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Western Gulf of Mexico Sea Turtle Workshop Proceedings

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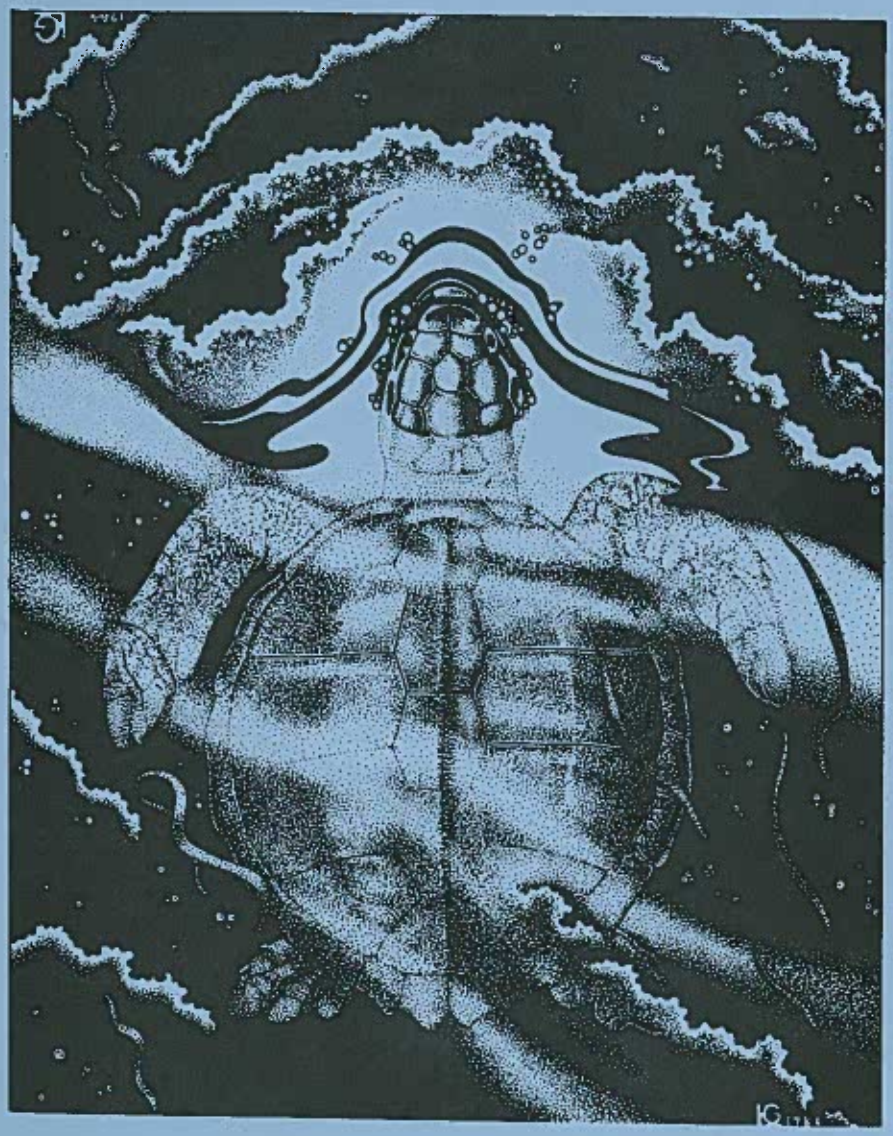
TAMU-SG-84-105
R/F-15; NA83AA-D-00061
October 1983
$3



WESTERN GULF OF MEXICO SEA TURTLE WORKSHOP

PROCEEDINGS

JANUARY 13-14, 1983

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October 1983

TAMU-SG-84-105

Partially Supported through Institutional Grant NA83AA-D-00061

to Texas A&M University

by the Office of Sea Grant

National Oceanic and Atmospheric Administration

Department of Commerce

Cover illustration by Lori Grassman

Price: $3

For additional copies, write

Marine Information Service
Sea Grant College Program
Texas A&M University
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R/F-15
TAMU-SG-84-105
500 October 1983

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ACKNOWLEDGMENTS

This workshop was sponsored by the Texas A&M University College Sea Grant College Program with special assistance from the Southeast Fisheries Center Galveston Laboratory of the National Marine Fisheries Service. We particularly thank René Márquez and the Instituto Nacional de Pesca for their vigorous support of this workshop and other conservation projects in the western Gulf of Mexico.

The organizers especially acknowledge Ed Klima, Jack Woody, Henry Hildebrand, Larry Ogren, Steve Rabalais and Jim Dixon for logistic support, which greatly facilitated the meeting's activities. We also extend our special thanks to Ila Loetscher and the members of Sea Turtle, Inc., for their active participation and financial support of the workshop.

In the Sea Grant Office, Feenan D. Jennings, Willis H. Clark, Lauriston R. King, Laura Colunga, Bland Crowder, and Allen Martin were very helpful with organizational and publication matters. We also acknowledge Jan Ensink for assistance with translations. In the Department of Biology, we thank Jay Dippel and Debbie Eschbach for assistance with mailings and publication preparations.

INTRODUCTION

The western Gulf of Mexico is an important habitat for many sea turtle species. The only major nesting beach of the Kemp's ridley sea turtle (Lepidochelys kempi) is located in the far western Gulf of Mexico. Additionally, the Kemp's ridley is believed to have at least two important feeding grounds in the western Gulf, one in the Bay of Campeche and the other off Louisiana. The coastal waters of the western Gulf are the habitat of many loggerhead sea turtles (Caretta caretta) and occasionally are inhabited by the leatherback sea turtle (Dermochelys coriacea) and by the hawksbill sea turtle (Eretmochelys imbricata). Furthermore, the extensive grass beds in South Texas bays once were an important feeding ground for the green sea turtle (Chelonia mydas). Unfortunately, as in most of the world's oceans, the western Gulf of Mexico has seen a drastic decrease in the number sea turtles during the 20th century.

This worldwide decrease in sea turtle populations has necessitated the development and implementation of sea turtle conservation strategies. These strategies can be developed and implemented most effectively when the specific habitats and behaviors of sea turtles in discrete areas of the world are considered. The Western Gulf of Mexico Sea Turtle Workshop was held at Texas A&M University on January 13-14, 1983, so that researchers, students and others concerned with sea turtle programs could discuss the status of sea turtle populations in the western Gulf and develop an effective conservation strategy for preserving those populations. This publication summarizes each presentation given at the workshop and includes a transcript of the discussion following each presentation. It also lists priorities that resulted from the discussions at the workshop.

PRIORITIES FOR RESEARCH AND CONSERVATION
(The priorities are numbered for reference purposes,
and are not ranked in order of importance.)

Colonies and Populations Requiring Maximum Protection

1. To protect Lepidochelys kempi throughout its geographical distribution, especially Rancho Nuevo, Tamaulipas, Mexico; Padre Island, Texas; and Vera Cruz, Mexico.

Comprehensive Regional Programs

2. To promote cooperation between the states through regional or umbrella conventions such as the Western Hemisphere or the Migratory Species Convention as the framework for international sea turtle agreements.

3. To schedule regional meetings to review exploitation and evaluate present conservation strategies.

4. To establish subgroups in consultation with the IUCN/SSC (International Union for Conservation of Nature and Natural Resources, Species Survival Commission) Marine Turtle Specialist Group to develop and coordinate turtle conservation efforts in each region, with particular attention to monitoring implementation of the Sea Turtle Conservation Strategy.

Regional Management

5. To commend Mexico and the United States for the joint recovery program that has been mounted to conserve Kemp's ridleys, and encourage these two governments to continue and even to augment this multiphase program for the restoration of this critically endangered turtle.

6. To encourage the IUCN Commission on National Parks and Protected Areas to undertake, with the assistance of the IUCN/SSC Marine Turtle Specialist Group and other knowledgeable experts, the compilation of data on sea turtle habitat (nesting, feeding, migration, etc.) and human use of and activities in these areas, to determine where new parks and sanctuaries are needed for marine turtles.

7. To recommend that when nesting beach sanctuaries are established, adjacent nearshore waters and a buffer zone further offshore be included to protect marine turtles while they are breeding and migrating in the vicinity.

8. To make available to appropriate state agencies expertise in placement, planning, developing and managing sea turtle parks, preserves, sanctuaries and reserves suited to the needs of each state.

Trade and Regulations

9. To strengthen customs import and export control on all international shipments of marine turtle products.

10. To discourage all trade in souvenirs and curios made from sea turtle (polished shells, stuffed turtles and other items).

11. To investigate modification of the Endangered Species Act to allow for reporting of incidental capture of endangered sea turtles.

Surveys

12. To survey the developmental and feeding habitat of Lepidochelys kempi, especially current status of feeding grounds on the Mississippi River Delta, the Gulf coast of Florida, and the Tabasco River.

13. To survey the feeding grounds of sea turtles of the western Gulf of Mexico, specifically, Caretta caretta, Chelonia mydas, and Dermochelys coriacea.

14. To survey associations between sea turtles and oil exploration and production platforms, including questionnaires distributed to pilots, ship captains and rig personnel, followed by on-site visits.

15. To survey the entire Gulf coast for additional sea turtle nesting populations.

Management Techniques

16. To thoroughly evaluate management techniques (headstarting, hatcheries, sex determination, disease research, etc.), and emphasize their experimental nature.

17. To focus research on development of an effective tag for permanently marking turtles.

18. To urge all governments to encourage voluntary participation in marine turtle survey, tagging and research programs.

19. To encourage the establishment of a world-clearing house for data on all tag series used by all investigators throughout the world.

20. To encourage international and national fisheries commissions to promulgate regulations requiring the use of gear that precludes the capture of sea turtles and mandating the closure of areas and seasons as appropriate to protect them.

21. To commend the U.S. National Marine Fisheries Service and the U.S. shrimp industry and to encourage them to accelerate their improvement and utilization of the Turtle Excluder Device (TED), which prevents the capture of sea turtles.

Research Needed for Conservation

22. To initiate ecological and behavioral studies of turtles on their foraging grounds and at points along migratory routes.

23. To instigate research into the behavior, reproductive periodicity and physiology of sea turtles, with an increased emphasis on males, at both feeding and nesting grounds.

24. To initiate and maintain a total saturation tagging program for a reproductively isolated rookery of each sea turtle species, to generate data on recruitment of adults into the breeding population.

25. To investigate the chronic influence of pollution on sea turtles and on their marine, estuarine and coastal habitats.

26. To survey the lines of Sargassum drift off nesting beaches to gain better understanding of the ecology and distribution of hatchling and young sea turtles.

27. To initiate research that involves underwater observation of sea turtle behavioral ecology.

28. To investigate diseases associated with stranded sea turtles.

29. To investigate the population genetics of sea turtle species in order to optimize management techniques.

Education

30. To encourage all government and non-government conservation and research organizations to inform, through regularly published scientific publications, newsletters, and other media, biologists and managers of information available on sea turtle management and research.

31. To maximize efforts to inform local citizens, children, tourists, commercial fishermen, sportsmen and coastal industrialists of the need to conserve sea turtles.

32. To encourage the further development of mobile natural history museum exhibits on sea turtle ecology and conservation.

33. To urge all sea turtle conservation projects to employ and train local people.

34. To publish informative pamphlets to promote application of the Sea Turtle Conservation Strategy.

35. To commend Sea Turtles Inc. and HEART (Help Endangered Animals - Ridley Sea Turtle) for their efforts in educating the young people of Texas regarding the unique problems of sea turtle conservation.

36. To encourage educators and curriculum developers to produce materials in Spanish and English, describing the sea turtles, their plight and conservation efforts.

37. To encourage the Texas A&M University Sea Grant College Program to work with the National Marine Fisheries Service to develop educational materials regarding the Turtle Excluder Device (TED).

CURRENT STATUS OF THE KEMP'S RIDLEY POPULATION

René Márquez

Undoubtedly, the marine turtle population that is in the most precarious situation as a biological entity is the Kemp's ridley turtle (Lepidochelys kempi). It is also the species that has received the greatest amount of continuous attention since 1966.

It can be said modestly that the efforts developed to stop the extinction of this species have been very successful, because the rapid decrease in its numbers has been halted. However, its future is still doubtful due to the reduced number of nesting females and the great impact made on its reproductivity by both man and nature.

Because it is a diurnal nester and has been studied on its nesting beach, in Tamaulipas, Mexico at Rancho Nuevo , for a long time, this species is the best understood with regard to the diverse aspects of its life cycle. However, many unknowns remain, such as mortality due to fishing and natural causes, where the young mature, behavioral differences between young and adults, and the age of sexual maturity.

Although the significance of these unknowns has been difficult to evaluate, the available data have been adapted for the development of a mathematical model to estimate the population size (Márquez et al., 1982). However, every year provides new evidence concerning these aspects, which permits a confirmation or elimination of various hypotheses used in the model. It is hoped that the resistance of this species to disappearing altogether will provide us with enough time to answer these questions and enable us to say that we have prevented its extinction. The following table, which uses the analyses of turtle groups and the influence of calculated mortality of different ages, allows us to estimate the total number

TABLE 1

Table 1 - Theoretical change in populations of Lepidochelys kempi (Adapted from Marquez, et al. 1982)

Year	H_r	N_v	S = 0.914 $N_{0.17}$	S = 0.0246 N_7	S = 0.0145 N_8	S = 0.0086 N_9	S = 0.0050 N_{10}	S = 0.0030 N_{11}	S = 0.0017 N_{12}	S = 0.0010 N_{13}	S = 0.0006 N_{14}	S = 0.0004 N_{15}
1966	22.1	44.56	40.73	1096	646	381	225	132	78	46	27	16
1967	20.7	41.73	38.14	1027	605	357	210	124	73	43	25	15
1968	20.8	41.94	38.33	1032	608	359	211	125	73	43	25	15
1969	23.5	47.38	43.31	1166	687	406	239	141	83	49	29	17
1970	18.2	36.69	33.53	903	532	314	185	109	64	38	22	13
1971	17.7	35.69	32.62	878	518	306	180	106	62	37	22	13
1972	14.4	29.03	26.53	714	421	248	146	86	51	30	18	10
1973	22.3	44.96	41.09	1106	652	385	227	134	79	46	27	16
1974	20.3	40.93	37.41	1007	593	350	206	122	72	42	25	15
1975	11.2	22.58	20.64	555	327	193	114	67	40	23	14	8
1976	36.9	74.40	68.00	1830	1079	637	375	221	130	77	45	27
1977	28.9	58.27	53.26	1433	845	499	294	173	102	60	36	21
1978	48.6	97.98	89.55	2410	1421	839	494	291	171	101	60	35
1979	65.8	132.02	120.66	3248	1914	1135	660	396	224	132	80	53
1980	48.5	97.78	89.37	2405	1417	841	489	293	166	98	59	39
1981	55.1	101.09	101.53	2487	1466	869	505	303	172	101	61	40
1982	48.1	96.97	88.53	2385	1406	834	485	291	165	97	58	39

Note: The total population size of any year can be estimated after maturity (7 years) by adding succeeding year classes. Example: the class of 1978 will be formed after 7 years (1985) with ages 7 through 15, equal to 4,272 adults of both sexes.

of individuals actually in the sea from a virgin stock (theoretical number of eggs protected every year on the nesting beach). This table takes into consideration such catastrophic events as hurricane Allen in 1980 and the flooding of the nests in the protected area in 1981 (Márquez, 1982), because it uses as the initial value the number of young released into the sea (column HR). For more details, the reader should refer to Márquez et al. (1982).

References

Márquez M., R., 1982. Atlantic Ridley Project 1981. Marine Turtle Newsletter, 21 (May): 3

Márquez M., R. A. Villanueva O. and M. Sanchez P. 1982. The population of the Kemp's Ridley Sea Turtle Lepidochelys kempi, Proceedings of the World Sea Turtle Conference, Washington: 159-164

Discussion
Larry Ogren, Leader

Ogren:
René, could you summarize the figures for nesting females since 1978 when the joint project started?

Márquez:
In 1947 there were about 40,000 nesters per arribazon. In 1960, there were about 10,000 nesters. In 1968, there were about 2,000 nesters. At that time there was a dense population of coyotes. Now there are about 1,500 nesting females. The animals don't lay every year, and we don't know how many animals there are in the sea. The population is in improving health.

Rabalais:
Have you ever observed copulation offshore?

Márquez:
Yes, one time in 1968.

Cornelius:
Have you observed nesting two years in a row? In other words, do they always nest every other year?

Márquez:
Yes, some nest every year; 90 percent nest every other year.

Wibbels:
How many come up already tagged?

Márquez:
In 1982, 60 of the 197 captured had tagging scars. 40 had tags, and there were about 600 laying that year.

Ogren:
On tagging, how successfully is the recapture program coming along, especially for the northern Gulf?

Márquez:
There are two to three tag recoveries every year from the northern Gulf.

Ogren:
Reporting has dropped off drastically. We need to encourage people to report captures.

Márquez:
Important information comes from the beach. Some tags come back years after laying.

Wibbels:
How many tag returns per year for adults?

Márquez:
Now on the U.S. side, about two.

Wibbels:
Are the majority from the Mississippi delta area?

Márquez:
Yes, and three to five from Mexico, primarily from the area of Tabasco.

Carr:
Any returns of turtles tagged on Aldama and retrieved outside that beach?

Márquez:
No.

Leong
L. olivacea ridley eggs can be up to 80 percent infected by fungus. Is this true for the Atlantic ridley?

Márquez:
The high density of L. olivacea eggs is not found in ridley eggs, so fungal infections are not a problem. Handling by man however may be a problem.

Owens:
How seriously would it impact your population model if maturity is not reached within seven to eight years?

Márquez:
One year's difference would make heavy changes in total population.

Potter:
Has the time of sexual maturity been determined in the lab?

Rabalais:
We have four ridley's, one of which matured after 12 years -- its estradiol level shot up 100 times.

Owens:
Under optimal conditions males seem to mature earlier, at least by secondary sexual characteristics.

Wibbels:
Did the arribadas occur over small or large beach areas?

Márquez:
If the wind is strong, in a small area. If there is no wind or rain, then spread out over a larger area.

Bickham:
What if the sex ratio is not one-to-one? Then we should find out what would be the optimal ratio and try to alter temperatures to obtain optimum.

Carr:
That is far ahead of existing research levels.

Ehrhart:
Loggerhead ratio is 50:50, based on a fairly small sample size.

Fritts:
There may be differences in behavior that make one group more visible and skew apparant sex ratios.

Owens:
It is difficult to determine adult sex ratios.

Ogren:
Time of year, for example, may affect ratios.

Amoss:
Sex ratio may not be as important as the number of males necessary to fertilize all the females, that is, the fecundity and fertility rate, is important.

Ogren:
Would the Mexican government put a guard at the lower end (Barra del Tordo) to protect against poaching?

Márquez:
The government is thinking about it, but there are no plans now. In fact, we include this place during runnings and watching.

Carr:
Does the lack of tag returns from Mexico have anything to do with the law against the fishermen? Are they afraid to report?

Márquez:
People are afraid because they are forbidden to catch animals. If they catch one, they throw it away without reporting.

Ogren:
We need a mechanism so that accidental capture is not punished. It must be made legal to return tags.

Potter:
We need a reward incentive, but not enough to make people want to go out and catch turtles.

HISTORICAL BACKGROUND OF THE INTERNATIONAL CONSERVATION PROGRAM FOR KEMP'S RIDLEY

J.B. Woody

In late 1973, representatives of the U.S. Fish and Widlife Service, National Park Service, and National Marine Fisheries Service drafted a 10-year plan to attempt to establish a second nesting population of the endangered Kemp's ridley (Lepidochelys kempi) on Padre Island National Seashore. Subsequent meetings with representatives of Mexico's Instituto Nacional de Pesca indicated that they would cooperate and assist the effort of the United States. Beginning in 1978, the Fish and Wildlife Service began supplying beach workers and necessary equipment to help the Instituto Nacional de Pesca in its conservation efforts on the species sole nesting beach in southern Tamaulipas, Mexico. In exchange for the annual assistance, the United States was allowed to gather and export to the United States as many as 3,000 ridley eggs, approximately two to three percent of the annual egg production.

These viable eggs are received by and cared for through hatching by the National Park Service on Padre Island National Seashore. Upon hatching, and after entering the sea, the hatchlings are gathered and turned over to the Galveston Lab of the National Marine Fisheries Service. The Lab maintains the hatchlings for as long as one year and then marks and releases the turtles into jointly selected areas in the Gulf of Mexico.

Associated with this project have been a number of spin-off benefits related to better understanding of sea turtle biology and management, and specifically to better understanding of the Kemp's ridley. Research and investigations generated as a result of this international effort have had far-reaching impacts and have helped focus public interest and concern on

the problems and needs of the world's sea turtle populations.

Discussion
Pat Burchfield, Leader

Rabalais:
Jack, do you expect the patterns to continue the same or do you anticipate problems?

Woody:
Yes, we expect to continue in the same manner. However, some problems should be anticipated with the change in administration in Mexico.

Dixon:
What happens after the 10 years are up?

Woody:
If the species is to recover and be maintained, this level of cooperation will have to continue. The work will have to go on, and should go on.

Potter:
A move should be made now to get the budget lines open.

Woody:
Yes, you can lay all the plans you want, but they may not go through.

Dixon:
There was a human population explosion along Tamaulipas, more so than in the past.

Márquez:
People there know the turtle population is in danger.

Dixon:
Are people fined for poaching?

Márquez:
The people who are jailed for poaching are taken to a jail in a nearby town. Most of these people are from out of town. The people around there do not poach.

Carr:
Has the highway cut the coyote population?

Márquez:
Now the coyote is not a problem.

Fritts:
By air, we saw little poaching. Have there been attitudinal changes? Is poaching not as much of a problem any more?

Woody:
If our people are there in Rancho Nuevo there is no problem. If we're not there, then you get poaching.

Ogren:
There are upswings of poaching in Florida.

Owens:
Private groups are channeling energies into problems. What can private groups do, aside from our support of government? In Florida private groups make significant contributions to the conservation effort.

Woody:
Ila Loetscher is a good example. There are, however, some legal restraints. We do have a good stranding network.

L. Hendrickson:
There was a similar local conservation situation in Biosphere Research. The approach there is to call a meeting of local people and inform them, show them that practicing conservation can be to their advantage. People there now know how to husband the animal. They have combined human nutrition and conservation.

Witham:
The Florida model may not be used in other areas because of the thousands of miles of beaches there. It would be an impossible task there without the private sector's protection of the resource.

Fletcher:
If turtles ever start coming back to Padre, we will need the private sector then.

Woody:
Ila starts the beach patrol in September.

PADRE ISLAND HATCHERY RESEARCH

Robert King

At 1900 hours on June 23, 1982, Padre Island National Seashore received 20 styrofoam boxes of Kemp's Ridley turtles eggs (2,017 eggs) from Playa de Rancho Nuevo, Tamaulipas, Mexico, by the U.S. Fish and Wildlife Service. This marked the fifth year of National Park Service participation in the 10 year Kemp's ridley sea turtle restoration project. The styrofoam boxes were then opened and examined, and thermocoupled assemblies were placed on top of each clutch of eggs. The eggs were covered with plastic window screen, and the box was filled with Padre Island beach sand. The styrofoam boxes were transported to the incubation cage, and the thermocouples were connected to a CR-5 multi-channel digital recorder. The CR-5 provided 24-hour monitoring of clutch temperatures at one-hour intervals. (Observations began at 2000 hours June 23, 1982.) Clutch moisture was checked often with the "pie crust pinch technique." Distilled water was used to maintain proper sand moisture. The eggs were left to incubate.

The clutches were checked periodically around the projected hatching date. When hatching was detected, the thermocouple was removed along with the plastic screen and sand. Hatching was allowed to proceed uninterrupted. To alleviate overcrowding, hatchlings were transferred to holding boxes to await imprinting. The turtles were imprinted to Padre Island beach using the method used in previous years, i.e., once active in the holding boxes they were placed on the beach and allowed to crawl approximately 50 meters to the surf, where they were allowed to swim briefly before being captured. Once imprinted, the turtles were transported to the National Marine Fisheries Laboratory in Galveston. Transport flights were conducted by Training Air Wing Four, Training Squadron VT 28 and VT 31,

Corpus Christi Naval Air Station. On August 16, 1982 the last hatchlings were transfered to Galveston, completing the Service's involvement in this year's project.

Park Biologist Robert King was responsible for the National Park Service Padre Island National Seashore portion of the project. Park Technician Donna Shaver (3rd year) and Park Ranger Anne Anderson collected all data and coordinated the imprinting process. Student Conservation Association employee Pam Plotkin assisted in all portions of the project. These persons were also involved in an extensive beach temperature profile study, which was conducted simultaneously with this project.

During past years numerous visitors to the National Seashore have come to watch the release and imprinting sequence. This interest led Park Naturalist Bob Whistler to develop a special interpretive program dealing with the Kemp's ridley project. International multi-agency cooperation, as well as the life history of the Kemp's ridley, were stressed in this program. The park information daily telephone recording included information on imprinting releases. In past years as many as 10 of these formal interpretive programs were given. This year, however, in an effort to minimize any effect of crowds and noise on the imprinting turtles, the number of formal programs was reduced to three. Media coverage continued on a regular basis throughout the incubation and imprinting period. The U.S. Navy's participation in transporting the hatchlings to Galveston also received television coverage.

To consolidate transfer to Galveston and to increase holding capability for hatchlings, some imprinted clutches were held in tubs of shallow seawater for periods as long as four days. Turtles held in this manner suffered no apparent harmful effects. This method provided hatchlings with

exposure to local seawater. This method replaced that in which the turtles were placed in wax boxes and periodically sprayed with seawater. Also, the tubs were kept in the turtle cage rather than inside the air-conditioned ranger station as in past years. No aggressive behavior was exhibited by the hatchlings during their periods in the tubs, and they appeared much more active than those held in boxes.

Once hatchlings are placed on the beach for imprinting they normally orient toward the morning sun and move across the beach in that direction. However, on August 9 the weather was overcast with no apparent sun and a 15- to 20-knot breeze out of the southeast. The extremely active state of clutch #645 necessitated an imprinting release. Once placed on the beach, the turtles milled around for a few minutes and then lifted their heads and headed into the wind. This led them in a southeast direction to the surf rather than the northeast direction they usually follow when orienting to the morning sun. Other than this new direction, imprinting proceeded as usual.

The graphs of the incubation temperatures clearly show than in every successful clutch, metabolic heat generation did not affect clutch temperature until completion of the second one-third of the incubation period. Consequently, metabolic heat can have no effect upon sex determination. Natural nests must be totally dependent upon sand temperature for sex determination.

All unhatched eggs were examined for embryonic development, after which all but 31 were buried. These 31 unhatched eggs were transferred to Dr. Chaney of Texas A&I University at Kingsville.

The present incubation cage is inadequate. Its small size cannot support the level of activity necessary to properly maintain 20 incubating

clutches. The location of the cage dictates excessive handling and needless transport of hatchlings. To be properly prepared for shipment to Galveston, the hatchlings must be transferred to the air-conditioned ranger station where they remain until transported to the airport, to avoid additional handling. A new facility is necessary. A properly designed and located facility would alleviate these problems. Such a design is presently under consideration, and, if approved, the new facility would be ready for the sixth year of the project.

The current practice of measuring only 10 turtles out of every clutch is not sufficient to detect what could be significant and detrimental shifts in hatchling size. The weighing and measuring of each hatchling should take place after imprinting and prior to shipment to Galveston. this is the only way yearly hatchling variation can be documented and differences between clutches illustrated. Weighing and measuring can be done quickly and need not expose the hatchling to undue harm. This new procedure will be instituted during 1983.

Discussion
Mark Grassman, leader

Witham:
What do eggs touch when they are laid?

Burchfield:
The eggs are handled with rubber gloves and are laid into clean plastic bags.

Witham:
Can plastic migrate into the eggs? Our environmental engineers say anything you want analyzed should not be put in plastic.

Burchfield:
Maybe we could use styrofoam boxes, we can't use glass.

Witham:
We use styrofoam boxes in the field, but the eggs are collected after they are laid, not as they are laid. You may be imprinting on plastic bags.

Amoss:
At some point between laying and hatching can you candle (to check fertility) the eggs to see what is there prior to hatching?

King:
That is not within the design of the project, although it should be done in the future. It is not feasible now due to the condition the population is in.

J. Hendrickson:
During the time prior to hatching this would be lovely. But I don't know how you would do this since membranes tear whenever you move the developing eggs.

Grassman:
How long does it take for a group of hatchlings to climb from the nest chamber to the surface? We speculate that they may imprint in the nest.

Márquez:
It's usually one to two days until the hatchlings appear on the beach. They also wait until the surface is the right temperature, about 5 a.m.

Witham:
What about the effect of littoral drift? Are Padre Island and Rancho Nuevo affected by this? In other words, will the same sand be there years later?

King:
There is a high drift on Padre Island. We take the sand from high up on the beach.

Wibbels:
Since the coast is roughly concave, the center of Padre Island is a convergent area for littoral drift.

King:
On the north end there is a net movement southward, and on the south end there is a net movement northward.

Grassman:
I would like to present some data that we have collected in our electronic monitoring system. This system monitors the movement of turtles into and out of four chambers. The number of entries into the chambers and time spent in each were recorded. While in the tanks, the turtles were exposed to either Padre Island sand and water or Galveston sand and water. We found that turtles, artificially imprinted on Padre Island sand, were significantly more attracted to Padre Island sand and water in terms of time spent per entry. We wonder now what would be the result if we tested Rancho Nuevo turtle's responses to Rancho Nuevo sand.

Crowder:
Did you do chemical analysis on the solutions?

Grassman:
No.

J. Hendrickson:
Imprinting is just a hypothesis that I personally have rejected for 20 years. Right now I've had my first solid evidence for conversion.

Grassman:
The best evidence for turtle imprinting until now has been that salmon do it.

Witham:
Could there be suppression of imprinting later in life?

Grassman:
Our turtles have not been exposed to Padre Island sand for 5 months.

Fritts:
Galveston is likely to differ a lot from other natural beaches.

Unknown participant:
Did they have the opportunity to react to more than one choice?

Grassman:
Each run lasted four hours. (During this time the animal could move freely.) The middle two hours were the most significant times in terms of entries. This could be a learning process.

Klima:
You may want to try larger animals?

Cornelius:
If they can detect the quality of water, then they are probably keying on a gradient. Is the gradient circumvented if during the imprinting process the turtles only take one gulp of water and are then picked up in a net?

Owens:
We need to continually re-evaluate the conservation process and practices being used. We think there is a time when imprinting is most likely to develop.

Carr:
It takes up to eight days for the turtles to come out of the nest in some species.

Unknown participant:
How many animals were used in your experiment?

Grassman:
The size of the experimental population was 12. Our data showed a high number of entries into Galveston sand and water, but more time spent per entry in Padre Island sand and water.

Leong:
Did you weigh the sand to use the same amount of sand per unit volume of water?

Grassman:
Yes.

Cornelius:
In October in Costa Rica a blind turtle participated in an arribada.

Owens:
This observation argues that olfaction is also important. There are probably many navigational components, such as is the case in birds. Olfaction may be very important for close-in navigation.

Márquez:
If you need Rancho Nuevo turtles and sand, we will send it to you, upon official request, through the Mexico-U.S. Gulf project.

Bickham:
Is the ridley really the one we should be working on? Is the ridley a good experimental animal?

Carr:
Sea turtles are good experimental animals because of their site-fidelity and site-tenacity. We don't know if this is true for freshwater turtles.

Witham:
Site-tenacity has also been shown for animals in aquatic environments.

Carr:
If they return to within one kilometer instead of 20 to 30 miles, then there must be something that gets the hatchlings back.

Fritts:
What about the bathymetric characteristics?

Whistler:
We need to pull all these together. If we could get a model of Rancho Nuevo, we could compare that model to other nesting areas. The model approach is best.

HEADSTARTING KEMPS RIDLEYS, 1982

Clark Fontaine, Jorge Leong and Charles Caillouet

Headstart

Kemp's ridley sea turtles (Lepidochelys kempi) are reared in captivity at the Galveston Laboratory under the Sea Turtle Headstart Research Project of the National Marine Fisheries Service (NMFS), Southeast Fisheries Center's (SEFC) Endangered Species Program. The growth and survival of the 1981 year class of Kemp's ridley turtles were very good. Disease problems were few, thereby accounting for the exceptionally good survival and growth. Of the 1,864 live[1] hatchlings received in 1981, 88.0 percent survived, and 1,639 in good condition[2] were tagged and released into the Gulf of Mexico as follows: (1) 1,521 turtles, averaging 649.8 g, were released off the Texas Coast on June 2, 1982, in the vicinity of the Padre Island National Seashore (PINS), with the intention of reinforcing their initial imprinting on that beach, and (2) 118 turtles, averaging 1,170.0 g, were released on July 14, 1982, off Galveston, Texas. For the first release, tagged yearling turtles were transported via U.S. Coast Guard aircraft from Galveston to Corpus Christi in approximately 200 specially padded and partitioned boxes. The tagged yearlings were released off PINS from the U.S. Coast Guard cutter Point Baker. The second release represented turtles retained for use as a captive brood stock in case no 1982 year class hatchlings were received. These were released off Galveston from the NMFS vessel OREGON II when the new hatchlings began to arrive.

[1] One hatchling was received dead, giving a total of 1,865 hatchlings received.

[2] One yearling was poorly developed, so it was not tagged and released, giving a total of 1,640 survivors.

As part of the international conservation program for the Kemp's ridley sea turtle, 6,812 captive-reared Kemp's ridley sea turtles have been tagged and released in the Gulf of Mexico since 1979. Of these, 154 have been recaptured. The recaptures have provided valuable data on the movements and growth of young ridleys (8 to 28 months old) in the wild. Of the recaptured ridleys that were accurately weighed, the majority had at least doubled or tripled in weight during time periods ranging from 244 to 533 days. The growth and movements as indicated by recaptured ridleys showed that they adapted well to life in the wild. Additionally, their growth rates suggested that it would take at least seven years for fast-growing Kemp's ridleys to mature sexually in the wild, and probably two or three times that long for slower-growing individuals.

Through December 8, 1982, 1,460 (95.8%) of the 1,524 Kemp's ridley sea turtles (1982 year class) received from the National Park Service between July 6 and August 16, 1982 had survived. All deaths of headstarted sea turtles were reported to the USFWS (U.S. Fish and Wildlife Service) on a 24-hour basis (except on weekends). All dead sea turtles were submitted to the Sea Turtle Pathology Research Project for necropsy. As of November 15, 1982 the 1982 year class averaged 174.0 g in weight, 9.7 cm in carapace length and 8.8 cm in carapace width, and were in very good condition.

Ten headstarted Kemp's ridley sea turtles of the 1978 year class remain at Sea Arama Marine World in Galveston, for development of a captive broodstock. As of December 1, 1981, these turtles averaged 19.3 kg in weight, 51.2 cm in carapace length, and 47.9 cm in carapace width. These turtles appeared to be in excellent condition and were receiving good care.

During 1982, four Kemp's ridley sea turtles from the sea turtle Head-

start Research Project were transferred to others for research purposes as follows:

(1) One from the 1978 year class (weight, 15.3 kg carapace length, 47.5 cam; carapace width, 46.5 cm) and one from the 1979 year class (weight, 12.0 kg; carapace length, 43.0 cm; carapace width, 38.4 cm) were transferred on September 2, 1982 to Dr. Steve Rablais, University of Texas, Institute of Marine Science, Port Aransas, Texas.

(2) One from the 1981 year class (weight, 462.0 g; carapace length, 12.4 cm; carapace width, 10.9 cm) was transferred on September 14, 1982 to Dr. David Owens, Texas A&M University, College Station, Texas.

(3) One from the 1978 year class (weight, 9.8 kg; carapace length, 38.3 cm; carapace width, 35.2 cm) was transferred on September 14, 1982 to Dr. Jorge Leong, NMFS SEFC Galveston Laboratory, Pathology Research Group.

Pathology

During 1982 the Sea Turtle Pathology Research Project received 65 sick Kemp's ridley hatchlings for clinical care and/or diagnosis and 168 dead hatchlings for necropsy, from the 1981 and 1982 year classes. The number of cases for each major category of disorder and number of turtles cured are shown in Table 1. The numbers and presumptive causes of death of sea turtles received for autopsy are shown in Table 2.

The most frequent illness and cause of death was mycosis (fungal infection). The predominant types of mycosis were those of the lungs, the liver and the yolk-sac, caused by either of two presumptive pathogens: Scolecobasidium constrictum and Paecilomyces sp. Many kinds of chemotherapy were tested on the various forms of mycosis, but none was effective. Occasionally, the progress of infection in a turtle stricken with scolecobasidial

pneumonia was arrested spontaneously, especially if the turtle was provided immediately with a clean and stable warmwater environment.

Internal mycoses, as with many other kinds of internal ailments in sea turtles, have been difficult to diagnose early or to monitor. Without adequate methods of diagnosis and monitoring, it is not possible to initiate medical treatments at an early stage of the disease nor to accurately evaluate the efficacy of therapy. Research is needed to develop such methods, if prophylaxes and cures for mycoses are to be developed.

An unusual and fatal urinary tract disorder occurred in the ridleys of the 1982 year class. Crystals, identified as ammonium magnesium phosphate, were found inside the urine collecting system. As of December 10, 1982, at least 9 (and perhaps 10) ridleys had died with urinary caculi. All were from the same rearing tank and the same clutch of 94 hatchlings from one female. Thus, the possibility of either genetic disease or microbial infection must be considered. This problem is being investigated jointly with the University of Texas Medical Branch in Galveston.

Another unusual disorder in the 1982 year class of Kemp's ridley hatchlings was the apparent non-absorption of the yolk-sac. Twenty-five hatchlings died with the yolk-sac still present in the body, along with other internal complications. No effective treatment or prophylaxis is known. However, one working hypothesis is that the condition may have been caused by feeding the animals too soon after hatching. It has been suggested that hatchlings need not be fed until after they are three to five days old. Further research is needed to confirm or reject this hypothesis.

The Sea Turtle Pathology Research Project continued to monitor a contract with the University of Rhode Island, the purpose of which is to determine the causes of death in stranded sea turtles.

On September 1, 1982, a total of 471 carcasses of Kemp's ridley hatchlings were shipped to Dr. Jack Frazier, Smithsonian Institution, Washington, D.C. The carcasses represented the remains from autopsied turtles that died between 1979 and 1982.

The following manuscripts are in various stages of preparation, review, and revision:

(1) The growth and movements of captive-reared Kemp's ridley sea turtles, Lepidochelys kempi, following their release in the Gulf of Mexico, by J.P. McVey and T. Wibbels.

(2) Disease studies aid Kemp's ridley sea turtle headstart project, by J.C. Clary III and J.K. Leong.

(3) The culture of young Kemp's ridley sea turtles (Lepidochelys kempi), by J.P. McVey, R.S. Wheeler, J.K. Leong, and R.M. Harris.

The following paper has been published:

(1) Radiologic evaluation of the differential absorption of diatrizoate in marine turtles, by G.L. McLellan and J.K. Leong. NOAA Tech. Memo. NMFS-SEFC-93, 15 p. May 1982.

Table 1. Turtle disorders and numbers cured.

Presumptive Diagnosis	Year Class 1981 No. Admitted	1981 No. Cured	1982 No. Admitted	1982 No.Cured
Mycosis	23	5	1	1[b]
Various types of surface body lesions	33	33	-	
Morphological malformation	3	2[a]	-	
Slight emaciation	2	2	-	
Hypertrophic optic gland	1	0	-	
Internal hemorrhage	1	0	-	
Alimentary canal disorder	1	0	-	
	64	42	1[c]	1[b]

a/ Turtles survived but remained deformed.
b/ Still under experimental medication as of 12/10/82.
c/ Beginning in October 1982, the treatment of sick or injured turtles was conducted by the Sea Turtle Headstart Research Project. The Sea Turtle Pathology Research Project continues to conduct diagnosis and autopsy, to recommend therapy and prophylaxis as requested, and to conduct research on diseases, injuries, and improvements in therapy and prophylaxis.

Table 2. Number of turtles and presumptive causes of death.

Presumptive Cause of Death	Year Class 1981 No.	1982 No.
Mycosis	74	6
Alimentary canal disorders	8	9
Lung/kidney hemorrhage	7	6
Liver disorder	4	-
Bacterial infection	5	-
Circulatory disorder	1	-
Urinary tract disorder	-	9
Emaciation/stunted growth	-	6
Non-absorption of yolk sac	-	25
Morphological malformation	-	1
Undetermined	3	4
	102	66

Discussion
Yuki Morris, Leader

Witham:
Have you seen viral infections recently?

Leong:
No. One time we did some electron microscopy work on lesions in Kemp's ridley turtles, but did not find any viruses.

Cornelius:
Why was SeaArama in Galveston so successful in raising sea turtles?

Klima:
At Seaquarium the animals were overfed and the animals were kept together. In Galveston they were kept separately. I don't know what happened at the Cayman Islands.

Owens:
There are considerable and important differences in rearing requirements for the different species.

Klima:
You cannot rear these animals together.

Leong:
Young Kemp's ridleys bite each other, but older animals don't seem to have these problems, as shown at Seaquarium where many three-year-old ridleys were reared together in large tanks.

Klima:
In one instance a ridley attacked a nurse shark.

Cornelius:
Olive ridleys in Costa Rica are very docile.

Owens:
It's the same with the olive ridley in Mexico.

Carr:
They also react to humans.

Márquez:
The ridley does not snap at feet. They may snap in tanks because they think they are being fed.

Witham:
If they get crowded, they are aggressive. True also for green turtles.

Morris:
We have testosterone radioimmunoassay data that pertains to the sex ratio question. We tested 30 to 35 turtles and found a slight bias towards males. This observation supports the temperature determined sex idea, in

that with lower temperatures we get more males.

Klima:
Could you discuss the sex ratio at SeaArama?

Morris:
We found a statistical difference in the sex ratios for L. kempi at SeaArama from those at Seaquarium. Perhaps the ones at Seaquarium were larger and older and may have experienced cooler temperatures during incubation.

Owens:
The temperature may only need to vary a degree or half a degree in order to cause an effect.

EXPERIMENTAL MARKING OF SEA TURTLES BY TISSUE MODIFICATION

L.P. Hendrickson and J.R. Hendrickson

In the Summer of 1980, we worked with three species of sea turtles (Chelonia mydas, Caretta caretta, and Lepidochelys kempi) at four locations (Miami, Grand Cayman Island, Galveston and Honolulu), to explore the feasibility of marking them with "living tags." Our goal was to develop a technique, practicable under field conditions, for marking large numbers of hatchlings with minimal disruption of nest-to-sea progression, disadvantage and unnatural influence, but with life-long, growing markings, recognizable whatever the age or size of the adult animal. To this end, we treated about 680 animals, exclusive of controls, with tissue grafts and a chemical melanin-suppressant.

At Miami (on C. caretta) and at Grand Cayman (on C. mydas) we tested monobenzylether of hydroquinone as the melanin-suppressant with little long-term success. At all four locations (all three species) we tried four variations of autografting procedures, some of which have given very encouraging results. Disks of tissue cut with a Keyes dermal punch and transplanted to sites prepared with the same instrument grew well, as did pieces of tissue gouged out by cutting obliquely with a dermal punch, then moved to sites prepared in like manner. Disks of plastral tissue inserted into pockets cut under the keratinous layer of carapace scutes were less successful. Small cylinders cut all the way through the marginal plates of the posterolateral carapace and replaced in reversed position gave the least satisfactory results. In all cases, waterproof surgical cement was used to seal off the operated site and hold the grafts in place. Although we tried to observe reasonable cleanliness and, in the treatment of two groups, applied a germicidal ointment over the completed, sealed graft,

aseptic procedures were not followed. Handling time for the procedures was less than three minutes per turtle. Survival of the experimental animals equalled or exceeded the rates of survival in untreated control groups.

The last inspection of all surviving experimental animals took place between 10 and 11 months post-operative. The animals were then released at sea with the exception of small groups kept in Miami, Grand Cayman and Honolulu for continued observation. At the time, nearly a year after grafting, the disk and gouge treatments showed more than 90% graft success in some cases of plastral tissue transplanted to the carapace. The success rate was lower with carapace tissue moved to the plastron. Now, 2.5 years after grafting, the remaining experimental animals in captivity still show conspicuous grafts on their carapaces, as did one Kemp's ridley headstarted at Galveston, recaptured after 289 days in the wild (about 19 months post-operative), and photographed before being released again. Most of the long-term captives have already achieved sizes comparable with wild turtles of considerably greater age, as estimated from what is presently known of growth rates in nature.

On the basis of the results described, further work is planned to refine the grafting procedures. In addition, the first major field test is being considered -- cohort marking of approximately 10,000 hatchlings. We invite discussion of the technique and solicit recommendations regarding site, species and protocols for the proposed major field test. We also invite discussion of the best way to establish suitable control of this marking system to avoid confusing replication of markings and to ensure maximum information retrieval.

Discussion
Lou Ehrhart, leader

Wibbels:
Can you make a tool (for skin transplants) to automate the process and increase speed and efficiency?

J. Henrickson:
We consulted several surgeons, but we were unable to come up with anything. The handling time is under two min/person. We can teach people to do this in about two hours.

L. Hendrickson:
An automated procedure would give precision of cut, but all the turtle shells may not have the same depth.

Witham:
The irregularity of the shape and growth may cause confusion later.

J. Hendrickson:
Until you understand tissue growth, you can't predict certain patterns.

Witham:
This is an inherent problem.

J. Hendrickson:
We now want to study the allometry of growth.

Carr:
Does this deserve mass attention? I think it does as long as you can prove you can work out the allometry problems.

J. Hendrickson:
Some of our transfers are good and some are bad. The question is, can we stretch it further? If Cayman Turtle Farm grows them twice as fast, are we seeing development now that we would normally see in the future?

Wibbels:
We got a recapture with a living mark nine months after marking. The carapace mark was good, but the plastron graft was not as good.

L. Hendrickson:
We think that plastron marks may not stay on as well because of rubbing on the cement bottom, etc. We may want to just mark on the dorsal surface, but this may present coding limitations.

Rabalais:
Can you go to the head for marking?

J. Hendrickson:
It didn't work on the head or flippers, but we didn't try very many.

Carr:
If you do a large release at a site, then coding wouldn't matter. You would just want to see if you got the tag back.

Klima:
You need a coding system or you will have confusion.

Carr:
If the coding won't work, you can at least do a large mark and release.

Harris:
If you use this instead of flipper tags, the public won't know about it.

Carr:
Flipper tags work well in the Carribean, but the living tag is good for finding out if the turtles return.

J. Hendrickson:
We are not proposing an overlap between the flipper tag and the living tag. The tags are testing for different things.

Carr:
But people will see it that way.

J. Hendrickson:
If we're ever going to get a life history table, this is the way to do it.

Owens:
The question is where to do a large study? Tortuguero is not good because there are too many places for the turtles to go. Ascension, Surinam, or Padre Island would be better, since the chances for ambiguity in interpreting tag returns would be minimal.

RANDOM NOTES ON SEA TURTLES IN THE WESTERN GULF OF MEXICO

Henry Hildebrand

This is intended as an informal report of my observations and ideas on sea turtle distribution and abundance in the western Gulf of Mexico. I have not had an opportunity to examine fully the data from the stranding network and the overflights, but what I have seen would not modify my views. Most reports indicate that marine turtles are rare animals in the western Gulf, consequently, they are difficult to study in their native haunts. If you are cost conscious it really leaves only the small arribadas of the ridley at Rancho Nuevo and the stranding of loggerheads on the Texas coast for the field observer. Fishermen are reluctant to give turtle information when asked and they rarely volunteer anything because of the strict endangered species laws.

I want to make a few brief remarks about the western Gulf as a habitat for turtles. If we look at the rainfall belts of the coastal plain as delineated by Hedgpeth (1953), three major regions are apparent. One, the humid areas, where the major rivers empty into the Gulf, are characterized by shallow turbid waters which are rich in shrimp and portunid crabs. These areas off Louisiana and Campeche-Tabasco are known from tagging returns to be congregating areas for the Kemp's ridley (Lepidochelys kempi), a crustacean eater. The ridley is, as far as is known, an inhabitant of the nearshore open Gulf waters and not a resident of bays and estuaries. Two, the region from Champoton, Campeche to the north shore of Yucatan is characterized by a karst topography with no surface rivers. Some freshwater springs are known offshore. From Campeche Bay to Punta Arenas, Mexico, is a low energy, everglade-type of coastline with no sand

for nesting beaches. The offshore waters are clear with submerged "grasses" including turtle grass, Thalassia testudinum. Three, the area from La Pesca to Corpus Christi, is a semi-arid zone -- a problem climate for geographers (Trewartha 1961). The coastal plain is downwind of a large body of water and meteorologists do not agree why this semiarid region with rainfall around 25 inches per year should be sandwiched between Vera Cruz with 60 inches and Galveston with 55 inches of rainfall per year. Furthermore the rainfall at stations within this zone may be highly variable from year to year -- yearly rainfalls of as much as 65 inches and as low as seven inches have been recorded at some stations during the past 80 years. Most rainfall is related to the hurricane season and in some years nearly all of it may fall in a 48-hour period. The coastline is a high energy one with well-developed sand beaches. Nesting records are rare indeed if we exclude some old reports from Washington Beach and the mouth of the Rio Grande. A few scattered records of ridley, loggerhead (Caretta caretta) and leatherback (Dermochelys coriacea) have been confirmed. The lagoons are connected to the Gulf by tidal passes which periodically close. Both major lagoons, Laguna Madre of Tamaulipas and of Texas, are hypersaline. The water is usually clear and near oceanic salinity at the larger more permanent inlets such as Aransas Pass and Brazos Santiago Pass, Texas. These areas in the past and today support turtle grass meadows. These "lost" turtle grassflats -- we have to go to the Chandeleur Island on the north and east or to Lobos Island to the south to find the nearest turtle grass pastures to Texas -- support few green turtles today, but in 1890, 550,000 pounds of green turtles (average size, 250 pounds per turtle) were harvested from the state.

Intriguing but brief accounts appeared in the popular press about the

early day turtle fishery, which disappeared entirely before any biologist became interested in the Texas coast. Available evidence supports the contention that young green turtles enter the bays during the summer--on the basis of Ixtoc oil spill data in late summer -- at about 22 cm carapace length. They wander around in the bays before finally settling in the turtle grass beds. At least, I have received small specimens or heard reports of them from a number of bays on the Texas coast which do not contain turtle grass. It is an enigma why there are virtually no records of big greens from the bays in recent years -- perhaps they cannot coexist with heavy boat traffic and fishing gear. Adult males and females are captured infrequently offshore by shrimp boats. Climatic factors must play a big role as well in the success or failure of the green on our coast. If one examines the record of average temperatures, it is essentially a straight line with no perceivable trend (Norwine, 1977). However, from time to time the coast is blasted by a severe cold front -- the conventional wisdom of the fishermen is once every ten years. The worst freeze on record was in February 1899, when temperatures dropped to below freezing ($29^{o}F$) as far south as Tuxpan, Mexico, and consequently, it has been blamed for destroying the green turtle fishery in Texas. Even a minor cold spell like the one of January 10-11, 1982 can cause severe losses -- seven moribund greens were found and all would have succumbed except that four were rescued in time. They recovered rapidly in aquaria. No nesting sites are known for the Texas population and only scattered nests are known in Tamaulipas, Vera Cruz, Campeche and the cays of Campeche Bank.

In Texas the hawksbill is recorded chiefly as neonates, which drift ashore during the summer and fall. They arrive as scattered individuals and are usually mutilated. Dinner-plate-sized individuals are occasionally

taken from the jetties or around oil field platforms, apparently survivors of a mild winter. Large ones are unknown, unless the rare eagle beak reported by old fishermen was this species. I have previously held the view that hawksbills arriving in Texas waters are waifs and probably sick or injured as well. However, the dramatic arrival and departure of oil from Ixtoc show the availability of a transport system for the hawksbill whereby it would remain in a suitable temperature throughout the year. The turtles seem to come ashore with Trichodesmium (a filamentous alga) and I have gone offshore and observed long windrows and patches of this blue green algae. The hawksbill is well camouflaged to live in these drift lines. Although Trichodesmium is not toxic to fish, they probably avoid it because it may clog their gills. As far as we know the hawksbill nests in widely scattered areas in the southern Gulf, including the environs of the city of Vera Cruz. Population estimates are unavailable, and I know no data which can be used to compute them. I saw only 7 in curio shops in Campeche in January 1982, and for what it is worth, my impression is that the number utilized is decreasing.

The loggerhead beyond a doubt is the most abundant turtle in Texas marine waters. This is based primarily on stranding reports and turtle sightings around oil production platforms. The strandings are certainly related to the activity of shrimpers fishing for white shrimp. I have previously postulated a north-south migration for loggerheads (personal observation) but there are no tagging data. They appear at the surface more often during the spring when Portuguese Man-of-War is abundant. Most of the loggerheads on the Texas coast are immatures of unknown origin. I have authenticated only two nests in Texas, one in 1977 and the other in 1979. Old newspaper accounts in the Corpus Christi newspaper mention

nesting of loggerheads on Pensacola Beach in the 1880s but I have discovered no accounts for Texas.

During 1979-80, Texas shrimpers were experimenting with longlines to catch swordfish. I had reports of one leatherback per 20 miles of line per night. If one used the data available on the number of trips, one would conclude that as many as 1,500 leatherbacks were captured during the season. Virtually all were released without mortality. This high capture rate was not consistent with what is known about the swordfishery elsewhere nor with the National Oceanic and Atmospheric Administration observer program on Japanese longliners in the central Gulf. If one disregards the pitfalls of extending one's data from a relatively small sample to the entire Texas fishery, one cannot account otherwise for the discrepancy except that, indeed, the catches off Texas were much higher than normal for the swordfishery. Experienced longliners inform me thay they may catch one or two leatherbacks in a year entangled in their buoy drops. I attribute the high catch rate in Texas in 1979-80 to three factors. One, our inexperienced fishermen were using exclusively surface lines instead of sinking the main line 60 or more feet below the surface. Two, the Ixtoc oil spill made the southern Gulf less inhabitable and concentrated the turtles near Texas. Three, our fishermen were fishing west and south of the normal fishing area in the Gulf and there may be a concentration of leatherbacks in the Brownsville eddy in the winter.

Finally, I think more work needs to be done on the neonates and young juveniles of all species. For example, my friend Harry Pederson attached a small styrofoam ball with a long string to the carapace of a neonate green turtle -- the turtle was several weeks old so it was past the period of swimming frenzy. He took the turtle out to a patch of floating Sargassum

in the clear Bahamian water for an underwater photography session. He found that the creature feared danger from above and would dive deep -- 50 feet or more -- rather than hide in the sargassum. These reactions, presumably to shadows, may be why greens are rarely recovered from Sargassum. On the other hand, loggerheads frequently are found associated with Sargassum, and this may mean they rely more on protective coloration.

Some years ago I was in Dos Bocas, Tabasco, and I saw the shell of a young ridley about 20 cm in length. The fishermen informed me thay they were not uncommon there. A few years later the same experience was repeated in Lafayette, Louisiana, but this time it was live ridleys in an aquarium at Southwestern University. Dr. Hoese of the biology department informed me thay they frequently obtained the small turtles from shrimpers. I also had the inquiry from a charter boat fishermen as to what species of small turtle occurred in the debris lines off Louisiana. Observations of turtles in driftlines must depend on extremely favorable sea conditions which are rarely found in the Gulf, because I have questioned a number of charterboatmen without eliciting a similar experience. On the other hand, I have flown over the Gulf when the large rivers were flooding in Tabasco, and the vast quantity of woody debris seemed like an ideal place for a small black turtle to hide, at least to my untrained eye.

In closing, I think many experiments on the behavior of turtles in relation to flotsam could be devised. Turtles, as reptiles, can tolerate a wide range of conditions and still survive, but as far as knowing what may be optimum for the species, we have few clues. The coasts and coastal waters of Texas and Mexico have changed greatly during the past 100 years as navigation, industry and agriculture has developed. Some areas previously untouched are now being modified. We need to understand and

mitigate the impact of development on marine animals. In some cases, we may be past the point of no return, but in most cases much can be done.

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Discussion
Ed Klima, leader

Wibbels:
Why do you think that the hatchlings are associated with the debris?

Hildebrand:
Hatchlings have been seen around solid objects such as floating logs.

Etchberger:
Do you see a lot of mutilations?

Hildebrand:
We see some shotgun wounds, some drownings. Some appear to be the results of boating accidents.

Ehrhart:
What are the trends in Laguna Madre?

Hildebrand:
It has basically remained the same over the years. Publicity gets an increase in reports from the public, but these die off after awhile.

Fritts:
Jack Frazier has studied turtles where there is an input of freshwater. Have you seen increased productivity where there is this freshwater input?

Hildebrand:
The rivers bring in sand which is necessary for nesting beaches on an otherwise rocky coast.

Fritts:
Do aggregations occur in association with freshwater?

Hildebrand:
Most aggregations of ridleys are out in deeper water.

Ehrhart:
Are there commercial gill net fisheries in Laguna Madre?

Hildebrand:
They are not legal.

Fritts:
What about the two leatherbacks that were caught in Mississippi in oyster dredges?

Ogren:
They were 16 to 18 inches, and they were reported four years ago in less than 20 feet of water. They haven't been seen since then.

Carr:
Were the Trichodesmid blooms large?

Hildebrand:
There is a linear relation.

Carr:
What was the smallest ridley you ever saw?

Hildebrand:
20 cm.

Carr:
René?

Márquez:
30 cm.

Carr:
One was seen in the Azores that had a carapace length of eight inches. This is at the opposite side of the Atlantic.

SEA TURTLE STRANDING AND SALVAGE RESEARCH

Steve Rabalais

Sea turtle strandings along the South Texas coast from Cedar Bayou to Brazos Santiago Pass have been documented for a second three-year period, January 1980 - December 1982. Information from these strandings has been included in a data base maintained by the Sea Turtle Stranding and Salvage Network (STSSN). According to the STSSN 1980 Annual Report the northwestern Gulf of Mexico (Texas, Louisiana and Mississippi) ranks third in strandings for 1980 compared to the northeast, middle, and southeast Atlantic. The loggerhead turtle (Caretta caretta) was the most frequently encountered turtle stranded in all four areas.

On the South Texas coast the number of strandings in 1980-1982 was sightly less than the number recorded during the three-year period 1976-1979 (Rabalais and Rabalais 1980; Table 1). The lack of adequate patrol on isolated beaches is one possible reason for the reduction in reported strandings. During 1976-1979, 11 and 23 turtles, respectively, were found on the two most isolated portions of the area covered, St. Joseph's Island and the area between Mansfield Pass and Big Shell Beach. In 1980-1982, two turtles were found in each of the two areas. These areas were patrolled regularly during 1976-1979 but were not frequently visited in 1980-1982.

The season during which turtles stranded and the relative abundance of the species stranded were similar during the two three-year periods. The majority of the strandings occurred in April, May and November in 1976-1979, and in July in 1980-1982. Loggerheads were the species most often encountered during both periods. In 1980-1982 the number of Kemp's ridleys (Lepidochelys kempi) strandings almost doubled but the relative number of neonates stranded decreased (six in 1976-1979 and eight in 1980-1982). No

neonate ridleys were reported in 1982. The number of greens, hawksbills, and leatherbacks increased in 1980-1982.

Discussion
Thane Wibbels, leader

Fritts:
You're correct about how a lack of people affects stranding data.

Rabalais:
I would rather see under-reporting than over-reporting. With over-reporting, one turtle can be reported several times.

Wibbels:
A good volunteer network needs good rapport with the public and good volunteers.

Ehrhart:
I'm surprised by the lack of adults, although I haven't done any research with animals from the eastern Gulf.

TURTLE EXCLUDER DEVICE

Wil Seidel

The purpose of this report is to review the development activities, results and status of the National Marine Fisheries Service, Southeast Fisheries Center, Mississippi Laboratories' Turtle Excluder Device (TED, see photo).

The Harvesting Systems and Fishing Surveys Division, Pascagoula, Mississippi, has conducted extensive research on techniques to reduce the incidental capture of sea turtles in shrimp trawls. This work resulted in the development of the extremely effective TED. Initial project objectives were to:

-- Reduce sea turtle capture at least 75 percent.

-- Restrict shrimp loss to less than 10 percent.

-- Insure that modification would be economical and easy to use.

Actual accomplishments met or exceeded the design objectives with results as follows:

-- Essentially eliminates sea turtle captures (>97% (eliminated)).
(<97% (caught)).

-- No shrimp loss.

-- $200-$600 cost depending on rigging.

-- Reasonably easy to handle.

Currently the major objectives have been accomplished. A technology transfer project has been initiated to publicize TED benefits to the shrimping industry and encourage voluntary acceptance and use of the device. The TED offers benefits to fishermen in addition to preventing sea turtle captures. Some of the benefits that can be realized are:

-- It eliminates the problem of handling large turtles and the damage a

turtle does to the shrimp catch.

-- It increases shrimp catch five to seven percent. Although not entirely explained, an actual shrimp catch increase occurs when TED is installed in a net, and the net and TED are properly balanced.

-- It reduces troublesome bycatch like jellyfish, horseshoe crabs, large fishes and loggerhead sponge.

-- If desired, finfish catch can be reduced approximately 50 percent during daytime trawling. Some species are reduced 80 to 90 percent. Finfish reduction is not very good at night, and additional work remains to try and improve the results.

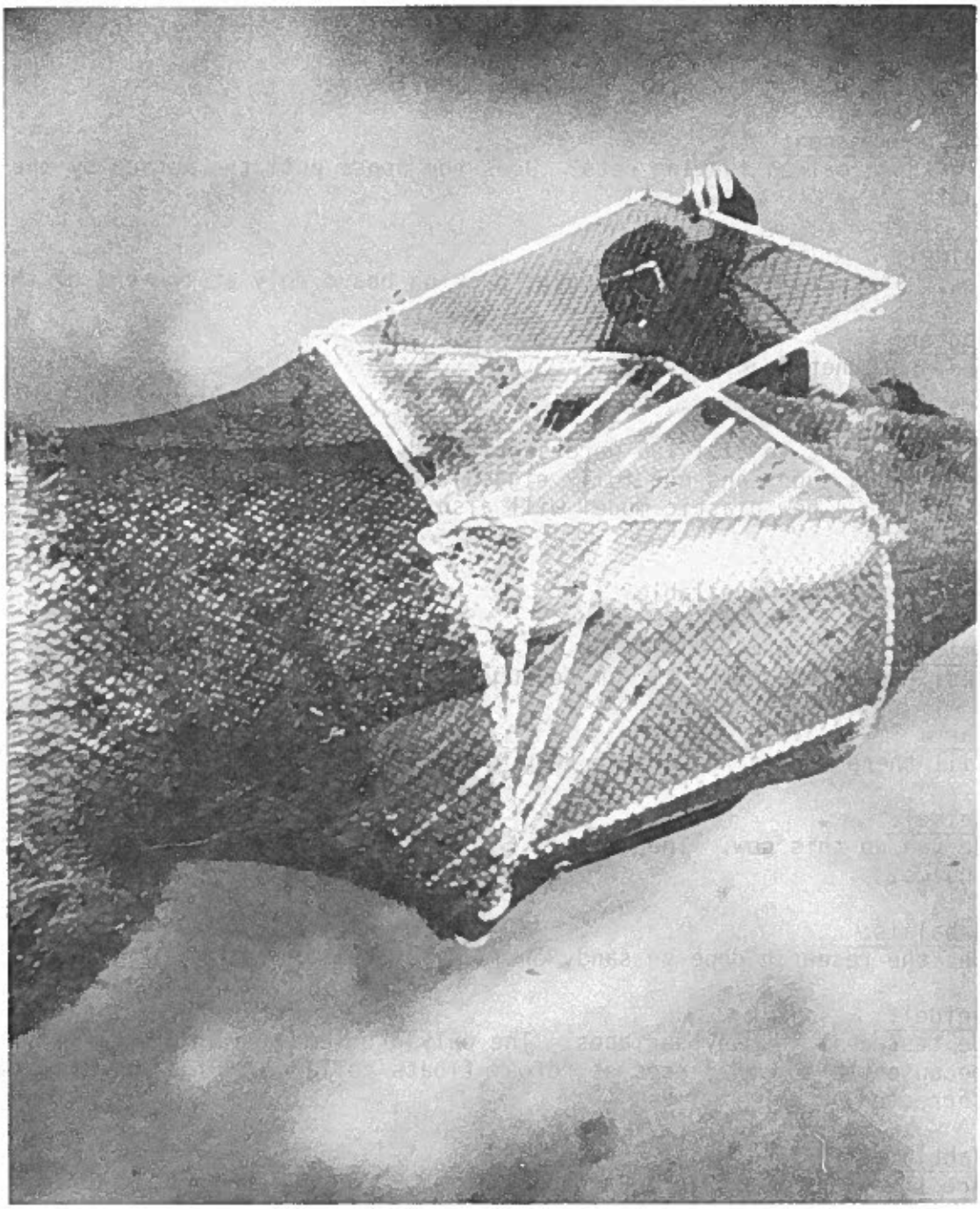
-- Overall drag is probably reduced. At the beginning of a tow, a trawl has a slightly higher drag with TED installed. However, during a three-hour tow, the drag becomes less than that of a standard net because of the reduced bycatch. To encourage voluntary use of TED, 196 devices were built and given to the shrimping industry on a first-come basis. Additional TED's have also been built privately.

During the fall of 1982 off south Georgia and northeast Florida, many of the TED's were installed on boats and used fulltime. NMFS, the Sea Grant College Program, and various shrimp associations have worked cooperatively to promote the use of the TED. What made the TED so attractive in the Georgia-Florida area, however, was the sudden arrival of "jellyballs" in such large numbers that vessels without the TED could not fish. Vessels using TED's could tow up to two hours. After installing TED's, many of the vessels continued to use the devices after the jellyfish left, because other unwanted bycatch was reduced. Once the crews got used to handling the device, it was "easier to leave the device in the net and use it than to take it out."

Currently, work is continuing to improve the nighttime fish separation rate. This feature is important to Gulf of Mexico shrimping, which is primarily a nighttime fishery. Work will also be directed at constructing a device from high-strength plastic. A plastic device would be much lighter and easier to handle on deck. It would also perform better in water than a metal device. The weight of a plastic TED could be adjusted to neutral buoyance, whereas a metal TED must be properly balanced with floats.

Overall, the TED has been very successful. It exceeds design goals and offers benefits to the shrimping industry in addition to protecting sea turtles.

NMFS, Sea Grant, the shrimp industry and environmentalists have worked well together in arriving at the mutually acceptable solution. The on going voluntary acceptance program has made good progress during its first season's efforts. It is anticipated that acceptance and use of the device will continue to grow during 1983.



Turtle Excluder Device

Discussion
Ralph Rayburn, Leader

J. Hendrickson:
Are these paired running nets? Does the noose pull the net up by the cod end?

Seidel:
Yes. The complete net is brought back on board only at the end of the day.

Potter:
Are these nets subsidized?

Seidel:
No. Only the initial 196 were subsidized. The cost varies from $200 (made in welding shops and not fully rigged) to $600 (manufactured, fully rigged). A new plastic model will also run about $200, not fully rigged.

Potter:
Are there plans available?

Seidel:
Yes, but we are currently improving them.

Carr:
Will there be refinements to keep the by-catch and let the turtles go?

Seidel:
We can do this now. The ability to get rid of the fish is the fisherman's choice.

Rabalais:
Was the research done on sandy or muddy bottoms?

Seidel:
We tested it on many surfaces. The only problems are in deeper water because the commonly used styrofoam floats collapse. This needs to be corrected.

Rabalais:
Are there any boats in Texas using this?

Seidel:
I don't know of any TEDs being used full-time in Texas.

OIL AND GAS IMPACTS ON MARINE TURTLES IN THE GULF OF MEXICO

Thomas H. Fritts

Little research has been performed on the impacts of petroleum exploration and production on marine turtles. Consequently, my discussion will be limited to two main perspectives: first, work already done on the effects of petroleum on the development and survival of marine turtle embryos, and secondly, a series of research approaches to the informational voids that hamper our evaluation of petroleum impacts on turtles.

Effects of Petroleum on the Development and Survival of Marine Turtle Embryos

Following the IXTOC oil spill, which occurred in Campeche Bay, Mexico in 1981, Bureau of Land Management (BLM, Minerals Management Service) asked the Denver Wildlife Research Center, U.S. Fish and Wildlife Service, to initiate studies on the effects of petroleum on reproductive success of turtles. Experiments were performed in the field and in the lab. Oiled beach sands from the spill area and sands treated with fresh crude oil were compared to control conditions employing clean sands. Experiments in the lab compared hatchability and development in relation to varying amounts of crude oil and varying time of exposure to crude oil. When oil was mixed uniformly with the sand at the beginning of incubation, no effects were detected with the concentrations used. However, when oil was introduced on top the sand after half of the incubation was completed, significant mortality was noted. Mortality resulted when 30 ml of fresh crude was deposted on 4 kg of sand. Samples receiving oil after 75 percent of the incubation period had the most pronounced mortality, but those receiving

oil after 50 percent of the incubation were also significantly affected. The stage of development at which mortality occurred was closely related to the time of oiling. Morphological differences were also detected between experimental and control samples, especially in those receiving oil early in the developmental period.

Although it is now clear that crude oil can reduce viability in even a tough animal like a turtle, several details remain to be determined regarding the causes of death and the actual degree of impact under natural conditions.

Because most oil would be transported onto beaches by wave action and turtles necessarily nest above normal high tide levels, most oil arriving during the nesting season would be deposited lower on the beach than would the nests. However, oil would be deposited in the nesting zone by storms (which in some cases would kill all eggs due to inundation) and during winter when no eggs would be present. Normally, most petroleum in the nesting area would be there several months prior to the nesting season and would be considerably weathered prior to contacting any turtle nests. Our observations in the field, using the well-weathered petroleum present on the beach in 1980, suggested that weathered oil had no effect on development or survival at least in the concentrations employed in experimental situations.

My preoccupation has consequently turned to the survival and growth of neonates and juveniles when they contact petroleum contaminants in the water instead of on the beach. To what extent do young turtles suffer from toxic effects or fouling? How many die due to immobilization of their appendages when fouled, due to suffocation, or due to reduced assimilation of nutrients because of petroleum in the gut? At present, one can only

wonder and speak to the value of initiating research into these and related topics.

The Gulf of Mexico represents a major portion of the warm oceanic waters of the continental United States and consequently comprises a major area for marine turtles normally confined to tropical and subtropical waters. Marine turtles have undergone significant reductions in population levels within historical times, and this decline may have been most severe in the western Gulf. Reduced population levels have been attributed in part to human harvest and to disruption of nesting. However, regulations and management practices directed at these human impacts have not resulted in significantly higher populations, and other factors may be threatening marine turtles in U.S. waters. Marine turtles have been shown by regular aerial surveys to be nearly 50 times as abundant in the eastern Gulf than in the western and central regions. Based on stranding frequency, mortality rates of turtles in the western Gulf appear to be higher than in other areas. Increased interest in the outer continental shelf (OCS) of the Gulf for oil and gas exploration creates additional environmental hazards to major concentrations of marine turtles. The strong influence of the Florida/Gulf Stream Current also threatens to carry any contaminants from the eastern Gulf to the Atlantic coast of Florida where major nesting of marine turtles occurs.

Marine turtle populations are concentrated within and adjacent to potential OCS lease areas. Our data suggest that marine turtles are primarily confined to continental shelf waters and their habitats are easily within reach of OCS drilling technology. Primary feeding grounds, wintering areas and nesting beaches are geographically close to areas of present and potential OCS activity. Whether turtles are more vulnerable to

petroleum at feeding grounds, or when aggregated for nesting or during winter dormancy, is still unknown.

Many aspects of the life history of marine turtles are poorly known. These voids pose the greatest threat to marine turtles in the face of oil and gas development. Major sources of mortality may be undetected, which would negate all other management and conservation efforts. Juvenile turtles are known to be fouled and killed by oil in the ocean, but the problem has not been adequately monitored. Plastic bags, which apparently resemble jellyfish, were present in a significant number of leatherbacks studied on the coast of Peru, an area of low human population densities. What is the impact of the massive amounts of marine garbage and other contaminants introduced into the Gulf by coastal and marine facilities? Active ingestion of petroleum globules and petroleum products is known to occur in both juveniles and adults. However, the habitats, foods and seasonal movements of juvenile turtles are poorly known, and no studies have been funded to investigate them adequately. The distribution and habitats of adults are better understood, but seasonal movements and activity patterns are critical voids that limit assessment of oil and gas impacts on adult turtles and their investigation.

Two investigative approaches are needed for studies of oil and gas impacts on marine turtles.

1. Intensive research is needed on critical voids in understanding the basic biology and behavior of all marine turtles.
2. Other research is needed on behavioral, physiological and ecological responses to petroleum contaminants and to environmental changes related to the oil and gas industry.

The latter applied approach is severely limited by the large size of most marine turtles, their low populations, levels, their protected status in U.S. waters and other factors limiting experimentation with oil and toxic substances in the field.

A Surrogate Species for Studies of Oil and Gas Effects

One turtle, the diamondback terrapin (Malaclemys terrapin), is readily available, occurs in marine waters in close proximity to oil lease sites, and is suitable for laboratory investigations. It is a potentially valuable alternative for investigations of a multidisciplinary scientific nature without the handicaps of other marine turtles. Information obtained from this species is relevant to interpretation of effects on other turtles less accessible for study, and such relationships could be investigated more efficiently once directed by work on the readily available species.

Terrapins occur in large numbers, are readily available without using costly research vessels and are not protected by regulatory agencies or public sentiment. This species is small, which facilitates capture, handling and laboratory maintenance during experimentation. A multi-faceted research program is needed in both field and laboratory situations and should be focused on population characteristics near oil production platforms, behavior, reproduction and toxicology.

Appropriate objectives of the study would be:

1. To assess survival, growth, reproduction, density and age structure of populations in relation to historical and present oil production sites.
2. To monitor movements, habitat utilization and feeding in relation to oil and gas structures and any contaminants.
3. To describe behavior in relation to detection, avoidance and accidental ingestion of petroleum and foods contaminated with petroleum.

4. To establish levels of physiological sensitivity to external fouling with petroleum and toxicological response to ingested petroleum components using histological, biochemical and behavioral criteria.
5. To determine sensitivity of embryos to petroleum contaminants in the nest media.

Field studies would involve monitoring two or more populations selected on the basis of proximity to oil and gas platforms. Surveys of basic population levels in several other areas would allow evaluation of any long-term effects on populations. Telemetric and marking techniques would be useful to track individuals and evaluate survival, growth, etc. Ideally, this study would span several field seasons to allow collection of adequate data on survivorship, movements, and population dynamics.

Critical Habitats in the Southeastern Gulf of Mexico

On the basis of systematic aerial surveys funded by BLM and incidental studies from other sources, it is evident that the Gulf, especially the southeastern area, supports a major concentration of marine turtles. Significant numbers of loggerhead, green, leatherback and Kemp's ridley turtles are present, even though major rookeries are largely lacking. This suggests that the area is a major feeding ground for non-breeding adults, subadults and potentially for juvenile turtles that are critical to the maintenance of populations in other areas of the Gulf of Mexico.

Studies conducted from boats are needed to (1) determine species, sizes and life stages of turtles present; (2) identify ecological correlates such as Sargassum, associated plant and animal species and bottom characteristics that might influence distribution, abundance and survival; and

(3) identify species on which turtles feed and their vulnerability to petroleum contamination.

The investigation of diel activity patterns is particularly critical to understanding the detectability of marine turtles. The estimation of population levels and densities depends upon knowing what proportion of time individuals spend at the surface and what variation occurs within a 24-hour period. The basking behavior of green and loggerhead turtles and the feeding of leatherbacks at the surface potentially expose these species to fouling by floating petroleum and to collisions with marine traffic. A knowledge of normal diving limits for each age class is essential to evaluating avoidance behavior and habitat utilization.

Vulnerability of Nesting Aggregations of Marine Turtles

The vulnerability of marine turtles to oil spills and other marine catastrophes may be greatly enhanced during the nesting season. When nesting occurs, breeding males and females aggregate off major nesting beaches. Females remain to renest at 12- to 14-day intervals. Males may be present only prior to and during the first two months of the nesting season. The pattern of movement of both sexes is unknown. Whether females remain immediately adjacent to the nesting beach or migrate considerable distances to feed and rest during the inter-nesting interval is unknown. A study is needed that would (1) provide quantitative estimates of relative abundance on a seasonal and geographic basis; (2) identify and map all marine turtles sighted, with special emphasis on distinguishing sexes; (3) monitor any reproductive behavior, aggregations of turtles, and associated vertebrates; (4) investigate associated ecological features such as currents, sea surface temperatures and bathymetric features that may characterize nesting beaches.

The Distribution and Ecology of Neonatal and Juvenile Turtles

The fate of marine turtle hatchlings entering waters contaminated by petroleum is unknown. Young turtles fouled with oil were recorded during the IXTOC oil spill and on several occasions on the Atlantic coast of Florida. Petroleum in the mouth and esophagus of some moribund turtles presumably resulted from active ingestion of petroleum globules mistaken for medusae or other prey.

The habitats of neonatal and juvenile turtles are unknown, and consequently the significance of oil-related mortality cannot be monitored at present. A review of all marine turtles in scientific collections and all other information sources is needed to identify juvenile habitats and immediately initiate field studies of the effects of oil.

The objectives of this study would be to (1) analyze all available data on the habitats of neonatal and juvenile marine turtles; (2) identify principal foods and feeding situations; (3) locate areas where young turtles are present; (4) define aspects of biology which might contribute to the mortality of young turtles; and (5) evaluate the influence of petroleum contaminants and other OCS activities on the survival of young age classes of marine turtles.

It is more important to know the effects of oil on populations than on individuals. It is important that we simultaneously investigate individual effects and their impacts on populations. The populations of marine turtles in the western Gulf are severely reduced. Consequently, careful planning, interagency cooperation and innovative research are needed if the complex problems related to marine turtles are to be solved.

Discussion
Marion Fischel, leader

Witham:
The possibility that a wave washing up may kill the eggs, that is not true. We have evidence that a wave washing over the nest does not harm the eggs.

Fritts:
Inundation does, however.

Green:
The water then does not actually reach the eggs. If the water does reach the eggs, it will kill them.

J. Hendrickson:
It may be suffocation rather than a chemical effect.

Fritts:
Suffocation, or air movements across the eggshell bringing in chemicals.

J. Hendrickson:
So as long as the oil is old and weathered it's not too bad?

Fritts:
Hatch rates were the same for oily and non-oily sand.

Witham:
Weathered oil is the problem with ingestion.

Fischel:
How many turtles have you found that ingested oil?

Witham:
Twenty to 30 greens, loggerheads, hawksbills and ridleys.

Potter:
On land after the oil is old -- about a year or so -- the volatile nature is gone and you can find herps living underneath it.

Carr:
After the IXTOC oil spill, did the helicopters visually select the area to dump the hatchlings?

Márquez:
They looked for oil-free, very clear places.

Witham:
They don't have to get caught in an oil spill; tarball ingestion is the problem.

Rabalais:
If we lost a year class wouldn't you see a lot of little dead turtles?

Woody:
By aerial observation, you may see a clean streak, but then an oily streak further on out. We won't know the effect for a few years.

Witham:
Just eyeballing an area and saying it's clean doesn't mean anything.

Wibbels:
It might be a disadvantage to feed turtles floating food pellets.

Witham:
No, turtles are very opportunistic.

Owens:
At the Mississippi meeting (Oil and Sea Turtles) we talked about doing some of the projects mentioned by Fritts. How do we stand on this Jake?

Lehman:
We are still not sure what the funding will be for the fiscal year 1983, which began in October 1982. The effect study on sea turtles is still being evaluated. We don't know what funding is available.

Fischel:
The Atlantic OCS is trying to get funding in 1984 for a study of the effect of oil on sea turtles. We have heard the chances of getting funded are marginal. Kleerekoper and Bennett looked at the effects of the soluble fraction of Louisiana oil. They found that turtles were very attracted to oil and even tried to chew on the entry point of the oil.

Discussion
David Owens, leader

Owens:
Do we all agree that Rancho Nuevo is our number one priority?

Fritts:
I think we could learn more about Kemp's ridley if we de-emphasize Rancho Nuevo and concentrate on the species.

Ogren:
I second that proposal.

Owens:
Rene, do you agree?

Márquez:
Yes.

Owens:
Is it possible to study the interaction between hatchlings and Sargassum? Could we do this with Kemp's ridley in conjunction with an oceanographic study?

Carr:
Absolutely. This has been suggested to the World Wildlife Fund.

Owens:
Are there any objections to any of the research recommendations made here (see list pages 5-8)? Should we talk about management now?

Márquez:
We are working to have another nesting colony on Padre Island. We have a small colony northwest of Veracruz. About 15 ridleys nest per year there. We hope to set up camp there next year. We may move some hatchlings from Rancho Nuevo to this new area.

Ogren:
We need to set up Sea Grant to get TED into this area.

Owens:
This is a good idea.

J. Hendrickson:
This is a modification of #21.

Owens:
Marine Information Service might be interested in writing this up.

Ogren:
Wil Seidel would participate in education.

Witham:
In #16 we should drop "by incubation temperature"; what we really want to know is how sex is determined.

Leong:
I would like to add in disease research under management techniques.

Fischel:
The distribution and ecology of juveniles is important. They might also be good for toxicity studies.

Potter:
A diamondback terrapin study would not work in Texas.

Fritts:
I think we should compare terrapin populations, if any, around rigs.

Owens:
Perhaps we should say to use other species whenever possible and appropriate.

Carr:
The problem is that turtles are becoming scarce in the western Gulf coast. Why not use turtles when they are abundant? Do well-thought out experiments for toxicity.

Witham:
We may be solving problems in the long range by using animals in the short range.

Carr:
There are sentimental problems.

Fritts:
We need to implement the TED.

Owens:
It's not true that you don't get many turtles in trawls. There are specific areas where turtles are abundant. Florida has contributed much to our research. Another resource for animals is genetically deformed turtles from the headstart program, such as those with stunted flippers.

Sizemore:
Ila has informed me she will allow you to use large animals that cannot go back into the wild, such as amputees.

Leong:
For a well-run experiment you must have enough animals to make your results statistically valid.

Witham:
To study the oil impact you need neonatal turtles. Larger turtles probably ingest tar without any problems.

Carr:
We've been talking about the problems associated with accumulated oil. Should oil spills be addressed also?

Witham:
We had a turtle come up that was covered with liquid oil. We couldn't save it.

Owens:
I recommend that we generate a committee for in-service training to look at stranded animals. What do you do when you find a carcass? We need to avoid duplication, maybe by marking ones already reported. We can learn a lot about reproductive physiology, parasitism, pathology, etc., from stranded animals.

Rabalais:
The advantage is that we may find other reasons why they are dying than shrimp trawlers.

Ehrhart:
A syndrome occurs on the Florida east coast in the spring where we find a lot of emaciated turtles. They are probably not feeding for months, and they are loaded with barnacles. We don't know much about it. Wolker at Rhode Island said spirochetes might be related. Kidney tubule necrosis might be related to low water temperature. You are going to have to make a better case for working on these carcasses or people are going to stop doing it. It's usually expensive and there is no visible gain.

L. Hendrickson:
What is the age of the emaciated animals?

Ehrhart:
They are all in the 50 to 85 cm range.

Leong:
There is no baseline data on the mortality of wild animals. We can only get this through experimentation. Death signs in pathology can be general or specific. We can't assign the signs of drowning until they have been experimentally determined. This is especially difficult since many of the animals are decomposed.

Wibbels:
Dr. Ehrhart, do you get the whole spectrum of decay?

Ehrhart:
Some animals are rotting before they die. The drowned animals are very ripe. We only freeze the freshest animals. However the pathologists say the tissues are not usable if they have been frozen. Until we get a way to get people on the beach together with people who can do a necropsy without freezing, we are missing the boat.

Leong:
In addition, some people are concerned from the legal point of view about the drowning of sea turtles. Unfortunately, turtles may not show classical drowning symptoms, so it is difficult to tell if the cause of death is really drowning. The characteristics of sea turtle drowning have not been well defined. Without this information, it is especially difficult to determine drowning in decaying dead turtles.

Owens:
A workshop on stranding and salvage techniques, without getting too ambitious, may solve some of these problems.

Potter:
We have a lot of people active on the coast. If we could get them informed of the need for information, we could use their observations.

Rabalais:
At UT we have a 10 by 10 (foot) freezer room available.

Ogren:
We need a cooler instead of a freezer.

Rabalais:
People need to know what tissues to collect.

Owens:
We have a necropsy manual available. Most organs are easy to find, an exception is the adrenal gland. Field dissections are important.

Witham:
We have a problem with the availability and direction of funds. There is an emphasis on getting a pathologist but not on getting people to pick up the animals.

Owens:
What do we need on oil production wells? I've heard there are about 2700 platforms in the northern Gulf. Can we contact any platform personnel?

Fischel:
This would probably be no problem. Crews find turtles there all the time. You would probably get a lot of cooperation. Shell allowed people to work on their rig. You could get a scientist on the rig as long as it doesn't affect their work.

Rabalais:
I know of half a dozen loggerheads that have been caught under rigs. I would be happy to help take information.

Owens:
Have you seen any ridleys?

Rabalais:
No.

Owens:
Helicopter pilots regularly see leatherbacks in the Gulf.

L. Hendrickson:
Are these recommendations listed in order of priority?

Owens:
No.

L. Hendrickson:
Education is important. It will be our future.

Owens:
Ila (Loetscher) has a good education program in South Texas, but we need this in North Texas, and perhaps we need educational programs in Spanish.

Loetscher:
We saw 10,000 school children last year. The schools are very eager to send students. They come from a radius of 100 to 150 miles. We get letters back that tell us the children learn what we are trying to teach them.

Bickham:
Nothing is known about the population genetics of turtles and other endangered species. It is difficult to design sound management if you don't know what you're managing. For example, the ridley vs. the green -- is there significant population variation? Loggerheads have significant genetic differences which can be used as tags.

Potter:
What about Sargassum ecology? If the hawksbill is associated with Trichodesmium, then perhaps we should study offshore neonate ecology to see if there is an association between Kemp's ridley and Sargassum.

Fritts:
We can draw Sargassum maps from aerial surveys.

Leong:
If I may go back to address the oil pollution issue. I would suspect research on pollutants other than oil should also be considered. There has been a lack of emphasis on the chronic effects of pollutants, for example, effects on reproductive capabilities and triggering the development of infectious diseases. We need studies on chronic effects.

Owens:
How do we get the shrimpers to get back in communication with us? Rewards? Lotteries?

Carr:
The fishermen are scared to report. The law is a good law, but the fishermen are scared. They would generally get rid of the turtle.

Owens:
What about a reward program?

Fritts:
I don't think that will work. If the shrimpers think the research will hurt their business they won't do it.

Ogren:
A reward system would be illegal. You couldn't put a reward out for tags. It would encourage hunting of turtles.

Wibbels:
We need local observers who can get out and talk to people and convince them to do it. Some shrimpers really support this.

Fischel:
What if you used "awards" instead of rewards?

Wibbels:
Isn't it illegal to even have ridleys on board?

Ogren:
We are trying to get it in the Federal Register to allow the capture of tagged animals.

Rayburn:
In reference to #9 and the Cayman Turtle Farm, is the government going to ease up on letting in farm-reared products?

Carr:
Some of your group got word that the shrimpers were against this, and this was a major influence.

Rayburn:
We met with congressmen and came out against it because this would stimulate demand for sea turtle products if the farm products were allowed in. If the law goes through, the turtle farm could bring in turtle meat. Interested groups should contact Secretary Watt.

Leong:
If I understand it correctly, a major handicap is, how one will know if the turtle meat which is being sold is not from the wild?

Wibbels:
How is the electrophoretic data?

Ogren:
You can tell the genus, but you can't tell within a species. We can't tell apart the farm stuff yet.

APPENDICES

APPENDIX I

FIELD NECROPSY GUIDE

1. Describe site of stranding, including weather. Photograph specimen.

2. Describe general body condition-ie. presence of barnacles, lacerations, amputation, & level of decomposition. Stage of rigor mortis, unnatural skin color, pooling of blood in specific areas i.e. mouth. Stage 2-putrefication, gas & foul odor produced.

3. Body measurements-weight (if possible), carapace length & width (straight preferred), plastron length, tail length-tip of tail to posterior edge of plastron.

4. Dissection of main body-performed with turtle on it's back.

a) Cut along bridge between carapace and the outermost plastron plates so that cartilage is cut.

b) Cut through skin along the posterior plastron edge and then separate the plastron from the underlying muscle mass to reveal the internal organs. Note odor if any and nature of any fluid present in body cavity.

5. Organ examination-

a) Note presence of lesions, parasitic infestations, or any other abnormalities present.

b) Lungs-in case of drowning lungs may be greatly expanded containing a watery fluid. Vomitus may be present in trachea and bronchi, and a persistant white foam may be expressed from nostrils by pressing on throat or may be present in trachea and bronchi and on cut sections of lung.

c) Stomach and intestines-check for presence of food or other substances (ie. plastic or petroleum) identifying them if possible. Check stomach and duodenum primarily, check for blockage also.

d) Sex animal and describe the reproductive status of gonads. In a female note relative size and number of follicles, corpora lutea, &/or eggs in oviduct (also note degree of calcification).

e) Anal area-check for prolapse (protrusion), exudates and fecal matter.

6. Dissection of throat-a mid-ventral incision is made posteriorly along the lower jaw to expose the trachea and esophagus. The mouth, trachea, and esophagus should be examined for presence of lesions, parasites or other obstructions.

7. Clean up site & properly dispose of animal.

Equipment List

1) Utility or butcher knife, 2) rubber gloves, 3) whirl packs, 4) plastic

bottle of formalin, 5) waterproof markers and labels, 6) scalpel, 7) tissue forceps, 8) scissors, 9) blunt probe, 10) tape measure &/or calipers, 11) camera.

NECROPSY DATA SHEET

Prosecector:	Phone:	Date:
Species	Tag#:	Sex:

Stranding site:

General body condition:

Carapace: LxW(S) LxW(C)	Plastron: (length)	Tail:

Status of body cavity: (Presence of fluid, parasites, lesions)

Lungs:	Stomach and Intestines:
Reproductive status:	Anal Area

Additional comments:

APPENDIX II

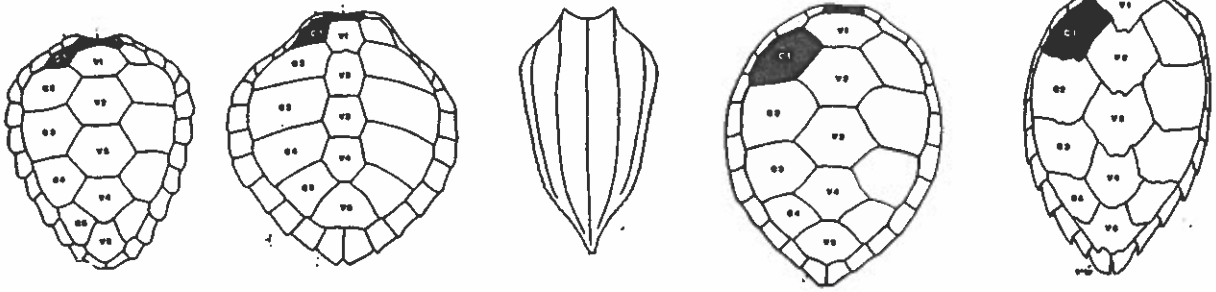
TURTLE SIGHTING REPORT

The purpose of this turtle sighting report is to record the incidence of sea turtles in the gulf of Mexico in the vicinity of oil platforms. It is suggested that they be sent to oil companies for distribution to their personnel. This was prepared in reference to the third recommendation under Surveys on page 6. Please make any suggestions that you feel would enhance the quality of this form.

Observer's name			Date	Platform		
Location					Lat.	Long.
How many turtles were seen?			How often are turtles seen?			
Are the turtles permanent or transient?						
Any growths, barnacles on turtle?			If yes, describe			
Was turtle tagged?		Tag number		Length of carapace		
Color of turtle	Gray		Brown		Black	Other
Weather conditions		Clear		Raining	Stormy	Other
Air temperature	30–50°	50–60°	60–70°	70–80°	80–90°	90–100°

Type of turtle

Loggerhead Ridley Leatherback Green Hawksbill



Sighted from	Boat	Platform	Helicopter	Scuba	Other
Condition of turtle	Healthy	Injured	Dead	Other	

Any other information on sighting

APPENDIX III

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