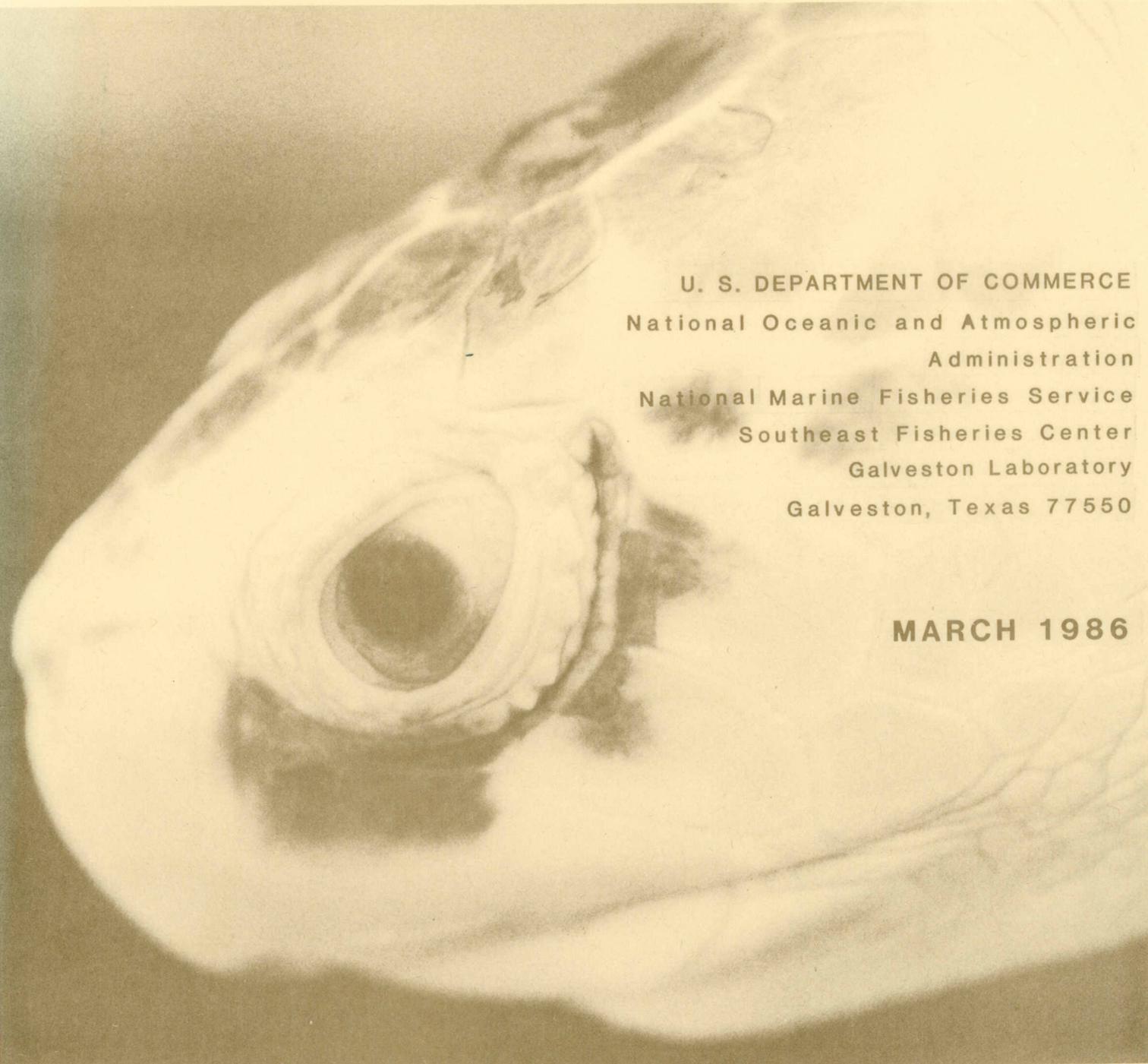




NOAA Technical Memorandum NMFS-SEFC-174

Caillouet et al. 1986

The Kemp's Ridley Sea Turtle Head Start Research Project: An Annual Report for Fiscal Year 1985



U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric
Administration
National Marine Fisheries Service
Southeast Fisheries Center
Galveston Laboratory
Galveston, Texas 77550

MARCH 1986



NOAA Technical Memorandum NMFS-SEFC-174

The Kemp's Ridley Sea Turtle Head Start Research Project: An Annual Report for Fiscal Year 1985

BY

Charles W. Caillouet, Jr., Clark T. Fontaine, Theodore D. Williams,
Sharon A. Manzella, Dickie B. Revera, Dennis B. Koi,
Kathy L. W. Indelicato, Marty G. Tyree, Jorge K. Leong,
Marcel J. Duronslet and Kenneth T. Marvin

U. S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary

National Oceanic and Atmospheric Administration
Anthony J. Calio, Administrator

National Marine Fisheries Service
William G. Gordon, Assistant Administrator for Fisheries

MARCH 1986

Technical Memoranda are used for documentation and timely communication of preliminary interim reports or special-purpose information, and have not received complete formal review, editorial control, or detailed editing.

COVER PHOTO CREDIT

Dave Schleser, Dallas Aquarium, Dallas, TX
(a Kemp's ridley of the 1984 year-class)

NOTICE

This technical memorandum should be cited as follows:

Caillouet, Charles W., Jr., Clark T. Fontaine, Theodore D.
Williams, Sharon A. Manzella, Dickie B. Revera, Dennis B.
Koi, Kathy L. W. Indelicato, Marty G. Tyree, Jorge K. Leong,
Marcel J. Duronslet and Kenneth T. Marvin. 1986. The Kemp's
ridley sea turtle head start research project: an annual
report for fiscal year 1985. NOAA Technical Memorandum
NMFS-SEFC-174 ii plus 37 pp, 29 Tables, 1 Figure and 5
Appendices.

Copies can be obtained by writing to the National Technical
Information Service, 5258 Port Royal Road, Springfield, VA 22161.

INTRODUCTION

The Kemp's ridley (Lepidochelys kemp) is the most endangered of the sea turtles and is facing possible extinction. Among the goals of the international program aimed at restoration of the Kemp's ridley sea turtle population is head starting, with a view toward establishing a new nesting colony at the Padre Island National Seashore near Corpus Christi, Texas. The ridley has only one known nesting beach, located near the village of Rancho Nuevo, Tamaulipas State, Mexico, in the western Gulf of Mexico (Chavez, Contreras and Hernandez 1968).

Head starting involves incubating, "imprinting" and hatching the eggs, "imprinting" the hatchlings, and rearing them in captivity to enhance their survival during the first year of life, then tagging and releasing them into the wild (Klima and McVey 1981; Mrosovsky 1983; Caillouet 1984; Fontaine et al. 1985). The head start project is a feasibility study based on the working hypothesis that eggs and hatchlings become "imprinted" to their surroundings, so that the turtles will return as adults to nest in the same surroundings. Biologists of the Instituto Nacional de la Pesca (INP) of Mexico, the U.S. Fish and Wildlife Service (FWS), and Gladys Porter Zoo collect the eggs in plastic bags at Rancho Nuevo and transfer them to polystyrene foam boxes containing sand from the Padre Island beach. The boxed eggs are transferred by aircraft to the National Park Service's (NPS) Padre Island National Seashore near Corpus Christi, Texas, where they are incubated in a hatchery under the surveillance of NPS personnel. Hatchlings are exposed to the same sand by being allowed to crawl down the Padre Island beach to the surf. They are scooped from the surf in nets, placed in boxes, and transferred to the National Marine Fisheries Service (NMFS), Southeast Fisheries Center (SEFC), Galveston Laboratory in Galveston, Texas. After 10-11 months of captive-rearing, survivors in good health and condition are tagged and released into the Gulf of Mexico.

So far, 9,258 head started Kemp's ridleys representing year-classes 1978-1984 have been tagged and released into the Gulf of Mexico (Table 1). Most of these were exposed ("imprinted") as eggs and hatchlings to conditions at Padre Island (Klima and McVey 1981; Owens et al. 1982; Caillouet 1984; Fontaine and Caillouet 1985; Fontaine et al. 1985). The growth, migration and survival of head started, tagged and released turtles are being determined from reports of their recapture or stranding^{1/}.

Head starting not only has provided tagged turtles for release, but also has led to expansion of the captive stock of Kemp's ridleys for experiments on captive breeding as a "safety net" for the species (Caillouet 1984). Since 1979, 245 captive-reared and tagged survivors have been relocated by distributing them among a turtle farm and 15 marine aquaria (Table 2). As of 18 September 1985, 106 of these, from 1 to 7 years old, remained alive in captivity. Another 15 yearlings of the 1984 year-class were being held at the Galveston Laboratory pending issuance of an international permit (CITES, Convention on International Trade in Endangered Species of Wild Fauna and Flora), to allow their transfer to Cayman Turtle Farm (1983) Ltd., Grand Cayman, B.W.I.

^{1/}Fontaine, C. T., R. M. Harris, W. J. Browning and T. D. Williams. Observations on distribution, growth and survival of captive-reared, tagged and released Kemp's ridley sea turtles (Lepidochelys kemp) from year-classes 1978-1983. In: Caillouet, C. W., Jr. and A. M. Landry, Jr. (editors), First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, National Marine Fisheries Service, Southeast Fisheries Center, Galveston Laboratory and Texas A&M University at Galveston, Department of Marine Biology, Galveston, TX, October 1985 (in preparation).

Two 5-year-old, Galveston-reared Kemp's ridleys nested at the Cayman Turtle Farm in May 1984 (Wood and Wood 1984). Only three eggs hatched, indicating that they had been fertilized, but the hatchlings did not survive. In spring-summer 1985, matings and crawls by the Kemp's ridleys at the farm (then 6-year-olds) occurred, but no nestings took place (James Wood, personal communication, August 1985). Some of the turtles lost weight, so diet was changed to a high-protein trout ration, and hopes are that nesting will occur in these turtles (now 7-year-olds) in the 1986 season (ibid.).

Plans are to maintain an inventory of the captive stock in the International Species Inventory System (ISIS), a computer-oriented, endangered animal inventory system (Caillouet and Revera 1985). Some wild-caught Kemp's ridleys also are being maintained in captivity and should be inventoried. We believe that a captive brood stock of at least 375 adult females and 175 adult males would be necessary to assure adequate genetic variability (see Soule and Wilcox 1980). For the time being, the international Kemp's ridley sea turtle working group has decided to limit the captive stock to no more than 150 animals.

A few head started turtles have been held longer than 1 year at the Galveston Laboratory before being released (Fontaine et al. 1985). Turtles that were stunted or exhibited other abnormalities, or were incurably sick or permanently injured, have been transferred to other investigators or disposed of humanely. A limited number of live-stranded sea turtles, including Kemp's ridleys and other species, have been rehabilitated then released, and a few have been held for extended periods at the head start facilities.

Gonads and kidneys have been excised from most Kemp's ridleys that died during head starting to provide a reservoir of specimens for sex determination. These specimens have been examined by Thane Wibbels, Dr. David Owens and others, Department of Biology, Texas A&M University, College Station, Texas, under contract with the NPS (Wibbels et al. 1985). About 170 tissue specimens have been trans-

ferred to Dr. Elliott Jacobson, University of Florida, Gainesville, FL, for collaborative research on Kemp's ridley pathology. Approximately 700 carcasses of Kemp's ridleys that died during head starting were sent to Dr. John Frazier, Smithsonian Institution, Washington, D.C. They have been archived by the Curator of Reptiles, FWS, National Museum of Natural History, Washington, D.C.

FACILITIES AND OPERATIONS

The head start research facilities described by Fontaine et al. (1985) include two metal-framed quonset huts (9.2 x 29.3 m; 30 x 96 ft), each covered by double layers of white, semi-opaque, polyethylene sheathing inflated by blowers. Together these quonset huts house 15 rectangular (1.8 x 6.1 m; 6 x 20 ft) fiberglass raceways, each filled with about 3,140 liter (830 gal) of seawater. The raceways are oriented approximately north and south on their long axes, and side by side in a linear array from east to west, each with a walk-space around them. The raceways are numbered 1-15 from east to west. Ten raceways (1-10) are housed in the east quonset hut and five (11-15) in the west quonset hut. Suspended within each raceway are 108 yellow plastic buckets (9.5 liter; 2.5 gal), in 6 columns numbered 1-6 from east to west and in 18 rows lettered A-R from south to north. The turtles are reared in isolation from each other in these buckets, one turtle per bucket, to prevent their biting and injuring one another (Klima and McVey 1981). Bucket codes (rows and columns) are used as identifiers for the turtles. Bottoms of the buckets are perforated with holes (diameter 2.5 cm; 1 in) to allow exchange of seawater and liberation of turtle excrement and uneaten food.

Seawater for the raceways is obtained from the surf zone of the Gulf of Mexico by suction-pumping through well-points buried in the sand below water (Fontaine et al. 1985). The seawater is pumped into a concrete sump (113,460 liter, 30,000 gal) to allow settling of particulates and then pumped into two redwood reservoirs (each

94,550 liter, 25,000 gal) that supply seawater for the entire laboratory. Both by gravity flow and by pumping, the seawater is transferred to two fiberglass reservoirs (each 37,850 liter, 10,000 gal) located near the quonset huts. These reservoirs, refilled as needed, provide the primary supply of seawater for head starting. Their contents can be pumped into four adjacent fiberglass reservoirs (each 28,390 liter, 7,500 gal) equipped with immersion heaters that heat the seawater during winter. As needed, seawater can be drained or pumped from the two larger reservoirs or from the four smaller reservoirs into the raceways. During winter, only heated water from the four smaller reservoirs is transferred to the raceways.

Raceways are drained, flushed by hosing with fresh (tap) water, and refilled with clean seawater thrice each week (Fontaine et al. 1985). Once each week, all raceways are scrubbed with brushes after draining to remove attached algae, uneaten food and excrement.

1984 YEAR-CLASS

Hatchlings Received

Between 24 and 27 July 1984, 921 untagged (60% of total) and 626 living-tagged^{2/} (40% of total) Kemp's ridley sea turtle hatchlings were transferred from the Padre Island National Seashore to the head start research facilities at the Galveston Laboratory (Tables 3-5). Dr. John and Mrs. Lupe Hendrickson, University of Arizona, Tucson, Arizona, living-tagged the 626 hatchlings at the National Seashore. The incubating, hatching, "imprinting," packing and transporting operations were carried out by Robert King (NPS) and his staff. Of the 1,547 hatchlings received by the Galveston Laboratory, 51 untagged

^{2/}Transplanting a piece of light-colored plastron tissue to the darker carapace in hopes of creating a permanent, contrasting mark.

(6% of the untagged subtotal) and 55 living-tagged (9% of the tagged subtotal) hatchlings were dead on arrival.

The clutches of eggs from which the hatchlings were obtained for head starting were collected from the Rancho Nuevo beach in the usual manner, from females identified by flipper tag numbers in Table 6. They were collected in plastic bags to prevent their contact with the Rancho Nuevo beach sand, and were packed in polystyrene foam boxes containing sand from the National Seashore. The boxes containing the eggs and Padre Island sand were flown by single-engine aircraft to the National Seashore where the eggs were incubated and hatched and the hatchlings were "imprinted". Hatchlings were taken to the Padre Island beach and allowed to crawl into the surf before being dip-netted, put in wax-coated cardboard boxes and transferred to the Galveston Laboratory. The boxes used to transport hatchlings contained a 2.5 cm (1 in) layer of seawater-moistened polyurethane foam to cushion the hatchlings and to prevent their desiccation.

Hatchlings from clutches 1-6, 15 and 16 received on 24 July 1984 were transported in eight boxes by NPS station wagon from the National Seashore to the U.S. Navy Base at Corpus Christi, Texas, and thence to Galveston's Scholes Field aboard a U.S. Navy aircraft. The boxes were transferred to a pickup truck and taken to the head start facilities, arriving about 1130 hr CDT (Central Daylight Time). Each box contained only one clutch (Table 3). Of the 506 hatchlings received, all except 10 in clutch 15 had been living-tagged, and 19 of the tagged hatchlings were dead on arrival. Clutch origin, identification numbers and history are shown in Tables 6 and 7.

The hatchlings received on 25 July 1984 were transported in 12 boxes by NPS station wagon from the National Seashore to the head start facilities, arriving about 1130 hr CDT (Table 4). Hatchlings from clutches 7-14 (all untagged) and clutch 18 (60 tagged and 10 untagged) were in nine separate boxes, one clutch per box. Another box was partitioned into five compartments and contained untagged representatives of clutches 1-4 and 16, one clutch per compartment.

Two other boxes contained representatives of clutch 17, one box with living-tagged individuals and the other with untagged individuals. Of the 941 hatchlings received on 25 July, all except 70 in clutch 17 and 60 in clutch 18 were untagged. On arrival, 36 living-tagged and 51 untagged hatchlings were dead. Clutch origin, identification numbers and history are given in Tables 6 and 8.

On 27 July 1984, 100 untagged hatchlings were received. Clutch 19 contained 99 hatchlings and clutch 10 contained one hatchling (Table 5). The clutches were separated in one partitioned box transported by NPS station wagon from the National Seashore to the U.S. Navy Base at Corpus Christi, and thence to Scholes Field by U.S. Navy aircraft. The box was transported by NMFS pickup truck to the head start facilities, arriving about 1600 hr CDT. None of the hatchlings were dead on arrival. Clutch origin, identification numbers and history are given in Tables 6 and 9.

Table 10 summarizes the data from Tables 3-5.

Distribution of Hatchlings Among the Raceways

As the clutches of previous year-classes (1978-1983) were received, they were assigned more or less sequentially to raceways 1-15^{3/}. Such assignment confounded the effects of clutches and their location (raceways in the quonset huts) on growth and survival of the turtles. For experiments on the effects of rearing conditions on growth and survival, the raceways are considered experimental units.

Prior to receipt of hatchlings of the 1984 year-class, an allocation procedure was developed to guide the distribution of clutches among the raceways. Initial allocation of clutches of hatchlings of

^{3/}Caillouet, C. W., Jr., D. B. Koi, C. T. Fontaine, T. D. Williams, W. J. Browning and R. M. Harris. (1986). Growth and survival of Kemp's ridley sea turtle, *Lepidochelys kempi*, in captivity. Manuscript submitted to the Editor, Chelonian Documentation Center Bulletin.

the 1984 year-class was controlled by an experimental design developed for a feeding experiment. Such allocation was necessary to reduce confounding among treatments, experimental units and clutches. It was anticipated that all 15 raceways would be used in the experiment, based on verbal information concerning good hatching success (Robert King, NPS, Padre Island National Seashore, personal communication, July 1984). Groups of 5 raceways were assigned to one of three blocks (raceways 1-5, 6-10, and 11-15, respectively).

For practical purposes, all turtles in a given raceway are treated similarly with regard to feeding, cleaning of the raceways, and seawater management. For that reason, it seemed appropriate to place clutches of similar age in a given raceway. In previous year-classes, there had been considerable variation in age among the clutches received^{3/}. Therefore, the randomization scheme used in 1984 anticipated that clutches of the year-class also would vary widely in age. In retrospect, this was not the case because all the clutches hatched between 15 and 23 July (Tables 7-9).

Appendix Table 1 shows the initial allocation of clutches of hatchlings among and within the raceways.

Short-Term Mortality in Hatchlings

Before the feeding experiment was initiated, we had to deal with an unprecedented, short-term mortality in Kemp's ridley hatchlings of the 1984 year-class. As consequences of verbal reports received from Robert King (NPS, Padre Island National Seashore, personal communication, July 1984), our own observations of hatchlings discovered dead on arrival, and subsequent mortality in hatchlings received on 24 July 1984, we decided to test the injection of antibiotics in curbing mortality. Four raceways (3, 5, 6 and 14) that were relatively full of sea turtles on the morning of 25 July were chosen to test the effects of injecting two antibiotics (dissolved in sterile saline), ampicillin and chloramphenicol (Appendix Table 2). Use of ampicillin was recommended by David Bowman (FWS, Albuquerque, NM, personal com-

munication, July 1984). The sterile saline solution used as a carrier for the antibiotics and in sham injection (saline only) was 0.9% sodium chloride injectable (bacteriostatic) containing 0.9% benzyl alcohol as a preservative. The antibiotic solutions were prepared at a concentration of 20 mg of antibiotic per ml of saline solution. Each turtle was injected subcutaneously in the neck with 0.05 ml of solution during each injection event.

Each of four treatments, three injection treatments and a control (no injection), were randomly assigned to one of the four raceways to avoid bias in the assignment (Appendix Table 2), and so that all hatchlings within a given raceway could be treated alike: saline only (raceway 3), ampicillin in saline (raceway 5), chloramphenicol in saline (raceway 6), and control (raceway 14).

On 25 July, all animals in raceways 3, 5 and 6 were injected once in the morning and again in the afternoon. Thereafter, they were injected once each day through 29 July. Observations were made from 25 July (after the first injections were made) through 1 August to record mortality by treatment and control. Though final injections were given on 29 July, counts of deaths continued until 1 August to allow additional time for treatment effects to take place.

Table 11 summarizes survival by treatment. Highest survival (99%) was observed in the control. Hatchlings injected only with saline exhibited the next to highest survival (97%). Hatchlings injected with ampicillin in saline had the next to lowest survival (93%). Hatchlings injected with chloramphenicol in saline had the lowest survival (87%). Many possible interpretations might be given to such results, but the important conclusion is that doing nothing probably would have been better than injecting the hatchlings as a means of curbing further mortality. The antibiotics either were ineffective or mildly toxic, and the injection itself may have caused mechanical injury.

By 7 August, the short-term mortality had subsided, but we continued to tabulate mortality data through 21 August (Table 12). Table

13 summarizes the overall mortality in hatchlings in 17 out of the 19 clutches, including those that were dead on arrival and those that died after arrival between 24 July and 21 August. Clutches 10 and 13 showed no mortalities on or after arrival.

The number of untagged animals dead on arrival (Table 13) was especially high in clutch 12 (37 deaths). This clutch as well as clutches 7, 9 and 11 had the largest numbers of deaths in untagged hatchlings from 24 July through 21 August (Table 13), among the hatchlings received alive (Table 10). Based upon the numbers of untagged hatchlings received by clutch (Table 10), clutches 1, 7, 8, 9, 11, 12 and 18 had total mortality rates (for deaths on arrival and deaths after arrival combined) among untagged individuals of 10% or higher (Table 13). Based upon the numbers of living-tagged hatchlings received by clutch (Table 10), all but clutch 5 of the 10 clutches containing tagged hatchlings exhibited total mortalities of 20% or higher in the tagged animals (Table 13).

Especially useful in the evaluation of the cause or causes of the hatchling mortality were the eight clutches (1-4 and 15-18), which contained both untagged and living-tagged hatchlings (Table 10). Of these, the untagged hatchlings in clutches 2-4 and 15-17 showed no mortality, and those in clutches 1 and 18 had mortalities of 56% and 10%, respectively, while the mortality in the living-tagged hatchlings from these clutches ranged from 20% to 88% (Table 13). Clutch 1 may not be representative because it was the smallest (only 29 hatchlings) of all the clutches received.

For all clutches combined, untagged hatchlings had about half the rate of total mortality (16%) as that (32%) exhibited by living-tagged hatchlings (Table 13). There also was a difference in ranges of total mortality among untagged clutches (0-70%) and tagged clutches (5-88%). Clearly, the overall mortality was higher in living-tagged than in untagged hatchlings. Nevertheless, untagged clutch 12 stood out as having the highest numerical (71 deaths) and second highest percentage (70%) total mortalities of all the clutches.

Were it not for additional information, one might be misled to suspect that tagging was the sole cause of short-term mortality in the Kemp's ridley hatchlings. However, consideration must be given to the possible effects of the handling operations at the National Seashore and subsequent transportation to the Galveston Laboratory. Robert King was able to isolate, to some extent, the effects of tagging from other possible causes of mortality, by comparing the handling, tagging and transportation histories of each clutch with their initial mortalities at the National Seashore and in transport and with their subsequent mortalities at the Galveston Laboratory. This was accomplished with graphs presented by King at the international Kemp's ridley sea turtle working group meeting held at Gladys Porter Zoo, Brownsville, Texas, in October 1984. King used the day on which hatchlings were transferred to the Galveston Laboratory as a standard reference point, defining it as day zero on the abscissa of each graph. Days prior to the transfer were labeled on the abscissa as negative days and those following the transfer as positive days. The range was around -6 to +5 days for the data presented. For example, -6 represented 6 days before transfer and +5 represented 5 days after transfer. The percentage survival for each clutch was plotted on the ordinate of each graph. Separate graphs of data were presented for living-tagged hatchlings and for untagged hatchlings. Clutches held at the National Seashore for longer periods before transfer to the Galveston Laboratory had higher mortality rates than those held for shorter periods. Differences in mortality among the groups of hatchlings also may have been linked, in part, to the size of hatchlings. King observed that higher mortality rates were associated with clutches containing smaller hatchlings. This suggested that susceptibility of the hatchlings to the conditions to which they were exposed may have been influenced by their size.

For comparison, the mortality rates during transportation of hatchlings from seven other year-classes of Kemp's ridleys are tabulated in Table 14 along with that for year-class 1984. The reader is

cautioned that the counts of hatchlings dead on arrival for year-classes 1978-1980 may not be accurate, as records for those year-classes are incomplete.

Application of living-tags to Kemp's ridley sea turtle hatchlings is experimental. If living-tags are applied to Kemp's ridley hatchlings that are to be head started, the tagging must be done after the hatchlings are transferred to the head start facilities. This allows the hatchlings to recover from the stresses of hatching, "imprinting," handling and transportation and to grow to larger sizes before they are tagged. Also, in this way, any effects of handling, "imprinting" and transportation of the hatchlings are isolated and clearly distinguished from the effects of tagging alone. Finally, application of living-tags should be limited to fewer Kemp's ridley hatchlings until it can be proven beyond reasonable doubt that it is safe and reliable for that life stage of Kemp's ridleys.

Foods and Feeding

The foods and feeding methods used in head starting Kemp's ridleys^{3/} have been elaborated by Fontaine et al. (1985). The two foods used in head starting the 1984 year-classes were dry, floating, pelleted diets. Between 1 August and 10 November, a diet manufactured by Central Soya and Subsidiaries^{4/}, Decatur, Indiana, was used. After 10 November, a modified trout chow manufactured by Purina, Richland, Indiana, was used. The latter is the same diet used for rearing green sea turtles (Chelonia mydas) at the Cayman Turtle Farm (1983), Ltd. (James Wood, personal communication, August 1984).

The total quantity of pelleted food required for a given raceway each day was based on the monthly geometric mean weight per turtle in the raceway. Under this method of feeding, once the weight of food per turtle is calculated for a raceway, the food is distributed to

^{4/}Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

each turtle by volumetric measure based on the weight:volume ratio for the food.

Feeding Experiment

Some of the surviving hatchlings were redistributed (Appendix Table 3) in preparation for the feeding experiment, to make more efficient use of the available raceways following the short-term mortality in hatchlings of the 1984 year-class. In retrospect, it would have been better to have distributed the clutches sequentially among the raceways as they were received, waiting until the hatchlings adjusted to their new surroundings and until the short-term mortality subsided before redistributing them according to the experimental design for the feeding experiment. After redistribution of the survivors, fewer than 15 raceways were filled with hatchlings (Appendix Table 3).

Between 1 August and 5 September, each hatchling was fed the same daily amount of food equal to 10% of the initial arithmetic average weight of all of the hatchlings (Table 15). Beginning on 6 September, two feeding levels based on percentages of geometric mean body weight of the turtles were tested. The higher feeding level was 1.7 times the lower level; i.e., the ratio between the two percentages was held constant at 1.7:1. It had been planned that the initial daily rations of food would be 5% (higher level) and 3% (lower level) of their average body weight, and that the rations would be changed gradually to 1.5% and 0.9%, respectively, by June 1985, the projected end of the head starting period. The planned experimental feeding levels had to be altered from time to time because day to day conditions in the raceways were affected by temperature, the amount of uneaten food, the amount of turtle excrement, and seawater quality. In some cases, feeding had to be stopped for a day or two to allow the turtles to recover from bloating caused by overfeeding. The ratio between the two feeding levels was maintained near 1.7:1 until 28 February 1985, and the actual quantities of food were recorded at each feeding.

Two feeding frequencies were tested at the higher feeding level:

(1) once per day in the morning (raceways 3, 6 and 14), and (2) twice per day; once in the morning and once in the afternoon (raceways 4-8 and 12). The daily ration was divided into two equal portions for twice daily feeding. For example, when the daily feeding level was 5% of average body weight, then the daily ration of food was divided into two equal portions, each representing 2.5% of average body weight. At the lower feeding level, only once-daily feeding was done in the morning (raceways 2, 9 and 13). Occasionally, turtles in the twice-daily feeding treatment were not fed twice-daily, in which case only half the daily ration was fed once daily.

For the first time since head starting began in 1978, the assignment of turtles to buckets and raceways, the feeding levels, and the feeding frequencies were controlled by an experimental design. The major finding was that twice-daily feeding at the higher level produced the highest weight gain, biomass increase, and survival, as well as the best food conversion of all the treatments (Table 16)^{5/}. Faster-growing (larger) turtles received more food than the slower-growing turtles, and the additional food enhanced the growth of the former. However, smaller turtles require a higher rate of feeding in

^{5/}Caillouet, C. W., Jr., D. B. Koi, C. T. Fontaine, T. D. Williams, S. A. Manzella and M. G. Tyree. Effects of experimental feeding on growth and survival of the 1984 year-class of Kemp's ridley sea turtle, Lepidochelys kemp, in captivity. In: Caillouet, C. W., Jr. and A. M. Landry, Jr. (editors), First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, National Marine Fisheries Service, Southeast Fisheries Center, Galveston Laboratory and Texas A&M University at Galveston, Department of Marine Biology, Galveston, TX, October 1985 (in preparation).

terms of percent of body weight, so they may well have been underfed as compared to the larger turtles in the experiment. The experiment was terminated after weighing the turtles on 28 February 1985, because the smallest turtles appeared to be underfed at the lower feeding rate.

Continued Feeding After the Experiment

After the feeding experiment ended, all the turtles were fed twice-daily at the higher feeding rate. This was a "uniformity trial" in which all the turtles were treated alike. By 12 April 1985, some turtles outgrew their buckets and had to be transferred to larger containers (plastic laundry baskets) in raceways 2 and 4.

Schedule for Weighing and Measuring Turtles

All hatchlings were weighed (Table 15) and measured (carapace length and width) at the National Seashore by NPS personnel between 18 and 26 July 1984. Thereafter, at the Galveston Laboratory, random samples of turtles (30 per raceway) were taken for weighings at approximately 28-day intervals as follows:

22 August 1984	2 January 1985
13 September	31 January
11 October	28 February
8 November	28 March
6 December	25 April

All surviving turtles were weighed and measured (straight-line measure of carapace length and width) between 13 and 14 May 1985.

Health Care

Health care for the turtles consisted of prophylactic and therapeutic measures developed from previous research and experience (Clary and Leong 1984; Fontaine et al. 1985)^{6/}.

Environmental Variables

Seawater temperature and salinity were monitored daily, with few exceptions, in all raceways containing sea turtles during the rearing of the 1984 year-class of Kemp's ridley. Monitoring of pH in raceways was sporadic. These observations served as general guides to environmental conditions. Between 22 August 1984 and 20 May 1985, daily seawater temperature (averaged over raceways) varied between 16°C and 28°C (for 259 days of measurements). The pooled (over raceways) variance for daily seawater temperature was 0.2°C. Despite the heating of the air in the quonset huts with forced-air heaters and the incoming seawater with immersion heaters during winter, the temperature in the raceways dropped. However, maintenance of adequately high (>20°C) seawater temperatures during winter for the head starting of year-class 1984 was better than for previous year-classes. During the same period, daily levels of seawater pH (averaged over raceways)

^{6/}Leong, J. K., D. L. Smith, D. B. Revera, J. C. Clary III, D. H. Lewis, J. L. Scott and A. R. DiNuzzo. Health care and diseases of captive-reared loggerhead and Kemp's ridley sea turtles. In: Caillouet, C. W., Jr. and A. M. Landry, Jr. (editors), First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, National Marine Fisheries Service, Southeast Fisheries Center, Galveston Laboratory and Texas A&M University at Galveston, Department of Marine Biology, Galveston, TX, October 1985 (in preparation).

varied between 7.1 and 8.2, and the pooled variance was <0.1 pH units, for 101 days of measurements. Daily seawater salinity (averaged over raceways) varied between 20 and 35 ppt, with a pooled variance of 0.4 ppt, for 256 days of observations.

Morphometric Studies

Every two weeks during head starting, Dr. Andre Landry, Jr., Associate Professor, and his student assistants, Department of Marine Biology, Texas A&M University at Galveston, Galveston, Texas, took an array of morphometric measurements on a group of 100 Kemp's ridleys selected from the 1984 year-class (Table 17). One purpose was to determine whether or not the two sexes could be distinguished by morphometric analysis. Sex is to be determined by histological techniques in any animals that died during head starting or by future examination of typical secondary sexual characteristics and sex hormone titers in living animals transferred to other facilities and held in captivity beyond one year of age. Another purpose was to evaluate clutch effects and feeding experiment (treatment) effects on morphometry. Of the 100 turtles, 50 were selected for transfer to the captive stock, including 15 for the Cayman Turtle Farm (1983), Ltd. and 35 distributed among various marine aquaria (Table 2). The details and initial results of the morphometric study are reported elsewhere^{7/}).

^{7/}Landry, A. M., Jr. Morphometry of captive-reared Kemp's ridley sea turtles. In: Caillouet, C. W., Jr. and A. M. Landry, Jr. (editors), First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, National Marine Fisheries Service, Southeast Fisheries Center, Galveston Laboratory, and Texas A&M University at Galveston, Department of Marine Biology, Galveston, TX, October 1985 (in preparation).

Tags and Tagging

Types of tags that were applied to Kemp's ridleys of 1984 year-class included: monel flipper tags (see Fontaine et al. 1985), living-tags, internal, binary-coded, magnetic metal tags, and living-tags combined with internal disk tags. Living tags were applied to right costal scute 5 (LC5) and binary-coded, magnetic tags were inserted into the left front flipper, of all survivors according to schedules in Table 18. Monel flipper tags were applied to the trailing edge of the right front flipper of all survivors on 30 April 1985 (Table 18). An experimental implantation of small, perforated, stainless steel disks (surgical grade) was conducted on 22 survivors. The disks were placed beneath the living-tags in turtles tagged on 15 February and 17-19 April 1985 (Table 18).

Living-tags on carapace scutes are being used to distinguish year-classes of head started Kemp's ridleys from one another^{8/}. Table 19 summarizes the scutes used for living-tags on past year-classes and scutes reserved for future year-classes. Available records indicated that turtles released from year-classes 1978 and 1979 were not living-tagged. Part of year-class 1980 was living-tagged. No living-tags were placed on the 1981 year-class. Not all of the living-tagged Kemp's ridleys were released. For example, for year-classes 1982-1984, 77 living-tagged individuals were retained in captivity for extended head starting and captive breeding (Table 20). These will be examined from time to time to determine retention, quality and recognition of living-tags.

The scutes proposed for year-classes 1985-1995 were selected to minimize the probability of overlap between year-classes in use of the

^{8/}Caillouet, C. W., Jr., C. T. Fontaine, S. A. Manzella, T. D. Williams and D. B. Revera. Scutes reserved for living-tags. Manuscript submitted to Marine Turtle Newsletter.

same scute^{8/}. Reuse of a given scute would not occur until 1990 when right costal scute 4 would be used on the 1990 year-class (Table 19). Only one turtle of the 1980 year-class was living-tagged on right costal scute 4. Neural scute 2 is proposed for the 1991 year-class, as only 4 turtles of the 1980 year-class were tagged on that scute, and so forth. Neural scute 5 will be avoided because it occasionally is split into a sixth neural. Reuse of humeral, pectoral and abdominal scutes also is not proposed. Coordination among sea turtle investigators proposing use of living-tags will remain with the U.S. Fish and Wildlife Service, P. O. Box 1306, Albuquerque, NM 87103 (Bowman 1983).

Anyone encountering a living-tagged Kemp's ridley should contact the NMFS, Southeast Fisheries Center, Galveston Laboratory, 4700 Avenue U, Galveston, TX 77550 (commercial telephone no. 409-766-3500, -3517, -3523, -3507, -3525). The scute on which the living-tag is located, and details concerning the size of the turtle, location, date and method of recapture, sighting or stranding should be reported.

Relocation for Extended Head Starting and Captive Breeding

At the meeting of the international Kemp's ridley sea turtle working group in Brownsville, Texas, in October 1984, it was agreed that not more than 50 yearlings of the 1984 year-class would be held back for relocation to cooperating organizations for extended head starting and captive breeding experiments (Tables 2 and 20). These animals were selected from the survivors of the 100 turtles (Table 17) upon which morphometric measurements had been taken by Dr. Andre Landry and his assistants, to allow opportunities for further morphometric and tag retention studies on these animals in the future. Table 2 gives the tag identification codes for the 50 yearlings, the names of the recipient organizations and other pertinent information. During July to September 1985, 35 of these turtles were distributed among nine marine aquaria. The remaining 15 turtles were held back

until 16 January 1986 at which time they were transferred to the Cayman Turtle Farm (1983), Ltd. The delay was required pending issuance of a CITES permit through the FWS, to allow such international transfers for the purpose of research.

In addition to the flipper tags, living tags and internal tags placed on the 50 individuals distributed to marine aquaria and the turtle farm, each turtle was flipper printed for future identification. Impressions of front (and in a few cases, rear) flippers of each turtle were made by pressing a flipper onto soft potter's clay. Plastic castings of the clay impressions provided permanent prints for future examination. We intend to test computer imagery techniques for comparing prints as permanent, natural "tags" characterizing each turtle. Dr. Milford Fletcher, NPS, Santa Fe, NM is cooperating with us in this study.

Release

On 21 May 1985, 1,017 tagged Kemp's ridleys of the 1984 year-class were packed into wax-coated boxes and taken by truck to the U.S. Coast Guard station at Port Aransas, TX. The U.S. Coast Guard cutter POINT BAKER was not available, having been called away on an emergency rescue mission, but the Coast Guard contacted The University of Texas at Austin, Marine Science Institute, at Port Aransas, and the R/V LONGHORN was provided free of charge for the release. The turtles were loaded onto the LONGHORN and taken to the starting position of the release transect at latitude 27°37.5'N and longitude 96°55.5'W, or approximately 12-15 nautical miles offshore of Padre and Mustang Islands. The turtles were released on a course generally parallel to the coast. The area of the release was closed to commercial shrimping (i.e., the Texas Closure began on 20 May). In addition, 63 loggerhead juvenile (Caretta caretta), reared and tagged by Dr. Dave Owens and his students, Texas A&M University, College Station, TX, in cooperation with the Florida Department of Natural Resources, were released along with the ridleys. Attempts were made to release the turtles in

areas free of sargassum weed patches and flotsam to avoid their coming in contact with tar balls.

No turtles were dead at the time of the release. All of the Kemp's ridleys appeared to be in excellent condition. In most cases, the Kemp's ridleys dived immediately upon contacting the surface of the water and few were seen on the surface again. The LONGHORN proved to be an excellent vessel from which to release sea turtles. The starboard propeller was disengaged during the release, and all turtles were released off the starboard side. The LONGHORN's Captain, Mr. Don Gibson, turned the vessel down sea and adjusted the ship's speed to provide a very stable platform during the release. Further, the stern deck of the LONGHORN is near the surface of the water, consequently the turtles dropped only 1 or 2 ft to the water when released.

News media interest in and coverage of the release were more extensive than in previous years. ABC and NBC national network television news teams covered the preliminary preparations and the release itself. ABC aired its coverage of the release at 5:30 p.m. on 21 May, and again the next morning on "Good Morning America."

Max Rizley and photographer John Mihovil of the Galveston Daily News reported on plans for the release. Kevin Moran and photographer Joe Deering representing the Houston Chronicle released a news report before the release, then covered the entire event from beginning of packing during the night until completion of the release. Moran's first article was picked up by the Associated Press (AP) wire service and distributed widely. The Houston Post and Tom Curtis of the Dallas Times-Herald reported on preparations for the release, then carried AP coverage of the release. On board the LONGHORN, the Corpus Christi Caller had a reporter and photographer whose report appeared in the newspaper the following day. Other newspapers that covered the release were: The Morning Advocate (Baton Rouge, LA), The Advocate (Victoria, TX), The Dallas Morning News (Dallas, TX), The San Antonio Light (San Antonio, TX), and The Shreveport Times (Shreveport, LA).

Richard Spires of KILE radio in Galveston interviewed the head

start staff and Carole Allen of HEART on radio before the release. Television coverage before the release included KHTV-TV Channel 39, KHOU-TV Channel 11 (Doug Bunzie), and KTRK-TV Channel 13 (Debra Rigley) of Houston. Doug Bunzie's (Channel 11) coverage of the event from packing to release was distributed nationwide to CBS affiliate stations.

We were especially pleased that the ridley release was covered by media representatives surnamed Rizley (Galveston Daily News) and Rigley (KTRK-TV, Channel 13).

Release Participants

NMFS SEFC Galveston Laboratory

Clark T. Fontaine

Ted Williams

Sharon Manzella

Marty Tyree

Christine Olguin

Daniel Patlan

Medardo Olivarez

University of Texas at Austin, Marine Science Institute

Captain Don Gibson

Dr. Anthony Amos

Noe Cantu and other crew members of the R/V LONGHORN

National Park Service, Padre Island National Seashore

Yvette Weickum

Richard Snyder

HEART

Al Barr

1985 YEAR-CLASS

Between 9 July and 7 August 1985, 1,692 "imprinted" Kemp's ridley hatchlings of the 1985 year-class were received, 1,684 of them alive and only 8 dead on arrival (Table 21). These hatchlings were from 21 clutches, 20 of which came from eggs collected in the usual manner at the Rancho Nuevo beach, and one from a clutch of 97 eggs (clutch 21) collected from a nest on North Padre Island on 14 June 1985 by NPS personnel (Robert King, NPS, personal communication, October 1985). The turtle that laid Clutch 21 on 13 June was observed by a beachgoer who reported the nesting to NPS personnel, so it was not determined whether or not this turtle was a head started individual. Nevertheless, such a nesting is an encouraging sign for the Kemp's ridley recovery program.

The eggs of the 1985 year-class were incubated at the National Seashore at warmer temperatures than in previous years (King et al. 1985). They also were held for a longer period at Rancho Nuevo before shipment to the National Seashore (Pat Burchfield, Gladys Porter Zoo, personal communication). If sex in Kemp's ridley is influenced by incubation temperature in a fashion similar to that of other sea turtles, the proportion of females would be expected to be higher in the 1985 year-class than in previous years.

Tables 22 and 23 give the origin, identification number and history of each clutch. The hatchlings were "imprinted," weighed (Table 24) and measured (carapace length and width) at the National Seashore by NPS personnel. Table 25 gives the actual and proposed dates and sample sizes for weighings of Kemp's ridleys of the 1985 year-class. Appendix Table 4 shows the allocation of clutches 1-20 among the raceways as of 27 August 1985. Clutch 21 was placed in the standing basins described by Fontaine et al. (1985).

The turtles are being fed Purina pellets twice daily. Initially, the hatchlings received a daily ration equal to 5% of their arithmetic average weight. Feeding rates gradually are adjusted downward

as the turtles increase in size, based on percentage of geometric mean weight of samples of turtles weighed at 28-day intervals. No feeding experiment was planned for the 1985 year-class, and all turtles received the same amount of food daily. This constitutes a "uniformity trial" in which all experimental units and subjects are treated alike.

SEA TURTLE REHABILITATION

One of the head started Kemp's ridleys of the 1984 year-class released offshore of Padre Island in May 1985 was recovered stranded on the Bolivar Peninsula beach 15 days later. The turtle (monel flipper tag No. NNT529) was severely wounded and comatose. Dr. Joseph Flannigan, veterinarian with the Houston Zoo, Houston, TX, sutured its wounds and recommended treatment for the turtle. The turtle recovered and is presently being maintained at the head start facilities. It will be released with the 1985 year-class.

On 5 August 1984, a Kemp's ridley was found stranded on West Beach of Galveston Island. Its body was heavily coated with oil. The turtle was taken to Sea-Arama Marineworld where it was cleaned with mineral oil. The turtle was fed in the afternoon of 5 August, but would not eat the next day. On 6 August, the turtle regurgitated oil. The oil was cleaned from its mouth by Sea-Arama personnel, and the turtle was transferred to the head start facilities at the Galveston Laboratory on the same day. The NMFS head start staff nicknamed the turtle "Oiliver." The turtle appeared alert and swam actively. It was estimated to be 2-3 years old, considering its size in relation to head started yearlings. For about 2 weeks, Oiliver defecated oil but remained active and alert. Since then, Oiliver has been fed varying amounts of penaeid shrimp daily, and blue crab (Callinectes sapidus), squid and fish several times weekly. Table 26 gives the weights, measurements and other information concerning Oiliver by date.

On 26 September 1984, Reed Burgess of Hamshire, TX, found a hawks-

bill sea turtle (Eretmochelys imbricata) stranded and tangled in sargassum weed high on the beach at the Bolivar Peninsula, TX, 5 mi east of the Bolivar, ferry landing. On the same day, Clifford Taylor of Beaumont, TX, transferred the turtle to the Texas Parks and Wildlife Department office in Galveston, from which it was transferred to the head start facilities. The hawksbill appeared lethargic and desiccated upon receipt. The turtle was nicknamed "Bolivar." Bolivar recovered rapidly in seawater with no special treatment, showing no signs of disease or injury. The hawksbill has been fed varying amounts of penaeid shrimp daily, and blue crab, fish and squid several times weekly since then. Table 27 gives weights, measurements and other information concerning Bolivar by date. Bolivar has grown more slowly than Oiliver under similar conditions (Tables 26 and 27).

We continue to cooperate in the Marine Mammal and Sea Turtle Stranding and Salvage Network.

OLIVE RIDLEYS

On 21 September 1984, 12 olive ridley (Lepidochelys olivacea) hatchlings of the 1984 year-class were received from Ross Witham, Florida Department of Natural Resources, Jensen Beach, FL. They were head started by the same methods used for Kemp's ridleys of the 1984 year-class, but showed very limited growth (Table 28). During the year, 6 of them were used in tests to determine methods for attachment of small radio-transmitters to hatchlings. On 29 May 1985, the 6 survivors were transferred to Miami Seaquarium.

WILD-CAUGHT HATCHLINGS

On 24 August 1985 an injured hatchling was brought to Sea-Arama Marineworld by an undisclosed collector. Right front and rear flippers were bitten or cut off, and a portion of the left rear flipper was bitten or cut off. Presumably it was found stranded on the

Galveston beach. It was transferred to the Galveston Laboratory where it weighed 27.6 g on 26 August. The hatchling is being cared for at the Galveston Laboratory.

Evette Weickum, NPS, reported a Kemp's ridley hatchling found on 19 September 1985 in the surf about 2 mi south of the 10 mi marker at the Padre Island National Seashore. It weighed 59.5 g, and its carapace length and width were each 8 cm. A portion of one front (right or left) flipper was bitten or cut off. The turtle is being cared for by Dr. Anthony Amos, University of Texas at Austin, Marine Science Institute, Port Aransas, TX.

CHEMICAL ANALYSES OF SEA TURTLE FEEDS

During Fiscal Year 1985, samples of sea turtle feeds manufactured by Central Soya and Subsidiaries, Inc. and Purina were sent to Dr. Milford Fletcher, NPS, Santa Fe, NM, for chemical analyses for toxic materials. Dr. Fletcher (personal communication, October 1985) reported that neither food contained detectable levels of toxic materials (including anthropogenic hydrocarbons or heavy metals).

DISPOSAL OF SEA TURTLE TISSUES AND CARCASSES

Before Dr. Jorge Leong transferred to the U.S. Army's Dugway Proving Ground, Dugway, UT, he and his staff inventoried his collection of sea turtle tissue specimens and carcasses. Useful tissue specimens were sent to Dr. Elliott Jacobson, University of Florida, and useful carcasses were sent to Dr. John Frazier, Smithsonian Institution. Dr. Leong disposed of materials that were of no further use (Appendix Table 5).

SUMMARY OF KEMP'S RIDLEY SEA TURTLE RELEASES

Table 29 summarizes the release sites, dates of releases, numbers released and flipper tag series used for releases of head started Kemp's ridleys of the 1978-1984 year-classes. This is an update of Fontaine et al. (1985; Table 6).

TEST OF A RECIRCULATED SEAWATER SYSTEM

For some time, we have been interested in the possible use of closed, recirculating (reuse) seawater systems for head starting Kemp's ridley. Such systems might (1) reduce operating costs, (2) conserve seawater, (3) reduce the labor-intensive changing of seawater three times each week, (4) save energy associated with heating seawater in winter, and (5) enable us to continue operations in cases of oil spills or pump failure. In 1983, we tested a seawater reuse system similar to that described by Kennedy (1980), and the results are reported herein. Our purpose was to determine whether ammonia levels could be suppressed with this system. Although no ammonia-toxicity studies have been published for sea turtles to our knowledge, excessive levels of ammonia are known to have detrimental effects on captive-reared fish, including reduction in growth rate, damage to gill tissue, and occasional pathology in kidney and liver tissue (Liao and Mayo 1974). Larmoyeux and Piper (1973) suggested that high ammonia levels may cause debilitation in fish, predispose them to infestation by parasites, and reduce their stamina. Under the static water culture system used to rear Kemp's ridley, seawater ammonia level increases during the hiatuses between the thrice weekly exchanges of seawater (Fontaine et al. 1985).

Two raceways were used in the experiment. The control raceway (raceway 12) was drained and refilled with clean seawater three times a week. It was scrubbed once a week to remove excess algal growth. The test raceway (raceway 11) was similar in size and bucket arrange-

ment, but was equipped with a rotating biodisc (biological contactor) filter, a tube separator, a pump (30 liter/min capacity) to transfer seawater to the tube separator, and a circulation pump (568 liter/min capacity) to circulate seawater within the test raceway (Fig. 1).

The biodisc consisted of a series of 28 polystyrene foam discs, each 112 cm in diameter and 1.2 cm thick, with a total surface area of 45 m². The discs were mounted side by side, with a space between them, on a steel drive shaft. The biodisc was positioned so that about 40% of its surface was submerged in seawater at any given time. The biodisc and its tank were encased in a wooden box in which the biodisc was illuminated with fluorescent lights to assure uniform lighting of its surfaces. A motor rotated the biodisc, so the nitrifying microorganisms on the biodisc surface were alternately exposed to air and seawater.

The circulation pump maintained circulation in test raceway 11 in addition to emulsifying much of the sea turtles' solid wastes. The smaller pump transferred the water from the test raceway into the tube separator where most of the remaining solids settled out. The tube separator had a settling surface area of 7.4 m² over a surface area of 0.46 m² inclined at a 60° angle. Seawater free of large suspended particles flowed by means of gravity from the tube separator into the biodisc tank. After being exposed to the biodisc, the seawater flowed back into the raceway by gravity.

Test raceway 11 was filled with seawater, and the biodisc and associated equipment were installed. Seven buckets had to be removed from raceway 11 to make room for the pumps, leaving 101 buckets in the raceway. Control raceway 12 also contained only 101 buckets, to make it comparable with the test raceway. The biodisc was conditioned for nitrification of ammonia by rotating the discs in sea turtle wastewater for six weeks (see Siddall 1974). In February 1983, the two raceways were filled with clean seawater and turtles were added to the buckets at a rate of 12 per week per raceway to avoid overloading the system. The turtles in both raceways were fed a daily ration of dry

pellets (Central Soya and Subsidiaries), at a rate based on the arithmetic average body weight, as determined from the weights of the turtles at 30 day intervals. On 26 April 1983, when the number of turtles in each raceway had reached 101, a systematic analysis of the seawater was begun. The experiment was terminated 40 days later on 5 June 1983, when the turtles were released into the Gulf of Mexico.

Seawater samples were taken daily from three locations in both raceways and from the biodisc-discharge pipe in the test raceway. Samples were analyzed immediately after collection, or were frozen at 0°C and analyzed later. Ammonium-nitrogen ($\text{NH}_4\text{-N}$) and nitrite-nitrogen ($\text{NO}_2\text{-N}$) were determined by procedures described by Strickland and Parsons (1972), and nitrate-nitrogen ($\text{NO}_3\text{-N}$) by the method described by Jenkins and Medsker (1964). The turtles were weighed on 26 April 1983 and again about 10 days before the end of the experiment.

The range of $\text{NH}_4\text{-N}$ levels in the test raceway was 9-112 $\mu\text{g-atoms/l}$, while the range in the control raceway was 1-1,520 $\mu\text{g-atoms/l}$ (see Fontaine et al. 1985, Fig. 19). The $\text{NH}_4\text{-N}$ concentration in the biodisc-discharge pipe water was generally lower than that of the test raceway. The $\text{NH}_4\text{-N}$ concentration increased rapidly in the control, as compared to the relatively low levels in the test raceway. The low $\text{NH}_4\text{-N}$ levels maintained in the test raceway demonstrated the effectiveness of the biodisc in controlling ammonia levels in a raceway containing sea turtles.

The $\text{NO}_2\text{-N}$ concentration in the test raceway increased, as would be expected as the ammonia was oxidized. The concentration of $\text{NO}_2\text{-N}$ in the control raceway showed little variation until about 25 May 1983. It then became erratic, as did the $\text{NO}_2\text{-N}$ level in the test raceway. At the end of the experiment, the $\text{NO}_2\text{-N}$ levels in both raceways were identical.

The $\text{NO}_3\text{-N}$ concentration increased in the test raceway indicating oxidation of $\text{NO}_2\text{-N}$ to $\text{NO}_3\text{-N}$. The $\text{NO}_3\text{-N}$ in the control raceway showed no such increase.

There was no significant difference in mean wet weights of turtles between the control and test raceways at the beginning or end of the experiment. During the course of the experiment, one turtle died in the test raceway, and three died in the control raceway. None of the deaths appeared related to the conditions of the experiment. The dead turtles were replaced with live ones to prevent a reduction of organic load.

It seems that the time interval between replacements of seawater in raceways could be increased from 1-3 days to well over a month by use of a biodisc system. However, the degree of tolerance of Kemp's ridley to increased nitrate and nitrite levels is not known. Though the effects such seawater reuse might have on the abundance of sea turtle pathogens was not tested, the turtles appeared healthy during the experiment. A reuse system using biodiscs could reduce the man-hours required to scrub the raceways, reduce the amount of seawater required to maintain the turtles, and reduce the energy requirements for heating seawater during the winter. These savings would have to be contrasted with the added costs of equipment and of operating the biodisc drive motor and pumps before the net difference in costs could be determined.

CHANGES IN DIVISION STAFF

Kenneth Marvin retired in December 1984. In January 1985, Denise Daley resigned. Dennis Koi transferred to the Fishery Ecology Division at the NMFS SEFC Galveston Laboratory in March 1985. Dr. Jorge Leong transferred to the U.S. Army's Dugway Proving Ground in April 1985. Marty Tyree transferred to the Fishery Ecology Division in June 1985 and received a promotion. In July 1985, Ausbon Brown, Jr. transferred to the NMFS SEFC Miami Laboratory in Florida. David Smith transferred to the Fishery Ecology Division in November 1985.

Rhonda Elizondo of the Galveston Laboratory's Secretarial pool was assigned to secretarial support of the Life Studies Division in

September 1985. Sharon Manzella joined the staff in November 1984, and David Forcucci, Kathy Indelicato and Deborah Tarver in September 1985. The current staff of the Life Studies Division is as follows:

Charles Caillouet
Marcel Duronslet
Clark Fontaine
David Forcucci
Kathy Indelicato
Sharon Manzella
Dickie Revera
Deborah Tarver
Ted Williams
Zoula Zein-Eldin

PUBLICATIONS AND REPORTS IN FISCAL YEAR 1985

Caillouet, C. W., Jr. and D. B. Koi. 1985. Patterns and variability in first-year growth in weight of captive-reared Kemp's ridley sea turtle: a graphical analysis. NOAA Technical Memorandum NMFS-SEFC-164, i plus 4 p. and 52 figures.

Caillouet, C. 1985. Head-start project for Kemp's ridley sea turtles. NMFS SEFC Quarterly Highlights No. 5, p. 11, January-March 1985.

Caillouet, C. W., Jr. (translated to French by Raymond Cayouette). 1984 (December). Essai de prevention de l'extinction de la tortue de Kemp. Les Carnets de Zoologie 44(2):28-34.

Caillouet, C. W., Jr. 1985. Kemp's ridley sea turtles. NMFS SEFC Quarterly Highlights No. 6, p. 12, April-June 1985.

Caillouet, C. W., Jr. and M. J. Duronslet. 1985. Guest editorial-- sea turtle sex ratios and incubation temperature: are we on the right track? Marine Turtle Newsletter No. 35, p. 14-16.

- Caillouet, C. W., Jr. and D. B. Revera. 1985. Brood stock of captive-reared Kemp's ridley to be listed in international species inventory system. Marine Turtle Newsletter No. 34, p. 3-6.
- Fontaine, C. T. and C. W. Caillouet, Jr. 1985. Plans for the disposition of the 1984 year-class of head started Kemp's ridley sea turtles. NMFS SEFC Galveston Laboratory, Galveston, TX, 14 p., May 1985.
- Fontaine, C. T. and C. W. Caillouet, Jr. 1985. The Kemp's ridley sea turtle head start research project: an annual report for fiscal year 1984. NOAA Technical Memorandum NMFS-SEFC-152, ii plus 13 p. and 3 tables.
- Fontaine, C. T., K. T. Marvin, T. D. Williams, W. J. Browning, R. M. Harris, K. L. W. Indelicato, G. A. Shattuck, and R. A. Sadler. 1985. The husbandry of hatchling to yearling Kemp's ridley sea turtles (Lepidochelys kemp). NOAA Technical Memorandum NMFS-SEFC-158, iv plus 34 p., 10 Tables, 22 Figures, and 2 Appendices.
- Fontaine, C., T. Williams, S. Manzella, M. Tyree and C. Caillouet. 1985. Cruise report: release of the 1984 year-class of head started and tagged Kemp's ridley sea turtles (Lepidochelys kemp). NMFS SEFC Galveston Laboratory, Galveston, TX, 7 p. plus 1 Figure, June 1985.

ACKNOWLEDGEMENTS

This work was conducted under INP Permit No. 2534 (and Mexican Diplomatic Note 301976), INP Permit No. 301271 (and Mexican Diplomatic Note No. 174), under FWS Endangered and Threatened Species Permit No. PRT-676379, TPWD Scientific Permit No. SP 073-2, and FDNR Permit No. TP-015.

The Kemp's ridley eggs were made available to the NPS through the efforts of René Márquez M. (INP, Mexico), Jack Woody and David Bowman (FWS, Albuquerque, NM), and Pat Burchfield (Gladys Porter Zoo, Brownsville, Texas), and their staffs. The efforts of Robert King (NPS, Corpus Christi, Texas) and his staff in tending the eggs and providing the "imprinted" hatchlings were appreciated. John and Lupe Hendrickson (University of Arizona, Tucson, AZ) living-tagged 40% of the hatchlings received by NMFS. Dr. Milford Fletcher (NPS, Santa Fe, NM) cooperated in the flipper printing investigation and provided analyses of toxicants for the feeds.

Dr. Edward Klima and Fred Berry provided administrative support, guidance and encouragement throughout the year. Their efforts are gratefully acknowledged.

HEART (Help Endangered Animals - Ridley Turtles), a non-profit organization chaired by Mrs. Carole Allen, is a special committee of the Piney Woods Wildlife Society of North Harris County College, Houston, TX. HEART provided the food for the 1984 and 1985 year-classes of Kemp's ridleys and loaned the Galveston Laboratory an electronic balance for weighing turtles. HEART received donations totaling \$12,410 during fiscal year 1985 in support of Kemp's ridley research and conservation. Included among the donors were the Kempner Fund (Galveston, TX), Exxon USA (Houston, TX), Earl Burke (Pel-Tex Oil), and the general public. The donation from the Kempner Fund will be used to support Kemp's ridley research by a graduate student in the Department of Marine Biology, Texas A&M University at Galveston.

We thank Dr. Robert Jones, Director, and Dr. Anthony Amos,

University of Texas, Marine Science Institute, Port Aransas, TX, who provided the R/V LONGHORN for release of the 1984 year-class of Kemp's ridleys. The assistance of LONGHORN Captain Don Gibson and his crew also is appreciated.

We appreciate the participation of Dr. Andre Landry and his students, Texas A&M University at Galveston, Department of Marine Biology, in research related to the head start project.

We are grateful to Joseph Flannigan, DVM, Houston Zoo, for his assistance in rehabilitation of Kemp's ridleys and studies of their diseases, and to Dr. Elliott Jacobson, University of Florida, Gainesville, FL, and Dr. John Frazier, Smithsonian Institution, Washington, DC, for their roles in receiving specimens for research and archival.

The assistance of Medardo Olivarez, Ausbon Brown, Jr., Dennis Boss, Denise Daley, Fred Mattes, Christine Olguin, Julie Ramos, David Smith, and Zoula Zein-Eldin was greatly appreciated.

We thank Ross Witham, FDNR, Jensen Beach, FL, for providing olive ridley sea turtles for head start experimentation, and John Kerivan and his staff at Sea-Arama Marineworld, Galveston, TX, for their cooperation, both by maintaining Kemp's ridleys as potential breeders and by rehabilitating live-stranded sea turtles.

Beatrice Richardson typed the manuscript through its many revisions, and provided word processing support to the project throughout the fiscal year. Rosemund Boles, Ronnie Elizondo and Gladys Castle provided secretarial support to the Life Studies Division. Daniel Patlan provided photographic and graphics support.

News media coverage has helped generate greater public awareness of and interest in the head start project and the plight of Kemp's ridley.

Administrative and procurement support by Terry Johnstone, Connie Thompson and Frances Garcia are greatly appreciated.

LITERATURE CITED

- Bowman, D. 1983. Tag locations reserved. Marine Turtle Newsletter No. 25, p. 12-13.
- Caillouet, C. W., Jr. 1984. Essai de prévention de l'extinction de la tortue de Kemp. Les Carnets de Zoologie 44(2):28-34.
- Caillouet, C. W., Jr. and D. B. Revera. 1985. Brood stock of captive-reared Kemp's ridley to be listed in international species inventory system. Marine Turtle Newsletter No. 34, pp. 3-6.
- Chávez, H., M. G. Contreras, and T. P. E. Hernández D. 1968. On the coast of Tamaulipas. International Turtle and Tortoise Society Journal 2(4):20-29, 37 and 2(5):16-19, 27-34.
- Clary, J. C. III and J. K. Leong. 1984. Disease studies aid Kemp's ridley sea turtle head start research. Herpetological Review 15(3):69-70.
- Fontaine, C. T. and C. W. Caillouet, Jr. 1985. The Kemp's ridley sea turtle head start research project: an annual report for fiscal year 1984. NOAA Technical Memorandum NMFS-SEFC-152, ii plus 13 p. and 3 tables.
- Fontaine, C. T., K. T. Marvin, T. D. Williams, W. J. Browning, R. M. Harris, K. L. W. Indelicato, G. A. Shattuck and R. A. Sadler. 1985. The husbandry of hatchling to yearling Kemp's ridley sea turtles (Lepidochelys kemp). NOAA Technical Memorandum NMFS-SEFC-158, iv plus 34 p., 10 Tables, 22 Figures and 2 Appendices.
- Jenkins, D. and L. L. Medsker. 1964. Brucine method for the determination of nitrate in ocean, estuarine, and fresh waters. Analytical Chemistry 36(3):610-612.

- Kennedy, R. M. 1980. Recycling and reuse of water for the intensive culture of shrimp. Master of Science Thesis. Cullen College of Engineering, University of Houston, Houston, TX.
- King, R., P. Plotkin, Y. A. Weickum, D. Clark and D. J. Shaver. 1985. Padre Island National Seashore 1985 report: Kemp's ridley sea turtle restoration and enhancement project, incubation and imprinting. National Park Service, Department of the Interior, Corpus Christi, TX, 168 p.
- Klima, E. F. and J. P. McVey. 1981. Head starting the Kemp's ridley turtle, Lepidochelys kempi, p. 481-487. In: Bjorndal, K. A. (editor), Biology and Conservation of Sea Turtles, Proceedings of the World Conference on Sea Turtle Conservation, Smithsonian Institution Press, Washington, D.C. 583 p.
- Larmoyeux, J. D. and R. G. Piper. 1973. Effects of water reuse on rainbow trout in hatcheries. Progressive Fish-Culturist 35(1):2-8.
- Liao, P. B. and R. D. Mayo. 1974. Intensified fish culture combining water reconditioning with pollution abatement. Aquaculture 3:61-85.
- Mrosovsky, N. 1983. Conserving sea turtles. The British Herpetological Society, 176 p.
- Owens, D. W., M. A. Grassman and J. R. Hendrickson. 1982. The imprinting hypothesis and sea turtle reproduction. Herpetologica 38(1):124-135.
- Siddall, S. E. 1974. Studies of closed marine culture systems. Progressive Fish-Culturist 36(1):8-15.

- Soulé, M. E. and B. A. Wilcox (editors). 1980. Conservation biology: an evolutionary-ecological perspective. Sinauer Associates Inc. Publishers, Sunderland, MA, 395 p.
- Strickland, J. D. H. and J. R. Parsons. 1972. A practical handbook of seawater analysis. Fisheries Research Board of Canada Bulletin 177, 310 pp.
- Wibbels, T., D. Owens, G. Dienberg and J. Noell. 1985. Determination of sex ratios produced in the Kemp's ridley head start program. Final Report to the National Park Service, Contract No. PX 7490-5-0100, by the Department of Biology, Texas A&M University, College Station, TX, 14 p.
- Wood, J. R. and F. E. Wood. 1984. Captive breeding of the Kemp's ridley. Marine Turtle Newsletter No. 30, p. 12.

Table 1. Summary of "imprinted" Kemp's ridley sea turtle hatchlings received, and captive-reared survivors tagged and released or relocated, by year-class^{a/}.

Year-class	"Imprinted" Hatchlings Received				Tagged Turtles ^{b/}					
	Inclusive dates	"Imprinting" location	No.		Relocated ^{c/}		Released		Recovered	
			Alive	Dead	No.	%	No.	%	No.	%
1978	6 July-3 August	PINS ^{d/} RNe ^{e/}	1,854	1	41	2	1,267	68	50	4
	11 August		1,226	0	1	<1	752	61	25	3
			3,080	1	42		2,019	65	75	4
1979	26 June-23 July	PINS RN	1,656	2	66	4	1,279	77	17	1
			187	1	100	53	66	87	0	0
			1,843	3	166	9	1,345	78	17	1
1980	24 June-14 July 7 July	PINS RN	1,608	4	0		1,526	95	82	5
			207	3	0		197	95	5	3
			1,815	7	0		1,723	95	87	5
1981	24 July-22 August	PINS	1,864	1	0		1,639	88	49	3
1982	6 July-16 August	PINS	1,524	0	28	2	1,325	87	150	11
1983	8 July-12 August 8 July	PINS RN	230		2	<1	172	75	8	5
			20		0		18	90	1	<1
			250	0	2	<1	190	76	9	5
1984	24 July-27 July	PINS	1,441	106	61	4	1,017	71	5	<1
1985	9 July-7 August	PINS	1,684	8	0					
1978-1985		PINS	11,861		198	2	8,225		361	4
1978-1985		RN	1,640		101	6	1,033		31	3
Total			13,501	126	299	2	9,258		392	4

^{a/}As of 30 December 1985.

^{b/}Allocation of data between PINS and RN "imprinting" categories may be incorrect for year-classes 1978-1980, and should be considered only an approximation.

^{c/}Most transferred to other locations for extended head starting and breeding experiments; also includes some abnormal individuals transferred to other investigators.

^{d/}Padre Island National Seashore.

^{e/}Rancho Nuevo.

Table 2. Head started Kemp's ridley sea turtles relocated to the Cayman Turtle Farm (1983), Ltd. and marine aquaria for captive breeding, by year-class.

Year-class ^{a/}	Recipient organization	Clutch identification no. ^{b/}	Flipper-tag code ^{c/}	Living-tag scute code ^{d/}	Internal, binary-coded magnetic tag		Sex ^{f/}	Relocation Date	Other identifying characteristics
					Tag code	Tag location ^{e/}			
1978	Sea-Arama Marine World, Galveston, TX	Unknown	No Tag (NNA269)	None	None		F	Feb. 1980	Right front flipper missing
			2517 (NNA269)*	"	"	"	M	"	
			2514 (NNA240)*	"	"	"	F	"	
			2512 (NNA230)*	"	"	"	F*	"	
			2511 (NNA262)*	"	"	"	M	"	
			2510 (NNA243)*	"	"	"	F	"	
			2509 (J0051)*	"	"	"	F	"	
	2508 (NNA270)*	"	"	"	F	"			
	2507 (J0089)*	"	"	"	M	"			
1978	Miami Seaquarium, Miami, FL	Unknown	NNK015	NS-5	"		M	22 Feb. 1979	
		"	NNK021	None	"		M	"	
		"	NNK003	"	"	"	M	"	
		"	NNK001	RC-3	"	"	M	"	
		"	J1939	None	"	"	M	"	
	NNR464	LC-3	"	"	F	"			
1979	Miami Seaquarium, Miami, FL	"	No Tag (unknown)	None	"		M	17 Sept. 1979	Right front flipper missing & notch on right edge of carapace
1979	Cayman Turtle Farm (1983), Ltd., Grand Cayman, BVI	Unknown	1325 (NNA301)	None	"		M	4 July 1980	
		"	1330 (NNA302)	"	"		M	"	
		"	1320 (NNA305)	"	"	"	M	"	
		"	1332 (NNA312)	"	"	"	M	"	
		"	1323 (NNA317)	"	"	"	?	"	

Table 2. continued.

Year-class ^{a/}	Recipient organization	Clutch identification no. ^{b/}	Flipper-tag code ^{c/}	Living-tag scute code ^{d/}	Internal, binary-coded magnetic tag		Sex ^{f/}	Relocation Date	Other identifying characteristics
					Tag code	Tag location ^{e/}			
1979	Cayman Turtle Farm (1983), Ltd., Grand Cayman, BVI	Unknown	1353 (unknown)	None	None		F	4 July 1980	
		"	1349 (NNA373)	"	"		F	"	
		"	1354 (unknown)	"	"		?	"	
		"	1355 (NNA380)	"	"		F	"	
		"	1331 (NNA383)	"	"		M	"	
		"	1322 (NNA386)	"	"		M	"	
		"	1345 (NNA387)	"	"		M	"	
		"	1356 (unknown)	"	"		M	"	
		"	1341 (NNA392)	"	"		M	"	
		"	1352 (NNA393)	"	"		M	"	
		"	1348 (NNA394)	"	"		M	"	
		"	1326 (NNA397)	"	"		M	"	
		"	1324 (NNA319)	"	"		F	"	
		"	1335 (NNA320)	"	"		F	"	
		"	1318 (NNA322)	"	"		F	"	
		"	1344 (unknown)	"	"		F	"	
		"	1327 (NNA326)	"	"		M	"	
		"	1336 (NNA331)	"	"		F**	"	
		"	1358 (NNA332)	"	"		M	"	
		"	1359 (NNA347)	"	"		F**	"	
		"	1360 (NNA349)	"	"		M	"	
		"	1339 (NNA350)	"	"		F	"	
		"	1357 (NNA353)	"	"		M	"	
		"	1338 (NNA357)	"	"		M	"	
		"	1329 (NNA361)	"	"		F	"	
		"	1346 (NNA365)	"	"		M	"	
		"	1337 (NNA367)	"	"		M	"	
		"	1347 (NNA368)	"	"		M	"	
		"	1342 (NNA371)g/	"	"		F	"	

Table 2. continued.

Year-class ^{a/}	Recipient organization	Clutch identification no. ^{b/}	Flipper-tag code ^{c/}	Living-tag scute code ^{d/}	Internal, binary-coded magnetic tag		Sex ^{e/}	Relocation Date	Other identifying characteristics
					Tag code	Tag location ^{e/}			
1982	Clearwater Marine Science Center, Clearwater, FL	9	NNM107	None	D ₁ -2; D ₂ -20	RFF	?	9 Nov. 1983	
		12	NNM251	"	" -33	RFF	M	"	
		9	NNM154/NNM155	"	" -21	"	F	"	
		12	NNK710/NNK711	"	" -32	"	F	"	
		10	NNM330	LC-3	" -34	"	?	"	
1982	Gulfarium, Fort Walton, Beach, FL	4	NNL485	None	" -2	"	M	26 Jan. 1984	
		3	NNL298	"	" -8	"	F	"	
		4	NNL476	"	" -4	"	F	"	
		20	NNQ318	"	" -9	"	M	"	
1982 ^{h/}	Key West Municipal Aquarium, Key West, FL	6	No tag (NNK009)	"	" -68	"	F	9 Nov. 1983	
		19	NNM576	"	" -42	"	M	"	
		8	NNK008	"	" -40	"	M	"	
		7	No tag (NNM010)	LC-3	" -64	"	M	"	
		11	No tag (NNK011)	None	" -41	"	F	"	
1982	Marine Life Park, Inc., Gulfport, MS	5	NNL666	"	" -1	"	M	6 Feb. 1984	
		15	NNM703	LC-3	" -18	"	M	"	
		16	No Tag (NNM790)	"	" -17	"	M	"	
		18	No tag (NNM872)	LC-3	" -10	"	M	"	Notch on right rear of carapace
		17	No tag (NNM835)	None	" -16	"	M	"	

Table 2. continued.

Year-class ^a /	Recipient organization	Clutch identification no. ^b /	Flipper-tag code ^c /	Living-tag scute code ^d /	Internal, binary-coded magnetic tag		Sex ^f /	Relocation Date	Other identifying characteristics
					Tag code	Tag location ^e /			
1982 ⁱ /	Theater of the Sea, Islamorada, FL	5	NNL683	None	D ₁ -2; D ₂ -69	RFF	M	16 Apr. 1985	
		10	NNK012	LC-3	" -36	"	F	"	
		8	NNM375	LC-3	" -37	"	M	"	
		7	No tag (NNM024)	None	" -65	"	M	"	
		6	NNK027	"	" -66	"	F	"	
1984	Bass Pro Shops, Springfield, MO	4	NNT100	LC-5	D ₁ -2; D ₂ -72	"	?	17 July 1985	
		"	NNT110	"	" "	"	"	"	
		"	NNT111	"	" "	"	"	"	
		"	NNT114	"	" "	"	"	"	
		"	NNT176	"	" "	"	"	"	
1984	Dallas Aquarium, Dallas, TX	17	NNT996	"	" "	RFF, RRF	"	28 June 1985	
		"	NNT998	"	" "	"	"	"	
		"	NNV016	"	" "	"	"	"	
		"	NNV019	"	" "	"	"	"	
		"	NNV020	"	" "	"	"	"	
1984	Marineland, Inc., St. Augustine, FL	10	NNT118	"	" "	RFF	"	2 July 1985	
		"	NNT121	"	" "	"	"	"	
		"	NNT123	"	" "	"	"	"	
		"	NNT131	"	" "	"	"	"	
		"	NNT164	"	" "	"	"	"	
1984	New England Aquarium, Boston, MA	16	NNT043	"	" "	"	"	"	
		"	NNT045	"	" "	"	"	"	
		"	NNT052	"	" "	"	"	"	
		"	NNT059	"	" "	"	"	"	

Table 2. continued.

Year-class ^{a/}	Recipient organization	Clutch identification no. ^{b/}	Flipper-tag code ^{c/}	Living-tag scute code ^{d/}	Internal, binary-coded magnetic tag		Sex ^{f/}	Relocation Date	Other identifying characteristics
					Tag code	Tag location ^{e/}			
1984	North Carolina Marine Resources Center, Kure Beach, NC	8	NNF069	LC-5	D ₁ -2; D ₂ -72	RFF	?	30 July 1985	
		"	NNF070	"	"	"	"	"	"
		"	NNF078	"	"	"	"	"	"
1984	Pan American University, South Padre Island, TX	17	NNV004	"	"	RFF, LFF, RRF, LRF	"	1 Aug. 1985	
		"	NNV006	"	"	"	"	"	"
1984	Sea-Arama Marineworld, Galveston, TX	"	NNV003	"	"	LFF, RFF, RRF	"	30 Sept. 1985	
		"	NNV011	"	"	"	"	"	"
		"	NNV014	"	"	"	"	"	"
1984	Sea Turtle, Inc., South Padre Island, TX	9	NNF004	"	"	RFF	"	1 Aug. 1985	
		"	NNF087	"	"	"	"	"	"
		"	NNF097	"	"	"	"	"	"
1984	Sea World of Florida, Orlando, FL	2	NNF136	"	"	"	"	2 July 1985	
		"	NNF140	"	"	"	"	"	"
		"	NNF142	"	"	"	"	"	"
		"	(died 13 July 1985) NNF147	"	"	"	"	"	"
		"	NNF155	"	"	"	"	"	"
1984	Cayman Turtle Farm (1983), Ltd., Grand Cayman, BWI	13	NNF196	"	"	RFF, LFF	"	16 Jan. 1986	
		"	NNF244	"	"	"	"	"	"
		"	NNF245	"	"	"	"	"	"

Table 2. continued.

Year-class ^{a/}	Recipient organization	Clutch identification no. ^{b/}	Flipper-tag code ^{c/}	Living-tag scute code ^{d/}	Internal, binary-coded magnetic tag		Sex ^{f/}	Relocation Date	Other identifying characteristics
					Tag code	Tag location ^{e/}			
1984	Cayman Turtle Farm (1983), Ltd., Grand Cayman, BVI	13	NNT251	LC-5	D ₁ -D ₂ ; D ₂ -72	RFF, LFF	?	16 Jan. 1986	
		"	NNT253	"	"	"	"	"	
		11	NNT207	"	"	"	"	"	
		"	NNT227	"	"	"	"	"	
		"	NNT233	"	"	"	"	"	
		"	NNT238	"	"	"	"	"	
		"	NNT254	"	"	"	"	"	
		"	NNT257	"	"	"	"	"	
		"	NNT259	"	"	"	"	"	
		"	NNT260	"	"	"	"	"	
	"	NNT262	"	"	"	"	"		
	"	NNT290	"	"	"	"	"		

^{a/}With the exception of the 1979 year-class sent to Cayman Turtle Farm, all turtles were "imprinted" at the Padre Island National Seashore. The 1979 year-class sent to Cayman Turtle Farm, was "imprinted" at Rancho Nuevo, Mexico.

^{b/}Numbers preceded by 3 letters represent monel flipper-tags applied by NMFS. Clutch identification for 1978 and 1979 year-classes is unavailable. Clutch identification numbers for subsequent years were assigned to clutches by NPS at Padre Island National Seashore and were used by the NMFS SEFC Galveston Laboratory.

^{c/}Tag codes or explanations to the left represent current tag status. Tag codes in parentheses to the right represent the previous monel flipper tags that most recently have been either lost or removed. Turtles that have lost all tags are indicated as "No tag" followed by the previous tag code in parentheses if known. Untagged animals are scheduled for re-tagging with flipper tags. Tag codes separated by a slash (/) represent double-tagged turtles (i.e., on both front flippers). Sea-Arama Marineworld turtles of the 1978 year-class are tagged with orange plastic tags. All 1979 year-class turtles at Cayman Turtle Farm were doubled-tagged with medium rototags (plastic) on 14 May 1984. At that time, all but seven still had original monel tags in place; during the period 14 May 1984 to 1 September 1985, three of the seven died.

d/Miami Seaquarium turtles of the 1978 year-class were living-tagged in a study by Drs. John & Lupe Hendrickson in June 1980 and June 1981, under contract with the NMFS SEFC. All costal scutes and the 5th neural scute (N-5) were used in this study. All 1982 year-class turtles that were "living-tagged" were tagged on left costal scute 3 (LC-3). All 1984 year-class turtles were tagged on left costal scute 5 (LC-5).

e/Manufactured by Northwest Marine Technology Inc., Shaw Island, Washington. Tags were inserted subcutaneously in the dorsal aspect of the front flipper near the distal end of the humerus, and centered in the dorsal aspect of the rear flipper(s). Letters identify flipper(s) used: RFF = right front flipper; LFF = left front flipper; RRF = right rear flipper; LRF = left rear flipper.

f/Sex of 1978 and 1979 year-classes at Sea-Arama Marineworld and Miami Seaquarium was determined by an external, secondary sex characteristic (tail length), and by testosterone levels in blood samples taken by Dave Owens, TAMU. Sex of 1979 year-class turtles at Cayman Turtle Farm was obtained from a report from the farm dated 14 May 1984. Sex of all 1982 year-class turtles is predicted sex, based on testosterone levels from blood samples taken by Dr. Davide Owens on 10 July 1984. In this column, a single asterisk (*) indicates that the sex was verified by Dr. David Owens by laparoscopic examination. Double asterisks (**) in this column indicate that the turtle nested during May 1984. A question mark (?) in this column indicates that sex has not been determined.

g/This turtle escaped between 14 May 1984 and 1 September 1985.

h/These five turtles were transferred to Cayman Turtle Farm (1983), Ltd. on 16 January 1986.

i/These five turtles had been at Turtle Kraals, Key West, FL since 9 November 1983.

Table 3. Clutches of the 1984 year-class of "imprinted" Kemp's ridley sea turtle hatchlings received from the NPS on 24 July 1984, most having been living-tagged^{a/}.

Clutch identi- fication no.	Counts of Hatchlings by NMFS			Totals
	Live normal	Live deformed	Dead on arrival	
1	19	0	1	20
2	90	0	2	92
3	38	0	2	40
4	45	0	6	51
5	41	0	0	41
6	85	2	5	92
15 ^{a/}	78 (10 untagged)	0	0	78 (10 untagged) ^{a/}
16	89	0	3	92
Totals	485	2	19	506

^{a/}All tagged except 10 hatchlings in clutch 15.

Table 4. Clutches of the 1984 year-class of "imprinted" Kemp's ridley sea turtle hatchlings received from the NPS on 25 July 1984, including untagged and living-tagged individuals^{a/}.

Clutch identi- fication no.	Counts of Hatchlings by NMFS			Totals
	Live normal	Live deformed	Dead on arrival	
1	7	0	2	9
2	9	0	0	9
3	10	0	0	10
4	10	0	0	10
7	61	0	4	65
8	84	0	4	88
9	104	0	0	104
10	71	0	0	71
11	103	0	4	107
12	64	0	37	101
13	85	0	0	85
14	100	0	0	100
16	10	0	0	10
17	32	0	0	32
17(all tagged) ^{a/}	69	0	1	70
18 ^{a/}	35 (25 tagged; 10 untagged)	0	35 (tagged)	70
Totals	854	0	87	941

^{a/}Only portions of clutches 17 and 18 were tagged; all the other hatchlings were untagged.

Table 5. Untagged clutches 10 and 19 of the 1984 year-class of "imprinted" Kemp's ridley sea turtle hatchlings received from the NPS on 27 July 1984.

Clutch identification no.	Counts of Hatchlings by NMFS			Totals
	Live normal	Live deformed	Dead on arrival	
10	1	0	0	1
19	99	0	0	99
Totals	100	0	0	100

Table 6. Adult female Kemp's ridley sea turtles and clutches of eggs from which hatchlings of the 1984 year-class were obtained for head starting at the Galveston Laboratory^{a/}.

Flipper tag nos. ^{b/}	Carapace length, cm	Clutch identification no.	Polystyrene box no. ^{c/}	Date eggs laid	No. eggs ^{d/}
T-00208	76.0	1	512	28 May	123
T-00094 (C-01255)	72.0	2	513	28 May	122
C-17270	71.0	3	514	28 May	102
T-00185	71.5	4	515	28 May	96
T-00300	63.0	5	765	29 May	72
T-00417 (C-13096) (C-17061)	<u>-e/</u>	6	766	29 May	124
T-00355	72.5	7	767	29 May	91
C-17233	66.0	8	768	29 May	96
T-00114	70.0	9	769	29 May	113
T-00435	70.0	10	770	29 May	89
T-00357	62.0	11	771	29 May	112
C-17028 (L-5648)	70.0	12	772	29 May	119
C-17384	71.0	13	773	29 May	108
T-00101	70.5	14	774	29 May	109
T-00134	72.0	15	775	29 May	90
C-13112	71.5	16	776	29 May	119
T-00102	65.5	17	797	30 May	106
C-17469	63.0	18	798	30 May	108
T-00437	71.0	19	799	4 June	101

^{a/}Data provided by Robert King, NPS.

^{b/}Used by INP at Rancho Nuevo.

^{c/}Used by INP, FWS and Gladys Porter Zoo at Rancho Nuevo.

^{d/}Number of eggs incubated in each polystyrene foam box at the Padre Island National Seashore. It can be equal to or less than the number laid, because not all eggs laid by clutch were transferred to a box in every case. For example, any that accidentally touched Rancho Nuevo sand were not put into a box containing Padre Island sand.

^{e/}No data.

Table 7. Clutch histories of the 1984 year-class of "imprinted" Kemp's ridley sea turtle hatchlings received from the NPS on 24 July 1984^{a/}.

Clutch identi- fication no. ^{b/}	Dates		Incubation period, days	No. transferred	
	Hatched	"Imprinted" ^{c/}		Tagged	Untagged
1	15 July	19 July	49	20	0
2	18 July	19 July	52	92	0
3	18 July	19 & 22 July	52	40	0
4	15 July	19 July	49	51	0
5	20 July	20 July	52	41	0
6	17 July	20 & 22 July	50	92	0
15	18 July	19 July	51	68	10 ^{d/}
16	16 July	18 & 19 July	49	92	0
Combined			49-52	496	10.

^{a/}Data provided by Robert King, NPS.

^{b/}See Table 4 for polystyrene box numbers used at the beach near Rancho Nuevo.

^{c/}On the beach and in the surf at the Padre Island National Seashore.

^{d/}These hatchlings were held back by Robert King at the Padre Island National Seashore for a study of yolk absorption. Survivors were transferred to the Galveston Laboratory on 25 July 1984, before the study was completed.

Table 8. Clutch histories of the 1984 year-class of "imprinted" Kemp's ridley sea turtle hatchlings received from the NPS on 25 July 1984^{a/}.

Clutch identi- fication no. ^{b/}	Dates		Incubation period, days	No. transferred	
	Hatched	"Imprinted" ^{c/}		Tagged	Untagged
1	15 July	19 July	49	0	9
2	18 July	19 July	52	0	9
3	18 July	19 July	52	0	10
4	15 July	19 July	49	0	10
7	19 July	22 July	52	0	65
8	20 July	22 July	53	0	88
9	18 July	22 July	51	0	104
10	20 July	23 & 24 July	53	0	71
11	19 July	22 July	52	0	107
12	18 July	22 July	51	0	101
13	19 July	22 July	52	0	85
14	19 July	23 July	52	0	100
16	16 July	19 July	49	0	10
17	18 July	20 July (tagged) & 24 July (untagged)	51	70	32
18	18 July	19 July	51	0	70
Combined			49-53	70	871

^{a/}Data provided by Robert King, NPS.

^{b/}See Table 6 for polystyrene box numbers used at the beach near Rancho Nuevo.

^{c/}On the beach and in the surf at the Padre Island National Seashore.

Table 9. Clutch histories of the 1984 year-class of "imprinted" Kemp's ridley sea turtle hatchlings received from the NPS on 27 July 1984^{a/}.

Clutch identi- fication no. ^{b/}	Dates		Incubation period, days	No. transferred	
	Hatched	"Imprinted" ^{c/}		Tagged	Untagged
10	20 July	23 & 24 July	53	0	1
19	23 July	26 July	50	0	99
Combined			50-53	0	100

^{a/}Data provided by Robert King, NPS.

^{b/}See Table 4 for polystyrene box numbers used at the beach near Rancho Nuevo.

^{c/}On the beach and in the surf at the Padre Island National Seashore.

Table 10. Numbers of hatchlings of the 1984 year-class of Kemp's ridley sea turtles received from the NPS on 24, 25, and 27 July 1984, by clutch, including untagged and living-tagged individuals.

Clutch identi- fication no.	Live normal			Live deformed			Dead on arrival ^{a/}			Totals		
	Untagged	Tagged	Combined	Untagged	Tagged	Combined	Untagged	Tagged	Combined	Untagged	Tagged	Combined
1	7	19	26	0	0	0	2 (22)	1 (5)	3 (10)	9	20	29
2	9	90	99	0	0	0	0 (0)	2 (2)	2 (2)	9	92	101
3	10	38	48	0	0	0	0 (0)	2 (5)	2 (4)	10	40	50
4	10	45	55	0	0	0	0 (0)	6 (12)	6 (10)	10	51	61
5	0	41	41	0	0	0	0	0 (0)	0 (0)	0	41	41
6	0	85	85	0	2	2	0	5 (6)	5 (6)	0	92	92
7	61	0	61	0	0	0	4 (6)	0	4 (6)	65	0	65
8	84	0	84	0	0	0	4 (4)	0	4 (4)	88	0	88
9	104	0	104	0	0	0	0 (0)	0	0 (0)	104	0	104
10	72	0	72	0	0	0	0 (0)	0	0 (0)	72	0	72
11	103	0	103	0	0	0	4 (4)	0	4 (4)	107	0	107
12	64	0	64	0	0	0	37 (37)	0	37 (37)	101	0	101
13	85	0	85	0	0	0	0 (0)	0	0 (0)	85	0	85
14	100	0	100	0	0	0	0 (0)	0	0 (0)	100	0	100
15	10	68	78	0	0	0	0 (0)	0 (0)	0 (0)	10	68	78
16	10	89	99	0	0	0	0 (0)	3 (3)	3 (3)	10	92	102
17	32	69	101	0	0	0	0 (0)	1 (1)	1 (1)	32	70	102
18	10	25	35	0	0	0	0 (0)	35 (58)	35 (50)	10	60	70
19	99	0	99	0	0	0	0 (0)	0	0 (0)	99	0	99
Totals	870	569	1,439	0	2	2	51 (6)	55 (10)	106 (7)	921	626	1,547

^{a/}Percentage mortality on arrival is shown in parentheses and is based on the total numbers of hatchlings tagged, untagged, and combined, by clutch.

Table 11. Summary of survival of living-tagged and untagged Kemp's ridley sea turtle hatchlings of the 1984 year-class in an antibiotic injection test between 25 July and 1 August, by treatment.

	Control	Injected ^{a/}			Totals
		Saline only	Ampicillin in saline	Chloramphenicol in saline	
Initial no. ^{b/}	82	88	72	91	333
Final no.	81	85	67	79	312
Survival, %	99	97	93	87	94

^{a/}First injected at 9:00 a.m. CDT on 25 July 1984.

Last injected on 29 July 1984.

Injections were twice daily on 25 July, once in morning and once in the afternoon, and once daily (in morning) thereafter.

^{b/}As of 9:00 a.m. CDT, 25 July 1984.

Table 12. Daily^{a/} mortalities in untagged and living-tagged hatchlings in 17 out of 19 clutches of the 1984 year-class of Kemp's ridley sea turtle, received alive and placed in raceways at the NMFS SEFC Galveston Laboratory.

Clutch no.	24 July		25 July		26 July		27 July		28 July		30 July		3 August		21 August		Totals
	Tagged	Untagged	Tagged	Untagged	Tagged	Untagged											
1	2		4	2		1											9
2	6		20		3				1		1						31
3	3		7														10
4	1		8														9
5			1												1		2
6	7		14		3												24
7				12		7							^{c/}				21
8				2		4											6
9				5		2		5									12
11				6		13		1									20
12				22		12											34
14						2											2
15	7		9		2												18
16	7		4		4				1								16
17					13												13
18			5	1	9		3		1								19
19																1	1
Totals	33	0	72	50	34	41	3	6	3	0	1	0	0	2	1	1	247

^{a/}If a particular intervening date is not shown, then there were no mortalities reported for that date.

^{b/}There were no mortalities in clutches 10 and 13 during the period from 24 July through 21 August 1984.

^{c/}Found drowned and in holes in bottom of buckets.

Table 13. Summary of short-term mortalities in untagged and "living-tagged" hatchlings in 17 out of 19 clutches^{a/} of the 1984 year-class of Kemp's ridley sea turtle, from 24 July through 21 August 1984.

Clutch identi- fication no.	Dead on arrival			Died after arrival ^{b/}			Untagged	Totals ^{b/}	
	Untagged	Tagged	Combined	Untagged	Tagged	Combined		Tagged	Combined
1	2	1	3	3	6	9	5 (56)	7 (35)	12 (41)
2	0	2	2	0	31	31	0	33 (36)	33 (33)
3	0	2	2	0	10	10	0	12 (30)	12 (24)
4	0	6	6	0	9	9	0	15 (29)	15 (25)
5	0	0	0	0	2	2	0	2 (5)	2 (5)
6	0	5	5	0	24	24	0	29 (32)	29 (32)
7	4	0	4	21	0	21	25 (38)	0	25 (38)
8	4	0	4	6	0	6	10 (11)	0	10 (11)
9	0	0	0	12	0	12	12 (12)	0	12 (12)
11	4	0	4	20	0	20	24 (22)	0	24 (22)
12	37	0	37	34	0	34	71 (70)	0	71 (70)
14	0	0	0	2	0	2	2 (2)	0	2 (2)
15	0	0	0	0	18	18	0	18 (26)	18 (23)
16	0	3	3	0	16	16	0	19 (21)	19 (19)
17	0	1	1	0	13	13	0	14 (20)	14 (14)
18	0	35	35	1	18	19	1 (10)	53 (88)	54 (77)
19	0	0	0	1	0	1	1 (1)	0	1 (1)
Totals	51	55	106	100	147	247	151	202	353
% of Total Received ^{c/}	(6)	(10)	(7)	(11)	(26)	(17)	(16)	(32)	(23)

^{a/}There were no mortalities on or after arrival in clutches 10 and 13 during the period from 24 July through 21 August.

^{b/}This represents mortalities in hatchlings received alive over 24-27 July 1984 (see Table 10). Only four of these hatchlings died between 3 August and 21 August: one from clutch 5, one from clutch 19, and two from clutch 7 (these two were found stuck in holes in the bottom of the buckets containing them and apparently drowned). See Table 12.

^{c/}Nos. in parentheses are percentage mortalities based on the total numbers of hatchlings untagged, tagged and combined, by clutch. See Table 10 for total numbers of untagged, "living-tagged" and combined hatchlings received, by clutch.

Table 14. Mortality in seven year-classes of Kemp's ridley sea turtle hatchlings during shipment to NMFS by NPS.

Year-class	Hatchlings Received				
	Alive		Dead on arrival		Total
	No.	% ^{a/}	No.	%	No.
1978	3,080	99.97	1	0.03	3,081
1979	1,843	99.84	3	0.16	1,846
1980	1,815	99.62	7	0.38	1,822
1981	1,864	99.95	1	0.05	1,865
1982	1,524	100.00	0	0.00	1,524
1983	250	100.00	0	0.00	250
1984	1,441	93.15	106	6.85	1,547
1985	1,684	99.53	8	0.47	1,692
Combined	13,501	99.08	126	0.92	13,627

^{a/}Percentages are based on the total numbers of hatchlings received by year-class.

Table 15. Arithmetic mean weight (g) and ranges in weight of Kemp's ridley sea turtle hatchlings of the 1984 year-class^{a/}.

Clutch identi- fication no.	Date weighed ^{a/}	Age, days	No. hatchlings weighed	Arithmetic mean weight, g	Range in weight, g
1	19 July	4	100	14.1	10.5-15.6
2	19	1	119	15.7	14.4-17.2
3	19 & 22	1 & 3	92	16.0	14.3-17.4
4	19	4	93	15.7	13.2-17.4
5	20	0	43	16.7	13.9-18.8
6	20 & 22	3 & 5	101	16.5	13.5-17.8
7	22	3	65	15.5	13.5-17.4
8	22	2	88	17.9	15.0-19.6
9	22	4	106	15.2	13.7-17.1
10	23 & 24	3 & 4	72	16.0	13.1-18.1
11	22	3	107	17.9	15.9-19.8
12	22	4	105	16.6	14.6-18.0
13	22	3	85	18.6	17.7-20.1
14	23	4	100	16.4	14.5-17.6
15	19	1	81	17.3	15.7-19.7
16	18 & 19	2 & 3	110	17.0	15.1-18.6
17	20 & 24	2 & 6	102	16.6	15.2-18.3
18	19	1	106	15.7	12.5-17.5
19	26	3	99	16.2	13.8-18.1
Combined	19-26	0-6	1,774	16.4	10.5-20.1

^{a/}All weighed in July 1984. Data provided by Robert King, NPS.

Table 16. Results of the feeding experiment on Kemp's ridley sea turtles of the 1984 year-class^{a/}.

Raceway	Treatment ^{b/}	Weight gain, g	Biomass Increase, kg	Survival %	Gross Food Conversion ratio ^{c/}
4	H/2	419.3	43.9	97.2	1.6:1
8	"	344.9	37.2	100.0	1.8:1
11	"	366.5	31.6	81.5	1.7:1
3	H/1	284.5	26.9	88.9	2.0:1
6	"	293.8	28.9	95.2	2.1:1
14	"	273.4	23.8	85.6	1.8:1
2	L/1	160.5	15.0	88.9	1.9:1
10	"	156.9	14.8	94.1	2.0:1
13	"	191.9	19.6	95.4	1.6:1

^{a/}Based on weighings on 22 August 1985 and 28 February 1985.

^{b/}H/2 = High level of feeding, twice daily.

H/1 = High level of feeding, once daily.

L/1 = Low level of feeding, once daily.

^{c/}Dry weight of pellets fed:wet weight gained.

Table 17. Bucket identification codes^{a/} and clutch identification numbers^{b/} for the 100 Kemp's ridley sea turtles selected for morphometric study by Texas A&M University^{c/}.

<u>Raceway 2^{d/}</u>	<u>Raceway 3^{e/}</u>	<u>Raceway 4</u>	<u>Raceway 14</u>
<u>Clutch 9</u>	<u>Clutch 4</u>	<u>Clutch 13</u>	
A6	A3, A5	A1	
B1, B3	B1, B6		
C5	C3	C1, C3	
D2	D6	D2, D5	
E1, E6	E1, E2	E2, E5, E6	
F1, F2, F6	F2, F4	F1, F5	
<u>Clutch 8</u>	<u>Clutch 10</u>	<u>Clutch 11</u>	
G2, G3, G6	G3	G1, G2, G3	
H5, H6	H1, H3, H4	H4	
I2, I5	I2, I5	I3	
	J4, J6	J1, J2	
K4	K1	K3	
L5, L6	L1	L1, L4	
<u>Clutch 16</u>	<u>Clutch 2</u>	<u>Clutch 17</u>	<u>Clutch 17</u>
M3	M3		M5, M6
N4	N2, N5	N3, N5	N5
O4	O4	O2	O2, O6
P3, P5	P2, P5, P6	P3, P5, P6	P1, P6
Q2, Q6	Q2, Q6	Q2, Q4, Q6	Q2, Q4
R4, R5, R6	R4	R3	R1

^{a/}Letters designate the bucket row and numbers the bucket column.

^{b/}Used by the NPS at the Padre Island National Seashore.

^{c/}Conducted by Dr. Andre Landry and assistants, Department of Marine Biology, Texas A&M University at Galveston, Galveston, Texas.

^{d/}In raceway 2, F1 died on 7 January 1985, and F2 on 6 January 1985.

^{e/}In raceway 3, M3 died on 11 September 1984.

Table 18. Dates of tagging Kemp's ridley sea turtles of the 1984 year-class with internal, binary coded, magnetic tags, monel flipper tags, and living-tags.

Raceway	Bucket Row (letter) and Column (no.)	Clutch	Tagging Date		
			Internal Tag ^{a/}	Flipper Tag ^{b/}	Living-Tag ^{c/}
2d/	A1-F6	9	8 May 1985	30 Apr. 1985	12 Apr. 1985
	G1-L6	8	"	"	12 Dec. 1984
	M1-R6	16	"	"	July 1984
3	A1-F6	4	21 Mar. 1985	"	"
	G1-L6	10	"	"	12 Dec. 1984
	M1-R6	2	"	"	July 1984
4	A1	13	24 June 1985	"	13 Dec. 1984
	A2-B6	"	8 May 1985	"	"
	C1	"	24 June 1985	"	"
	C2	"	8 May 1985	"	"
	C3	"	24 June 1985	"	"
	C4-E1	"	8 May 1985	"	"
	E2	"	24 June 1985	"	"
	E3	"	8 May 1985	"	"
	E4	"	"	"	July 1984
	E5	"	"	"	13 Dec. 1984
	E6	"	24 June 1985	"	"
	F1-F6	"	8 May 1985	"	"
	G1-G3	11	24 June 1985	"	15 Feb. 1985
	G4-H3	"	8 May 1985	"	"
	H4	"	24 June 1985	"	"
	H5-I2	"	8 May 1985	"	"
	I3	"	24 June 1985	"	"
	I4-I6	"	8 May 1985	"	"
	J1-J2	"	24 June 1985	"	"
	J3-K2	"	8 May 1985	"	"
	K3	"	24 June 1985	"	"
	K4-K6	"	8 May 1985	"	"
	L1	"	24 June 1985	"	"
L2-L3	"	8 May 1985	"	"	
L4	"	24 June 1985	"	"	
L5-L6	"	8 May 1985	"	"	
M1-N5	17	"	"	July 1984	
N6	"	"	"	15 Feb. 1985	
O1-R6	"	"	"	July 1984	

Raceway	Bucket Row (letter) and Column (no.)	Clutch	Tagging Date		
			Internal Tag ^{a/}	Flipper Tag ^{b/}	Living-Tag ^{c/}
5	A1-A4	1	21 Mar. 1985	30 Apr. 1985	12 Apr. 1985
	A5-C5	1	"	"	July 1984
	C6-D1	3	"	"	12 Apr. 1985
	D2-E5	4	"	"	"
	(E6 empty)				
	F1-F3	5	"	"	July 1985
	F4-J3	6	"	"	"
	J4-K1	7	"	"	14 Dec. 1984
	K2-L1	8	"	"	"
	L2-L6	9	"	"	"
	M1-O3	9	"	"	12 Apr. 1985
	O4-Q2	11	"	"	"
	(Q3-R6 empty)				
	6	A1-F6	15	"	"
G1-L6		5	"	"	"
M1-N3		2	"	"	"
N4-N5		"	"	"	14 Feb. 1985
N6-O6		"	"	"	July 1984
P1-P2		"	"	"	14 Feb. 1985
P3		"	"	"	July 1984
P4		"	"	"	14 Feb. 1985
P5		"	"	"	July 1984
P6-Q2		"	"	"	14 Feb. 1985
Q3-Q4		"	"	"	July 1984
Q5		"	"	"	14 Feb. 1985
Q6-R2		"	"	"	July 1984
(R3-R6 empty)					
7	A-1	16	20 Mar. 1985	"	July 1984
	A2-B5	16	"	"	12 Apr. 1985
	B6-C5	18	"	"	"
	C6-D4	14	"	"	"
	D5-F6	19	"	"	"
	G1-G2	19	"	"	15 Dec. 1984
	(G3 empty)				
	G4-J5	17	"	"	July 1984
	(J6 empty)				
	K1-K4	15	"	"	14 Dec. 1984
	K5-L1	"	"	"	July 1984
	L2	"	"	"	14 Dec. 1984
	L3-L5	"	"	"	July 1984
	L6	"	"	"	14 Dec. 1984
M1-O3	13	"	"	14 Feb. 1985	
O4-P5	14	"	"	"	
(P6-R6 empty)					

Raceway	Bucket Row (letter) and Column (no.)	Clutch	Tagging Date		
			Internal Tag ^{a/}	Flipper Tag ^{b/}	Living-Tag ^{c/}
8	A1-F6	8	20 Mar. 1985	30 Apr. 1985	13 Feb. 1985
	G1-L6	10	"	"	11-12 Apr. 1985
	M1-R6	16	"	"	July 1984
<u>9e/</u>	A1-F6	19	"	"	14 Dec. 1984
	G1-L6	14	"	"	13 Feb. 1985
	M1-Q6	12	"	"	11 Apr. 1985
	(R1-R6 empty)				
<u>12f/</u>	A1-F6	11	19 Mar. 1985	"	12 Feb. 1985
	G1-L6	9	"	"	11 Apr. 1985
	M1-R6	7	"	"	15 Dec. 1984
13	A1-F6	13	"	"	9-10 Apr. 1985
	G1-L6	14	"	"	12 Feb. 1985
	M1-R6	19	"	"	16 Dec. 1984
14	A1-F6	6	"	"	July 1984
	G1-G4	3	"	"	"
	G5	"	"	"	16 Dec. 1984
	G6	"	"	"	July 1984
	H1-H2	"	"	"	16 Dec. 1984
	H3-I3	"	"	"	July 1984
	I4	"	"	"	16 Dec. 1984
	I5-J3	"	"	"	July 1984
	J4	"	"	"	16 Dec. 1984
	J5-K1	"	"	"	July 1984
	K2-K3	"	"	"	16 Dec. 1984
	K4-L2	"	"	"	July 1984
	L3	"	"	"	16 Dec. 1984
	L4-L6	"	"	"	July 1984
M1-R2	17	"	"	17-19 Apr. 1985	
(R3-R6 empty)					

a/ Binary-coded, magnetic metal tag inserted into the left front flipper.

b/ Monel tag inserted into the right front flipper.

c/ Applied to left costal scute 5.

d/ These turtles originally were placed in raceway 1. They were transferred to raceway 2 on 19 September 1984, maintaining the same bucket row and column location within raceway 2 as was the case in raceway 1.

e/ These turtles originally were placed in raceway 10. They were transferred to raceway 9 on 19 September 1984, maintaining the same bucket row and column location within raceway 9 as was the case for raceway 10.

f/ These turtles originally were placed in raceway 11. They were transferred to raceway 12 on 8 August 1984, maintaining the same bucket row and column location within raceway 12 as was the case for raceway 11.

Table 19. Scutes used for living-tags on head started Kemp's ridley sea turtles^{a/} of year-classes 1980 and 1982-1984, and those proposed for year-classes 1985-1995.

Scute	Year-Class														
	1980	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Left costal	1								TBA ^{b/}						
	2	87												TBA	
	3	unknown	432												
	4			192											
	5				1,067										
Right Costal	1							TBA							
	2	59 ^{c/}											TBA		
	3	122 ^{d/}													TBA
	4	1 ^{e/}								TBA					
	5					TBA									
Neural	1						TBA								
	2	4									TBA				
	3	4										TBA			
	4						TBA								
Left Humeral	98 ^{f/}														
Left Pectoral	94 ^{g/}														
Left abdominal	54 ^{h/}														

^{a/}Some of the turtles tagged were not released (see Tables 1, 2 and 20).

^{b/}TBA = numbers of living-tagged turtles to be arranged.

^{c/}45 of these also were listed as right costal 3 because they were living-tagged between scutes.

^{d/}45 of these also were listed as right costal 2 and 1 as right costal 4 because they were living-tagged between scutes.

^{e/}This also was listed as right costal 2 because it was living-tagged between scutes.

^{f/}Nine of these also were listed as left pectoral because they were living-tagged between scutes.

^{g/}Nine of these also were listed as left humeral because they were living-tagged between scutes.

^{h/}28 of these also were listed as left pectoral because they were living-tagged between scutes.

Table 20. Numbers of head started and living-tagged Kemp's ridley sea turtles of year-classes 1982-1984 released and retained in captivity.

Year-class	Released in the Gulf of Mexico	Retained in captivity
1982	432	25 ^a /
1983	190	2 ^b /
1984	1,017	50 ^c /

^a/These are being held in captivity for extended head starting and captivity breeding; there were 24 survivors as of 30 September 1985.

^b/These were stunted and were sent to Dr. Peter Lutz, Rosentiel School of Marine and Atmospheric Science, University of Miami, Florida, for study of effects of petroleum on sea turtles; there was 1 survivor as of 30 September 1985.

^c/These are being held in captivity for extended head starting and captive breeding; there were 49 survivors as of 30 September 1985.

Table 21. Clutches of the 1985 year-class of "imprinted" Kemp's ridley sea turtle hatchlings received from the NPS between 9 July and 7 August 1985.

Clutch identi- fication no.	Counts of Hatchlings by NMFS			Totals
	Live normal	Live deformed	Dead on arrival	
1	70		6	76
2	93			93
3	84	3		87
4	5			5
5	76			76
6	93	1	1	95
7	86			86
8	98			98
9	79	3		82
10	92			92
11	84		1	85
12	100			100
13	88	1		89
14	87			87
15	105			105
16	104			104
17	93			93
18	34			34
19	62			62
20	74			74
21 ^{a/}	69			69
Totals	1,676	8	8	1,692

^{a/}Clutch 21 was laid on 13 June 1985 at the Padre Island National Seashore. It is identified as clutch 0 in King et al. (1985).

Table 22. Adult female Kemp's ridley sea turtles and clutches of eggs from which hatchlings of the 1985 year-class were obtained for head starting at the Galveston Laboratory^{a/}.

Flipper tag nos. ^{b/}	Carapace length, cm	Clutch identification no.	Date eggs laid	No. eggs ^{c/}
T-00505	72.0	1	18 May	80
T-00652	74.0	2	19 "	99
T-00201 (T-00675)	-	3	20 "	95
T-00483	68.0	4	20 "	30
T-00484	66.0	5	20 "	96
T-00485	70.0	6	20 "	121
T-00665	68.0	7	20 "	104
T-00518	66.5	8	20 "	100
T-00928	68.0	9	20 "	87
T-00667 (T-00486)	73.0	10	22 "	107
T-00106 (G-4985)	71.0	11	28 "	121
T-00661 (T-00426)	72.0	12	29 "	103
T-00537	-	13	29 "	104
T-00526	68.0	14	30 "	91
T-00591 (C-0125)	71.0	15	30 "	114
T-00478	70.0	16	5 June	118
T-00454	76.0	17	8 "	110
T-00943	70.0	18	10 "	81
T-00711	71.5	19	11 "	80
T-00338	75.0	20	13 "	137
Unknown ^{d/}	-	21	13 "	97
Total				2,075

^{a/}Data provided by Robert King, NPS. Also see King et al. (1985; Table 2).

^{b/}Used by INP at Rancho Nuevo.

^{c/}Number of eggs incubated in each polystyrene box at the Padre Island National Seashore. It can be equal to or less than the number laid, because not all eggs laid by clutch were transferred to a box in every case. Also see King et al. (1985; Table 1).

^{d/}Padre Island nester. See Table 21, footnote a.

Table 23. Clutch histories of the 1985 year-class of "imprinted" Kemp's ridley sea turtle hatchlings received from the NPS between 9 July and 7 August 1985^{a/}.

Clutch identification no.	Dates		Incubation period, days ^{c/}	No. received
	Hatched	"Imprinted" ^{b/}		
1	3-5 July	8 July	46	76
2	4-6 "	8 "	46	93
3	4-8 "	8-9 "	45	87
4	9-10 "	11 "	50	5
5	6-7 "	9 "	47	76
6	5-8 "	8-9 "	46	95
7	4-7 "	8 "	45	86
8	5-7 "	8 "	46	98
9	7-10 "	9-11 "	48	82
10	8-10 "	11-13 "	47	92
11	16-18 "	19-20 "	49	85
12	16-18 "	18-20 "	48	100
13	18-23 "	23 "	50	89
14	19-21 "	22 "	50	87
15	18-23 "	22-23 "	49	105
16	22-26 "	26-28 "	47	104
17	27-29 "	29 July-1 Aug.	49	93
18	29-31 "	1-2 Aug.	49	34
19	30-31 "	1 "	49	62
20	1-5 Aug.	5-7 "	49	74
21	31 July-1 Aug.	1-2 "	48	69
Combined			45-50	1,692

^{a/}Data from King et al. (1985; Tables 1-3, 5).

^{b/}On the beach and in the surf at the Padre Island National Seashore.

^{c/}To first day of hatching.

Table 24. Arithmetic mean weight (g) and ranges in weight of Kemp's ridley sea turtle hatchlings of the 1985 year-class^{a/}.

Clutch identi- fication no.	Date weighed	No. hatchlings weighed	Arithmetic mean weight, g	Range in weight, g
1	8 July	76	13.4	11.6-17.1
2	8 "	93	17.5	15.8-19.5
3	8-9 July	87	17.9	14.6-19.6
4	11-July	5	15.3	14.4-16.3
5	9 July	76	16.0	14.2-17.4
6	8-9 July	95	16.0	11.9-17.6
7	8 July	86	15.5	13.4-17.3
8	8 "	98	15.2	12.7-17.0
9	9-11 July	82	16.0	14.6-17.4
10	11-13 July	92	14.8	12.7-16.0
11	19-20 July	85	16.2	14.1-17.9
12	18-20 July	100	14.6	12.2-17.8
13	23 July	89	17.3	14.6-18.9
14	22 July	87	16.1	13.5-18.2
15	22-23 July	105	15.0	12.5-16.9
16	26-28 July	104	15.3	13.0-16.8
17	29 July-1 Aug.	93	16.9	13.4-20.1
18	1-2 Aug.	34	13.7	8.6-17.1
19	1 Aug.	62	18.0	16.5-20.6
20	5-7 Aug.	74	13.0	12.0-17.5
21 ^{b/}	1-2 Aug.	69	15.3	12.4-16.6
Combined		1,692	15.7	8.6-20.6

^{a/}All weighed within a week of hatching. Data from King et al. (1985; Table 7 and Appendix II).

^{b/}Padre Island nester. See Table 21, footnote a.

Table 25. Dates for weighings and sample size for Kemp's ridley sea turtles of the 1985 year-classes.

Sample weighing sequence	Date ^{a/}	Sample size, total no. weighed
1 (hatchlings)	8 July-7 Aug. 1985 ^{b/}	1,692
2	29 Aug.	505
3	26 Sept.	"
4	24 Oct.	"
5	21 Nov.	"
6	19 Dec.	"
7	16 Jan. 1986	504
8	13 Feb.	"
9	13 Mar.	-
10	10 Apr.	-
11	8 May	-
12	27-30 May (prior to release)	all survivors
13	5 June ^{c/}	-

^{a/}Dates after 13 February 1986 are proposed dates.

^{b/}Data from King et al. (1985; Table 5).

^{c/}For any 1985 year-class survivors remaining in captivity on this date.

Table 26. Weights and measurements of "Oiliver," a Kemp's ridley sea turtle found stranded and oiled on West Galveston beach on 5 August 1984 and rehabilitated.

Date	Weight, kg	Carapace length, cm ^{a/}	Carapace width, cm ^{a/}	Remarks
6 Aug. 1984	1.1	22.0	19.2	
5 Oct.				Tagged with monel flipper tag NNP930
3 Jan. 1985	2.3			
28 Feb.	2.6			
8 Mar.		26.7	25.4	
28 "	2.7			
25 Apr.	2.8			
14 May	3.5			
30 Aug.	5.3			
10 Oct.	6.5			
21 Nov.	7.2			
19 Dec.	7.9			

^{a/}Straight line measure.

Table 27. Weights and measurements of "Bolivar," a hawksbill sea turtle, Eretmochelys imbricata, found on Bolivar Beach on 26 September 1984 and rehabilitated.

Date	Weight, kg	Carapace length, cm ^a /	Carapace width, cm ^a /	Remarks
26 Sept. 1984	0.9	19.0	14.2	
5 Oct.				Tagged with monel flipper tag NNP931
3 Jan. 1985	1.4			
28 Feb.	1.7			
19 Mar.		23.8	18.1	
28 "	1.9			
25 Apr.	2.1			
14 May	2.5			
30 Aug.	4.0			
10 Oct.	5.0			
21 Nov.	5.2			
19 Dec.	5.9			

^a/Straight line measure.

Table 28. Growth in weight of six head started olive ridley sea turtles (Lepidochelys olivacea) of the 1984 year-class received from Florida Department of Natural Resources^{a/}.

Date weighed	Weight, g	
	Arithmetic Mean	Range
28 March 1985	87.3	70-96
24 April	102.2	82-116
14 May	114.6	85-137

^{a/}Hatchlings were received from Ross Witham, FDNR, Jensen Beach, FL on 21 September 1984.

Table 29. Summary of head started Kemp's ridley sea turtle release sites, dates of releases, numbers of turtles released, and flipper tag series used, by year-classes.

Year- class	"Imprinting" location ^{a/}	Release site	Release date	No. released	Flipper tag series ^{b/}
1978	PINS	Sandy Key, FL	22 Feb. 1979	135	G----
	PINS	East Cape, FL ^{c/}	"	52	G----
	PINS	East Cape, FL	28 Feb. 1979	1	13582
	PINS	East Cape, FL	"	166	G----
	PINS	Sandy Key, FL	5 Mar. 1979	172	G----
	RN	Homosassa, FL	8 May 1979	751	G----, F----
	PINS	Homosassa, FL ^{c/}	"	628	G----, F----
	PINS	Padre Island, TX	7 July 1979	112	G----, F----
	RN	Padre Island, TX	"	1	G0985
	PINS	Homosassa, FL	3 June 1980	1	NNA260
1979	PINS	Homosassa, FL (offshore) ^{c/}	"	665	NNN----
	RN	Homosassa, FL (nearshore)	5 June 1980	66	NNA----
	PINS	Homosassa, FL (nearshore) ^{c/}	"	608	NNN----, NNA----
	PINS	Padre Island, TX	2 June 1981	5	K----
	PINS	Galveston, TX	28 Sept. 1981	1	J0096
1980	PINS	Padre Island, TX	2 June 1981	1,426	NNB----, K----
	PINS	Padre Island, TX	"	100	8001-8100 (Inconel)
	RN	Campeche, MX	3 Mar. 1981	197	NNB----, K----
1981	PINS	Padre Island, TX	2 June 1982	1,521	NNG----, NNH----
	PINS	Sabine Pass, TX	14 July 1982	118	NNG----, NNH----
1982	PINS	Padre & Mustang Islands, TX	7 June 1983	1,159	NNL----, NNM----
	PINS	Nueces Bay, TX	"	96	NNL----, NNM----
	PINS	Sabine Pass, TX	15 July 1983	69	NNL----, NNM----
	PINS	Mustang Island, TX	5 June 1983	1	NNM428
1983	PINS	Mustang Island, TX	"	172	NNQ----
	RN	Mustang Island, TX	"	18	NNQ----
1984	PINS	Padre & Mustang Islands, TX	21 May 1985	1,017	NNT----, NNV----
Total				9,258	

^{a/}PINS = Padre Island National Seashore;
RN = at Rancho Nuevo.

^{b/}Monel tags, unless noted otherwise. Each dash represents a numerical digit from 0-9; actual numerical series are not given because they were mixed. Details concerning the numerical series can be obtained from the NMFS SEFC Galveston Laboratory, 4700 Avenue U, Galveston, TX 77550.

^{c/}This release included turtles also tagged with radio-transmitters (see Klima and McVey 1981; Wibbels 1984).

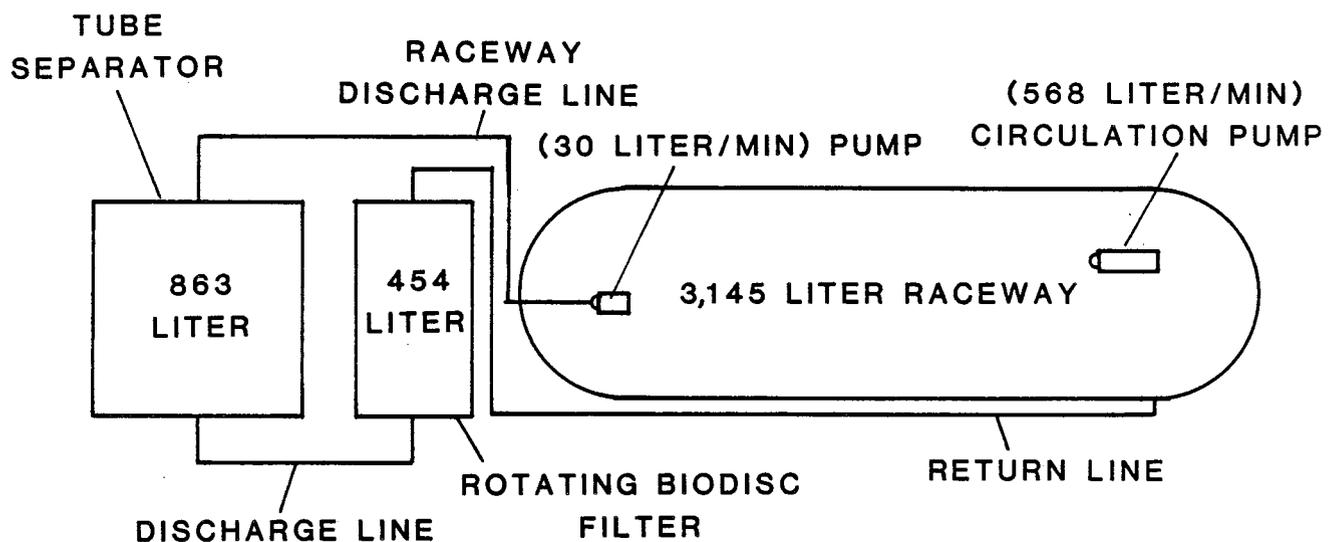


Figure 1. Schematic representation of test raceway 11 and associated water treatment equipment.

Appendix Table 1 (continued)

Block 2		Raceway 6						Raceway 7						Raceway 8						Raceway 9						Raceway 10					
Bucket Row	Column	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
A		15	15	15	15	15	15	4	16	16	16	16	16	8	8	8	8	8	8	7	7	7	7	7	7	19	19	19	19	19	19
B		15	15	15	15	15	15	16	16	16	16	16	10	8	8	8	8	8	8	7	7	7	7	8	8	19	19	19	19	19	19
C		15	15	15	15	15	15	19	19	19	19	19	19	8	8	8	8	8	8	8	8	8	8	8	8	19	19	19	19	19	19
D		15	15	15	15	15	15	19	19	19	19	19	19	8	8	8	8	8	8	8	8	8	8	9	9	19	19	19	19	19	19
E		15	15	15	15	15	15	19	19	19	19	19	19	8	8	8	8	8	8	9	9	9	9	9	9	19	19	19	19	19	19
F		15	15	15	15	15	15	19	19	19	19	19	19	8	8	8	8	8	8	9	9	9	9	9	9	19	19	19	19	19	19
G		5	5	5	5	5	5	19	19	19			10	10	10	10	10	10	9	9	9	9	9	9	14	14	14	14	14	14	
H		5	5	5	5	5	5						10	10	10	10	10	10	9	9	9	9	9	9	14	14	14	14	14	14	
I		5	5	5	5	5	5						10	10	10	10	10	10	9	9	9	9	9	9	14	14	14	14	14	14	
J		5	5	5	5	5	5						10	10	10	10	10	10	10	10	10	10	10	10	14	14	14	14	14	14	
K		5	5	5	5	5	5						10	10	10	10	10	10	10	10	10	10	10	10	14	14	14	14	14	14	
L		5	5	5	5	5	5						10	10	10	10	10	10	10	10	10	10	10	10	14	14	14	14	14	14	
M		2	2	2	2	2	2						16	16	16	16	16	16	10	10	10	10	10	10	12	12	12	12	12	12	
N		2	2	2	2	2	2						16	16	16	16	16	16	10	10	10	10	10	10	12	12	12	12	12	12	
O		2	2	2	2	2	2						16	16	16	16	16	16	10	10	10	10	10	11	12	12	12	12	12	12	
P		2	2	2	2	2	2						16	16	16	16	16	16	11	11	11	11	11	11	12	12	12	12	12	12	
Q		2	2	2	2	2	2						16	16	16	16	16	16	11	11	11	11	11	11	12	12	12	12	12	12	
R		2	2	2	2	2	2						16	16	16	16	16	16	11	11	11	11	11	11	12	12	12	12	12	12	

Appendix Table 1 (continued)

Block 3		Raceway 11						Raceway 12						Raceway 13						Raceway 14						Raceway 15					
Bucket Row	Column	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
A		11	11	11	11	11	11							13	13	13	13	13	13	6	6	6	6	6	6	11	11	11	11	11	11
B		11	11	11	11	11	11							13	13	13	13	13	13	6	6	6	6	6	6	11	11	11	11	11	11
C		11	11	11	11	11	11							13	13	13	13	13	13	6	6	6	6	6	6	12	12	12	12	12	12
D		11	11	11	11	11	11							13	13	13	13	13	13	6	6	6	6	6	6	12	12	12	12	12	12
E		11	11	11	11	11	11							13	13	13	13	13	13	6	6	6	6	6	6	12	12	12	12	12	12
F		11	11	11	11	11	11							13	13	13	13	13	13	6	6	6	6	6	6	12	12	12	12	12	12
G		9	9	9	9	9	9							14	14	14	14	14	14	3	3	3	3	3	3	12	12	12	12	13	13
H		9	9	9	9	9	9							14	14	14	14	14	14	3	3	3	3	3	3	13	13	13	13	13	13
I		9	9	9	9	9	9							14	14	14	14	14	14	3	3	3	3	3	3	13	13	13	13	13	14
J		9	9	9	9	9	9							14	14	14	14	14	14	3	3	3	3	3	3	14	14	14	14	14	14
K		9	9	9	9	9	9							14	14	14	14	14	14	3	3	3	3	3	3	14	14	14	14	14	14
L		9	9	9	9	9	9							14	14	14	14	14	14	3	3	3	3	3	3	14	14	14	14	14	14
M		7	7	7	7	7	7							19	19	19	19	19	19	15	15	15	15	15	15	14	14	14	14	14	14
N		7	7	7	7	7	7							19	19	19	19	19	19	15	15	15	15	15	15	14	14	14	17	17	17
O		7	7	7	7	7	7							19	19	19	19	19	19	15	15	15	15	15	15	17	17	17	17	17	17
P		7	7	7	7	7	7							19	19	19	19	19	19	15	15	15	15	15	15	17	17	17	17	17	17
Q		7	7	7	7	7	7							19	19	19	19	19	19	15	15	15	15	15	15	17	17	17	17	17	17
R		7	7	7	7	7	7							19	19	19	19	19	19	15	15	15	15	15	15	17	17	17	17	17	17

^a/Includes hatchlings that died between 24-27 July after having been received alive. Raceways 1, 3, 4, 6, 8, 10, 11, 13, and 14 were sectioned raceways and 2, 5, 7, 9, and 15 were spill-over raceways. There were not enough hatchlings to fill raceway 7 and none were left for raceway 12.

Appendix Table 2. Locations of living-tagged hatchlings of Kemp's ridley sea turtles of the 1984 year-class that had survived within raceways 3, 5, 6 and 14 until 9:00 am CDT on 25 July 1984 before the test of anti-biotic injections began (numbers in the table are clutch identification numbers).

Treatment	Saline only (Sham injection)						Ampicillin in Saline						Chloramphenical in Saline						Control (no injection)						
	Raceway 3 (Block 1)						Raceway 5 (Block 1)						Raceway 6 (Block 2)						Raceway 14 Block 3)						
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	
Bucket Row Bucket Column																									
A		4	4	4	4	4					1	1	15	15	15		15	15	6	6	6	6	6	6	
B	4			4		4		1	1	1		1	15	15	15	15		15		6				6	6
C	4	4		4	4		1	1	1	1	1	1	15	15	15	15		15	6	6	6	6	6	6	
D	4	4	4	4	4	4	1		2		2		15	15	15	15	15	15		6	6	6	6		
E	4		4	4	4	4	2	2	2	2			15	15	15	15			6	6	6	6		6	
F	4	4	4	4	4	4		2	2	2				15	15	15	15	15	6	6	6	6			
G	6		6	6	6	6	2	2	3	3		4	5	5	5	5	5	5		3	3			3	
H	6	6	6				4	4	4	4	4	4	5	5	5	5	5	5			3	3	3	3	
I		6	6		6	6	4	4	5	5	5	5	5	5	5	5	5	5	3	3	3		3	3	
J	6	6	6	6	6		5	6	6	6	6		5	5	5	5	5	5	3	3	3		3	3	
K	6	6	6	6	6	6	6	6	6	6	6		5	5	5	5	5	5	3			3	3	3	
L	6	6		6			6	6				15	5	5	5	5	5	5	3	3		3	3	3	
M	2	2		2	2	2	15	15	15	15	16	16	2			2		2	15	15	15	15		15	
N	2	2	2	2	2	2	16		16	16	16	16	2			2	2	2	15	15	15		15	15	
O	2		2	2	2	2	16	16	16	16	16	16	2	2	2	2	2	2			15	15	15	15	
P	2	2	2	2	2	2	16	16	16				2		2		2		15	15		15	15	15	
Q	2	2	2	2		2							2	2	2	2	2	2	15		15	15	15	15	
R	2	2	2	2	2	2							2		2			2	15		15		15	15	

Appendix Table 3. Redistribution of 19 clutches of Kemp's ridley sea turtle hatchlings of the 1984 year-class among and within raceways in preparation for the first feeding experiment (numbers in the table are clutch identification numbers) 2.

Block 1		Raceway 1 ^{b/}						Raceway 2						Raceway 3						Raceway 4						Raceway 5					
Bucket Row	Bucket Column	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
A		9	9	9	9	9	9							4L	4L	4L	4L	4L	4L	13	13	13	13	13	13	1	1	1	1	1L	1L
B		9	9	9	9	9	9							4L	4L	4L	4L	4L	4L	13	13	13	13	13	13	1L	1L	1L	1L	1L	1L
C		9	9	9	9	9	9							4L	4L	4L	4L	4L	4L	13	13	13	13	13	13	1L	1L	1L	1L	1L	3
D		9	9	9	9	9	9							4L	4L	4L	4L	4L	4L	13	13	13	13	13	13	3	4	4	4	4	4
E		9	9	9	9	9	9							4L	4L	4L	4L	4L	4L	13	13	13	13L	13	13	4	4	4	4	4	
F		9	9	9	9	9	9							4L	4L	4L	4L	4L	4L	13	13	13	13	13	13	5L	5L	5L	6L	6L	6L
G		8	8	8	8	8	8							10	10	10	10	10	10	11	11	11	11	11	11	6L	6L	6L	6L	6L	6L
H		8	8	8	8	8	8							10	10	10	10	10	10	11	11	11	11	11	11	6L	6L	6L	6L	6L	6L
I		8	8	8	8	8	8							10	10	10	10	10	10	11	11	11	11	11	11	6L	6L	6L	6L	6L	6L
J		8	8	8	8	8	8							10	10	10	10	10	10	11	11	11	11	11	11	6L	6L	6L	7	7	7
K		8	8	8	8	8	8							10	10	10	10	10	10	11	11	11	11	11	11	7	8	8	8	8	8
L		8	8	8	8	8	8							10	10	10	10	10	10	11	11	11	11	11	11	8	9	9	9	9	9
M		16L	16L	16L	16L	16L	16L							2L	2L	2L	2L	2L	2L	17L	17L	17L	17L	17L	17L	9	9	9	9	9	9
N		16L	16L	16L	16L	16L	16L							2L	2L	2L	2L	2L	2L	17L	17L	17L	17L	17L	17	9	9	9	9	9	9
O		16L	16L	16L	16L	16L	16L							2L	2L	2L	2L	2L	2L	17L	17L	17L	17L	17L	17L	9	9	9	11	11	11
P		16L	16L	16L	16L	16L	16L							2L	2L	2L	2L	2L	2L	17L	17L	17L	17L	17L	17L	11	11	11	11	11	11
Q		16L	16L	16L	16L	16L	16L							2L	2L	2L	2L	2L	2L	17L	17L	17L	17L	17L	17L	11	11				
R		16L	16L	16L	16L	16L	16L							2L	2L	2L	2L	2L	2L	17L	17L	17L	17L	17L	17L						

Appendix Table 3. continued

Block 2		Raceway 6						Raceway 7						Raceway 8						Raceway 9						Raceway 10 ^{C/}					
Bucket Row	Bucket Column	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
A		15L	15L	15L	15L	15L	15L	16L	16	16	16	16	16	8	8	8	8	8	8							19	19	19	19	19	19
B		15L	15L	15L	15L	15L	15L	16	16	16	16	16	18	8	8	8	8	8	8							19	19	19	19	19	19
C		15L	15L	15L	15L	15L	15L	18	18	18	18	18	14	8	8	8	8	8	8							19	19	19	19	19	19
D		15L	15L	15L	15L	15L	15L	14	14	14	14	19	19	8	8	8	8	8	8							19	19	19	19	19	19
E		15L	15L	15L	15L	15L	15L	19	19	19	19	19	19	8	8	8	8	8	8							19	19	19	19	19	19
F		15L	15L	15L	15L	15L	15L	19	19	19	19	19	19	8	8	8	8	8	8							19	19	19	19	19	19
G		5L	5L	5L	5L	5L	5L	19	19		17L	17L	17L	10	10	10	10	10	10							14	14	14	14	14	14
H		5L	5L	5L	5L	5L	5L	17L	17L	17L	17L	17L	17L	10	10	10	10	10	10							14	14	14	14	14	14
I		5L	5L	5L	5L	5L	5L	17L	17L	17L	17L	17L	17L	10	10	10	10	10	10							14	14	14	14	14	14
J		5L	5L	5L	5L	5L	5L	17L	17L	17L	17L	17L		10	10	10	10	10	10							14	14	14	14	14	14
K		5L	5L	5L	5L	5L	5L	15L	15L	15L	15L	15L	15L	10	10	10	10	10	10							14	14	14	14	14	14
L		5L	5L	5L	5L	5L	5L	15L	15L	15L	15L	15L	15L	10	10	10	10	10	10							14	14	14	14	14	14
M		2L	2L	2L	2L	2L	2L	15L	15L	13	13	13	13	16L	16L	16L	16L	16L	16L							12	12	12	12	12	12
N		2L	2L	2L	2	2	2L	13	13	13	13	13	13	16L	16L	16L	16L	16L	16L							12	12	12	12	12	12
O		2L	2L	2L	2L	2L	2L	13	13	13	14	14	14	16L	16L	16L	16L	16L	16L							12	12	12	12	12	12
P		2	2	2L	2	2L	2	14	14	14	14	14		16L	16L	16L	16L	16L	16L							12	12	12	12	12	12
Q		2	2	2L	2L	2	2L							16L	16L	16L	16L	16L	16L							12	12	12	12	12	12
R		2L	2L											16L	16L	16L	16L	16L	16L												

Appendix Table 3. continued

Block 3																																
		Raceway 11						Raceway 12 ^{d/}						Raceway 13						Raceway 14						Raceway 15						
Bucket Row	Bucket Column	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	
A							11	11	11	11	11	11	13	13	13	13	13	13	6L	6L	6L	6L	6L	6L								
B							11	11	11	11	11	11	13	13	13	13	13	13	6L	6L	6L	6L	6L	6L								
C							11	11	11	11	11	11	13	13	13	13	13	13	6L	6L	6L	6L	6L	6L								
D							11	11	11	11	11	11	13	13	13	13	13	13	6L	6L	6L	6L	6L	6L								
E							11	11	11	11	11	11	13	13	13	13	13	13	6L	6L	6L	6L	6L	6L								
F							11	11	11	11	11	11	13	13	13	13	13	13	6L	6L	6L	6L	6L	6L								
G							9	9	9	9	9	9	14	14	14	14	14	14	3L	3L	3L	3L	3	3L								
H							9	9	9	9	9	9	14	14	14	14	14	14	3	3	3L	3L	3L	3L								
I							9	9	9	9	9	9	14	14	14	14	14	14	3L	3L	3L	3	3L	3L								
J							9	9	9	9	9	9	14	14	14	14	14	14	3L	3L	3	3	3L	3L								
K							9	9	9	9	9	9	14	14	14	14	14	14	3L	3	3	3L	3L	3L								
L							9	9	9	9	9	9	14	14	14	14	14	14	3L	3L	3	3L	3L	3L								
M							7	7	7	7	7	7	19	19	19	19	19	19	17	17	17	17	17	17								
N							7	7	7	7	7	7	19	19	19	19	19	19	17	17	17	17	17	17								
O							7	7	7	7	7	7	19	19	19	19	19	19	17	17	17	17	17	17								
P							7	7	7	7	7	7	19	19	19	19	19	19	17	17	17	17	17	17								
Q							7	7	7	7	7	7	19	19	19	19	19	19	17	17	17	17	17	17								
R							7	7	7	7	7	7	19	19	19	19	19	19	17	17												

^{a/}As of 0830 hr, 22 August 1984, just prior to weighing the turtles.

^{b/}The turtles in raceway 1 were transferred to raceway 2 on 19 September 1984, maintaining the same bucket row and column location within raceway 2 as was the case in raceway 1.

^{c/}The turtles in raceway 10 were transferred to raceway 9 on 19 September 1984, maintaining the same bucket row and column location within raceway 9 as was the case for raceway 10.

^{d/}The turtles in raceway 12 originally were placed in raceway 11. They were transferred to raceway 12 on 8 August 1984, maintaining the same bucket row and column location within raceway 12 as was the case for raceway 11.

Appendix Table 4. Initial allocation of clutches 1-20 of Kemp's ridley sea turtle hatchlings of the 1985 year-class as of 27 August 1985. (Numbers in the table are clutch identification numbers)^{a/}.

Bucket Row Bucket Column	Raceway 1						Raceway 2						Raceway 3						Raceway 4						Raceway 5					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	6	6	6	6	6	6	8	8	8	8	8	8
A	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	6	6	6	6	6	6	8	8	8	8	8	8
B	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	6	6	7	7	7	7	8	8		8	8	8
C	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	7	7	7	7	7	7	8	8	8	8	8	8
D	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	7	7	7	7	7	7	8	8	8	8	8	8
E	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	7	7	7	7	7	7	8	8	8	8	8	8
F	1	1	1	1	1	1	2	2	2	2	2	2	3	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8
G	1	1	1	1	1	1	2	2	2	2	2	2	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8
H	1	1	1	1	1	1	2	2	2	2	2	2	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8
I	1	1	1	1	1	1	2	2	2	2	3	3	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8
J	1	1	1	1	1	1	3	3	3	3	3	3	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8
K	1	1	1	1	1	1	3	3	3		3	3	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8
L	1	2	2	2	2	2	3	3	3	3	3	3	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8
M	2	2	2	2	2	2	3	3	3	3	3	3	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8
N	2	2	2	2	2	2	3	3	3	3	3	3	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8
O	2	2	2	2	2	2	3	3	3	3	3	3	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	5	5
P	2	2	2	2	2	2	3	3	3	3	3	3	6	6	6	6	6	6	7	7	7		7	7	5	5	5	5	5	5
Q	2	2	2	2	2	2	3	3	3	3	3	3	6	6	6	6	6	6	7	7	8	8	8	8	5	5	5	5	5	5
R	2	2	2	2	2	2	3	3	3	3	3	3	6	6	6	6	6	6	8	8	8	8	8	8	5	5	5	5	5	5

Appendix Table 4 (continued)

Bucket Column	Row	Raceway 6						Raceway 7						Raceway 8						Raceway 9						Raceway 10					
		1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
A		5	5	5	5	5	5	9	9	9	9	9	9	10	10	10	10	10		12	12	12	12	12	12	13	13	13	13	13	13
B		5	5	5	5	5	5	9	9	9	9	9	9	10	10	10	10	10	10	12	12	12	12	12	12	13	13	13	13	13	13
C		5	5	5	5	5	5	9	9	9	9	9	9	10	10	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13
D		5	5	5	5	5	5	9	9	9	9	9	9	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13
E		5	5	5	5	5	5	9	9	9	9	9	9	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13
F		5	5	5	5	5	5	9	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13
G		5	5	5	5	5	5	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13
H		5	5	5	5	5	5	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13
I		5	5	5	5	5	5	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13
J		5	5	4	4	4	4	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13
K		4	9	9	9	9	9	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13
L		9	9	9	9	9	9	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	13	13	13	14	14	14
M		9	9	9	9	9	9	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	14	14	14	14	14	14
N		9	9	9	9	9	9	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	14	14	14	14	14	14
O		9	9	9	9	9	9	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	14	14	14	14	14	14
P		9	9	9	9	9	9	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	14	14	14	14	14	14
Q		9	9	9	9	9	9	10	10	10	10	10	10	12	12	12	12	12	12	13	13	13	13	13	13	14	14	14	14	14	14
R		9	9	9	9	9	9	10	10	10	10	10	10	12	12	12	12	12	12	13	13	13	13	13	13	14	14	14	14	14	14

Appendix Table 4 (continued)

Bucket Row Bucket Column	Raceway 11						Raceway 12						Raceway 13						Raceway 14						Raceway 15					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
A	14	14	14	14	14	14	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	19	19	19	19	19	19
B	14	14	14	14	14	14	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	19	19	19	19	19	19
C	14	14	14	14	14	14	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	20	20	20	20	20	20
D	14	14	14	14	14	14	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	20	20	20	20	20	20
E	14	14	14	14	14	14	15	15	15	15	15	15	16	16	16	16	16	16	18	18	18	18	18	18	20	20	20	20	20	20
F	14	14	14	14	14	14	15	15	15	15	15	15	16	16	16	16	16	16	18	18	18	18	18	18	20	20	20	20	20	20
G	14	14	14	14	14	14	15	15	15	15	15	15	16	16	16	17	17	17	18	18	18	18	18	18	20	20	20	20	20	20
H	14	14	14	14	14	14	15	15	16	16	16	16	17	17	17	17	17	17	18	18	18	18	18	18	20	20	20	20	20	20
I	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	18	18	18	18	18	18	20	20	20	20	20	20
J	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	18	18	19	19	19	19	20	20	20	20	20	20
K	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	19	19	19	19	19	19	20	20	20	20	20	20
L	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	19	19	19	19	19	19	20	20	20	20	20	20
M	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	19	19	19	19	19	19	20	20	20			
N	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	19	19	19	19	19	19						
O	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	19	19		19	19	19						
P	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	19	19	19	19	19	19						
Q	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	19	19	19	19	19	19						
R	15	15	15	15	15	15	16	16	16	16	16	16	17	17	17	17	17	17	19	19	19	19	19	19						

^a/Clutch 21, laid on 13 June 1985 at the Padre Island National Seashore, was allocated to the standing basins described by Fontaine et al. (1985).

Appendix Table 5. Sea turtle tissues and carcasses and other samples processed by Dr. Jorge K. Leong and staff and incinerated on 1 April 1985^a/.

Case No.	Species	Date Preserved
A. Miscellaneous		
M-83-1	<u>Caretta caretta</u>	19 May 1983
M-84-03	<u>Chelonia mydas</u>	18 May 1984
M-83-04	" "	1 August 1983
No Case No. 82-94	<u>Lepidochelys kempi</u> (3)	19 May 1983
No Case No. (large turtle from 1978 year-class; 31 jars with different body parts)	" "	14 June 1982
No Case No.	" " (M-148)	No Date
No Case No.	Unknown (T-1) (2)	No Date
No Case No.	Unknown (C-14) (2)	No Date
No Case No.	Unknown (14) (2)	No Date
No Case No.	Unknown (5-18) (6)	No Date
No Case No.	Unknown (5-17) (3)	No Date
No Case No.	Unknown (5-19) (3)	No Date
No Case No.	Unknown (C-15) (2)	No Date
83-77A	<u>L. kempi</u> (1)	13 May 1983
83-77A	" " (1)	9 June 1983
83-77B	" " (1)	10 June 1983
No Case No.	" " (J1968)	10 July 1981
No Case No.	Unknown	No Date
Sand Samples: CS# M-83-7/HA,HB, LA,LB,KC,GA,GD,GG,GJ,GE,GH,GK,GB,GL,GI,GF,KA		
Egg Specimens: CS# M-83-7/BB,BG, BH,BI,CB,CD,CA,BD,BG,BC,BF,JI,JE,JF,JH,JD,A,JB, B,C,JG,IA,JC,JA,BA		
B. 1977 Year-Class		
78-12	<u>C. caretta</u>	No Date
78-23	" "	No Date
78-09	" "	22 May 1978
78-27	" "	No Date
T-77-59	" "	20 October 1978
No Case No.	<u>L. kempi</u> (2)	No Date (for structural study)

Appendix Table 5. Continued

Case No.	Species	Date Preserved
C. 1978 Year-Class		
79-48	<u>L. kempi</u>	7 March 1979
78-107	"	No Date
79-67	"	No Date
79-49	"	No Date
78-89	"	7 December 1978
79-66	"	3 April 1979
?	?	13 February 1979
78-64	<u>L. kempi</u>	?
78-94	"	8 December 1978
78-38	"	4 November 1978
79-20	"	5 February 1979
78-89	"	?
78-87	"	?
78-71	"	?
78-85	"	?
No Case No.	"	21 May 1979
79-68	"	5 April 1979
79-66	"	3 April 1979
78-63	"	5 December 1978
78-36	"	1 November 1978
D. 1979 Year-Class		
79-155B	"	?
79-278	"	10 December 1979
80-21A	"	?
80-37	"	13 May 1980
79-260	"	19 November 1979
E. 1980 Year-Class		
81-11	"	2 March 1981
81-01	"	11 January 1981
81-36	"	13 August 1981
F. 1981 Year-Class		
81-76	"	2 October 1981
82-07	"	20 January 1982
82-24A	"	16 February 1982
82-25	"	17 February 1982
82-08	"	20 January 1982
82-09	"	21 January 1982
82-05	"	18 January 1982
82-55	"	18 March 1982

Appendix Table 5. Continued

Case No.	Species	Date Preserved
G. 1982 Year-Class		
82-152	<u>L. kempi</u>	2 November 1982
83-82B	"	1 August 1983
82-167	"	?
83-29	"	6 April 1983
83-17	"	28 February 1983
83-35B	"	4 April 1983
83-36	"	1 April 1983
83-65A	"	13 May 1983
83-19	"	21 March 1983
83-56B	"	7 July 1983
83-44	"	22 April 1983
83-15	"	6 July 1983
83-18	"	28 February 1983
83-63A	"	12 May 1983
83-84B	"	7 July 1983
82-159	"	3 December 1982
83-82B	"	28 July 1983
83-34	"	7 April 1983
83-81	"	?
83-43A	"	18 April 1983
83-12B	"	10 February 1983
83-21	"	14 March 1983
83-43B	"	18 April 1983
83-51	"	6 May 1983
83-50A	"	4 May 1983
C. 1983 Year-Class		
83-117	"	23 December 1983

a/See text footnote6/.