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NOAA Technical Memorandum
NMFS-SEFC-202

CARE AND MAINTENANCE STANDARDS
FOR KEMP'S RIDLEY SEA TURTLES
(Lepidochelys kempii) HELD
IN CAPTIVITY

BY

Clark T. Fontaine, Theodore D. Williams, Dickie B. Revera



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U. S. DEPARTMENT OF COMMERCE
C. William Verity, Jr., Secretary

National Oceanic and Atmospheric Administration

National Marine Fisheries Service
William E. Evans, Assistant Administrator for Fisheries

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In 1978, an informal agreement was reached between representatives of Mexico's Instituto Nacional de la Pesca (INP), U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), National Park Service (NPS) and Texas Parks and Wildlife Department (TPWD) to cooperate in a 10-year feasibility study of head starting Kemp' ridley sea turtle (Lepidochelys kemp). Head starting is one of a number of projects of the international Kemp's ridley recovery program in which the United States assists Mexico in Kemp's ridley management and research. In exchange, Mexico provides the U.S. with 2,000 Kemp's ridley eggs, approximately 2-3% of the total eggs laid each season on the only known primary nesting beach for this species, located near the village of Rancho Nuevo, Tamaulipas, Mexico.

The eggs removed from the nesting beach in Mexico are translocated to the Padre Island National Seashore near Corpus Christi, Texas where NPS personnel incubate them in Padre Island beach sand until hatching occurs. After hatching, the turtles are allowed to crawl across the beach and into the surf in hopes that they will become "imprinted" so they will later return as adults to mate offshore and nest on this beach. At the conclusion of "imprinting", the hatchling turtles are transported to the NMFS Southeast Fisheries Center's Galveston Laboratory in Galveston, Texas where most of them are reared for 9-11 months, tagged, and released into the Gulf of Mexico, usually offshore of Padre Island, Texas.

Some head started Kemp's ridley sea turtles have not been released into the Gulf of Mexico, but instead have been relocated to the Cayman Turtle Farm (1983) Ltd., Grand Cayman Island, B.W.I. and to a number of private, State and university oceanaria (Table 1). There they have been maintained in captivity. Purposes of maintaining such a captive stock include (1) captive propagation as a "safety net" for the species should all other management measures fail to save the natural population (Caillouet 1984), and (2) super head starting to provide turtles for release at larger sizes. This technical memorandum outlines recommendations and procedures representing what we believe are minimum requirements for humane care and maintenance of endangered Kemp's ridley sea turtles in captivity. Such

standards include those that must be met as conditions of endangered and threatened species permits authorizing activities otherwise prohibited by the U.S. Endangered Species Act (ESA) of 1973 and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) of 1973. For further information on the Kemp's ridley sea turtle head start research project and sea turtle husbandry, in general, the reader is referred to Klima and McVey (1982), Pritchard et al. (1983), Caillouet (1984), Fontaine et al. (1985), and Caillouet (1986).

FACILITIES

Holding Tanks - The tanks in which Kemp's ridley sea turtles are held must be deep enough to hold sufficient water to allow complete submersion of the specimens, large enough to permit unimpeded turning and swimming, and of a configuration and surface texture that will not lead to injury. A rule of thumb is to provide no less than 38 liters (10 gal) per kg (2.2 lb) of sea turtle. The inside surfaces of holding containers must be non-abrasive, free of burrs or projections and free of toxic heavy metals or organics. Use of non-finished concrete tanks should be avoided as we have found that rough surfaces lead eventually to epidermal abrasions and severe lesions in the turtles, particularly in the plastron area. Further, the tanks must have adequate lighting (sunlight and/or artificial lighting) on a normal or simulated diurnal photoperiod.

SEAWATER

Quantity - There must be a sufficient volume (no less than 38 liters/kg of turtle) of seawater to promote growth and allow complete submersion and free movement. Kemp's ridley sea turtles may be kept out of seawater for a cumulative maximum of 10 hr per week (as when draining water for cleaning of tanks, or in an emergency), but they must be kept moist and protected from physical damage during such periods. Additionally, turtles kept out of seawater must be protected from extremes of temperature and never placed

in direct sunlight while dry. The facility must have the ability to provide adequate quantities of seawater for normal and emergency conditions.

Quality - Seawater containing Kemp's ridleys should be maintained at salinities of 25 ppt or higher and temperatures of 20°C or higher, preferably near 25°C. Lower and upper extremes may induce disease or injury, or cause death and should be avoided. Salinities of less than 25 ppt and temperatures of less than 24°C may result in disease in Kemp's ridley sea turtles. In particular, fungus diseases are a problem when seawater temperature drops below 24°C. Seawater pH must be maintained between 7.5 and 9.0. Seawater must be kept free of contaminants such as toxic heavy metals and organics that may be deleterious to the health of the sea turtles.

General Condition - The seawater surface must be unencumbered to allow the Kemp's ridley sea turtles to surface to breathe and to float. It must be free of non-food, floating objects or substances that may be ingested or otherwise harm the sea turtles. A flow-through seawater system that allows 3-6 total replacements per 24 hr is preferred. Re-cycled wastewater treatment systems may be used, provided that adequate filtration is applied to maintain total ammonia at <0.5 ppm and nitrite at <0.8 ppm. If a static seawater system is used, the tanks should be cleaned and the seawater replaced at least three times weekly.

The staff of the facility must have the instruments and ability to monitor seawater quality, to correct any situation in which the described limits are exceeded, and to properly care for the sea turtles while corrective measures are being taken.

BEHAVIOR

Behavior - Kemp's ridley sea turtle less than 2 yr old are very aggressive and will bite others of their kind and other species with very little provocation, particularly at feeding time. They also will aggravate larger sea turtles to the point of retaliation, as has been observed espe-

cially with larger loggerheads (Caretta caretta). For these reasons, hatchling and juvenile Kemp's ridley sea turtles should be kept isolated from one another in individual containers and from other sea turtle species. Experience has shown, however, that aggression in these turtles is not a hard and fast rule. It may be related to age or size, nutrition, size of the holding tank and environmental factors presently not understood. For instance, Kemp's ridley juveniles placed together in large tanks or in oceanarium reef-communities containing fishes, etc., appear to do well, while others placed together in small tanks with other sea turtles remain aggressive. Some Kemp's ridleys placed as groups in small, shallow tanks show no aggression, while others begin immediately to chase and attack one another. In general, the interspecific and intraspecific aggressive behaviors of these turtles appear to lessen at age 2 and continue to decline thereafter. In any case, when the situation dictates that Kemp's ridleys be placed together, they must be closely observed until it is determined that they display no aggression that might cause serious injury or death. We recommend that at the first sign of such aggression the turtles be separated (unless, of course it is associated with courtship and copulation).

Small Kemp's ridleys should never be housed with larger turtles of another species. As mentioned, larger species can injure or kill smaller Kemp's ridleys, and juvenile Kemp's ridleys display highly aggressive behavior toward other species which may lead to retaliatory attacks causing them serious injury or death.

Feeding a group of large Kemp's ridleys held in a common tank should be done by broadcasting or spreading the food around the tank to avoid congregating the turtles. They may injure one another while competing for food.

Any turtle that develops a light spot or pathological lesion on its skin or shell should be isolated from others to avoid "worrying" of the spot by other turtles. Juvenile Kemp's ridleys should be monitored closely for aggressive behavior and the establishment of a "peck order." When any antagonistic behavior is noted, the turtles should be separated immediately.

FOODS AND FEEDING

Kemp's ridleys must be fed food of suitable quantity and quality to optimize their growth and survival and to maintain their health.

It is known (Pritchard and Marquez, 1973) that the diet of wild Kemp's ridley sea turtles consists primarily of crustaceans, particularly crabs (e.g., Callinectes sapidus and C. ornatus). The Kemp's Ridley Sea Turtle Head Start Research Project at the Galveston Laboratory has obtained good growth and survival in captive Kemp's ridleys (hatchlings to yearlings) by feeding them a dry, pelletized, floating Turtle Chow manufactured by Ralston PURINA's plant in Richland, Indiana. Kemp's ridleys held in captivity beyond their first year of life should be fed a combination of natural foods and a nutritious, dry, pelletized, floating diet such as PURINA's Turtle Chow. PURINA's minimum order for Turtle Chow is 4,000 lb (1814 kg). However, a number of oceanaria can "pool" together to make a minimum order, and then distribute the food among themselves. Oily or fatty fish must be avoided as foods for captive Kemp's ridleys, because they cause fatty degeneration of the liver and steatitis leading to death.

HEALTH CARE

Measures must be taken to preserve the health of captive Kemp's ridleys and to prevent spread of disease or occurrence of injury among them. Injured or diseased sea turtles must receive adequate medical care and corrective treatment in isolation from other sea turtles. Isolated sick or injured animals should be kept in clean seawater. Lesions caused by injury may be treated with a broad-spectrum, antibacterial ointment with good results. Exposure of 1-2 hr per day to direct sunlight also aids in treatment of fungal lesions of the skin.

Those holding Kemp's ridley sea turtles in captivity must have access to good veterinary diagnostic and treatment services.

NECROPSY AND DISPOSAL OF CARCASSES

Animals that die in captivity should be packed in crushed ice immediately. This will maintain tissues in relatively good condition for as long as 24 hr. Deterioration begins immediately at death so promptness in packing the turtle in ice is of utmost importance.

A veterinarian, veterinary diagnostic clinic, or qualified pathologist of a college or university should perform a necropsy of the dead animal. In the event that such expertise is not available or that resources are inadequate for a professional necropsy, then a member of your staff should conduct post-mortem examination to try to determine cause of death. Necropsy procedures and nomenclature should follow those published by Wolke and George (1981) and Rainey (1981). Appropriate endangered and threatened species permits (Federal and State) should be obtained in advance by individual(s) who perform the necropsies, so that the carcasses of this endangered species can be held in their possession and examined legally.

The kidneys, with attached gonads, should be removed and fixed in 10% neutral buffered formalin (Animal Tissue Techniques by Gretchen L. Humason, fourth edition, 1979). These must be transferred later to the Galveston Laboratory for sex determination by histological techniques. The volume of buffered formalin solution should be ten times the volume of tissue to be fixed. The initial formalin solution should be replaced with an equal volume of fresh solution after tissues have been in the original fixative for 24-36 hr. The kidneys with gonads, or in the case of an adult turtle the gonads only, should be sent in a plastic bag to the Sea Turtle Head Start Research Project, NMFS SEFC Galveston Laboratory, 4700 Avenue U, Galveston, Texas 77551-5997, as soon as possible. They are essential to an ongoing study of sex ratios and their relation to incubation temperature in Kemp's ridley sea turtles, in cooperation with the National Park Service.

In the event that you have access to someone with the ability and facilities to make and examine frozen tissue sections from organs that appear diseased or abnormal and to report the findings, this would be the optimum procedure. Otherwise, organs or portions of organs that appear to be

affected should be fixed in 10% neutral buffered formalin for histological sectioning, staining and examination by a veterinarian or pathologist.

A brief report, including date of death, pertinent information on size and condition prior to death, probable cause of death, a copy of the necropsy report, and the results of pathological or histological studies, should be sent to the NMFS SEFC Galveston Laboratory, to the attention of the Laboratory Director, NMFS SEFC Galveston Laboratory, 4700 Avenue U, Galveston, Texas 77551-5997, within 2 weeks of the date the turtle died. A phone call must be made to the Sea Turtle Head Start Operations Manager (409-766-3507, -3516) within 24 hr of the death of the turtle.

Each head started Kemp's ridley sea turtle you received from the Galveston Laboratory has been tagged in one or more of the following ways: (1) external, metal, flipper tag on the trailing edge of the right front flipper; (2) externally visible living tag on one of the scutes of the carapace; (3) internal, binary-coded, magnetic tag implanted in the tissue of the "knuckle" area of the left front flipper; and (4) internal, passive integrated transponder (PIT) tag implanted in the tissue of the left shoulder. For our long-term evaluations of these tags, it is extremely important that we recover samples of the surrounding tissue in which these tags are imbedded or to which they are attached should any of these animals die in captivity. As soon as possible after their death, remove both front flippers, including the shoulder area, and the carapace scute containing the living tag (the living tag may be recognized as a whitish or lighter spot on a scute). The flippers and the scute should be fixed in 10% buffered formalin. However, if this not practical, the samples may be frozen. Please send this material (with appropriate labelling and copies of permits attached) to the Operations Manager at the aforementioned address.

The remaining carcass also should be frozen or preserved in buffered formalin after necropsy and returned to the Sea Turtle Head Start Research Project.

TAGGING

Information about tags and tag application procedures can be obtained upon request from the Sea Turtle Tagging Coordinator, NMFS SEFC Panama City Laboratory, 3500 Delwood Beach Road, Panama City, FL (904-234-6541). The flipper tags attached to the turtles you received are adequate until the turtles reach 20 kg in total weight. Larger flipper tags are required for application to turtles that are larger than 20 kg. All tags should be thoroughly cleansed and sterilized by autoclaving before application.

Any turtle that loses a tag should be re-tagged as soon as possible with a new tag of a size depending on the size of the turtle. Its tag is the only means by which each turtle can be linked by tag records to its clutch of origin and the female turtle that laid the clutch.

Flipper tagging procedure -

- a) The tag should be applied to the trailing edge of a front flipper.
- b) The tag insertion area should be swabbed with tincture of iodine to disinfect it (both sides of the flipper).
- c) After snapping the tag into the applicator, apply a broad-spectrum antibacterial ointment (such as Neosporin) to the sharp, penetrating point of the tag.
- d) After the tag has been applied, check to assure that the sharp point has been "crimped" properly to lock the tag in place. If the point has not been "crimped" sufficiently, a pair of pliers can be used to complete the process.
- e) Normally, tagged Kemp's ridley sea turtles will not feed for 1-2 days post-tagging. If this condition lasts for more than 2 days, have your veterinarian examine the turtle.

Report the dates of tag loss, the old tag number, the re-tagging and the new tag number on the monthly report forms (Figure 1) provided by the Galveston Laboratory. Send the forms to the Sea Turtle Head Start Research Project, NMFS SEFC Galveston Laboratory, 4700 Avenue U, Galveston, TX 77551-5997 (409-766-3516, -3507, -3500). If old tags that have been replaced are recovered, they should also be returned to the Galveston Laboratory for examination and archival.

EXPOSURE TO STRANDED SEA TURTLES

Occasionally, wild-caught or live-stranded sea turtles may be brought into your facilities for rehabilitation. These turtles, regardless of species, must not be held in the same holding tank with captive-reared Kemp's ridleys. Also, captive-reared Kemp's ridleys should not be exposed to the same seawater in which wild-caught or live-stranded sea turtles are kept, until an adequate period of quarantine has passed to assure absence of diseases or parasites in the wild animals. Cross-contamination with pathogenic organisms between wild and head started sea turtles has occurred in some instances. Furthermore, there are inter- and intra-specific antagonistic behaviors between wild and captive reared sea turtles. We recommend that organizations rehabilitating wild-caught or live-stranded sea turtles provide separate facilities for their care, not only in the physical plant but in seawater maintenance and treatment systems as well, to avoid injury due to aggressive behaviors, or sickness or death through transfer of pathogens or parasites to captive-reared Kemp's ridleys.

BIOLOGICAL EXPERIMENTS

No experiment shall be conducted that causes injury, death or suffering to Kemp's ridley sea turtles.

REPORTING REQUIREMENTS

You are required to submit monthly reports (Figure 1) to the NMFS SEFC Galveston Laboratory Sea Turtle Head Start Research Project, 4700 Avenue U, Galveston, Texas 77551-5997, supplying the following information:

- a) Daily measurements of holding seawater temperature in °C or °F;
- b) Daily measurements of holding seawater salinity in ppt (chlorinity or conductivity can be substituted, but must be convertible to salinity);
- c) Weekly measurements of holding seawater pH;
- d) Daily records of type(s) of food and vitamins, including amounts fed (by weight, number of items and/or volume) and notes on utilization of feed;
- e) Body measurements of each turtle must be reported monthly for the first 12 months after receipt of the turtles. Thereafter, body measurements should be taken at the end of each 6-month period. Body measurements include: (1) total weight (kg); (2) straight line, standard carapace length (cm); and (3) straight line, standard carapace width (cm). Straight line, standard carapace length and width are depicted in Figure 2.
- f) Feeding and water quality measurements must continue to be reported on a monthly basis after the first 12 months.

An annual summary report of your Kemp's ridley rearing and holding activities must be submitted to the Laboratory Director, NMFS SEFC Galveston Laboratory by December 1 of each year, as required under federal threatened and endangered species permits.

CONCLUSION

The standards presented in this technical memorandum provide minimum requirements for care and maintenance of captive-reared Kemp's ridley sea turtles. They will be revised periodically as more information is gathered about the needs of this species in captivity. Comments and suggestions regarding these standards are welcomed and should be directed to the Sea Turtle Head Start Operations Manager, NMFS SEFC Galveston Laboratory, 4700 Avenue U, Galveston, Texas 77551-5997.

ACKNOWLEDGEMENTS

The Kemp's Ridley Sea Turtle Head Start Research Project of the NMFS SEFC Galveston Laboratory is indebted to the various oceanaria (private, State and university) and their staffs who have assisted in extended captive-rearing of head started Kemp's ridley sea turtles. Following is a list of facilities and persons who are presently maintaining head started sea turtles. We applaud their professionalism and greatly appreciate their cooperation.

Mr. J. Kevin Bowler
Audubon Park and Zoological Gardens
P.O. Box 4327
New Orleans, LA 70178
(504)861-2537

Mr. Gary Daily
Bass Pro Shop
1935 S. Campbell
Springfield, MO 65807
(417)887-1915

Dr. James Wood
Cayman Island Turtle Farm (1983) Ltd.
P. O. Box 645
Grand Cayman, Cayman Islands, BWI
(809)949-3894

Mr. Dennis Kellenberger
Clearwater Marine Science Center
251 Windward Passage, Suite F
Clearwater, FL 33515
(813)441-1790

Mr. Steve Robertson
Dallas Aquarium
P.O. Box 26193
Dallas, TX 75226
(214)670-8450

Mr. Greg Siebenalar
Gulfarium
Hwy. 98 East
Ft. Walton Beach, FL 32548
(904)243-9046

Dr. Mobashir Solangi
Marine Life, Inc.
P.O. Box 4078
Gulfport, MS 39502-4078
(601)864-2511

Dr. Joann Whaley (DVM)
Marineland, Inc.
Rt. 1, Box 122
St. Augustine, FL 32086
(904)471-1111

Mr. Jose Hoyo
Miami Seaquarium
4400 Rickenbacker Causeway
Miami, FL 33149
(305)361-5705

Mr. Don Laughlin
New England Aquarium
Central Wharf
Boston, MA 02110
(617)973-5230 (5248)

Dr. Frank Judd
Pan American University
Coastal Studies Laboratory
P.O. Box 2591
S. Padre Island, TX 78597
(512)761-2644

Mr. Paul Barrington
North Carolina Resources
Center/Fort Fisher
P.O. Box 130
Kure Beach, NC 28449
(919)458-8257

Mr. Russell L. Smith
San Antonio Zoological Gardens
3903 N. St. Mary's St.
San Antonio, TX 78212-3199
(512)734-7183

Mr. Eddie Lewis
Sea-Arama Marineworld
P.O. Box 3068
Galveston, TX 77550
(409)744-4502

Ms. Ila Loetscher
Sea Turtles, Inc.
P.O. Box 2575
S. Padre Island, TX 78597
(512)761-2544

Mr. Frank Murru
Sea World of Florida
7007 Sea World Dr.
Orlando, FL 32821
(305)345-5156

Mr. Mike Wood
Theater of the Sea
P.O. Box 407
Islamorada, FL 33036
(305)664-2431

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Tech. Memo. NMFS-SEFC-82:20 p.

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NOAA Tech. Memo. NMFS-SEFC-24:82 p.

Table 1. Captive stock of head started Kemp's ridley sea turtles^{1/}.

Holding facilities	Year-Classes	Male	Female	Unknown	Total
Sea-Arama Marine World, Galveston, TX	1978	3	5		8
	1982	4	1		5
	1984			5	5
Miami Seaquarium, Miami, FL	1978		1		1
	1979	1			1
Cayman Turtle Farm, Ltd. Grand Cayman, Cayman Islands	1979	16	12		28
	1982		4		4
	1984			15	15
Clearwater Marine Science Center Clearwater, FL	1982	2	3		5
Gulfarium, Ft. Walton Beach, FL	1982	1			1
Theater of the Sea, Islamorada, FL	1982	3	2		5
Audubon Park Zoo, New Orleans, LA	1984			3	3
Bass Pro Shops, Springfield, MO	1984			5	5
Dallas Aquarium, Dallas, TX	1984			2	2
Marineland, Inc., St. Augustine, FL	1984			7	7
	1985			1	1
North Carolina Resource Center Kure Beach, NC	1984			3	3
Pan American University, South Padre Island, TX	1984			2	2
San Antonio Zoo, San Antonio, TX	1985			1	1
	1986			2	2
Sea World of Florida, Orlando, FL	1984			2	2
Totals		30	28	48	106

^{1/}October 1, 1987.

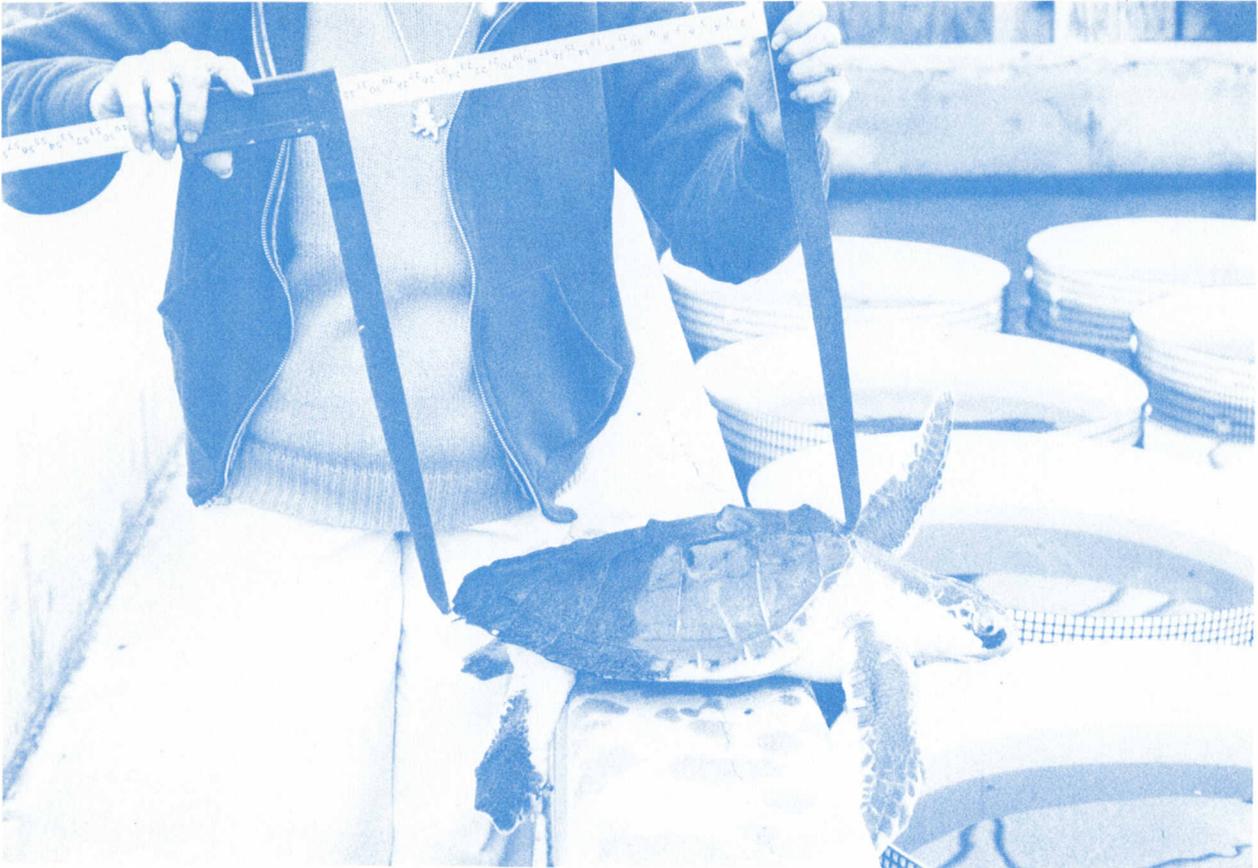
ORGANIZATION: _____ REPORT DATE: ____/____/____
DAY MON YR

REPORTED BY: _____ FOR MONTH OF _____, 19__

DATE	WATER TEMP., C	SALINITY		FOOD		COMMENTS
		PPT	pH	TYPE	AMOUNT	
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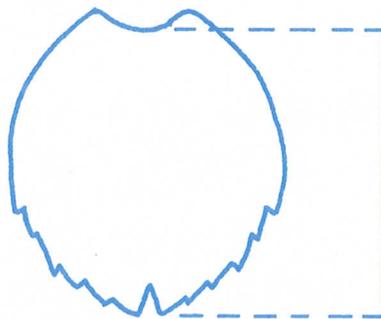
DATE	WATER		SALINITY		FOOD		COMMENTS
	TEMP., C		PPT	pH	TYPE	AMOUNT	
23							
24							
25							
26							
27							
28							
29							
30							
31							

QUESTIONS CONCERNING THIS REPORT SHOULD BE DIRECTED TO: MS. DICKIE B. REVERA, SEA TURTLE HEAD START RESEARCH PROJECT, NATIONAL MARINE FISHERIES SERVICE, GALVESTON LABORATORY, 4700 AVENUE U, GALVESTON, TEXAS 77550. TELEPHONE: AREA CODE 409; DICKIE REVERA 766-3516; TIM FONTAINE 766-3517; DR. CHARLES W. CAILLOUET 766-3525.



Measuring carapace length: straight-line method using calipers (recommended method).

A sliding or hinged caliper (often available from forestry supply houses) is usually used, although a tape measure or ruler held parallel to and carefully aligned with the shell is an alternative.



Standard carapace length (SCL) - precentral scute at carapace midline to posterior margin of postcentrals.