PADRE ISLAND NATIONAL SEASHORE
KEMP'S RIDLEY SEA TURTLE PROJECT
1992 REPORT

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ABSTRACT

Patrols for nesting sea turtles and related public education efforts continued at Padre Island National Seashore (PAIS) during 1992. From mid-April through August, PAIS employees and volunteers spent 2,243 hours patrolling a total of 20,110 km of beachfront.

Two loggerhead sea turtle (*Caretta caretta*) nests were laid at PAIS during 1992. These were the only confirmed sea turtle nests laid on PAIS beaches (and the entire Texas coast) this year. The eggs from both nests were packed into styrofoam boxes and incubated at the park facility. The first clutch contained 91 eggs and had a 93% hatching rate. Forty-five percent of the 130 eggs in the second clutch hatched. All viable hatchlings from both clutches were released on the beach at PAIS and entered the surf. Two other sets of sea turtle tracks were located at PAIS. Although the tracks from these green (*Chelonia mydas*) and loggerhead turtles were quite visible, no eggs were located at either location and the nesting emergences were apparently false crawls. Two possible nesting emergences by Kemp's ridley sea turtles (*Lepidochelys kempii*) were reported at PAIS during 1992. However, upon investigation by PAIS patrollers, neither report could be substantiated.

Four clutches of Kemp's ridley sea turtle eggs laid in captivity were transferred to PAIS for incubation. Eight of the 76 eggs (11%) from the first clutch hatched. One of the hatchlings escaped in the surf at PAIS, one died while being held for observation, and the remaining six were released 8 km offshore from Port Aransas, Texas. Although none of the eggs from the other three clutches hatched, some fertile eggs were found in two of the clutches.

Twelve sea turtle hatchlings were found stranded along Padre and Mustang Islands from 3 June through 27 September, including nine Kemp's ridley, two loggerhead, and one hawksbill (*Eretmochelys imbricata*). The three smallest Kemp's ridleys may have emerged from nests laid on South Texas beaches. Two of the Kemp's

ridleys were found dead and the remainder of the stranded hatchlings were found alive. Four of the seven live Kemp's ridley and both of the loggerhead hatchlings were brought to the PAIS sea turtle hatchling rehabilitation facility for stabilization and care. All six survived and were released into the Gulf of Mexico.

BACKGROUND

During each summer, from 1978 to 1988, approximately 2,000 Kemp's ridley sea 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 for head starting. Overall, approximately 12,000 yearlings were released into the Gulf of Mexico after 9 to 11 months of head starting. To date, no Padre Island imprinted turtles have been confirmed to have returned and nested at PAIS. However, it is unknown how many have survived after release and none may have attained adulthood yet.

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 at PAIS (Shaver, 1989a). Also significant in our efforts is the location and protection of all sea turtle nests and stranded hatchlings from local beaches. Public education programs, beach patrols, and protection and monitoring of nesting sea turtles, nests, and stranded hatchlings will be continued at the park for the foreseeable future. This report summarizes these efforts during 1992.

BEACH PATROLS

Seasonal beach patrols for nesting sea turtles, tracks, nests, and hatchlings began at PAIS in 1986 and continued through 1992. From mid-April through August 1992, two patrols were conducted during most weekdays, one heading north from the Ranger Station and one heading south. Northern patrols covered the area from

the Ranger Station to the Nueces/Kleberg County line. The southern patrol route encompassed the area from the Ranger Station to the Mansfield Channel and back, approximately 193 km. However, due to vehicle speed and personnel time limitations, only the northern half of the southern area was patrolled on a number of occasions. Twenty-two of the southern patrols involved overnight camping at the Mansfield Channel. Camping trips increased the number of days that park personnel could be present on the beach, increased patrol efficiency, and reduced mechanical wear of patrol vehicles.

Complete coverage of the entire patrol area on all days of the patrol season (mid-April through August) was not possible because of shortages in personnel and vehicles. It was necessary to concentrate efforts in areas, and at times, when they would be most effective. Weekend patrols were not conducted due to the high likelihood that beach visitors would detect and report turtle sightings. Additionally, areas and dates of coverage were based upon historical trends of nesting and hatchling stranding dates and locations. Most sea turtle tracks and nests found along the Texas coast during the last 10 years were located between the 27 and 72 km markers on PAIS, from mid-April and mid-July (Table 1). Most stranded hatchlings were found on North Padre Island, north of the PAIS 27 km marker, and Mustang Island, from July through August. During August, patrols to the Mansfield Channel for nesting turtles were terminated and more effort was concentrated on patrolling north of the 27 km marker for stranded hatchlings.

Patrol speed and vehicle type also varied during the season. Patrols exclusively for nesting turtles, tracks, and nests (mid-April through June) were conducted at speeds of 16-26 km/hr, whereas patrols exclusively for stranded hatchlings (August) were conducted at speeds of 8 km/hr or less.

Three different types of vehicles were used for patrolling. Four-wheel drive trucks, used primarily to search for nesting turtles and tracks, logged more patrol distance than any other vehicle type (12,141 km) (Fig. 1). "Mules", small all-terrain

vehicles obtained from military surplus property, were utilized for 2,326 km of patrolling. All-terrain 4-wheel cycles (ATVs) were used to patrol 5,643 km. Mules and ATVs were used to search for stranded hatchlings and nesting activity. Although these vehicles provided excellent vantage for observations and could be operated at slow speeds, they could not be utilized for long distance patrols. This was the first year that ATVs were extensively utilized for patrolling at PAIS. They proved extremely effective for this purpose and were the vehicle type used during most sightings of tracks and hatchlings.

Similar amounts of time were spent patrolling during 1991 (2,355 hours) (Shaver, 1991) and 1992 (2,243 hours). However, the total distance patrolled during 1992 (20,110 km) was significantly higher than during 1991 (13,703 km). The expanded use of ATVs was probably the most significant factor leading to the increase in distance patrolled during 1992. Two people were needed to conduct all patrols using four-wheel drive vehicles and most patrols using mules, with one individual operating the motor vehicle and the other scanning the beach for pertinent sightings. However, ATV patrols were conducted by one person and hence were less labor-intensive. Also, ATVs were used to locate stranded hatchlings during 1992, replacing slow walking patrols used for this purpose during 1990 and 1991.

A large work force was necessary to conduct patrols because of the extensive area (125 km) and season (5 months) of coverage. Due to extremely rigorous beach conditions, each individual was limited to no more than 2-3 patrol days/week. Additionally, at least one of the individuals conducting each patrol had to be intensively trained in patrol protocol and data collection methodology. To amass a sufficient contingent of people, park staff from three divisions and volunteers participated in patrols this year (Fig. 2).

Park employees patrolled a total of 1,344 hours. All members of the Resources Management Division were trained to conduct patrols and respond to turtle

sightings. This year, resources managers patrolled a total of 1,045 hours, Ranger Division employees a total of 200 hours, and Maintenance Division employees a total of 99 hours.

Volunteers participated in patrols again this year and nine donated a total of 899 hours during this effort. Four were intensively trained, allowed to conduct patrols without park staff members, and contributed 94% of the total volunteer hours. Prior to conducting a patrol, each of the five remaining untrained volunteers was shown an introductory slide presentation to instruct them on procedures to be used to search for nesting turtles, tracks, nests, and hatchlings.

STAFF AND VISITOR EDUCATION

Efforts to educate the park staff and public about the Kemp's ridley project continued this year. Since PAIS is 105 km long and extensive areas are often devoid of park personnel, it is imperative that park employees and visitors assist with detection and reporting of turtle sightings. Therefore, great emphasis was placed on alerting them of the potential for nesting Kemp's ridleys and urging them to look for nesting turtles, tracks, and stranded hatchlings.

All park employees were shown photographs of sea turtle tracks and instructed to report all sightings. All were trained to collect pertinent information from visitors so that their sightings could be located and investigated further.

A variety of methods were used to educate park visitors about the possibility of sighting nesting turtles and stranded hatchlings. Posters, detailing the need to report sea turtle nestings and tracks, were displayed at PAIS and other local parks and establishments. Additional posters, alerting visitors about the possibility of encountering stranded hatchlings, were distributed at a number of locations within the park. 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. Magnetic signs, stating

that vehicles were conducting turtle patrols and that all live sea turtle sightings should be reported, were affixed to four-wheel drive trucks that were used to conduct patrols.

SEA TURTLE TRACKS AND NESTS

All four sea turtle tracks that were documented for the Texas coast in 1992 were located at PAIS and investigated by patrollers. Two loggerhead (*Caretta caretta*) sea turtle nests were located at two of the four sets of tracks. These nestings were the first confirmed for this species on the Texas coast and PAIS since 1990 (Table 1).

The first set of sea turtle tracks was located by a Resources Management Division patroller at the PAIS 20 km marker on 25 June 1992. The prominent tracks were 75 cm wide with alternating flipper impressions. They extended approximately 25 m from the surf to mid-beach, were U-shaped, and terminated in an area of disturbed sand where the nest was located. Five to seven broken eggs were found intermixed with loose sand about 20-40 cm from the nest cavity. No predator tracks were found in the area and it appears that the nesting turtle may have broken these eggs during nest covering. Ninety-one unbroken eggs were located in the nest cavity. The uppermost eggs were 10 cm from the sand surface and the bottom nest depth was 48 cm. Eggs from this clutch were retrieved from the nest site due to threats from passing vehicles and predators. The 91 eggs from this clutch were packed into two styrofoam boxes (39 eggs in box 1, 52 eggs in box 2) containing moist sand from the nest cavity. Incubation, hatching, and release information for this clutch is presented below (see Sea Turtle Egg Incubation Techniques and Sea Turtle Egg Incubation Results).

Another set of loggerhead sea turtle tracks was located by a Resources Management Division patroller at the PAIS 22.4 km marker on 25 June 1992. The tracks were visible, despite having been traversed by passing vehicles. They were 67 cm wide with alternating flipper impressions, were U-shaped, and extended

17.5 m from the surf to mid-beach. No areas of disturbed sand or eggs were located at the tracks and hence this emergence was deemed a false crawl. It is likely that the same turtle produced these tracks and the set described above, due to the temporal and spacial proximity of both.

The second set of sea turtle tracks that yielded a nest was observed by patrol volunteers during a morning walk. The tracks were located about 90 m south of the PAIS Malaquite Pavilion on 6 July 1992. They were 72 cm wide with alternating flipper impressions, were very prominent, and extended approximately 21 m from the surf to mid-beach. Although the tracks meandered, they terminated in an area of disturbed sand where the nest was located. One hundred and thirty eggs were located in the nest cavity. The uppermost eggs were 13 cm from the sand surface and the bottom nest depth was 45 cm. Eggs from this clutch were retrieved from the nest site due to threats from visitors, predators, and lights from the Malaquite Pavilion. The 130 eggs from this clutch were packed into two styrofoam incubation boxes (65 eggs/box) containing moist sand from the nest cavity. During egg retrieval, bottom eggs were noted to have a greenish hue and the sand in the lower portion of the nest cavity was extremely moist. Incubation, hatching, and release information for this clutch is presented below (see Sea Turtle Egg Incubation Techniques and Sea Turtle Egg Incubation Results).

The last set of sea turtle tracks was located at the PAIS 48.3 km marker on 14 July 1992. The tracks were quite prominent when first observed by Resources Management Division patrollers at 1145 h but became less visible during the three hour investigation of the area. The tracks were 134 cm wide with opposite flipper impressions. They meandered and extended 37 m from the surf to the base of the fore-dunes. An uncovered nest cavity that was about 35 cm deep was located at the base of the dunes. The area of disturbed sand measured 135 cm from the tip of the head impression from the nesting turtle to the center of the nesting cavity. Another area of disturbed sand was located at mid-beach but had no nest cavity. No eggs were located at either area of disturbed sand and the nesting emergence

was deemed a false crawl.

There were two additional reports of sea turtle nesting activity at PAIS this year that could not be substantiated by patrol personnel. Details of the two reports lent credence to their validity and indicated that the nesting emergences were by Kemp's ridley turtles.

First, a visitor reported seeing a "nesting turtle" on the beach at the PAIS 71 km marker at approximately 1600 h on 25 May 1992. The report was logged by a Ranger Division employee at 2000 h. However, no details were obtained and the report was not transferred to the turtle patrol personnel until the next day. Patrol staff investigated the area on 26 May but found no evidence of tracks or a nest. Unfortunately, both days were particularly windy and any tracks would have probably disappeared by the time of investigation. This report was deemed to be credible because: 1) it was particularly windy that day and Kemp's ridleys tend to nest on windy days; 2) one of the largest arribadas at Rancho Nuevo, Mexico this year was on the same day that this turtle was reported [similarly, the only confirmed Kemp's ridley nesting on the Texas coast in 1991 (Shaver, 1991) also occurred on an arribada day at Rancho Nuevo]; and, 3) most sea turtle mating and nesting at PAIS has occurred in the general vicinity that this report was made (Shaver, 1992).

The second report was made by PAIS Ranger Division personnel who had been trained to identify sea turtle tracks. Two members of the Ranger Division reported sighting sea turtle tracks at the PAIS 64 km marker during the early morning hours on 22 June. The two rangers reported that the tracks were 51-61 cm wide. They stated that one portion of the tracks was seen when their vehicle passed the area at 0700 h and both the entrance and exit portions of the tracks were visible when the vehicle passed again at 0900 h. Unfortunately, the rangers were unable to mark the location or promptly report the sighting. Turtle patrol personnel investigated the area at 1100 h, but found no evidence of tracks or a nest.

EGGS LAID IN CAPTIVITY

Four clutches of Kemp's ridley eggs were laid in captivity at Sea World of Texas (San Antonio) and later transferred to PAIS for incubation. Eggs from each of the four clutches were packed into separate styrofoam boxes containing PAIS sand. The first two clutches (containing 76 and 24 eggs, respectively) were laid on 30 June 1992 and brought to the park for incubation on 2 July 1992. The second two clutches (containing 26 and 30 eggs, respectively) were laid on 1 September 1992 and transferred to PAIS the next day. Incubation, hatching, and release information for these clutches is presented below (see Sea Turtle Egg Incubation Techniques and Sea Turtle Egg Incubation Results).

SEA TURTLE EGG INCUBATION TECHNIQUES

The following protocol was utilized to care for sea turtle eggs within the PAIS incubation facility. Identical techniques were used for eggs laid in PAIS beaches and those laid in captivity and transferred to PAIS for incubation. Sea turtle eggs were transported to the park incubation facility as soon as possible after collection. Each of the smaller styrofoam boxes, containing the eggs, was placed into a larger styrofoam box. Styrofoam box dimensions and incubation procedures were the same as those used since 1986 (Shaver et al., 1986; Shaver et al., 1988a). Ambient and control box temperatures were monitored at the three shelf heights. Incubation, ambient, and control box temperatures were recorded at hourly intervals and transferred directly into a computerized database using a Data Acquisition System.

Attempts were made to elevate incubation temperatures in order to avoid the potentially masculinizing effect of incubating sea turtle eggs in styrofoam boxes (Morreale et al., 1982; Mrosovsky, 1982; Dutton et al., 1985). The incubation facility and practices were once again modified to produce mean middle third of incubation period temperatures that approximated or 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, 1989b).

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, 1989b; Shaver and Chaney, 1989). Plastic sheeting and bamboo shades were placed over the shed walls to trap heat and reduce temperature fluctuations.

Eggs were not detected, collected, and placed into the incubation facility until late-June 1992. From late-June through August, there was no threat of incubation temperatures becoming too low. However, during August, last third of incubation period temperatures could have exceeded lethal limits due to metabolic heat and high ambient temperatures (Shaver et al., 1987; 1988a; Shaver, 1989b; Shaver and Chaney, 1989).

Several means were utilized to reduce incubation temperatures of the first loggerhead clutch during the latter portion of the incubation period. This was the only clutch in which incubation temperatures exceeded 36.0 C and hence reached a potentially injurious level. A portable air conditioner was utilized during periods of hot diurnal temperatures. The clutch was moved to the cooler, lower shelf and incubation box lids were removed to reduce incubation temperatures after they exceeded 34-35 C. 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 of natural nests at mid-nest depth (30 cm) (Shaver et al., 1988a; 1988b). From 5-12 August, lids were removed from box 1 (39 eggs) on eight occasions for a total of 27.5 hours and from box 2 (52 eggs) on 11 occasions for a total of 37.0 hours. Because of these precautions, incubation temperatures of box 2 from this clutch reached and/or exceeded 36.0 C for only 5 hours and peaked at 36.1 C. Incubation temperatures of box 1 from this clutch, and all other clutches, never exceeded 36.0 C.

During September and October, repeated cold fronts passed through South Texas and dramatically decreased ambient temperatures. Incubation boxes placed into the PAIS facility during that time were restricted to top shelves, where temperatures are typically the warmest (Shaver et al., 1987; 1988a). A portable heater was utilized to moderate excessive fluctuations in temperatures, particularly during nocturnal hours. Additionally, during periods of extremely cool temperatures in October, a tarpaulin was installed around the heater, incubation boxes, top shelf control box, and top shelf ambient probe. This arrangement was effective in maintaining incubation temperatures between 27 and 31 C, despite ambient temperatures reaching as low as 17 C.

Styrofoam incubation boxes were opened approximately once every two weeks throughout incubation to check for fungal infections, insects, and sand moisture. No fungal infected eggs or insects were found in any of the clutches. Moisture content of the sand above the eggs was monitored by the "pie-crust" pinch technique. Decreased sand moisture was detected in only the first loggerhead clutch. Fifty ml of distilled water was added to the top sand layer of both boxes on 2 August.

Incubation boxes were checked for hatching twice daily beginning on the 45th day of incubation. All emerged hatchlings were transferred to other double styrofoam boxes containing moist Padre Island sand. They were held in transfer boxes for approximately 24 hours to allow them to gain strength and enter their infantile frenzy. Activity levels of the hatchlings were monitored to determine the appropriate release time. All hatchlings were released on Closed Beach, PAIS during early morning hours.

Unhatched eggs were allowed to incubate for up to 5 days after the remainder of the clutch had hatched. After that time, all unhatched eggs were preserved for later analysis. Clutches that had not hatched by 56 days of incubation were unearthed to determine whether any of the eggs were viable and all non-viable

eggs were preserved. Unhatched eggs 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) and Miller (1985) were used as to classify Kemp's ridley and loggerhead embryos, respectively.

INCUBATION OF EGGS LAID ON SOUTH TEXAS BEACHES

Incubation facility temperatures - Mean ambient and control box temperatures were calculated for the period when viable eggs incubated at the park facility (25 June-26 August). Mean ambient shed temperatures recorded from the top (mean = 29.7 C, SE = 0.1 C), middle (mean = 29.6 C, SE = 0.1 C) and bottom (mean = 29.5 C, SE = 0.0 C) shelves in 1992 were significantly different from one another (ANOVA, $F = 4.4760$, $P = 0.01$). Mean temperatures of control boxes located on top (mean = 30.0 C, SE = 0.0 C), middle (mean = 29.8 C, SE = 0.0 C), and bottom (mean = 29.5 C, SE = 0.0 C) shelves in 1992 were significantly different from one another (ANOVA, $F = 191.0495$, $P < 0.01$).

CC-1 Clutch - Incubation temperatures of both boxes of eggs from the first loggerhead clutch ranged from 28.7-36.1 C (Table 2). It was feared that the box containing 52 eggs would have warmer incubation temperatures and hatch earlier than the box with 39 eggs. To counteract possible temperature differences, the two boxes were placed at different shelf heights and the number of hours that lids were removed from both was different. These manipulations were apparently successful since for both boxes: 1) the overall mean incubation temperatures were within 0.2 C; 2) the mean temperature during the middle third of the incubation period was the same (30.7 C); and, 3) the date and time of hatching detection was the same (0700 h on 13 August 1992) (Table 2).

The incubation period (from egg laying to pipping) for this clutch was 50 days. Eighty-five of the 91 eggs hatched (93.4%) and emerged from their egg shells.

Eighty-three of the hatchlings were released on the beach at 0445 h on 15 August. All were extremely active and entered the surf within 15 minutes. The hatchlings were guarded from beach predators by 24 staff members and invited guests who attended the release. Available moonlight allowed ample viewing of the hatchlings. The two late hatching individuals from this clutch were released at 0645 h on 17 August. One individual did not orient properly during release and was recaptured in the surf. It was returned to the PAIS rehabilitation facility and placed into a 75.6 liter aquarium for observation. On 18 August, it was deemed that the hatching was healthy and it was released approximately 8 km offshore from Port Aransas, Texas.

All hatchlings were measured and weighed at the PAIS laboratory just prior to their release. The mean straight-line carapace length (SLCL) (mean = 48.48 mm, SE = 0.11 mm, range = 45.00-51.80 mm, N = 85) and mean weight (mean = 24.19 g, SE = 0.10 g, range = 21.47-27.30 g, N = 85) of the hatchlings was significantly larger than the mean SLCL (mean = 44.35 mm, SE = 0.12 mm, range = 41.20-47.25, N = 78) and weight (mean = 22.52 g, SE = 0.14 g, range = 19.63-24.72, N = 78) of the 1988 clutch of loggerhead eggs laid on Mustang Island, Texas and incubated at PAIS (Shaver et al., 1988a) ($P < 0.05$).

The six unhatched eggs from this clutch were preserved after full-term clutch incubation. Three were found to be infertile and two were fertile but contained no identifiable embryos. A stage 12 embryo (Miller, 1985) was found within one egg. Unfortunately, the embryo was not large enough to remove gonads for histological sex determination.

A direct estimate of clutch sex ratio could not be made based upon examination of specimens. No dead hatchlings or late-staged embryos were available from this clutch for sex determination. However, based upon the mean middle third of incubation period temperature (30.7 C) and incubation period (50 days) for this clutch, it is likely that there was a preponderance of females (Mrosovsky, 1982;

1988).

CC-2 Clutch - Incubation temperatures of both boxes of eggs from the second loggerhead clutch ranged from 27.9-34.1 C (Table 2). Since equal numbers of eggs were placed into each of the two incubation boxes and both boxes were placed at the same shelf height, it was hoped that incubation temperatures and hatch times would be similar for both. These assumptions were apparently correct since for both boxes: 1) the overall mean incubation temperatures were within 0.1 C and were not significantly different from one another ($P>0.05$); 2) the mean temperature during the middle third of the incubation period was the same (30.3 C); and, 3) the date and time of hatching detection was the same (0800 h on 26 August 1992) (Table 2).

The incubation period for this clutch was 52 days. Fifty-eight of the 130 eggs hatched (44.6%) and emerged from their egg shells. Fifty-one of the emerged hatchlings entered their infantile frenzy at 0700 h on 27 August. It was deemed preferable to immediately release the hatchlings rather than to hold them until that evening. It was thought that they would have expended considerable energy trying to escape from the incubation boxes during the intervening 14 hours. A random sample of ten of the hatchlings was quickly measured. By 0800 h, all were transported to Closed Beach, PAIS for release. Approximately 15 staff members observed and guarded the hatchlings from beach predators. All of the turtles were extremely active and entered the surf within 15 minutes.

Seven individuals from this clutch hatched and were released later than the other 51 hatchlings. All seven were measured and weighed at the PAIS laboratory just prior to their release. Two were released on 28 August, four on 29 August, and one on 31 August. All were extremely active when placed on the beach at 0800 h and entered the surf within 15 minutes.

Two of those that were released on 29 August could not swim and were

recaptured in the surf. Both were returned to the PAIS rehabilitation facility and placed into 75.6 liter aquariums for observation. However, neither could swim in the aquariums and each was transferred to an individual tub containing approximately 2 cm of sea water. The first individual was the smallest of the clutch. While in both the surf and tank, the rear portion of the animal sunk towards the bottom, prohibiting surfacing for air. Once placed into the tub of shallow water, the turtle was active and had no difficulty obtaining air. However, the hatchling died on 31 August. Upon subsequent necropsy, it was found that the hatchling contained a large quantity highly vascularized yolk, indicating malabsorption of the yolk sac (Leong et al., 1989). The other individual was blind, continually inverted itself in the water, and had difficulty reaching the surface for air. When transferred to the tub, the turtle was able to obtain air but continued to invert itself. This hatchling died on 2 September and was necropsied.

Only 17 of the 58 individuals from this clutch were measured and selection of these 17 was not completely random (ie. the last seven individuals to hatch were all measured). Hence, statistical comparisons using hatchling measurements for this clutch were inappropriate. However, the mean SLCL (mean = 49.02 mm, SE = 0.60 mm, range = 43.00-53.45 mm, N = 17) and mean weight (mean = 26.94 g, SE = 0.58 g, range = 20.88-29.71 g, N = 17) of the hatchlings from this clutch were larger than the mean values for both the first clutch of loggerhead eggs laid at PAIS this year (CC-1) and the clutch of loggerhead eggs laid on Mustang Island, Texas and incubated at PAIS in 1988 (Shaver et al., 1988a).

The 72 unhatched eggs from this clutch were preserved after full-term clutch incubation. Three burst in the incubation boxes, three were infertile, and 58 were fertile but contained no identifiable embryos. Eight eggs contained well-developed embryos; one stage 28 and seven stage 29 (Miller, 1985). All of the eight embryos possessed deformities involving the head and pigmentation. Only the least deformed of the eight embryos was necropsied to obtain gonads for sex determination.

A direct estimate of clutch sex ratio could be made based upon examination of only three specimens. Since the stage 29 embryo and both of the hatchlings that died during the observation period were females, a clutch sex ratio of 0M:100F was derived. Based upon the mean middle third of incubation period temperature (30.3 C) and incubation period (52 days) for this clutch, it is likely that there was a preponderance of females (Mrosovsky, 1982; 1988).

The hatching percentage from this clutch (44.6%) was exceptionally low. It is doubtful that movement induced mortality (Limpus et al., 1979) accounted for the low hatching success of this clutch since: 1) extreme care was exercised during the removal and short transport (4 km) of the eggs to the PAIS incubation facility; and, 2) membranes were still attached to the inside of the eggshells of the fertile unhatched eggs. As noted above, when the clutch was first excavated and transplanted to styrofoam incubation boxes, the bottom-most eggs had a green hue and the bottom of the nest cavity was extremely moist. Perhaps these factors were influential in the low hatching success of this clutch. However, it is doubtful that a microbial infection affected the eggs since they had no mottling or discoloration, typical of such infections. Additionally, sand moisture content within the incubation boxes was comparable to that used for all other clutches incubated at the park facility within the past few years. Incubation temperatures did not fluctuate excessively or fall within levels that would be injurious to developing embryos. Perhaps old sperm fertilized the eggs and resulted in the poor hatching success of this clutch (Byles, pers. comm.).

INCUBATION OF EGGS LAID IN CAPTIVITY

LK-1 Clutch - This was the first clutch of Kemp's ridley eggs that was laid in captivity in Texas that successfully hatched. From 1988-1992, 744 Kemp's ridley eggs, laid at various captive facilities in Texas, were transferred to PAIS for incubation (Tables 3&4). Previous to 1992, none hatched and all were found to be infertile (Shaver et al., 1988a; Shaver, 1990; 1991) (Table 4).

Incubation temperatures of this Kemp's ridley clutch ranged from 28.0-32.2 C (Table 3). Attempts were made to maintain middle third of the incubation period temperatures near or slightly above the pivotal temperature for this species, 30.2 C (Shaver et al., 1988b). These manipulations were apparently successful since the mean middle third of incubation period temperature was 30.3 C (SE = 0.0, range = 28.7-31.7 C). Only small amounts of metabolic heating were detected in this clutch. However, the mean incubation temperature of this box (mean = 30.2, SE = 0.0 C) was significantly higher than the mean temperature of the corresponding control box (mean = 30.0 C, SE = 0.0 C) ($P < 0.05$).

After a 52 day incubation period, the clutch was detected hatching at 0800 h on 20 August. Eight of the 76 eggs hatched (10.5%) and emerged from their egg shells. The U.S. Fish and Wildlife Service (USFWS) was notified of the hatching and requested that we hold the hatchlings for approximately one week to determine their suitability for release into the Gulf of Mexico. USFWS suggested that we release the hatchlings on the beach and recapture them in the surf using aquarium dip nets, as done from 1978-1988 (Shaver et al., 1988a; Shaver, 1989b).

The first hatchling was released on the beach at 0800 h on 23 August and the other seven at 0800 h on 24 August. All were active and swam vigorously in the surf. One hatchling escaped in the surf and the remaining seven were recaptured after they swam approximately 5-10 m.

The seven recaptured hatchlings were measured and weighed at the PAIS laboratory after their release and recapture. The mean SLCL (mean = 44.43 mm, SE = 0.3 mm, range = 43.20-45.75 mm, N = 7) and mean weight (mean = 16.95 g, SE = 0.4 g, range = 15.69-18.18 g, N = 7) of the hatchlings was significantly larger than the mean SLCL (mean = 42.17 mm, SE = 0.1 mm, range = 40.00-43.85 mm, N = 100) and mean weight (mean = 16.64 g, SE = 0.1 g, range = 15.06-18.82 g, N = 100) of the clutch of Kemp's ridley eggs laid and incubated at PAIS during

1991 ($P<0.05$). However, the mean SLCL and weight for this clutch were not significantly different than mean SLCL (mean = 44.42 mm, SE = 0.1 mm, range = 42.10-46.35, N = 95) and mean weight (mean = 17.84 g, SE = 0.1 g, range = 15.11-19.14, N = 95) of the clutch of Kemp's ridley eggs laid on Mustang Island, Texas and incubated at PAIS during 1988 ($P>0.05$).

After recapture in the surf, each of the seven hatchlings was transferred to the PAIS rehabilitation facility and placed into a 75.6 liter aquarium for observation. All were extremely active in the tanks and appeared healthy. Lengths and weights were monitored to gauge vigor and determine when feeding should be initiated. To avoid gut impaction, feeding was not initiated until one week post-hatching (Fontaine et al., 1989). Each hatchling was offered small pieces of shrimp, totalling up to 5% of their body weight each day. Six of the seven individuals readily accepted and consumed the food provided.

After the one week observation period, the USFWS was contacted to gain approval for release of the hatchlings. Deep Sea Headquarters (Port Aransas, Texas) donated use of a vessel to transport the hatchlings offshore. Unfortunately, unusually rough offshore water conditions prevailed during the week that was selected for release of the turtles. An attempt was made to release the hatchlings on 2 September. Each was packed into an individual tub, containing a piece of moistened foam rubber, and was transported approximately 25 km. Unfortunately, the release had to be aborted due to rough seas and the turtles were promptly returned to their tanks. On 3 September, the hatchling that had not consumed any food items was found dead within the tank. The hatchling was immediately transported to Dr. Robinson (Texas A&M University Veterinary Diagnostic Laboratory) for necropsy. Dr. Robinson reported that the hepatic capsule was coated with a layer of heterophils, indicating a bacterial peritonitis. On 4 September, the remaining six hatchlings were successfully released approximately 8 km offshore from Port Aransas, Texas.

The 68 unhatched eggs from this clutch were preserved after full-term clutch incubation. Thirty-two were found to be infertile and 33 were fertile but contained no identifiable embryos. Three eggs contained identifiable embryos; two stage 13 and one stage 30 (Cratz, 1982).

A direct estimate of clutch sex ratio could be made based upon examination of only two specimens. Considering the hatchling that died during the observation period (male) and the stage 30 embryo (female), a clutch sex ratio of 50M:50F was derived. 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 found to be correlated with clutch sex ratio (Shaver et al., 1988b; Shaver, 1989b). Clutch LK-1 values for the mean middle third of incubation period temperature (30.3 C) and incubation period (52 days) 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)], it was estimated that 57.0% of the clutch was female. However, it was estimated that only 10.9% of the clutch was female when the equation correlating percent female with the incubation period [Y = 772.343-14.643X (Shaver, 1989b)] was used. The low number of viable eggs in this clutch produced relatively little metabolic heat, probably resulting in a longer incubation period. Hence, the estimate of sex ratio that was based upon the mean middle third of the incubation period temperature, rather than the incubation period, is probably more reliable.

LK-2, LK-3, LK-4 Clutches - No metabolic heat was detected in these three clutches and no eggs hatched. After 56 days of incubation, all eggs were orange and severely indented. All were examined for fertility (Shaver and Chaney, 1989). Of the 24 eggs in clutch LK-2, 19 appeared to be infertile and 5 fertile but without identifiable embryos (Table 3). Fifty-eight percent of the 26 eggs in clutch LK-3 (laid by Sea World turtle LK-7) appeared to be fertile, but contained no identifiable embryos; the 11 remaining eggs were classified as infertile. All of the 30 eggs in

clutch LK-4 (laid by Sea World turtle LK-12) appeared to be infertile.

HATCHLING STRANDINGS

Because of the high number of hatchlings that were found stranded on North Padre and Mustang Islands in 1990 (Shaver, 1990), PAIS expended considerable effort to detect stranded hatchlings during 1991 and 1992. Twelve sea turtle hatchlings were found stranded along Mustang and North Padre Islands from 3 July to 27 September, 1992. Among the 12, were nine Kemp's ridley, two loggerhead, and one hawksbill (Fig. 3). However, as during 1990, most of the hatchlings were located by pedestrians in heavily visited beach areas (Shaver, 1990).

Stranding locations and dates were noted for each hatchling and all were measured for straight-line carapace length (SLCL), straight-line carapace width (SLCW), curved carapace length (CCL), curved carapace width (CCW), and weight (Table 5). To access possible age and origin of the hatchlings, hatchlings were examined for the presence of an umbilical scars, internal yolk (if dead), egg teeth, wounds, and epizoans.

Two *L. kempii* hatchlings were dead when located on Padre Island and were necropsied at PAIS to examine yolk reserves, retrieve gut contents, and remove gonads for histological sex determination (Table 5). Both individuals were later identified as males.

Ten of the hatchlings were found alive and transported to two local rehabilitation facilities. Six of the turtles (including four *L. kempii* and two *C. caretta*) were taken to the facility at PAIS; all survived and were ultimately released into the Gulf of Mexico (see Hatchling Rehabilitation Facility). The other four live hatchlings (including three *L. kempii* and one *E. imbricata*) were brought to the University of Texas Marine Sciences Institute (UTMSI), Port Aransas, Texas for rehabilitation. One hatchling Kemp's ridley died almost immediately at UTMSI, while the three remaining individuals are being held for prolonged rehabilitation.

Stranding dates and locations for the 12 hatchlings were compared to release dates and locations for Kemp's ridleys and loggerheads incubated at the PAIS facility. None of the stranded hatchlings appeared to have originated from those clutches incubated at the park facility. However, three of the stranded *L. kempii* hatchlings found in 1992 may have emerged from other South Texas nests. These individuals were the size of the newly released hatchlings (<20 g), possessed a prominent umbilical scar and/or large quantities of internal yolk, possessed an egg tooth, and had no epizoans (Table 5). The origin of the nine remaining stranded hatchlings is more difficult to ascertain since these turtles were of varying sizes, stranded over a period of 3 months, and stranded along a distance of 138 km (Table 5). Most were a size larger than newly emerged hatchlings (Table 5). All had obviously been in the water for several days since they possessed epizoans, gut contents indicating offshore feeding, and/or well-healed wounds.

HATCHLING SEA TURTLE REHABILITATION FACILITY

More hatchlings stranded during the summer of 1990 than during any summer from 1980-1989 (Fig. 3). Forty of the 53 hatchlings found in 1990 were alive. Most were injured and in need of immediate care and stabilization. Unfortunately, there was no suitable local facility available where the hatchlings could be taken for rehabilitation.

It was feared that similarly high numbers of hatchlings might strand during successive summers. The park staff and Kemp's Ridley Sea Turtle Working Group concluded that improved, local rehabilitation efforts must be undertaken in the future to ensure the survival of these stranded hatchlings. In May, 1991, EXXON Corporation, USA donated $30,000 to PAIS for the construction of a hatchling rehabilitation facility at the park. Specific plans for the facility were formulated after consultation with individuals from the U.S. Fish and Wildlife Service, National Marine Fisheries Service, Texas State Aquarium, and National Park Service Southwest Regional Office who had expertise in the care, maintenance, and

rehabilitation of sea turtles. The rehabilitation facility was designed to hold up to 70 hatchlings, each in an individual 75.6 liter aquarium, in sterilized water. Although the building was not completed in time for the 1992 stranding season, it should be completed prior to the initiation of the 1993 season.

During 1991 and 1992, a temporary rehabilitation facility was established at the park. Holding conditions, practices, and techniques were similar to those that will be utilized during future years. Up to 12 individual 75.6 liter aquariums were placed into the temporary facility at any given time. Each was filled with Gulf of Mexico water that had been pumped through a series of filters and an ultraviolet sterilizer to remove inert elements, particles, bacteria, protozoa, and fungi. Each aquarium had an individual, external, biological filter and an undergravel filter. Water quality was monitored at least once a week and the majority of water within each tank was replaced biweekly.

Six live hatchlings were placed into the facility from July to September, 1992. Each was fed small pieces of shrimp and squid and provided a nutritional supplement that contained vitamins, trace elements, and amino acids. Attempts were made to feed turtles using as little human contact as possible. Each individual was first offered food items that were placed into the tank and allowed to sink. Those turtles that could not catch the falling food were next given pieces placed within a ladle. This year, all turtles that were unable to feed using the first two methods, readily consumed small food items that were held in front of them within soft forceps.

As recommended for hatchling Kemp's ridley sea turtles (Fontaine et al., 1989), each hatchling held at the PAIS facility was fed approximately 5% of their body weight each day. SLCL, SLCW, CCL, CCW, and weight were measured weekly and hatchling health was closely monitored. Veterinary care was provided by Dr. Martin Frey and Dr. Mike Hughes, both of whom have previous experience in treating sea turtles.

All six hatchlings that were placed into the PAIS rehabilitation facility during 1992 survived and were later released into the Gulf of Mexico. After three to six weeks of care, the four Kemp's ridley hatchlings had increased their initial SLCLs approximately 2 cm (Fig. 4) and doubled their initial weights (Fig. 5). The two stranded loggerhead hatchlings also grew considerably during 2-3 weeks of care at the PAIS rehabilitation facility. After these recuperative periods, the hatchlings were extremely active and deemed healthy enough for release.

The USFWS was consulted to gain approval on release locations, dates, and conditions. All hatchlings were released approximately 8 km offshore from Port Aransas, Texas. To avoid habituation to humans, hatchlings were released as soon as they were judged to be healthy, necessitating three separate releases this year. The first three Kemp's ridley hatchlings received for rehabilitation at PAIS this year were released on 14 August 1992, from a small private vessel owned by a Resources Management employee. On 4 September 1992, Deep Sea Headquarters (Port Aransas, Texas) donated use of a vessel to take hatchlings offshore for the second release. At this time, the last rehabilitated Kemp's ridley hatchling and the six surviving Kemp's ridley hatchlings from a clutch that was laid at Sea World of Texas were set free. Lastly, the two rehabilitated loggerhead hatchlings were liberated on 6 October 1992, using a park vessel. During all releases, the hatchlings swam vigorously and headed directly east.

FUTURE PLANS

Public education programs, beach patrols, and protection and monitoring of nesting sea turtles and nests will be continued at the park during 1993. Attempts will be made to continue volunteer participation in this project. ATVs, which proved very effective for patrols in 1992, will be used to an even greater extent during 1993. By the beginning of the hatchling stranding season, construction of the sea turtle hatchling rehabilitation facility should be completed and the facility should be operational.

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Table 1. Documented sea turtle nestings on Texas beaches from 1979 through 1992. PAIS = Padre Island National Seashore, Padre Island, PBP = Padre Balli Park, Padre Island, SPI = South Padre Island, and MI = Mustang Island.

Species	Number of eggs	Lay date	Nesting location	Incubation location and method	Percent hatch
Loggerhead	84	15 June 1979	SPI	SPI, nest site	1
Kemp's ridley	67	17 June 1979	PAIS	PAIS, styrofoam box	97
Kemp's ridley	113	30 April 1980	PBP	PAIS, styrofoam box	55
Kemp's ridley	115	22 May 1980	PAIS	PAIS, nest site	2
Kemp's ridley	97	13 June 1985	PAIS	PAIS, styrofoam box	72
Green	2	13 July 1987	PAIS	PAIS, styrofoam box	50
Kemp's ridley	104	27 April 1988	MI	PAIS, styrofoam box	91
Loggerhead	113	26 June 1988	MI	PAIS, styrofoam box	69
Loggerhead	83	11 June 1990	PAIS	PAIS, nest site	100[1]
Kemp's ridley	107	29 April 1991	PAIS	PAIS, styrofoam box	94
Loggerhead	91	25 June 1992	PAIS	PAIS, styrofoam box	93[2]
Loggerhead	130	6 July 1992	PAIS	PAIS, styrofoam box	45

[1] Nest not detected until after hatching; lay date projected based upon a 60 day incubation period and nest detection two weeks after hatching; number of eggs and hatching rate estimated from examination of egg shells.

[2] Totals based upon 91 eggs recovered for styrofoam box incubation and do not include 5-7 broken eggs found at the top of the nest

Table 2. Incubation, hatching, and release information for loggerhead sea turtle clutches incubated at Padre Island National Seashore during 1992.

Parameter	Clutch No. CC-1	CC-2
Pertinent dates		
Lay date	25 June	6 July
Hatch date and time	13 Aug. 0700 h	26 Aug. 0800 h
Middle third of incubation dates	12-27 July	23 July-8 Aug.
Hatchling release dates	15-17 Aug.	27-31 Aug.
No. of eggs		
box 1 = (1)	39	65
box 2 = (2)	52	65
total	91	130
Incubation temperatures (C)		
middle third mean±1SE, range (1)	30.7±0.0, 29.3-32.6	30.3±0.0, 29.6-31.5
(2)	30.7±0.0, 29.3-33.1	30.3±0.0, 29.5-31.4
overall mean±1SE, range (1)	31.4±0.1, 28.7-35.6	30.6±0.0, 27.9-33.5
(2)	31.6±0.1, 28.9-36.1	30.7±0.0, 27.9-34.1
Hatching data		
Incubation period (days)	50	52
Hatching percent	93.4	44.6
No. dead hatchlings	0	2
No. surviving hatchlings released	85	56
Hatchling measurements		
no. hatchlings measured	85	17
SLCL mean±1SE (mm)	48.48±0.11	49.02±0.60
range	45.00-51.80	43.00-53.45
weight mean±1SE (g)	24.19±0.10	26.94±0.58
range	21.47-27.31	20.88-29.71
Unhatched eggs[a]		
no. unhatched	6	72
no. burst in box	0	3
no. infertile	3	3
no. fertile but without embryos	2	58
no. stage 12 embryos	1	0
no. stage 28 embryos	0	1
no. stage 29 embryos	0	7
no. deformed embryos	0	8
Sex determination dead individuals		
no. analyzed	0	3
no. males	0	0
no. females	0	3

[a] Miller (1985) used to categorize embryonic stage of development at death.
stage 12 corresponds to 6.7±.5% of the incubation period
stage 28 corresponds to 78.3±2% of the incubation period
stage 29 corresponds to 86.0±2% of the incubation period

Table 3. Incubation, hatching, and release information for Kemp's ridley sea turtle clutches laid in captivity at Sea World of Texas (San Antonio) and transferred to Padre Island National Seashore for incubation during 1992.

Parameter	Clutch No. LK-1	LK-2	LK-3	LK-4
Pertinent dates				
Lay date	30 June	30 June	1 Sept.	1 Sept.
Hatch date and time	20 Aug. 0800 h	-	-	-
Middle third of incubation dates	17 July - 2 Aug.	-	-	-
Hatchling release dates: beach	23-24 Aug.	-	-	-
offshore	4 Sept.	-	-	-
Incubation and hatching data				
No. of eggs	76	24	26	30
Incubation period (days)	52	-	-	-
Hatching percent	10.5	0	0	0
No. dead hatchlings	1	-	-	-
No. surviving hatchlings released	7	-	-	-
Incubation temperatures (C)				
middle third mean±1SE	30.3±0.0	-	-	-
range	28.7-31.7	-	-	-
overall mean±1SE	30.2±0.0	-	-	-
range	28.0-32.2	-	-	-
Hatchling measurements				
no. of hatchlings measured	7	-	-	-
SLCL mean±1SE (mm)	44.42±0.32	-	-	-
range	43.20-45.75	-	-	-
weight mean±1SE (g)	16.95±0.39	-	-	-
range	15.69-18.18	-	-	-
Unhatched eggs[a]				
no. unhatched	68	24	26	30
no. infertile	32	19	11	30
no. fertile but without embryos	33	5	15	0
no. stage 13 embryos	2	0	0	0
no. stage 30 embryos	1	0	0	0
Sex determination dead individuals				
no. analyzed	2	0	0	0
no. males	1	-	-	-
no. females	1	-	-	-

[a] Cratz (1982) used to categorize embryonic stage of development at death.
stage 13 corresponds to 15 days of development
stage 30 corresponds to 50 days of development

Table 4. Kemp's ridley sea turtle eggs laid in captivity and incubated at Padre Island National Seashore.

Lay date	No. of eggs	Captive facility	Percent hatch	Percent fertile
3 July 88	39	Sea Turtles, Inc.	0	0
25 July 88	61	Sea Turtles, Inc.	0	0
11 May 90	91	Texas A&M Univ.	0	0
13 May 90	40	Texas A&M Univ.	0	0
7 June 90	107	Sea World of Texas	0	0
6 June 90	25	Sea World of Texas	0	0
7 June 90	44	Sea World of Texas	0	0
13 July 90	96	Sea World of Texas	0	0
21 June 91	85	Sea World of Texas	0	0
30 June 92	76	Sea World of Texas	11	58
30 June 92	24	Sea World of Texas	0	21
1 Sept. 92	26	Sea World of Texas	0	58
1 Sept. 92	30	Sea World of Texas	0	0

Table 5. Sea turtle hatchlings stranded on Padre and Mustang Islands from 3 July - 27 September 1992.

I.D. #	Species	SLCL (cm)	SLCW (cm)	CCL (cm)	CCW (cm)	Weight (g)	Stranding location	Stranding date	Condition Facility[1]	Fate[2]	Sex[3]	Comments[4]
LK-01	Lk	4.0	3.3	4.3	4.3	14	PI, near Bob Hall Pier	3 July	live PAISRF	R 14 Aug.	U	et, us, w
LK-02	Lk	4.0	3.4	4.3	4.3	13	PAIS, 3 km S. of C.B/S.B. barricade	6 July	dead	-	M	y, et, us, w
LK-03	Lk	5.0	4.6	5.1	5.3	22	PAIS, 0.5 km N, of Ranger Station rd.	22 July	live PAISRF	R 14 Aug.	U	ep, w
LK-04	Lk	5.5	5.1	5.5	6.0	28	PI, near Bob Hall Pier	22 July	live PAISRF	R 14 Aug.	U	ep, w
LK-05	Lk	5.5	5.1	5.8	5.9	26	PAIS, 48 km marker	18 Aug.	live PAISRF	R 4 Sept.	U	us, et, w
LK-06	Lk	7.5	7.1	7.8	8.5	54	PAIS, 84 km marker	22 Aug.	dead	-	M	w
LK-07	Lk	4.5	4.4	4.5	5.0	18	MI, Port Aransas County Park	26 July	live UTRF	died	U	us, et
LK-08	Lk	6.0	6.7	6.1	6.9	48	MI, 100 m S. of S. jetty	16 Sept.	live UTRF	H	U	w
LK-09	Lk	5.8	5.3	6.4	6.4	43	MI, 7.4 km S. of access rd. #1	18 Sept.	live UTRF	H	U	ep
EI-01	Ei	5.6	5.6	7.0	7.0	45	MI, at base of S. jetty	9 Sept.	live UTRF	H	U	w
CC-01	Cc	5.6	4.6	6.0	6.0	30	PAIS, 1 km S. of N.B/C.B barricade	16 Sept.	live PAISRF	H	U	us, et, ep, w
CC-02	Cc	6.0	5.1	6.4	6.3	40	PAIS, 3 km S. of C.B./S.B. barricade	27 Sept.	live PAISRF	H	U	ep

[1] PAISRF = Padre Island National Seashore rehabilitation facility,
UTRF= University of Texas Marine Sciences Institute rehabilitation facility

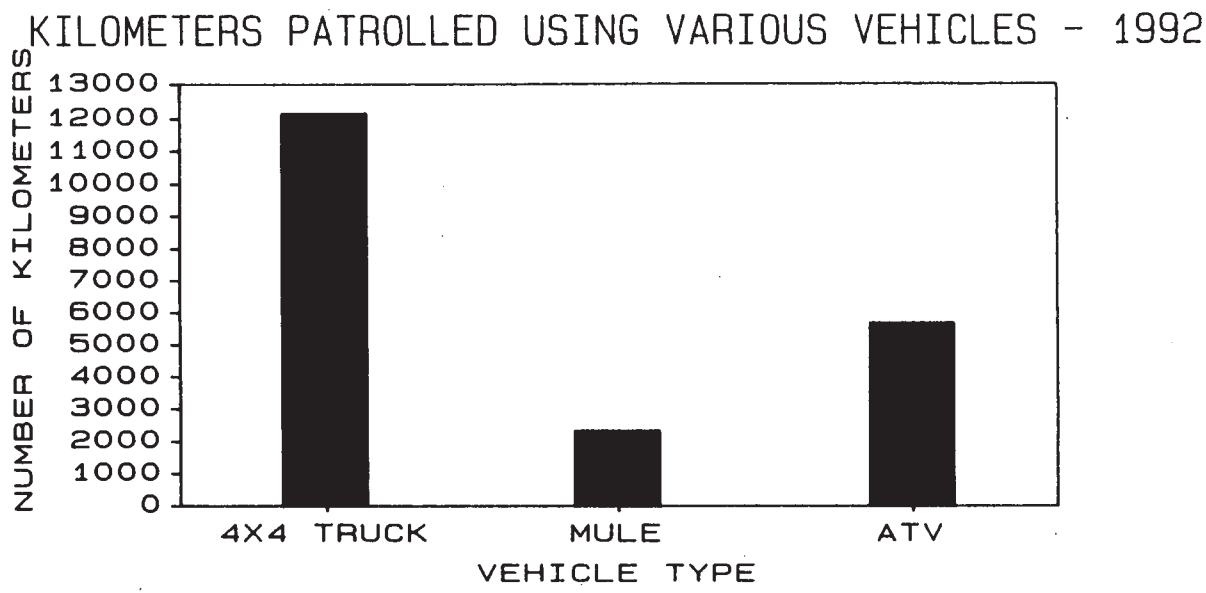
[2] R = released 8 km offshore from Port Aransas, Texas, H = still being held for rehabilitation

[3] M = male, F = female, U = unknown

[4] y = internal yolk, et = egg tooth, us = umbilical scar, ep = epizoan, w = external wounds

Fig. 1. Number of kilometers patrolled using various types of vehicles from mid-April through August, 1992.

Fig. 2. Number of hours that various groups spent conducting patrols from mid-April through August, 1992.


KILOMETERS PATROLLED USING VARIOUS VEHICLES - 1992
NUMBER OF KILOMETERS
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
4X4 TRUCK
MULE
ATV
VEHICLE TYPE

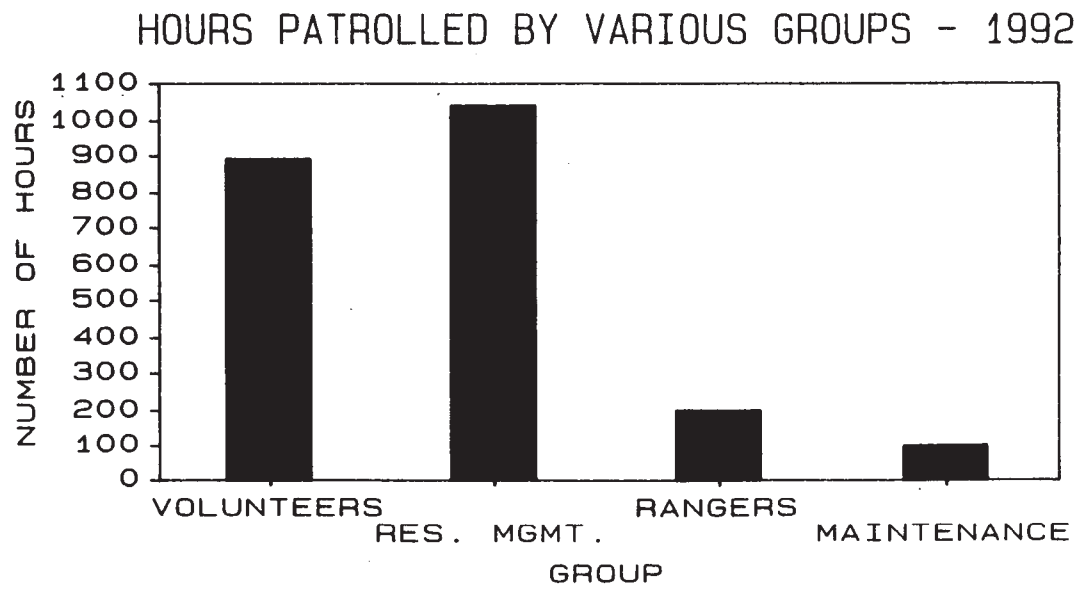

HOURS PATROLLED BY VARIOUS GROUPS - 1992
NUMBER OF HOURS
1100
1000
900
800
700
600
500
400
300
200
100
0
VOLUNTEERS
RES. MGMT.
RANGERS
MAINTENANCE
GROUP

Fig. 3. Sea turtle hatchlings and post-hatchlings stranded on North Padre and Mustang Islands from 1980-1992.

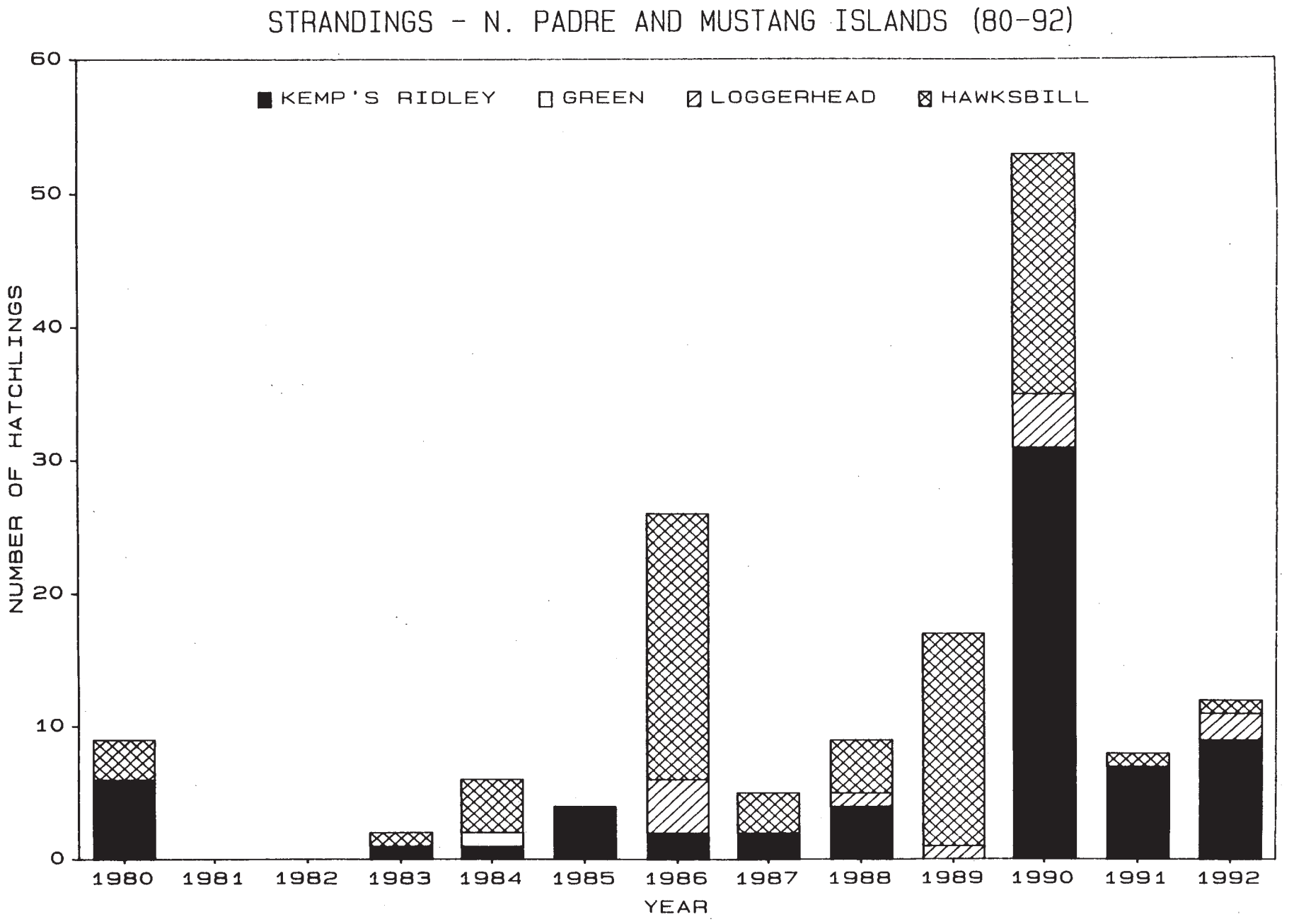

STRANDINGS - N. PADRE AND MUSTANG ISLANDS (80-92)
KEMP'S RIDLEY
GREEN
LOGGERHEAD
HAWKSBILL
NUMBER OF HATCHLINGS
0
10
20
30
40
50
60
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
YEAR

Fig. 4. Straight-line carapace lengths of sea turtle hatchlings held at the Padre Island National Seashore rehabilitation facility during 1992.

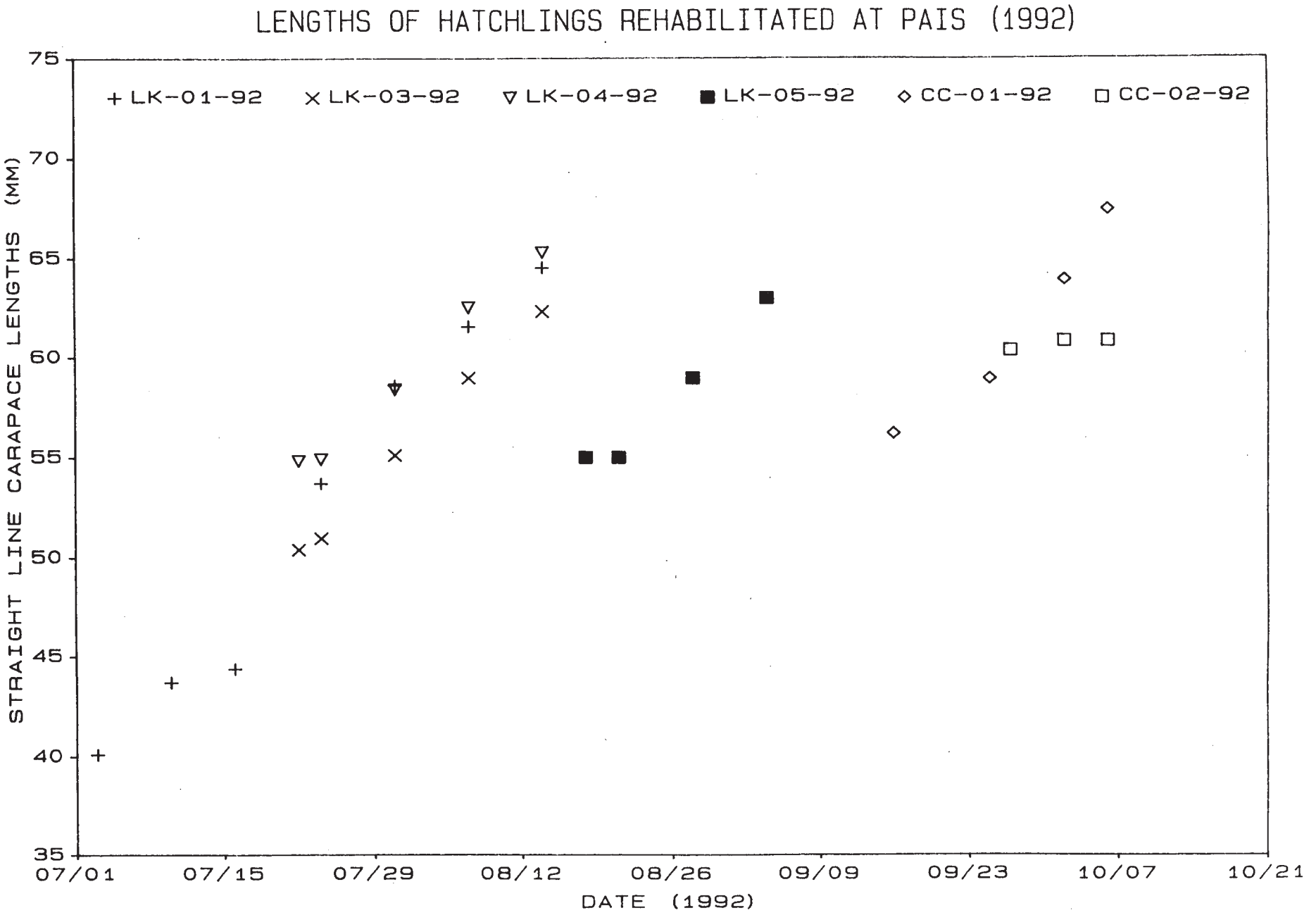
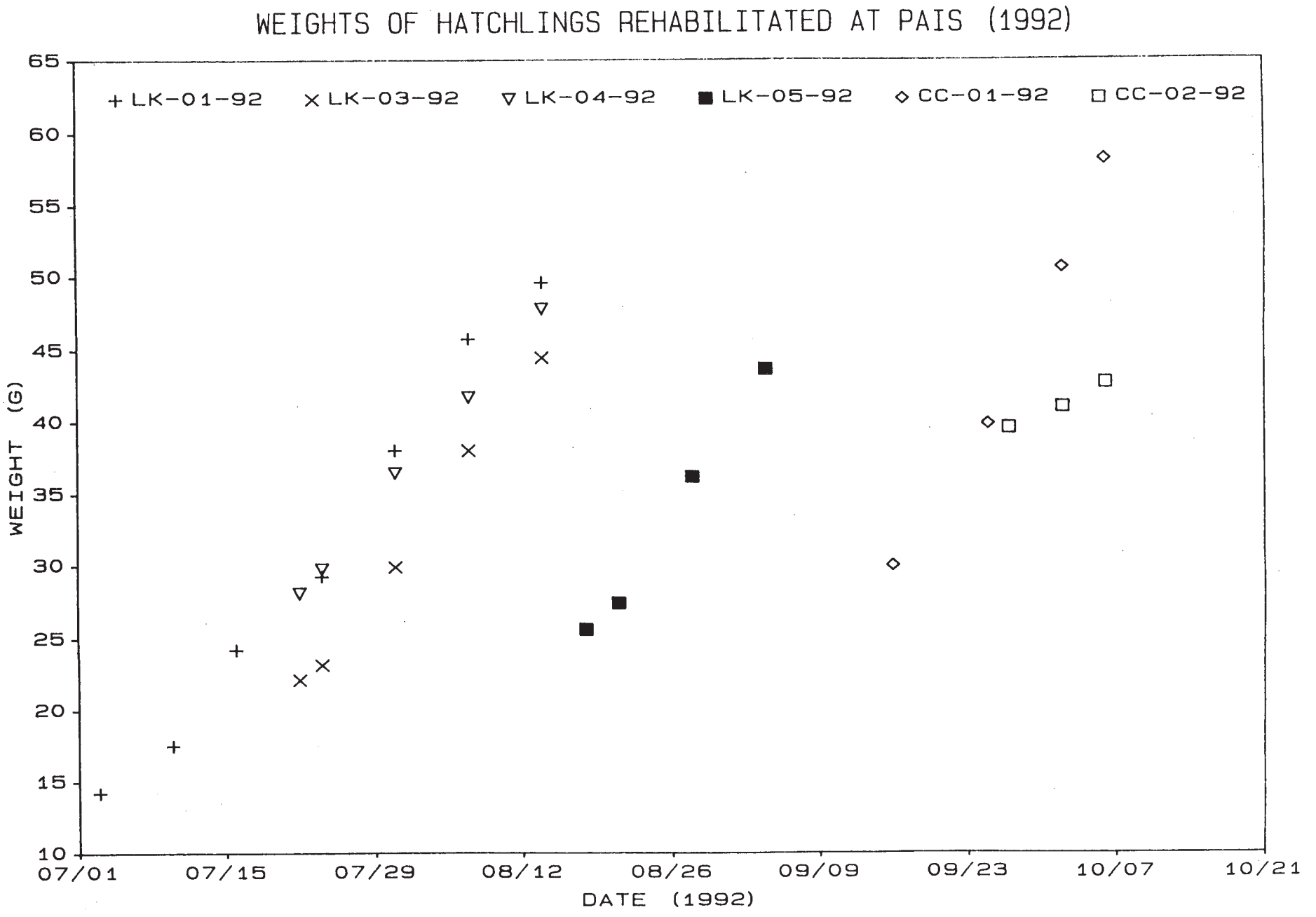

LENGTHS OF HATCHLINGS REHABILITATED AT PAIS (1992)
LK-01-92
LK-03-92
LK-04-92
LK-05-92
CC-01-92
CC-02-92
STRAIGHT LINE CARAPACE LENGTHS (MM)
75
70
65
60
55
50
45
40
35
07/01
07/15
07/29
08/12
08/26
09/09
09/23
10/07
10/21
DATE (1992)

Fig. 5. Weights of sea turtle hatchlings held at the Padre Island National Seashore rehabilitation facility during 1992.


WEIGHTS OF HATCHLINGS REHABILITATED AT PAIS (1992)
LK-01-92
LK-03-92
LK-04-92
LK-05-92
CC-01-92
CC-02-92
WEIGHT (G)
65
60
55
50
45
40
35
30
25
20
15
10
07/01
07/15
07/29
08/12
08/26
09/09
09/23
10/07
10/21
DATE (1992)