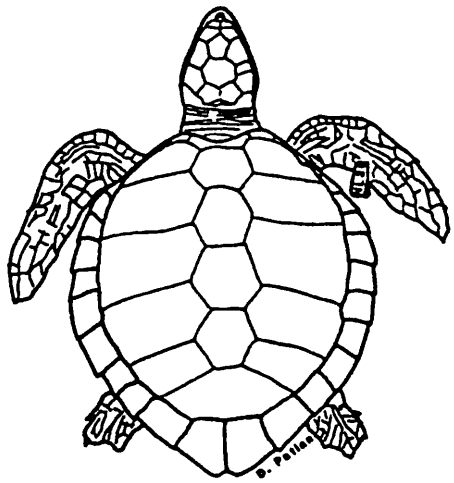
NOAA Technical Memorandum

NMFS-SEFC-255

Marine Turtle Habitat Plan



March 1990

U.S. Department of Commerce

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

Southeast Fisheries Center

75 Virginia Beach Drive

Miami, Florida 33149

NOAA Technical Memorandum

NMFS-SEFC-255

Marine Turtle Habitat Plan

by

Nancy Thompson, Chair

Tyrrell Henwood

Sheryan Epperly

Ren Lohoefener

Gregg Gitschlag

Larry Ogren

John Mysing

Maurice Renaud

March 1990

The Technical Memorandum series is used for documentation and timely communication of preliminary results, interm reports, or special-purpose information. Although the memoranda are not subject to complete formal review, editorial control, or detailed editing, they are expected to reflect sound professional work.

U.S. Department of Commerce

Robert A. Mosbacher, Secretary

National Oceanic and Atmospheric Administration

John A. Knauss, Under Secretary for Oceans and Atmosphere

National Marine Fisheries Service

William W. Fox, Jr., Assistant Administrator for Fisheries

Notice

The National Marine Fisheries Service (NMFS) does not approve, recommend, or endorse any proprietary product or material mentioned in this publication. No reference shall be made to NMFS, or to this publication furnished by NMFS, in any advertising or sales promotion which would indicate or imply that NMFS approves, recommends, or endorses any proprietary product or proprietary material mentioned herein or which has as its purpose any intent to cause directly or indirectly the advertised product to be used or purchased because of NMFS publication.

This report should be cited as follows:

Thompson, N.[1], T. Henwood[2], S. Epperly[3], R. Lohoefener[4], G. Gitschlag[5], L. Ogren[6], J. Mysing[4], and M. Renaud[5]. 1990. Marine Turtle Habitat Plan. NOAA Technical Memorandum NMFS-SEFC-255, 20 p.

Copies may be obtained by writing:

Dr. N.B. Thompson		NTIS
Southeast Fisheries Center, Miami Laboratory	or	5258 Port Royal Rd.
75 Virginia Beach Dr.		Springfield, VA 22161
Miami, FL 33149		

[1] Miami Laboratory, Miami, FL 33149

[2] Southeast Regional Office, St. Petersburg, FL 33702

[3] Beaufort Laboratory, Beaufort, NC 28516

[4] Mississippi Laboratories,Pascagoula, MS 39567

[5] Galveston Laboratory, Galveston, TX 77550

[6] Panama City Laboratory, Panama City, FL 32407

Table of Contents

Introduction	1
Responsibilities of Other Agencies	2
Information Needs	4
Habitat Research Priorities	6
Step Down Research Plan	12
Program Management Recommendations	15
Summary of Research Recommendations	17
Acknowledgements	20

Introduction

The goal of the Endangered Species Program is to conserve endangered and threatened species and their critical habitats by taking appropriate actions to recover listed species to the point that measures provided pursuant to the Endangered Species Act (1973 and amendments, herein noted as ESA) are no longer necessary. Within the southeast, marine turtles remain the focus of endangered species research. Of the five marine turtle species that occur in southeast U.S. waters, the Kemp's ridley (Lepidochelys kempi), leatherback (Dermochelys coriacea), hawksbill (Eretmochelys imbricata) and Florida breeding populations of green turtle (Chelonia mydas) are listed as endangered under the provisions of the ESA. The loggerhead turtle (Caretta caretta) and green turtle, outside Florida, are listed as threatened under the ESA. All five species are fully protected under the ESA. Under a Memorandum of Understanding with the U.S. Fish and Wildlife Service (FWS), NMFS is the lead agency for the protection of turtles in the water, and FWS has jurisdiction over turtles on land. Although we recognize that many critical nesting habitat issues must be addressed to effectively recover listed species, our program plan deals only with turtles in the water. Our research efforts, however, will be closely coordinated with FWS to ensure that both of our agencies are taking necessary actions to conserve the species.

To meet our program goals, prudent management measures must be developed and implemented. The success of these measures will rely on accurate information on the status of turtle stocks and the identification of factors preventing recovery. We have determined that the most appropriate approach to obtain this information is through characterization of turtle habitat. This approach is considered ideal for defining research needs for highly migratory species that utilize different habitats during different life history stages. This approach is consistent with that agreed on at the Workshop on Marine Mammals and Turtles in the Gulf of Mexico (Minerals Management Workshop, New Orleans, La. Aug. 1989, Draft Proceedings). Most importantly, this approach allows for the identification of potential interactions between turtles and human activities that result in both direct and indirect impacts on turtles, their habitats and dispersal mechanisms.

The primary research objective of our plan is to determine the temporal and spatial distributions of species and to identify factors that control these distributions over both the short and long term. We must first characterize habitat, then determine distributions within turtle habitat. Thus, we must be able to evaluate trends in distributions and abundance stratified by time, space, species and size/age/sex class. It is our intent that this document be used by the Program Manager for guidance to guarantee and to evaluate progress toward the program goal. Much of the proposed research must be done through the cooperative efforts of industry and other agencies, to the benefit of marine turtles. Without this information, we cannot effectively take management actions to recover listed species, nor can we adequately identify and quantify the sources and consequences of man-induced mortalities.

Responsibilities of Other Federal Agencies

An important part of our research plan involves cooperative research with other federal agencies. Section 7 of the ESA specifically addresses Interagency Cooperation, and outlines in detail the obligations of federal agencies with respect to endangered and threatened species. Excerpts from this Section follow:

"All other Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act." Section 7(a)(2) further states that "Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical."

In the southeast, several federal activities have been identified as potential sources of mortality to marine turtles. Most noteworthy are channel dredging operations by the U.S. Army Corps of Engineers (COE) and the U.S. Navy, Minerals Management Service (MMS) and COE oil and gas activities, and incidental take by fisheries under jurisdiction of NMFS. In each instance, the responsible federal agency has an obligation under the ESA to provide information necessary to determine whether their activities may jeopardize the recovery of listed species. To provide the required information, federal agencies must first determine what species occur, when they occur, where they occur, how many individuals may be present, and what impacts might be expected as a result of their activities. To facilitate communication with these agencies, Section 7 issues as related to them are embodied and highlighted in this plan.

The Minerals Management Service is responsible in the marine environment for the timely development of minerals within the EEZ. To fulfill their Section 7 obligations, MMS completes 1) a lease sale Environmental Impact Statement (EIS) and 2) conducts pre- and post-lease consultations. Lease sale EIS issues include all phases of preparing and submitting the EIS including the consideration of potential impacts from the sale and subsequent exploratory drilling. Statements are prepared by the Leasing and Environmental Studies Branches of the MMS Regional Offices. Environmental impact with respect to sea turtles is considered by Impact Producing Factors (IPFs). IPF's are: 1) offshore-related oil spills 2) collision with support vessels 3) explosive demolition of platforms 4) Outer Continental Shelf (OCS) oil/gas pipeline construction on beaches and 5) entanglement/ingestion of offshore oil/gas related debris and trash. Based on available information, MMS assigns a risk factor to each IPF. These risk factors can be organized into 3 variables: 1), the risk of the IPF occurrence; 2) the risk of the IPF encountering a sea turtle, and 3) the risk to the turtle after encountering an

IPF. Section 7 obligations directly relate to variables 2 and 3, and indirectly to variable 1. Risks to turtles may be instantaneous and lethal, as in the case of explosive platform removals, or sublethal and chronic, as in the case of oil spills, long term pollution, or habitat destruction/alteration.

Recent MMS post-lease consultations have focused on the potential impact of using high-velocity explosives to shear platform support structures. This risk to turtles can change depending on the occurrence of turtles relative to platforms. The question of creating habitat (i.e. platforms as resource rich areas for turtles) and then removing this habitat needs to be addressed relative to influencing present and future turtle distributions. Ideally, turtle distributions could be compared to distributions in the absence of existing platforms. Because this is not possible, one surrogate for this control is comparing turtle distributions in areas of high platform density with similar areas of no or low platform density.

The COE is responsible for maintaining the nation's navigable waters. In the southeast there are 7 district offices with responsibilities from Texas to North Carolina. The COE programs include those considered Civil Works (beach nourishment, wetland restoration, flood control and maintaining and developing shipping channels and water supplies). Channel dredging that impacts transportation of military vessels is coordinated with the U.S. Navy. Another program incorporates regulatory activities and includes issuing permits to complete civil works projects. Those activities that pose risks to marine turtles include maintenance dredging of the intracoastal waterway and about 45 ship channels in both the Gulf and Atlantic; disposal of dredged materials; beach nourishment; and marina construction. The COE is the counterpart of MMS for mineral activities in state territorial waters. Thus, those risks identified for MMS EEZ mineral development activities apply to the COE in inshore and offshore state waters.

In the past, MMS, COE and the U.S. Navy have funded channel surveys and surveys of offshore platforms to provide information needed to meet their ESA obligations. Such surveys have direct application to our programmatic needs and provide an opportunity to incorporate these efforts in an overall regional marine turtle plan. Additionally, cooperative research ventures are extremely useful in obtaining information which meets ESA obligations of federal agencies while allowing NMFS to obtain other information which may be of importance in meeting our specific programmatic objectives. MMS, in particular, has expressed an interest in continued funding of protected species research in the Gulf of Mexico to satisfy their ESA responsibilities.

Information Needs

We have ranked the relative importance of this research based on the known status of a species and potential risks within a given habitat, and the quality and extent of available information on habitat characterization and turtle distributions. In addition, the proposed plan first provides for research that characterizes habitat and defines turtle distributions stratified by species, size/age/sex class within this habitat; second, identifies the risks to species recovery; and lastly defines the research needed to address these risks.

We divide habitat into inshore and offshore. Inshore habitat is defined as inside the 72 COLREGS demarcation line (the collision regulation line as defined by the U.S. Coast Guard and overlaid on NOAA nautical charts of scale 1: 80,000). Offshore waters are defined as beyond the 72 COLREGS line. Within the offshore habitat the nearshore habitat is defined as within 30m water depth from the bottom. The distinction between inshore and offshore is consistent with existing and future management for marine turtles in southeast U.S. waters. The waters inside this line include all the bays, sounds, lagoons, and estuaries of the southeast U.S. The definition of offshore waters includes all waters beyond the barrier and coastal islands. The additional distinction in the offshore waters to include the term nearshore is to remain consistent with our knowledge of sea turtle habitat utilization. Therefore, offshore waters are divided into those equal to and less than 30m depth (referred to as nearshore) and those greater than 30m depth referred to as deeper offshore waters.

The Kemp's ridley is the most critically depleted marine turtle species in the world. Except for the pelagic juvenile stage, it is increasingly apparent that inshore waters within both the Gulf of Mexico and the Atlantic are critical developmental and foraging habitat for this species. The continued increase in human activities in inshore waters places all life history stages of the Kemp's ridley at risk. Therefore, obtaining information on spatial, temporal and size class composition of Kemp's ridleys in inshore waters is identified as the highest priority information need.

Within the area we define as offshore, coastal waters are important foraging habitat for the Kemp's ridley turtle. The extent of human activities in these coastal waters place this species at risk within offshore waters. Research within these waters to define spatial/temporal distributions and abundance of the Kemp's ridley is considered the second most important information requirement.

The leatherback turtle is the only largely pelagic species. Increased human utilization of deeper offshore waters places all life history stages of this species at increasing risk. However, while we have some data which show this species is present in offshore waters, we do not know their spatial/temporal distributions and what mechanisms determine

the distributions for this far ranging species. This information gap is identified as the next priority.

The impacts of human activities on the juvenile, sub-adult and the adult life history stages of the green turtle is greater in inshore waters than offshore waters. Green turtles aggregate on sea grass beds which are found inshore. Thus, research in inshore waters that focus on this species is the next priority. It is likely that because the highest priority focuses efforts on the Kemp's ridley in inshore waters, information on green turtles can easily be collected at no or low additional cost. Specifically the Cedar Key area and Florida Bay support both species and should be index areas for this species in addition to providing information on the Kemp's ridley. The Indian-Banana River complex is the site of several years of research by Dr. Lew Ehrhart, University of Central Florida. This continuous research resulted in this area being the only index area for this species in Florida waters. This research must continue to provide an index for this species in inshore Florida waters. We strongly recommend continuation of this research.

The most abundant species in U.S. waters is the loggerhead turtles. This turtle is present in inshore and offshore waters. However, we have baseline information on the distributions and abundance of this species within southeast U.S. offshore waters to the 200 m isobath. It is most important that sampling for this species focus on index areas to develop a time series that is adequate for the determination of status. We know more about this species in offshore waters and have developed indices of abundance. The current information need is for comparative data. When these data are collected, it will represent the first data base adequate for the determination of trends in distribution and abundance, which is critical in evaluating the status of any species. For these reasons, this information on the distribution and abundance of loggerhead turtles in offshore waters is identified as next in priority. Comparative data can only be provided via consistency in sampling. Thus, all long term research programs must be planned with consistency in sampling as the basis.

All marine turtles demonstrate a pelagic stage which begins with the hatchling stage and may extend up to four or five years, depending on the species. There is increasing evidence that this life history stage is associated with weedlines in the pelagic zone. This zone also concentrates debris and pollutants which pose risks to this life history stage. The magnitude of this risk is not known and we recommend continued research through the NWAFC Entanglement and Debris Program to determine the extent of risk to small pelagic turtles. Because small turtles may aggregate in this zone, impacts to the population could be significant under catastrophic conditions, such as a large oil spill which might eliminate one or several cohorts in this zone. While there is a significant need to obtain information on this life history stage, research is extremely expensive. Because of our limited ability to conduct comprehensive research on small turtles in this zone, this research is given a relatively low priority.

The hawksbill turtle forages on live bottom and coral reefs. The extent of it's distribution within U.S. waters tends to be restricted within U.S. Caribbean Sea offshore waters.

Because this species is found primarily outside U.S. waters, obtaining information on the distribution, abundance, and habitat requirements is identified as the lowest priority. However, as available habitat is altered and lost, habitat within U.S. waters may increase in importance. Priorities within this plan may be altered at any time to accomodate changes in habitat quality and quantity and available information on habitat requirements.

Habitat Research Priorities

Research recommended to fill information gaps are identified in the priority order previously identified. For both the inshore and offshore waters of the southeast, the known and potential impacts to turtles are identified first but not in the order of releative importance. The priority areas are identified next and finally the recommended research approach is defined.

Inshore Waters

Impacts

Inshore waters are utilized more extensively than offshore waters by man resulting in intense competition for common resources with marine species or alteration of habitat. The impacts of human activities are numerous and direct and or indirect. We define direct impacts as those that directly impact turtles, at the individual and population level; indirect impacts are those that effect available and potential turtle habitat through alteration or loss.

Activities that can directly impact turtles are:

a. oil related activities regulated by the COE including both platform placement and removal; and channelization for access to platforms.

b. maintenance of navigable waterways (COE)

c. incidental catch in fisheries including shrimp trawling, finfish trawling, gill nets, pound nets, dredges, seines, hook and line, clam kicking, traps and pots, channel nets, butterfly nets, scallop trawls, and trot-lines

d. entrainment in power plants

e. bombing by the military

Activities in the inshore habitat that can indirectly impact turtles are:

a. dredging, filling, and spoil disposal

b. stream diversion and channelization

c. upland drainage

d. impoundments

e. point source pollution

f. accumulation of debris

Priority Areas

Extensive bay and estuarine systems in the southeast include: the Laguna Madre system in southern Texas; the entire salt marsh system in Louisiana; Mississippi Sound; Cedar Key and Homassassa Springs of the Florida west coast; the Ten Thousand Islands and Florida Bay complex in southwestern Florida; the Indian and Banana Rivers complex in east Florida; the extensive sounds and bays of Georgia and South Carolina; and the Pamlico-Albemarle-Core Sound complex of North Carolina.

Our mark-recapture and stranding data indicate that these systems and all inshore waters of the Gulf and Atlantic are likely crucial developmental and foraging habitat for juvenile, sub-adult, and adult Kemp's ridleys. Our data suggest that the Western and Central Gulf of Mexico, from eastern Texas to the Mississippi Sound is currently crucial habitat for all size classes of Kemp's ridleys except the relatively brief pelagic year or years. This area is also heavily utilized by man and the potential for interaction between man and Kemp's in this area is high. Because of the magnitude of risk presented to Kemp's within this area, we consider the characterization of this habitat as crucial to the Kemp's ridley to be the highest priority.

Second in priority is the characterization of the Atlantic as developmental habitat for the Kemp's ridley. The primary risks to turtles within this area includes fishing (particularly shrimp trawling), channel dredging and military operations. Characterization of the Pamlico-Albemarle-Core Sound Complex of North Carolina, the largest inshore water complex within the southeast must continue. It is imperative that similar work be conducted within the inshore waters of both South Carolina and Georgia. A mass stranding of approximately 100 juvenile and sub-adult Kemp's ridley turtles in October 1988 to January 1989 demonstrated the importance of the inshore Georgia waters to this species during the late fall and winter. Evidence is also accumulating that Kemp's ridleys that inhabit the Atlantic are not "waifs" and lost to the reproductive portion of the population. Thus, the characterization of the North Atlantic as Kemp's ridley habitat and discerning their distribution within inshore waters is essential.

Our third priority is the continued characterization of the Eastern Gulf. This area is known to be important to the Kemp's ridley but the extent of human use in this area is limited. Priorities will shift in response to changes in turtle nabitat preferences and needs. In addition, areas which are important to turtles now may be less important in the future, and those areas not currently utilized may increase in importance with time. For example, the Kemp's ridley has been observed within Florida Bay. Given the protective status of this eastern Gulf of Mexico bay, this area is a candidate safe refuge for this and other species.

The last area includes all the sea grass beds that likely have green turtles associated with them. Sea grass beds are important foraging and developmental areas for the green turtles and possibly Kemp's ridleys. However, the relative importance of other discrete sea grass areas to turtles is not known. Because information on the importance of grass beds to turtles will likely be obtained while sampling inshore waters for Kemp's ridleys, this specific information requirement is given lowest priority.

Research Approach

As a first step each area must be characterized. It is unlikely that all the physical, chemical and biological factors that cumulatively result in turtle habitat can be described, measured, or compared over time and space. It is recommended that five or so key parameters be identified that can be measured with sufficient precision to index changes over time and space. These factors should include water temperature, current patterns, prey or forage item availability and predictability, and bottom type, which correlate with other factors that structure the ecosystem. This task will be labor intensive because of the considerable data currently available that must be first examined. Filling in the gaps will require empirical sampling. Given the extent of use of the Western Gulf by MMS and ship channels within the North Atlantic, these areas may already be sampled and a cooperative approach is recommended for obtaining habitat data.

Once habitat is characterized throughout the Gulf and Atlantic, available information on turtle distributions must be overlaid. This task necessitates a review of existing information collected from prior surveys (aerial and vessel), dredge and vessel observer data, mark-recapture and stranding data, nesting records, historical sighting and capture records, etc.

Once areas of turtle abundance are characterized from existing data, information gaps are filled via empirical sampling for turtle presence or absence, size and sex class, species composition, and seasonal movements should be implemented. This can be accomplished through a variety of capture methods, most of which are labor intensive and area specific. To examine distributions and or movements of turtles over large areas, satellite tags and aerial surveys may be the most cost effective methods. Satellite tags provide information on specific individuals, and given large sample sizes, can be used to educe population or stock movements. Aerial surveys have provided synoptic

information for loggerhead and leatherback turtles. Leatherbacks are large and loggerhead coloration provides a contrast to water color, facilitating their observation at the surface of the water from an aerial platform. However, in certain areas, such as Florida Bay, water clarity may allow for the detection and identification of green turtles. In addition, it may be possible to develop estimates of Kemp's ridley and green turtles from aerial surveys based on applying species composition data from other sources to aerial survey data.

Local movements and short range habitat fidelity can be measured with sonic and radio tagging. Local areas or "hot spots" for Kemp's ridleys already identified should be the first areas investigated. These areas include the Sabine Pass to Pearl River area within the Western Gulf, and the Cedar Key area in the Eastern Gulf.

At some time in conjunction with field work, the impact of satellite, radio, and sonic tags on turtle behavior needs to be evaluated for two reasons. First, the tags themselves may alter behavior and resulting data cannot be generally applied. Second, the tags may increase mortality either directly or indirectly. Evaluations of the effect of tags can be accomplished through laboratory and field studies. It is generally accepted that tags that weigh less than 10% of any animal's body weight will not negatively affect turtle behavior (R. Byles, pers. comm.). However, this has yet to be demonstrated and needs to be addressed. Therefore, it appears that tagging in local areas using sonic and radio tags under a strict experimental regime, is the best approach to answering important questions on turtle habitat utilization. If tags are found to alter behavior, it is imperative that NMFS develop tags or alternative methods that do not impact turtle behavior and mortality.

In addition to directed sampling, several existing sampling programs targeting other resources can provide opportunistic data on the presence of turtles. Among these programs is the NMFS Marine Recreational Fishing Statistics Survey (MRFSS) and the port agent program. These programs can incorporate questions on the presence of turtles but inclusion in the MRFSS requires Office of Management and Budget (OMB) approval. The opportunistic cooperation of fishermen has been locally successful. For example, in North Carolina utilizing pound net fishermen for turtle mark recapture has provided very useful information on turtles in inshore N.C. waters. In addition, the placement of posters requesting information on turtle sightings at fish houses and docks have also proven successful in N.C.. These opportunistic programs provide information on where turtles may occur and are useful in identifying "hot spots." They will not tell us which habitats are avoided or not utilized by turtles or give us data on habitats not utilized by man.

Offshore

Impacts

This area includes a wide diversity of habitat types. All species of sea turtles occur in the offshore waters of the U.S. during specific phases of their life histories. Many of the same risks to turtles in inshore waters apply to turtles in offshore waters. Again impacts can be direct or indirect.

Activities in the offshore environment that can directly impact turtles are:

a. incidental take in fisheries including longlines, shrimp trawling, finfish trawling, gill nets, hook and line

b. oil related activities (MMS) include all phases of exploration, development, production, and abandonment and removal; and associated vessel traffic and oil transport

c. pollution including entanglement in ghost fishing gear, chronic effects of ingestion, and mechanical impacts

Activities that can indirectly impact turtles are:

a. oil exploration and platform placement and removal

b. pollution

c. accumulation of debris and toxins

Priority Areas

The Kemp's ridley is found within nearshore waters of the Gulf of Mexico and Atlantic. Human activities and the risks placed on turtles in inshore waters include oil and gas development (both COE and MMS); point source pollution (EPA) and the effects of the accumulation of debris; channel dredging and disposal of dredged materials; vessel traffic; and fishing activities particularly shrimp trawling. The potential impacts to the Kemp's ridley within nearshore waters are great and addressing these impacts is the highest priority within offshore waters.

The extent and intent of human use of deeper offshore waters places all life history stages of leatherback turtle at risk. The two immediate concerns include the exploration and possible development for minerals and increased fishing effort, especially longlining both in deeper Gulf of Mexico waters . As MMS allows for the exploration and production of oil and other minerals in deeper waters, the impact of the creation or

degradation of habitat relative to these activities needs to be addressed. The Japanese longline fishery for bluefin tuna in the Gulf of Mexico reported significant catches of leatherback turtles. The increase of domestic longlining in the Gulf of Mexico for yellowfin tuna is probably resulting in the incidental capture of leatherback turtles. Thus, this area is considered next in priority.

Habitat utilization by hawksbill and juvenile green turtles is considered to be a lower priority item within the context of the southeast U.S. sea turtle program. This does not imply that such research is not vital to our understanding of the biology of these species, just that our funding levels are insufficient to do everything that is needed. Presently, it appears that the most immediate threats to hawksbills are the continued poaching of eggs at nesting beaches and legal and illegal trade in hawksbill shell. As areas of importance to hawksbill turtles shift to include U.S. waters, then our plan must evolve to accommodate these changes. For now, we hope that information on marine turtles can be obtained opportunistically through existing programs on reef resources. The NOAA Marine Sanctuary Program is an appropriate vehicle to obtain information on marine turtles associated with reefs in the U.S. Caribbean.

Evidence is accumulating that individuals of all species of marine turtles pass through a pelagic developmental stage, and are associated with weedlines or areas of convergence. These are also areas where debris accumulate placing these turtles at risk from entanglement or ingestion of debris. The effects of ingestion may be acute or chronic and the effect of accumulating toxins from debris have not been determined. Currently, the Northwest Fisheries Center (NWFC) supports research on these issues in the southeast through the Debris and Entanglement Program. Support from this project is certainly not adequate to address these issues. To properly address these issues will require increased funding.

Additional research that needs to be folded into these on-going projects is the examination of satellite imagery to determine the possibility of identifying convergence areas via thermal fronts, and transmitting real time imagery to vessels for ground truthing for the presence of turtles. This research is vital to understanding this pelagic stage and the impacts of debris on all species. While some of these issues are being addressed by the NWFC, they cannot address all of these particularly as related to Section 7 questions. Thus, many of these issues can only be addressed through interagency cooperation.

Research Approach

The research approach needed to obtain information on turtle distributions and abundance in offshore waters is similar to that within the inshore waters. Existing information needs to be examined, and preferred turtle habitat characterized. Aerial surveys are not useful in censusing Kemp's ridleys on a regional basis. In fact, its relative

rareness prohibits synoptic sampling within this zone. Thus, areas where Kemp's are most likely found need to the focus of sampling. When Kemp's are encountered, satellite tagging is the preferred means of obtaining the necessary information on a large scale.

Observer programs, vessel surveys and a variety of other capture methods might also be appropriate to obtain the needed information within specific areas. While the placement of observers on vessels is the best way to collect data on incidental turtle take and mortality in the target fishery, these programs are expensive (cost, of course is dependent on the extent of the fishery), and require the cooperation of industry, which cannot be guaranteed to provide information over all fishing seasons, regions and target species or gear. Turtle distributions can be elucidated through sonic and radio tagging in coordination with small vessel netting surveys. It seems likely that some combination of methods of surveying turtle distributions may be the "best" approach to meeting our information needs.

Aerial surveys to census marine mammals in waters greater than 30m can provide information on loggerhead and leatherback turtles. However, aerial surveys over waters beyond 200m depth are not cost effective and are dangerous. The alternative, vessel surveys, are not an appropriate platform to census leatherback turtles. However, if turtles are captured via longlines, then the application of satellite tags will provide information on the movements of this highly migratory species. Because there is no efficient method currently used to census turtle in deep offshore waters, it is the responsibility of NMFS to develop such a methodology. As a first step, opportunistic sighting and tagging can be accomplished by piggy-backing on marine mammal and other oceanographic vessel surveys. However, because these do not target marine turtles, these data will be limited in interpretation. It is recommended that research and development towards a sampling methodology for deep offshore waters be initiated. One methodology must address the distributions and abundance of leatherback turtles. A separate methodology must address the distribution and abundance of the small pelagic life history stage of all species. Research and development of these methodologies will require funding beyond the scope of the present base, if it is done correctly. However, NMFS will have progressed far in answering questions about the spatial/temporal distributions and size/age/sex/species composition of marine turtles in deep offshore water

Step Down Research Plan

We recommend that the following questions be addressed in order to optimize research on marine turtles within the context of habitat. The diversity of habitats utilized by turtles demands that a step down plan be followed. While each question when answered will provide the information needed to optimally manage these resources, this plan does not preclude conducting relevant projects simultaneously to maximize

the allocation of limited funding to to take advantage of opportunities that are consistent with this plan as they arise.

Inshore Habitat

Our highest priority is identifying and characterizing the inshore habitats of primarily the Kemp's ridley and secondarily the green turtle. With the possible exception of the leatherback turtle, inshore estuarine areas of the southeast coasts appear to be important to juvenile, subadult and adult turtles.

What is the inshore habitat of the Kemp's ridley?

a. Research will first focus on the western and northern Gulf of Mexico from Texas along the Louisiana and Mississippi coasts, including the Mississippi Sound. The approach will include collating and summarizing existing data. Opportunisitic sources of information will be included such as public sighting programs, fishermen interviews, and ongoing coastal research programs.

b. The next area will include the Atlantic coast and the approach will be the same.

c. The last area of focus will include the eastern Gulf of Mexico including the coasts of Alabama and Florida. The research approach is the same.

What are the inshore habitat requirements of the green turtle?

a. Research will focus in Florida inshore waters that support sea grass beds. Because there are areas where the distributions of the Kemp's ridley and green turtle overlap, including Florida Bay and Cedar Key within the Eastern Gulf, these areas should represent the initial focus. Data on green turtles can be collected with information on the Kemp's ridley.

b. Additional research must focus on areas of extensive sea grass bed development, which once supported green turtles.

c. Continued research within the Indian-Banana River complex is important to maintain this as an area to index green turtles within Florida inshore waters.

What are the inshore habitats of the loggerhead turtle?

a. The determination of the broad spatio-temporal distributions of this species in inshore waters will probably be a result of the research on the Kemp's ridley. Once areas of aggregation or importance are identified, research can be site specific. One area where research can now be directed is the Florida Bay system of the western Gulf of Mexico. Areas where research is currently ongoing including the Cedar Key complex and the Indian Lagoon system must be continued as representative or key index areas.

What is the relative importance of inshore habitat to turtles over the short and long term?

a. Monitoring surveys must be conducted to answer this question, recognizing that turtles are migratory and habitats are dynamics systems. Vessel and aerial surveys in addition to radio and sonic tracking will be appropriate to examine short range and short term movements. Habitat type will dictate the methodology applied.

b. A second means of obtaining information on habitat utilization by turtles is the placement of observers on platforms of opportunity or through the cooperative efforts of industry to document turtle distributions, abundance, and relative movements.

c. Long range and long term movements can only be discerned from synoptic surveys and the application of satellite tags. Remote sensing requires signigicant sample sizes initially stratified seasonally, by species, size class, and gender.

Offshore

Research on the offshore waters is identified as second in priority. We know that offshore waters are important to the leatherback turtle and are less certain of the distributions of Kemp's, green, loggerhead, and hawksbill turtles. We do know that every species goes through a pelagic stage for one or several years, but the distributions of large juvenile, sub-adult, and adult turtles are not known. This lack of information demonstrates a need to initiate research to define distributions in these waters and measure abundance on a regional basis.

What are the offshore habitat requirements of Kemp's ridleys?

a. The Kemp's ridley is given the highest priority and the greatest effort initially must be allocated to nearshore waters . Current survey techniques are not useful in providing regional information on this species in nearshore waters.. The application of vessel and aerial surveys with radio or satellite tagging must be investigated to develop an appropriate census method. This area is large and this species is rare, therefore filling this gap will be expensive and well beyond the current level of funding.

What are the offshore habitat requirements of the leatherback turtle?

a. Current and potential development of the Gulf of Mexico offshore waters by oil companies provides a basis for establishing the Gulf of Mexico as the highest priority area. Existing data bases must first be collated and summarized to identify areas of known importance to turtles in offshore waters. It is imperative that offshore marine mammal surveys include sighting effort dedicated to turtles. It is unlikely that vessel surveys alone will provide sufficient information on distributions. However, tagging, both radio and satellite will be useful if done on a large scale basis to monitor movements throughout this relatively large area.

b. It appears that leatherback non-breeding distributions can be seasonally predicted and are temperature and resource (jellyfish) dependent. Satellite tagging appears to be the most cost effective method of learning more about the distribution and long range movements of this highly migratory species. An examination of the distributions and dispersal mechanisms of jellyfish could also be important to identify potential areas of leatherback aggregation.

What are the offshore habitat requirements of the loggerhead turtle?

a. The loggerhead turtle is found throughout offshore waters. It is the most consipicuous and abundant species in the U.S. It's relative abundance translates into being placed at risk from human activities in offshore waters. It is given third priority. However, it is likely that information on this species will be obtained from research that focuses on the Kemp's ridley and leatherback turtles.

What are the offshore habitat requirements of the hawksbill turtle?

a. The offshore distributions of the hawksbill can be identified using the distributions of live bottom, particularly coral reef sites. Ongoing research which focuses on reef sites must include censusing hawksbill turtles.

What are the habitat requirements for the juvenile, pelagic life history stage of every species?

a. All species pass through a pelagic life history stage. Development and increasing human utilization of deeper offshore waters places all species at risk. The extent of area and expense of sampling all offshore waters greater than 200m in depth results in obtaining inforamtion on the distribution and abundance of turtles in these waters as the lowest priority at this time. The best available approach to sample these waters is to examine real time satellite imagery for areas of convergence where small turtles might be found and sample these areas by vessel. Once animals are located, radio or satellite tags must be developed to allow for tracking over short and long range.

Program Management Recommendations

There will be information and research needs that are not anticipated by this plan. To address unexpected developments or immediate information needs, the following protocol is recommended: (1) A need is identified by the SER through the Section 7 process or by the Program Manager through legislative or headquarters requirements. (2) A pre-proposal is developed and distributed to this working group and the Program Manager for review (3) The pre-proposal reviews are consolidated by program management. (4) The Program Manager determines who should conduct the research (two or more laboratories may be tasked to participate in the project), and requests

development of a formal proposal. (5) The principal investigator and Program Manager are responsible for negotiating the research. When ESA Section 7 consultation information requirements are addressed, the SER retains lead responsibility in determining whether the proposed research satisfies ESA needs. The Program Manager must negotiate the proposal with the funding agency, and SER must be involved in this process to ensure that the final proposal satisfies ESA requirements.

Through the use of electronic transfer, this exchange can be done quickly and a proposal can be developed within a few days. Thus, the Program Manager is the focal point for all research program needs and remains the lead in determining what research can be done to address specific questions. The Regional Office continues to identify and communicate information needs relative to Section 7 and the management of marine turtles. The current Habitat Working Group is the logical vehicle to provide the Manager with review of existing and proposed research.

Both short term and long term research requirements are addressed in this plan. In general, many short term questions deal with Section 7 issues and the immediate removal of an impact to individual turtles. ESA consultations underscore the necessity to known what species, how many, where, and when turtles may occur relative to a real time risk. However, because turtles are migratory and commonly shift distributions depending on the availability of resources, research that monitors population movements and abundance must be extended over the long term.

One mechanism to ensure long term research commitments is through the establishment of Section 6 cooperative agreements with states. At this time, only one such agreement, with South Carolina, is in place and two (Georgia and Florida) are pending. We support the Office of Protected Resources, NMFS headquarters, in realizing Section 6 Cooperative Agreements with as many states as possible and coordinating funding with the FWS.

Utilizing existing sampling programs to obtain information on marine turtles can also provide data over the long term. For example, adding a question about the presence and species of turtles to the Marine Recreational Fisheries Statistics Survey has been done successfully in North Carolina, and can easily be expanded throughout the range of the program. This information provides supportive evidence on the distribution of turtles where recreational fishing occurs. Other NOAA agencies including NOS, NESDIS, and OAR incorporate sampling programs on oceanographic features which may be important dispersal mechanisms for turtles or their resources. The SEFC/Bay St. Louis laboratory, which has remote sensing and oceanographic expertise, should coordinate with other NOAA offices on obtaining, summarizing and interpreting these data. The NOAA Marine Sanctuary Program and Estuarine Programs Office may provide opportunities to obtain information on marine turtles in specific locations. Observer programs designed to obtain fisheries statistics should, if possible, allow for the observation of marine turtles and mammals.

Finally, we must continue to inform turtle researchers outside the SEFC of our research plans and ongoing research. They, likewise, should periodically advise NMFS of their activities to help eliminate unnecessary redundancy in research efforts. Such coordination with nongovernment entities is of particular importance in attaining our mutual objectives of species recovery.

Summary of Recommendations

Priority 1. Kemp's ridley in inshore waters

Areas in Priority Order

1. Texas to Mississippi Sound
2. Pamlico-Albemarle-Core Sound Complex
3. Inshore Atlantic waters outside North Carolina
4. Eastern Gulf of Mexico particularly Cedar Key and Florida Bay

Research Approach

1. Assemble all available data on distributions
2. Utilize opportunistic platforms to develop supportive data base
3. Characterize known habitat
4. Implement or continue sampling turtle habitat to define distributions and abundance
5. Implement radio/sonic tagging to determine short range/term movements
6. Implement satellite tagging to determine long range/term movements

Priority 2. Kemp's ridleys in offshore waters

Areas in Priority Order

1. Nearshore waters in Gulf of Mexico
2. Nearshore waters in Atlantic

Research Approach

1. Assemble all available data on distributions of turtles

2. Utilize opportunistic platforms for presence of turtles

3. Implement radio/sonic and satellite tracking to determine turtle movements

4. Characterize habitat from information on presence of turtles to determine potential areas of aggregation for directed sampling either with vessels or aircraft and satellite tags

Priority 3. Leatherback turtles in offshore waters

Areas in Priority Order

1. Deeper offshore waters of the Gulf of Mexico

2. Deeper offshore waters of the Atlantic

Research Approach

1. Utilize marine mammal and opportunistic sampling programs to identify areas of aggregation

2. Identify areas of known or real time concentration of jellyfish and sample for leatherback turtles via opportunistic and directed sampling

3. Determine movements with satellite tags

Priority 4. Green turtles in inshore waters

Areas in Priority Order

1. Areas of known aggregation, such as the Indian-Banana Rivers, Cedar Key and Florida Bay

2. Areas of sea grass beds within U.S. waters.

Research Approach

1. Identify all known and potential areas where turtles occur

2. Characterize habitat

3. Implement and continue sampling in site specific habitats of known aggregation

4. Radio/sonic and satellite tagging to determine movements and relative importance of habitats

Priority 5. Loggerhead turtles in inshore waters

Data on this species will be collected during sampling for Kemp's ridleys and green turtles

Priority 6. Hawksbill turtles in offshore waters

Areas in Priority Order

1. Live bottom and coral reef sites within U.S. waters

Research Approach

1. Utilize sampling within coral reef areas including marine parks and sanctuaries

Priority 7. Offshore waters for pelagic stage

Areas in Priority Order

1. Gulf of Mexico

2. Atlantic waters

Research Approach

1. Utilize existing real time satellite imagery analysis capabilities to target where are zones of water convergence where turtles may occur

2. Develop and evaluate effects of sonic/radio/satellite tags for small turtles

Acknowledgements

This plan is the result of the perserverance of the authors and Dr. Walter Nelson, Director of the Mississippi Laboratories. An earlier draft was distributed and constructive suggestions made by Drs. Walter R. Nelson; Bradford Brown, Acting Science Director Southeast Fisheries Center; Edward Klima, Director of the Galveston Laboratory; Ford Cross, Director of the Beaufort Laboratory; John Merriner, Chief, Fisheries Division, Beaufort Laboratory; and Warren Stuntz, Pascagoula Laboratory. We gratefully appreciate their time and effort spent in reviewing this document.