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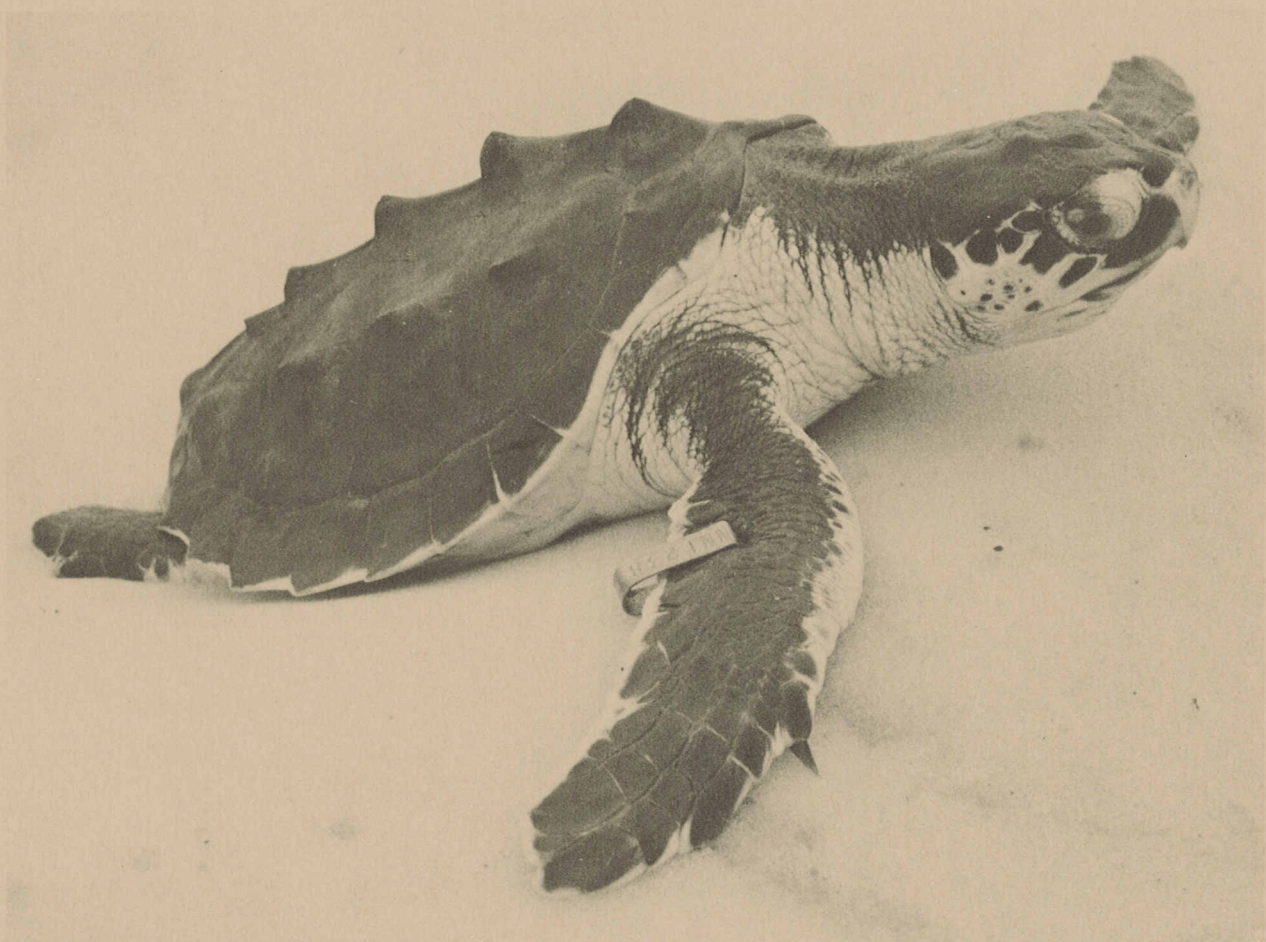

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National Oceanic and Atmospheric Administration
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Southeast Fisheries Center
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KEMP'S RIDLEY HEAD START AND SEA TURTLE RESEARCH AT THE GALVESTON LABORATORY: ANNUAL REPORT-FISCAL YEAR 1987

BY

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U. S. DEPARTMENT OF COMMERCE
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National Oceanic and Atmospheric Administration

National Marine Fisheries Service
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ABSTRACT

The National Marine Fisheries Service, Southeast Fisheries Center, Galveston Laboratory has increased its involvement in sea turtle research and conservation over the past years, beyond its work in head starting Kemp's ridley sea turtles (Lepidochelys kempi). The Kemp's Ridley Head Start Research Project completed its 9th year by rearing, tagging and releasing 1,630 turtles of the 1986 year-class. The release took place on 21 April 1987, off Padre Island, TX. This brought the total number to 12,422 head started turtles released into the Gulf of Mexico since the project began in 1978. Survival of the 1986 year-class while in captivity was 98.6%, the highest of any year-class reared to date.

In July 1987 1,282 hatchlings of the 1987 year-class were delivered to the head start facilities by the National Park Service, from the Padre Island National Sea Shore near Corpus Christi, Texas, where they had been incubated, hatched and "imprinted," following collection of the eggs at the Rancho Nuevo nesting beach. In August 1987, 160 Kemp's ridley hatchlings produced from the captive propagation experiments at Cayman Turtle Farm, (1984) Ltd., Grand Cayman, B.W.I., arrived at the facilities for head starting.

The Galveston Laboratory has expanded its sea turtle research to include participation in Sea Turtle Stranding and Salvage Network. Intensified and expanded beach sampling surveys are documenting strandings of sea turtles along the coasts of Texas and southwest Louisiana. Carcasses of stranded sea turtles are being necropsied to determine sex, reproductive development, food habits and possible cause of death. Debris and entanglement sampling surveys are being conducted in conjunction with STSSN activities.

Research on physiology, husbandry, pathology, is being conducted in cooperation with several universities in Texas and Louisiana.

INTRODUCTION

Kemp's ridley sea turtle (Lepidochelys kempi) is the most endangered of the sea turtles. During the 1987 nesting season, fewer than 600 nested at the principal nesting beach near the village of Rancho Nuevo, Tamaulipas State, Mexico, bordering the western Gulf of Mexico (Jack Woody, U.S. Fish and Wildlife Service, Albuquerque, NM, personal communication, September 1987). In June 1947, an estimated 40,000 nested there in a single day (Hildebrand 1963). An international program aimed at restoring the Kemp's ridley sea turtle population has been in effect since 1978 (Klima and McVey 1982; Woody 1986).

Among the goals of the international program is head starting the turtles in an attempt to establish a new nesting colony at the Padre Island National Seashore near Corpus Christi, TX. Phases of head starting include collecting, incubating, "imprinting" and hatching the eggs, "imprinting" the hatchlings, rearing the hatchlings in captivity for one year or less, and tagging and releasing the turtles into the wild (Klima and McVey 1982; Mrosovsky 1983; Caillouet 1984; Fontaine et al. 1985). Survival of the turtles during their critical first year of life in captivity is increased by head starting as compared to survival in the wild during the same period. The working hypothesis of the Kemp's ridley head start research project is that eggs and hatchlings become imprinted to their natal surroundings in such a way that when they reach sexual maturity they will return to copulate and nest at the same location (Owens, Grassman and Hendrickson 1982).

Each nesting season, biologists of the Instituto Nacional de la Pesca (INP) of Mexico, the U.S. Fish and Wildlife Service (FWS), and Gladys Porter Zoo collect eggs in plastic bags as females lay them at Rancho Nuevo. The eggs are placed in polystyrene foam boxes containing sand from the Padre Island beach, then transferred by aircraft to the National Park Service's (NPS) Padre Island National Seashore. There the eggs are incubated in a hatchery under the surveillance of NPS personnel. Upon emergence, hatchlings are taken by NPS personnel to the Padre Island beach

and allowed to crawl into the surf where they are scooped up in dip nets and placed in boxes. Hatchlings are then transferred to the National Marine Fisheries Service (NMFS), Southeast Fisheries Center (SEFC), Galveston Laboratory in Galveston, TX. After captive-rearing for 1 yr or less, most survivors in good health and condition are tagged and released into the Gulf of Mexico. Some are held longer than 1 yr at various cooperating oceanaria and universities, as "super head starts," then released into the wild (E. F. Klima, NMFS SEFC Galveston Laboratory, Personal communication, October 1986). Others have been retained as a captive brood stock at the Cayman Turtle Farm (1983), Ltd. and selected oceanaria.

ACCOMPLISHMENTS

As of September 1987, 12,422 Kemp's ridleys, representing year-classes 1978-1986, had been head started, tagged and released into the Gulf of Mexico (Table 1). Most had been "imprinted" as eggs and hatchlings to Padre Island, but some were "imprinted" to Rancho Nuevo (Klima and McVey 1982; Owens et al. 1982; Caillouet 1984; Fontaine and Caillouet 1985; Fontaine et al. 1985). Growth, migration and survival of the head started, tagged and released turtles have been determined from reports of their recapture or stranding[1/]. Sporadic nestings of Kemp's ridleys and obser-

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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 kempi) from year-classes 1978-1983. Manuscript submitted for publication in the Proceedings of the 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.

vations of a few hatchlings in the surf at Padre Island have been reported in 1985 and 1987 by the National Park Service. However, it is not known whether or not these events represented nestings of head started Kemp's ridleys.

A stock of captive-reared Kemp's ridleys has been established, in part to develop captive propagation as a "safety net" for the species (Caillouet 1984). Out of 264 captive-reared and tagged Kemp's ridleys distributed among the Cayman Turtle Farm, oceanaria and universities (Table 2), 107 ranging in age from 3 to 9 years old were alive as of 1 September 1987. This stock also provides "super head started" individuals for release, and provides opportunities for studies of tag retention/recognition, reproductive physiology, morphometry, etc. In spring 1986, a number of nests were laid by Kemp's ridleys at the farm, and viable hatchlings were produced in captivity for the first time. As of 1 September 1987, 33 of these, now yearlings, remained alive (James Wood, personal communication, September 1987). During spring 1987 seven Kemp's ridleys nested at the farm and 160 of the hatchlings that were produced were transferred to the Galveston Laboratory in August for head starting.

During fiscal year 1987, some of the facilities that are holding captive-reared Kemp's ridleys were visited. Even though organizations that received head started Kemp's ridleys agreed to written guidelines regarding their care and husbandry a number of problems associated with maintaining the captive stock of Kemp's ridleys at some of these locations were identified:

(1) failure to maintain seawater quality and sufficient space for the turtles;

(2) improper diet dominated by oily fish, leading to fatty degeneration of the liver, or in the worst case, steatitis, eventually leading to death;

(3) injuries caused by bites from other sea turtles, both interspecific and intraspecific;

(4) death caused by injuries from bites from larger turtles (e.g., loggerheads, Caretta caretta); and

(5) failure to maintain adequately high seawater temperature, resulting in fungal and other infections leading to death.

Much useful information has been gained from monitoring the captive stock. Distribution of turtles among the turtle farm, oceanaria and universities for maintenance of a captive stock has lessened the risks of their loss due to epidemic at any one location. When turtles show signs of sexual maturity (e.g., turtles at Sea-Arama Marineworld have dropped eggs into the water), they can be introduced to turtles from other clutches from other aquaria to minimize the probability of in-breeding. Such wide distribution also provides opportunities for research and for more persons to gain experience with Kemp's ridley care and husbandry and to educate the public of the need for sea turtle conservation.

A few head started Kemp's ridleys that were stunted, otherwise abnormal, incurably sick, or permanently handicapped by injuries have been used in research, transferred to other organizations, agencies or investigators, or euthanized (Fontaine et al. 1985).

Gonads and kidneys are routinely excised from Kemp's ridleys that die during head starting so that sex of these turtles can be determined histologically (Wibbels et al. 1985). This has provided NPS with information necessary to determine the relationship between incubation temperature and sex ratio in Kemp's ridley.

DNA analyses to determine the sexes of immature Kemp's ridley are ongoing in co-operation with the Center for Reproductive Biology, Collierville, TN. Of five female and three male Kemp's ridleys from which blood was sampled, four females were found to have a segment of DNA that was not present in the remaining four animals. Failing to find this small

segment of DNA in one of five known females could have been the result of a technical error. Though not conclusive, these results are encouraging. Testing more samples from known-sex Kemp's ridleys and refining the technique are in progress.

Two other cooperative studies were completed this year. The first, conducted by Dr. Ron Malone and his graduate students, Department of Civil Engineering, Louisiana State University, Baton Rouge, LA, involved development and testing of recycled sea water systems for head starting Kemp's ridleys. A modification of Dr. Malone's system will be tested in fiscal year 1988 as a prototype system at the sea turtle head start research facility. It couples maintenance of sea water quality through recycling with currents to provide exercise for the head started Kemp's ridleys. The second study, one of swimming speed and stamina in head started Kemp's ridleys, was conducted by Erich Stabenau, a graduate student in the Department of Wildlife and Fisheries Sciences, Texas A&M University. Data analysis is presently being conducted on the differences in performance of turtles reared in two types of containers (plastic buckets and plastic cartons) and exposed to various exercise regimen.

Participation in the Sea Turtle Stranding and Salvage Network (STSSN) resulted in rehabilitation of a few live-stranded sea turtles, including Kemp's ridleys and other species. After rehabilitation at the head start facilities, they were later tagged and released. Since fall 1985 an increased sampling effort along the upper Texas coast and southwest Louisiana coast by Galveston STSSN observers has resulted in the collection of carcasses of various species of sea turtles. Many of the carcasses are being necropsied to determine probable cause of death and to make biological observations and measurements. Surveys of beach debris and entanglement of marine animals in marine debris are being coupled with STSSN surveys in the same survey area. The debris-entanglement surveys are funded by the NMFS Northwest and Alaska Fisheries Center.

Over the years of head starting, preserved specimens of Kemp's ridley tissues were transferred to Dr. Elliott Jacobson, University of Florida, Gainesville, FL, and Dr. John Campbell, University of Texas at Arlington,

TX. Carcasses of Kemp's ridleys that died during head starting were sent to Dr. John Frazier, Smithsonian Institution, Washington, D.C., where they have been archived by the Curator of Reptiles, FWS, National Museum of Natural History, Washington, D.C.

HEAD START FACILITIES AND OPERATIONS

The head start research facilities have been described by Fontaine et al. (1985). One change this year was the use of plastic (milk) cartons along with buckets as rearing containers to determine which type of container is better for rearing turtles to 9-10 months of age. The cartons are fastened together with plastic bolts and nuts in units of 10 (two rows of five cartons), and their walls are lined with rigid, white plastic sheathing 3.2 mm thick. The cartons, 30.5 cm wide, 35.6 cm long and 24.1 cm deep, provide the turtles with more space for movement and growth than do the buckets.

1986 YEAR-CLASS

Hatchlings Received

Between 6-26 July 1986, 1,759 "imprinted" Kemp's ridley hatchlings representing 22 clutches were received from the NPS' Padre Island National Seashore (Caillouet et al. 1987a). None were dead on arrival. The incubating, hatching, "imprinting," packing and transporting operations were carried out by the staff at the National Seashore (Shaver et al. 1986).

All of the clutches came from eggs collected in the usual manner at the Rancho Nuevo beach. Though there were reports of several crawls and one nest excavation by Kemp's ridley at the National Seashore in 1986, egg laying was not reported (Shaver et al. 1986).

The eggs of the 1986 year-class were incubated at the National Seashore at warmer temperatures than in previous years (Shaver et al. 1986). If sex in Kemp's ridley is influenced by incubation temperature, as it is in other sea turtle species (Wibbels et al. 1985), then the proportion of females

should be higher in the 1986 year-class than in previous year-classes. Wibbels et al. (1985) found the 1982 and 1984 year-classes significantly male dominated and the 1978 and 1979 year-classes male dominated but not significantly so.

Distribution of Hatchlings Among the Raceways

As the clutches of hatchlings of the 1986 year-class were received, they were assigned more or less sequentially to the raceways from east to west (see Caillouet et al. 1987a, Appendix Table 1).

Schedule for Weighing and Measuring Turtles

All hatchlings of the 1986 year-class were weighed (see Caillouet et al. 1987a, Table 5) and measured (carapace length and width) at the National Seashore by NPS personnel between 6 and 26 July 1986. Thereafter, at the Galveston Laboratory, random samples of turtles (25 per raceway, 30 for raceways 3-8) were taken for weighings at approximately 28-day intervals and all surviving turtles were weighed and measured before the release (Table 3).

Foods and Feeding

The foods and feeding methods used in head starting Kemp's ridleys have been elaborated by Fontaine et al. (1985) and Caillouet et al. (1987b). The food used in head starting the 1986 year-class is a dry, floating, pelleted, diet manufactured by Purina, Richland, IN. It is the same diet used for rearing green sea turtles (Chelonia mydas) at the Cayman Turtle Farm (1983), Ltd. (James Wood, Cayman Turtle Farm, personal communication, August 1984).

Comparison of Rearing Containers

Among the major objectives of head starting is the production of yearlings that are in as good health and physical condition as possible, to enhance their survival in the wild. Turtles of the 1986 year-class reared in buckets outgrew their containers before the release. This was

probably due to improved food quality and control of seawater temperature. Regardless, it has become clear that the buckets are not large enough to hold fast-growing ridleys for more than 9 months. For this reason, buckets of the type used since 1978 as standard rearing containers were compared with larger, plastic (milk) cartons. The working hypothesis was that the larger cartons would provide the turtles more room for exercise so that they would be better fit physically than those reared in buckets.

Fewer plastic cartons than buckets can be placed in a raceway. A raceway can hold 80 cartons arrayed in 5 columns and 16 rows. The standard configuration of buckets in a raceway is 108 buckets arrayed in 6 columns and 18 rows. However, cartons have the added advantage that they can be temporarily partitioned into two compartments with a sheet of rigid plastic inserted diagonally. In this way, two hatchlings can be placed in one partitioned carton, and left there until they grow large enough to require another container. The partition can then be removed to allow more room for the remaining turtle. A raceway can hold 160 hatchlings in such partitioned cartons, as a convenience, until it becomes necessary to redistribute half of the turtles.

Raceways 3-8 in the east quonset hut were selected for an experiment whose objective was to compare buckets and cartons as rearing containers for Kemp's ridley. The raceways were grouped into two blocks (replications) of three raceways each in a randomized complete block design to test three treatments:

Treatment A - 54 buckets and 40 cartons.

Treatment B - 80 cartons

Treatment C - 108 buckets

Treatment C was considered to be the control, as it represented the standard method using 108 buckets per raceway. Response variables selected for comparisons among the treatments were growth, survival and biomass, but only the results for growth are included herein (Table 4). For raceways 4 and 6 containing Treatment A, the locations of the groups of buckets and cartons were randomized between south and north halves of each raceway, but the buckets were placed together as a group in the raceway as were the car-

tons.

Assignment of clutches to raceways representing treatment-block combinations was random with the proviso that some siblings from each selected clutch occurred in all three treatments within a given block. Also, assignment of numbers of turtles from a given clutch to buckets or cartons in the three raceways within a block was approximately proportional to clutch size (Caillouet et al. 1987a). The assumptions underlying this assignment procedure were (1) that larger clutches are healthier and more vigorous, perhaps coming from larger females and more successful hatches, and (2) that such clutches should be more heavily represented in the experiment than smaller clutches. Clutches assigned to Blocks 1 and 2 were not the same, so any difference detected between blocks could be due in part to clutch differences as well as raceway location or microenvironmental effects (i.e., clutch and block effects are confounded).

The experiment began on 7 August 1986, on the day that hatchlings from the selected clutches were transferred from their initial (temporary) locations to their reassigned locations within the experimental design (see Caillouet et al. 1987a, Appendix Table 1), and it ended on 10 April 1987.

An analysis of covariance of growth in weight was conducted, using the square root of turtle age (A, days) as a covariate and the logarithm of weight (W,g) as the dependent (response) variable. The analysis also tested for treatment and block effects. There were no significant differences (at the 95% level of confidence) between blocks or among treatments. There were significant regression effects represented by ln(W) vs $A^{1/2}$, representing growth, but the regression slopes did not differ significantly from one another.

Implications of the analysis are that buckets and cartons did not have a significantly different effect on growth rate. It appears that the higher costs of cartons and the reduced capacity (number) of turtles per raceway resulting from use of cartons cannot be justified on the basis of growth rate alone. However, the buckets obviously are more confining than cartons, especially toward the end of the head start period. This requires

that, for any given growth rate, the turtles must be released sooner if grown in buckets than if grown in cartons. This has practical significance with regard to choosing release dates.

Morphometric Studies

Students from the Department of Marine Biology, Texas A&M University at Galveston (TAMUG), TX, took weekly morphometric measurements on a group of 20 Kemp's ridleys selected from the 1986 year-class. Measurements included: plastron length and width, straight and curved carapace length and width, hind flipper length and width, and front flipper length and width. These measurements were taken to determine whether morphological changes were isometric or allometric, and whether or not this affected swimming performance, as part of the comparison of bucket and carton rearing methods.

Health Care

Health care for the head started turtles consisted of prophylactic and therapeutic measures developed from previous research and experience[2/] (Clary and Leong 1984; Fontaine et al. 1985). The Texas Veterinary Medical Diagnostic Laboratory System, College Station, TX conducted necropsies on some of the turtles that had died. Also during the year, a few turtles

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2/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. Manuscript submitted for publication in the Proceedings of the 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.

were provided medical treatment by Dr. Joseph Flanagan, DVM, of the Houston Zoo, Houston, TX. Usually turtles were treated for or had died from bacterial infections. Overall, the 1986 year-class exhibited few maladies, and survival to 21 April 1987 was 98.6%.

Environmental Variables

During head starting of the 1986 year-class of Kemp's ridley, seawater temperature, salinity and pH were usually monitored daily in raceways 1, 6, 10, 11 and 15, beginning 26 July 1986 and ending 20 April 1987. These measurements served as general guides to environmental conditions in the raceways. An analysis of variance was performed for each of the three variables, (temperature, salinity, pH) with factorial arrangement of the effects of raceway, month, and raceway by month interaction. Daily variations within months were lumped into "experimental error".

For temperature the two main effects and the interaction were highly significant ($P = 0.0001$). However, the effect of month was the strongest and the interaction the weakest contributor to overall variability. Monthly mean temperatures ranged from a high of 28.2°C in July 1986 to a low of 24.9°C in January 1987. Mean temperatures of the raceways ranged from 25.4°C to 26.6°C and reflected the location of the raceways in the quonset huts.

The effect of months was highly significant for salinity ($P = 0.0001$). The raceway effect and the interaction were not significant. The highest monthly mean salinity, 35.0 ppt, occurred in August 1986 and the lowest, 23.5 ppt, in January 1987.

For pH the raceway and month effects as well as the interaction were highly significant ($P = 0.0001$), with months contributing most to the overall variability and raceways contributing least. The highest monthly mean pH, 7.80, was in August 1986, and the lowest, 7.26, in February 1987.

The only environmental variable under our control was sea water temperature, yet none of the three environmental variables showed wide variation. The heating of the air in the quonset huts with forced-air heaters and the incoming seawater with immersion heaters during winter obviously stabilized the temperature in the raceways quite well.

Tags and Tagging

Tags were applied to all Kemp's ridleys of 1986 year-class that were healthy (Table 5). Types of tags included: inconel flipper tags, living-tags, and internal, binary-coded magnetic tags. Inconel flipper tags were applied to the trailing edge of the right front flipper. The flipper tag code series included PPK001-PPK999 and PPL001-PPL715. Living tags were applied to neural scute 4 (Caillouet et al. 1986). Binary-coded, magnetic tags were inserted into the distal end of the left front flipper.

Anyone encountering a tagged or marked Kemp's ridley should contact the NMFS SEFC Miami Laboratory, 75 Virginia Beach Drive, Miami, FL 33149 (Commercial telephone no. 305-361-4488, -4225, or -4487), or NMFS SEFC Galveston Laboratory, 4700 Avenue U, Galveston, TX 77550 (commercial telephone no. 409-766-3523, -3516, -3507, -3525). The location of the tag or mark, and measurements (straight line) of the carapace length and width, weight of the turtle, location, date and method of recapture, sighting or stranding should be reported to NMFS.

Release

On 21 April 1987, 1,630[3/] multi-tagged Kemp's ridleys of the 1986 year-class were packed into wax-coated, corregated cardboard boxes and transported by truck to the dock at the University of Texas' Marine Science Institute at Port Aransas, TX. The turtles were transferred to the University of Texas' research vessel LONGHORN and from there to the release site in the Gulf of Mexico about 12 nautical mi off Mustang Island (Table 7). All turtles were alive and appeared to be in good condition at the time of the release. In most cases, the turtles floated on the surface for a short time, then dove as has been observed in previous offshore releases.

[3/] 100 of the 1986 year-class were not released and are being held at the Galveston Laboratory for "super head starting" (Table 6).

SUMMARY OF KEMP'S RIDLEY SEA TURTLE RELEASES AND RECOVERIES

Table 7 summarizes the release sites, dates of releases, numbers released and flipper tag series used for releases of head started Kemp's ridleys of the 1978-1986 year-classes.

Of the 12,422 tagged Kemp's ridleys released, 533 had been recovered as of 1 September 1987 (Table 8). Most of these were from the 1982 year-class in which a number of turtles were oiled and washed ashore at Padre Island shortly after their release about 4 nautical mi offshore. The least recoveries were from the 1986 year-class which had been at sea only 4 months. Many of the 105 recaptures of the 1985 year-class were caught within the bays in which they were released, or in adjacent bays, shortly after the release.

Most of the recoveries have been in Texas (Table 9) near the release site (Table 7). Louisiana and Florida are second and third in recoveries, followed by North Carolina and South Carolina, respectively. A few head started tagged turtles have been recovered as far away as France and Morocco. Kemp's ridleys frequent the bays as shown by recovery locations in which 47% were from oceanside and 53% from bayside (Table 9).

In many cases (24.2%), the method of recovery has not been reported (Table 10). Of the reported methods of recovery, three dominated: stranded dead (24.6%), shrimp trawl (23.3%) and stranded alive (18.8%). Of the trawl-caught recoveries (Table 11), most were reported from Texas (50.8%) and Louisiana (27.4%). Table 12 shows the condition of the tagged sea turtles at the time of their recovery. More than half (58%) of the turtles were recovered alive and were reported to have been released back into the environment.

1987 YEAR-CLASS

Hatchlings Received

Between 6-23 July 1987, 1,282 "imprinted" Kemp's ridley hatchlings of the 1987 year-class were received from the NPS's Padre Island National Seashore (Table 13). These hatchlings were from 20 clutches collected in the usual manner from the Rancho Nuevo beach. Four were dead on arrival (Table 14).

Tables 15 and 16 give the origin, identification number and history of each clutch. The hatchlings were "imprinted," weighed (Table 17) and measured (carapace length and width) at the National Seashore by NPS personnel (Donna Shaver, National Park Service, Padre Island National Seashore, TX, personal communication, August 1987). The actual and proposed dates and sample sizes for weighings of Kemp's ridleys of the 1987 year-class are given in Table 18.

Appendix Table 1 shows the distribution of clutches among the raceways as of 10 September 1987, following reallocation from their initial sequential allocation among the raceways.

Captive Propagation

In 1987, seven Kemp's ridleys nested at the Cayman Turtle Farm. A total of 877 eggs were laid, producing 266 hatchlings. On 31 August 1987, 160 of 179 surviving hatchlings were imported to the head start facility. One was dead on arrival.

A quarantine shed was installed at the head start facility to hold the hatchling Kemp's ridleys from Cayman Turtle Farm. Green sea turtles (Chelonia mydas) at the Cayman Farm are known to be susceptible to several herpesviruses, but there is no evidence that Kemp's ridley at the farm contract such viruses. Nevertheless, plans to head start these turtles for 9-10 months include quarantine procedures. If no herpesvirus is evident in these turtles during the quarantine period, they will be tagged and released along with the 1987 year-class of head started Kemp's ridleys from Rancho Nuevo stock. The production of Kemp's ridley hatchlings at the

turtle farm and their export to the U.S. indicate that captive propagation is feasible.

All facilities holding captive Kemp's ridleys were contacted in fiscal year 1987 to obtain information on mating, attempted mating, or other courtship behavior. None of these behaviors were observed among the 1984 year-class captives. Of the five facilities holding 1982 year-class Kemp's, only Clearwater Marine Science Center, Clearwater, Florida, reported observing mating behavior; on 26 April a male was observed attempting to mount various other males and females. In March 1987, Jorge Fraga, Miami Seaquarium, Miami, Florida, observed a 1979 year-class male chasing and attempting to mount a 1978 year-class female.

Texas A&M University has also participated in captive propagation experiments by conducting reproductive physiology studies on the captive stock. Sea-Arama Marineworld, in conjunction with Dr. David Owens and David Rostel, Biology Department, Texas A&M University, made special efforts this year to prepare for Kemp's ridley captive propagation. Eight Kemp's ridleys of the 1978 year-class have been reared by Sea-Arama in isolation from each other since 1979. Therefore, the sea turtles had no opportunity for social or sexual interaction. For this reason, the turtles were introduced to each other in a controlled manner to allow a very detailed account of their behavior. Two females were put into a 14 ft (4.3 m) diameter circular tank 4 ft (1.2 m) deep (approximately 25,000 gal or 94.625 l), and allowed to acclimate for 1 hr before introducing a male. The male was observed for $2\frac{1}{2}$ hr, and his behavior toward the females was recorded as follows: investigation, attempt to mount, and mount. Analyses are in progress of different combinations of male and female behaviors in correlation with blood hormone assays, laparoscopy, and ultrasound scan of the reproductive system.

Loggerhead Sea Turtles

In July-August 1987, 124 hatchlings and 28 yearling loggerhead sea turtles (Caretta caretta) were received from the Florida Department of Natural Resources. Their growth and survival are being compared to those of Kemp's ridleys.

OTHER ACTIVITIES

By-Catch of Sea Turtles in Shrimp Trawls

Two sea turtle by-catch data files are being maintained at the Galveston Laboratory. One is a subset of the recovery data file for head started-tagged Kemp's ridleys and the other is a data file for wild turtles of all species.

As of 1 September 1987, 124 (23% of all recoveries) head started-tagged Kemp's ridleys had been caught in shrimp trawls. The recoveries were reported by shrimpers who caught the turtles or by port agents who knew of their capture. Most (70%) were reported as alive when caught and released. Texas and Louisiana led other states in capture of head started-tagged Kemp's ridleys in shrimp trawls.

The by-catch data file for non-head started turtles contains data on turtles caught and reported by shrimpers during 1986. Some of the turtles were reported during the 1986 Texas Closure. It was mandatory for shrimpers to report any turtles they caught during that time. There were 11 records of wild, trawl-caught sea turtles as of 17 June 1987: three loggerheads, five Kemp's ridleys, one hawksbill and two unidentified. All were reported as being alive when caught. Eight reportedly were released, two were held for rehabilitation, and the disposition of one turtle was not reported.

NMFS is implementing regulations effective in 1987-1989 requiring phased-in mandatory use of TEDs (Turtle Excluder Devices or Trawling Efficiency Devices) in offshore waters of the Gulf of Mexico and Atlantic coast to reduce by-catch and kill of sea turtles in shrimp trawls (USDOC, NOAA, NMFS 1987).

Sea Turtle Sightings

The Galveston Laboratory maintains a sea turtle sighting data file. A sighting is an event in which a sea turtle is seen, usually swimming at the surface. Sea turtle strandings or turtles caught in trawls are excluded from this file. Some of the sightings were reported by divers belonging to

dive clubs whose cooperation had been solicitated by Galveston Laboratory personnel. Other sightings were made by NMFS employees, and by boat operators, fishermen, and the general public who reported the sightings.

As of 13 July 1987, there were 27 sightings in the file. All sightings occurred in Texas and three species were represented: one leatherback, five loggerheads, and eight Kemp's ridleys. An additional 13 sightings were made, but no species identification was possible. Twenty-four of the turtles were alive, one was dead, and two reports did not indicate whether the turtles were dead or alive. Of the 27 sightings, 18 were associated with some sort of structure such as an oil platform, dock, shrimp boat, etc.

Sea Turtle Stranding and Salvage Network

The Galveston Laboratory expanded and intensified its participation in the NMFS SEFC's STSSN, with a focus on the coasts of Texas and southwest Louisiana. Increased strandings of sea turtles on these coasts in 1985 and 1986 provided the impetus. A statistically-based, stratified random, beach sampling survey was implemented in July 1986 to document sea turtle strandings and their causes. The entire Texas coast from the Rio Grande River to the Sabine River (excluding the Padre Island National Seashore covered by NPS, and the Wynn Ranch covered by FWS on Matagorda Island) and the southwest Louisiana coast from the Sabine River to the Mermentau River were surveyed twice per month. From January to August 1987, 145 sea turtles and 35 marine mammals had been found stranded in the survey area (Table 19). The FWS is cooperating with Mexico in carrying out a survey of sea turtles stranded on the upper gulf coast of Mexico.

Conducting beach surveys every two weeks increases the chances that stranded turtles are found before they get redistributed by tides, destroyed by decomposition and carrion feeders, or removed by man. The survey area is divided into segments or strata, each of which is traversed twice each month, using 4-wheel drive vehicles, 4-wheel all-terrain-vehicles, or dirt bikes, depending upon remoteness and accessibility. In addition, reports from the public concerning strandings are responded to

by STSSN participants who collect the data and salvage the specimens.

Reconnaissance surveys for sea turtle strandings were conducted within Matagorda Bay, Galveston Bay, Trinity Bay, and Sabine Lake, Texas and in Calcasieu Lake, Louisiana to determine feasibility of surveying sea turtle strandings in estuarine areas. Shallow draft boats were used for the estuarine surveys. Only one stranded sea turtle was found, represented by a Kemp's ridley skeleton on the shoreline of Trinity Bay.

Strandings of hundreds of sea turtles on beaches bordering the Gulf of Mexico each year are symptomatic of something radically wrong in the coastal ecosystem of which sea turtles are a part. Either man's at-sea activities or major changes in the biotic and abiotic conditions within the sea turtles's natural environment or both are stressing sea turtles and causing their mortalities. NMFS has concluded that one of the major causes of strandings is incidental capture and kill of sea turtles in shrimp trawls. NMFS, based on direct observations on commercial shrimp boats, has estimated incidental take and kill of thousands of sea turtles per year in the Gulf (Henwood and Stuntz, In press). Even those sea turtles that survive entrainment in shrimp trawls may be so weakened by the experience that they succumb to predators or are unable to surface and later die. Juvenile sea turtles frequent the estuaries and shallow nearshore zone, especially in warm months. There is some evidence, from stomach contents analysis of stranded animals, that the turtles may be pursuing crabs and shrimp as natural prey or scavenging on crustacean and finfish by-catch discarded by shrimpers or both.

Hook-and-line fishermen, both commercial and recreational, occasionally catch sea turtles, either as direct by-catch (hooking) or through entanglement in discarded monofilament line. Sea turtles are thought to be injured or killed by underwater explosions associated with petroleum platform severance and salvage operations. Ingestion of debris, especially plastics and tar balls, and collisions with boats or their propellers are additional causes of sea turtle injury and mortality, as are a number of other causes of minor significance.

Statistically-based beach sampling surveys not only provide a means of

quantifying the species, numbers, and sizes of stranded sea turtles, but also provide valuable information concerning life history and possible causes of sea turtle mortality. The temporal-spatial distribution and habitat selection of sea turtles can be surmised from strandings in combination with information on ocean currents, stomach contents, and sessile organisms (e.g., barnacles, etc.) growing on their shells. The landfall of stranded turtles depends upon location where turtles were injured or killed, and if killed, how long it takes the carcass to swell with gas and float as well as the direction and speed of prevailing surface currents.

Sea turtle carcasses are collected and necropsied to determine probable cause of death, sex, reproductive development and food habits. A total of 49 necropsies had been performed as of 30 September 1987. Stomach contents were removed from 40 animals and the gonads were removed from 31 specimens.

Necropsies were performed on 20 turtles in 1986 (Oct. 1-Dec. 31) and stomach contents were taken from all 20. Gonads were removed from 17 turtles.

Necropsies were performed on 29 turtles in 1987 (Jan. 1-Sept. 30) with stomach contents removed from 20 of these and gonads were removed from 14. Stomach contents from six loggerheads examined contained Libinia, Hepatus and Persephona crabs, assorted shell parts, wood and plastic. Three Kemp's ridley stomachs contained Osteichthys, Diopatra, assorted shell parts, Insecta, Hydrozoa, Nassarius and unknown pieces.

After necropsy, some carcasses are saved for later curation for scientific and educational purposes and public display. For example, the long bones of sea turtles may be useful to studies of age and growth (Zug, Wynn and Ruckdeschel 1986). Damaged or mutilated skeletons are examined to determine causes of injury and death, and to confirm species identification. The carcasses are also of taxonomic value.

Systematic sampling surveys of sea turtle strandings are essential in evaluation of conservation and management measures such as the NMFS' implementation of mandatory use of TEDs, regulations concerning petroleum platform severance through Section 7 Consultation (under the Endangered Species Act, ESA) with Minerals Management Service (MMS), petroleum companies and

their salvage contractors, and Section 7 Consultations concerning the impacts of U.S. Army Corps of Engineer's dredge-fill projects.

Debris and Entanglement

Galveston Laboratory staff served on the Texas Coastal Cleanup Steering Committee sponsored by the Center for Environmental Education (CEE), and coordinated stranding, salvage and entanglement-debris survey activities with the Texas General Land Office's "Adopt-a-Beach" and "Don't Mess With Texas Beaches" programs, as well as with an assortment of similar cleanup programs involving coastal Counties, Municipalities and Conservation organizations. Rotting carcasses of sea turtles, marine mammals, finfishes, etc. on heavily trafficked public beaches pose unique "debris" problems and require special kinds of cleanup methods. Carcasses of sea turtles, etc. in the marine environment can be considered pollutants. On occasion, curious beachgoers mutilate the carcasses to obtain skulls or shells as souvenirs in violation of the ESA, and at the same time risk exposure to potential health hazards. Marine animals that ingest galley garbage dumped at sea may inadvertently become vectors of communicable diseases. Municipal or County beach cleanup crews may also be in violation of the ESA and Marine Mammal Protection Act when ridding the beaches of sea turtle and marine mammal carcasses. From the point of view of coastal tourism, the decaying bodies of sea turtles, etc. represent unsightly nuisances that cause negative economic impacts, along with the tar and debris that accumulate on the beaches.

Sea Turtle Rehabilitation

Live stranded sea turtles were collected, rehabilitated, tagged and returned to their natural habitat or transferred to oceanaria. Six live stranded sea turtles were rehabilitated this fiscal year. Rehabilitation gives sea turtle biologists and cooperating veterinarians further experience in medical treatment and rehabilitation of live-stranded sea turtles.

"Bolivar", a hawksbill sea turtle (Eretmochelys imbricata) found

stranded and entangled in sargassum weed high on the beach 5 mi east of the Bolivar ferry landing on 26 September 1984 (Caillouet et al. 1986), was rehabilitated and released into the Gulf of Mexico on 23 September 1986 near a Buccaneer Oil Field platform. Bolivar was found alive on the west Galveston beach 6 days after its release, and was again maintained at the Galveston Laboratory before being transferred to Sea-Arama Marineworld of Galveston. Table 20 gives weights, measurements, flipper tag number and other information concerning Bolivar by date.

Media coverage of major stranding events and activities of the STSSN provided greater public awareness of the plight of sea turtles and the need for their conservation.

Public Outreach

The head start facility received over 5,900 visitors this past year. HEART held its annual open house in February 1987 and over 1,000 people visited the head start facility in one day. The Galveston Laboratory held its annual open house in May 1987, and 260 visitors toured the head start facility. Other outreach activities included slide presentations at various schools, adult organizations and nature clubs. Numerous packets of information on sea turtles were sent to interested persons.

CHANGES IN DIVISION STAFF

The current permanent staff of the Life Studies Division working on sea turtles includes:

Charles Caillouet
Marcel Duronslet
Clark Fontaine
Sharon Manzella
Dickie Revera
Theodore Williams

Throughout the fiscal year a number of temporary staff members resigned: Pamela Howes and Kathy L. W. Indelicato of the head start staff, and John Stacy and Sherman Jones of the STSSN. The current temporary staff of the division working on sea turtles includes:

STSSN

Andre Landry
Erich Stabenau
Kerry Stanley
Robert Heinley
Pam Plotkin
Rosemary Breedlove
Robert Barber
Mervin Doucet
Mike Pena
Mark King
Matthew Dickinson

HEAD START

Billy Ross
George O'Donohoe
George Wyatt
Joanne Williams
Valerie Graves
Bridgette Davidson

PUBLICATIONS AND REPORTS IN FISCAL YEAR 1987

PUBLICATIONS

Caillouet, C. W., Jr., C. T. Fontaine, T. D. Williams, S. A. Manzella, A. A. Landry, Jr., K. L. Indelicato, M. J. Duronslet and D. B. Revera. 1987. Can we save Kemp's ridley sea turtle? Believe it or not! Paper accepted for publication in Proceedings of the 10th Annual International Herpetological Symposium on Captive Propagation and Husbandry of Reptiles and Amphibians, held 25-28 June 1986, in San Antonio, TX.

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puter digitization and comparison of dermatoglyphic patterns of the foreflipper. A paper presented at the 7th Annual Sea Turtle Workshop, Wekiwa Springs, FL, 25-27 February 1987.

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The Kemp's ridley eggs from year-classes 1986 and 1987 were made available to the NPS through the efforts of Rene Marquez M. (INP, Mexico), Jack Woody (FWS, Albuquerque, NM), Pat Burchfield (Gladys Porter Zoo, Brownsville, Texas), and their staffs. The efforts of Dr. Milford Fletcher (NPS, Santa Fe, NM), Bill Lukens, Jenny Bjork, Donna Shaver and staff (NPS, Corpus Christi, Texas) in incubation, hatching and "imprinting" phases were appreciated.

HEART (Help Endangered Animals - Ridley Turtles), a non-profit, special committee of the Piney Woods Wildlife Society of North Harris County College, Houston, TX, chaired by Mrs. Carole Allen, provided the food for the 1986 and 1987 year-classes, and continued to lend the Galveston Laboratory an electronic balance for weighing turtles. HEART received donations totaling $18,442.58 during fiscal year 1987 in support of Kemp's ridley research and conservation. Included among the donors were Exxon Company USA, Pel-Tex Oil & Gas, Piney Woods Wildlife Society, and the general public. Additional funds were pledged toward construction of the new Kemp's ridley rearing facility.

We thank Dr. Robert Jones, Director, University of Texas, Marine Science Institute, Port Aransas, TX, who provided the R/V LONGHORN for the

offshore release in April 1987. The assistance of Dr. Anthony Amos, LONGHORN Captain Don Gibson and his crew, and Carole Allen and Donna Shaefer of HEART in the release also is appreciated.

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Mr. William Schaaf, Southeast Packing Company, Galveston, TX, provided temporary frozen storage for sea turtle food when our freezers were inoperable.

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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/].

"Imprinted" Hatchlings Received					Tagged Turtles[b/]					
			No.		Held back[c/]		Released		Recovered	
Year-class	Inclusive dates	"Imprinting" location	Alive	Dead	No.	%	No.	%	No.	%
1978	6 July-3 August	PINS[d/]	1,854	1	41	2	1,267	68	50	4
	11 August	RN[e/]	1,226	0	1	<1	752	61	25	3
			3,080	1	42		2,019	65	75	4
1979	26 June-23 July	PINS	1,656	2	66	4	1,279	77	21	2
		RN	187	1	100	53	66	87	0	0
			1,843	3	166	9	1,345	73	21	2
1980	24 June-14 July	PINS	1,608	4	0		1,526	95	81	5
	7 July	RN	207	3	0		197	95	5	3
			1,815	7	0		1,723	95	86	5
1981	24 July-22 August	PINS	1,864	1	0		1,639	88	51	3
1982	6 July-16 August	PINS	1,524	0	28	2	1,325	87	156	12
1983	8 July-12 August	PINS	230		2	<1	172	75	10	6
	8 July	RN	20		0		18	90	1	6
			250	0	2	<1	190	76	11	6

Table 1. (continued).

"Imprinted" Hatchlings Received					Tagged Turtles[b]					
			No.		Held back[c]		Released		Recovered	
Year-class	Inclusive dates	"Imprinting" location	Alive	Dead	No.	%	No.	%	No.	%
1984	24 July-27 July	PINS	1,441	106	61	4	1,017	71	23	2
1985	9 July-7 August	PINS	1,684	8	12	1	1,534	91	102	7
1986	6 July-26 July	PINS	1,759	0	100	6	1,630	93	8	<1
1987	6 July-23 July	PINS	1,278	4						
1978-1987		PINS	14,898	126	310	2	11,389	76	502	4
1978-1985		RN	1,640	4	101	6	1,033	63	31	3
Total			16,538	130	411	2	12,422[f]	75	533	4

[a] As of 1 September 1987.

[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 captive propagation experiments, but some kept beyond 1 year at the Galveston Laboratory; also includes some abnormal individuals transferred to other investigators or oceanaria.

[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 propagation and "super head starting," 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	Identifying physical characteristics and noteworthy events
					Tag code	Tag location[e]			
1978	Sea-Arama Marine World, Galveston, TX	Unknown	2520 (NNA269)	None	None		F*	Feb. 1980	Right front flipper missing
			2514 (NNA240)	"	"		M*	"	
			2512 (NNA230)	"	"		F*	"	
		"	2511 (NNA262)	"	"		F*	"	
			2510 (NNA243)	"	"		M*	"	
		"	2509 (J0051)	"	"		F*	"	
			2508 (NNA270)	"	"		F*	"	
		"	2507 (J0089)	"	"		M*	"	
1978	Miami Seaquarium Miami, FL	Unknown	NNK015	NS-5	"		M	22 Feb 79	Died June 1986
		"	NNK021	None	"		M	"	Died 8 July 1986
		"	NNK003	None	"		M	"	Died 1 July 1986
		"	NNK017 (NNK001)	RCS-3	"		M	"	Died 19 June 1986
		"	J1939	None	"		M	"	Died 1 July 1986
		"	AAL008 (NNR464)	LCS-3	No		F	"	
1979	Miami Seaquarium, Miami, FL	"	No Tag (unknown)	None	"		M	17 Sept. 1979	Right front flipper missing & notch on right edge of carapace

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: Tag code	Internal, binary-coded magnetic tag: Tag location[e]	Sex[f]	Relocation Date	Identifying physical characteristics and noteworthy events
1979	Cayman Turtle Farm (1983), Ltd., Grand Cayman, BWI	Unknown	1325 (NNA301)	None	"		M	4 July 1980	Died between 9/1986-9/1987
		"	1330 (NNA302)	"	"		M	"	
		"	1320 (NNA305)	"	"		F	"	Died between 9/1985-9/1986
		"	1332 (NNA312)	"	"		M	"	
		"	1323 (NNA317)	"	"		F	"	
		"	1353 (unknown)	None	None		F	"	Nested 1986 & 1987
		"	1349 (NNA373)	"	"		F	"	Nested 1986 & 1987
		"	1354 (unknown)	"	"		F	"	
		"	1355 (NNA380)	"	"		F	"	
		"	1331 (NNA383)	"	"		M	"	
		"	1322 (NNA386)	"	"		M	"	
		"	1345 (NNA387)	"	"		M	"	
		"	1356 (unknown)	"	"		M	"	
		"	1341 (NNA392)	"	"		M	"	
		"	1352 (NNA393)	"	"		M	"	Died between 9/1986-9/1987
		"	1348 (NNA394)	"	"		M	"	
		"	1326 (NNA397)	"	"		M	"	
		"	1324 (NNA319)	"	"		F	"	Nested 1986 & 1987
		"	1370 (NNA320)	"	"		F	"	Nested 1986 & 1987
		"	1318 (NNA322)	"	"		F	"	Nested 1986 & 1987
		"	1344 (unknown)	"	"		F	"	
		"	1327 (NNA326)	"	"		M	"	
		"	1336 (NNA331)	"	"		F	"	Nested 1984, 1986 & 1987
		"	1358 (NNA332)	"	"		M	"	Nested 1984
		"	1359 (NNA347)	"	"		F	"	Died between 9/1986-9/1987
		"	1360 (NNA349)	"	"		M	"	
		"	1339 (NNA350)	"	"		F	"	Nested 1987
		"	1357 (NNA353)	"	"		M	"	Died between 9/1985-9/1986
		"	1338 (NNA357)	"	"		M	"	
		"	1329 (NNA361)	"	"		F	"	
		"	1346 (NNA365)	"	"		M	"	
		"	1337 (NNA367)	"	"		M	"	
		"	1347 (NNA368)	"	"		M	"	
		"	1342 (NNA371)	"	"		F	"	Escaped between 14/5/84-1/9/85

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: Tag code	Internal, binary-coded magnetic tag: Tag location[e]	Sex[f]	Relocation Date	Identifying physical characteristics and noteworthy events
1982	Clearwater Marine Science Center, Clearwater, FL	9	NNK779/(NNM107)	None	D_1-2; D_2-20	RFF	M	9 Nov. 1983	
		12	(NNM251)/NNK708	"	" -33	RFF	M	"	
		9	NNK779/(NNM155)	"	" -21	"	F	"	
		12	NNK710/(NNM711)	"	" -32	"	F	"	
		10	No tag/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[g]	Cayman Turtle Farm (1983), Ltd., Grand Cayman, BWI	6	1361 (NNK009)	"	" -68	"	F	10 Jan. 1986	
		19	1362 (NNM576)	"	" -42		F	"	
		8	1363 (NNK008)	"	" -40	"	F	"	
		11	1364/(NNK001)	None	" -41	"	F	"	
		7	No tag (NNM010)	LC-3	" -64	"	M	"	Dead on arrival from Key West, FL on 16/1/1986
1982[h]	Sea-Arama Mrineworld, Galveston, TX	5	NNL666	"	" -1	"	M	27 Aug. 1987	
		15	NNM703	LC-3	" -18	"	M	"	
		16	No Tag (NNM790)	"	" -17	"	M	"	
		18	No tag (NNM872)	LC-3	" -10	"	F	"	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: Tag code	Internal, binary-coded magnetic tag: Tag location[e]	Sex[f]	Relocation Date	Identifying physical characteristics and noteworthy events
1982[i]	Theater of the Sea, Islamorada, FL	5	NNW568/(NNL683)	None	D_1-2; D_2-69	RFF	M	16 Apr. 1985	
		10	NNW569/(NNK012)	LC-3	" -36	"	F	"	
		8	NNW563/564	LC-3	" -37	"	M	"	
		7	NNW565/566	None	" -65	"	M	"	
		6	NNW567/NNK027	"	" -66	"	F	"	
1984[j]	Audubon Park Zoo New Orleans, LA	17	AAL878/(NNT996)	"	" "	RFF, RRF	?	27 Aug. 1987	
		"	AAL877/(NNT998)	"	" "	"	"	"	
		"	AAL876/(NNV020)	"	" "	"	"	"	
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	NNV016	"	" "	RFF, RRF	"	28 June 1985	
		"	NNV019	"	" "	"	"	"	
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: Tag code	Internal, binary-coded magnetic tag: Tag location[e]	Sex[f]	Relocation Date	Identifying physical characteristics and noteworthy events
1984	North Carolina Marine Resources Center, Kure Beach, NC	8	NNT069	LC-5	D_1-2; D_2-72	RFF	?	30 July 1985	
		"	NNT070	"	"	"	"	"	
		"	NNT078	"	"	"	"	"	
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[k]	Sea Turtle, Inc., South Padre Island, TX	9	NNT004	"	"	RFF	"	1 Aug. 1985	Died 26/9/1986
		"	NNT087	"	"	"	"	"	Died June 1986
		"	NNT097	"	"	"	"	"	Released 21/4/1987
1984	Sea World of Florida, Orlando, FL	2	AAL826/(NNT136)	"	"	"	"	2 July 1985	
		"	AAL827/(NNT140)	"	"	"	"	"	Died 2/7/1987
		"	NNT142	"	"	"	"	"	Died 13/7/1985
		"	AAL828/(NNT147)	"	"	"	"	"	
		"	AAL829/(NNT155)	"	"	"	"	"	
1984	Cayman Turtle Farm (1983), Ltd., Grand Cayman, BWI	13	NNT196	"	"	RFF, LFF	"	16 Jan. 1986	
		"	NNT244	"	"	"	"	"	
		"	NNT245	"	"	"	"	"	

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	Identifying physical characteristics and noteworthy events
					Tag code	Tag location[e]			
1984	Cayman Turtle Farm (1983), Ltd., Grand Cayman, BWI	13	NNT251	LC-5	D_1-D2; D_2-72	RFF, LFF	?	16 Jan. 1986	
		"	NNT253	"	"	"	"	"	
		11	NNT207	"	"	"	"	"	
		"	NNT227	"	"	"	"	"	
		"	NNT233	"	"	"	"	"	
		"	NNT238	"	"	"	"	"	
		"	NNT254	"	"	"	"	"	
		"	NNT257	"	"	"	"	"	
		"	NNT259	"	"	"	"	"	
		"	NNT260	"	"	"	"	"	
		"	NNT262	"	"	"	"	"	
		"	NNT290	"	"	"	"	"	
1985[1]	Marine Land, Inc. St. Augustine, FL	7	NNX021	RC-5	D_1-D_2; D_2-73	RFF	"	7 Jan. 1987	Died 1/2/1987
		7	NNX380	"	"	"	"	"	Died 8/2/1987
		8	NNX439	"	"	"	"	"	Died 30/1/1987
		8	NNX494	"	"	"	"	"	
		5	NNX524	"	"	"	"	"	Died 22/2/1987
		5	NNX533	"	"	"	"	"	Died 3/2/1987
		10	NNX679	"	"	"	"	"	Died 19/2/1987
		10	NNX797	"	"	"	"	"	Died 20/1/1987

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

[b]/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.

Table 2. (continued).

c/Numbers preceeded by three letters represent monel flipper tags applied by NMFS. 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 studies 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 the studies. 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 a front flipper near the distal end of the humerus, and centered in the dorsal aspect of a rear flipper. 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 Miami Seaquarium was determined by an external, secondary sex characteristic (tail length), and by testosterone levels in blood samples taken by Dr. David 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. Owens on 10 July 1984. A question mark (?) in this column indicates that sex has not been determined.

*Sex of the 1978 year-class at Sea-Arama Marineworld was verified by Dr. Owens by laparoscopic examination (indicated by a single asterisk (*) in this column.

g/These five turtles were transferred to Cayman Turtle Farm (1983), Ltd. from Key West Municipal Aquarium, Key West FL, on 16 January 1986. They had been at Key West Municipal Aquarium since 9 November 1983. One was dead on arrival at the Cayman Turtle Farm (Original Tag NNM010).

h/These five turtles had been at Marine Life Park, Gulfport, Mississippi, since 6 February 1984.

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

j/These three turtles were returned to the NMFS Facility, Galveston, Texas on 31 July 1986, where they remained until transferred to Audubon Park and Zoological Gardens, New Orleans, LA, on 27 August 1987.

Table 2. (continued).

k/Two turtles transferred back to NMFS Galveston 25 September 1986. Remaining turtle released 21 April 1987.

l/These eight turtles were tagged with Passive Integrated Transponder (PIT) tags in the left fore flipper 1 July or 11 Nov. 1986. They were transferred to Marine Land, Inc. on 7 January 1987 to be held for an indefinite period for evaluation of the PIT Tag. The animals suffered cold shock with subsequent fungal and bacterial infections resulting in the death of 7 animals between 19 January and 8 February 1987. The one surviving turtle is apparently recovering and is growing and gaining weight.

Table 3. Geometric mean weighs of combined samples of Kemp's ridley sea turtles of the 1986 year-class by date.

Date	Combined samples, total no. weighed	Geometric mean of all turtles weighed
July 1986[a]	1,759	-
31 July	400	27.3
28 August	405	61.8
25 September	405	118.6
23 October	405	205.6
20 November	405	334.5
18 December	405	461.9
15 January 1987	405	545.5
12 February	405	655.8
12 March	405	887.0
9-15 April[b]	1,704	986.9
7 May[c]	24	1,443.6
4 June[c]	35	1,607.2
2 July[c]	25	1,974.4
24 September[c]	30	3,303.2

[a]Data provided by Donna Shaver, NPS.
[b]Final weighing of all turtles before their release on 21 April 1987.
[c]Turtles retained in captivity after 21 April 1987.

Table 4. Regression statistics for the regression of the logarithms of weights (W, in g) on square roots of age (A, in days) for Kemp's ridley sea turtles of the 1986 year-class, by block, treatment and raceway .

Block	Treatment	Raceway	Slope, [a] b	Intercept, lna	s^2 dev.	r^2	n
1	Buckets/Cartons	4	0.301	2.129	0.042	0.950	270
1	Cartons	5	0.302	2.143	0.037	0.955	270
1	Buckets	3	0.298	2.168	0.034	0.958	270
2	Buckets/Cartons	6	0.290	2.317	0.029	0.962	270
2	Cartons	7	0.294	2.287	0.030	0.961	270
2	Buckets	8	0.293	2.223	0.036	0.954	270
Combined			0.296	2.212	0.03530	0.955	1,620

[a]/An index of growth rate based on the linear regression model:
$\ln W = \ln a - bA^{0.5}$

Table 5. Schedule of tagging the 1986 year-class of Kemp's ridley sea turtles.

Raceway	Clutches	Tagging date		
		Living tag[a]	Internal tag[b]	Flipper-tag[c]
1	1,2	8-9 Dec 1986	9 Mar 1987	24 Mar 1987
2	2,3,4,5,7	10 "	10 "	"
3	4,6,10,13	11 "	"	27 "
4	4,6,10,13	12-15 "	"	"
5	4,6,10,13	15-16 "	11 "	"
6	5,8,9,12	16-17 "	"	"
7	5,8,9,12	17-19 "	12 "	"
8	5,8,9,12	31 "	16 "	30 "
9	2,6,7,8,9,10,13	2 Jan 1987	17 "	"
10	7,11,12,13	5-7 "	18 "	"
11	14	5-7 "	19 "	1 Apr 1987
12	15	15 "	23 "	1,10 "
13	16,17,22	" "	"	1 "
14	18,19,21	" "	23,25 "	7 "
15	19,20	" "	25 "	"
16	14,21,22	" "	26-27 "	7-10 "
17	16,17,19,20,21	" "	27 "	10 "
SB[d]	20	" "	15 Apr 1987	"

[a] Applied to neural scute 4.

[b] Binary-coded metal tag inserted into the left front flipper.

[c] Inconel tag inserted into right front flipper.

[d] Standing basins.

Table 6. Raceway and bucket identification codes, clutch identification numbers and inconel tag numbers for the 100 Kemp's ridley sea turtles of the 1986 year-class held beyond the release date (21 April 1987) for continued study[a].

Raceway/ Bucket ID[b]	Clutch[c]	Tag Number
1A5	1	PPK062
1B1	1	PPK004
1G2	1	PPK020
116	2	PPK087
1L2	2	PPK035
1M6	2	PPK099
1T2	2	PPK059
2B2	2	PPK125
2F4	3	PPK195
2F6	3	PPK197
2G3	3	PPK140
2H3	3	PPK143
2P6	5	PPK227
2S6	7	PPK236
3A1	10	PPK240
3B6	10	PPK297
3F5	10	PPK310
3H1	13	PPK261
1I5	13	PPK319
3J1	6	PPK267
3K2	6	PPK271
3K4	6	PPK326
4A1	10	PPK348
4D2	4	PPK357
4D5	4	PPK405
4F4	13	PPK408
4H1	6	PPK368
4I4	4	PPK414
4K4	10	PPK420
5B3	10	PPK448
5B5	10	PPK495
5F1	10	PPK458
5F4	6	PPK502
5J1	6	PPK470
5J5	4	PPK511
5P4	13	PPK521
6B1	8	PPK526
6D3	12	PPK534
6F2	9	PPK539
6F5	9	PPK585
6K5	9	PPK597
6N1	12	PPK562
6O6	8	PPK610

Table 6. (continued).

Raceway/ Bucket ID[b]	Clutch[c]	Tag Number
7C1	8	PPK623
7D5	8	PPK672
7H3	8	PPK640
7J2	9	PPK645
7J4	9	PPK683
7K5	12	PPK686
7L5	12	PPK688
8B1	9	PPK700
8B4	9	PPK771
8F6	9	PPK760
8L1	8	PPK730
8L4	8	PPK781
8O2	8	PPK740
9A4	7	PPK861
9E2	7	PPK815
9E3	7	PPK814
9E4	7	PPK873
9K5	8	PPK890
9O7	9	PPK845
9P5	6	PPK905
9T2	13	PPK859
10A1	11	PPK924
10A6	11	PPK986
10G5	11	PPK004
10I2	11	PPK949
10K4	11	PPK015
10O3	12	PPK968
14A3	18	PPK716
14B1	18	PPK717
14B2	18	PPK718
14B3	18	PPK719
14C4	18	PPK720
14D2	18	PPK721
14D3	18	PPK722
14E1	18	PPK723
14E2	18	PPK724
14F1	18	PPK725
14G1	18	PPK726
14G2	18	PPK727
14G3	18	PPK728
14H1	18	PPK279
14H5	18	PPK730
14I1	18	PPK731
14I2	18	PPK732
14I5	18	PPK733

Table 6. (continued).

Raceway/ Bucket ID[b]	Clutch[c]	Tag Number
14I6	18	PPK734
14J6	18	PPK735
14K2	18	PPK736
14K4	18	PPK737
14K6	18	PPK738
14L1	18	PPK739
14L4	18	PPK740
14M4	18	PPK744
14N6	18	PPK745
14O2	18	PPK742
14P6	18	PPK741
14Q1	18	PPK743

[a]/30 of these turtles (in raceway 14) were used for studies of swimming speed, stamina and physical fitness conducted by Erich K. Stabenau, Department of Wildlife and Fisheries Sciences, Texas A&M University, and 70 more were held back as "super head starts," having been the largest turtles selected from the clutches of the year-class.

[b]/The first number designates the raceway, the letter designates the bucket row and the second number the bucket column.

[c]/Used by the NPS at the Padre Island National Seashore.

Table 7. 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---

Table 7. (continued).

Year-class	"Imprinting" location[a/]	Release site	Release date	No. released	Flipper tag series[b/]
1985	PINS	Copano Bay, TX	22 April 1986	448	NNX---, NNY--- (inconel)
	PINS	Italian Bend, TX	"	22	NNX---, NNY--- "
	PINS	Port Bay, TX	"	49	NNX---, NNY--- "
	PINS	Padre Island, TX	6 May 1986	961	NNX---, NNY--- "
	PINS	Galveston Island, TX	23 Sept. 1986	54	NNX---, "
1986	PINS	Mustang Island, TX	21 April 1987	1,630	PPK--, PPL---(inconel)
Total				12,422	

[a/]PINS = Padre Island National Seashore;
RN = at Rancho Nuevo.

[b/]Monel tags, unless noted otherwise. For example, Inconel tags were used on the 1985 and 1986 year-classes. 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 lupon request.

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

Table 8. Summary of recoveries of head started, tagged and released Kemp's ridley sea turtles by year-class.[a/]

Year-class	No. of recoveries	Percent of total recoveries	Percent of total released by year-class
1978	75	14.1	15.1
1979	21	3.9	4.2
1980	86	16.1	17.3
1981	51	9.6	3.1
1982	156	29.3	31.3
1983	11	2.1	2.2
1984	23	4.3	4.6
1985	102	19.1	6.6
1986	8	1.5	0.5
Total	533	100.0	4.3

[a/]As of 1 September 1987.

Table 9. Summary of recoveries of head started, tagged and released Kemp's ridley sea turtles of the 1978-1986 year-classes, by nation, state and recovery zone (oceanside vs bayside).[a/]

Nation/State	Oceanside	Bayside	Not reported	Total
Mexico	5	1	1	7
USA				
Texas	125	147	78	350
Louisiana	29	22	14	65
Mississippi	2	4		6
Alabama	3		1	4
Florida	20	17	12	49
Georgia	5		5	10
South Carolina		4	8	12
North Carolina		16	2	18
Virginia		1	1	2
Maryland		1	1	2
New Jersey	1		1	2
New York		1	1	2
France	1		1	2
Morocco		1		1
Not Reported			1	1
Total[b/]	191(35.8)	215(40.3)	127(3.8)	533(100.0)

[a/]As of 1 September 1987.

[b/]Percentage in parentheses.

Table 10. Summary of recoveries of head started, tagged and released Kemp's ridley sea turtles of the 1978-1986 year classes by method of recovery.[a/]

Recovery method	No. of recoveries	Percent of recoveries
Not reported	129	24.2
Stranded dead	131	24.6
Shrimp trawl	124	23.3
Stranded alive	100	18.8
Hook and line	23	4.3
Gill net	15	2.8
Dip net	4	0.8
Cast net	2	0.4
Swimming	2	0.4
Butterfly net[b/]	1	0.2
Beach seine	1	0.2
Crab pot	1	0.2
Total	533	100.0

[a/]As of 1 September 1987.

[b/]Wingnet used to catch shrimp.

Table 11. Summary of recoveries (by-catch) by shrimpers of head started, tagged and released Kemp's ridley sea turtles of the 1978-1986 year-class by nation/state.[a/]

Nation/State[b/]	Recoveries (by-catch) by shrimpers	Percent of recoveries (by-catch) by shrimpers
Mexico	4	3.2
USA		
Texas	63	50.8
Louisiana	34	27.4
Mississippi	1	0.8
Alabama	2	1.6
Florida	8	6.5
Georgia	4	3.2
South Carolina	4	3.2
North Carolina	2	1.6
Virginia	1	0.8
Not Reported	1	0.8
Total	124	100.0

[a/]As of 1 September 1987.

[b/]In which the turtles were recovered.

Table 12. Condition of head started, tagged and released Kemp's ridley sea turtles when recovered, by year-class.[a/]

Year-class	Alive, returned to the environment	Alive, rehabilitated, returned to the environment	Alive, attempted rehabilitation, later died	Dead	Unknown	Total
1978	60	3	1	7	4	75
1979	15	1	0	3	2	21
1980	47	1	2	16	20	86
1981	27	0	0	20	4	51
1982	91	6	3	49	7	156
1983	8	0	0	3	0	11
1984	12	0	0	11	0	23
1985	26	7	3	65	1	102
1986	5	2	0	1	0	8
Total	291	20	9	175	38	533
Percent	54.6	3.7	1.7	32.8		
	58.3		34.5		7.1	

[a/]As of 1 September 1987.

Table 13. Number of "imprinted" hatchlings Kemp's ridley sea turtles in clutches of the 1987 year-class recieved from the NPS from 6-23 July 1987.

Clutch identification no.	July											Total
	6	8	11	13	15	17	18	19	20	21	23	
1	46											46
2		4	2									6
3			2									2
4			9	4								13
5					64	4						68
6					39	20						59
7							63	12	7	1		83
8						16			72	9		97
9							40	26		3		69
10										78	8	86
11							63	30				93
12								50	5			55
13								61	5	5	1	72
14								49	19	8		76
15								78	12	5		95
16								50		5		55
17						6	66		7	1		80
18							62			1		63
19											81	81
20								80	3			83
Total	46	4	13	4	103	46	294	436	130	116	90	1,282

Table 14. Summary of mortality in eight year-classes of "imprinted" Kemp's ridley sea turtle hatchlings during shipment to NMFS by NPS.

Year-class	Hatchlings Received by NMFS from NPS				
	Alive		Dead on arrival		Total
	No.	%[a]	No.	%[a]	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
1986	1,759	100.00	0	0.00	1,759
1987	1,278	99.68	4	0.31	1,282
Combined	16,538	99.22	130	0.78	16,668

[a]/Percentages are based on the total numbers of hatchlings received by year-class.

Table 15. Adult female Kemp's ridley sea turtles and clutches of eggs from which hatchlings of the 1987 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]
K0246	68.5	1	238	16 May 1987	70
T00941	72.0	2	240	"	92
K0053	69.8	3	245	19 May 1987	94
K0028	67.0	4	249	20 May "	107
K0131	69.2	5	270	25 May "	83
T00849	74.0	6	278	26 May "	115
K0163	69.0	7	326	20 May "	99
T00834	70.0	8	327	"	122
K0115	71.3	9	328	"	86
K0262	69.5	10	329	"	116
T00457	72.0	11	330	"	102
K00177	68.5	12	331	"	94
T00502	66.5	13	332	"	108
C17270	70.5	14	333	"	98
K0116	70.2	15	334	"	120
T00331	72.0	16	335	"	87
T00627	70.0	17	337	"	106
K0202	69.0	18	338	"	92
T00857	72.0	19	397	2 June 1987	117
K0205	71.0	20	398	"	92
Total					2,000

[a]Data provided by Donna Shaver, 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.

Table 16. Clutch histories of the 1987 year-class of "imprinted" Kemp's ridley sea turtle hatchlings received from the NPS from 6-23 July 1987[a].

Clutch identification no. [b]	Dates		Incubation period, days
	Hatched	"Imprinted"[c]	
1	2 July	5 July	48
2	6 "	8-10 "	52
3	10 "	10 "	53
4	5 "	10-13 "	47
5	12 "	14-16 "	49
6	11 "	15-16 "	47
7	14 "	18-21 "	46
8	14 "	17-21 "	46
9	15 "	18-21 "	47
10	16 "	21-22 "	48
11	15 "	18-19 "	47
12	16 "	19-20 "	48
13	15 "	19-22 "	47
14	15 "	19-21 "	47
15	15 "	19-21 "	47
16	15 "	19-21 "	47
17	15 "	17-21 "	47
18	15 "	18-21 "	47
19	17 "	22-23 "	46
20	17 "	19-20 "	46
Combined	2-17 "	5-23 "	46-53

[a] Data provided by Donna Shaver, NPS. See Table 15 for numbers of hatchlings received by clutch.

[b] See Table 17 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 17. Arithmetic mean weight (g), geometric mean weight and ranges in weight of "imprinted" Kemp's ridley sea turtle hatchlings of the 1987 year-class[a].

Clutch identification no.	Date weighed[a]	Age, days	No. hatchlings weighed	Arithmetic mean weight, g	Geometric mean weight, g	Range in weight, g
1	5 July	3	46	15.3	15.3	13.3-17.1
2	8-10 "	2-4	6	14.4	14.4	13.7-14.9
3	10 "	1	2	17.1	17.1	17.0-17.2
4	10-13 "	5-8	13	15.9	15.9	14.8-16.9
5	14-16 "	2-4	68	14.3	14.2	11.9-15.9
6	15-16 "	4-5	59	14.4	14.4	12.5-15.5
7	18-21 "	4-7	83	14.4	14.3	10.5-16.8
8	17-21 "	3-7	97	13.0	13.0	12.3-15.8
9	18-21 "	3-6	69	13.3	13.3	10.6-15.1
10	21-22 "	5-6	86	15.6	15.6	13.0-17.6
11	18-19 "	3-4	93	15.5	15.6	12.1-16.7
12	19-20 "	3-4	55	15.0	14.9	12.2-17.4
13	19-22 "	4-7	72	14.4	14.3	12.6-15.9
14	19-21 "	4-7	76	16.1	16.0	14.1-17.9
15	19-21 "	4-7	95	14.7	14.7	13.0-16.4
16	19-20 "	4-6	55	14.7	14.7	12.6-15.9
17	17-21 "	2-6	80	12.1	12.1	10.5-13.5
18	18-21 "	3-6	63	14.9	14.9	11.3-16.9
19	22-23 "	5-6	81	16.6	16.5	14.4-18.7
20	19-20 "	2-3	83	15.8	15.7	13.6-17.4
Combined	5-23 July		1282	14.7	14.6	10.5-18.7

[a]All weighed in July 1987. Data provided by Donna Shaver, NPS.

Table 18. Dates for weighings of combined samples of Kemp's ridley sea turtles of the 1987 year-class.

Sample weighing sequence	Date[a]	Combined samples, total no. weighed
1 (hatchlings)[b]	July 1987	1282
2	30 July 1987	250
3	3 September	350
4	24 September	350
5	22 October	350
6	19 November	350
7	17 November	
8	17 December	
9	14 January 1988	
10	11 February	
11	11 March	
12	8 April	
13	6 May	

[a]/Dates after 3 September 1987 are proposed weighing dates.

[b]/Data provided by Donna Shaver, NPS.

Table 19. Numbers of sea turtles stranded by county, arranged in geographic order, for the Texas and Southwest Louisiana coastlines, January -August 1987.

		Species						
County	State	Loggerhead	Kemp's Ridley	Green	Hawksbill	Leatherback	Unknown	Total
Cameron	LA	11	10			1		22
Orange	TX						1	1
Jefferson	TX	4	3					7
Galveston	TX	14	4	1			1	20
Brazoria	TX	1	2	1			1	5
Matagorda	TX	7			1		3	11
Calhoun	TX	11	3		1		5	20
Aransas	TX		1					1
Nueces	TX	26	10	3	4			43
Kelberg	TX	2	1					3
Willacy	TX	1						1
Cameron	TX	10		1				11
TOTAL		87	34	6	6	1	11	145

Table 20. 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			
16 Jan. 1986	6.3			
13 Feb.	6.8			
13 Mar.	7.0			
29 Aug.	9.1			
22 Sept.	10.1	43.3	33.3	Tagged with tag and AAV501
23 Sept.				Released near Buccaneer oil field 32 mi SE of Galveston, TX
29 Sept.	9.7	43.2	32.9	Found stranded alive on West Galveston Island. Currently being held at Galveston Laboratory
7 May 1987	32.5	47.6	37.1	
7 July 1987	15.9	49.3	37.5	Transferred to Sea-Arama Marineworld, Galveston, TX

[a/]Straight line measurement.

Appendix Table 1. Locations of 20 clutches of "imprinted" Kemp's ridley sea turtle hatchlings of the 1987 year-class, beginning 3 September 1987 (numbers in the table are clutch identification numbers).

	Raceway 1					Raceway 2					Raceway 3					Raceway 4					Raceway 5				
Column	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Row																									
A	1	1	1	1	1	5	5	5	5	5	7	8	8	8	8	7	7	7	7	7	18	18	18	18	18
B	1	1	1	1	1	5	5	5	5	5	8	8	8	8	8	7	7	7	7	7	18	18	18	18	18
C	1	1	1	1	1	5	5	5	5	5	8	8	8	8	8	7	7	7	7	7	18	18	18	18	18
D	1	1	1	1	1	5	5	5	5	5	8	8	8	8	8	7	7	7	7	7	18	18	18	18	18
E	1	1	1	1	1	5	5	5	5	5	8	8	8	8	8	7	7	7	7	7	18	18	18	18	18
F	1	1	1	1	1	5	5	5	5	5	8	8	8	8	8	7	7	7	7	7	18	18	18	18	18
G	1	1	1	1	1	5	5	5	5	5	8	8	8	8	8	7	7	7	7	7	18	18	18	18	18
H	1	1	1	1	1	5	5	5	5	5	8	8	8	8	8	7	7	7	7	7	18	18	18	18	9
I	1	1	1	1	2	5	5	5	5	5	8	8	8	8	8	7	7	7	7	7	9	9	9	9	9
J	2	2	2	2	2	5	5	5	5	5	8	8	8	8	8	7	7	7	7	7	9	9	9	9	9
K	3	3	4	4	4	5	5	7	7	7	8	8	8	8	8	7	7	18	18	18	9	9	9	9	9
L	4	4	4	4	4	7	7	7	7	7	8	8	8	8	8	18	18	18	18	18	9	9	9	9	9
M	4	4	4	4	5	7	7	7	7	7	8	8	8	8	8	18	18	18	18	18	9	9	9	9	9
N	5	5	5	5	5	7	7	7	7	7	8	8	8	8	8	18	18	18	18	18	9	9	9	9	9
O	5	5	5	5	5	7	7	7	7	7	8	8	8	8	8	18	18	18	18	18	9	9	9	9	9
P	5	5	5	5	5	7	7	7	7	7	8	8	8	8	8	18	18	18	18	18	9	9	9	9	9

Appendix Table 1. (continued).

	Raceway 6					Raceway 7					Raceway 8					Raceway 9					Raceway 10				
Column	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Row																									
A	9	9	9	9	9	20	20	20	20	20	12	12	12	12	12	14	14	14	14	14	19	19	19	19	19
B	9	9	9	9	9	20	20	20	20	20	12	12	12	12	12	14	14	14	14	14	19	19	19	19	19
C	9	9	9	9	9	20	20	20	20	20	12	12	12	12	12	14	14	14	14	14	19	19	19	19	19
D	9	9	9	9	9	20	20	20	20	20	12	12	12	12	12	14	14	14	14	14	19	19	19	19	19
E	9	9	9	16	16	20	20	20	20	20	12	12	12	12	12	10	10	10	10	10	19	19	19	19	19
F	16	16	16	16	16	20	20	20	20	20	12	12	12	12	12	10	10	10	10	10	19	19	19	19	19
G	16	16	16	16	16	20	20	20	20	20	12	12	12	12	12	10	10	10	10	10	19	19	19	19	19
H	16	16	16	16	16	20	20	20	20	20	12	12	12	12	12	10	10	10	10	10	19	19	19	19	19
I	16	16	16	16	16	20	20	20	20	20	12	12	12	12	12	10	10	10	10	10	19	19	19	19	19
J	16	16	16	16	16	20	20	20	20	20	12	12	12	12	12	10	10	10	10	10	19	19	19	19	19
K	16	16	16	16	16	20	20	20	20	20	14	14	14	14	14	10	10	10	10	10	19	19	19	19	19
L	16	16	16	16	16	20	20	20	20	20	14	14	14	14	14	10	10	10	10	10	19	19	19	19	19
M	16	16	16	16	16	20	20	20	20	20	14	14	14	14	14	10	10	10	10	10	19	19	19	19	19
N	16	16	16	16	16	20	20	20	20	20	14	14	14	14	14	10	10	10	10	10	19	19	19	19	19
O	16	16	16	16	16	20	20	20	20	20	14	14	14	14	14	10	10	10	10	10	19	19	19	19	19
P	16	16	16	16	16	20	20	20	20	20	14	14	14	14	14	10	10	10	10	10	19	19	19	19	14
Q											14	14	14	14	14	10	10	10	10	10					
R											14	14	14	14	14	10	10								
S											14	14	14	14	14										

Appendix Table 1. (continued).

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

Appendix Table 1. (continued).

Standing Basins	Row[a/]	1	2	3	4	5	6	7	8	9	10
	W	6	6	6	6	6	6	6			6
Top level											
	E	8	8	8	8	8	8	8	8	8	8
	E	6	6	6	6	6	6	6	6	6	6
Middle level											
	E	6	6	6	6	6	6	6	6	6	6
	W	6	6	6	6	6	6	6			
Bottom level											
	E	6	6	6	6	6	6	6	6	6	6

[a/]W = West, E = East.