17)	42.49	13.55-17.80	16.25(0.10)	16.36
10	96	39.35-44.52	42.52(0.11)	42.51	15.17-18.90	17.20(0.07)	17.22
11	58	35.54-44.23	40.58(0.23)	40.90	9.89-16.81	14.43(0.19)	14.66
13	24	40.90-47.70	44.42(0.33)	44.55	15.84-19.96	18.29(0.22)	18.18
14	98	45.92-49.37	47.75(0.08)	47.76	20.62-25.57	23.06(0.12)	22.80
15	92	45.92-49.45	47.99(0.72)	47.99	19.82-26.09	23.81(0.09)	23.90
16	94	46.63-51.43	49.01(0.10)	49.01	23.42-28.47	25.47(0.10)	25.47
17	169	47.08-54.55	52.55(0.08)	52.60	19.95-31.30	27.57(0.10)	27.74
18	41	40.67-47.16	43.91(0.26)	44.04	15.73-21.00	18.74(0.21)	18.93

¹ N = number measured.

Table 8. Results of analyses of unhatched Kemp's ridley eggs^{1,2} and histological sex determination³ for Kemp's ridley clutches detected along the Texas coast and incubated in the incubation facility at Padre Island National Seashore during 2000.

Parameter	Clutch Number										
	1	2	3	4	5	6	7	8	9	10	11
<u>Analyses of unhatched eggs</u>											
no. unhatched	2	1	15	18	4	0	15	38	16	8	26
no. infertile	1	0	1	2	1	0	0	2	0	0	1
no. fertile w/o embryos	1	1	12	1	1	0	2	33	4	1	5
no. stage 10 embryos	0	0	0	0	0	0	0	0	0	0	2
no. stage 11 embryos	0	0	0	0	0	0	0	0	0	0	1
no. stage 12 embryos	0	0	0	0	0	0	0	0	0	0	0
no. stage 13 embryos	0	0	0	0	0	0	0	0	1	0	0
no. stage 14 embryos	0	0	0	0	0	0	0	0	1	0	0
no. stage 15 embryos	0	0	0	0	0	0	0	0	0	0	1
no. stage 18 embryos	0	0	0	1	0	0	0	0	1	0	0
no. stage 20 embryos	0	0	0	2	0	0	0	1	0	0	1
no. stage 22 embryos	0	0	0	0	0	0	0	0	0	0	0
no. stage 25 embryos	0	0	0	0	0	0	0	0	0	0	0
no. stage 27 embryos	0	0	1	0	0	0	0	0	0	0	1
no. stage 28 embryos	0	0	0	0	0	0	0	0	0	0	2
no. stage 28-29 embryos	0	0	0	1	0	0	4	0	4	2	4
no. stage 29 embryos	0	0	0	2	0	0	5	2	1	2	3
no. stage 29-30 embryos	0	0	0	4	0	0	2	0	3	3	2
no. stage 30 embryos	0	0	1	5	2	0	2	0	1	0	3
<u>Histological sex determination for late-staged embryos and dead hatchlings³</u>											
no. analyzed	0	0	2	12	2	0	10	2	5	7	7
no. males	0	0	2	4	1	0	5	1	1	2	6
no. females	0	0	0	8	1	0	5	1	4	5	1

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

² No twins were found.

³ Included in sex determination analyses was one deformed hatchling from clutch 3 that was transferred to UTMSI for prolonged care but succumbed.

Table 9. Results of analyses of unhatched loggerhead and green turtle eggs^{1,2} and histological sex determination³ for loggerhead and green turtle clutches detected along the Texas coast during 2000.

Parameter	Clutch Number					
	13	14	15	16	17	18
<u>Analyses unhatched eggs</u>						
no. unhatched	98	3	6	2	5	41
no. infertile	10	0	1	0	0	8
no. fertile w/o embryos	51	2	5	2	4	17
no. stage 17 embryos	2	0	0	0	0	0
no. stage 18 embryos	3	1	0	0	0	0
no. stage 19 embryos	1	0	0	0	0	0
no. stage 20 embryos	1	0	0	0	0	0
no. stage 21 embryos	1	0	0	0	0	2
no. stage 22 embryos	0	0	0	0	0	1
no. stage 24 embryos	1	0	0	0	0	2
no. stage 25 embryos	0	0	0	0	0	2
no. stage 26 embryos	3	0	0	0	0	1
no. stage 27 embryos	3	0	0	0	1	1
no. stage 28 embryos	12	0	0	0	0	2
no. stage 29 embryos	8	0	0	0	1	5
no. stage 30 embryos	2	0	0	0	0	1
<u>Histological sex determination for late-staged embryos and dead hatchlings</u>						
no. analyzed	22	1	0	0	0	6
no. males	6	0	0	0	0	3
no. females	16	1	0	0	0	3

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

² One set of twins found in clutch 17 and one set of twins found in clutch 18.

³ Included in sex determination analyses was one weak hatchling from clutch 14 that was transferred to UTMSI for rehabilitation but succumbed.

Table 10. Deformed hatchlings from sea turtle eggs located along the Texas coast and deformed embryos found within unhatched eggs that had undergone full-term incubation in the incubation facility at Padre Island National Seashore during 2000.

Clutch Number	Species	Stage	Deformities Observed and Comments
3	LK	hatchling	No left eye, no left front flipper, soft spot in center of plastron; live hatchling too weak for release, transferred to UTMSI and died there
5	LK	30	No egg tooth, no snout, no eyes, top jaw split; dead embryo
8	LK	29	Small eyes, bump on head; dead embryo
9	LK	28-29	No left eye, bump on head, snout twisted to the right, jaws crossed; dead embryo
11	LK	28-29	Snout short; dead embryo
12	LK	hatchling	Kyphotic; live hatchling that was released

Table 11. Estimated and identified sex ratios for sea turtle clutches detected along the Texas coast and incubated at the incubation facility at Padre Island National Seashore during 2000.

Clutch Number	Estimated % Female Based on Temperature ¹	Estimated % Female Based on Incubation Period ²	Identified % Female Based on Histology ³
1	78.2&88.6	26.0	-
2	55.9&77.3	55.3&69.9	-
3	84.6	40.6	0.0
4	83.3	100.0	66.6
5	79.8	40.6	50.0
6	67.5&79.3	55.3&84.5	-
7	89.3&99.6	11.4&40.6	50.0
8	64.0	40.6	50.0
9	81.8	99.2	80.0
10	99.6	99.2	71.4
11	70.2	40.6	14.3
13	-	-	72.7
14	-	-	100.0
15	-	-	-
16	-	-	-
17	-	-	-
18	-	-	50.0
Overall ⁴			
<i>L. kempii</i>	87.1	58.7	47.8
<i>C. caretta</i>			72.4

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 eight Kemp's ridley and three loggerhead clutches from which samples were analyzed. No samples were analyzed for *C. mydas*.

Table 12. Sea turtles found stranded along the Texas coast during 2000. Hatchlings and post-hatchlings are included, but head-started individuals are excluded.

Species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
CC	8	25	15	10	23	5	14	18	15	9	6	15	163
LK	5	9	16	11	9	13	10	3	10	10	3	1	100
CM	10	8	9	8	11	7	5	3	0	14	6	9	90
DC	0	0	3	7	3	0	0	1	0	0	0	0	14
EI	1	0	1	2	4	2	1	5	7	4	1	0	28
UN	0	3	1	0	2	3	0	2	1	2	0	3	17
Total	24	45	45	38	52	30	30	32	33	39	16	28	412

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 2000.

Species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
LK	0	0	1	0	0	0	0	0	0	0	0	0	1

Table 14. Sea turtle hatchlings and post-hatchlings (<10.0cm SLCL) found stranded (S) or washed ashore after a hatchling release (W) on the Texas coast during 2000.

I.D.	Species	SLCL			CCL			CCW			Weight (g)	Location ¹	Date	Type	Condition		Sex ⁴	Fate ³	Comments ⁵
		(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)					Facility ²	live			
LK	LK	5.1	4.9	5.6	5.6	5.6	5.6	24.0	MI, near Horace Caldwell Pier	18 June	S	live	UTRF	live	U	ep	D	26 July	
LK-00-34	LK	4.6	4.5	4.9	5.2	19.1	MI, Sandpiper Condominiums	19 June	S	live	UTRF	live	UTRF	live	F	wf	D	26 July	
LK-00-20	LK	4.1	3.6	4.5	4.4	10.5	NPI, PAIS, 0.8 km marker	20 June	S	dead					F	wf, wh, ep, et, Y, g, us	-		
LK-00-35	LK	4.4	3.9	4.6	4.6	15.7	MI, just S. of south jetty	20 June	S	live	UTRF	live	UTRF	live	F	us, wf, g	D	24 June	
LK-00-32	LK	4.7	4.5	5.0	5.4	20.1	MI, 91.5 m S. of Access Rd. 1	22 June	S	live	UTRF	live	UTRF	live	M	us, et	D	29 July	
LK	LK	5.2	5.0	-	-	-	GI	24 June	S	live	UTRF	live	UTRF	live	U	-	D	26 June	
LK-00-28	LK	4.5	4.2	4.5	4.8	14.9	NPI, 457.5 m S. of Bob Hall Pier	24 June	S	live	NMFS	live	UTRF	live	F	et, us, g, wf, ep	D	24 June	
LK-00-31	LK	5.0	4.6	5.3	5.5	19.4	Rockport Beach	24 June	S	live	UTRF	live	UTRF	live	M	wf, g	D	30 June	
LK-00-33	LK	4.8	4.4	4.9	5.3	21.9	MI, between markers 21 and 22	25 June	S	dead					F	wf, g	-		
LK-00-29	LK	5.6	5.4	6.3	6.9	28.6	NPI, PAIS, Closed Beach	27 June	S	dead					F	wh, ep, g	-		
LK	LK	5.5	5.1	-	-	-	0.8 km S. of Quintana Beach	1 July	S	live	NMFS	live	UTRF	live	U	wu	D	3 July	
LK	LK	4.9	4.8	-	-	-	Quintana Beach	4 July	S	live	NMFS	live	UTRF	live	U	wu	D	22 July	
LK-00-30 ⁶	LK	3.8	3.3	3.8	3.7	11.4	NPI, PAIS, 9.0 km marker	6 July	S	dead					M	et, us, Y, ep, wf	-		
LK ⁷	LK	4.0	3.2	4.4	4.4	12.9	NPI, Gulf Stream Condominiums	10 July	W	live	UTRF	live	UTRF	live	U	et, us	D	5 Aug.	
LK	LK	4.5	4.6	4.5	4.5	13.5	MI, marker 26	14 July	S	dead					U	wf, wh, us, et	-		
LK	LK	5.8	5.6	-	-	-	GI, 1.6 km S. of seawall	21 July	S	dead					U	wu	-		
LK ⁸	LK	3.8	3.2	4.5	4.5	16.6	BCB	22 July	W	live					U	et, us	R	23 July ⁹	

Table 14. Continued.

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
EI	EI	6.8	5.4	-	-	-	GI, 10 th and seawall	10 Aug.	S	live	D	U	-
LK	LK	4.3	4.1	-	-	-	GI, Indian Beach	16 Aug.	S	NMFS dead	12 Aug.	U	wu
LK	LK	4.6	4.2	-	-	-	GI, 61 st and seawall	21 Aug.	S	live	D	U	wu
EI	EI	6.5	5.4	6.9	6.6	44.5	NPI, near Luby Surf Pier	30 Aug.	S	NMFS live	22 Aug.	U	wf
EI	EI	9.5	7.5	9.8	9.8	112.4	Mustang Island State Park	17 Sept.	S	live	D	U	wh
EI	EI	5.6	5.3	6.9	6.5	35.2	NPI, just S. of Zahn Road	24 Sept.	S	UTRF live	26 Sept.	U	-
EI	EI	5.0	5.2	-	-	-	MATI, 11.3 km N. of Wynne Access Road	24 Sept.	S	dead	-	U	wu
EI	EI	-	-	7.6	6.5	-	SPI, Sandpiper Pavilion	5 Oct.	S	dead	-	U	wu

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

² UTRF = University of Texas Marine Sciences Institute rehabilitation facility, NMFS = National Marine Fisheries Service Laboratory in Galveston, Texas.

³ D = died, H = still being held for rehabilitation, R = released.

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.

⁶ Possibly from an undetected clutch that was laid in south Texas.

⁷ Likely from clutch 9 or clutch 10, released from 7-10 July 2000.

⁸ Likely from clutch 12, released on 22 July 2000.

⁹ Released approximately 11.3 km offshore from South Padre Island.

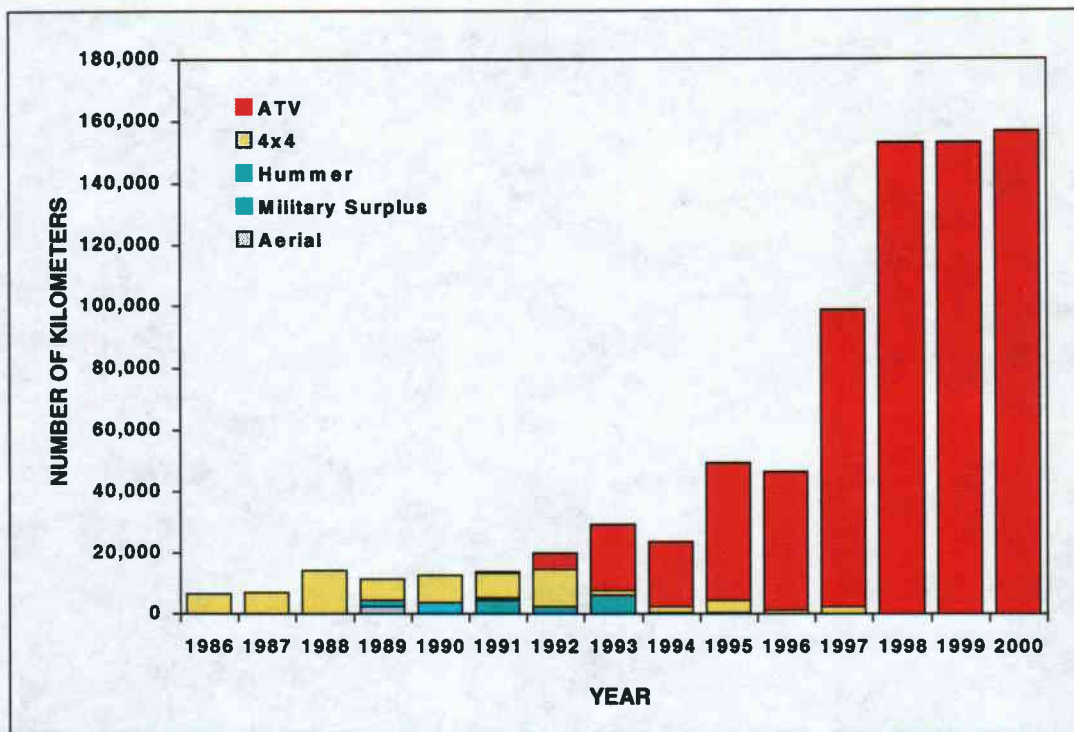


Figure 1. Number of kilometers patrolled on North Padre Island, Texas from 1986-2000.

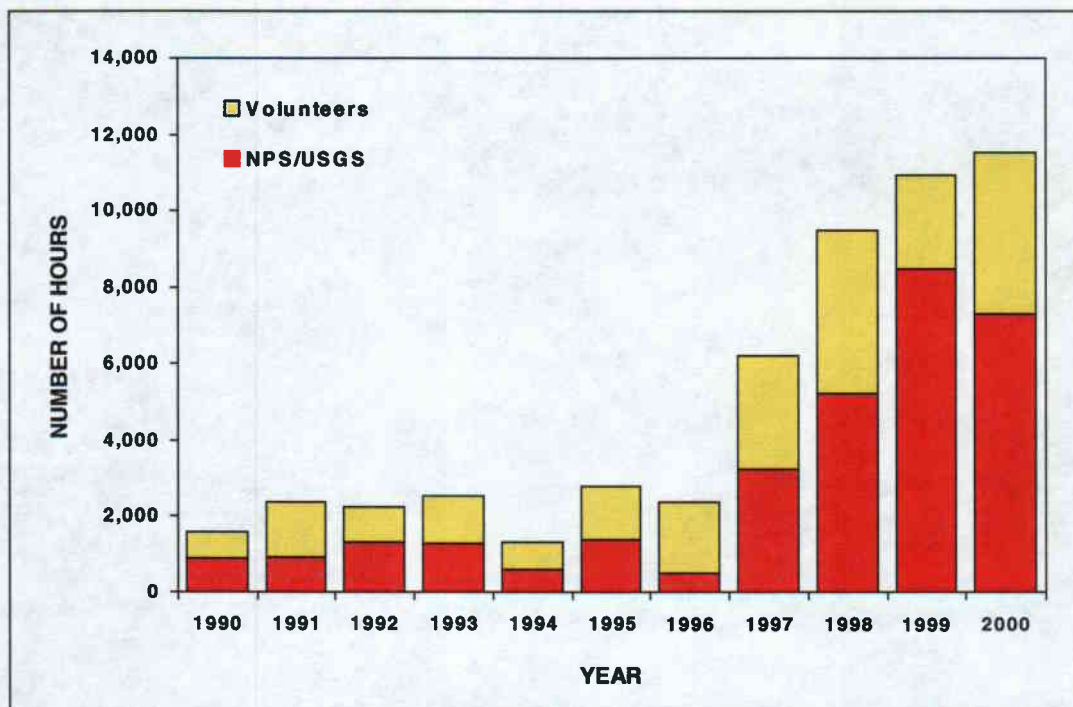


Figure 2. Number of hours various groups spent conducting patrols on North Padre Island, Texas from 1990-2000.

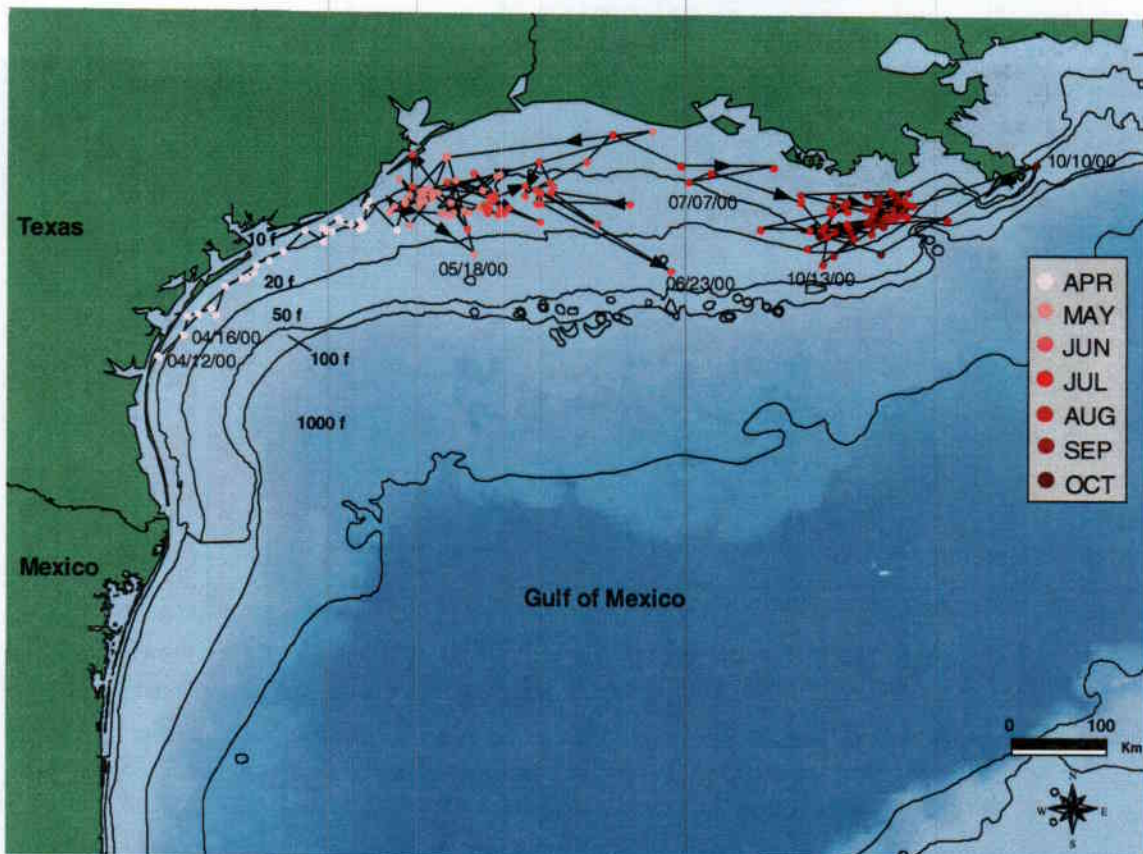


Figure 3. Movements of a Kemp's ridley sea turtle after deployment of transmitter 21811A, 12 April 2000 – 13 October 2000.

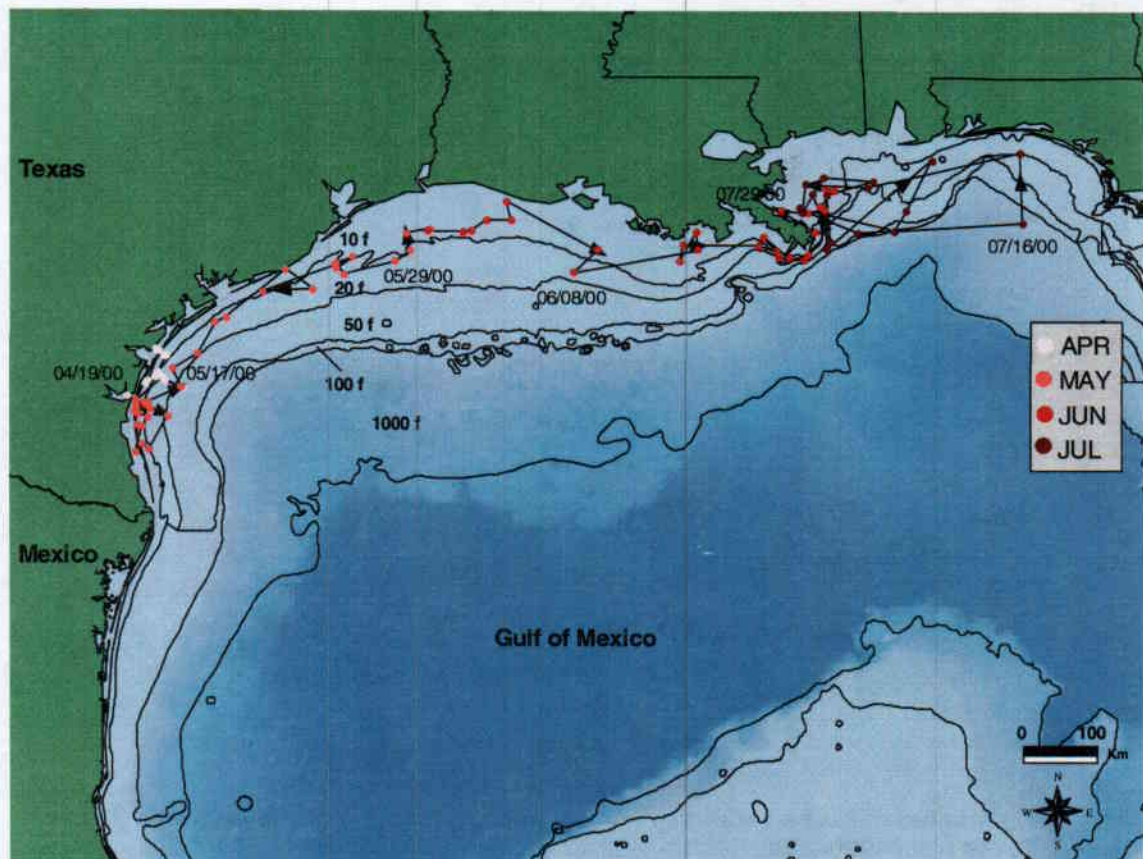


Figure 4. Movements of a Kemp's ridley sea turtle after deployment of transmitter 18277A, 19 April 2000 – 29 July 2000.

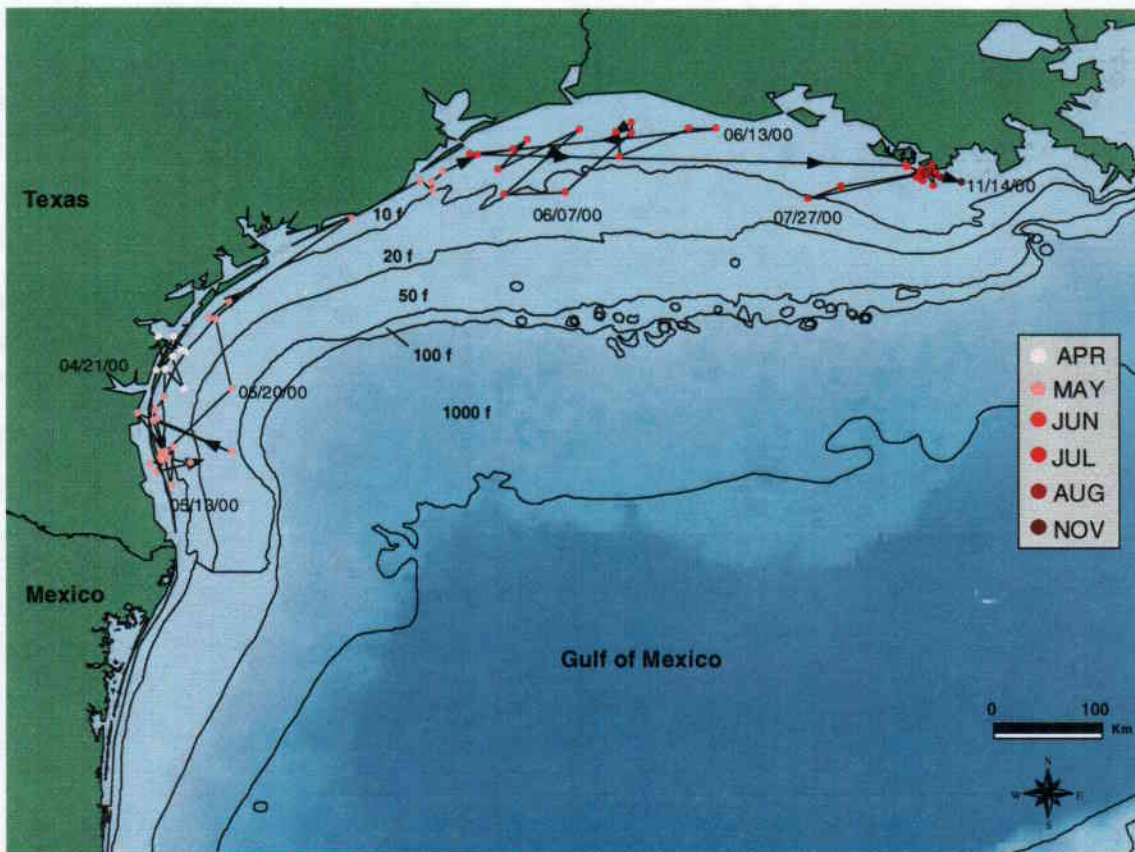


Figure 5. Movements of a Kemp's ridley sea turtle after deployment of transmitter 24857, 21 April 2000 – 14 November 2000.

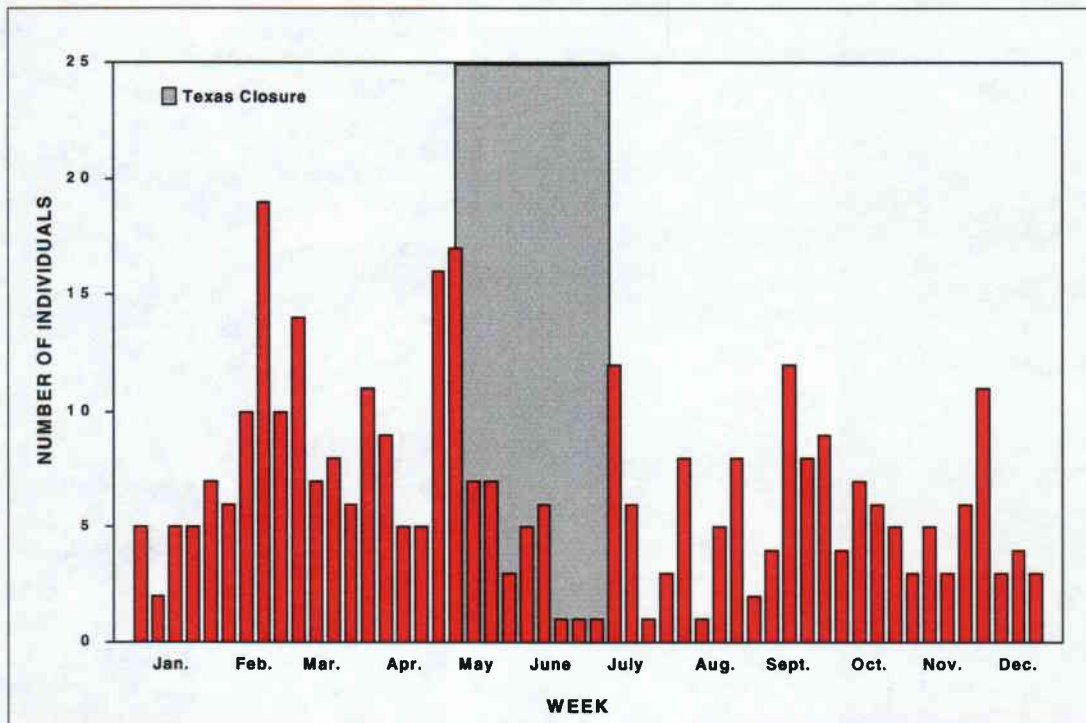


Figure 6. Number of stranded sea turtles (excluding head-started turtles and hatchlings/post-hatchlings) located on offshore beaches along the Texas coast during each week from January through December, 2000.