A RECOVERY PLAN FOR MARINE TURTLES

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Prepared by

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This Marine Turtle Recovery Plan has been approved by the National Marine Fisheries Service. It does not necessarily represent official positions or approvals of cooperating agencies, and it does not necessarily represent the view of all recovery team members who played the key role in preparing this plan. This plan is subject to modification as dictated by new findings and changes in species status and completion of tasks assigned in the plan.

This U.S. Government Recovery Plan identifies actions that can be taken to promote the recovery and conservation of sea turtles. Reference to marine turtle conservation in other countries is to assist with an understanding of required U.S. actions within U.S. boundaries relative to cross-national migratory species.

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1. INTRODUCTION

1.1 RATIONALE AND OBJECTIVE OF THE RECOVERY PLAN

The Endangered Species Act of 1973 (Public Law 93-205) provides for the conservation, protection and propagation of species of wild fauna and flora actually or potentially in danger of becoming extinct. All but one species of marine turtles have been listed as either "endangered" or "threatened" under the Act, and the jurisdictional responsibilities for them are administered jointly by the Departments of Interior and Commerce. The two categories are defined as follows:

> "Endangered Species" means any species, subspecies or distinct population segment of fish, or wildlife or plant which is in danger of extinction throughout all or a significant portion of its range.
>
> "Threatened Species" means any species, subspecies or distinct population segment of fish, or wildlife or plant which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

The endangered category is more restrictive than the threatened category which permits exceptions to the protective prohibitions described in the Act. The status of discrete breeding populations of listed species must be reviewed every five years and recommendations made to the Secretary(ies) for delisting or reclassification if warranted by biological data.

In recent years considerable evidence has indicated a decline in the populations of marine turtles (Fed. Reg.; 1977). Consequently,

three of the turtles, i.e., Kemp's ridley (Lepidochelys kempi), hawksbill (Eretmochelys imbricata) and leatherback (Dermochelys coriacea) were listed as endangered. The Florida nesting population of the green turtle (Chelonia mydas) and the Mexican west coast nesting populations of the green turtle and olive ridley (Lepidochelys olivacea) are also endangered. All of the remaining populations of green turtle, olive ridley and loggerhead (Caretta caretta) are threatened. The only unlisted species is the locally protected Australian flatback turtle (Chelonia depressa).

The Act requires the preparation of recovery plans for all listed species, unless the Secretary(ies) makes a finding that a recovery plan will not further the recovery of a particular species. It allows for the formation of recovery teams responsible for developing recovery plans. The objective of these plans is the survival and eventual recovery of listed species or populations, so they may be removed from the endangered or threatened list. However, the species must be protected after it is delisted. This Marine Turtle Recovery Plan describes management programs that, if enacted, will foster the survival and recovery of the remaining sea turtle populations. These management programs also include the conservation of habitat.

The marine turtles of the southeast region comprise six species of five genera and two families. They differ in their ecological needs as well as in their survival outlook. Therefore, this Recovery Plan contains six recovery plans, one for each species. Each plan describes objectives and specific long and short range goals for preserving the populations of marine turtles. These objectives are compatible with international agreements ratified by the U.S. and with all federal and

state laws, rules and regulations. The first objective of the Recovery Plan is to prevent extinction of any marine turtle species. Where possible, declining populations would be stabilized and then increased.

The priorities listed in the Implementation Schedules were derived relative to a given species. No attempt was made by the Team to make decisions on priorities between species. Thus, it must be the agencies decision on how best to partition their available resources between sea turtle species and to use the Recovery Plan's suggested priorities within each species. The implementation of certain priority tasks will impact several species, and such accumulative benefits should be considered.

The recovery procedure is based on a study of population dynamics, habitat characteristics, and management methods. Objectives are both species-specific and general, but all develop methods for enhancing the populations. These objectives are to:

1. Obtain baseline data on population status for each species.
2. Identify problems by establishing species-specific data bases from available information.
3. Set priorities for research necessary to describe the population and habitat characteristics.
4. Develop management recommendations.
5. Reduce turtle mortality at sea and on land.
6. Enhance production on the nesting beaches.
7. Monitor the populations.
8. Assess the success or failure of the applied management.
9. Recommend changes in management.

As new information becomes available, the Recovery Plan will be updated. Updating the Plan and monitoring the implementation of the Plan will be a continuing responsibility of the Recovery Team until all species of marine turtle can be removed from the endangered species list. Many recommendations have already been acted upon during the course of preparing the Plan.

1.2 INTERNATIONAL COOPERATION

The primary purpose and focus of this Recovery Plan is to identify actions to be undertaken within U.S. boundaries by U.S. agencies and citizens. These actions are designed to prevent extinction of marine turtle species and, where possible, to stabilize and increase their populations.

However, conservation problems throughout the international range of a species have been identified, because marine turtles are migratory and may occupy territorial waters of more than one nation as well as international waters.

Recovery actions outside U.S. jurisdictional waters and territories are within the sovereign authority of 26 major political entities in the area covered by the Plan. It is hoped that nations in the Wider Caribbean Region will work together in bilateral and multilateral cooperation to achieve common marine turtle conservation objectives. The U.S. is currently working cooperatively with many countries in the region and desires to continue to work cooperatively within the context of existing relevant international agreements and technical liaisons and to consider further cooperative mechanisms as required.

Specifically, all references to actions which are under the jurisdiction of other nations in the Plan area are actions which the U.S. understands may be (1) underway or (2) contemplated or considered desirable for the species in view of their migratory nature. (See Section 4.)

1.3 EVOLUTIONARY AND TAXONOMIC BACKGROUND

The principal evolutionary changes necessary for successful colonization of the marine environment were:

1. A large body size, presumably as a defense against a wide variety of marine predators.
2. Paddle-like limbs for swimming.
3. High reproductive potential (a hundred or more eggs per nest and multiple nestings per season) to compensate for the unavoidably high predation upon the hatchlings in the littoral and marine environments.
4. A thick neck and non-retractile head in the interest of streamlining the anterior part of the body.
5. Physiological respiratory mechanisms and electrolyte balance for existence at sea.

The first marine turtles are known from the late Jurassic and the Cretaceous periods of Europe and are included in the extinct family Thallassemyidae. These turtles showed parallels with modern marine turtles, but the limbs were relatively short and incompletely adapted for the marine environment. Other marine turtle families flourished briefly during the early Cretaceous. One of these, the Toxochelyidae, probably was derived from the Thallassemyidae and included both littoral and

pelagic species. Although the front flippers were well developed, the hind limbs were relatively unmodified from the primitive terrestrial condition. Another marine turtle family, the Protostegidae, reached its zenith in the early Cretaceous in the Niobrara Sea which occupied what is now the central United States. Earlier members of the subfamily Chelospharginae were relatively small and had comparatively well ossified shells, although the more advanced genera, Protostega and especially Archelon, were very large. Archelon ischyros, with a two meter carapace and a skull nearly half that length, was one of the largest turtles that ever lived.

Modern marine turtles belong to the families Cheloniidae and Dermochelyidae. The latter family includes only the highly divergent leatherback (Dermochelys coriacea) and differs from other turtles in numerous anatomical features including lack of scutes, scales and claws.

Some taxonomists recognize two subfamilies of the remaining marine turtles, the Carettiinae and the Cheloniinae, with the former including the loggerhead (Caretta caretta) and the two species of Ridley turtles (Lepidochelys) and the latter including the green turtle (Chelonia mydas) and the flatback turtle (Chelonia depressa). The position of the hawksbill turtle (Eretmochelys imbricata) is arguable; some taxonomists place it closer to the loggerhead and some closer to the green turtle.

Although there are only seven modern marine turtle species, they are not relicts from prehistoric times. The small number of species testifies to the relative uniformity of marine environments rather than to the group being unsuccessful or obsolete. Most species are distributed throughout all of the tropical oceans. However, the loggerhead occurs primarily in temperate latitudes, and the leatherback, although

nesting in the tropics, frequently migrates into cold waters at higher latitudes (Bleakney, 1965) because of its unique physiology (Frair et al., 1972).

From the viewpoint of their role in the marine ecosystem, marine turtles show a wide range of ecological functions. The green turtle grazes on marine grasses and algae; the leatherback is a specialized feeder upon jellyfish, and the hawksbill dwells on coral reefs and feeds principally upon sponges. The loggerhead is primarily carnivorous and has jaws well adapted to crushing heavy-shelled molluscs and crustaceans and to grazing on encrusting organisms attached to reefs, pilings and wrecks (See Pritchard 1979a for discussion).

Until relatively recently, sea turtles existed in such huge populations that their function in marine ecosystems must have been highly significant (Parsons, 1962). Today, that function has been reduced in most places. Although marine habitats appear to be largely intact, relative numbers of turtles have been reduced by turtle fisheries that take turtles for food and other products and by other fisheries that inadvertently kill turtles in the course of their fishing operations. Most marine turtle species have not yet reached the point of no return; they remain vigorous and potentially capable of recovering. Hopefully, if the measures in the Plan are carried out, they will recover.

1.4 GEOGRAPHIC DEFINITIONS OF RELEVANT STOCKS

The Recovery Plan addresses all stocks of marine turtles known to spend any or all of their life cycle within the National Marine Fisheries Service, Southeast Region, which includes the Gulf of Mexico, the Atlantic coast (as far north as and including North Carolina), Puerto

Rico, the U.S. Virgin Islands, and adjacent jurisdictional waters of the Fishery Conservation Zone. Turtles are migratory, and recovery plans for them must include recommendations for the Northeast Region of NMFS and recommendations for liaison with foreign countries where these species might nest or forage. This geographic region contains twenty-six major political entities, and cooperation from these countries will have to be obtained before a comprehensive recovery plan can succeed.

The Recovery Plan addresses the following taxa:*

1. Loggerhead (Caretta caretta)
2. Green turtle (Chelonia mydas)
3. Kemp's ridley (Lepidochelys kempi)
4. Olive ridley (Lepidochelys olivacea)
5. Hawksbill (Eretmochelys imbricata)
6. Leatherback (Dermochelys coriacea)

The Recovery Plan addresses West Atlantic stocks, as defined below of these following taxa:

1. The loggerhead throughout the eastern and Gulf of Mexico seaboards of the United States and the Greater Antilles. Other Caribbean nesting populations are also considered, including those of the Guajira Peninsula (Colombia), scattered colonies in Belize, the Albuquerque Keys (Colombia) and elsewhere.
2. The green turtle nesting in Florida, the Caribbean (including Costa Rica, Aves Island, and Quintana Roo, Mexico) and along the South American coast as far as Guyana. The decision not to consider green turtle populations nesting beyond the Guyana/Surinam border was reached because head-started green

*Subspecies of marine turtles are imperfectly defined and are omitted from this plan.

turtles released in Florida are known to travel as far as Guyana.* The Surinam nesting population is known to migrate exclusively eastward to Brazil and apparently does not come close to the United States Southeastern Region.

3. The Kemp's ridley throughout its range. Since the species is critically endangered and an integral part of its feeding range exists in Gulf and Atlantic waters of the United States, the Plan will address the Kemp's ridley wherever the species is found.

4. Although olive ridleys are almost unknown in the Southeastern Region, they are on the U.S. endangered species list. Also, occasional individuals have been recorded in the northern Caribbean, including Puerto Rico. The olive ridley nests in small numbers on Shell Beach, Guyana, and in larger but sharply declining numbers at Eilanti, Surinam. A few individuals also nest at Bigisanti, Surinam, and at Silebache, French Guiana, but these may not constitute separate nesting colonies. Since the Surinam population is declining, it is felt that inclusion of this species within the Plan might aid in its recovery.

5. The hawksbill occurring in southeastern U.S. waters, the Gulf of Mexico, the Caribbean and the Bahamas. There are a few nesting records for Florida, and stray animals have been

*One case of a head-started Florida green turtle recovered in Rio de Janeiro.

reported as far north as New England. Some nesting takes place on Vieques, Culebra and Mona Islands, Puerto Rico, and on the U.S. Virgin Islands. Special emphasis is placed on recovery of hawksbills nesting on Caribbean islands under United States jurisdiction.

6. The leatherback frequenting the entire Gulf of Mexico and the eastern seaboard of the United States as far as Canada. Nesting on the mainland is very rare, and mainly confined to the Atlantic coast of Florida. Small but important nesting colonies are on St. Croix (U.S.V.I.) and on Vieques and Culebra Islands, Puerto Rico. The recovery plan addresses discrete nesting populations on Caribbean islands under United States jurisdiction. Broad geographical areas which appear to contain significant numbers of non-breeding animals are also considered. The Plan includes leatherbacks nesting elsewhere in the Atlantic system, since individuals from these colonies are known to migrate occasionally to United States waters.

Major leatherback nesting colonies of interest in the western Atlantic but not under United States jurisdiction are listed in order of magnitude:

French Guiana (Silebache-Point Isere)

Costa Rica (Limon to Parismina)

Surinam (Bigisanti and Marowijne beaches)

Panama (Chiriqui Gulf area)

Trinidad (Matura Bay, etc.)

Colombia (Golfo de Uraba)

Guyana (Shell Beach)

1.5 POPULATION ESTIMATES OF RELEVANT STOCKS

It is difficult to give even approximate numerical estimates for any marine turtle population. This difficulty results from large gaps in the knowledge of population characteristics and is compounded by the cyclic nature of nesting populations. Obviously the total number of all individuals reaches a peak during or immediately after each hatching season when large numbers of hatchlings are generated, but this number is reduced as hatchlings are eliminated by predation and other factors.

Young turtles are largely inaccessible to census, and for this reason no attempt is made to estimate total population size for any species in the Recovery Plan. Turtle populations are currently estimated by counting nesting females. Estimating total stock size from these counts is difficult. Some of the complicating factors are as follows:

1. Nesting frequency varies within a season for individuals (Carr et at., 1978).
2. Individuals do not nest in successive years for most species of marine turtles (Carr et al., 1978; Hughes, 1976).
3. The number of turtles nesting on a given beach varies from one year to another (Limpus, 1978).
4. Information on the sex ratio of marine turtle populations is fragmentary, and some populations appear to deviate significantly from a 1:1 sex ratio. Estimating the male segment of the population from counts of nesting females is speculative.

Sufficient data on marine turtle nesting cycles are now available to permit order-of-magnitude estimates for certain populations. The estimates are summarized below:

Loggerhead: The nesting female population of the southeastern United States (coasts of Florida to North Carolina), has most recently been estimated to be about 14,150 (Murphy and Hopkins, 1984). Populations elsewhere in the western Atlantic currently cannot be estimated but are much smaller.

Green turtle: It is unclear whether Florida ever had a large nesting population of green turtles (Dodd, 1982) [1981], although there is historical evidence that immature green turtles were once common in the state. The fishery for immature green turtles was outlawed by the Florida Department of Natural Resources in 1974.

Small numbers of green turtles have been reported during the last two decades nesting on the Atlantic coast of Florida (Dodd, 1982 [1981]), with one nest confirmed in Georgia (Litwin, 1980), false crawls reported on Cape Romain, South Carolina (Hopkins, pers. obs.) and 5 nests at Camp Lejeune, N.C. (Schwartz et al., 1981). The population trend in Florida has been increasing (Dodd, 1982 [1981]; Ehrhart, 1979; Witham, pers. obs.). Ehrhart (1979) suggests there may now be as many as 300-400 adult females in this population.

In the Caribbean, the largest green turtle colony is on Tortugero Beach, Costa Rica, with an estimated average 24,692 adult females (Carr et al., 1982). The colony nesting on Aves Island is much smaller, with an estimated number of about 1,000 adult females (Laiz Blanco, 1979). Although Hurricane David removed the nesting beach sand in August of 1979, Cuellar (pers. comm.) reports the sand has been re-deposited and nesting has returned to normal levels.

The size of the green turtle population in Quintana Roo, Mexico, has not been established, but local fishermen captured 2200-2300 turtles in 1960-62. The catch declined to about 200 animals in 1963 and fewer than 100 in 1971 (Rames, 1974).

There are other green turtle populations in the Caribbean that have not been evaluated, including Shell Beach (Guyana), and the southern coast of Cuba. Scattered nesting by green turtles also takes place on most of the islands of the Greater and Lesser Antilles and on Little Inagua Island (Bahamas), but the total number of animals involved is probably small.

Kemp's ridley: The single known colony of this species, almost all of which nests near Rancho Nuevo, Tamaulipas, Mexico, is severely depleted and in danger of extinction. An estimated 40,000 females nested on a single day in 1947 (Carr, 1963), but since 1978 there have been less than 1000 nests recorded per season (Pritchard, 1979b,80,81). The species is known to nest in consecutive years but probably does not always do so, and only a small proportion of females nest more than once per season. If we assume that the individuals that nest twice in a season

equal the number of individuals that fail to nest the following season, the number of nests recorded per year is an approximation of the world-wide population of breeding females. Therefore, the nesting female population of Lepidochelys kempi is of the order of 800 individuals per season (Bacon et al., 1984).

Olive ridley: Schulz (1982) reports that 3,290 nests were made in Surinam in 1968, 890-1270 per year from 1972-1977 and only 795 in 1979. It is assumed that a female lays on an average between 1.4 and 2.0 nests per season and that the mean interval between nesting seasons is 1.4 years.

Hawksbill: No estimates have been made of the numbers of hawksbill in the southeastern region. Estimates are exceedingly difficult to make, as this species is not a colonial nester, and the usual population census techniques cannot be applied (Witzell, 1983).

Leatherback: The few leatherback nests observed in Florida and Georgia are probably deposited by less than a dozen females annually. It is not yet known if this is a Florida nesting population or if these nesting individuals are strays from a larger population elsewhere. The latter possibility is feasible since individual leatherbacks in the Guianas are capable of laying widely dispersed clutches within a single season (Schulz, 1975).

Nesting by leatherbacks in the U.S. Virgin Islands is regularly observed on the beaches of St. Croix and Culebra (Towle, 1978; K.L. Eckert, pers. comm.). Approximately 113 leatherback nests were recorded in 1983 (Eckert and Eckert, 1984). Nesting by leatherbacks on the other Virgin Islands is very rare. An estimated 113 nests per year corresponds to about twenty adult female turtles, assuming an average of 5.8 nests per turtle per year (Eckert and Eckert, 1984). Nesting on Vieques is less frequent than on St. Croix, (Pritchard and Stubbs, 1982).

Other colonies, such as those on the Dominican Republic, have yet to be quantified. The nesting colony in French Guiana is very large; Pritchard (1971) estimated about 15,000 adult females, with about 300 turtles nesting per night. Preliminary data supplied by Carr and Ogren (1959) indicate the population at Matina Beach to number at least 1000 animals. The Surinam and Trinidad populations are smaller, perhaps 200-400 animals in each, although leatherbacks nesting in Surinam interchange fairly freely with those in French Guiana. The Colombian and Guyanese colonies are probably very small, perhaps less than 20 nesting individuals in each.

The world population of a particular species of marine turtle should not be viewed as a single entity. Because most species of marine turtles apparently consist of several non-interbreeding populations, the decline or extirpation of one population will not be demographically reinforced by another (Carr, 1975; Carr and Stancyk, 1976). Therefore, the abundance of one nesting group may not benefit the whole complex, and protection given to any one breeding unit will not necessarily contribute to the survival of other units.

1.6 CAUSES FOR DECLINES IN STOCKS

Five factors have been listed as resulting in declines in marine turtle stocks (Fed. Reg. Vol. 43, No. 146, pp. 32800-32811). They are:

1. Destruction or modification of habitat: This factor is a major cause of decline in many endangered species, not just marine turtles. Coastal development, beach mining (sand aggregate for construction) and natural erosion of beaches and/or nests, along with erosion control structures, have either made former nesting beaches unsuitable or have eliminated them entirely. For example, loggerhead turtles have deserted some developed beaches in South Carolina and Georgia but still utilize the heavily developed beaches on the east coast of Florida along with green turtles. Although nesting may be successful on these beaches, disoriented hatchlings are often killed on highways, by desiccation or by subsequent predation when attracted away from the sea by artificial lighting (MacFarlane, 1963).

   In the ocean, sea turtles may be adversely affected by the following activities and substances (Coston-Clements and Hoss, 1983):

   A. Pollutants from industrial and residential development. These include oil, pesticides, herbicides, radionoclides, PCB's heavy metals and sewage. The effects of pollutants are difficult to detect and evaluate, except for oil and

tar balls that are known to have killed sea turtles by fouling and/or ingestion. The other contaminants may cause physiological problems that can reduce reproductive success.

B. Exploratory oil and gas drilling. These actvities may affect sea turtles by attracting them to lighted platforms where they may be susceptible to increased predation; by disrupting feeding habitat when disposing of drilling muds and sediments; and by discharging oil which may contaminate turtles and cause irritation or permanent damage to eyes, affect respiration, and produce abnormal behavior.

C. Disposal of garbage at sea. Plastic and other foreign materials that are ingested by turtles may cause death. Also, turtles may be fouled by plastic which could adversely affect survival if the animals are unable to shed the plastic. Additionally, turtles attracted to refuse may be subjected to more predators such as sharks which may also be attracted to the refuse.

D. Dredge and fill. These activities may affect habitat that turtles use or the equipment (e.g., dredge cutter head) may harm or kill turtles if encountered during the dredging operation.

E. Power boats. Power boats can injure or kill sea turtles.

2. Overutilization for commercial, scientific or educational purposes: The commercial taking of turtles for meat, jewelry and the curio trade is a cause for declines. The green, hawksbill and two ridley species have suffered from excessive egg harvest. The impact of projects for scientific or educational purposes on nesting beaches is difficult to assess. As more and more turtle colonies are actively managed or intensively studied, the cumulative effects of such projects should be carefully monitored. The same caution should be exercised when evaluating educational or public relation uses.

3. Inadequate regulatory mechanisms: Illegal marketing of eggs is prevalent for all species. Inadequate laws and law enforcement result in overutilization for commercial purposes. The six species of marine turtles were only recently protected by the U.S. Endangered Species Act and are still unprotected in many countries throughout their range. Lack of personnel, extensive and inaccessible coastlines, and incompatible management programs among different countries make enforcement difficult or impossible.

4. Disease and/or predation: These act as natural controlling mechanisms on all marine turtle populations. Nests can be destroyed by a variety of factors such as plant roots, invertebrate predators (ants, ghost crabs) and vertebrate predators (raccoons, mongooses, feral hogs, foxes, rats, coatimundi, coyotes,

vultures and jaguars). Hatchlings may be destroyed on the beach by nest predators or taken at sea by birds (gulls, jaegers, frigate birds) and fish. Juvenile and adult turtles are also vulnerable to attacks by sharks and killer whales. The extent of egg loss has been documented for some species, but mortality of hatchlings, juveniles and adults in the marine environment is unknown for all species.

5. Other natural or man-made factors: Marine turtle populations incur losses from pollution (Witham, 1978) and incidental catch (Hillestad et al., 1978). Losses to incidental catch are particularly costly to the populations since the animals involved are either adults or the larger juveniles which have already survived most natural predators.

Factors which have brought about declines in marine turtle stocks have affected all species to varying degrees. It is not known whether any one cause, acting singly, would have brought about the declines noted above; however, it is doubtful if any species can withstand the combined pressures of all factors acting together.

2. GENERAL TOPICS

2.1 POPULATION MODELS AND ESTIMATES

It is not the intention of this section to discuss marine turtle tagging activities. There are many reasons to tag marine turtles, including the investigation of migratory destinations, incidental and directed take and such behavioral phenomena as remigration intervals and within-season multiple nesting. This section deals with its potential and limits to predictive population models of marine turtles. Furthermore, not all marine turtle species and not all tagging projects can obtain the comprehensive data required of population models.

Given limited funds and the directive of the Endangered Species Act not to harass protected species without just cause, tagging efforts should be directed toward filling the existing knowledge gaps. Certain marine turtle species and certain populations will return more of scientific value from tagging programs than other species. For instance, nesting female loggerheads on U.S. beaches have been intensively tagged for many years. Those who tag this segment of the loggerhead population must evaluate what they have learned and direct their efforts toward the remaining unanswered questions. Anything less could be construed as tagging for recreational purposes and not in compliance with the Endangered Species Act (see Sec. 1.6, Number 2).

Population estimation is a fundamental tool of management programs. The relative effect of directed and incidental capture, habitat loss, predation and other extrinsic causes of mortality on a population of sea turtles can be assessed most objectively if total population numbers can be predicted. In spite of intensive investigations for 25 years,

some marine turtle population parameters remain unknown or, at best, conjectural. Most notable among these elusive parameters are: age at breeding maturity, survivorship to maturity, years of reproductive activity, recruitment to the nesting population, numbers of adult males and turnover within the nesting population.

Sea turtles do not lend themselves to classical methods of population analysis, such as mark-recapture and catch-per-unit-effort, because such methods require a series of assumptions that cannot generally be met when sampling only nesting populations. For example, a population can be confidently measured only if it is closed between consecutive samples. In other words, there must be negligible mortality, recruitment and movement of individuals into and out of the study population. Nesting populations of sea turtles are not closed from season to season (sample to sample). Since a single sample represents an entire season of tagging records, many years of data would be needed for even the most simple population estimate.

Current efforts to estimate sea turtle populations are limited to small portions of the life cycle (Marquez and Doi, 1973; Carr et al., 1978; Bjorndal, 1980; Marquez et al., 1981a,b; Meylan, 1981; Richardson and Richardson, 1981; Richardson, 1982; Cornelius and Robinson, 1983; Frazer, 1983). It is possible to count numbers of nesting females along a given length of beach, and it is possible to measure the number of hatchlings which enter the ocean along the same section of beach. It is even possible to measure numbers of juvenile turtles observed along a reef or caught per unit of tow time in a trawl net. The interrelatedness of these measurements, however, is not known. Changes in recruitment of the nesting stock cannot yet be predicted from knowledge of the number of

hatchlings entering the ocean per unit length of beach. To do so requires the development of a comprehensive population model which considers all aspects of a sea turtle life cycle.

The development of comprehensive population models for sea turtles is still in its infancy. A series of empirical observations have been concluded from field studies, primarily of nesting females. Fragments of population models have been derived from these observations. Missing portions of the models could be estimated with the Delphi technique, whereby a consensus of expert opinions is used in place of solid measurements. The reliability of the predictions from such completed models would depend on the confidence of the observations and opinions of the experts. Currently, sea turtle population modeling is exclusively conceptual; it does not yet have predictive capability.

The most important mission of modeling efforts is to develop an understanding of population means or average values. These include, for example, <u>average</u> reproductive effort per turtle and <u>average</u> lifespan of a nesting adult. Extreme values (oldest turtle, most nests for a turtle in one season, etc.) indicate scope and potential; <u>mean</u> values provide the foundation upon which future population models will be built. Population modeling helps to integrate diverse categories of existing data and to locate and define areas of knowledge. Ultimately, population models should be able to simulate observed population behavior and to predict population response to selected perturbations. Sea turtle recovery efforts must include a continuing effort to develop comprehensive population models with the predictive capability of assisting the management process.

2.1.1 Empirical Observations: In order to build a population model the following attributes need to be known.

1. Clutch size (fecundity, in part)

The mean number of eggs per clutch is well documented for all species of marine turtles. Mean clutch size for a given species appears to differ slightly from one geographic locality to another, but variation in clutch size from a single locality is of sufficient magnitude that statistical differences between localities are masked.

2. Clutches per turtle per season (fecundity, in part)

The average number of clutches per female per laying season, when combined with clutch size, provides a measure of annual reproductive potential or fecundity of a population. Extremes of six or more clutches for a single turtle in one season are well documented but overemphasized in the literature. The observed mean number of clutches per turtle is directly related to the efficiency of the beach tagging program. Realizing this fact, there has been a tendency for tagging programs to predict an unrealistically high mean number of clutches per turtle by rationalizing that means derived from observed data are much too low because of incomplete beach surveys (missed nests). Evidence suggests that the average number of clutches for loggerheads and greens will range between two and three clutches per turtle per season. However, there is still no definitive answer to tag loss or dispersed nesting outside of the study area, so current estimates of clutches per season may change in the future. The average number of

clutches per turtle per season is a potentially valuable parameter for predicting total numbers of nesting females from direct nest counts. Such a prediction must be adjusted to reflect the manner with which females disperse their nesting effort along a beach.

3. Distribution of nesting efforts

A fundamental step in estimating population numbers is to define the limits or boundaries of the population to be studied. For instance, the population of greens nesting on Ascension Island has fully defined boundaries. A population of loggerheads nesting along 10 km of coastal Florida is less easily defined. Existing tagging studies of loggerheads, Kemp's ridleys, and greens are probably sufficient to permit the dispersal of nesting effort to be defined as a probability function of distance from a known nest site. The smaller the unit of beach to be studied, the more important it becomes to consider nesting overlap in population estimates. It is not presently known if nesting site fidelity of individual female turtles is stronger on continuous mainland shores or on stretches of nesting habitat that is interrupted by features such as passes, sounds, cliffs, mangroves, or rocks. The measurement of nesting dispersal along various coastlines is a prerequisite for estimating total nesting females from counts of nests.

4. Remigration intervals

Marine turtles, have reproduction cycles (remigration intervals) of one to five years, with 2- and 3-year cycles being the most commonly encountered. If a population of sea turtles maintains a stationary age

distribution (total numbers of individuals in each sex and age class remain constant from year to year), the total number of nesting females can be predicted from remigration intervals. Carr et al. (1978) provides a formula for calculating total females, if the number of nesting females per year and the distribution of remigration intervals are known. Approximately 36% of adult West Caribbean green (Carr et al., 1978) and 40% of adult Georgia loggerhead females (Richardson & Richardson, 1982) would be expected to nest in any given season.

5. Remigration rates (years of reproductive activity)

The contribution of an individual turtle to its species reproduction effort may be defined, in part, by the number of years that the turtle remains reproductively active. Similarly, the mean number of reproductive years play a role in determining a population's ability to replace itself. The probability that a turtle will return to nest in subsequent seasons is its remigration rate.

Remigration rate has proved to be one of the most elusive of population parameters because of serious tag loss and the scarcity of intensive beach surveys. However, remigration rate remains an essential parameter for calculating population turnover, i.e., the ability of a population to replace itself. Remigrant turtles which have lost their tags (calloused turtles) must either be returning for the first time (neophyte when last observed) or for a second or subsequent time (not a neophyte when last observed). These two alternatives establish maximum and minimum rates of remigration. The selection of a mean remigration rate, however, remains a subjective process.

6. Age to sexual maturity (growth rates)

Age to sexual maturity determines, in part, the response time of a population to changes in reproductive effort. In other words, the rate with which a population can increase its numbers is significantly affected by generation time. Recent evidence suggests that generation time in some sea turtle species is much longer than previously thought, (Balazs, 1979; Frazer, 1982; Limpus, 1979; Zug et al., 1983), although captive reared turtles are known to mature in less than ten years (Wood and Wood, 1980).

Growth rates of juvenile turtles in wild populations will have to be determined before generation times can be calculated. The ability to predict the rate of a population's response to management efforts will depend on the accuracy with which generation times are known.

7. Recruitment

Recruitment is the rate with which new animals are being added to a population. Recruitment is often measured by marking all individuals present in the population at one time (saturation tagging) and then monitoring the appearance of unmarked (new) animals into the population. Recruitment to the adult female nesting population should theoretically be measurable after approximately five years of intensive beach tagging efforts given the remigration intervals measured for most species. In actuality, inefficient beach surveys, tag loss and nesting dispersal combine to prolong this period for most tagging programs to at least ten years. For species other than sea turtles, recruitment can often be measured by observing size classes or age classes, but indeterminate growth rates prevent the application of this method to populations of

sexually adult sea turtles. Recruitment has not been measured for populations of juvenile sea turtles.

Recruitment, if measurable, could possibly indicate the efficiency of hatchery and restocking programs or, alternatively, the efficiency with which a natural population is replacing itself. If juvenile growth rates prove to be as slow as is presently indicated, monitoring programs and restocking efforts must be willing to wait many years for evidence of recruitment to appear. Similarly, the impact of hatching success and egg predation may also be delayed many years before the effects are manifested in the number of adults entering the breeding population.

Recommendations for building population models using empirical observations:

1. Determine clutch size from published and unpublished data.
2. Re-examine existing data sets to determine mean numbers of clutches per turtle per season. The efficiency of the beach survey, differences in behavior between neophytes and remigrants and the degree with which populations disperse their nesting effort along a beach should be taken into account. To maximize the quality of the data collected, the scope (kilometers of beach patrolled) for each tagging study should be adjusted downward such that the number of times a turtle is encountered laying a clutch of eggs approaches 100% of the total number of nests deposited within the study area.
3. In order to refine the relationship of total nests to total turtles along a given length of beach, tagging programs should include calculations of mean nesting dispersal.

4. Remigration intervals from various existing data sets should be compared to determine if there are significant changes from one geographical locality to another for each species.
5. The determination of the mean migration rate will only be achieved by long term tagging studies in which tag loss is no longer a problem (see Section II).
6. Tagging studies of wild juvenile populations should be intensive enough and maintained long enough to determine growth rates and, thus, age to sexual maturity.
7. Researchers desiring to obtain a measurement of recruitment must be committed to intensive tagging programs of long duration.

2.1.2 Derived Parameters:

1. Turnover: The rapidity with which a population replaces its members is the turnover rate. Turnover in the population of adult nesting females can be derived from remigration rates and remigration intervals. An annual replacement of 16% of total adult females has been observed in this manner for a population of Georgia loggerheads (Richardson and Richardson, 1982). Turnover time is the reciprocal of turnover rate or 6.2 years for Georgia loggerheads. In other words, the number of adult nesting females currently being replaced in the nesting population every 6.2 years is equal to the estimated size of the entire nesting female population at any one time.

2. Survival rate: Survival rate is another population attribute which can be derived from remigration rates and remigration intervals. Using

the example of the Georgia loggerheads, a predicted 20% of an initial cohort of adult females would remain after ten years. Only one out of 20 females would still be active after 17 years of nesting activity. The acceptability or inacceptability of a derived survival rate, from a management perspective, is a subjective decision not discussed here.

In conclusion, a word of caution is needed concerning the use of models and predictions which are derived parameters. Models carry with themselves an aura of respectability and correctness which usually goes unchallenged by most observers. Models predict population responses with absolute finality, yet it is possible for the responses simulated to have no resemblance at all to natural populations in the real world. An accurate and precise population model is an elegant management tool. Most models, however, fall somewhere short of this high ideal. They are created as an intellectual exercise to organize diverse observations and data into a conceptual framework and to suggest possible population responses that can later be tested with empirical observations. If an incomplete or biased model is used to generate certain management decisions, such as sustained yield or harvest quotas, the results could be disastrous for an endangered species. The development of a population model is a rewarding and worthy endeavor for any management program, but the uses to which the model is directed must never exceed the capabilities of the model itself.

2.1.3 Standardization of Measurements

A serious problem with demographic studies of sea turtles is the lack of standardized survey methods. The following measurements proce-

dures, and the population parameters derived from them, are particularly susceptible to misinterpretation caused by sampling errors.

1. Tagging programs with nesting females:

The efficiency of a tagging program on a nesting beach is directly related to the proportion of nests within the study area which can be identified with a female turtle of known tag number. Actual saturation efficiencies of such tagging studies range from 99% of all nests to below 50%. Low efficiences usually occur when tagging programs start after the beginning of the nesting season or when the nesting beach being surveyed is greater in length than can be efficiently surveyed at regular hourly intervals throughout each night of the nesting season.

A saturation tagging program to evaluate population dynamics and develop models of nesting females is an intensive, demanding undertaking which should not be attempted unless a thorough survey is achieved with continuity over six (6) or more consecutive years of surveys. If done properly, the results of such an undertaking provide an understanding of local population dynamics and a means for developing abbreviated sampling procedures and conversion factors. An abbreviated sampling procedure might be the assessment of total numbers of nesting females from selected 2-week sampling periods, and a conversion factor would permit the assessment of total nesting females from daytime counts of nests per kilometer of beach. The future of sea turtle monitoring programs depends on the development of these simplified sampling techniques.

Recommended guidelines for a saturation tagging program sufficient for population models are as follows:

Survey area: Select a section of beach that can be entirely surveyed on foot and on an hourly basis. Intensive surveys usually fail when motorized transportation breaks down or high tides exclude vehicles from the beach, leaving a survey area that is too extensive to cover by foot in the meantime. Such an area is acceptable if alternate modes of transportation, continuous access to the beach, and/or backup personnel are available to the project as needed. Finally, the survey area must remain available for replicated beach surveys for at least six(6) consecutive seasons. If the survey area is shifted, year-to-year comparisons become invalid.

Survey schedule: The survey schedule must bracket the nesting season. A survey from 15 May to 15 August would cover nearly all nesting activity of southeastern U.S. loggerheads. Other species of sea turtle and other geographic areas would require different survey dates.

Tagging techniques: The best available tags should be employed (see Section 2.2 - tags and tagging) to reduce the chronic problem of tag loss. Two or more tags should be applied to each turtle until loss is reduced to manageable levels. Similarly, returning turtles with old tags should receive new tags, if necessary. All tag numbers on a multiple tagged turtle should

be recorded at every sighting to reduce the frequency with which records are rejected because of recording errors and to determine rate of tag loss. The problem of misread tags occurs with frustrating consistency with nearly all sea turtle tagging programs.

Essential field data:

-Date for all nests in the study area.

-Location of crawls within the study area.

-Tag numbers of the nesting females for at least 90% of the nests within the study area.

-A careful inspection of each turtle (first sighting) for old tags or evidence of previous tagging history (old tag scars). This information is critical for measuring recruitment to the nesting population.

Desirable field data of less critical importance:

-Tag numbers of females associated with false (non-nesting) crawls.

-Climatological conditions associated with nesting activity.

-Reasons for false crawls, if known.

-Carapace measurements. Over-the-curve and straight line carapace measurements appear to be sufficiently correlated to permit the derivation of one from the other. One or the other of the two measurement techniques should be consistently used and indicated on the records.

If nesting activity occurs adjacent to the study area, two or more years of intensive tag monitoring on either side of the study area are

highly desireable. Such information permits the calculation of nesting dispersal by individual turtles across study area boundaries and a means for correcting density estimates for this error.

Primary population parameters: (mean and variance)

-Fecundity (in part): clutches per nesting female per season.

-Density: nesting females per unit of beach.

-Recruitment: addition of adult females to the nesting population.

-"Mortality": disappearance of adult females from the nesting population.

-Remigration intervals: interval in years between consecutive nesting visits.

Secondary population parameters: (mean and variance)

-Average linear distribution of nesting effort by individual turtles.

-Dispersal of nesting females away from the nesting beach (tag returns).

-Relative frequency of various mortality causes (tag returns).

-Growth rates of the adult females.

2. Daytime beach surveys of sea turtle nesting activity:

Agencies responsible for managing sea turtle nesting beaches should establish a minimum objective of surveying nesting activity. A properly designed and replicated beach survey can provide valuable relative population data. When compared to tagging studies, beach surveys can be converted to absolute population data. Daytime beach surveys require

only part-time effort from a single individual, as opposed to tagging programs which are labor and equipment intensive. Beach surveys provide the ground truth needed for converting the relative data of aerial surveys to absolute population estimates.

An efficient daytime beach survey of sea turtle nesting activity should locate all nesting crawls and most false crawls which occurred since the previous survey. Recommended constraints for such a program are as follows:

Survey area: Select a section of beach that can be surveyed at least every other day for its entire length, on foot. If motorized transportation fails or becomes otherwise unavailable, the continuity of the surveys need not be broken if patrols can continue on foot. If backup transportation is available, a larger survey area is acceptable. A survey area must also be permanently located (some beaches migrate from year to year due to erosion/accretion cycles), so that comparative replicate surveys may be taken from one year to the next. If the survey area is shifted, year-to-year comparisons become invalid.

Survey schedule: While daily surveys are best, standardized sampling at selected days through the season can be used. Nesting crawls and false crawls above high water should be marked and numbered. Where predators or poachers are present, care should be taken not to mark the exact site of a nest, but rather a stake may be placed at a coded distance and direction. Stakes or flags can be removed from false crawls when tracks

become faded. Surveys should extend for the duration of the laying season.

Observer bias: It is not always easy to discriminate nesting crawls from certain false crawls, and individual observers may tend to overestimate or underestimate nesting crawls. A statistically adequate sample of nests should be carefully probed and reconcealed to permit the observer to adjust for this bias. Questionable false crawls should always be probed for similar reasons. Obvious false crawls should be marked but need not be probed.

There is the continuing concern that probing can destroy nests, if one or more eggs are punctured, with resulting contamination of the remaining eggs. This concern must be weighed against the importance of the information gained.

3. Determination of hatching success:

Hatching success represents one segment of sea turtle life history which is directly measurable. Nest success can range from near zero on heavily depredated beaches to near 100% where eggs are fully protected from predators and climatological damage. The success of nests required to maintain a population of sea turtles at a stationary level is still unknown and, at the very least, will vary in response to the effects of mortality rates on juveniles and adults. The determination of a minimum acceptable nest success rate should be a top priority of present and future modeling efforts.

Survey area: Establish limits for the survey area (meters of beach) and/or sample size (numbers of nests) in the same manner as was done for monitoring beach nesting activity. Experimental nests should be staked for easy reference.

Survey schedule: Monitor fate of the eggs (predation, erosion, compaction, etc.) for 75 days following deposition. Nests should be checked during each survey and daily after the fiftieth day of incubation. If possible, determine the extent of predation by counting discarded shells of destroyed eggs.

Technique: Excavate contents of nests 72 hours after the first major hatch or 75 days after laying, whichever occurs first.

- -Count unhatched eggs, dead hatchlings, fetal abnormalities, etc.
- -Count egg shells left by normal hatchlings to determine the number of hatchlings which left the nest.
- -Calculate hatching percentage and hatchling emergence rate.

4. Aerial survey of nesting beaches:

A. Optimize the number of flights according to the purpose of the survey, but at least ten (10) should be completed for statistical analysis and the results averaged. However, one flight is sufficient for discovering new nesting grounds.

B. Use experienced observers, at least two observers (if possible), and a recorder.

C. Fly low, slow, and during the early morning hours in a high wing aircraft or helicopter aircraft, if possible.

D. Concentrate on fresh (previous night) crawls.

E. Use the aerial survey as a relative index, and calibrate this against dependable ground truth data to obtain quantitative estimates.

F. Record start and finish times, weather for previous 24 hours, altitude and air speed and numbers of nests, false crawls and "uncertain" crawls.

G. Aerial surveys should be conducted as specified in Pritchard et al. (1983).

H. It is preferred that coordinated surveys of an entire state's or region's nesting beaches be conducted.

2.2 TAGS AND TAGGING

No single factor has plagued the study of sea turtle populations more than the inability of the profession to develop an identification tag with staying power. The challenge is not a small one. A turtle tag must be resistant to salt water corrosion, intense solar radiation, and acid dissolution associated with encrusting organisms and to physical abuse from powerful swimming and feeding behavior of the turtles for periods of many years between consecutive contacts with the tagged animal. It must also be minimally toxic and cause no physical disturbance to the tagged animal. Many tag designs have been tested, but the perfect tag has not been found. The ultimate challenge is a hatchling tag that will be identifiable at maturity; this has never been achieved.

Flipper Tags: The most commonly used tag for sea turtle studies is the flipper tag, usually placed on the trailing edge of the fore flipper. A variety of materials have been tested, but results differ between species and between geographic areas.

1. Style 4-1005 size 49 monel (T-400 alloy, 35 mil), manufactured by National Band and Tag Company (NBT), has been extensively used. The standard bubble bridge locking mechanism proved adequate for nesting greens (Caribbean, Costa Rica) but failed for U.S. loggerhead work; the bridge corroded, releasing the tag within a two year period. A modified thru-the-tag locking mechanism (size 19) for the size 49 monel tag has had success on Georgia loggerheads; corrosion persists, but tag life now

exceeds three years, long enough to replace old tags with new ones. A smaller, size 681 monel tag has a standard thru-the-tag locking mechanism. This tag, also manufactured by NBT, has been used on juveniles and headstart yearlings with considerable success; its mean longevity on a wild turtle is not known, but tag returns of more than 5 years and, in one case, nearly 7 years have been obtained (Witham, 1980).

2. Nylon "Jumbo" rototags, manufactured by Dalton Supplies, Ltd. (distributed by Dalton and Nasco Co.), have had limited success on southeastern U.S. loggerheads. Corrosion is nonexistent, but the halves of the tag will separate and be lost if the tag is placed on a thick portion of the flipper, and breakage is common. Abrasion of the surface, with concomitant loss of readability, is also commonly encountered unless specially deep imprinting is requested from the factory. The mid-sized "Rototag" and the small "Mini" are also available.
3. "Riese" size 2 tags, manufactured and distributed by Dalton Supplies, Ltd., are a relatively new (1977) product currently being tested in Georgia. The "Riese" is similar in design to the Jumbo rototag, but the material of the Riese has retained its resiliency and not broken after two years at sea on adult female loggerheads. Readability of the initial tags was poor, but the problem now appears to have been corrected with deeper imprinting at the factory. The Riese shows considerable promise as a plastic sea turtle tag.

Future designs for flipper tags: The best plastic tag now available

would appear to be the Riese, with deep imprinting of the numbers requested. However, Riese and nylon plastic tags do not form a closed loop when the tag is in place, thus raising the possibility that the tag will be lost if the tag hole in the flipper enlarges as a result of irritation. The best metal tag would be a size 681 or 19 Inconel (625 alloy, 45 mil) with a thru-the-tag locking mechanism, manufactured by NBT. The Inconel has been tested on Hawaiian greens for six years, with no sign of corrosion. An initial subsidy of at least $50,000 would probably be required for National Band and Tag Company to gear up for the production of this tag, but its availability would revolutionize the quality of all sea turtle research dependent on flipper tags. Titanium tags now in use on Australian turtles have shown no sign of corrosion after several years on the animals and appear very promising (C. Limpus, pers. comm.). Recommendations for flipper tags:

1. Investigate the possibility of funding the production of the Inconel "supertag".
2. Position flipper tags carefully during application. Tag hole will tear if the tag is placed too close to the trailing edge of the flipper. Halves of tag will be forced apart if the tag is placed through a thickened portion of the flipper, too distant from the trailing edge.
3. Always apply a minimum of two tags per turtle, use a variety of tag types, and replace old (2-3 year) tags with new, whenever necessary.
4. Consider the rear flipper as a tagging location. Tags on the rear flipper wear less, but the application of a tag on the

rear flipper appears to be a more painful experience for the animal. A rear flipper application might be recommended for any turtle captured onboard a vessel but not for an adult female in the act of laying her eggs.

Carapace Tags: There have been a number of efforts to develop a carapace tag, with unconfirmed success. Aluminum rivets in the marginal scutes of captive greens caused extensive necrosis and were lost. Preliminary efforts to bolt opposing stainless steel washers through the marginal scutes of South Carolina loggerheads appear promising (Hopkins, MT Newsletter 1981). Identification number and return address are stamped on the washers.

Internal Tags: One solution to the continuing loss of external tags would be the development of an internal tag. Binary or color coded internal tags have been used successfully for US west coast salmon investigations (Jefferts et al., 1963) and also for prawns (Prentise and Rensel, 1977). A similar technique is being developed for hatchling sea turtles in North Carolina (Schwartz, 1981).

Internal tags are, in theory, superior to external tags if there is no loss rate. Liabilities of the internal tag are as follows:

1. Possible traumatic manipulation to hatchlings at a time when dispersal and possible imprinting behavior would be most sensitive.
2. Difficulty to identify an internally tagged turtle at a later date.
3. Need to have radiographic equipment available for reading tags.

The development and use of internal tags for sea turtles is in its infancy. The internal tag is promising and should receive further technical development at selected laboratories equipped for the work; it should not be indiscriminately employed with endangered hatchlings until more is known about potential harm to the tagged animals.

Mutilation Tagging: Domestic animals are commonly marked (tattooed, ear clipped, etc.) for permanent identification. The concept has appeal for sea turtles, but preliminary results have been discouraging. Tattooed green sea turtles lost their identifying marks within a year (Balazs, 1978). Carapace notching of neonate sea turtles has value for short term studies of hatchling dispersal but has not yet been proven effective for long-term studies (Hughes, pers. comm.). Mutilation tagging of hatchlings is traumatic and potentially lethal during their dispersal from the natal beach. Mutilation tagging of large numbers of hatchings should be avoided until trauma inherent in the technique has been eliminated and long-term retention of the scars has been confirmed.

Grafting of shell plugs from pigmented to unpigmented areas and vice versa appears to have merit and is being tested (Hendrickson and Hendrickson, 1982; Mrosovsky, 1982). However, a drawback is the uniform dorsal and ventral pigmentation of hatchlings of several sea turtle species (Lepidochelys, Caretta, Eretmochelys).

2.3 REMOTE SENSING

Remote sensing techniques have been applied to marine turtle species primarily to extend the knowledge of pelagic movements and activities of turtles. While conventional tagging has given us much information on the nesting behavior of adult females, it has been a long and difficult process to relate the information gained from these tag returns to at-sea movements. Remote sensing is a technique "to extend the range of man's observations" (Craighead and Craighead, 1965). When applied to marine turtles, these techniques allow the accumulation of data while the turtle is at sea and cannot be observed and identified by conventional methods. The success of telemetric monitoring depends on the suitability of the equipment to answer the question being asked and the resourcefulness and perserverance of the researcher. Under the proper circumstances, an almost continuous flow of information can be made available to the researcher.

Electronic tags, such as radio and acoustic (sonic) transmitters, are part of the ontogeny of tags and tagging techniques which have been employed in the study of marine turtles. Initially, general observations of marine turtle species as to number, activity and location were undertaken. This was followed by development of suitable tags which provided identification of individual turtles (Schmidt, 1916; Harrison, 1956; Caldwell, Carr, and Hellier, 1956). There is now available a variety of electronic (telemetric) tags which greatly expand the ability to locate marine turtles at sea and provide the opportunity to collect rapidly a variety of new data. However, electronic tags will not replace flipper tags, just as flipper tags have not replaced general observation.

Each is a tool that has its own application to marine turtle recovery. The use of telemetric equipment to solve problems in the recovery of marine turtles should be carefully considered and prioritized, as there are many costly pitfalls. Electronic telemetric techniques provide a volume of varied data, and the researcher should take care to have the data collection priorities matched to the goals of the project. It is easy to lose sight of biological goals in lieu of research and development of equipment.

Early studies (Baldwin, 1972; Soma and Ichihara, 1977) demonstrated the feasibility of using electronic remote sensing equipment on marine turtles. While the equipment in these studies was constructed from component parts, there is currently a variety of commercially available transmitters and receivers which may be tailored for use with turtles. The selection of the instruments to be used should be based on the suitability of type, frequency, size, weight, cost, shape, range, color, life expectancy, harness and placement of the unit. The basic types of transmitters available are radio and sonic, both single and multiple channel. Many options are currently available to the researcher, from activity and mortality sensors to aerospace satellite telemetry. The selection of type is generally dependant on need and budget.

The type of system selected should be suited to the expected use. Radio telemetry is largely restricted to air-to-air or fresh water transmission and is inadequate for transmission through a marine environment. Thus, the use of radio transmitters requires a harness and trailer in order to receive the radio signal when the turtle surfaces or is in shallow water. Low frequency transmitters have excellent properties of penetration and low bounce or defraction. They are, however,

limited by antenna size and the ground hugging characteristics of the signal. Higher frequencies are more easily miniaturized and have the property of increased range when the antenna is elevated.

Acoustic or sonic transmitters are used for transmission through water but have the disadvantage of high cost and sensitivity of the signal to physical barriers. The sonic frequency selected should not be audible to the instrumented turtle. The weight, range and battery life expectancy must be considered together, as each affects the other. In other words, extended range or life expectancy of a unit results in increased size of the unit. Thus, the needs of the researcher must be matched to a balance of these three elements. This becomes increasingly more important as the size of the instrumented turtle decreases.

The placement, size, shape and color of transmitters should be compatable with the shape and habits of marine turtles. The hydrodynamics of the equipment should be considered. Interference of normal locomotion or reproduction must be avoided. Abrasion of an animal by the transmitter package is sometimes a problem, and the area of instrumentation may be used by external parasites or as a site for infection. Transmitters should also be attached so as to avoid mechanical stranding of the animal due to fouling of the instruments or harness with the substrate. The color of a unit should blend with the environment according to the behavioral habits of the instrumented turtle. It is important that the instrument does not modify behavior, reduce competitive ability or increase mortality.

The cost of telemetric equipment is highly variable depending on the type used. Costs range from under $100 per unit, for a simple radio location transmitter, to several thousand dollars per unit for a satel-

lite compatable transmitter. The price of radio receivers begins at $300 and may exceed $10,000, even for land based units. The cost of sonic equipment is slightly more than double the cost of radio equipment. Considerable additional expense is also encountered in the collection of data, such as fees for boats and aircraft and salaries. The use of computers for data analysis may also be expensive but desirable.

The recent application of remote sensing techniques to the problems of management of marine turtle species has focused on the activities around the nesting beach. Ireland et al. (1978) monitored hatchling green turtles with miniature acoustic transmitters, and Stoneburner et al. (1982) reported on radio instrumented loggerhead hatchlings. Hopkins and Murphy (1981) monitored the nesting and internesting activities of 37 adult female loggerheads by using a combination of sonic and radio telemetry during three nesting seasons. Mendonca (1981) monitored immature turtle activity in a Florida lagoon while Ireland (1980) monitored homing and site tenacity of immature green turtles in Bermuda. Satellite telemetry has been utilized by Stoneburner (1982) to monitor internesting activity of loggerheads, and a cooperative project by the National Fisheries Engineering Laboratory and the Denver Wildlife Research Center monitored long distance, non-nesting movements of loggerhead turtles in the Gulf of Mexico (Kolz, 1980).

Telemetric field work has also been accomplished by Pritchard and co-workers with Kemp's ridley (Pritchard, 1980; Gicca, 1979), Fletemeyer used satellite telemetry to monitor activities of green turtles near Ascension Island (Fletemeyer, pers. comm.), and Richard Byles (pers. comm.)

is using radio and sonar tracking in monitoring the sea turtles of Chesapeak Bay. The National Marine Fisheries Service is also involved in sonic and radio telemetric monitoring of loggerheads at Port Canaveral, Florida (Kemmerer et al., 1983) and of head-started Kemp's ridleys (Timko and DeBlanc, 1981). Much of the work with telemetric monitoring of marine turtle species is currently undergoing data analysis and is not yet published .

It is clear that remote sensing techniques, when applied to questions of marine turtle biology, hold the promise of vastly extending our knowledge and, in many cases, can answer specific questions dealing with recovery in a short period of time. Research employing remote sensing techniques is needed:

1. to determine the marine habitat used by turtles in order to offer protection of these habitats and minimize negative man-turtle interactions,
2. to quantify periodicity of surface activity of marine turtles and relate this to aerial survey counts of turtles,
3. to evaluate management actions such as headstarting,
4. to evaluate the impact of human activities such as channel maintainance on marine turtle use,
5. to evaluate turtle stocks and their management in light of migration routes documented by satellite telemetry,
6. to monitor at-sea activities associated with nesting in order to evaluate the effects of beach disturbance and alterations as well as understand aspects of navigation and nest site selection and tenacity, and
7. to ultimately monitor hatchlings and their activities during the "lost years".

2.4 INCIDENTAL CATCH OVERVIEW

Introduction

Incidental catch or take is defined as the capture of species other than those towards which a particular fishery is directed. Sea turtles are threatened or endangered with extinction and protected by law; their incidental capture is of considerable biological and political importance. The following overview describes the incidental capture of sea turtles, the species and size classes most frequently taken, and the fishery(ies) and fishing gear involved. Mortality rate, physiological implications of drowning, and resuscitation techniques are also discussed, as well as recent developments proposed to reduce or eliminate accidental sea turtle mortality.

Primary sources of information regarding the incidental capture of sea turtles range from fortuitous encounters of tagged turtles by fishermen to direct observation by fishery biologist/observers stationed on-board commercial fishing vessels. Interview data from vessel captains provide additional information on capture and mortality rates and on areal and temporal distribution of captures. Important life history information can, in this manner, be obtained regarding turtle species, size, behavior and environmental characteristics associated with time and place of capture.

Commercial fishermen have been implicated in many, if not most, of the carcass strandings on southeast U.S. beaches because of the documented history of incidental capture and mortality by the commercial

fishing industry. Not all beach carcasses, however, are the result of drowning in fish nets, and more needs to be done to determine the precise cause of death of these animals.

Turtles wash ashore, buoyed by the gases of decomposition and at this stage are unfit for postmortem examination to determine cause of death. Death by drowning, according to pathologists, is difficult to determine, even under ideal conditions. For some of the carcasses, natural causes of death are indicated. In a few instances, dead turtles show signs of severe trauma or mutilation that can best be described as deliberate acts by man and not caused by predators or collisions with vessels. For the most part, however, circumstantial evidence points to drowning in fishing nets as the principal cause of mortality in beach carcasses.

Species Involved and Marine Habitat

All of the six species of turtles discussed in this recovery plan have, at one time or another, been captured incidental to fishing effort. However, the hawksbill sea turtle appears to have the lowest incidental capture rate of any of the sea turtle species. The paucity of records of incidental captures of hawksbills may be attributed to their preference for tropical reefs and insular habitats for foraging and nesting and to their absence from areas more frequently fished by trawlers and other vessels in search of pelagic and demersal fish stocks (i.e., not reef fish species). It is apparent that the loggerhead,

followed by Kemp's ridley and the olive ridley, is the most frequently captured turtle. The loggerhead is the most numerous turtle in U.S. coastal waters and, therefore, would be encountered more frequently by fishermen. The coastal bays, sounds and nearshore waters inhabited by the loggerhead overlap the area within which most of the southeast region's fishing effort is directed, including the use of drag nets, trawls, pound nets, beach seines and the gill-net fishery. Within this narrow range, the loggerhead is further concentrated in areal distribution by its foraging habits and preference for crabs and mollusks. Feeding areas frequently coincide with the highly productive shrimp grounds. It appears probable that loggerheads are also being attracted to areas of intense shrimping because of the quantities of bycatch discarded during the sorting procedure; bycatch represents an array of food items desired by the turtles. The same is true for Kemp's ridley and presumably for the olive ridley, although the latter may be more pelagic in habits than previously believed. The reported decrease in incidental captures of adult Kemp's ridleys over the last decade is probably the result of a declining population, indicated by the well-documented population decline of the nesting females at Rancho Nuevo, Mexico, over the last 15 years.

Incidental capture rates for the two remaining species, the green and leatherback, are low because of their low relative abundance in this region and because of their preferred habitat. The leatherback is usually pelagic, while the green is most frequently found in association

with shallow marine grass flats dissected by gulleys, scattered reefs, and rock outcrops. Juvenile green turtles are more frequently captured than adults, perhaps because they are more numerous, omnivorous and range widely. The green turtle, as a primarily herbivorous adult, is less likely to encounter fishing gear directed towards the capture of demersal fish and shrimp. The pelagic leatherback rarely encounters trawlers, except when it ranges onto the continental shelf and inshore, feeding on concentrations of medusae and ctenophores which drift shoreward. In recent years, it has been reported that leatherbacks are frequently captured at certain times of the year by longlines set for tuna and swordfish and are also caught and drowned in squid nets in the south-central Pacific (Balazs, pers. comm.).

Size Classes

Sea turtles captured by fishing gear vary according to size and age class. Subadult or immature turtles account for the majority of incidentally captured turtles taken in shrimp trawls. The age class most frequently captured is the larger, older immatures who have survived the period of high mortality experienced by neonates and small juveniles. They are important individuals that must be recruited into the present breeding population.

The preponderance of captured immatures may simply be a reflection of the size distribution of the population (if the capture method is assumed to be random), or it may reflect differences in the habits of

young turtles as compared to adults. The adults may be stronger swimmers and avoid capture by outdistancing the trawl. Adult loggerheads, except when breeding and nesting, apparently frequent deeper offshore waters where they are found on reefs, wrecks, oil rigs or other bottom irregularities usually avoided by the trawl fishery.

Neonate or hatchling turtles and small juveniles are considered to be epipelagic in habits and, thus, should not be vulnerable to demersal and mid-water trawls. They are apparently not captured by surface nets such as purse seines, being either absent from fishing areas or too small to be confined by the larger meshes of the seine. It is generally believed that neonates swim directly out to sea after emerging from the nest and remain as a pelagic animal for an undetermined length of time until they return to coastal waters as midsized juveniles.

Fisheries Involved

In general, two types of fishing gear are involved in the incidental capture of sea turtles. These can be classified as either active or passive. Active fishing gear is pulled through the water, a water straining device. Passive fishing gear is stationary, a trap, a set of hooks or a net. Incidental capture can also be described as occurring in two types of fisheries, the finfish fishery and the shellfish fishery. The latter includes sedentary as well as nektonic or swimming forms. Both fisheries use active and passive gear.

Of all the fishery methods currently employed in the southeastern region, the trawl is believed to capture more turtles incidentally than any other gear. Not only is the trawl effective in capturing turtles,

but the number of trawlers in the fleet is large. In addition to these factors, economic constraints recently placed on the shrimp industry have concentrated the fishing effort along U.S. coastal waters. Rising fuel costs, large inventories of cheaper imported shrimp, and exclusion of U.S. fishermen from traditional overseas fishing grounds have exacerbated this problem. The trawler is now one of the most common types of fishing vessel operating in the coastal zone (more than 6000 shrimp vessels operate in the southeastern U.S. alone). That fact and the previously mentioned occurrence of the loggerhead and ridley sea turtles in commercial shrimping grounds probably accounts for the significantly higher capture rate for this type fishing gear as compared to others.

Other fishing gear employing nets and involved in the incidental capture of sea turtles are the seine, trammel net, gill net and pound net. These are utilized primarily in the shallow coastal waters and in bays and sounds, with the exception of the gill-net fishery for coastal pelagic fishes. All of the above nets, except the pound net, can be either active (straining) or passive (stationary); the pound net is a stationary gear. The sturgeon net fishery has recently been implicated in the capture of sea turtles, primarily loggerheads. Other nets, similarly located and set for shad and sharks, have been implicated as well. If the spring sturgeon run is long, the nets may be intercepting the shoreward movement of sea turtles from their wintering grounds. Breeding adults begin to congregate in coastal areas prior to the onset of the nesting season.

The pound net fishery of the Chesapeake Bay area is believed to be responsible for mortalities of sea turtles. Deaths from this cause have been reported more or less regularly for the past decade. Recent information from biologists studying this problem in Chesapeake Bay have determined that mortalities occur when the turtles become "gilled" or entangled in the larger meshed lead nets that guide fish into the trap; the lead net is not regularly inspected by the fishermen (Lutcavage, 1981). Turtles that manage to enter the pound net are usually not injured and can be released alive by the fishermen when they remove the catch.

Turtles have been captured with baited hook and line, including sport fishing tackle. In many cases it is apparent that the turtles were attracted to the bait since they actually were hooked in the mouth. However, leatherbacks are frequently captured in the longline fishery for tuna and swordfish, where numerous hooks are suspended from the main line which may extend for miles. It would seem doubtful that the leatherback was primarily attracted to the fish/squid baited hooks, since this species is thought to subsist almost entirely upon coelenterates (cnidarians) and ctenophores. Rather, the placement and extreme length of these longlines, set at the shelf break in a pelagic habitat shared by the leatherback, simply entangle or snag them. Leatherbacks are particularly vulnerable to longline gear because they have the greatest breadth or flipper span of any sea turtle and their epidermis is very soft, not armored with thick scutes as in the other sea turtle species.

Trot lines set for seatrout and redfish in the shallow lagoons of south Texas capture juvenile green turtles, though not necessarily because of baited hooks. Artificial lures have been used in the past, and many of the turtles were hooked in the body or tangled in the lines. Pot warps (buoy lines) of crab and lobster traps ensnare several species of turtles. Encrusting organisms grow on the submerged portion of the floats and warps, when traps and their marker floats are left in the water for long periods of time. The carnivorous turtle is attracted to this food source as well as to crabs or lobsters within the trap. The feeding turtle becomes entangled in the slack warp and drowns. Large numbers of pots, with their attendant floats and warps set closely together, can offer a serious obstacle to turtles swimming through the area; the potential for entanglement is high in this situation.

Capture and Mortality Rate

Discontinuities in fishing efforts and sea turtle distributions confound incidental capture and mortality statistics throughout the southeastern U.S. Furthermore, information collected by interviews is frequently biased and increasingly difficult to obtain. Widespread publicity and sanctions against those responsible for killing turtles are causing this information source to dry up as long as trawlers are implicated. However, reliable information regarding incidental catch rates is being collected by onboard observers and scientists aboard chartered trawlers and government survey vessels. Adequate sampling of the deepwater trawling fleet (over 6,000 documented vessels in the southeast), which includes an equal number of smaller "bay" shrimpers, will require considerable effort and resources distributed over a large geographic area.

Surveys in the south Atlantic and Gulf states have produced preliminary information that resulted in regional estimates of total captures and mortalities (Hillestad et al., 1977; Hillestad et al., 1982; Ulrich, 1978). Information from interviews suggests that the predicted uneven distribution of sea turtle populations reinforces the observed uneven catch distribution among trawlers. Some experienced fishermen risk gear loss by dragging their nets close to underwater obstructions, where they are rewarded by good catches of shrimp from isolated populations that have not been depleted. These fishermen report frequent captures of loggerheads at such sites. The turtles are apparently attracted to the reef-like habitat and bottom disconformities. Capture rates of turtles per hour of trawling effort from these early surveys have been estimated to be less than 0.1 for the Atlantic coast shrimp vessels and less than 0.01 for the Gulf of Mexico fishery. Estimated mortality rates for those turtles captured in both fisheries ranged widely from less than 10% to over 40%. Mortality estimates calculated from interview data were usually much lower than observed mortalities. Other factors could bias observed mortalities, such as the recapture of dead turtles in heavily trawled areas, however.

Seasonal abundances of juvenile turtles also account for differences in catch rate. The younger age classes are highly migratory, moving between developmental areas and, seasonally, out of shallow (colder) coastal waters in the winter months. For the Atlantic fishery, encounters with turtles appear more or less evenly distributed along nearshore waters. An exception would be Cape Canaveral, Florida, an area where an unusual concentration of loggerheads is found in the Port

Canaveral ship channel. The turtle population of the Gulf of Mexico consists primarily of immature turtles, now that the large nesting aggregations of Kemp's ridley have been reduced in size. Concentrations of adult loggerheads have been seen off Western Florida (Ogren, pers. comm.).

Continuing efforts by the NMFS observer program provided additional incidental catch statistics for shrimp trawlers operating off the southeastern U.S. The annual catch of sea turtles, primarily loggerheads, was estimated to be over 45,000. The average mortality rate was estimated to be about 27%, or over 12,000 turtle deaths per year (NMFS, draft regulations (withdrawn)). Despite the greater number of trawlers fishing in the northern Gulf of Mexico, capture rate was lower. This may reflect a lower sea turtle density in the Gulf as compared to the south Atlantic coastal area. Mortality rates were higher in the Gulf, however, and may be the result of longer tow times recorded for this fishery. Study and analysis continues to this date to determine what is the actual range or numbers for the annual mortality of captured turtles.

Capture and mortality rates for other fishing industries are less well documented. Several hundred loggerhead deaths are attributed to the pound net fishery of Chesapeake Bay each season. The smaller sturgeon fishery of South Carolina accounts for some loggerhead mortality, but the duration of the sturgeon fishery is not as long as other fisheries. In the Gulf of Mexico, swordfishermen are accidentally capturing leatherbacks. Some believe the catch rate is high enough to cause

concern. Some of these captains report an incidental capture rate of 15-20 turtles per trip, but only during winter months, and some of the turtles are released alive (Hildebrand, 1980).

Physiological Implications of Forced Submergence

Sea turtles tolerate the anoxic effects of prolonged submergence during normal behavioral activities such as deep diving, resting (sleeping) and winter refuging (dormancy). In situations involving forced submergence, such as capture by trawls or set nets, the exertion to escape may lead to death. The initial reaction of a turtle to a trawl is to outswim the device. This strenuous effort results in an increase in oxygen consumption, with no opportunity to replenish this debt. Once captured, the turtle will struggle to escape the webbing, or, in the case of set nets, to free itself from entanglement. If the exhausted turtle is not released, it will soon drown.

The clinical diagnosis of death by drowning in sea turtles is not completely understood but probably involves several physiological responses, including shock, asphyxia and seawater aspiration. A preliminary report investigating the cause of drowning in trawl-captured turtles reported that the major trauma to these animals was exhaustion from stress and that the length of the submergence period was secondary (Lutz and Dunbar-Cooper, 1979). However, a positive correlation has been found between trawl duration and mortality rate. Thus, length of submergence may be critical to the revival of comatose turtles. Additional research on the physiology of stress in sea turtles will be required before effective resuscitation techniques can be devised.

Besides directly related drowning deaths, mortalities of sea turtles may involve a complex chain of events. For example, the traumatic experience of being captured in a trawl could weaken the turtle and increase its vulnerability to attack by pathogens, parasites or predators. Reports of periodic occurrence of moribund turtles far offshore the south Atlantic coast, and, more recently, of weakened and emaciated individuals washing ashore at Cape Canaveral, may be related to multiple events, especially if premature arousal of winter dormant turtles had occurred or trawl stressed turtles were involved (Carr et al., 1980). Whether or not turtles weakened by disease are more susceptible to "drowning" in trawls or, conversely, exhausted turtles released or escaped from trawls are predisposed to disease related illness and death remains to be determined. Severely traumatized sea turtles may live for months before they become moribund, accumulating an epibiota and parasite load uncharacteristic of normal turtles as they passively drift in tidal and oceanic currents which is uncharacteristic of normal, more active turtles.

Trawlermen believe that turtles, exhausted from a previous capture, are more susceptible to drowning if they are recaptured the same day. Foreign turtle fishermen must remove their catch from tangled nets shortly after capture to have live animals for market. Apparently, netted turtles soon become comatose or drown. Up to 50% of all green turtles caught in tangle nets drown when nets are only checked twice per day (Pritchard, pers. comm.).

Other Marine Activities

Unusually dense aggregations of sea turtles occur in certain marine or coastal localities because of man-made structures or activities. Aggregations involving natural occurrences of breeding, feeding or migrating turtles will not be discussed here. Loggerheads and perhaps Kemp's ridleys and greens congregate near seafood processing plants where offal is discarded in adjacent tidal creeks. Crab processing plants sited on the bays and sounds in Georgia are typical examples. Other man-induced feeding aggregations occur wherever the trawlers cull their catch, especially in Georgia and South Carolina where specific inshore sounds are used regularly by shrimpers for this purpose.

Turtles occur in the Port Canaveral, Florida, navigation channel at densities much higher than natural sounds and channels. The man-made channel may enhance feeding, but the main attraction is believed to be the water depth ($\fallingdotseq$50 feet) and steep-sided profile that affords a reef-like habitat for winter refuging and escape from cold temperatures, a loafing area for the turtles during the remainder of the year and an internesting habitat for reproductively active loggerheads (Ogren and McVea, 1982). The presence of several seafood processing plants (both fish and shellfish) in the Canaveral area and the proximity to shrimping activity with its attendant culling operations may well be an important additional attraction. In short, the Canaveral bight may have been an area of average importance for feeding and overwintering turtles in the past, but now the habitat has been altered for these species by man's activities. The highest incidental catch rates ever reported have occurred in the Port Canaveral navigation channel.

Solutions to the Problem

Changes in the existing rules and regulations, as pertaining to the Endangered Species Act of 1973, have been proposed in order to reduce or eliminate the incidental capture of sea turtles in the southeastern United States. Progress in gear technology has resulted in refining the existing excluder design(s) and enhancing the efficiency of the trawl. Results of comparative gear trials were very promising. A 97% reduction in sea turtle captures was achieved with a 7% increase in shrimp catch in the trawls equipped with the excluder device (Easley, 1982). In addition, the TED considerably reduces by-catch.

The Endangered Species Act of 1973 (ESA) has created a paradoxical situation for both endangered species and people and does not lend itself to recovery efforts for the species. In some instances, special regulations permitting "first aid" for threatened sea turtles taken incidentally have been written and implemented. These regulations do not apply to endangered species and, therefore, possession of an endangered species without a permit is a violation of federal law (ESA). Prior to 1982, regulations could not be written for endangered species, only for threatened species. Thus, if a fisherman took an endangered species in his trawl, he legally could not take action to attempt to save the animal, nor could he report or provide the specimen to an authorized third party. Rather than leave the endangered species on deck to see if the animal revives, he must immediately return the turtle to the sea where survival chances are slim in its weakened condition. Amendments were made to the Endangered Species Act in 1982 that may correct this problem. Under Section 10(a) 1(A)

of the ESA, if certain conditions are met such as preparation of a specific conservation plan, it may be possible to legally allow the incidental take of an endangered species. The Services have not yet issued regulations implementing these amendments. This should be done promptly to allow for the resuscitation and gathering of biological data on endangered sea turtles.

Resuscitation Techniques

Regulations originally set forth by NMFS stated that sea turtles taken incidentally must be handled with care and returned to the water immediately, whether dead or alive. However, resuscitation must be attempted on comatose turtles by turning the turtle on its back and pumping its plastron by hand or foot. Recent regulations now include the previous instructions, additional actions required to effect a safe release, and an alternate revival technique. All turtles are to be released over the stern only after the trawls are out of the water, the vessel is in neutral gear and the vessel is in an area where recapture is unlikely. In addition to the plastral-pumping method, comatose turtles may be placed on their plastrons and posteriorly elevated from one to twenty-four hours until they revive. All turtles must be returned to the water before the vessel reaches port. All turtles held on deck should be shaded from direct sunlight and kept moist.

These instructions, if followed, may save many of the turtles incidentally captured that appear lifeless when taken from nets or trawls. Preliminary findings from field and laboratory investigations on other air-breathing aquatic vertebrates suggest that additional

methods may be applicable in resuscitating "drowned" turtles. For example, if an acid/base imbalance is involved in drowning deaths, appropriate measures to buffer this condition could be recommended. Although it may not be practical for fishermen to apply all methods, biologists on research vessels, as well as other professional and/or government personnel associated with the fishing industry, could be easily trained and equipped to do so.

It is conjectural whether comatose turtles should be held on deck belly up or belly down or whether one position inhibits normal ventilative movements more than the other. Former Florida commercial fishermen routinely revived "lifeless" turtles by placing them belly down in the bilge of their boat and elevating the posterior end. Once the turtles became active, they were turned upside down to immobilize them while being held for market. However, these animals were primarily small, sub-adult green turtles well below 100 pounds. Historically, mature green turtles were kept alive for long periods of time, belly up in the holds of fishing and transport vessels. These were primarily large specimens immobilized with their flippers tied together. Conversely, captured greens in the Baja California region of Mexico were routinely kept belly down in dry, sandy pens until they were either shipped to canneries or butchered locally. Research on the physiology of stress and resuscitation technology should be given high priority if we are to develop methods to prevent unnecessary mortalities of incidentally captured sea turtles.

Up-to-date instructions to southeastern U.S. fishermen regarding recommended procedures for resuscitating sea turtles accidentally caught in an apparent lifeless (comatose) condition have been prepared by NMFS

for distribution. These instructions are temporary and have evolved empirically rather than from scientific facts.

A. When a Sea Turtle is brought on board a fishing vessel (in a net or on a line), observe it briefly for activity.

B. If the turtle is actively moving, return it to the water without harm or damage (away from prop, or with vessel in neutral) in an area where recapture is unlikely.

C. If the turtle is not moving or is apparently lifeless (comatose), it must be returned to the water, BUT FIRST follow this procedure:

1. Place the turtle on its belly (plastron).
2. Prop up the rear end of the turtle (several inches, higher up with larger turtles).
3. Keep the turtle shaded and wet or moist.
4. If the turtle recovers and begins to move actively, return it to the water according to instruction B above.
5. If the turtle does not move within several hours (up to 24, if possible), it is presumed dead. Then the turtle must be returned to the water.

D. Important Information:

1. Sea turtles caught and held under water are physiologically stressed and often become comatose and apparently lifeless. These stressed turtles may appear to be dead, but death cannot usually be determined by the turtle's appearance or lack of movement. When the turtle has a chance for the lungs to drain, it often recovers to an active state. This recovery may require one or two or up

to 24 hours. Throwing a comatose turtle into the water will drown it.

2. Some sea turtles that are caught in nets or on lines may have been dead for some time before being brought on board. These turtles will usually be extremely bloated and have a strong and bad smell. Return them to the water immediately.
3. All records of captured or killed sea turtles are important. Records of loggerhead sea turtles caught (including where, when, and how caught and released) should be kept and made available to scientists upon request.
4. Do not return to dock or shore with any sea turtle on board without a Federal or State Permit--this is illegal.
5. The above applies to loggerhead sea turtles, the most common species in U.S. waters. At present it is <u>illegal to catch</u> ridley, hawksbill or leatherback sea turtles and Florida breeding populations of green sea turtles.

2.5 NESTING BEACH MANAGEMENT TECHNIQUES

Introduction

A number of environmental and man-induced influences affect sea turtle eggs and, thus, the recruitment potential for a given beach. Factors affecting hatching success and possible management techniques for maximizing the reproductive potential of threatened and endangered species of sea turtles are reviewed in this section.

Physical Environmental Factors Affecting Hatching Success

Excessive rainfall floods turtle nests and destroys eggs (Ragotskie 1959, Kraemer and Bell 1980). Ackerman (1975) inferred that heavy rainfall, even if it does not result in actual flooding of the nest, can affect incubation time and decrease hatching rates by interfering with necessary gas exchange within the nest. Saltwater inundation of nests by spring or storm driven tides adversely affects egg survival. Salt, per se, may not be toxic to the eggs; deleterious effects may be caused by decreased gaseous diffusion to the nest because of beach waterlogging.

Erosion is a serious problem on some high-energy beaches. Large quantities of partially developed turtle eggs may be washed into the surf when wave action cuts into the beach platform.

Biotic Factors Affecting Hatching Success

Natural and introduced predators: A variety of predators such as raccoons, mongooses, feral hogs, peccaries, dogs, coyotes, rats, vultures, coatimundi and ghost crabs prey on the eggs of sea turtles. In addition to the destruction of developing eggs, certain predators may

take considerable numbers of hatchlings just prior to or upon emergence from the sand. In remote sections of the Tortuguero beach, the white-lipped peccary is particularly devastating to hatchlings just under the sand's surface prior to emergence (Carr, 1967).

High Density Nesting: On major turtle beaches, the intensity of nesting on certain stretches of beach may be such that many nests are destroyed by the digging activities of subsequent laying females. This is particularly a problem for populations of olive ridley turtles that nest in arribadas. It is also suggested by Ackerman (1975) that, even when nests are not physically disturbed, gas exchange within nests may be adversely affected if nests are too close together. The build up of organic materials in the sand, over time, may increase bacteria and fungi to levels detrimental to embryo survival.

Man's Impact

Egg Collection: A widespread and serious impact of man on sea turtles is the harvesting of eggs for food or profit. On some beaches this is an illegal activity, but many important turtle beaches are in remote areas where law enforcement is difficult. In some areas (i.e. Surinam), the harvesting of eggs is sanctioned and supervised by the government to provide a needed protein source and traditional subsistence income for local Indians.

Heavy Equipment and Foot Traffic: The use of mechanized beach cleaning equipment, off-road vehicles and heavy human foot traffic poses

a significant threat to turtle nests on certain Florida beaches. Mann (1978) found that nests on fine grained beaches were less susceptible to damage from pedestrian and heavy equipment traffic because nest excavations were more resistant to collapse. Cattle and horses walking on nests may be more deleterious than human foot traffic because of the smaller foot size relative to body weight of these animals.

Beach Nourishment Projects: Beach nourishment projects may adversely affect hatching success. If conducted during the nesting season, excessive sand may be deposited over existing nests, increasing the difficulty of the hatchling's route to the surface. Furthermore, gaseous diffusion in the nest is controlled by sand grain size; fine grained sands have the poorest diffusion rates (Ackerman, 1975). The applied overburden in a beach nourishment project should match the existing substrate on nesting beaches so that nests will not be adversely affected by reduced gas exchange. Additional adverse effects which may potentially result from beach nourishment projects include: (1) scarp development at the edge of the beach fill rendering the beach inaccessible to nesting turtles, (2) entrapment of hatchlings in vehicle tracks, (3) compaction or cementation of beach sediments, (4) alterations in moisture levels or other aspects of the micro-habitat within the nest cavity, (5) alteration of unknown beach signature components which may disrupt nest site fidelity, (6) alteration of the native physical beach characteristics (slope, dome shape, etc.) such that nesting attempts are reduced, and (7) the possibility of short repetitive maintenance intervals which could effectively eliminate all natural nesting for a given beach.

Management Techniques

It should be the goal of beach management to maximize reproductive potential of threatened or endangered marine turtles, in a cost-effective manner. Prior to implementing a management plan, possible adverse effects, such as interference with beach imprinting mechanisms of the hatchlings or alteration of sex ratios, should be thoroughly considered. The following discussion lists activities that might be used to increase recruitment of hatchlings, with comments on their advantages and disadvantages.

Protection of Nests in Situ: The use of wire enclosures, chemical repellents, and aversion conditioning of predators have been suggested as possible means of preventing predation of turtle nests. Lithium chloride was not effective in preventing racoon predation in South Carolina (Hopkins & Murphy, in press). Only the use of wire screening or enclosures have been demonstrated to be effective for most types of predators. Minimal disturbance to nests is the major advantage of this technique. Incubation and hatchling emergence are not affected. It is, however, quite labor intensive, requiring nightly or daily beach patrol as it has been shown that loss to predators is extensive for the first two nights after the eggs are laid. In situ protection is not effective in preventing losses to erosion and human poaching; however, moving nests a few yards has been successful in detering human poaching.

Hatcheries: Hatcheries have been used for a number of years to prevent predator and erosion losses and provide semi-controlled hatching conditions for sea turtle eggs. Hatcheries are of two basic types: (1)

those in which eggs are placed in hand-excavated nests in the beach sand within a fenced enclosure and (2) operations using styrofoam boxes or plastic buckets as a substitute nest. Such egg containers are kept in a building, usually at ambient air temperature, although hatching under controlled temperature and humidity has been done.

When beach hatcheries are used, incubation and emergence conditions most closely resemble natural nests. However, they are subject to mortality from excessive rainfall on poorly drained sites. The use of styrofoam containers, incubated inside of a hatchery building, eliminates this problem, and operations of this type are capable of consistently high hatch rates. The recently raised question of the effect of incubation temperatures on hatchling sex ratios (Mrosovsky, 1982) should be answered before this method receives wide-spread use. Investigation of the temperature modulated sex ratio question should not rely solely on laboratory, constant-temperature incubation experiments (Yntema and Mrosovsky, 1980; Wood & Wood, 1982) but should also include the temperature regime and sex ratio of natural nests (Mrosovsky & Yntema, 1980; Morreale et al., 1982; Mrosovsky et al., in press). Determination of in situ hatchling sex ratios and their relationship with environmental parameters may make it possible to adequately control hatchery incubation conditions to produce the desired sex ratios. Work is currently in progress to provide data on natural parameters and resultant sex ratios and should continue until these unknowns are determined.

Hatchery operations should insure that release of the hatchlings mimics the natural situation as closely as possible, so as not to interfere with possible beach imprinting and hatchling dispersal mechanisms or to attract abnormal numbers of marine predators to the vicinity of the release point. Hatchlings should be released close to natural emergence times, usually around midnight. Hatchlings should be allowed to crawl a moderate distance to the water, and their release point should be dispersed along the nesting beach.

The operation of hatcheries and the protection of nests in situ would be most economically feasible if operated in conjunction with a research/tagging project incorporating beach patrols. This would make optimum use of man-power and insure that the maximum number of nests is found and protected.

Predator Reduction Programs: In terms of cost effectiveness, predator reductions would seem the most viable approach to increasing hatchling production on many nesting beaches, particularly if the removal operations could be conducted prior to onset of turtle nesting and continued throughout the season as needed. This approach would be effective for animal predators resident to the beach areas and not for opportunistic arrivals from inland populations, i.e., coyotes and dogs. Predators of the latter type would have to be removed throughout the nesting season.

Increased Law Enforcement: In areas where egg poaching occurs, additional law enforcement activity is needed to reduce illegal egg loss.

"Head-Starting" Techniques: An additional management technique that may be used in certain cases is the rearing of hatchlings under controlled conditions for 6-12 months before release, commonly referred to as "head-starting". The rationale for using this technique is to reduce first year hatchling predation, i.e., holding the animals until they are large enough to be less susceptible to most natural predators. The use of head-starting is a costly program which should only be considered for clearly endangered species such as a Kemp's ridley.

Potential Problems Associated With Head-Starting: Head-starting remains an unproven technique for increasing recruitment to the target population. There is adequate evidence that head-started turtles can and do survive under natural conditions and become widely dispersed from the release location (Witham, 1976; Witham and Futch, 1977; Witham, 1980). However, there has been no positive return of a head-start turtle to a nesting beach as a breeding adult, but sufficient time has not elapsed for maturation. This may be due to deficiencies in present tagging methodology, but head-starting should be considered an experimental technique until recruitment of head-started turtles to the breeding population has proven to be greater than that of natural recruitment. Until then, only a limited percentage of a local population's annual egg production should be utilized for such experiments. Pritchard has recommended that this percentage be no more than 10%.

An understanding of hatchling behavior dispersal patterns and habitat requirements should be known if head-starting is to have a

reasonable chance of success. Head-start turtles should be released in areas where turtles of that size normally occur. Release of yearling turtles from the nesting beach may be asynchronous with their life cycle, but another choice may not be available if wild stocks of related size cannot be located. Until the concept of imprinting to the natal beach is resolved, the potential of "head-starting" to disrupt this process must be considered. Several currently employed methodologies which address this problem are as follows:

1. Incubate transferred eggs in sand taken from the natal beach.
2. Allow emerging hatchlings to descend the natal beach and enter the water before transferring them to headstart facilities.
3. Allow yearling headstart turtles to descend the beach at time of release.

Rearing head-start turtles under high-density culture conditions makes these animals susceptible to group contamination and mortality from a variety of disease organisms, another reason for committing only a small percentage of annual egg production to head-starting. Facilities for conducting head-starting should have an adequate supply of clean sea water, either a high volume flow-through system or a closed or semi-closed system with treatment and filtration. A system for isolating and treating diseased animals should be available, and the services of a veterinary pathologist are desirable for disease diagnosis and treatment.

2.6 HYPOTHERMIC STUNNING AND PETROLEUM IMPACTS

2.6.1. Hypothermic Stunning

Marine turtles in the bays, sounds and lagoons of the eastern U.S. are infrequently stunned by low water temperatures during periods of extremely harsh winter weather. Kemp's ridleys and occasionally other species are found in a cold stunned condition in winter in the New England area. Turtles may drown or die of exposure to the elements when in this condition. The species perhaps most severely affected by these conditions in Florida is Chelonia mydas. The loss of relatively few individuals may be significant because its numbers are so low in U.S. waters. Although the need will be extremely infrequent, the small U.S. populations of the species dictate the need for organized rescue efforts. Procedures set forth below are addressed to Chelonia mydas but can be applied to other species of cold-stunned marine turtles.

Dealing With One or a Few Individuals

1) Immerse the animal in fresh or salt water to about half shell depth.

2) Support the head slightly so that it is roughly in alignment with longitudinal axis of the body (water will bathe the underside of the head but not cover the mouth).

3) Allow the animal to warm gradually, preferrably to 15-17°C. Higher temperatures will cause increased activity and create the need for feeding. Ordinarily, confinement should be of short duration and feeding should not be necessary.

4) Replace the water daily or when it becomes soiled.

5) Release the turtle to the wild when water temperatures in the habitat approach 15°C (green turtles have been known to survive and thrive when released into water at 13°C).

Massive Cold-stunning Episodes

1) Subdivisions of the various state natural resource (conservation) agencies charged with responsibility for sea turtles should be aware that abnormally harsh winter weather can cause marine turtles to be stunned and killed by low water temperatures.

2) A procedure for monitoring and reporting water temperatures during extended cold spells should be established.

3) If water temperature falls to the 9-11°C range or lower on two successive nights, officers and agents on routine patrol should be alerted to the possibility that turtles may be stunned and begin to float at the surface. Additional reconnaissance should be arranged where personnel and vehicles are available.

4) If stunned turtles are sighted and if overnight temperatures continue in the 9-11°C range or lower, systematic reconnaissance of the affected waters should be organized. This can be done by boat and from shore (the wind drives the immobilized animals against the leeward shore) but aerial reconnaissance is the most effective method for locating turtles where large numbers are involved. Stunned turtles are generally visible from the air, and locations can be transmitted to surface vehicles to facilitate retrieval. Stunned turtles may drown or succumb to exposure if not rescued.

5) Where possible, rescued turtles should be taken to local aquariums or other institutions with facilities for handling marine

vertebrates. In most cases such facilities will be unavailable. In such cases the turtles can be kept on their backs or upright in open shade or indoors for two or three days. They should be splashed with water frequently. If possible, they should be held at temperatures ranging from 15°C to 17°C, for reasons given above.

6) On about the third day evidence of dehydration (especially wrinkling of the plastron scutes) appears and, if confinement continues much beyond that length of time, arrangements should be made to permit total immersion of the animals in a pond, swimming pool or other water-filled enclosure. Plans for the recapture and removal of the animals (feasibility of draining, availability of capture nets, etc.) should be made prior to their introduction to the enclosure. The water can be fresh or saline and, again, temperatures in the 15°-17°C range are desirable.

7) As above, turtles should be recaptured and released when temperatures in the natural habitat approach 15°C.

2.6.2. Petroleum and Petroleum Residue Impacts

Sea turtles of most species have been adversely impacted by petroleum and its tar residue (Witham, 1978 unpublished data; Fritts and McGehee, 1982). The affected turtles found on Florida beaches have been in the 7.5 to 15.0 cm carapace length range. Turtles, being non-selective feeders, ingest floating tar. While the immediate effect of ingesting tar appears to be mechanical in that it seals the mouth shut and may clog the nostrils, the crude oil phase may have a toxic effect.

Most of the petroleum impacted turtles have been found on beaches. They apparently become comatose, float at the surface and are carried

ashore by prevailing winds and currents. It is likely that some may die at sea after being impacted, should winds and currents carry them away from beaches. Cooperating agencies, organizations and individuals should be alerted to this type of impact and be ready to rescue turtles as needed.

Tar impacted turtles, if recovered soon enough, are amenable to treatment, but it is not known if those impacted by liquid oil can be treated. 1) Excess tar should be gently scraped off. The residual tar or oil can be removed from the body and mouth by using vegetable oil, mineral oil or a mechanic's waterless hand cleaner. 2) A cotton tipped swab should be used to clean the mouth, and care should be taken to determine that the nostrils are clear. 3) After cleaning with one or another of these materials, the turtle(s) should be rinsed with a mild detergent, followed by a clean water rinse. 4) If the turtle(s) appear to have swallowed any of the petroleum, a small dose (1-2 ml) of mineral oil may be administered. 5) Following cleaning, the turtle(s) should be kept in an aquarium until they have fully recovered and are actively feeding and swimming before being released.

2.7 PUBLIC EDUCATION

The wide distribution of the six species of marine turtles considered in the Recovery Plan and the relatively few law enforcement agents stationed throughout the management area, necessitate a voluntary effort on the part of the public to reduce detrimental human/turtle interactions. Most people will show concern for a threatened or an endangered species and will take appropriate action not to harm it if they are given an appropriate action to take. Thus, an aware and enlightened public is important to the recovery of marine turtles.

This section addresses the informational needs for recovery and the various modes by which this information can be transferred to the public at large and to special interest groups. Terrestrial and pelagic aspects of sea turtle management are discussed with regard to these individual groups, along with suggestions for reaching them through responsible agencies and private organizations. Some of these needs have already been met during the course of preparing this plan.

Terrestrial Aspects

A majority of human/turtle interactions occur on the nesting beaches because turtles nest in temperate regions during the high use summer season or in tropical regions where beach use can be high all year. Permanent beach residents could provide a core group to disseminate information to reduce the negative impacts of turtle/human interactions on the beach. These adverse impacts may be caused by the residents themselves, by transient renters, or indirectly from lights and sea walls. There is also a need to create an attitude among beach

users which will result in involvement in the prevention or prosecution of violations.

Modes of implementation: The following are suggested procedures for public education:

1. Displays at visitor centers in national and state parks and refuges.
2. Signs posted at beach access points and near nesting areas.
3. Posters at shopping centers, real estate offices, and in beach rental units.
4. Public service announcements on T.V., radio, newspapers, magazines or bumper stickers.
5. Sanctuary signs at town limits.
6. Turtle patrols for the non-technical monitoring of strandings through organized stranding networks.
7. Speakers bureaus, including movies and slides for school and civic groups.
8. Brochures for beach users, both permanent residents and transients. These brochures should contain the following information:
   a) Beach use and its effects on nesting females, nests and hatchlings.
   b) Beach alteration and its effect on nesting females, nests and hatchlings.
   c) The detrimental effect of trade in turtle products.
   d) Identification of degree of threat, reasons for threatened or endangered status and value of the species.

e) Prohibited acts and reporting of violations (See section 11321C in loggerhead stepdown plan).

The modes of implementation should be conducted by Fish and Wildlife Service, National Park Service, National Marine Fisheries Services, state agencies, non-governmental organizations and schools. Assistance could be provided by Youth Conservation Corps, Young Adult Conservation Corps and interested civic groups and private organizations.

Marine Aspects

Incidental catch, boat collisions, and malicious target shooting are sources of negative human/turtle interactions in the marine environment. Some may be more serious than others, depending upon the specific area and species involved. There is a need to inform the commercial fisheries sector on the causes and significance of incidental take mortality. Information on gear modifications, resuscitation and handling techniques, new rules and regulations and reporting incidental catches need to be made available to commerical fishermen (See Section 2.4). There is also a need to educate the boating public to reduce mortality from collisions and firearms.

Mode of implementation:

1. Posters and brochures provided to all commercial fishermen.
2. Incidental catch logs provided on selected boats in commercial fleets.
3. Speakers' bureau to explain and/or demonstrate new gear or regulations.

4. Post signs on speed limits in areas where necessary.

The majority of implementations would be by NMFS and state agencies.

General Public

There is a need to raise the awareness of the public at large to the plight of marine turtles. Broad-based public support by non-user groups, as well as those with direct contact, is needed to attain the support necessary for recovery. This same support is needed to reduce fashion acceptance and provide peer pressure against the commercialization of turtle products.

Modes of implementation:

1. Full color identification poster of all marine turtle species.
2. Displays at state museums and at the Smithsonian Institution.
3. Displays at the new National Aquarium in Baltimore. Displays at the Miami Seaquarium and Sea World, Orlando are good examples.
4. Displays at airports and cruise ship terminals to make tourists aware of illegal turtle products and the penalties for importation of these products. These displays should be bilingual (English and Spanish).
5. Brochures provided on airlines and cruise ships with similar information.
6. A series of marine turtle stamps issued by the U.S. Post Office.
7. Turtle "awareness" months declared by state governments.
8. Programs by private organizations, such as National Wildlife

Week; TV spots featuring marine turtles; booklets for school distribution.

9. Other agencies within the context of this plan should be encouraged to develop similar information campaigns. These modes of implementation could be conducted by National Marine Fisheries Service, Fish and Wildlife Service, State Department, Customs Service, Post Office and private organizations.

The ideas presented here should not be regarded as the only means to bring about education and public awareness. Each agency or private group should call upon the talents of its own personnel for developing materials in its particular area or targeted at a particular interest group.

2.8 UNITED STATES FEDERAL LAW

1. Endangered Species Act of 1973 as ammended (ESA)

Scope and Provisions:

The ESA is federal legislation which provides for acquisition and/or protection of turtle nesting habitat, for turtle protection and for funding of sea turtle research and protection through cooperative agreements with the states. The ESA also protects endangered and threatened species from import, export, sale, offer for sale, take, transport, etc. The only exemptions to the above for endangered species are for scientific research and enhancement of survival of the species. For threatened species exemptions include scientific research, enhancement of survival of the species, zoological exhibition, educational purposes, and special purposes that are consistent with the Act. All species of sea turtles, except the Australian flatback are protected in the United States under the ESA.

The ESA is one of the most advanced statutory statements of environmental ethic in the world. Fully utilized in conjunction with other USA statutes, state statutes, and international agreements which the U.S. has ratified, it provides a solid legal basis for U.S. recovery activities (See p. 1).

2. Pelly Amendment to the Fisherman's Protective Act

Scope and Provisions:

The importance of this statute is that it provides economic sanctions for the U.S. Government to use in trying to influence other govern-

ments to conduct fishing operations in a manner which will not decrease the effectiveness of an international fishery program. This includes not only programs for the conservation of fish but also those pertaining to any "living resource of the sea."

Implementation:

Although this act has not been invoked, the threat of its use has been an effective tool in support of cetacean conservation.

Actions Required:

The Departments of Commerce and/or Interior should recommend use of the Pelly Amendment to the President, when appropriate, to insure that Parties to the international agreements comply with stated or implied agreement objectives to protect endangered and threatened species of sea turtles.

3. Coastal Zone Management Act of 1972

Scope and Provisions:

The Coastal Zone Management Act (CZMA) was enacted to encourage and assist coastal states and territories in dealing with the increasing and competing demands for the use of the Nation's coastal resources. The Act has as its objective "to preserve, protect, develop, and where possible, to restore or enhance the resources of the Nation's coastal zone for this and succeeding generations." To achieve this objective, it provides federal financial and technical assistance to coastal state and territorial

governments to establish and administer Coastal Zone Mangement (CZM) programs that meet federal objectives, including protection of natural resources.

Implementations:

All 35 coastal states and territories have participated in the CZM program. Of these, 28 have federally-approved management programs and one, Virginia, is expected to submit a program for approval in FY 1984.

Required Actions:

The National Oceanic and Atmospheric Administration should encourage coastal states and territories with federally-approved CZM programs to develop and implement measures to protect sea turtle nesting areas and foraging water areas within their coastal zones.

4. Fishery Conservation and Management Act of 1976

Scope and Provisions:

It establishes an exclusive fishery conservation zone 200 miles wide. The Act asserts exclusive management authority in the zone over fish and "all other forms of marine life..." The Act permits, on a discretionary basis, gear restrictions, area closures, and limitations on incidental catch.

Implementation:

Some fishery Management Plans have been produced for the Plan area.

Actions Required: Department of Commerce

Fishery Management Plans could be amended to incorporate TED use, area closures, etc.

5. Marine Protection Research and Sanctuaries Act of 1972

Scope and Provisions:

The objective of the Act is to create marine sanctuaries out of water areas above the continental shelf, out to the edge of the continental shelf, for the purpose of preserving or restoring such areas for their conservation, recreational, ecological, or aesthetic values.

Implementation:

Three sanctuaries have been designated which potentially protect sea turtle habitat, including the Key Largo and Looe Key Sanctuaries of Florida and Gray's Reef Sanctuary of Georgia. La Parguera, Puerto Rico is proposed for designation as a marine sanctuary.

Action Required:

The Department of Commerce should continue to use the sea turtle habitat protection potential of the Act to establish protection for the sea turtles in areas of high concentration as well as foraging areas.

6. The Land and Water Conservation Fund Act of 1965

Scope and Provisions:

Although originally designed for generating and distributing revenues for outdoor recreation purposes, it has funded many projects of substantial benefit to wildlife. A substantial amount of the funding for the Fish and Wildlife Services land aquisition program for endangered and threatened species has come from this source.

Actions Required:

The Department of the Interior should make maximum use of this Act to provide funds to aquire land and water areas needed as protection for sea turtles. Funds provided to coastal states under this Act should be similarly used.

7. The National Wildlife Refuge System Administration Act of 1966 and the Refuge Recreation Act of 1972

Scope and Provisions:

The Act of 1966 consolidated all of the various federal wildlife refuges into a single system. It left unchanged the Act of 1962 which authorizes the Secretary of the Interior to acquire and protect land for the conservation of threatened and endangered species.

Actions Required:

The Department of the Interior should utilize the provision of these Acts, as appropriate to acquire and protect sea turtle nesting habitat.

8. Statutes of Coastal States in the Plan Area, Puerto Rico and U.S. Virgin Islands

Scope and Provisions:

It is recommended that legislation be reviewed for possible strengthening to improve habitat protection and management.

Action Required:

Departments of Commerce and Interior, in cooperation with the states, should make an inventory of states' statutes, to identify gaps in state legislation.

9. Lacey Act Amendments of 1981

Scope and Provisions:

The Lacey Act is a catchall federal statute which makes it unlawful to import, export, transport, sell, etc., in interstate or foreign

commerce any unlawfully taken, transported or acquired wildlife. These prohibitions apply to violations of federal, state or foreign laws. The statute also makes it unlawful to transport any wildlife taken in violation of any federal law. In this case, no interstate commerce is required.

Action Required:

U.S. Customs Service and the Departments of Commerce and Interior should make maximum use of this Act to curtail the unlawful importation of sea turtle products.

3.1

LOGGERHEAD TURTLE RECOVERY PLAN

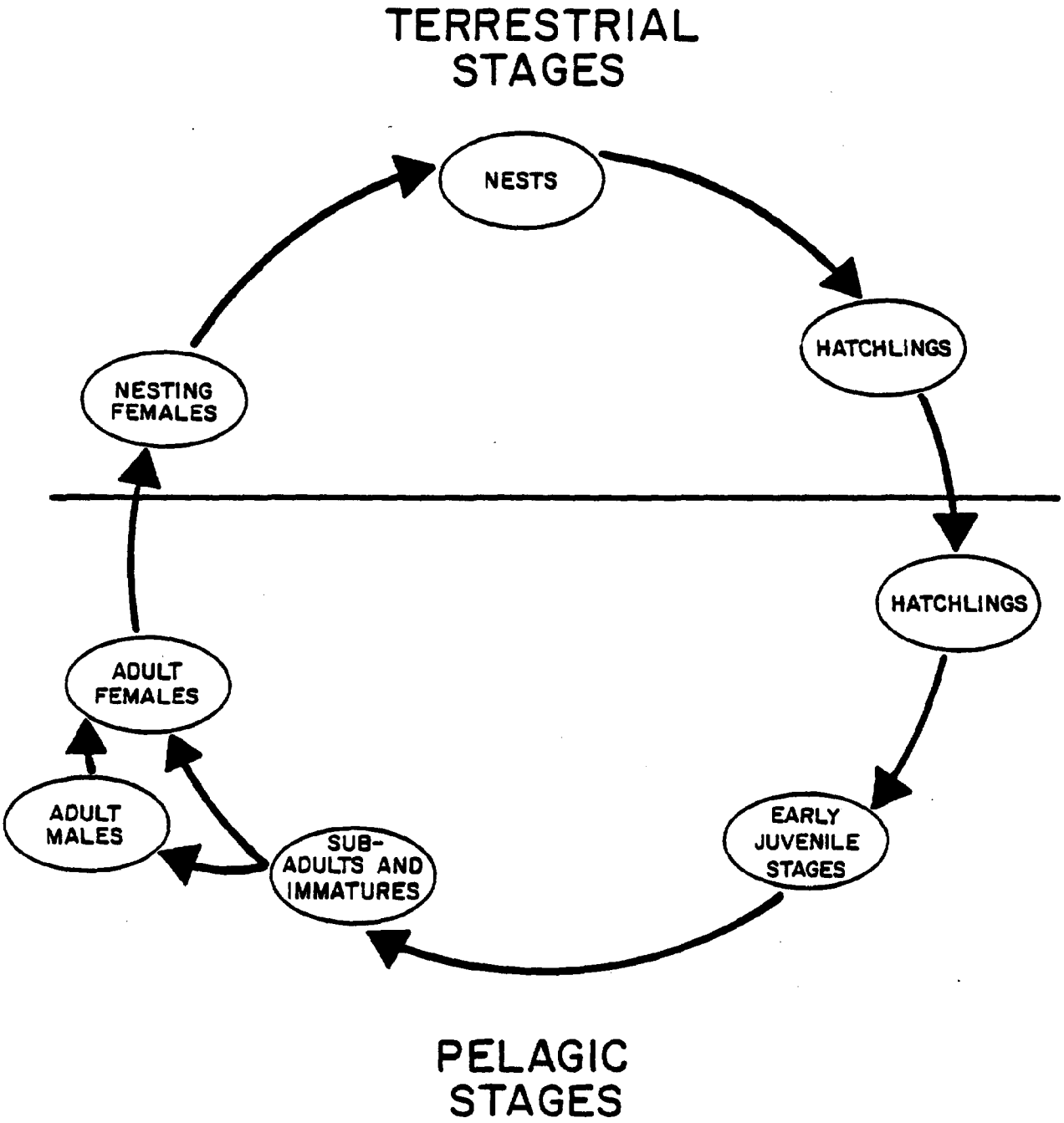
INTRODUCTION

One of the world's largest concentrations of loggerheads (Caretta caretta) nests on the beaches of the southeastern U.S.(Ross, 1982). Major nesting concentrations may be found on the coastal islands of North Carolina, South Carolina, and Georgia and on the Atlantic and Gulf coasts of southern Florida. In addition, scattered examples of loggerhead nesting are found north to New Jersey and along most of the Gulf and Caribbean shoreline.

The life cycle of a loggerhead, like other species of sea turtles, is easy to conceptualize (Figure 1) but difficult to measure. Adult females appearing on nesting beaches from May through August can be counted and tagged. Tagging studies reveal that some females, restrict their nesting activity to a few kilometers of "home" nesting beach. They lay from one to seven clutches of eggs per season (average of two clutches) at approximately 13-day intervals and females usually return to nest on 2-year and 3-year intervals. However, small percentages nest either annually or at intervals greater than three years. An average clutch contains approximately 120 eggs, although individual clutches will commonly vary from 60 to 180 eggs.

A well drained dune with clean sand and scattered grassy vegetation provides an ideal nest site. If the eggs escape predation and conditions remain sufficiently stable to allow for a 60-day incubation period, hatchlings will emerge and crawl to the sea, usually during

Figure 1. Schematic drawing of loggerhead life cycle stages partitioned according to terrestrial and pelagic phases.


TERRESTRIAL STAGES
NESTS
HATCHLINGS
NESTING FEMALES
HATCHLINGS
ADULT FEMALES
ADULT MALES
SUB-ADULTS AND IMMATURES
EARLY JUVENILE STAGES
PELAGIC STAGES

hours of darkness. The majority of hatchlings from a normal nest emerge as a group from the nest cavity within a period of two to three minutes. This onset and continuation of frenzied departure activity may be critical to the timing of life cycle events; hatchlings restrained during the evening hours and released the following day may suffer a reduction in fitness and in survival potential. Early morning releases may increase the predation hazard.

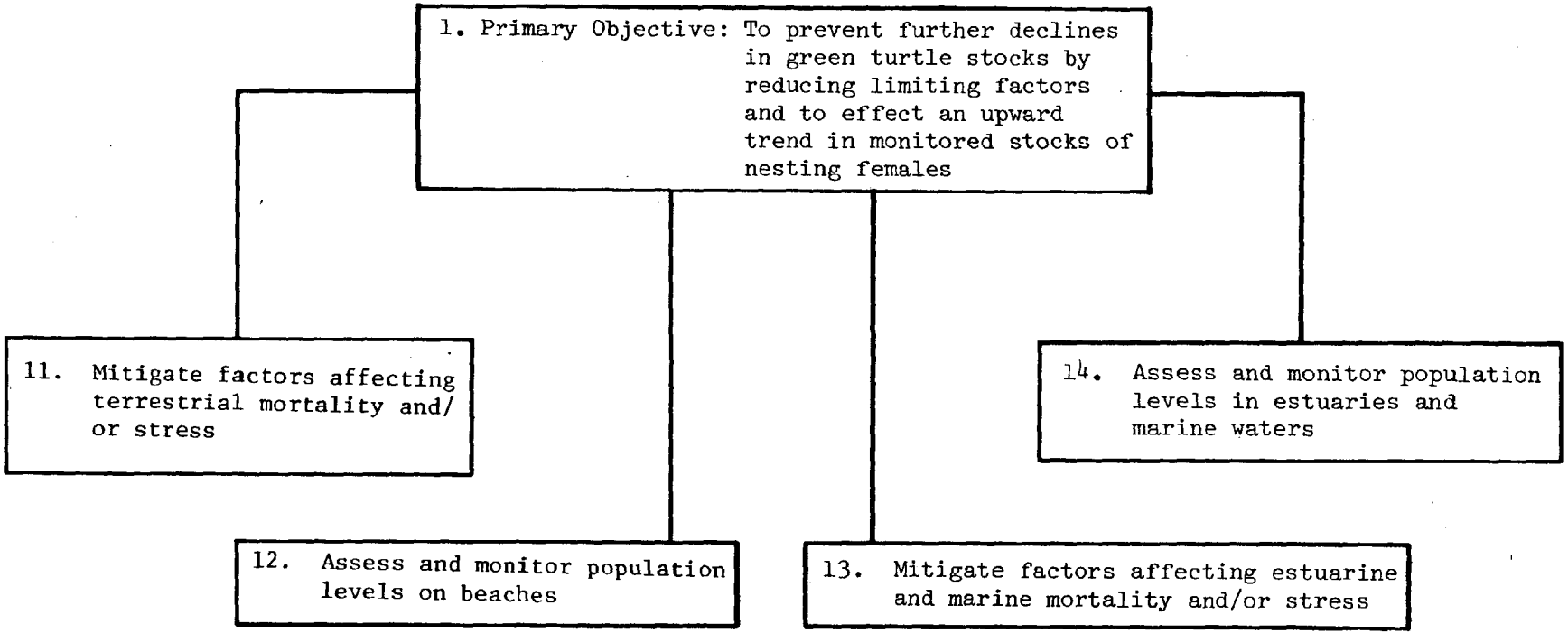
The terrestrial stage of the loggerhead life cycle ends when the hatchlings enter the sea and contact with them and associated management options are reduced. Most hatchlings apparently become pelagic, because loggerheads smaller than 50cm are rarely seen on the U.S. coast. The occurrence of juveniles smaller than this category in eastern North Atlantic waters indicates a dispersed, pelagic existence during the "lost years".

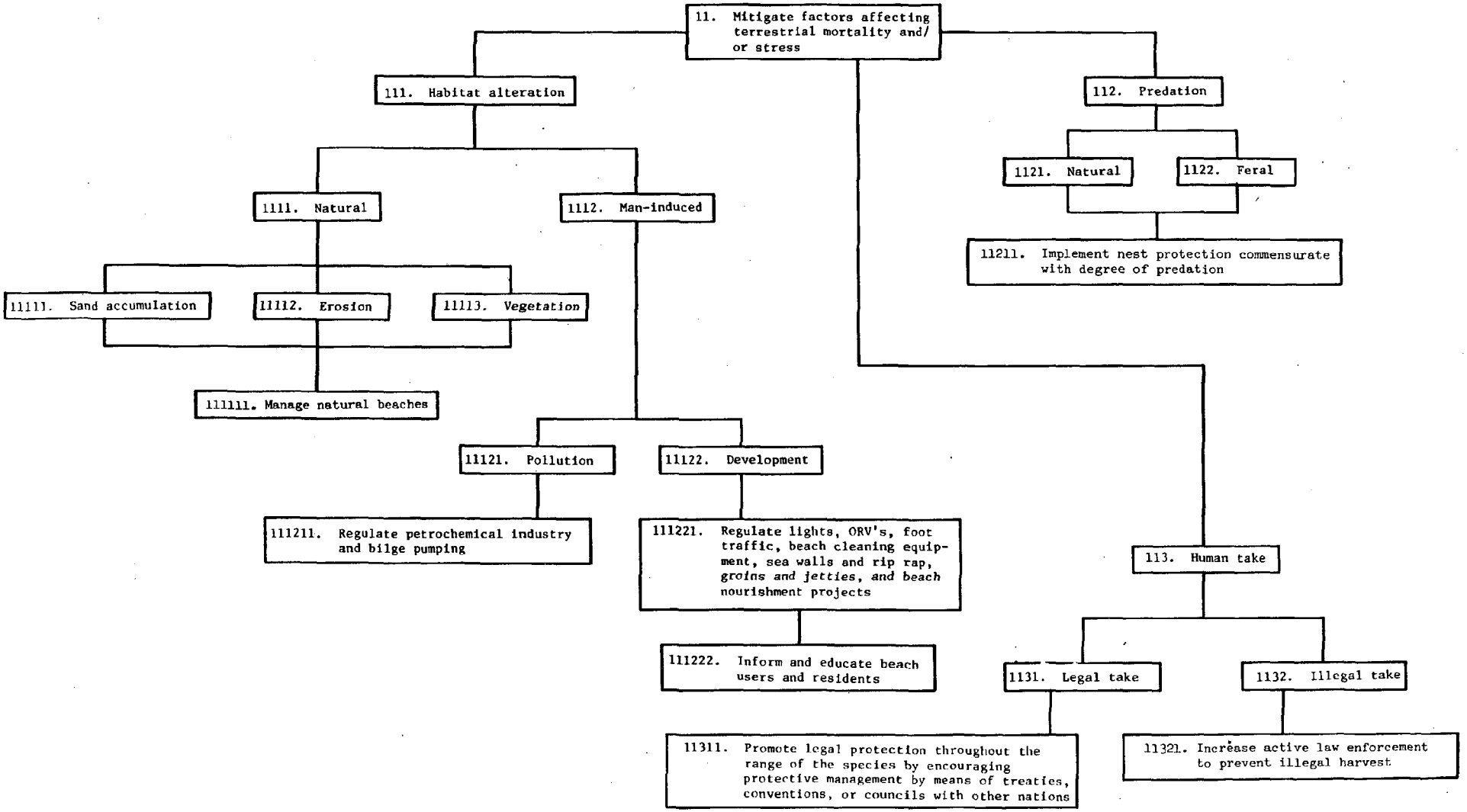
Turtles, with a carapace length of 50-90 cm, common in coastal U.S. waters from April to October and year-round in Florida, are presumed to be the hatchlings reappearing from their "lost years." However, there is no measure of the years required for a hatchling to reach this size. Furthermore, a subadult cannot be identified with its natal beach. For example, the majority of subadults on the South Carolina coast may represent recruitment from Florida rookery beaches or South Carolina beaches or both. Finally it is not known if hatchlings return as adults to nest at their natal beach. For these reasons, the loggerhead life cycle has not been quantified. Our understanding of loggerhead population dynamics must improve before we can predict population responses.

The loggerhead recovery plan identifies some possible mortality factors. At some future date, sustainable losses may become predictable and manageable, and the loggerhead may be removed from threatened status. Until then, known mortality factors must be mitigated until their individual and collective effects on population numbers can be measured. A series of potential indices of population numbers and vitality (numbers of nesting females, numbers of hatchlings per kilometer of nesting beach, numbers of subadult carcasses appearing on beaches, etc.) should be monitored. Taken collectively, they represent the best available approach to measuring loggerhead population vitality and response to management efforts.

Introduction to the Loggerhead Stepdown Plan

For the loggerhead, there are four major components in the stepdown plan, shown on the following page. These components are: terrestrial limiting factors, monitoring of beaches, marine limiting factors, and monitoring at sea. Sections of the flow diagram are combined with each section of the stepdown plan to give a more cohesive presentation of the loggerhead turtles' problems and their solutions. The final level of the flow diagram is the "action needed" box. Each of these boxes is then elaborated in the stepdown plan with specific recommendations given. While this is not the usual way stepdown plans are shown, the Team feels this will reduce repetition and be clearer to the reader. The Implementation Schedule places priorities at the level of the "action needed" boxes.


1. Primary Objective: To prevent further declines in green turtle stocks by reducing limiting factors and to effect an upward trend in monitored stocks of nesting females
11. Mitigate factors affecting terrestrial mortality and/or stress
12. Assess and monitor population levels on beaches
13. Mitigate factors affecting estuarine and marine mortality and/or stress
14. Assess and monitor population levels in estuaries and marine waters


11. Mitigate factors affecting terrestrial mortality and/or stress
111. Habitat alteration
112. Predation
1121. Natural
1122. Feral
11211. Implement nest protection commensurate with degree of predation
1111. Natural
1112. Man-induced
11111. Sand accumulation
11112. Erosion
11113. Vegetation
111111. Manage natural beaches
11121. Pollution
11122. Development
111211. Regulate petrochemical industry and bilge pumping
111221. Regulate lights, ORV's, foot traffic, beach cleaning equipment, sea walls and rip rap, groins and jetties, and beach nourishment projects
111222. Inform and educate beach users and residents
113. Human take
1131. Legal take
1132. Illegal take
11311. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, conventions, or councils with other nations
11321. Increase active law enforcement to prevent illegal harvest

Loggerhead - Stepdown Plan

1. Primary Objective: To maintain the loggerhead population at current levels by reducing limiting factors until a stable or upward trend can be determined, based on the quantitative criteria listed in the plan.

11. Mitigate factors affecting terrestrial mortality and/or stress.

111111. Manage natural beaches.

Natural processes on some beaches may prove to be a significant source of mortality to nests in the range of the loggerhead.

A. Assess the vulnerability of nests.

B. If nest sites are poor (below the MHW line, on the edge of scarped dunes, in vegetation or in swales with poor drainage), then nests may be transferred to a better site or to a hatchery (see section 2.5).

C. Natural sand accumulation is not considered a significant factor.

Certain forms of exotic vegetation (e.g., Casuarina) present problems for nesting beach habitat management. They form impenetrable root mats which prevent nest cavity excavation.

D. Remove trees from potential nest sites on important nesting beaches.

E. Prevent further spread by removing seedlings and by discouraging plantings.

F. Maintain all undeveloped beaches, currently used for nesting, in a natural condition.

111211. Regulate petrochemical industry and bilge pumping.

Nesting beaches are susceptible to oil spills from tankers and from bilge pumping offshore. This problem could become more serious if Outer Continental Shelf (OCS) oil production is begun on the southeast embayment.

A. Conduct research to determine effects of petrochemical spills, clean up methods (including detergents) and bilge effluents on developing eggs.

B. Establish a monitoring program to document spills. (See green turtle stepdown plan).

C. Incorporate turtle nests into spill contingency planning by federal and state agencies, including effects of detergents. (See green turtle stepdown plan).

111221. Regulate lights, ORV's, foot traffic, beach cleaning equipment, sea walls and rip rap, groins and jetties, and beach nourishment projects.

Lights disorient hatchlings and cause them not to reach the sea, and lights may discourage adults from nesting.

A. Determine effects of various wavelengths of lights, screening devices and light intensities on hatchling behavior.

B. Prohibit lights on undeveloped beaches, and develop means of screening already installed lights.

C. Restrict use of beach lights during the nesting and hatching seasons.

D. Develop hatchling rescue contingency plans with agencies, organizations, or individuals in areas where hatchlings are likely to become disoriented.

ORV's, foot traffic and beach cleaning equipment compact sand, crush nests and make ruts which can trap hatchlings.

E. Restrict ORV's and beach cleaning equipment on nesting beaches during the nesting and hatching seasons.

F. Transfer nests to a better site or to a hatchery if protection of natural nests is impossible (see section 2.5).

Sea walls and rip rap prevent adults from nesting by destroying the dune system and by eliminating access to nest sites.

G. Prohibit the construction of sea walls and rip rap on important nesting beaches.

Groins, jetties, and wave attenuation breakwaters, including spoil areas, divert currents and restrict natural sand movement. This could alter the suitability and accessibility of nesting beaches. There is also considerable interest in attempting to control beach erosion by the use of wave attenuation techniques. These techniques may include plastic seaweed, or, conceivably, "hard" materials such as concrete. Each suggested material should be evaluated for its possible impact upon sea turtles. Impact might involve eating, attempting to eat, or becoming a physical barrier to beach access.

H. Careful evaluation of these effects should precede the permitting and construction of such structures.

Beach nourishment is conducted by two means: hydraulic pumping and mechanical transfer of sand with heavy equipment. Pumping conducted during the nesting season smothers nests. Sand removal may be detrimental if its source degrades adjacent nesting areas. Hydraulic pumping may create or improve nesting beaches; however, this activity is not advocated. Sand-moving equipment used to maintain artifical dunes can disrupt existing nests or result in an excessive overburden over others.

I. Prohibit to the extent possible all beach nourishment projects on nesting beaches during the nesting and hatching season.

J. Evaluate sites of sand source so as to avoid detrimental effects on the nourished and adjacent nesting beaches.

K. Determine the suitability of replacement sand for nesting, and modify texture and cohesive nature if necessary.

L. Maintain or enhance all currently used nesting beaches.

M. If prohibition of beach nourishment is impossible, relocate eggs to a safe area or hatchery.

111222. Inform and educate beach users and residents. (see section 2.7)

11211. Implement nest protection commensurate with degree of predation.

Predation on nests and hatchlings varies in severity throughout the range of the species. Research or management plans should address specific predators and intensity of predation.

A. Quantify the nature and extent of predation on major nesting beaches.

B. Design and implement plans to mitigate nest losses to predators. Management might include screening, aversion conditioning, hatcheries, nest transplants or predator reduction programs. Utilize approved nest management techniques (see section 2.5).

11311. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, conventions, or councils with other nations (see 1.2, 2.8 and 4.4).

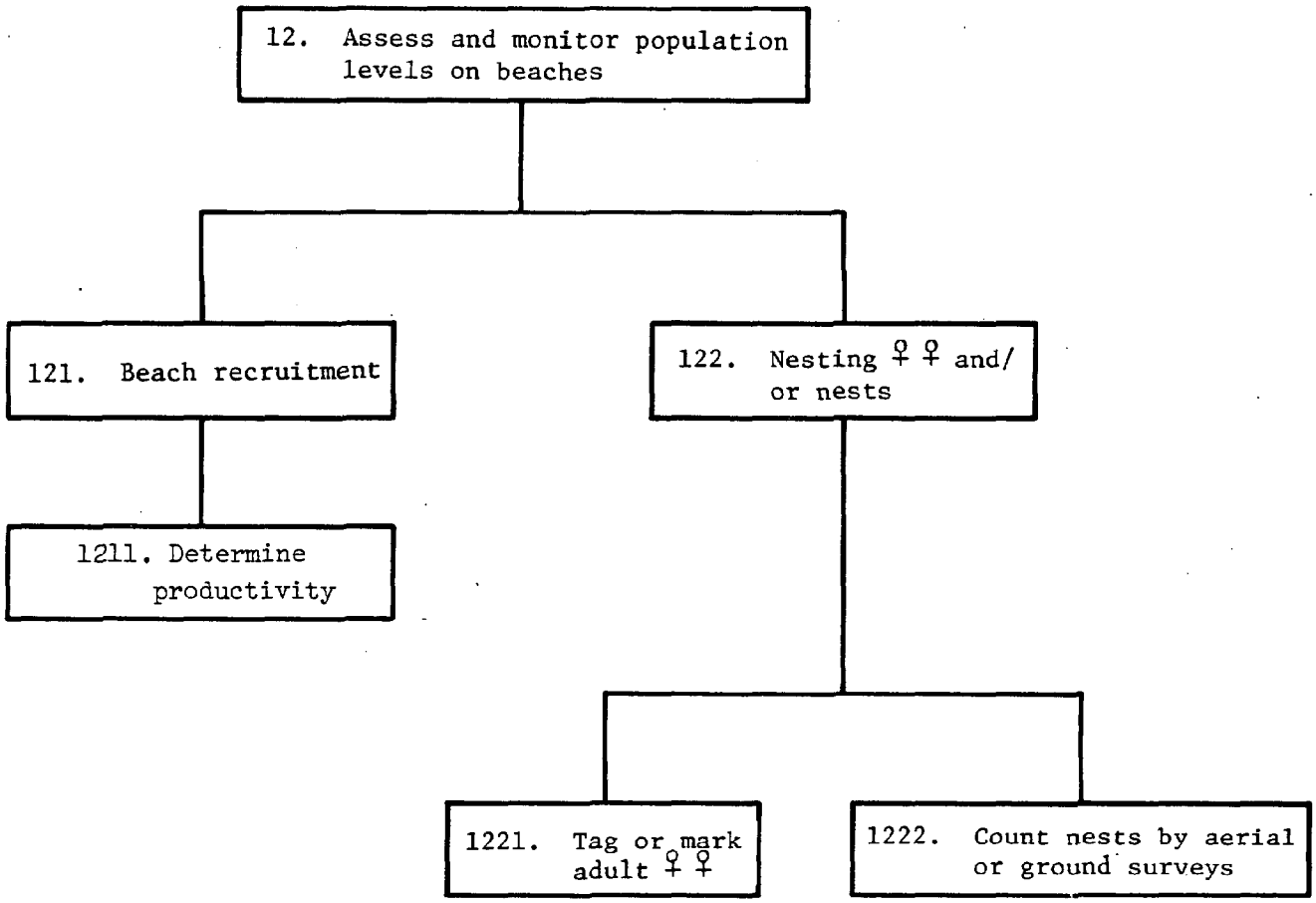
11321. Increase active law enforcement to prevent illegal harvest.

At this time, Federal law enforcement efforts are strained to cover needs throughout the range of the species. More coordination with state law enforcement agencies could alleviate this strain.

A. Determine through surveillance and undercover operations the areas and extent of illegal take of eggs and adult turtles.

B. Schedule basic law enforcement actions (night patrols, daytime patrols, aerial patrols, cooperative patrols with other agencies) to curtail illegal activity.

C. Conduct public relations campaigns with other agencies to publicize the laws and the status of turtles (see section 2.7).


12. Assess and monitor population levels on beaches
121. Beach recruitment
122. Nesting ♀♀ and/or nests
1211. Determine productivity
1221. Tag or mark adult ♀♀
1222. Count nests by aerial or ground surveys

12. Assess and monitor turtle population levels on beaches.

1211. Determine productivity.

An important segment of loggerhead life history is the two month incubation period which begins with the laying of the eggs and ends with the departure of the hatchlings to the ocean. Unlike most of a sea turtle's life history, incubation can be monitored easily. The minimum desirable production for a nesting beach should be: 50% of the nests to hatch, and of these nests, 70% hatchability overall.

A. Establish reasonably limits for area (km of beach) and/or size (numbers of nests) of the proposed monitoring program.

B. Mark experimental nests.

C. Evaluate productivity based on above goal.

1221. Tag or mark adult females.

A. Undertake tagging programs for nesting loggerheads following recommendations in Sections 2.1 and 2.2.

B. Establish limits for the sample area and conduct surveys of nesting females (see section 2.1 - tagging programs of nesting females).

C. Employ the best available tagging technology (see section 2.2 - tagging technology).

D. Continue replicate surveys for a minimum of six consecutive years.

1222. Count nests by aerial or ground surveys.

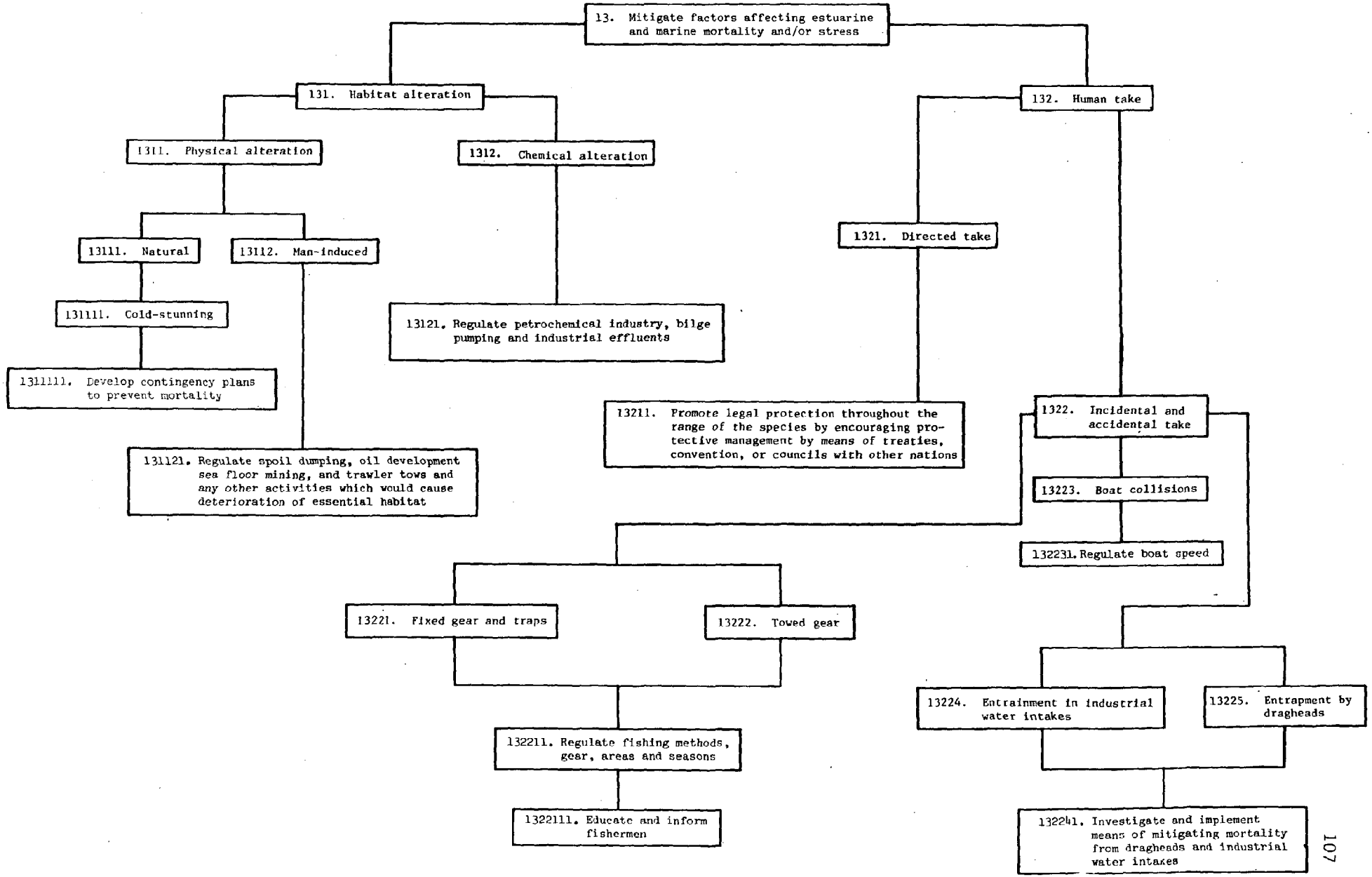
There is no established format at the present moment for an aerial survey which will produce a statistically quantitative measure of nesting turtles and/or nests. There is, however,

no other reasonable method for obtaining a first approximation of these data for extended areas of coastline. (See Section 2.1 for standardization of methodology). Accurate ground nest counts along selected portions of beach are probably the best low cost means of estimating population numbers. Ground counts also provide the essential ground truth data for quantifying aerial surveys.

A. Select survey area and survey schedule (see section 2.1 - survey of nesting activity).

B. Monitor nesting activity each season, and replicate surveys for a minimum of six (6) consecutive seasons.

C. Use running 3-year average to determine changes in nesting effort.


13. Mitigate factors affecting estuarine and marine mortality and/or stress
131. Habitat alteration
132. Human take
1311. Physical alteration
1312. Chemical alteration
1321. Directed take
13111. Natural
13112. Man-induced
131111. Cold-stunning
13121. Regulate petrochemical industry, bilge pumping and industrial effluents
1311111. Develop contingency plans to prevent mortality
13211. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, convention, or councils with other nations
1322. Incidental and accidental take
131121. Regulate spoil dumping, oil development sea floor mining, and trawler tows and any other activities which would cause deterioration of essential habitat
13223. Boat collisions
132231. Regulate boat speed
13221. Fixed gear and traps
13222. Towed gear
13224. Entrainment in industrial water intakes
13225. Entrapment by dragheads
132211. Regulate fishing methods, gear, areas and seasons
1322111. Educate and inform fishermen
132241. Investigate and implement means of mitigating mortality from dragheads and industrial water intakes

13. Mitigate factors affecting estuarine and marine mortality and/or stress.

1311111. Develop contingency plans to prevent cold-stunning mortality (see section 2.6).

131121. Regulate spoil dumping, oil development, sea floor mining, and trawler tows and any other activities which would cause deterioration of essential habitat.

Spoil disposal and oil development, if done on live bottom habitats, may destroy turtle feeding areas by smothering the benthic organisms with sediments and drilling muds.

A. Evaluate disposal sites of these materials to avoid live bottom habitats.

Sea floor mining and trawler gear may disrupt the configuration of bottom relief, thus destroying cover, loafing and feeding areas.

B. Locate areas of high turtle utilization that are vulnerable to destruction.

C. Regulate or prohibit these activities on essential habitat.

13121. Regulate petrochemical industry, bilge pumping, and industrial effluents.

Compounds associated with these sources of pollution could affect turtles directly or indirectly through the food chain. These effects can be insidious and difficult to prove, since they often result in reduced reproductive effort. Mortality is also difficult to detect in the open ocean and impossible to quantify.

A. Determine the affects of sewage and industrial effluents, both chronic and acute, on turtles.

B. Regulate effluent dumping in estuarine and pelagic areas of high turtle utilization.

C. Encourage enforcement of provisions of Laws of the Sea regarding oceanic pollution and dumping.

13211. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, conventions or councils with other nations (see sections 1.2, 2.8 and 4.4).

132211. Regulate fishing methods, gear, areas and seasons.

Incidental take of marine turtles during commercial fishing activities has been identified as a cause of mortality.

Towed gear, Fixed gear and Traps

A. Develop resuscitation, handling and relocation methodology for incidentally caught turtles and implement by rule and regulation (see Section 2.4).

B. Investigate and implement fishing methodologies, such as reduced tow time, or curtailment of night fishing, to mitigate mortality if TED is not used.

C. Actively promote volunteer use of the TED through a comprehensive government-industry-conservation community educational program.

D. Prioritize areas for critical habitat designation. Restrict or prohibit certain types of fishing methods in above designated areas.

E. Prohibit certain types of fishing during specified seasons.

1322111. Educate and Inform Fishing Industry (see sections 2.4 and 2.7).

132231. Regulate boat speed.

Boat collisions are a source of mortality in areas of high use by both people and turtles.

A. Regulate speed in areas where collisions with turtles are likely.

132241. Investigate and implement means of mitigating mortality from dragheads and industrial water intakes.

Turtle entrainments and mortalities have been observed in water intakes at power plants.

A. Assess the extent of the entrainment and mortality.

B. Develop excluder mechanisms.

C. Investigate turtle behavior modifications to exclude turtles from areas where they may be drawn to the intake pipes.

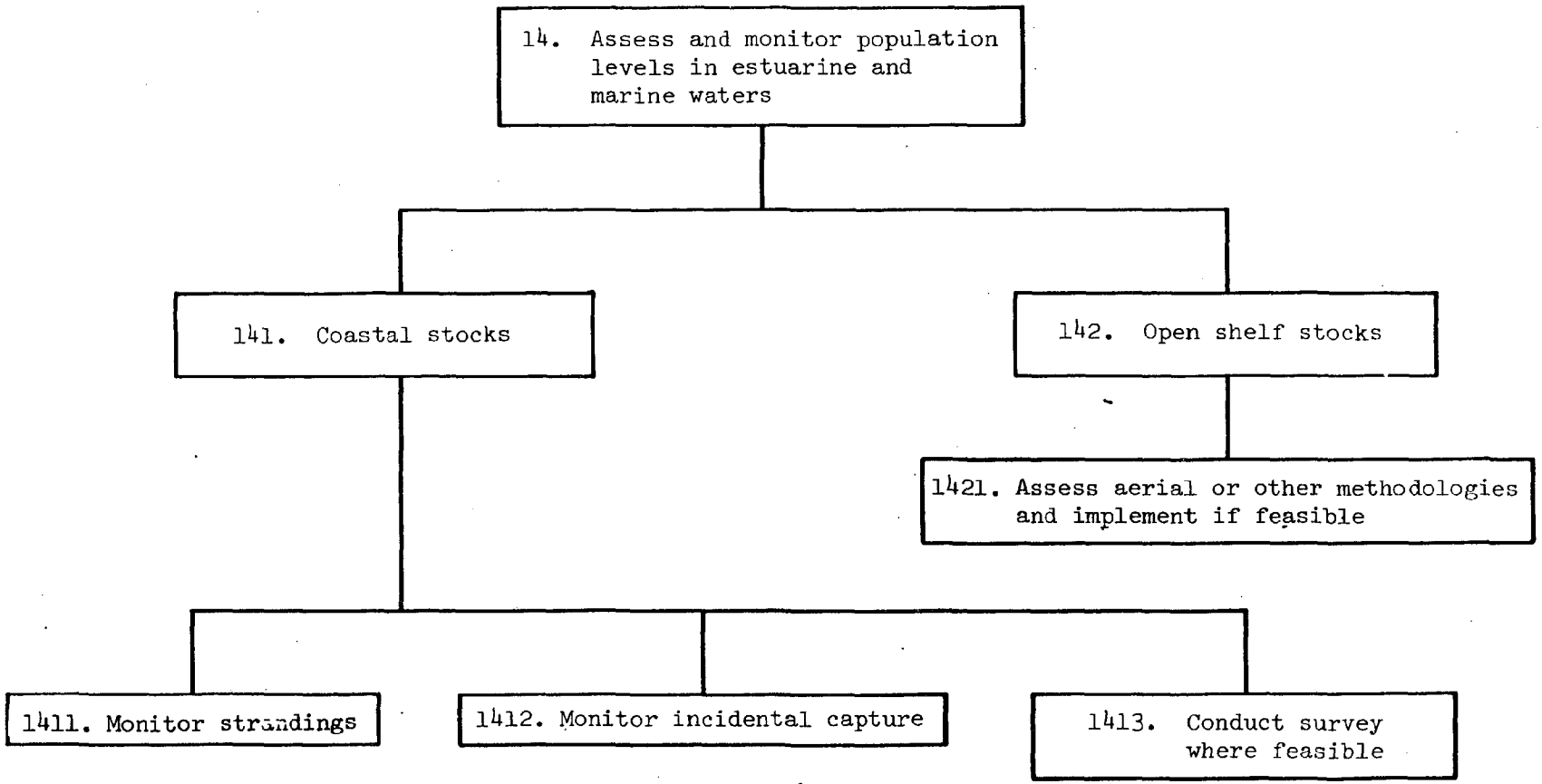
Turtles are entrapped and crushed on the dragheads of commercial and government dredges.

D. Investigate and develop modifications to the draghead to exclude turtles.

E. Remove turtles from the vicinity of dredging operations.

F. Investigate turtle behavior modifications (see step 132241 C.).

G. Prioritize areas for critical habitat designation, including Port Canaveral Ship Channel. Mitigate mortality from dredging in areas where turtles are likely to be taken.


14. Assess and monitor population levels in estuarine and marine waters
141. Coastal stocks
142. Open shelf stocks
1421. Assess aerial or other methodologies and implement if feasible
1411. Monitor strandings
1412. Monitor incidental capture
1413. Conduct survey where feasible

14. Assess and monitor population levels in estuarine and marine waters.

1411. Monitor strandings.

An undetermined proportion of loggerheads die in nearshore waters and wash onto coastal beaches. Stranded carcasses represent a complex interaction of nearshore population densities and mortality from disparate causes, such as cold stunning and drowning in trawl nets. Counts of stranded carcasses provide indices of local mortality, particularly when followed from year to year.

A. Determine the relationship between beached carcasses and total mortality at sea.

B. Determine cause of death, when possible.

C. Continuously monitor the numbers of dead turtles on beaches by standardized stranding network procedures which guard against counting individual carcasses more than once and make data available through publication.

1412. Monitor incidental captures.

On-board monitoring of incidentally caught loggerheads is the most direct and logical approach to assessing the impact of specific fisheries on sea turtle populations.

A. Establish a statistical sampling program which considers the various fishing industries, their localities, and their seasons of activity.

B. Monitor capture rates of sea turtles.

C. Consider the possibility and reliability of voluntary self-monitoring, such as incidental catch logs, as opposed to the mandatory placement of observers on-board fishing vessels.

1413. Conduct aerial survey where feasible.

Concentrations of nearshore loggerheads may be quantifiable with aerial surveys in areas where turbidity of the water is low. Other methods such as SCUBA and net capture can be considered.

A. Investigate the application of various surveys methods for monitoring nearshore stocks in selected areas.

B. Assess nearshore stocks by aerial survey, where feasible.

1421. Assess aerial and other methodologies and implement if feasible.

Loggerheads are distributed across the western North Atlantic, particularly the area of U.S. jurisdiction which includes the continental shelf eastward to the Gulf Stream. The distribution of turtles within this area is not uniform, however, and much work remains to be done before shelf aerial surveys can provide quantitative data.

A. Continue current investigations into offshore aerial surveys as a quantitative sampling technique, including behavioral studies to determine the surface/submergence time ratios of sea turtles.

B. Assess offshore stocks by aerial survey, if feasible.

Loggerhead Implementation Schedule

Plan Section		Lead Agency	Cooperators	Priorities
111111	Manage beaches	FWS	SCA, NPS, U, PI, DOD, NASA, CG	3
111211	Regulate Petro-chemical Industry	FWS	PWRC, USCG, SCA, EPA, I, MMS	2
111221	Regulate Beach Disturbance and Manipulations	FWS	SCA, CZM, COE, LG, NPS, EPA	1
111222	Educate Beach Users	FWS	SCA, NPS, SG, U, CG, LG	2
11211	Nest Protection	FWS	SCA, NPS, U, DOD, PL, NASA, CG, LG	1
11311	International Agreements	FWS	DS, CG, NMFS	4
11321	Law Enforcement	FWS	SCA, USC, NPS NMFS, USCG	2
1211	Determine Productivity	FWS	SCA, NPS, U, PL, DOD, NASA, CG	1
1221	Mark Adult Females	FWS/NMFS	SCA, NPS, U, PL, DOD, NASA, CG	1, 3*
1222	Count Nests	FWS	SCA, NPS, U, PL, DOD, NASA, CG	1
1311111	Cold-Stunning	NMFS	SCA, U, CG, LG, FWS, NPS, NASA	3
131121	Regulate Sea-Floor Disturbance	NMFS	COE, SCA, MMS, I CZM, CEQ	3
13121	Regulate Industrial Dumping	NMFS	COE, MMS, CZM, EPA, USCG, CEQ, U, I, SCA	2
13211	International Agreements	NMFS	DS, CG, FWS	3
132211	Regulate Fishing Methodology	NMFS	FI, SCA, CG, FWS	1
1322111	Educate Fishing Industry	NMFS	SCA, SG, U, FI, CG	1
132231	Regulate Boat Speed	NMFS	SCA, LG, USCG	4

*Long-term tagging studies are #1 priority. New tagging programs lower (#3) priority.

Plan Section		Lead Agency	Cooperators	Priorities
132241	Draghead & Water Intakes	NMFS	COE, SCA, I, DOE	3
1411	Monitor Standings	NMFS & FWS	SCA, CG, U, PI, NPS, DOD, NASA, LG, USCG	1
1412	Monitor Incidental Captures	NMFS & FWS	I, U	2
1413	Conduct Surveys	NMFS & FWS	USCG, MMS, U	3
1421	Asses Survey Methodologies	NMFS	U, MMS, USCG, FWS	3

Priorities: 1=highest, 2=high, 3=moderate, 4=low

DEFINITIONS

FWS = Fish and Wildlife Service

NMFS = National Marine Fisheries Service

DOD = Department of Defense

MMS = Minerals Management Service

COE = Army Corps of Engineers

NASA = National Aeronautics and Space Admin.

USCG = United States Coast Guard

NPS = National Park Service

CEQ = Council on Environmental Quality

DS = Department of State

PWRC = Patuxent Wildlife Research Center

USC = United States Customs Service

DOE = Department of Energy

SCA = State Conservation Agencies

CZM = Coastal Zone Management

EPA = Environmental Protection Agency

SG = Sea Grant

U = Universities

CG = Conservation Groups

I = Industry

LG = Local Governments

FI = Fishing Industry

PI = Private Individuals

Explanatory note for nesting distribution maps and tables:

1. Density symbols on maps are based on data through 1980. Additional years of data were added to tables where possible.
2. Densities which are defined as nests/km on maps should be interpreted as nests/km year. Densities which are defined as Density km in tables should also be interpreted as nest/km year.

TABLE 1. MARYLAND - VIRGINIA
Loggerhead Turtle Nesting Activity

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Assateague NS, Md.	1977	32	32	1	1	0.03	Chincoteague NWR, Ayles, Prog. Rpt. #11
	1978	32	32	0	1	0.03	Florschutz
	1979	32	32	0	1	0.03	"
Chincoteague NWR, Va.	1975	16	16	2	2	0.13	Chincoteague NWR, Appel, Prog. Rpt. #7 & #11
	1976	16	16	0	1	0.06	Florschutz
	1977	16	16	0	1	0.06	"
	1978	16	16	0	1	0.06	"
	1979	16	16	0	1	0.06	"
	1980	18	15	0	0	0.00	Chincoteague NWR, Ayles
Wallops Island, Va.	1975	8	8	1	1	0.13	Chincoteague NWR, Appel, Prog. Rpt. #7 & #11
	1976	8	8	0	1	0.13	Florschutz
	1977	8	8	0	1	0.13	"
	1978	8	8	0	1	0.13	"
	1979	8	8	1	1	0.13	Chincoteague NWR, Ayles Prog. Rpt. #11
	1980	8	8	0	0	0.00	Chincoteague NWR, Ayles
Paramore Island, Va.	1979	13	13	1	2	0.15	Nature Conservancy, Truitt, Florschutz, VIMS
	1980	13	13	0	0	0.00	Nature Conservancy-Hennessey, Vims-Byles

Table 1 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Other Va. Banks owned by Nature Conservancy	1979	63	8	0	4	0.06	Florschutz, Nature Conservancy
	1980	63	63	0	0	0.00	Nature Conservancy, Hennessey, VIMS, Byles weekly aerial surveys
Back Bay NWR, Va. including Fisherman Island NWR	1976	7	7	1	1	0.14	Refuge Files, Holland, Prog. Rpt. #8,9,10 & 11, Florschut
	1977	7	7	0	1	0.14	Refuge Files, Holland, Prog. Rpt. #9,10 & 11, Florschutz
	1978	7	7	0	1	0.14	Refuge Files, Bond, Prog. Rpt. #10 & 11, Florschutz
	1979	7	7	1	1	0.14	Refuge Files, Bond, Prog. Rpt. #11
	1980	9½	8	1	1	0.13	Back Bay NWR, Bond & Poetter
False Cape St. Park, Virginia	1977	9	9	0	1	0.11	Florschutz
	1978	9	9	0	1	0.11	"
	1979	9	9	1	1	0.11	Prog. Rpt. #11, Bond
	1980	9	9	0	0	0.00	Back Bay NWR, Bond & Poetter, VIMS

TABLE 2. NORTH CAROLINA
Loggerhead Turtle Nesting Activity

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Currituck Banks, Va. Line to CHNS	1979	74	74	1	3	0.04	N.C. WRC Aerial Census, Schwartz, Florschutz
	1980	74	74	0	1	0.01	FWS, Crouse-WRC aerial survey *
Cape Hatteras National Seashore (Whale Bone Junction to Ocracoke Inlet excluding Pea Island NWR)	1977	99	99	11	11	0.11	Shabica, NPS
	1978	99	99	12	12	0.12	N.C. WRC Aerial Survey Shabica, NPS
	1979	99	99	11	11	0.11	N.C. WRC Aerial Survey Shabica, NPS
	1980	99	99	15	25	0.25	Crouse-WRC,* Florschutz
Pea Island NWR	1971	21	21	1	5	0.05	Refuge Files, N.F. Williamson, Jr., Turtle Transplant Study Prog. Rpt. #3
	1972	21	21	9	10	0.48	FWS Refuge Files, Turtle Transplant Study Prog. Rpt.#4
	1973	21	21	5	7	0.33	FWS Refuge Files, Turtle Transplant Study Prog. Rpt.#5
	1974	21	21	2	4	0.19	FWS Refuge Files, Turtle Transplant Study Prog. Rpt.#6
	1975	21	21	7	10	0.48	FWS Refuge Files, Turtle Transplant Study Prog. Rpt.#7
	1976	21	21	8	10	0.48	FWS Refuge Files, Turtle Transplant Study Prog. Rpt.#8
	1977	21	21	5	7	0.33	FWS Refuge Files, Turtle Transplant Study Prog. Rpt.#9
	1978	21	21	7	10	0.48	FWS Refuge Files, Turtle Transplant Study Prog. Rpt. #10

Table 2 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
	1979	21	21	9	9	0.43	FWS Refuge Files, Turtle Transplant Study Prog. Rpt. #11, Mike Elkins
	1980	21	21	12	12	0.57	Crouse-WRC,* NWR** Hight
Core Banks North, CLNS	1978	39	0	1	25	0.64	NPS, Hoggard, Florschutz
	1979	39	39	24	30	0.77	NPS, Hoggard
	1980	39	39	5	7	0.18	Crouse-WRC,* NPS,** Florschutz
Core Banks South, excluding Cape Lookout, CLNS	1978	23	7	4	20	0.87	NPS, Hoggard, Florschutz
	1979	30	30	19	24	0.80	"
	1980	30	30	11	15	0.50	Crouse-WRC,* NPS,** Florschutz
Cape Lookout, CLNS	1978	6½	6½	23	25	3.85	NPS, Hoggard, Stoneburner
	1979	10½	10½	23	23	2.19	"
	1980	10½	10½	30	30	2.86	NPS,* Crouse-WRC*
Shackleford Banks, CLNS	1978	14½	0	0	5	0.34	NPS, Hoggard, Florschutz
	1979	14½	14½	6	8	0.55	NPS, Hoggard
	1980	14½	14½	4	6	0.41	Crouse-WRC,* NPS, Florschutz
Bogue Banks	1975	39	39	6	6	0.15	Schwartz
	1976	39	39	12	12	0.31	"
	1977	39	39	6	6	0.15	"
	1978	39	39	8	8	0.21	N.C. WRC Aerial Survey, Schwartz
	1979	39	39	8	10	0.26	"
	1980	39	39	14	14	0.36	Schwartz

Table 2 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Bear & Brown Islands	1975	11	11	23	30	2.73	Hammocks Beach State Park, Schwartz, Camp Lejeune
	1976	11	11	35	42	3.82	Hammocks Beach State Park, Schwartz, Camp Lejeune
	1977	11	11	43	50	4.55	Hammocks Beach State Park, Schwartz, Camp Lejeune
	1978	11	11	22	37	3.36	Hammocks Beach State Park, Schwartz, Camp Lejeune
	1979	11	11	62	62	5.64	Hammocks Beach State Park, Schwartz, Camp Lejeune
	1980	11	11	38	60	5.45	State Parks,** USMC,** Crouse-WRC
Onslow Beach	1974	11½	6½	54	54	8.31	Camp Lejeune, Wooten, Schwartz
	1975	11½	6½	45	45	6.92	Camp Lejeune, Wooten, Schwartz
	1976	11½	6½	23	23	3.54	Camp Lejeune, Wooten, Schwartz
	1977	11½	6½	21	21	3.23	Camp Lejeune, Wooten, Schwartz
	1978	11½	11½	35	40	3.48	Camp Lejeune, Peterson, Schwartz
	1979	11½	11½	52	57	4.96	Camp Lejeune, Peterson, Schwartz
	1980	11½	11½	64	64	5.57	Camp Lejeune, USMC * ** Beach Police, Schwartz, USMC

Table 2 continued

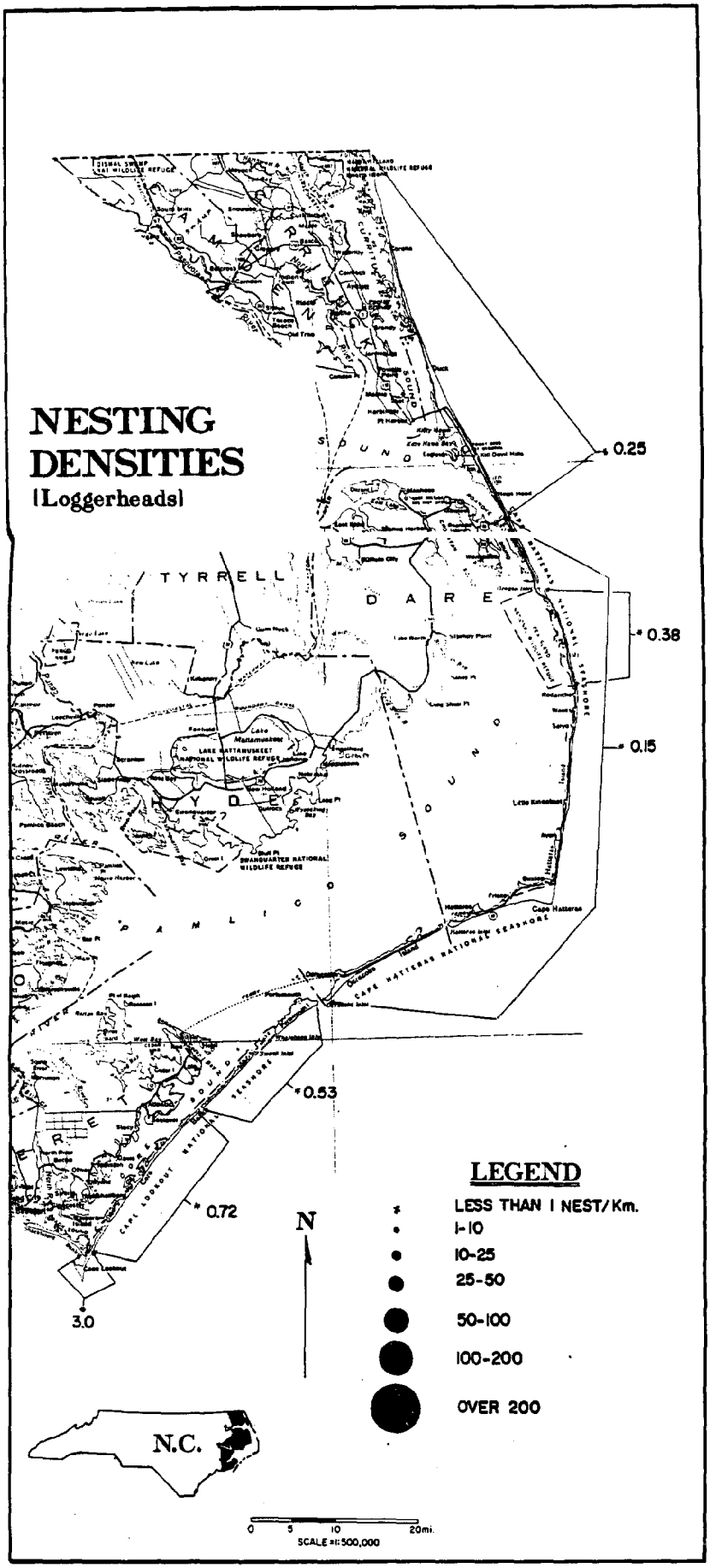
Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Topsail Island	1975	35	13	2	10	0.77	Surf City & New Topsail Beach Police, Schwartz, USMC
	1976	35	13	6	10	0.77	Surf City & New Topsail
	1977	35	35	18	21	0.60	Surf City & New Topsail Beach Police, Schwartz, USMC
	1978	35	35	22	22	0.63	"
	1979	35	35	12	12	0.34	Surf City & New Topsail Beach Police, Schwartz, USMC
	1980	35	35	0	35	1.00	Crouse-WRC,* Florschutz
New Topsail Inlet to Carolina Beach Inlet	1975	38	1½	1	2	1.33	Schwartz, USMC
	1976	38	1½	0	2	1.33	"
	1977	38	1½	0	2	1.33	"
	1978	38	1½	0	2	1.33	"
	1979	38	1½	0	2	1.33	"
	1980	38	38	0	35	0.92	Crouse-WRC,* Florschutz
Carolina Beach Inlet to Corncake Inlet	1977	20	3	1	2	0.67	N.C. Marine Resources Center, Schwartz
	1978	20	3	1	2	0.67	"
	1979	20	3	1	2	0.67	"
	1980	20	20	0	6	0.30	Crouse-WRC,* Florschutz

Table 2 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Baldhead Island (Smith Island)	1977	10	4	9	16	4.00	Baldhead Corp., McPherson, Schwartz
	1978	10	4	13	20	5.00	"
	1979	10	4	13	20	5.00	"
	1980	13	13	72	86	6.62	Crouse-WRC,* **
Cape Fear River to Lockwood Folly Inlet	1977	21	5	4	6	1.20	Long Beach Police Dept., Schwartz
	1978	21	5	4	6	1.20	"
	1979	21	5	4	6	1.20	"
	1980	21	21	0	28	1.33	Crouse-WRC*, Florschutz
Holden Beach (Lockwood Folly Inlet to Shallotte Inlet)	1977	12	0	0	0	0.00	Kinlaw, Johnson, Schwartz
	1978	12	0	0	0	0.00	"
	1979	12	0	0	0	0.00	"
	1980	12	12	0	11	0.92	Crouse-WRC*, Florschutz
Shallotte Inlet to Little River (S. C. Line)	1977	14½	2	3	5	1.43	Ocean Isle Beach Shrimp House, Schwartz, Worthington
	1978	14½	3½	3	5	1.43	"
	1979	14½	3½	3	5	1.43	"
	1980	14½	14½	0	12	1.14	Crouse-WRC*, Florschutz

* Aerial surveys by N.C. Wildlife Resources Comm. Flown 2-3 times a week for 25 flights. All crawls were recorded and ground truth determined approximately one half the crawls resulted in nests (Crouse). This ratio was used on all beaches in N.C. which were not ground truthed.

** Beaches which had ground truth for aerial surveys.


NESTING
DENSITIES
(Loggerheads)
TYRRELL
DARE
HYDE
PAMLICO
SOUND
0.25
0.38
0.15
0.53
0.72
3.0
LEGEND
LESS THAN 1 NEST/Km.
1-10
10-25
25-50
50-100
100-200
OVER 200
N
N.C.
0 5 10 20mi.
SCALE 1:500,000

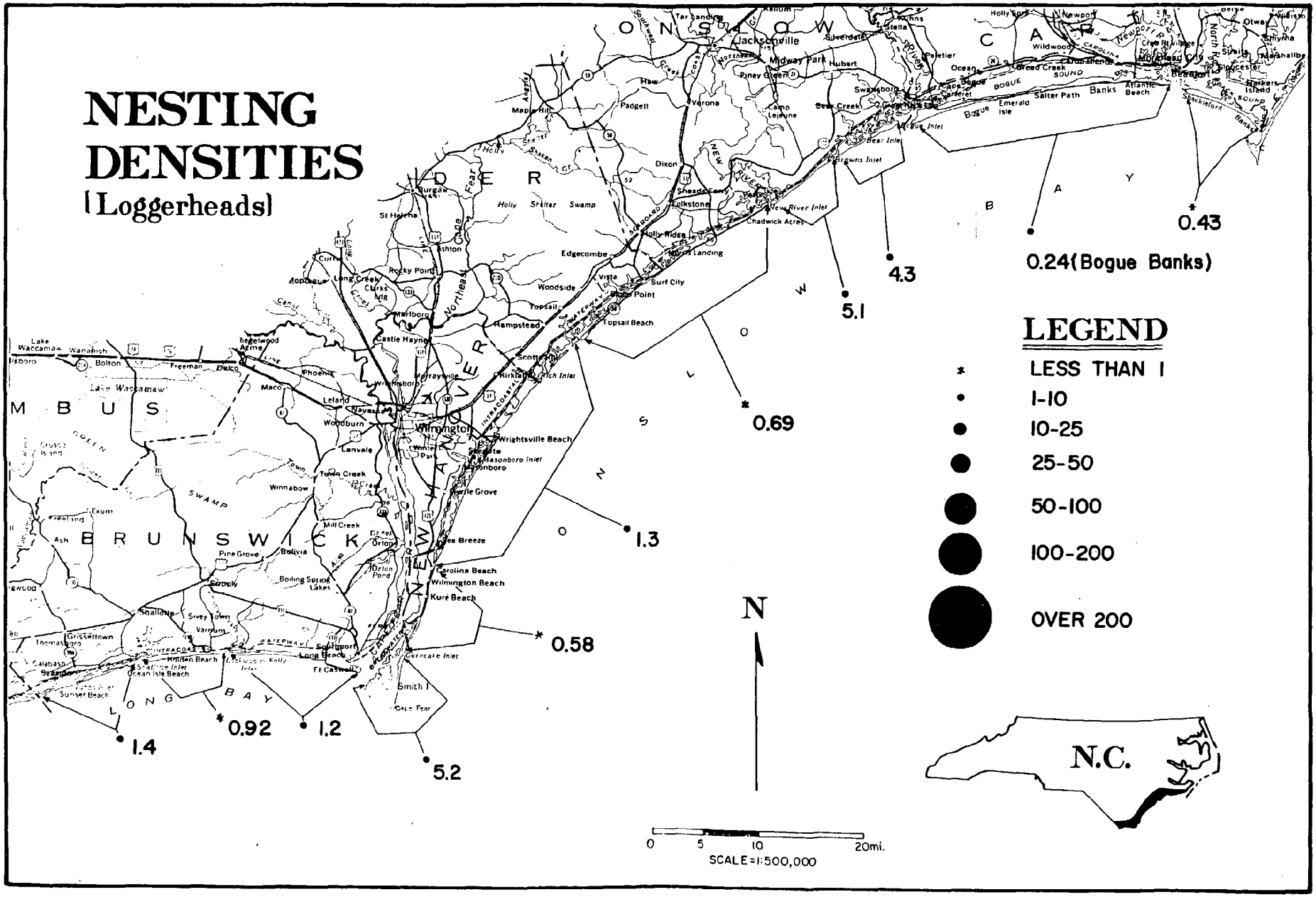

NESTING DENSITIES
(Loggerheads)
0.24(Bogue Banks)
0.43
4.3
5.1
0.69
1.3
0.58
0.92
1.2
1.4
5.2
LEGEND
LESS THAN 1
1-10
10-25
25-50
50-100
100-200
OVER 200
N
N.C.
0 5 10 20mi.
SCALE=1:500,000

Table 3. SOUTH CAROLINA
Loggerhead Turtle Nesting Activity

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Grand Strand	76*	71.0	71.0	-	-	0.7	Stancyk unpub. aerial survey
	77**	71.0	71.0	-	-	0.2	"
	78***	71.0	71.0	-	-	0.3	"
Debidue Island	76	7.1	7.1	-	-	6.1	"
	77	7.1	7.1	-	-	3.5	"
	78	7.1	7.1	-	-	5.8	"
North Island	76*	13.5	13.5	-	-	21.0	"
	77	13.5	9.0	79	100	11.1	Hopkins et al. 1978
	78***	13.5	13.5	-	-	9.5	see Stancyk above
Sand Island	76*	4	4	-	-	31.3	", includes South Island
	77	4	3	163	200	66.7	Hopkins et al. 1978
	78	4	3	247	260	86.7	Hopkins et al. 1981
	79	4	3	252	275	91.7	"
	80	4	3	150	175	58.3	Hopkins unpub. ground survey
	81	4	3	272	300	100.0	"
	82	4	3	239	250	83.3	"

Table 3 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
South Island	76*	5	5	-	-	31.3	see Stancyk above includes Sand Island
	77	4	3	91	91	30.3	Hopkins et al. 1978
	78	4	3	163	163	54.3	Hopkins et al. 1981
	79	4	3	123	123	41.0	"
	80	4	3	133	133	44.3	Hopkins unpub. ground survey
	81	4	3	162	170	56.7	"
	82	4	3	111	115	38.3	"
Cedar Island	76*	4.3	4.3	-	-	27.9	Stancyk unpub. aerial
	77	4.3	4.3	-	-	23.0	" - ground survey
	78	4.3	4.3	-	-	25.8	" - ground survey
Murphy Island	76*	9.0	9.0	-	-	9.0	Stancyk unpub. aerial
	77**	9.0	9.0	-	-	3.9	"
	78***	9.0	9.0	-	-	8.6	"
Cape Island	75	8.0	8.0	1248	2654	331.7	G. Garris, Cape Romain NWR ground survey
	76	8.0	8.0	907	2359	294.9	"
	77	8.0	8.0	352	1329	166.1	"
	78	8.0	8.0	580	1596	198.3	"
	79	8.0	8.0	1093	1093	136.6	"
	80	8.0	8.0	856	856	107.0	"
	81	8.0	8.0	1043	1043	130.4	"
	82	8.0	8.0	1087	1087	135.9	"

Table 3 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Raccoon Key	75	9.0	9.0	20	80	8.9	"
	76	9.0	9.0	25	100	11.1	"
	77	9.0	9.0	22	88	9.8	"
	78	9.0	9.0	36	109	12.1	"
	79	9.0	9.0	23	206	22.9	"
	80	9.0	9.0	26	104	11.5	"
	81	9.0	9.0	35	140	15.6	"
	82	9.0	9.0	24	102	11.3	"
Bulls Island	75	10.5	10.5	28	85	8.1	G. Garris, Cape Romain NWR ground survey
	76	10.5	10.5	30	90	8.6	"
	77	10.5	10.5	20	60	5.7	"
	78	10.5	10.5	28	55	5.3	"
	79	10.5	10.5	7	25	2.4	"
	80	10.5	10.5	15	45	4.3	"
	81	10.5	10.5	30	80	7.6	"
	82	10.5	10.5	27	77	7.3	"
Capers Island	76*	5.2	5.2	-	-	1.2	Stancyk unpub. aerial
	77**	5.2	5.2	-	-	1.5	"
	78***	5.2	5.2	-	-	5.6	"
Dewees Island	76*	4.0	4.0	-	-	1.9	"
	77**	4.0	4.0	-	-	0.7	"
	78***	4.0	4.0	-	-	2.3	"

Table 3 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Isle of Palms	76*	10.0	10.0	-	-	0.9	"
	77**	10.0	10.0	-	-	0.2	"
	78***	10.0	10.0	-	-	2.1	"
Sullivan's Island	76*	6.3	6.3	-	-	0.0	"
	77**	6.3	6.3	-	-	0.0	"
	78***	6.3	6.3	-	-	0.0	"
Morris Island	76*	5.4	5.4	-	-	0.9	"
	77**	5.4	5.4	-	-	0.9	"
	78***	5.4	5.4	-	-	0.9	"
Folly Beach	76*	10.4	10.4	-	-	0.2	"
	77**	10.4	10.4	-	-	0.0	"
	78***	10.4	10.4	-	-	0.7	"
Kiawah Island	72	15.8	15.8	-	-	12.4	Talbert et al. 1980 ground survey
	73	15.8	15.8	-	-	12.3	"
	74	15.8	15.8	-	-	12.9	"
	75	15.8	15.8	-	-	8.5	"
	76	15.8	15.8	-	-	2.4	"
	77	15.8	15.8	39	-	2.4	Kiawah Is. Corp. unpub.
	78	15.8	15.8	55	-	3.4	"
	79	16.4	16.4	82	-	5.2	"
	80	16.4	16.4	84	-	5.3	"
	81	16.4	16.4	165	175	10.7	"
	82	16.4	16.4	141	150	9.2	"

Table 3 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Seabrook	76*	5.6	5.6	-	-	1.9	Stancyk unpub. aerial
	77**	5.6	5.6	-	-	1.0	"
	78***	5.6	5.6	-	-	5.5	"
Deveaux Bank	76*	4.0	4.0	-	-	0.8	"
	77**	4.0	4.0	-	-	0.4	
	78***	4.0	4.0	-	-	0.7	
Botany Bay Island	76*	7.2	7.2	-	-	10.5	"
	77**	7.2	7.2	-	-	3.5	"
	78***	7.2	7.2	-	-	14.0	"
	81	7.2	4.3	114	127	29.5	Starck & Mundell unpub. ground survey
	82	7.2	4.3	120	120	27.9	"
Eddingsville Beach	76*	2.9	2.9	-	-	10.1	Stancyk unpub. aerial
	77**	2.9	2.9	-	-	3.8	"
	78***	2.9	2.9	-	-	15.4	"
	81	2.9	2.4	55	65	27.1	Starck & Mundell unpub. ground survey
Edisto Beach	76*	8.2	8.2	-	-	6.2	Stancyk et al. 1979
	77**	8.2	8.2	-	-	2.0	"
	78***	8.2	8.2	-	-	4.7	"
	81	8.2	2.1	40	55	26.2	Starck & Mundell unpub. ground survey
	82	8.2	8.2	140	180	22.0	"

Table 3 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Pine Island	78***	4.1	4.1	-	-	2.3	Stancyk unpub. aerial
Otter Island	76*	4.3	4.3	-	-	14.7	"
	77**	4.3	4.3	-	-	10.4	"
	78***	4.3	4.3	-	-	20.6	"
Harbor/Hunting Island	76*	9.0	9.0	-	-	3.9	"
	77**	9.0	9.0	-	-	3.1	"
	78***	9.0	9.0	-	-	7.6	"
	81	9.0	6.0	89	100	16.7	Reed unpub. ground survey
	82	9.0	6.0	111	115	19.2	"
Fripp Island	76*	6.0	6.0	-	-	7.4	Stancyk unpub. aerial
	77**	6.0	6.0	-	-	3.4	"
	78***	6.0	6.0	-	-	5.8	"
	81	6.0	4.0	125	130	32.5	Smoak unpub. ground survey
	82	6.0	4.0	117	120	30.0	"
Pritchards Island	76*	4.0	4.0	-	-	18.9	Stancyk unpub. aerial
	77**	4.0	4.0	-	-	4.0	"
	78***	4.0	4.0	-	-	20.0	"
	82	4.0	4.0	50	75	18.6	McCullum & Cain unpub. ground survey
Little Capers Island	76*	4.0	4.0	-	-	13.9	Stancyk unpub. aerial
	77**	4.0	4.0	-	-	5.3	"
	78***	4.0	4.0	-	-	18.6	"

Table 3 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
St. Phillips/Bay Point	76*	6.3	6.3	-	-	11.5	"
	77**	6.3	6.3	-	-	6.7	"
	78***	6.3	6.3	-	-	18.5	"
Hilton Head Island	76*	29.0	29.0	-	-	2.4	"
	77**	29.0	29.0	-	-	1.0	"
	78***	29.0	29.0	-	-	2.1	"
	81	29.0	29.0	39	50	1.7	Polk & Rupert unpub ground survey
	82	29.0	29.0	64	80	2.8	"
Daufuskie Island	76*	8.1	8.1	-	-	0.2	Stancyk unpub. aerial
	77**	8.1	8.1	-	-	0.4	"
	78***	8.1	8.1	-	-	1.7	"
Turtle Island	76*	4.0	4.0	-	-	0.8	"
	77**	4.0	4.0	-	-	0.1	"
	78***	4.0	4.0	-	-	0.2	"

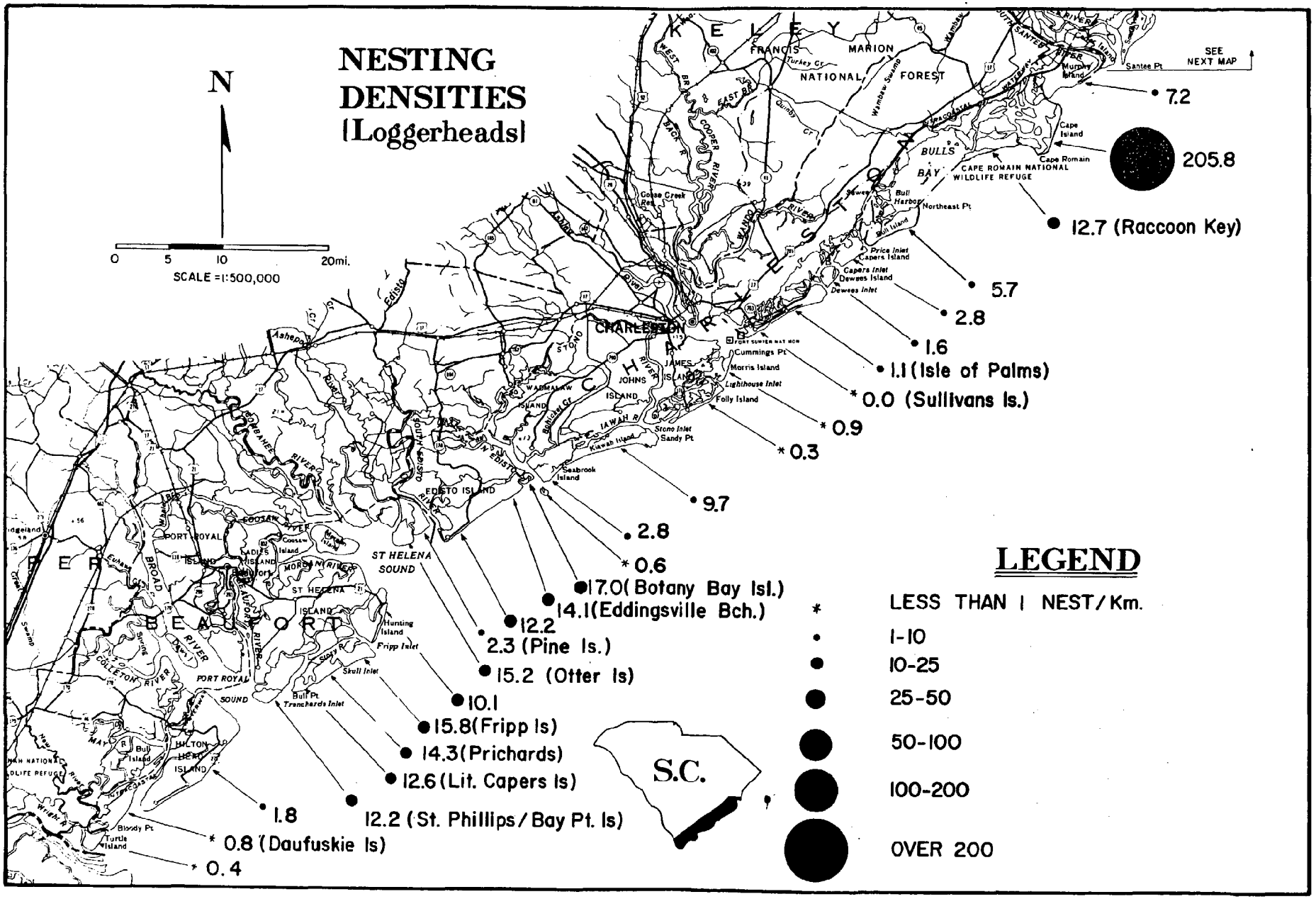
* 1976--Flights on 7-8 day intervals, one observer. Ground Truth from Kiawah (daily), Capers and Dewees (weekly), and Cape Island (Refuge staff). Counted all visible tracks.

Estimated nests = (# tracks with Body Pits) x (% Body Pits that were Nests (1977-1978) x (inverse of % of Ground Truth Nests spotted from air).

**1977--Flights every 5 days, two observers. First half of season, resumed 1976 methods (counted all visible tracks, distinguish between Body Pits and False Crawls). Second half of season, counted only fresh tracks, relied entirely on Cedar and Cape Ground Truth for N/False crawl ratio.

Estimated nests = (# tracks seen during summer) x (% Ground Truth tracks that were nests) x (inverse of % of total Ground Truth tracks spotted from the air). Two halves of season computed separately due to change in technique.

***1978--Flight every 4 days, two observers. Counted fresh tracks only, no separation of N and false crawls. N/False ratios from daily Cedar/Cape Ground Truth. Equation as noted above.


NESTING DENSITIES (Loggerheads)
N
0 5 10 20mi.
SCALE = 1:500,000
SEE NEXT MAP
7.2
205.8
12.7 (Raccoon Key)
5.7
2.8
1.6
1.1 (Isle of Palms)
* 0.0 (Sullivans Is.)
* 0.9
* 0.3
9.7
2.8
* 0.6
17.0 (Botany Bay Isl.)
14.1 (Eddingsville Bch.)
12.2
2.3 (Pine Is.)
15.2 (Otter Is)
10.1
15.8 (Fripp Is)
14.3 (Prichards)
12.6 (Lit. Capers Is)
12.2 (St. Phillips/Bay Pt. Is)
1.8
* 0.8 (Daufuskie Is)
* 0.4
S.C.
LEGEND
* LESS THAN 1 NEST/Km.
1-10
10-25
25-50
50-100
100-200
OVER 200
CHARLESTON
EDISTO ISLAND
ST HELENA SOUND
PORT ROYAL SOUND
HILTON HEAD ISLAND
BEAUFORT
BULLS BAY
CAPE ROMAIN NATIONAL WILDLIFE REFUGE
FRANCIS MARION NATIONAL FOREST

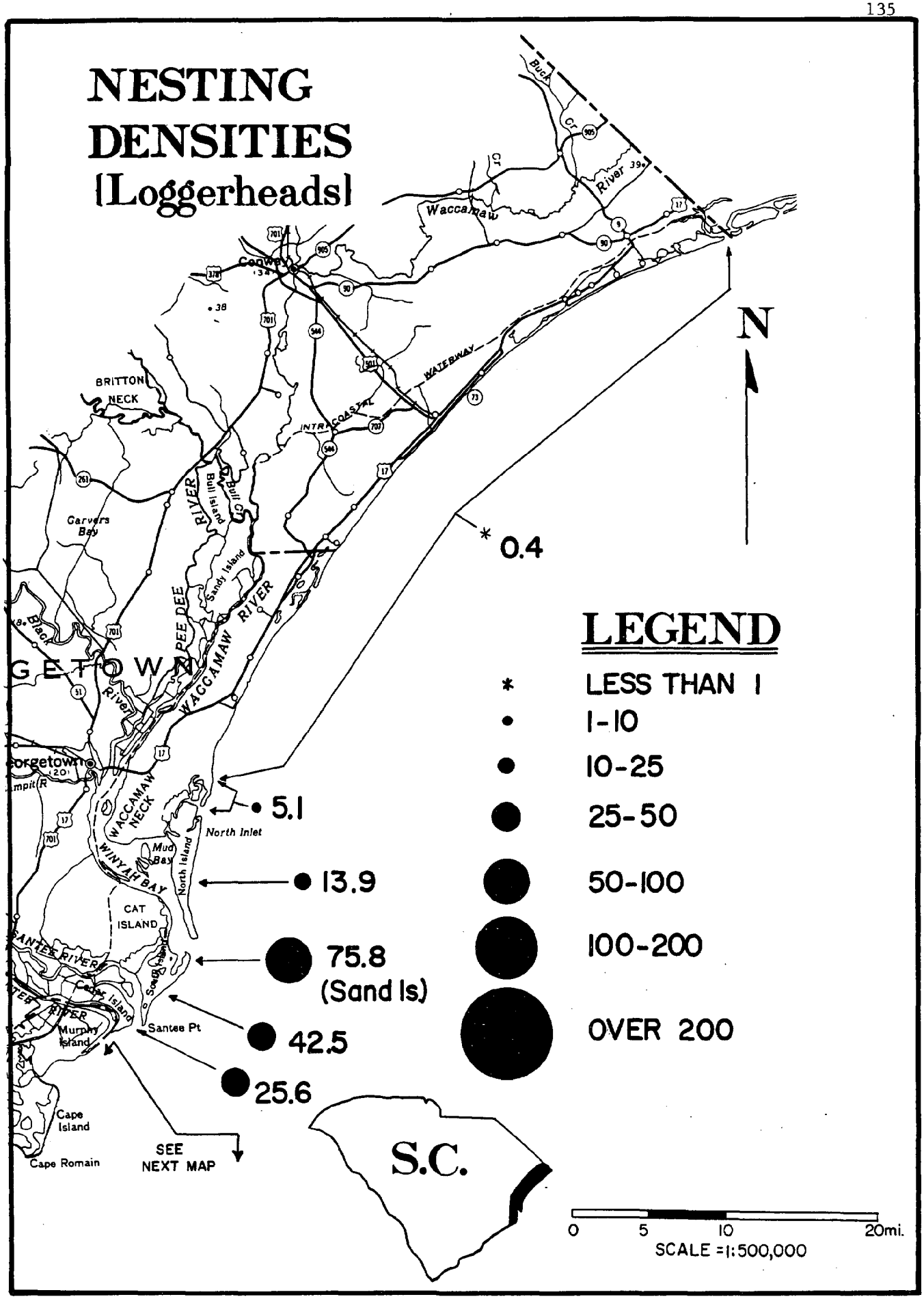

NESTING
DENSITIES
(Loggerheads)
N
0.4
LEGEND
* LESS THAN 1
• 1-10
10-25
25-50
50-100
100-200
OVER 200
5.1
13.9
75.8
(Sand Is)
42.5
25.6
S.C.
SEE
NEXT MAP
0 5 10 20mi.
SCALE =1:500,000
Waccamaw
WATERWAY
INTRACOASTAL
BRITTON
NECK
Garvers
Bay
PEE DEE
RIVER
Bull Island
Sandy Island
WACCAMAW
RIVER
WACCAMAW
NECK
North Inlet
North Island
Mud
Bay
WINYAH BAY
CAT
ISLAND
SANTEE RIVER
Cape Island
Murphy
Island
Santee Pt
Cape
Island
Cape Romain

TABLE 4. GEORGIA
Loggerhead Turtle Nesting Activity

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Tybee Island	77	5.7	5.7	1*	-	.5**	Hillestad et al. 1977 aerial survey
Little Tybee Island	77	9.0	9.0	11*	-	3**	"
Wassaw Island	74	10.6	10.6	77		7	FWS unpub.
	75	10.6	10.6	56		5	"
	76	10.6	10.6	56		5	"
	77	10.6	10.6	76		7	"
	78	10.6	10.6	64		6	"
	79	10.6	10.6	54		5	"
	80	10.6	10.6	50		5	"
Pine and Little Wassaw Island	77	3.8	3.8	7*	-	5**	See Hillestad above
Raccoon Key	77	1.8	1.8	36*		55**	"
Ossabaw Island	74	18.8	14.2		86***	6	Ossabaw Island Found. unpub.
	75	18.8	7.9		29***	4	"
	76	18.8	-		-	-	"
	77	18.8	14.2		86***	6	"
	78	18.8	14.2		106***	7	"
	79	18.8	14.2		124***	9	"
	80	18.8	7.9		55***	7	"
St. Catherine Island	77	21.2	21.2	29*	-	1**	See Hillestad above

Table 4 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Blackbeard Island	68	12.4	12.4	172		14	FWS unpub.
	69	12.4	12.4	221		18	"
	70	12.4	12.4	210		17	"
	71	12.4	12.4	226		18	"
	72	12.4	12.4	17.1		14	"
	73	12.4	12.4	105		8	"
	74	12.4	12.4		162	13	"
	75	12.4	12.4	186		15	"
	76	12.4	12.4	149		12	"
	77	12.4	12.4	231		19	"
	78	12.4	12.4	202		16	"
	79	12.4	12.4	195		16	"
Sapelo Island	77	9.8	9.8	16*	-	5**	Hillestad et al. 1977 aerial survey
Wolf Island	77	5.7	5.7	18*	-	9**	"
Little St. Simons	77	11.4	11.4	23*	-	6**	"
Sea Island	77	9.7	9.7	8*	-	2**	"
St. Simons Island	77	6.6	6.6	0*	-	0**	"

Table 4 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Jekyll Island	72	14.7	4.2	-	127***	30	Coastal Audubon Society unpub.
	73	14.7	4.2	-	70***	17	"
	74	14.7	4.2	-	106***	25	"
	75	14.7	4.2	-	74***	18	"
	76	14.7	4.2		59***	14	"
	77	14.7	4.2		53***	13	"
	78	14.7	4.2		38***	9	"
	79	14.7	4.2		78***	19	"
Little Cumberland	70	5.9	5.9		146***	25	Little Cumberland Island Association, unpub.
	71	5.9	5.9		192***	33	"
	72	5.9	5.9		247***	42	"
	73	5.9	5.9		118***	20	"
	74	5.9	5.9		120***	20	"
	75	5.9	5.9		137***	23	"
	76	5.9	5.9		103***	18	"
	77	5.9	5.9		106***	18	"
	78	5.9	5.9		143***	24	"
	79	5.9	5.9		137***	23	"
	80	5.9	5.9		105***	18	"

Table 4 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Cumberland Island	74	29.8	8.1		144***	18	National Park Service unpub.
	75	29.8	8.1		148***	19	"
	76	29.8	8.1		120***	15	"
	77	29.8	8.1		97***	12	"
	78	29.8	8.1		215***	27	"
	79	29.8	8.1		173***	22	"
	80	29.8	8.1		142***	18	"
	80	29.8	29.8	234		8	Nat. Park Serv. unpub.

*Nest counts are summed over 14 flights, flown on 3 day intervals (26 June - 31 July).

**Density = (aerial density)/.57 The figure of .57 is derived by comparing aerial counts to ground truth on Wassaw, Blackbeard, and Little Cumberland Islands.

***Estimated nests = (turtles observed) (1.9 nests/turtle)

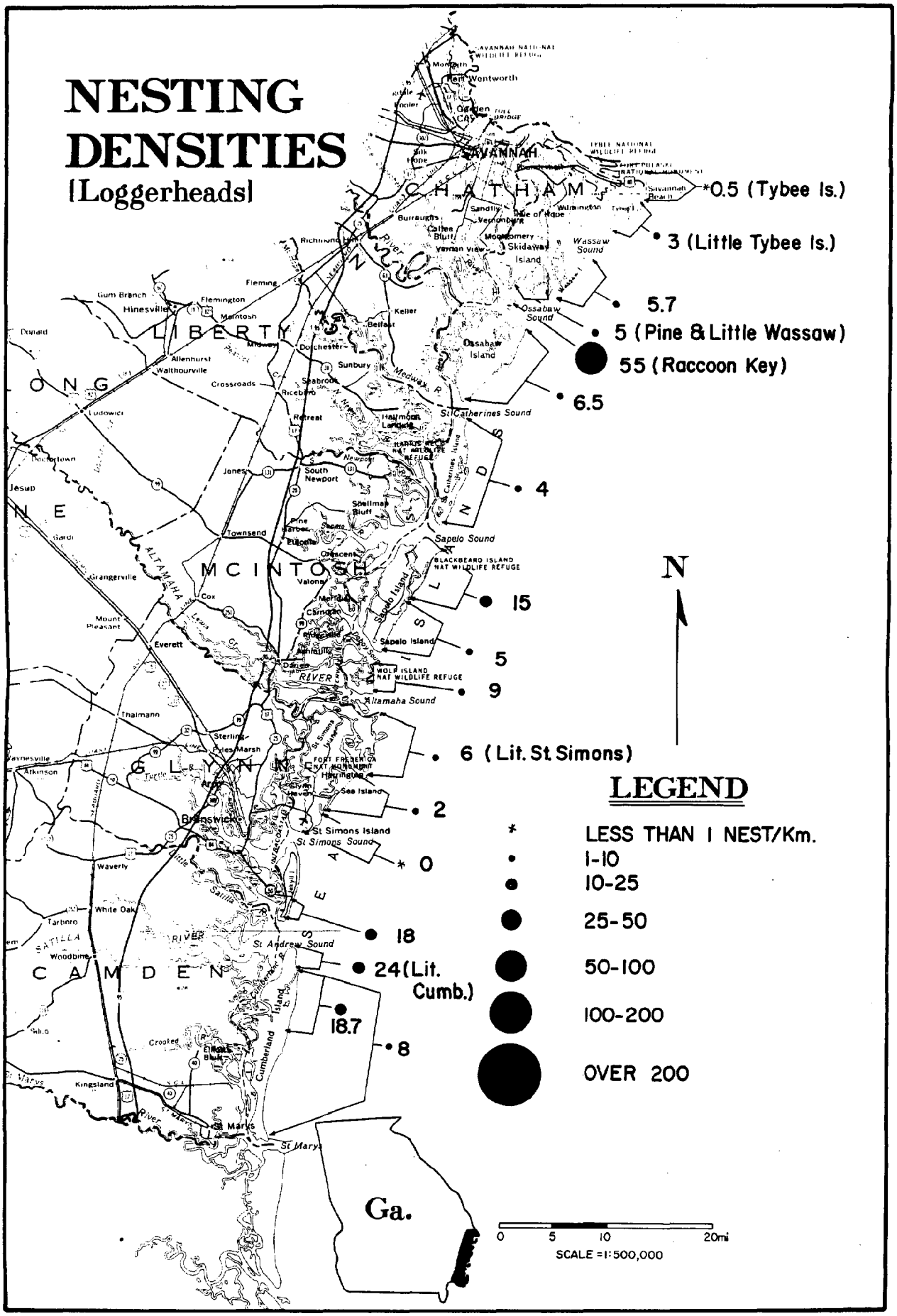

NESTING DENSITIES
(Loggerheads)
*0.5 (Tybee Is.)
3 (Little Tybee Is.)
5.7
5 (Pine & Little Wassaw)
55 (Raccoon Key)
6.5
4
15
5
9
6 (Lit. St. Simons)
2
* 0
18
24 (Lit. Cumb.)
18.7
8
N
LEGEND
* LESS THAN 1 NEST/Km.
• 1-10
• 10-25
• 25-50
• 50-100
• 100-200
OVER 200
Ga.
0 5 10 20mi
SCALE = 1:500,000
SAVANNAH
CHATHAM
LIBERTY
LONG
MCINTOSH
GLYNN
CAMDEN
Ossabaw Island
St Catherines Island
Sapelo Island
St Simons Island
Cumberland Island
Wassaw Sound
Ossabaw Sound
St Catherines Sound
Sapelo Sound
Altamaha Sound
St Simons Sound
St Andrew Sound
St Marys
Brunswick

TABLE 5. FLORIDA
Loggerhead Turtle Nesting Activity

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Little Talbot Island	79	8	8	32	32	4	Fla. DNR 1979
	80	8	8	32	32	4	Fla. DNR 1980
Fort Matanzas	80	0.8	0.8	3	3	3.6	"
Volusia County	80	8.0	8.0	392	392	49	" (D. Stoneburner)
Cape Canaveral	75	50	8.0	-	254	31.8	" (L. Ehrhart)
	76	50	34	-	1350	39.7	" "
	77	50	34	-	1285	37.8	" "
	78	50	34	-	2232	65.8	" "
	79	50	34	-	2674	53.5	" "
	80	50	50	1261	1624	32.5	" "
Port Canaveral to Patrick AFB	80	21	21	265	265	12.6	Fritts pers. comm.*
	82	27	27	-	459	17	L. Ehrhart pers. comm.**
Patrick AFB to Melbourne Beach	80	19.3	19.3	670	670	34.7	Fritts pers. comm.*
	82	13	13	-	1677	129	L.Ehrhart pers. comm.**
Melbourne Beach to Sebastian Inlet	80	23	23	2951	2951	128	Fritts pers. comm.*
	82	20	20	4425	8980	449	L. Ehrhart pers. comm.**
Indian River and St. Lucie Counties	80	36.8	36.8	726	-		† R. Witham pers. comm.
Hutchinson Island	75	36.3	11.25	1490	4808	132.5	Applied Biology, 1979
	77	36.3	11.25	930	3001	82.7	"
	79	36.3	11.25	1449	4676	128.8	"
	80	36.3	5.0	528	-	105.6	Fla. DNR 1980

Table 5 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Hobe Sound NWR	75	6.4	6.4	894	-	139.7	Hobe Sound NWR unpub.
	76	6.4	6.4	1058	-	165.3	"
	77	6.4	6.4	962	-	150.3	"
	78	6.4	6.4	1029	-	160.8	"
	79	6.4	6.4	1316	-	205.6	"
	80	6.4	5.6	1104	-	197.1	Fla. DNR, 1980
Jupiter Island	79	12.3	12.3	2086	-	169.6	Lund and White unpub.
	80	12.3	12.3	2194	2394	194.6	"
Juno Beach	79	1.6	1.6	295		184.3	Fla. DNR 1979
	80	1.6	1.6	384	-	240.0	Fla. DNR 1980
Lost Tree Village	80	2.8	2.8	189	-	67.5	"
Highland Beach	80	4.5	4.5	511	-	112.3	"
Boca Raton	77	4.2	4.2	238	-	56.7	Wagner, 1978
	78	4.2	4.2	335		79.9	Wagner, 1979
	79	4.2	4.2	452		88.8	Fla. DNR, 1980
	80	4.2	3.2	127		39.7	"
Broward County	78	37	19	352	538	28.3	Fletemeyer, 1979
	79	37	36	654	1086	30.0	"
	80	37	37	555	888	24.6	Fla. DNR, 1980
Miami Beach	80	16.1	16.1	10	10	0.62	"
Key Biscayne	80	5.0	2.4	67	67	13.4	Tropical Audubon 1980 Fla. DNR, 1980

Table 5 continued

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Everglades National Park (Cape Sable)	72	56.5	56.7	1644	-	29.0	Davis & Whiting, 1977
	73	56.7	56.7	1068	-	18.8	"
Cape Romano	75	4.8	4.8	35	35	7.3	Caretta Research, Inc. unpub.
	76	4.8	4.8	45	45	9.4	"
Naples Beach	75	6.4	6.4	30	30	4.7	Caretta Research, Inc. unpub.
	76	6.4	6.4	35	35	5.5	"
	77	6.4	6.4	38	38	5.9	"
	78	6.4	6.4	40	40	6.3	"
	79	6.4	6.4	55	55	8.9	"
Vanderbilt Beach	75	8	8	35	35	4.4	"
	76	8	8	30	30	3.8	"
	77	8	8	45	45	5.6	"
	78	8	8	38	38	4.8	"
	79	8	8	45	45	5.6	"
Bonito Beach	75	9.7	9.7	40	40	4.1	"
	76	9.7	9.7	44	44	4.5	"
	77	9.7	9.7	32	32	3.3	"
	78	9.7	9.7	40	40	4.1	"
	79	9.7	9.7	52	52	5.4	"
Wiggins Pass	80	13.4	13.4	22	22	1.6	Fla. DNR, 1980
Cayo Costa	79	8.0	6.4	12	12	1.9	Fla. DNR, 1979
	80	8.0	8.0	19	19	2.4	Fla. DNR, 1980

Table 5 continued

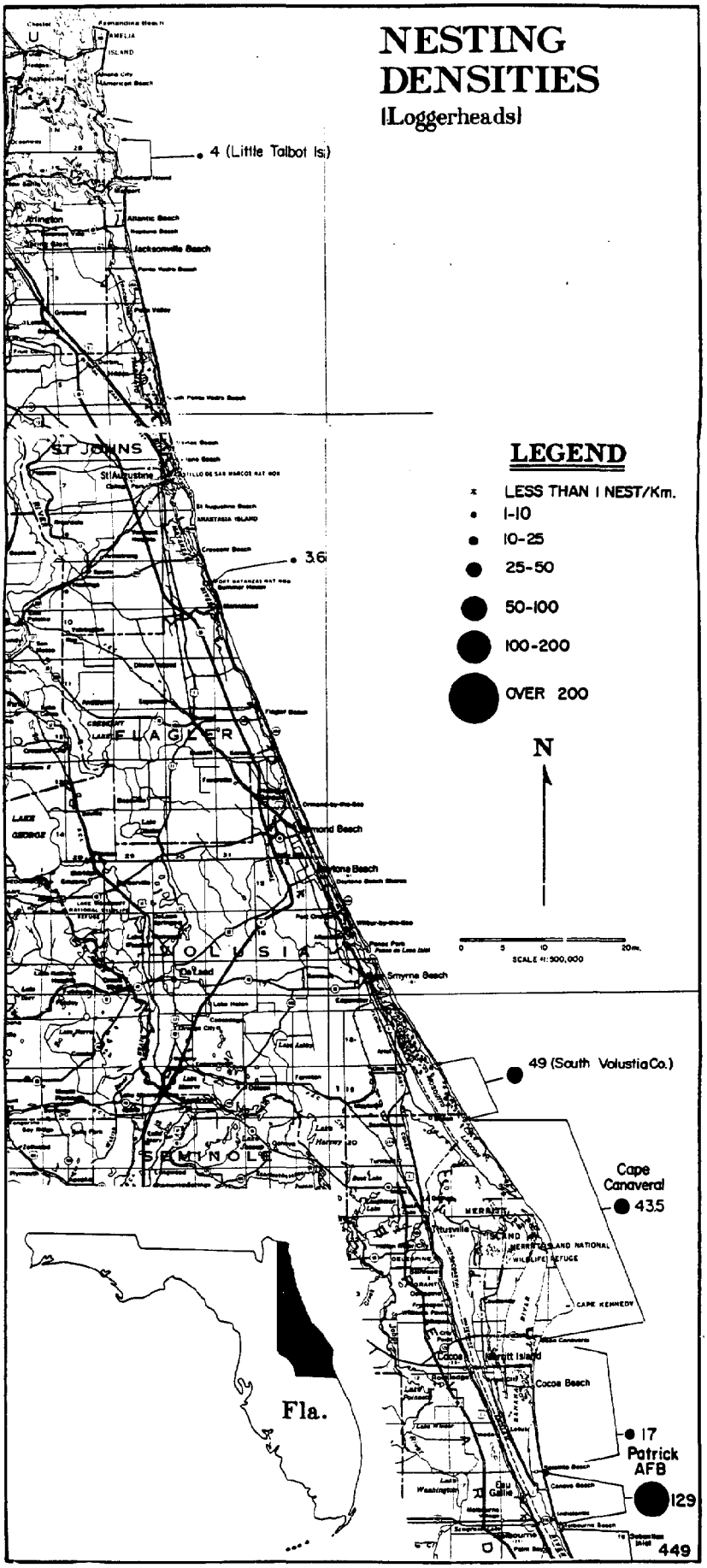
Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Sanibel Island	75	18.5	17.7	120	120	6.8	Caretta Research, Inc. unpub.
	76	18.5	17.7	100	100	5.7	"
	77	18.5	17.7	90	90	5.1	"
	78	18.5	17.7	115	115	6.5	"
	79	18.5	17.7	86	86	4.9	"
	80	18.5	18.5	65	65	3.5	"
Manasota Key	75	16.1	16.1	150	150	9.3	"
	76	16.1	16.1	160	160	9.9	"
	77	16.1	16.1	140	140	8.7	"
	78	16.1	16.1	150	150	9.3	"
	79	16.1	16.1	180	180	11.2	"
	80	16.3	11.3	80	80	7.1	Fla. DNR, 1980
Casey Key	75	6.4	6.4	32	32	5.0	Caretta Research, Inc. unpub.
	76	6.4	6.4	63	63	9.8	"
	77	6.4	6.4	37	37	5.8	"
	78	6.4	6.4	46	46	7.2	"
	79	6.4	6.4	50	50	7.8	Fla. DNR, 1979
	80	6.4	6.4	56	56	8.7	Fla. DNR, 1980
Longboat Key	79	5.8	5.8	15	15	2.6	Fla. DNR, 1979
	80	5.8	5.8	17	17	3.0	Fla. DNR, 1980
St. Vincent N.W.R.	79	11.3	11.3	16	16	1.4	Fla. DNR, 1979
	80	11.3	11.3	6	6	0.5	Fla. DNR, 1980

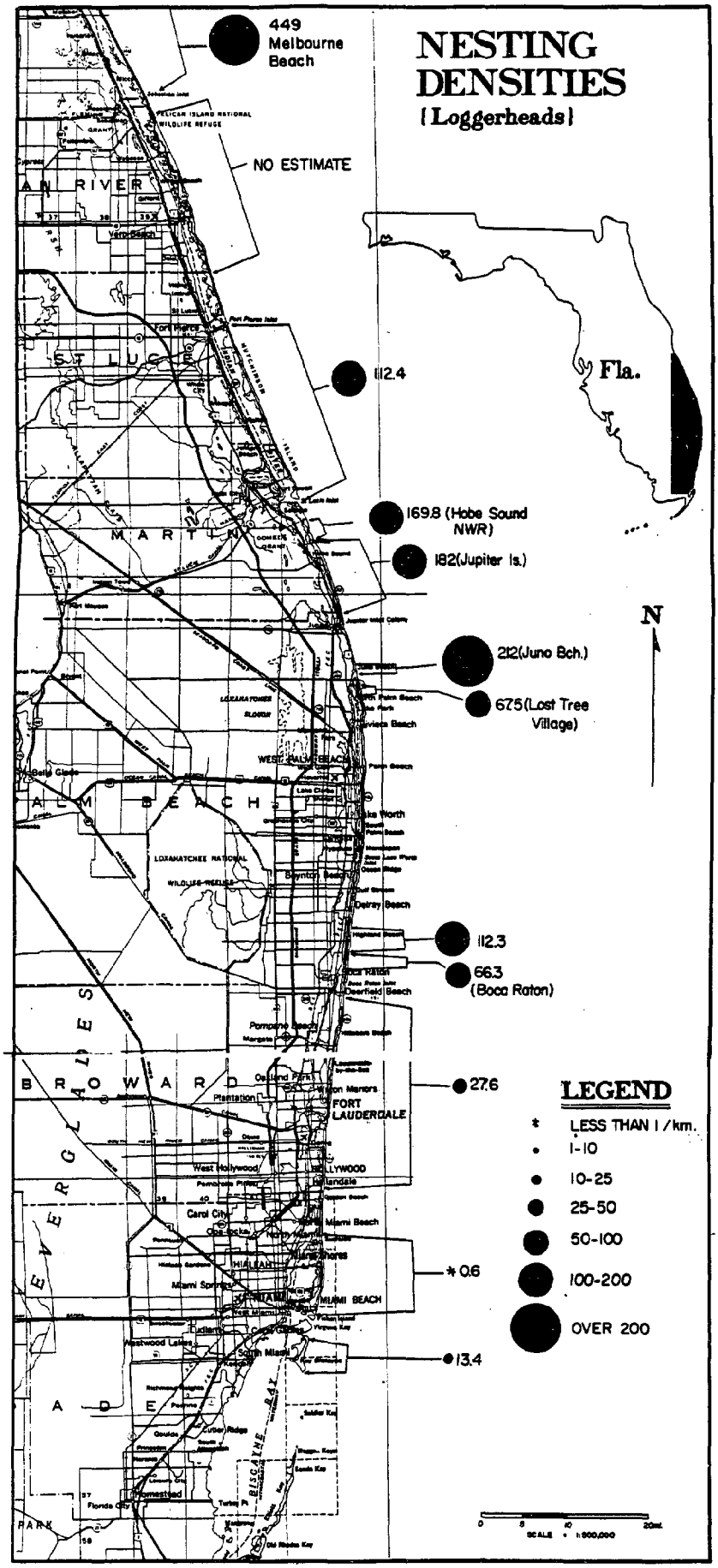
Table 5 continued

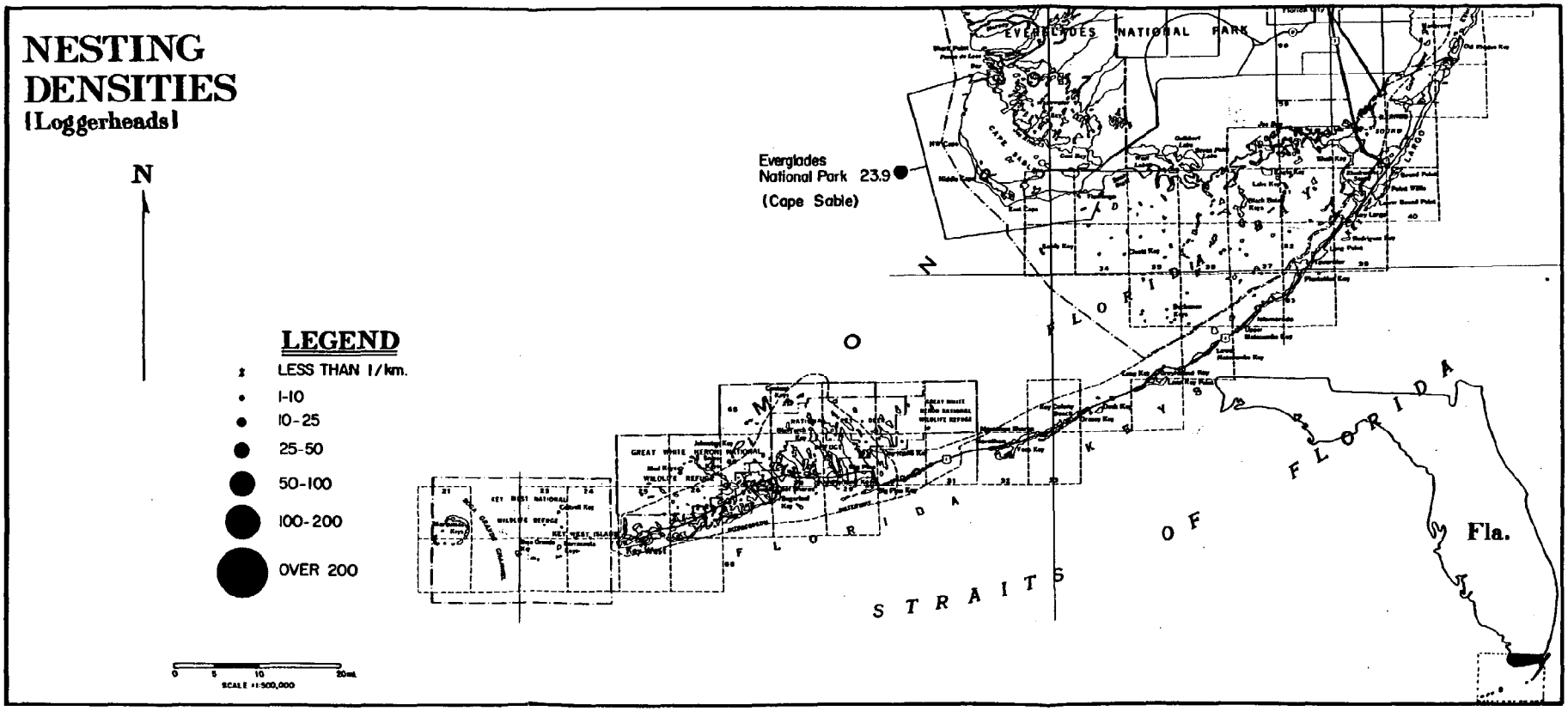
† Survey every two weeks.

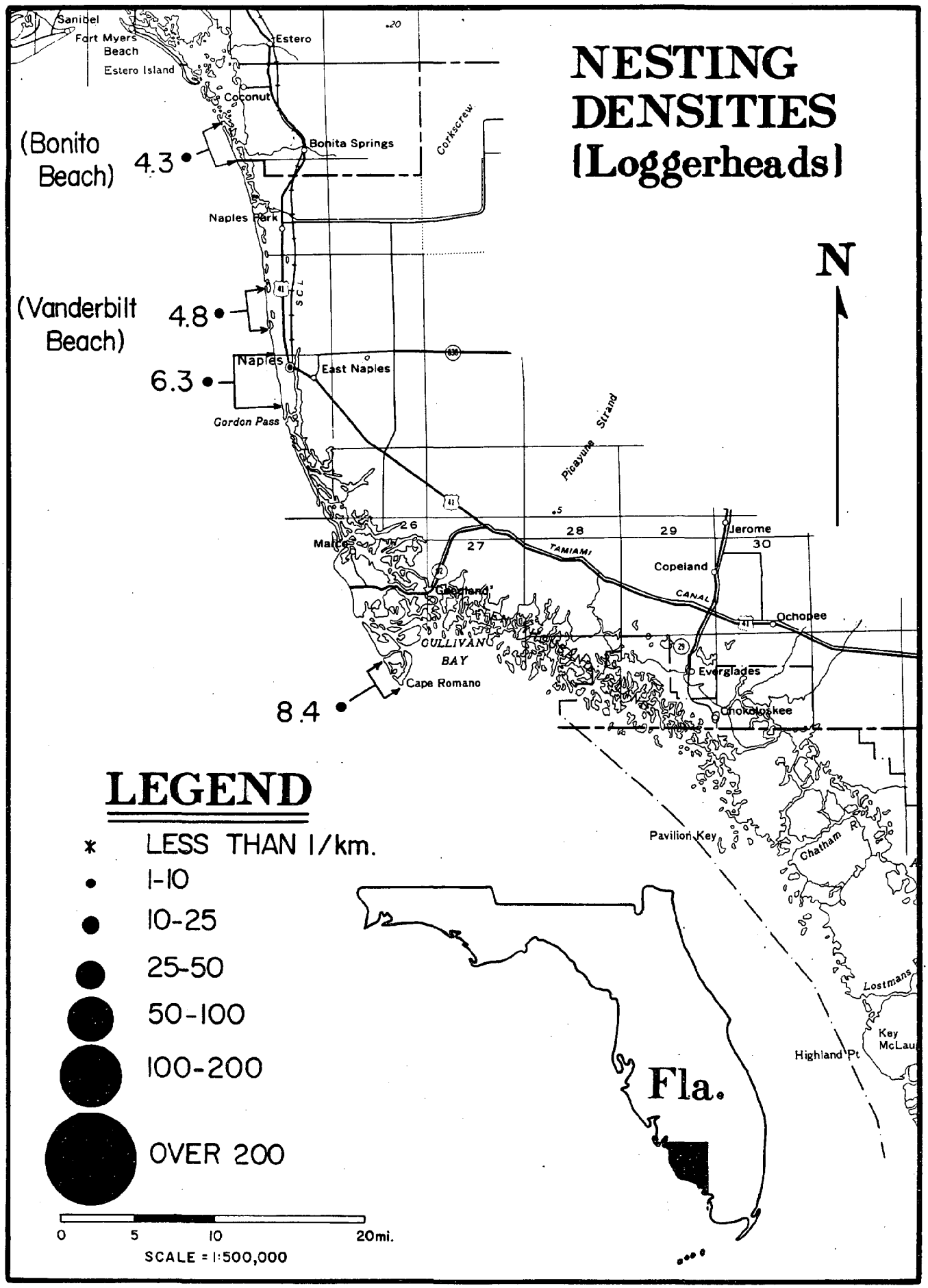
* Survey for 28 days only in July.

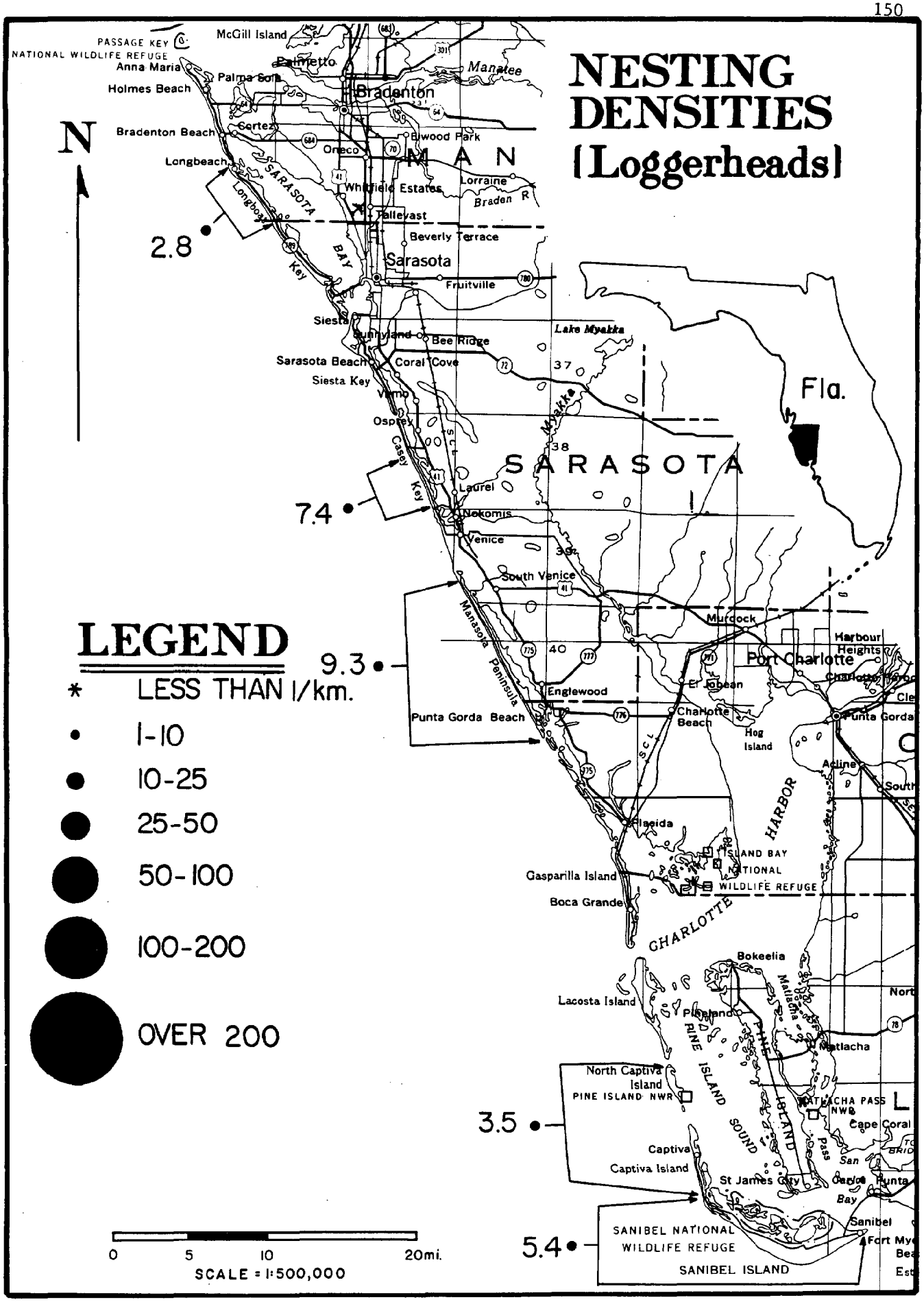
** Estimate for 17 May to 23 August 1982.


NESTING DENSITIES
(Loggerheads)
4 (Little Talbot Is.)
3.6
49 (South Volustia Co.)
Cape Canaveral
43.5
17
Patrick AFB
129
449
LEGEND
LESS THAN 1 NEST/Km.
1-10
10-25
25-50
50-100
100-200
OVER 200
N
SCALE 1:500,000
Fla.
ST JOHNS
FLAGLER
VOLUSIA
SEMINOLE
Jacksonville Beach
St Augustine
Daytona Beach
Smyrna Beach
Titusville
Cocoa
Cocoa Beach
Merritt Island
CAPE KENNEDY


NESTING DENSITIES
(Loggerheads)
449 Melbourne Beach
NO ESTIMATE
112.4
169.8 (Hobe Sound NWR)
182(Jupiter Is.)
212(Juno Bch.)
67.5(Lost Tree Village)
112.3
66.3 (Boca Raton)
27.6
* 0.6
13.4
Fla.
N
LEGEND
* LESS THAN 1/km.
1-10
10-25
25-50
50-100
100-200
OVER 200
ST LUCIE
MARTIN
PALM BEACH
BROWARD
EVERGLADES
FORT LAUDERDALE
HOLLYWOOD
MIAMI BEACH
Fort Pierce
Jupiter Inlet Colony
Delray Beach
Boca Raton
Deerfield Beach
Pompano Beach
Oakland Park
Plantation
West Hollywood
Hollandale
Carol City
Miami Beach
Miami Springs
Westwood Lakes
South Miami
Homestead
Florida City
Cutler Ridge
Sandy Key
Old Rhodes Key
SCALE 1:500,000


NESTING
DENSITIES
(Loggerheads)
N
LEGEND
LESS THAN 1/km.
1-10
10-25
25-50
50-100
100-200
OVER 200
Everglades
National Park 23.9
(Cape Sable)
EVERGLADES NATIONAL PARK
STRAITS OF FLORIDA
Fla.
0 5 10 20mi.
SCALE 1:500,000


NESTING DENSITIES (Loggerheads)
N
(Bonito Beach)
4.3
(Vanderbilt Beach)
4.8
6.3
8.4
Sanibel
Fort Myers Beach
Estero Island
Estero
Coconut
Bonita Springs
Corkscrew
Naples Park
Naples
East Naples
Gordon Pass
Picayune Strand
Marco
Goodland
CULLIVAN BAY
Cape Romano
TAMIAMI CANAL
Jerome
Copeland
Ochopee
Everglades
Chokoloskee
Pavilion Key
Chatham R
Lostmans
Key McLau
Highland Pt
Fla.
LEGEND
LESS THAN 1/km.
1-10
10-25
25-50
50-100
100-200
OVER 200
0
5
10
20mi.
SCALE = 1:500,000


NESTING DENSITIES (Loggerheads)
N
LEGEND
* LESS THAN 1/km.
1-10
10-25
25-50
50-100
100-200
OVER 200
2.8
7.4
9.3
3.5
5.4
PASSAGE KEY NATIONAL WILDLIFE REFUGE
McGill Island
Anna Maria
Palmetto
Palma Sola
Holmes Beach
Bradenton
Manatee
Bradenton Beach
Cortez
Oneco
Elwood Park
Longbeach
SARASOTA BAY
Whitfield Estates
Lorraine
Braden R
Tallevast
Beverly Terrace
Sarasota
Fruitville
Siesta
Sunnyland
Bee Ridge
Lake Myakka
Sarasota Beach
Coral Cove
Siesta Key
Vamo
Osprey
Casey Key
Laurel
Nokomis
Venice
South Venice
SARASOTA
Fla.
Murdock
Harbour Heights
Port Charlotte
Manasota Peninsula
Englewood
El Jobean
Punta Gorda Beach
Charlotte Beach
Hog Island
Punta Gorda
Acline
Placida
ISLAND BAY NATIONAL WILDLIFE REFUGE
Gasparilla Island
Boca Grande
CHARLOTTE HARBOR
Bokeelia
Lacosta Island
Pineland
PINE ISLAND SOUND
Matlacha
North Captiva Island
PINE ISLAND NWR
MATLACHA PASS NWR
Cape Coral
Captiva
Captiva Island
St James City
Sanibel
SANIBEL NATIONAL WILDLIFE REFUGE
SANIBEL ISLAND
0 5 10 20mi.
SCALE = 1:500,000

3.2

GREEN TURTLE RECOVERY PLAN

Introduction

The green turtle has the unique ability among marine turtles to digest plant material. However, the species is not strictly herbivorous because hatchlings and yearlings are primarily carnivorous and mature specimens eat marine animals, particularly cniderians whenever they are available.

Atlantic green turtles are characterized by a single pair of prefrontal scales on the head and usually four costal scutes on the smooth carapace. Carapace pigmentation varies among adults from light to dark olive-brown with superimposed darker streaks, rays, and spots. Normal carapace color for hatchlings is black. Plastron color is white to yellowish. The body shape is generally oval, and in adults the head appears to be somewhat small in comparison to body size. Each paddle-shaped flipper usually has one claw.

Nesting beaches are distributed widely in tropical and subtropical regions and as far north as the Cape Canaveral area of Florida. The eastern limit of the nesting range is Ascension Island, and the southern limit is apparently French Guiana. Mature turtles appear to remain within the geographic area from the southeastern United States to Ascension Island and Brazil. Young turtles are dispersed very widely, and small green turtles are found from Massachusetts to the eastern Atlantic and southward to Rio de Janeiro state in Brazil.

Turtles nest in the northernmost part of their range from June through August (occasionally from late May through early September). In Costa Rica, turtles nest from July to September, in Surinam from February to July, at Aves Island from March to December, and at Ascension Island from February to April. Courtship and mating occur in

the vicinity of nesting beaches and possibly enroute to nesting beaches. As in other species of sea turtles, green turtle nesting is the most readily observed part of the life cycle. Individuals do not usually nest annually but on varying cycles of two, three, or four years, with three years being the predominant cycle. Nesting occurs at night, with an hour or more being required to complete the nesting process. Within-season nesting frequency is variable; some individuals lay one clutch and others lay several. Clutch size ranges from less than 100 to over 200 eggs. High energy beaches are preferred, and nesting requires sand deep enough for deposition of eggs below one meter. Incubation times vary greatly depending on temperature and vary from 48 to 70 days.

Mature green turtles demonstrate navigational ability by returning to their nesting beaches. The longest known migration is from Brazil to Ascension Island. Establishing nest site specificity may result from natal beach imprinting or may be learned coincidentally with subadult migrations or with nesting migrations of experienced adults already familar with a specific beach.

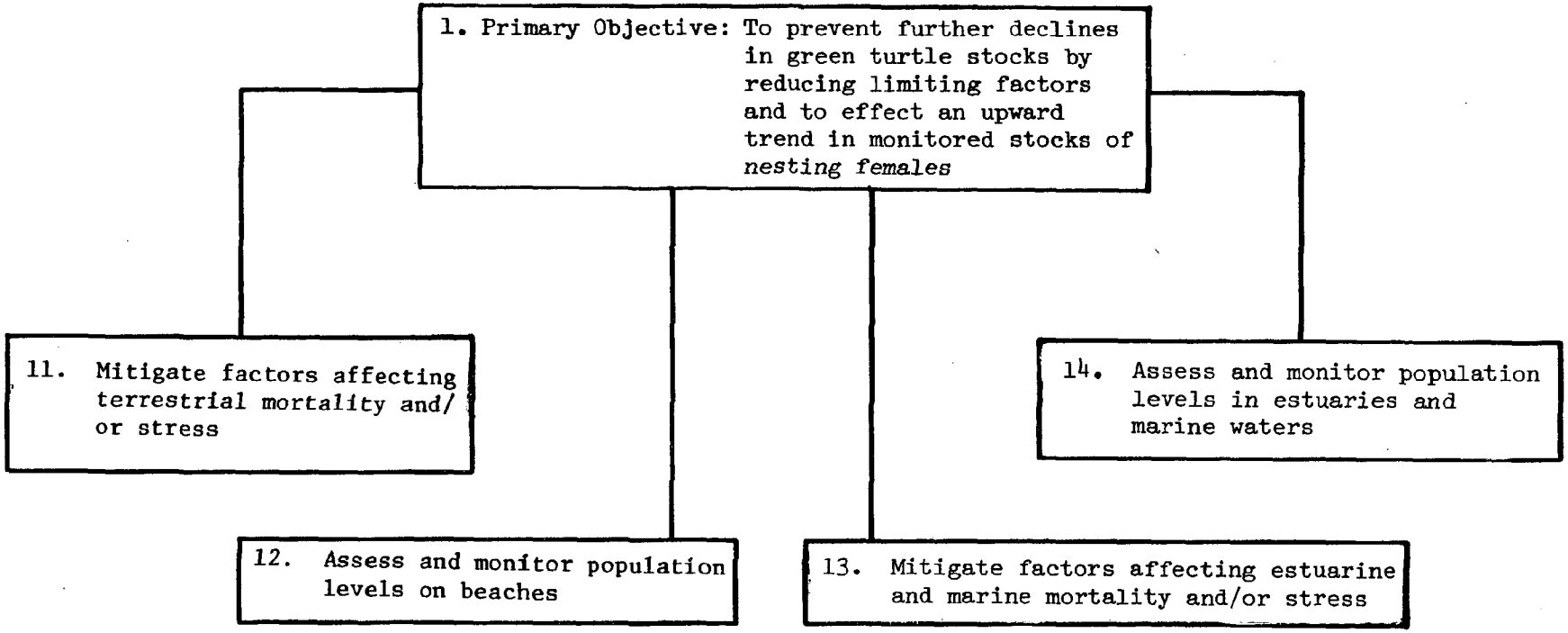
Hatchling dispersal seems more likely to be a response to wave forces and ocean currents in their subsequent movements rather than migration.

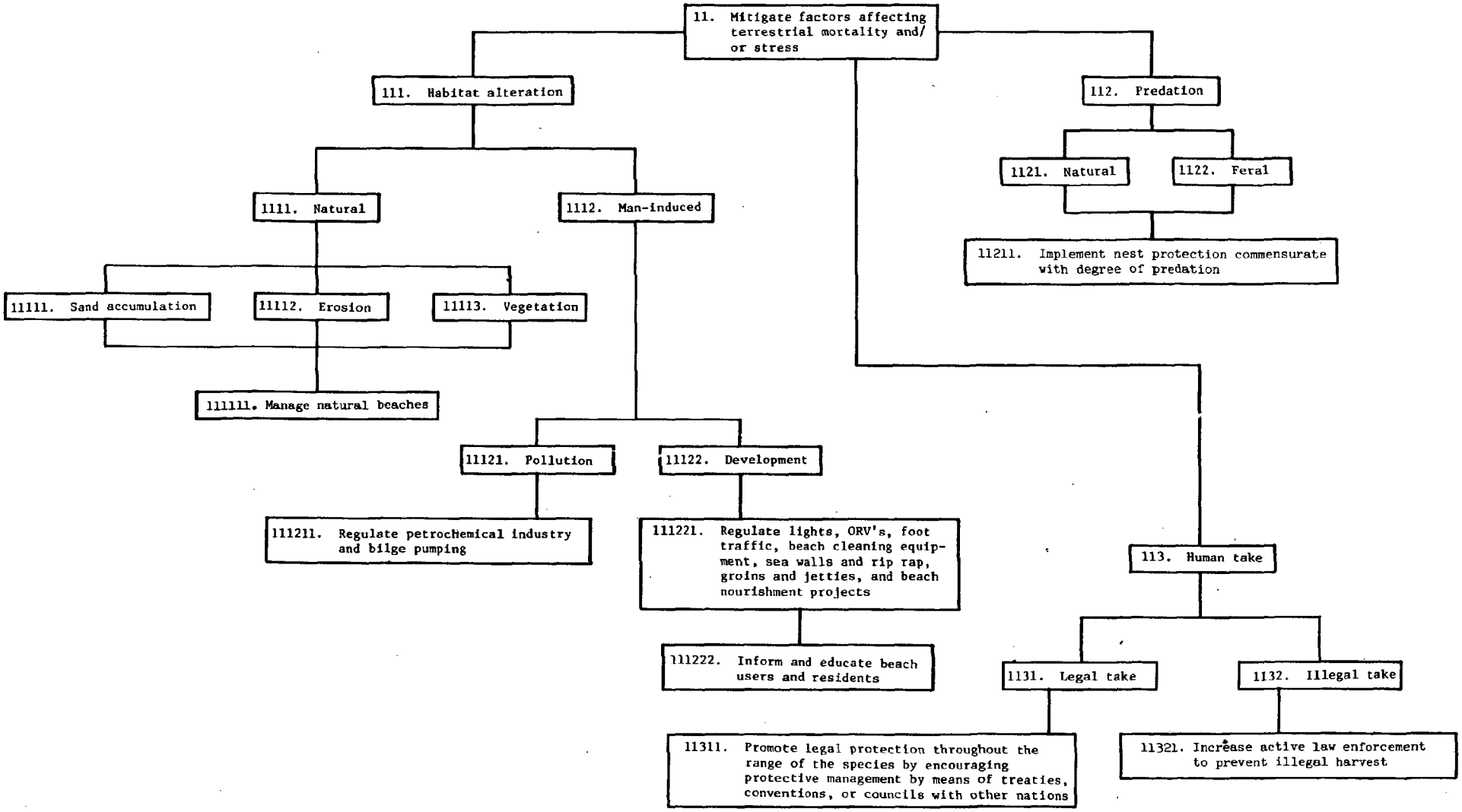
Green turtles are considered the most palatable of all sea turtles, and they became a prime source of meat for mariners and settlers of colonial America. If we assume correct identification from historical reports, the species was once so abundant that one of Columbus' early voyages reported "flotillas" of them near Grand Cayman Island. Nesting in some areas may have been eliminated by overuse of the resource from

commercial harvest by fishermen. Depletion was rapid, and by 1620 Bermuda passed a law against the taking of sea turtles.

Estimates of historic population densities are made more difficult by misidentification of species. Some early observers may have incorrectly associated nests and species and, thus, misidentified nesting beaches. The most valid evidence of population declines appears from captures of turtles by fishermen. The first such reported declines were from Bermuda. Records show drastic declines in the Florida catch during the late 1800's. Similar declines occurred in other areas. Current problems for the green turtle include coastal development of nesting beaches and other human activities, which are harmful to turtles of all sizes.

Green turtles were listed as Threatened/Endangered under the Endangered Species Act in 1978. The species is also listed in Appendix I of the Convention on International Trade in Endangered Species of Flora and Fauna (CITES). In the United States the species is also protected by state laws in coastal states. Other countries protect these turtles, but enforcement is variable and sometimes ineffective. All of the Atlantic green turtle populations are Threatened except those turtles which nest on Florida beaches which are listed as Endangered.


1. Primary Objective: To prevent further declines in green turtle stocks by reducing limiting factors and to effect an upward trend in monitored stocks of *nesting females*
11. Mitigate factors affecting terrestrial mortality and/or stress
12. Assess and monitor population levels on beaches
13. Mitigate factors affecting estuarine and marine mortality and/or stress
14. Assess and monitor population levels in estuaries and marine waters


11. Mitigate factors affecting terrestrial mortality and/or stress
111. Habitat alteration
112. Predation
1111. Natural
1112. Man-induced
1121. Natural
1122. Feral
11211. Implement nest protection commensurate with degree of predation
11111. Sand accumulation
11112. Erosion
11113. Vegetation
111111. Manage natural beaches
11121. Pollution
11122. Development
111211. Regulate petrochemical industry and bilge pumping
111221. Regulate lights, ORV's, foot traffic, beach cleaning equipment, sea walls and rip rap, groins and jetties, and beach nourishment projects
111222. Inform and educate beach users and residents
113. Human take
1131. Legal take
1132. Illegal take
11311. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, conventions, or councils with other nations
11321. Increase active law enforcement to prevent illegal harvest

Green Stepdown Plan

Primary Objective: To prevent further declines in green turtle stocks by reducing limiting factors and to effect an upward trend in monitored stocks of nesting females.

11. Mitigate factors affecting terrestrial mortality and/or stress.

111111. Manage natural beaches

Natural processes may prove to be a significant source of mortality to nests on some beaches in the range of the green turtle.

A. Assess the vulnerability of nests.

B. If nests sites are poor (below MHW line, on edge of scraped dunes, in vegetation, or in swales with poor drainage), then nests may be transferred to a better site or a hatchery (see section 2.5).

C. Natural sand accumulation is not considered a significant factor.

Certain forms of exotic vegetation (e.g., Casuarina) present problems for nesting beach management. They form impenetrable root mats which prevent nest cavity excavation.

D. Remove trees from potential nest sites on important nesting beaches.

E. Prevent further spread by removing seedlings and by discouraging plantings.

111211. Regulate petrochemical industry and bilge pumping.

Nesting beaches are susceptible to oil spills from offshore wells, tankers and bilge pumping.

A. Conduct research to determine effects of petrochemical spills, clean-up methods (including detergents) and bilge effluents on developing eggs.

B. Establish spill monitoring programs to coordinate with agencies responsible for sea turtle management. Establish spill monitoring programs where none exist.

111221. Regulate lights, ORV's, foot traffic, beach cleaning equipment, sea walls and rip rap, groins and jetties, and beach nourishment projects.

Lights cause hatchlings to become disoriented so that they may not reach the sea, and such lighting may discourage nesting females.

A. Determine effects of various wavelengths, light intensities, and light screening devices on hatchling behavior.

B. Discourage use of lights on nesting beaches during the nesting season.

C. Develop hatchling rescue contingency plans with agencies, organizations or individuals in areas where hatchlings are likely to be disoriented.

ORV's, foot traffic and beach cleaning equipment compact sand, crush nests and make ruts which can trap hatchlings.

D. Restrict ORV's and beach cleaning equipment on nesting beaches during the nesting and hatching seasons.

E. Transfer nest to a better site or to a hatchery if protection of natural nests is impossible (See section 2.5).

Sea walls and rip rap prevent adults from nesting by destroying the dune system and eliminating access to nest sites.

F. Prohibit the construction of sea walls and rip rap on important nesting beaches.

Groins, jetties and wave attenuation breakwaters, including spoil areas designed for that purpose, divert currents and restrict natural sand movement. This could alter the suitability and accessibility of nesting beaches.

G. Careful evaluation of these effects should precede the permitting and construction of such structures.

Beach nourishment is conducted by two means; hydrolic pumping of sand and mechanical transfer with heavy equipment. If nourishment is conducted during the nesting season, nests will be smothered. Sand removal may be detrimental if its source degrades adjacent suitable nesting areas. Nourishment may create or improve nesting beaches. However, this activity is not advocated. Sand moving equipment to maintain artificial dunes can disrupt existing nests or result in excessive overburden over others.

H. Prohibit to the extent possible all beach nourishment projects on nesting beaches during the nesting season.

I. Evaluate sites for sand source so to avoid detrimental effects on the nourished and adjacent nesting beaches.

J. Determine the suitability of replacement sand for nesting, and modify texture and cohesive nature, if necessary.

K. If prohibition of beach nourishment is impossible relocate eggs to a safe area or hatchery.

111222. Inform and educate beach users and residents.

(See section 2.7).

11211. Implement nest protection comensurate with the degree of predation.

Predation on nests and hatchlings varies in severity throughout the range of the species. Research or management plans should address specific predators and intensity of predation.

A. Quantify the nature and extent of predation on major nesting beaches.

B. Design and implement plans to mitigate nest losses to predators. These might include: in situ screening, aversion conditioning, hatcheries, nest transplants or predator reduction programs. Utilize approved nest management techniques. (See section 2.5)

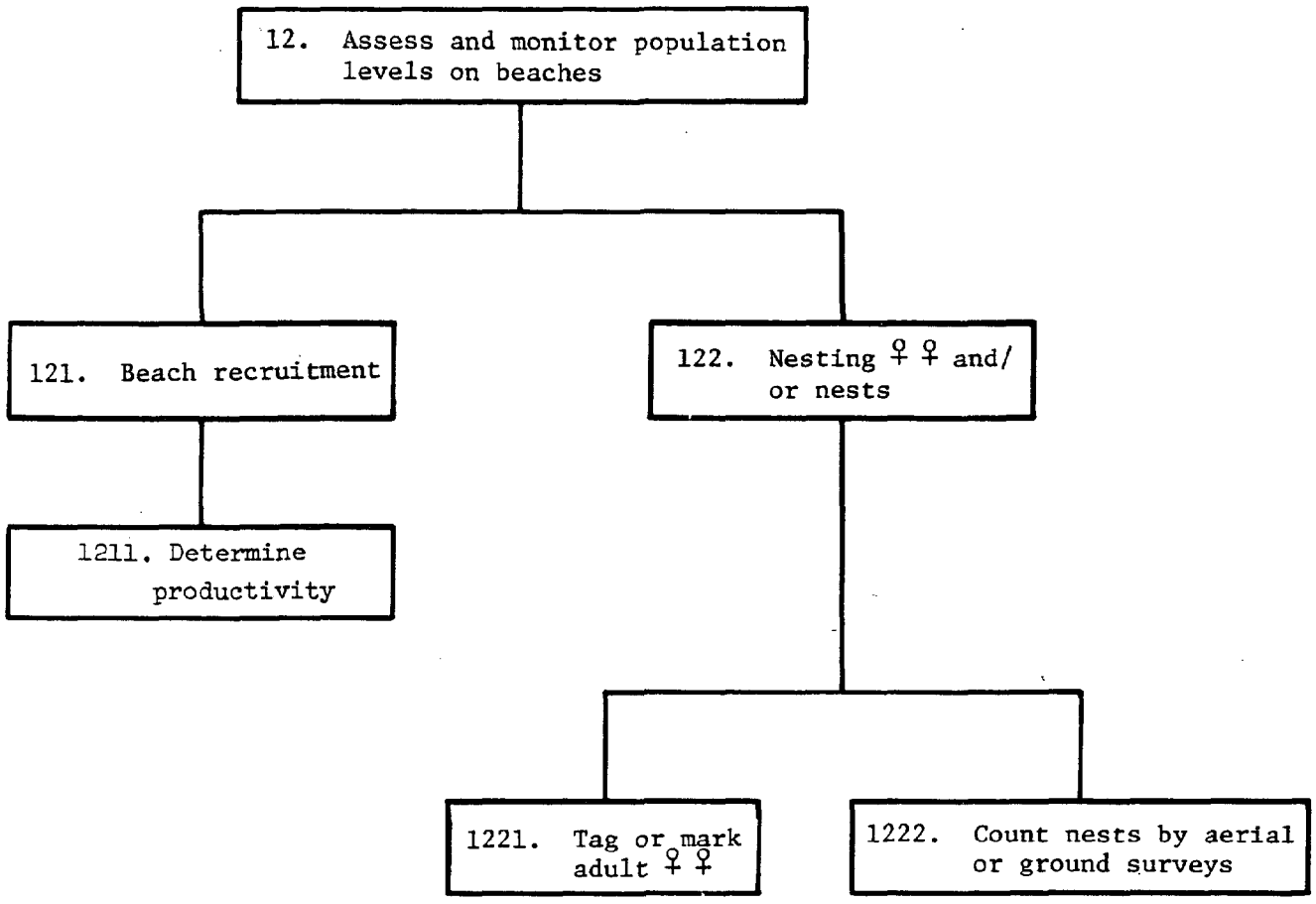
11311. Promote legal protection and research throughout the range of the species by encouraging protective management by means of treaties, conventions or councils with other nations. (See sections 1.2, 2.8 and 4.4).

11321. Increase active law enforcement to prevent illegal harvest. At this time, Federal law enforcement efforts are strained to cover needs throughout the range of the species. Increased coordination with state law enforcement agencies could alleviate this deficiency.

A. Determine through surveillance and undercover operations the areas and extent of illegal eggs and turtles.

B. Schedule basic law enforcement actions (night and day patrol, aerial patrols, cooperating patrols with other agencies) to curtail illegal activities.

C. Conduct public relations campaigns with other agencies to publicize the laws and status of turtles. (See section 2.7).


12. Assess and monitor population levels on beaches
121. Beach recruitment
122. Nesting ♀♀ and/or nests
1211. Determine productivity
1221. Tag or mark adult ♀♀
1222. Count nests by aerial or ground surveys

12. Assess and monitor turtle population levels on nesting beaches.

1211. Determine productivity.

An important segment of the green turtle's life history is the incubation period which begins with egg laying and ends with the departure of the hatchlings to the sea. Unlike most of a sea turtle's life history, the incubation period can be realistically monitored.

A. Establish limits for area (km of beach) and/or size (number of marked nests) of the proposed monitoring program (see section 2.1 -estimating hatching success).

B. Determine hatching success.

1221. Tag or mark adult females.

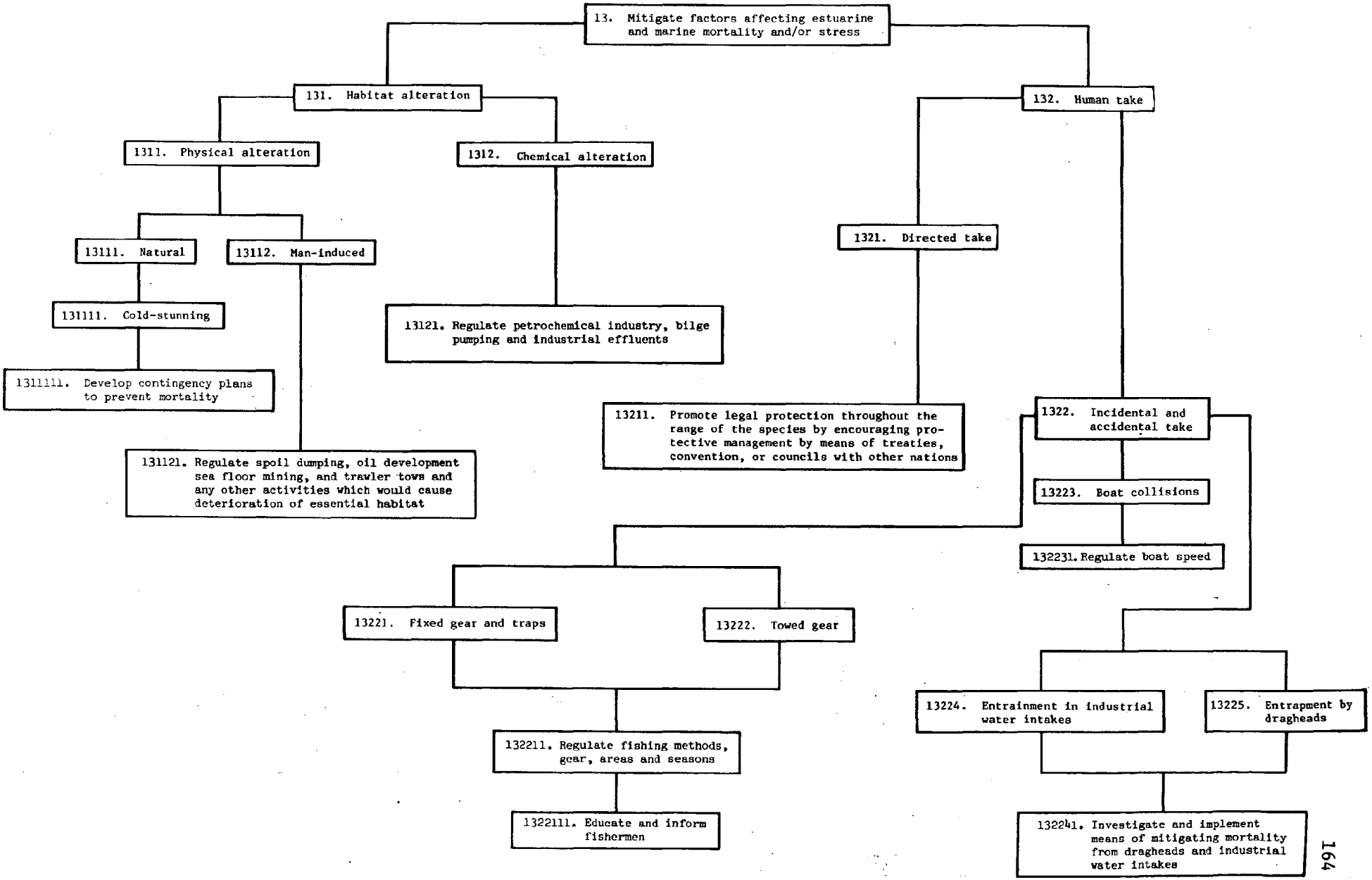
A tagging program for nesting green turtles must be rigorously defined and implemented, or the results of the program will be of little statistical value.

A. Establish area limits and conduct survey of nesting females (see section 2.1 - tagging programs for nesting females).

B. Use the best available tagging technology (see section 2.2 -tagging technology).

C. Continue surveys for a minimum of six years.

1222. Count nests by aerial or ground surveys. (See 2.1 for Standardization of methodology).


13. Mitigate factors affecting estuarine and marine mortality and/or stress
131. Habitat alteration
132. Human take
1311. Physical alteration
1312. Chemical alteration
1321. Directed take
13111. Natural
13112. Man-induced
131111. Cold-stunning
1311111. Develop contingency plans to prevent mortality
13121. Regulate petrochemical industry, bilge pumping and industrial effluents
13211. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, convention, or councils with other nations
131121. Regulate spoil dumping, oil development sea floor mining, and trawler tows and any other activities which would cause deterioration of essential habitat
1322. Incidental and accidental take
13223. Boat collisions
132231. Regulate boat speed
13221. Fixed gear and traps
13222. Towed gear
13224. Entrainment in industrial water intakes
13225. Entrapment by dragheads
132211. Regulate fishing methods, gear, areas and seasons
1322111. Educate and inform fishermen
132241. Investigate and implement means of mitigating mortality from dragheads and industrial water intakes

13. Mitigate factors affecting estuarine and marine mortality and/or stress.

1311111. Develop contingency plans to prevent cold-stunning mortalities (See section 2.6).

Where cold-stunning is likely to occur, personnel and facilities should be identified for the rapid rescue and holding of turtles. Such turtles should be held for release until water temperatures are appropriate, or they should be delivered to a suitable area for release.

131121. Regulate spoil dumping, oil development, sea floor mining, trawler tows and any other activities which would cause disruption of essential habitat.

Spoil disposal and oil development, if done on grass bed habitats, may destroy turtle feeding areas by smothering plants with sediments or drilling muds.

A. Evaluate sites for disposal of these materials and regulate to avoid grass bed habitats.

Sea floor mining and trawler gear may disrupt bottom habitat, thus destroying cover, loafing and feeding areas.

B. Locate areas of high turtle utilization that possess a potential for alteration.

C. Regulate or prohibit these activities on essential habitats.

D. Establish priorities for areas to be designated as critical habitat.

13121. Regulate petrochemical industry, bilge pumping, and industrial effluents.

Compounds associated with these sources of pollution could directly affect turtles or indirectly affect them through the food chain. These effects can be insidious and difficult to prove, since they often result in reduced reproductive effort. Direct mortality is also difficult to detect in the open ocean.

A. Determine the effects of sewage and industrial effluents, both acute and chronic, on turtles.

B. Discourage effluent dumping in estuarine and pelagic areas of turtle utilization.

C. Encourage enforcement of provisions of Laws of the Sea regarding oceanic pollution and dumping.

13211. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, conventions or councils with other nations (see Sections 1.2, 2.8 and 4.4).

132211. Regulate methods, gear, areas and seasons.

Incidental take of marine turtles during commercial fishing activities has been identified as a cause of mortality.

A. Develop resuscitation, handling and relocation methodology for incidentally caught turtles and implement by rule and regulation (see section 2.4).

B. Investigate and implement fishing methodologies (such as reduced tow time or curtailment of night fishing) to mitigate mortality.

C. Require TED (turtle excluder device) commensurate with the level of turtle mortality.

D. Establish priorities for designation of critical habitat.

E. Restrict or prohibit certain fishing methods in designated areas.

F. Prohibit certain types of fishing during specified seasons.

1322111. Educate and inform fishing industry. (see section 2.7)

132231. Regulate boat speed.

Boat collisions are a source of mortality in areas of high use by people and turtles.

Regulate speed in areas where collisions with turtles are a factor.

132241. Investigate and implement means of mitigating mortality from dragheads and industrial water intake.

A. Assess the extent of entrainment and mortality.

B. Develop excluder methods.

C. Investigate turtle behavior modifications to exclude turtles from areas where they may be drawn into intake pipes.

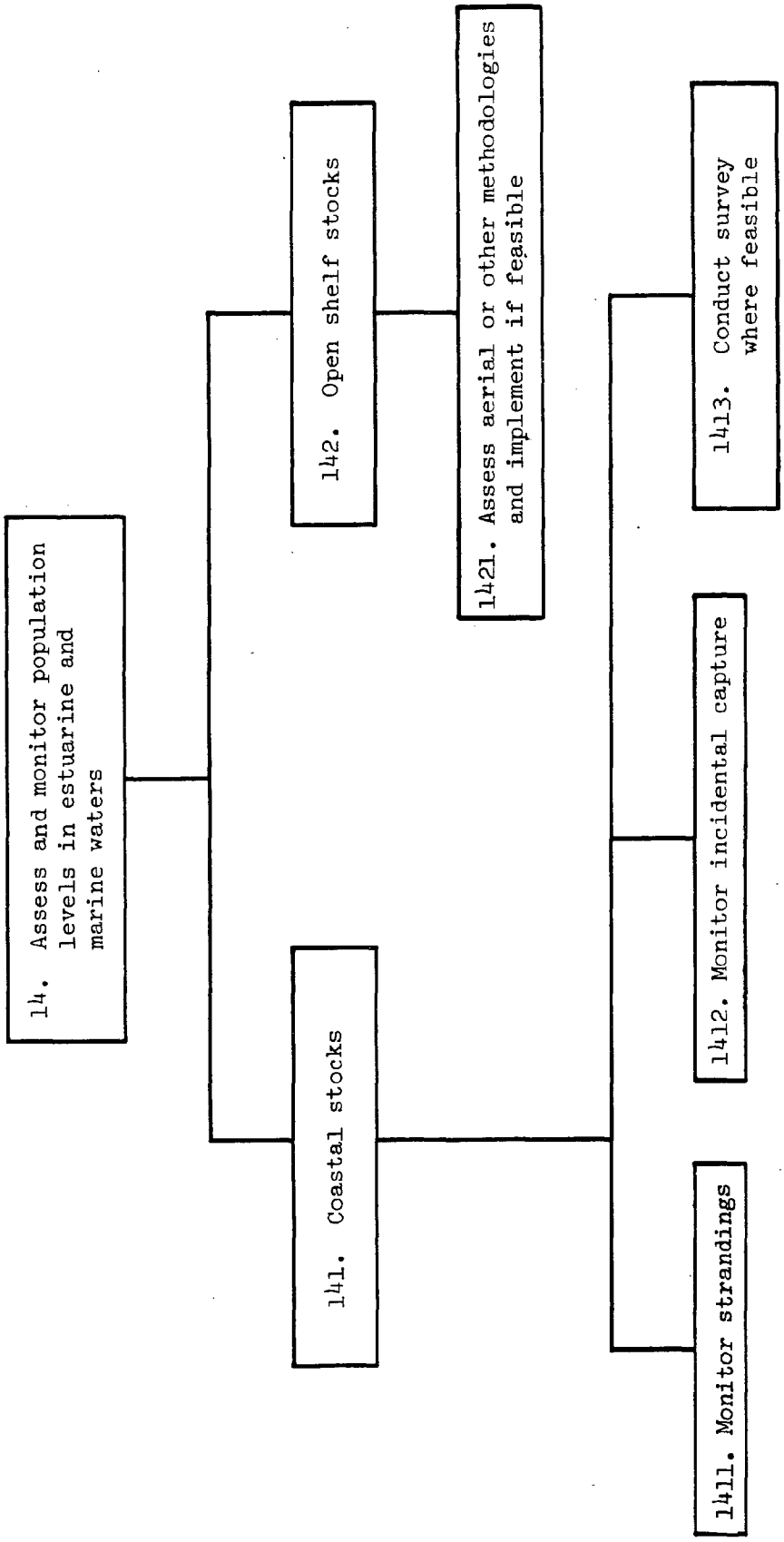
Turtles are entrapped and crushed by the dragheads of commercial and government dredges.

D. Investigate and develop modifications to the draghead to exclude turtles.

E. Remove turtles from the vicinity of dredging operations.

F. Investigate turtle behavior modification (see step C. above).

G. Prohibit dredging in areas where turtles are likely to be taken, and establish priorities for areas to be designated as critical habitat.


14. Assess and monitor population levels in estuarine and marine waters
141. Coastal stocks
1411. Monitor strandings
1412. Monitor incidental capture
1413. Conduct survey where feasible
142. Open shelf stocks
1421. Assess aerial or other methodologies and implement if feasible

14. Assess and monitor population levels in estuarine and pelagic waters.

1411. Monitor strandings.

An undetermined proportion of green turtles which die in nearshore waters wash ashore as bloated carcasses. Carcass stranding numbers represent a complex interaction of nearshore population densities and mortality from such disparate causes as cold stunning and drowning in trawl nets. Counts of carcass strandings provide indices of local mortality, particularly when followed from year to year.

A. Determine the relationship between beached carcasses and various causes of death, particularly the proportion of carcasses resulting from each cause of death.

B. Monitor continuously the numbers of dead turtles on beaches, using stranding network procedures which guard against counting individual carcasses more than once.

C. Develop a model for total mortalities at sea from strandings.

1412. Monitor on-board captures.

On-board monitoring of incidental captures of green turtles is the most effective and logical approach to assessing the impacts of specific fisheries on sea turtle populations. This will require a solution to the "self incrimination" problem.

A. Establish a statistical sampling program which considers the various fishing industries, their localities and their seasons of activity.

B. Monitor capture rates of sea turtles.

C. Consider the possible use and reliability of voluntary self-monitoring, such as incidental take logs, as opposed to the mandatory placement of observers on-board fishing vessels.

1413. Conduct aerial surveys where feasible.

Concentrations of estuarine and pelagic green turtles may be quantifiable with aerial surveys in areas where turbidity of the water is low.

Investigate the application of aerial surveys for monitoring estuarine and pelagic populations.

1421. Assess aerial or other methodologies, and implement if feasible.

Green turtles are widely distributed in the North Atlantic. The distribution of turtles within their range is not uniform, however, and various methods of estuarine and pelagic surveying need to be considered.

A. Continue investigations into aerial surveys as a quantitative off-shore sampling technique.

B. Investigate other methodologies such as SCUBA, submersibles, and underwater cameras for estuarine and pelagic sampling.

Green Turtle Implementation Schedule

Plan Section		Lead Agency	Cooperators	Priorities
111111	Manage Beaches	FWS	SCA, NPS, U, PI, DOD, NASA, CG	3
111211	Regulate Petro-chemical Industry	FWS	PWRC, USCG, SCA, MMS, I, EPA	2
111221	Regulate Beach Disturbance and Manipulations	FWS	SCA, CZM, COE, LG, NPS, EPA	1
111222	Educate Beach Users	FWS	SCA, NPS, SG, U, CG, LG	2
11211	Nest Protection	FWS	SCA, NPS, U, DOD, PL, NASA, CG, LG	1
11311	International Agreements	FWS	DS, CG, NMFS	4
11321	Law Enforcement	FWS	SCA, USC, NPS NMFS, USCG	2
1211	Determine Productivity	FWS	SCA, NPS, U, PL, DOD, NASA, CG	1
1221	Mark Adult Females	FWS/NMFS	SCA, NPS, U, PL, DOD, NASA, CG	1, 3*
1222	Count Nests	FWS	SCA, NPS, U, PL, DOD, NASA, CG	1
1311111	Cold-Stunning	NMFS	SCA, U, CG, LG, FWS, NPS, NASA	3
131121	Regulate Sea-Floor Disturbance	NMFS	COE, SCA, MMS, I, CZM, CEQ	3
13121	Regulate Industrial Dumping	NMFS	COE, MMS, CZM, EPA, USCG, CEQ, U, I, SCA	2
13211	International Agreements	NMFS	DS, CG, FWS	3
132211	Regulate Fishing Methodology	NMFS	FI, SCA, CG, FWS	1
1322111	Educate Fishing Industry	NMFS	SCA, SG, U, FI, CG	1
132231	Regulate Boat Speed	NMFS	SCA, LG, USCG	4

*Long-term tagging studies are #1 priority. New tagging programs lower (#3) priority.

Plan Section		Lead Agency	Cooperators	Priorities
132241	Draghead & Water Intakes	NMFS	COE, SCA, I, DOE	3
1411	Monitor Standings	NMFS & FWS	SCA, CG, U, PI, NPS, DOD, NASA, LG, USCG	1
1412	Monitor Incidental Captures	NMFS & FWS	I, U	2
1413	Conduct Surveys	NMFS & FWS	USCG, MMS, U	3
1421	Asses Survey Methodologies	NMFS	U, MMS, USCG, FWS	3

Priorities: 1=highest, 2=high, 3=moderate, 4=low

DEFINITIONS

FWS = Fish and Wildlife Service

NMFS = National Marine Fisheries Service

DOD = Department of Defense

MMS = Minerals Management Service

COE = Army Corps of Engineers

NASA = National Aeronautics and Space Admin.

USCG = United States Coast Guard

NPS = National Park Service

CEQ = Council on Environmental Quality

DS = Department of State

PWRC = Patuxent Wildlife Research Center

USC = United States Customs

DOE = Department of Energy

SCA = State Conservation Agencies

CZM = Coastal Zone Management

EPA = Environmental Protection Agency

SG = Sea Grant

U = Universities

CG = Conservation Groups

I = Industry

LG = Local Governments

FI = Fishing Industry

PI = Private Individuals

Explanatory note for nesting distribution maps and tables:

1. Density symbols on maps are based on data through 1980. Additional years of data were added to tables where possible.
2. Densities which are defined as nests/km on maps should be interpreted as nests/km year. Densities which are defined as Density km in tables should also be interpreted as nest/km year.

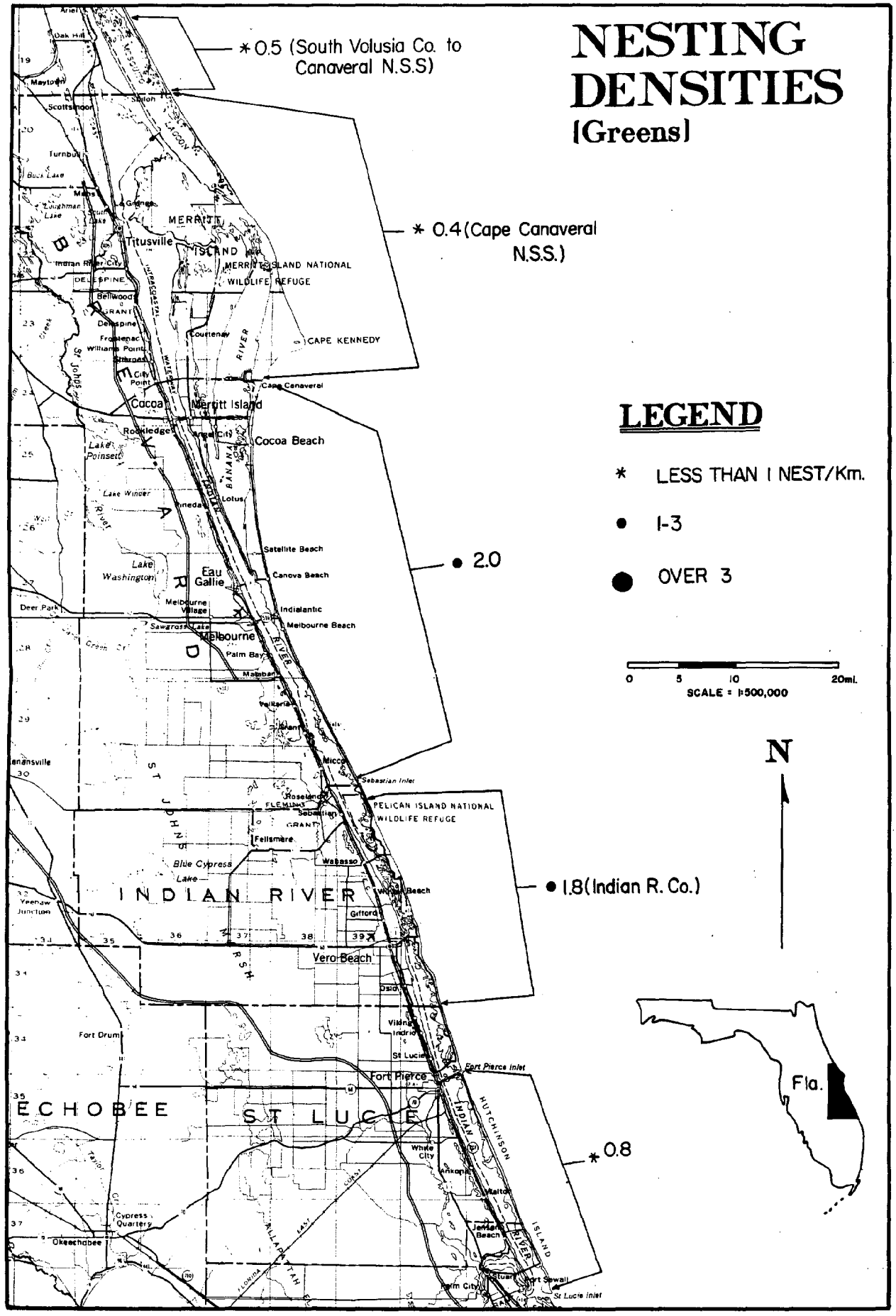
TABLE 6. FLORIDA
Green Turtle Nesting Activity

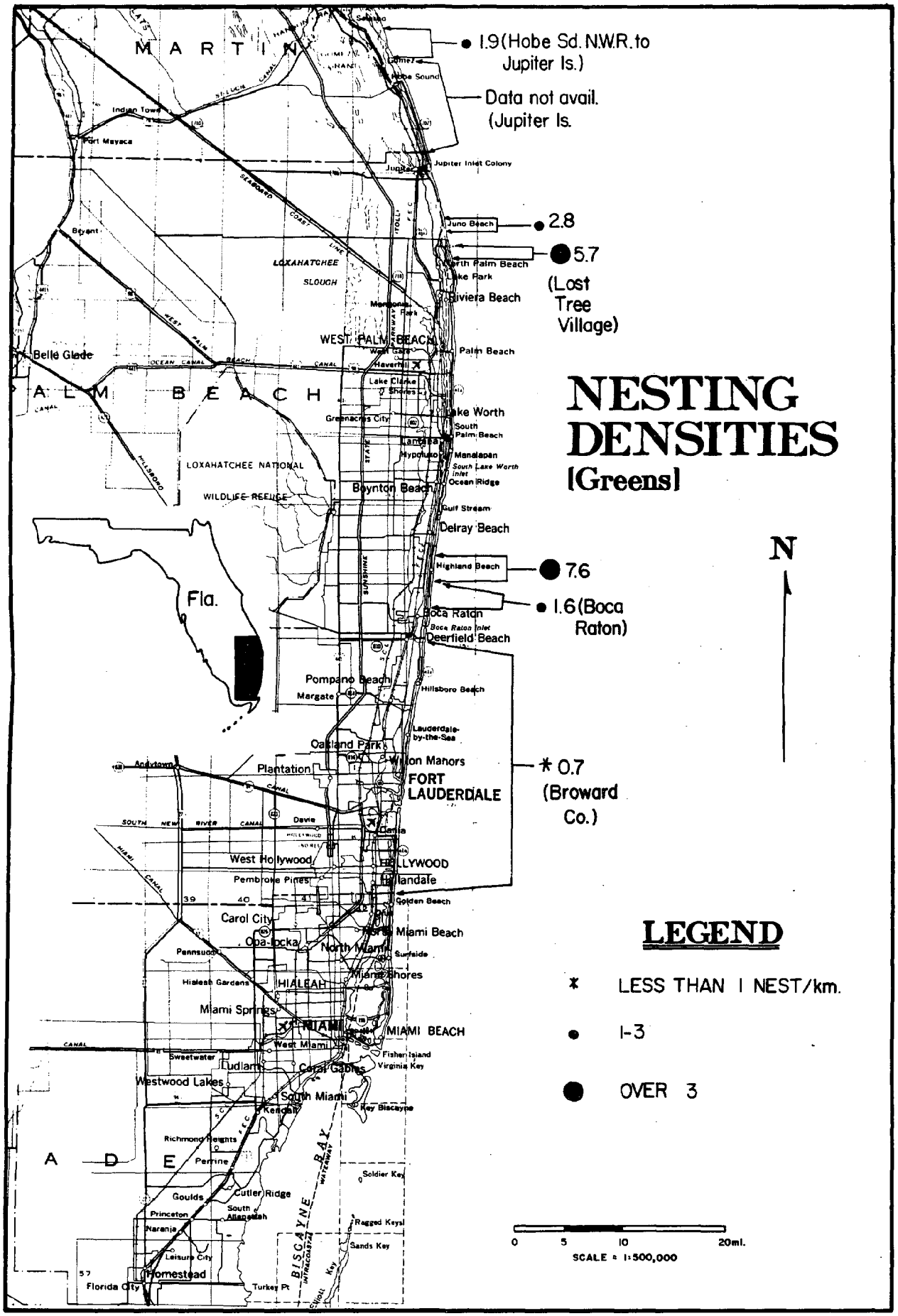
Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
South Volusia Co., Canaveral National Seashore	1980	8	8	4	4	0.5	FDNR 1980
	1975	50	8	2	2	0.3	Ehrhart, 1976
	1976	50	34	4	4	0.1	Ehrhart, 1980
	1977	50	34	2	2	0.1	"
	1978	50	34	23	23	0.7	"
	1979	50	50	18	18	0.4	Ehrhart, 1979
	1980	50	50	33	33	0.7	FDNR, 1980
Port Canaveral to Patrick AFB	1980	21	21	2	-	0.1	Fritts pers. comm.†
Patrick AFB to Melbourne Beach	1980	19.3	19.3	15	-	0.8	Fritts pers. comm.†
Melbourne Beach to Sebastian Inlet	1980	23	23	107	-	4.7	Fritts pers. comm.†
	1982	20	20	38	-	1.9	L. Ehrhart pers. comm.††
Indian River and St. Lucie counties.	1980	36.8	36.8	65(*)		1.8	Witham pers. comm.
Hutchinson Island	1975	36	36	37	37	1.0	Applied Biology, 1979
	1976	36	36	10	10	0.3	FDNR unpubl.
	1977	36	36	5	5	0.1	Applied Biology, 1979
	1978	36	36	61	61	1.7	FDNR unpubl.
	1979	36	36	15	15	0.4	Applied Biology, 1979
	1980	36	11	14		1.3	FDNR, 1980

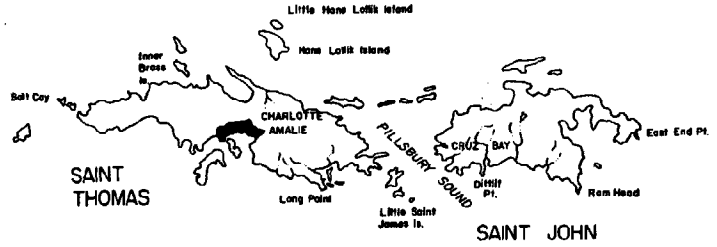
Table 6. continued

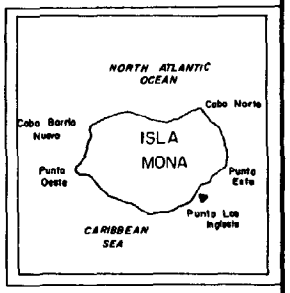
Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Density Km	Reference and Remarks
Hobe Sound NWR	1975	6.4	6.4	20	20	3.1	Hobe Sound NWR unpubl.
	1976	6.4	6.4	0	0	0	"
	1977	6.4	6.4	3	3	0.5	"
	1978	6.4	6.4	16	16	2.5	"
	1979	6.4	6.4	9	9	1.4	"
	1980	5.6	5.6	23	23	4.1	"
Jupiter Island	1979	12.3	12.3	13	13	1.1	F. Lund unpubl.
	1980	12.3	12.3	39	39	3.2	"
Juno Beach	1979	1.6	1.6	7	7	4.3	FDNR unpubl.
	1980	1.6	1.6	2	2	1.2	"
Lost Tree Village	1980	2.8	2.8	16	16	5.7	FDNR, 1980
Highland Beach	1980	4.5	4.5	34	34	7.6	"
Boca Raton	1977	4.2	4.2	0	0	0	Wagner, 1978
	1978	4.2	4.2	17	17	4.1	Wagner, 1979
	1979	4.2	4.2	6	6	1.4	FDNR, 1979
	1980	4.2	4.2	2	2	0.7	FDNR, 1980
Broward Co.	1978	19	19	1	1	<0.1	Fletemeyer, 1979
	1979	36	36	6	6	0.2	Fletemeyer, 1980
	1980	37	37	21	21	1.8	FDNR, 1980

(†) July only; mainly south end of section.
(††) Estimate for 17 May to 23 August 1982.
(*) Survey every two weeks; total nests not estimated.


NESTING DENSITIES
(Greens)
* 0.5 (South Volusia Co. to Canaveral N.S.S)
* 0.4 (Cape Canaveral N.S.S.)
• 2.0
• 1.8 (Indian R. Co.)
* 0.8
LEGEND
* LESS THAN 1 NEST/Km.
• 1-3
OVER 3
0 5 10 20mi.
SCALE = 1:500,000
N
Fla.
MERRITT ISLAND
MERRITT ISLAND NATIONAL WILDLIFE REFUGE
CAPE KENNEDY
PELICAN ISLAND NATIONAL WILDLIFE REFUGE
INDIAN RIVER
ST LUCIE
ECHOBEE
BREVARD
Titusville
Cocoa
Merritt Island
Cocoa Beach
Satellite Beach
Eau Gallie
Melbourne
Indialantic
Melbourne Beach
Palm Bay
Sebastian Inlet
Fellsmere
Wabasso
Vero Beach
Fort Pierce
Fort Pierce Inlet
St Lucie Inlet
Okeechobee
Fort Drum


NESTING DENSITIES
[Greens]
N
LEGEND
LESS THAN 1 NEST/km.
1-3
OVER 3
1.9 (Hobe Sd. N.W.R. to Jupiter Is.)
Data not avail. (Jupiter Is.
2.8
5.7 (Lost Tree Village)
7.6
1.6 (Boca Raton)
0.7 (Broward Co.)
0 5 10 20mi.
SCALE = 1:500,000
MARTIN
PALM BEACH
ADE
Fla.
LOXAHATCHEE SLOUGH
LOXAHATCHEE NATIONAL WILDLIFE REFUGE
WEST PALM BEACH
Palm Beach
Belle Glade
Riviera Beach
Juno Beach
Jupiter
Jupiter Inlet Colony
Hobe Sound
Indian Town
Fort Mayaca
Bryant
Lake Worth
Boynton Beach
Delray Beach
Highland Beach
Boca Raton
Deerfield Beach
Pompano Beach
Margate
Hillsboro Beach
Oakland Park
Wilton Manors
FORT LAUDERDALE
Plantation
Davie
West Hollywood
HOLLYWOOD
Hallandale
Pembroke Pines
Carol City
Opa-locka
North Miami
North Miami Beach
Miami Shores
HIALEAH
Miami Springs
MIAMI
MIAMI BEACH
West Miami
Coral Gables
Westwood Lakes
South Miami
Kendall
Perrine
Cutler Ridge
Homestead
Florida City
BISCAYNE BAY





The VIRGIN ISLANDS NESTING LOCATIONS for GREENS

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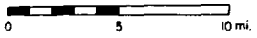
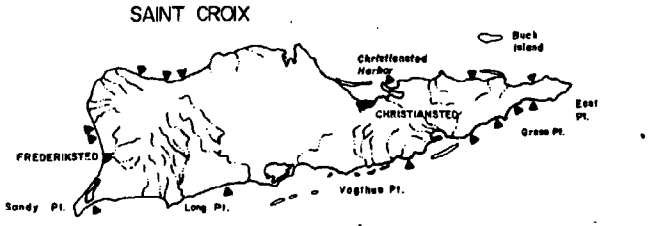




3.3

LEATHERBACK TURTLE RECOVERY PLAN

Introduction

The leatherback is the largest living turtle and is so distinctive that it is placed in a separate family, Dermochelyidae. All other living sea turtles are in the Cheloniidae. The median carapace length in the western Atlantic is approximately 155 cm long, though lengths of close to 183 cm have been recorded. Unconfirmed records of 240-270 cm leatherbacks are undoubtedly incorrect. The average adult weight is approximately 360 kgs, and the maximum is about 590 kgs.

Whereas other sea turtles have bony plates covered with horny scutes on the carapace, the carapace of the leatherback, distinguished by a rubber-like texture, is somewhat flexible but has seven hard longitudinal ridges. No sharp angle is formed between the carapace and the much softer plastron, resulting in the animal being somewhat barrel-shaped. The front flippers are very long and may span 270 cm in an adult specimen. Both front and hind flippers lack claws. The dominant color of this turtle is black, with varying degrees of white spotting. The undersurface is mostly pinkish-white.

Internal anatomy of the leatherback sea turtle is also distinctive. The skeleton of an adult retains many embryonic characteristics found only in hatchlings of other species. For example, the limb bones retain extensive cartilaginous ends, and the skull and pelvis contain so much cartilage that these parts fall apart when the skeleton is dried. The "shell" of the leatherback is about 4 cm thick, and is made primarily of tough, greasy cartilage. Immediately beneath the carapace skin of an adult leatherback is a continuous layer of mosaic bones a few millimeters thick; these bones are enlarged and thickened along the longitudinal ridges.

Although sometimes seen in nearshore waters, leatherbacks show several pelagic adaptations. Leatherbacks have anatomical adaptations that could enable them to dive into the cold depths of the ocean or live in near polar latitudes. Other soft-skinned turtles can exchange gases through their skin. Leatherbacks probably have the same ability, since they have sphincter muscles in the pulmonary arteries capable of diverting blood from the lungs to the skin. This species has such an extensive network of superficial capillaries on the underside that the unpigmented areas often appear pink. Some evidence indicates the leatherback can maintain its body temperatures considerably above ambient temperature. In one instance, the deep body temperature of a leatherback was 18°C (32.4°F) above that of the water from which it was taken (Frair et al. 1972). The barrel-shaped body, small surface/volume ratio relative to other sea turtles, and thick cartilaginous shell (which functions as insulation) favor heat retention from muscular activity and minimize heat loss.

The oil found within both the skeleton and flesh of the animal is another interesting feature, and several theories about the purpose of this oil have been formulated. A likely explanation is that, as in certain whales, the oil lessens decompression problems during rapid diving and resurfacing.

The diet of the leatherback consists primarily of soft-bodied animals such as jellyfish and tunicates, together with associated juvenile fishes, amphipods and other organisms. Attempts to raise hatchlings artificially and to keep adults in captivity have been largely unsuccessful. Feeding captive animals is a major problem - starved captives often survive longer than those which are fed. If given fish

to eat, these turtles may become fatally packed with undigested food. In the early 1970s, the Miami Seaquarium maintained leatherback hatchlings for several months (Witham, 1977). Their diet consisted entirely of jellyfish (Cassiopea), and the turtles ate about twice their weight in jellyfish daily. Phillips (1976) maintained three leatherbacks for eight months on a diet of minced chicken livers. The Seaquarium turtles died, but Phillips released his into the Gulf of Mexico.

Another problem with captive leatherbacks is their proclivity for swimming into the walls of the pool or tank in which they are kept. Hendrickson (1980) successfully raised hatchlings to weights of over 9 kgm and stipulates that the turtles be kept in a soft-walled tank to prevent serious injury and that all skin injuries be treated with gentian violet. He also specified feeding the young turtles soft food; he suggested chopped squid. Hendrickson also suggested keeping the temperature at a constant 80°F (26.7°C), saying that lower temperatures also can lead to death due to intestinal impaction. However, Phillips kept his specimens at 73.4°F (23°C), saying that it prevented injuries from too much activity.

The life history of the leatherback is poorly known since juvenile turtles are rarely observed.

Courtship and mating are believed to occur in water adjacent to the nesting beaches just prior to the time of egg laying, but no systematic search for mating pairs during the nesting season has been conducted. Nesting habits of the leatherback turtle are very well known since nesting is the only part of the life cycle easily observed by researchers. In the northern Atlantic, nesting begins in March and continues into July. Renesting occurs about every ten days and commonly

occurs six or seven times a season. Certain females have nested nine times per season (Eckert & Eckert, 1983). Data on the intervals between nesting seasons is less abundant, but evidence points to alternate year nesting as the norm.

Female leatherbacks nest at night, even in rainy weather, and are not easily perturbed, and they can sometimes be tagged as they first come up out of the sea. Usually the time on shore is 1½ to 2 hours. In Surinam and French Guiana, an average of 86 normal eggs is laid, plus an average of about 30 smaller yolkless eggs. The incubation period is about 60 days, and the hatchlings emerge "explosively," usually shortly after dark.

Within the Region, leatherbacks nest on St. Croix, Vieques, Culebra Islands and the mid-Atlantic coast of Florida, and there are recent isolated nestings reported from Georgia to North Carolina. Because leatherback sea turtles are rarely seen away from the nesting beaches, very little is known of their movements. They occur with sufficient frequency off the Maritime Provinces of Canada, that there may be some migration to these areas. There have been very few long-distance recoveries from tagged individuals. However, five females, tagged while nesting in Surinam and French Guiana, were recovered later, four near the coasts of New Jersey, South Carolina, Texas and Mexico and one off the coast of Ghana, West Africa, 6,800 kilometers away (Pritchard, 1976). A female tagged on St. Croix was recovered on the coast of New Jersey, 80 days later (R. Boulon, pers. comm.).

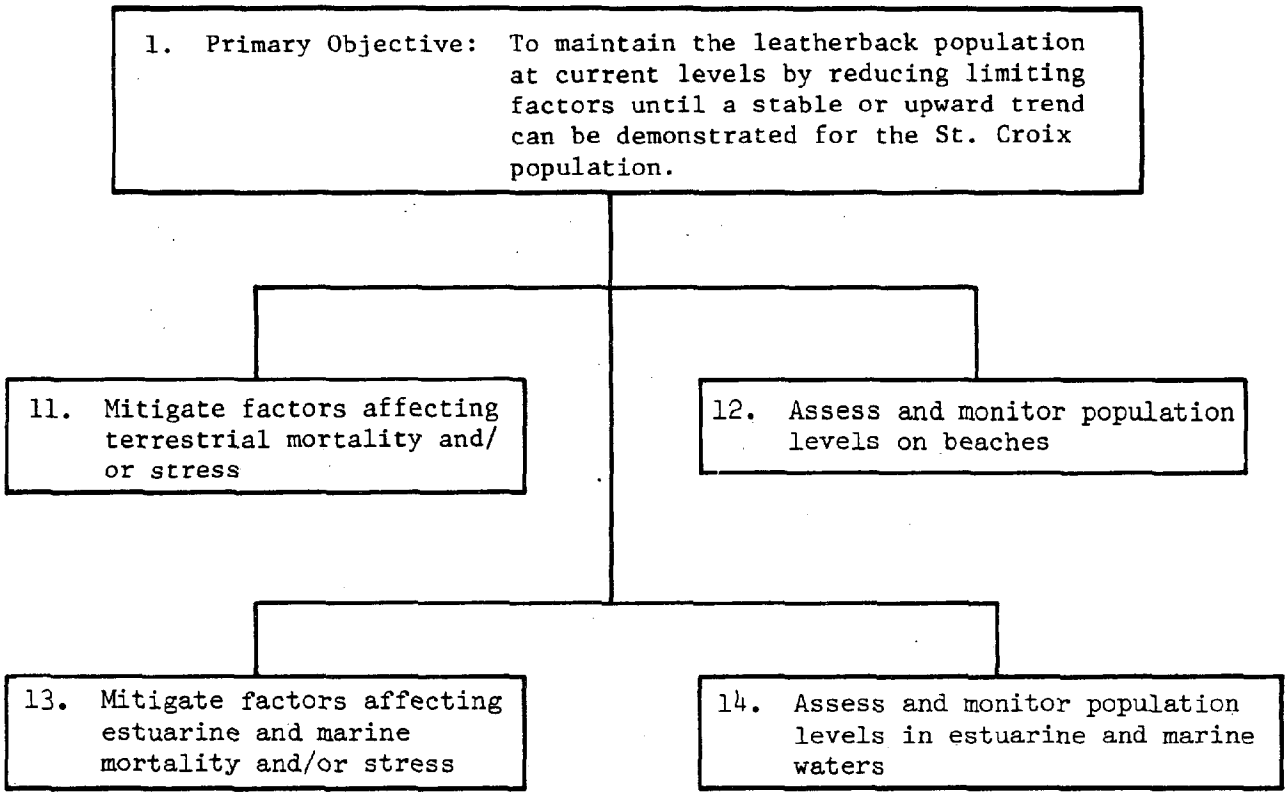
The deliberate taking of adults constitutes a threat to the species. Although their flesh is considered less palatable than that of other turtle species, leatherbacks are eaten in some areas, and a large

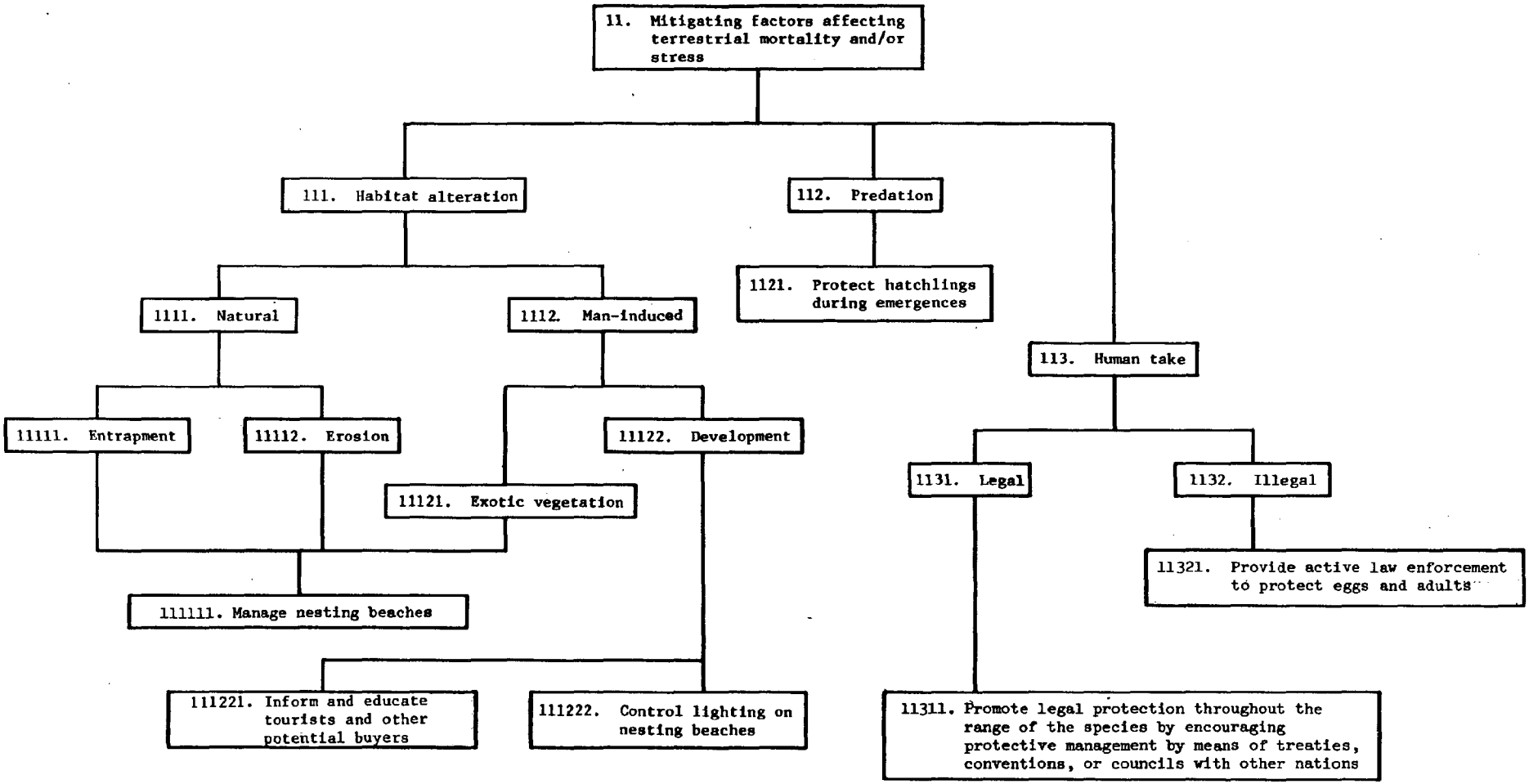
percentage of nesting turtles are killed for food in the Dominican Republic. Killing leatherbacks for food was a problem in Trinidad until very recently. Leatherbacks are killed and rendered for oil to treat boat timbers in Arabia and India and for oil to treat respiratory ailments in the British Virgin Islands. The oil is still bottled and sold by the interisland trading vessels at their ports of call.

Wanton slaughter of leatherback sea turtles apparently occurs in Guyana, where the nesting turtles are killed simply because they are believed to be "useless."

The greatest threat to this species is egg collecting. In Mexico, egg collecting is illegal but commonly occurs. Eggs are harvested in Trinidad, and subsistence take of eggs is high in the Dominican Republic. The large French Guiana nesting population is thought to be relatively safe because the beach is inaccessible and few people subsist off the land. Populations in Surinam, which have adequate protection, have increased in recent years though for the most part are following erosion of the adjacent French Guiana beaches. Other causes of mortality for leatherbacks are longlines (Hildebrand, 1980) (see section on Incidental Catch) and ingestion of indigestible materials such as plastics (Mrosovsky, 1981).

The leatherback turtle was listed as an endangered species by the U.S. Department of Interior in 1970. It is also listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This species is protected by law in most of the countries where nesting occurs; however, enforcement of these laws varies with the country.


1. Primary Objective: To maintain the leatherback population at current levels by reducing limiting factors until a stable or upward trend can be demonstrated for the St. Croix population.
11. Mitigate factors affecting terrestrial mortality and/or stress
12. Assess and monitor population levels on beaches
13. Mitigate factors affecting estuarine and marine mortality and/or stress
14. Assess and monitor population levels in estuarine and marine waters


11. Mitigating factors affecting terrestrial mortality and/or stress
111. Habitat alteration
112. Predation
113. Human take
1111. Natural
1112. Man-induced
1121. Protect hatchlings during emergences
11111. Entrapment
11112. Erosion
11121. Exotic vegetation
11122. Development
1131. Legal
1132. Illegal
11321. Provide active law enforcement to protect eggs and adults
111111. Manage nesting beaches
111221. Inform and educate tourists and other potential buyers
111222. Control lighting on nesting beaches
11311. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, conventions, or councils with other nations

Leatherback Stepdown Plan

1. Primary Objective: To maintain the leatherback population at current levels by reducing limiting factors until a stable or upward trend can be demonstrated for the U.S. nesting beaches.

11. Mitigate factors affecting terrestrial mortality and/or stress.

111111. Manage nesting beaches.

Natural processes sometimes are deleterious to turtle nesting beaches. An accumulation of storm tossed sand on high energy beaches may bury nests or, conversely, storm waves may expose nests. South American nesting leatherbacks are sometimes trapped by soft expanses of mud and/or mangrove roots.

A. Assess the vulnerability of nests on St. Croix.

B. Transfer nests on St. Croix to a better site or to a hatchery if these nests are endangered.

C. The Fish and Wildlife Service should purchase as soon as possible Sandy Point, St. Croix, U.S. Virgin Islands, as a refuge for nesting leatherbacks.

A great many species of tropical plants are now circumtropical because of the actions of man. Some of these provide dense masses of roots or deep shade. Either of these factors can interfere with nesting.

D. Monitor for future problems on St. Croix, and control invasion by such plants.

E. Monitor conservation program established for Vieques Island as stated in the 1981 Sec. 7 Consultation Proceedings between the Department of Defense, U.S. Navy

and the FWS and NMFS with regard to potential adverse impacts on the bombing-gunnery range.

111222. Control lighting on nesting beaches.

Development is often detrimental to nesting beaches and probably poses the greatest threat to the St. Croix and other populations of leatherbacks.

D. Develop a plan for handling disoriented hatchlings on St. Croix beaches.

E. Control lights and development which affect turtle nesting beaches.

111221. Inform and educate beach users and residents

(See section 2.7).

1121. Protect hatchlings during emergences.

Predation varies greatly from one geographic region to another. Populations which nest on oceanic islands have fewer natural predators than those which nest on mainland beaches or islands close to the mainland. The particular problem should be analyzed and handled by any appropriate means.

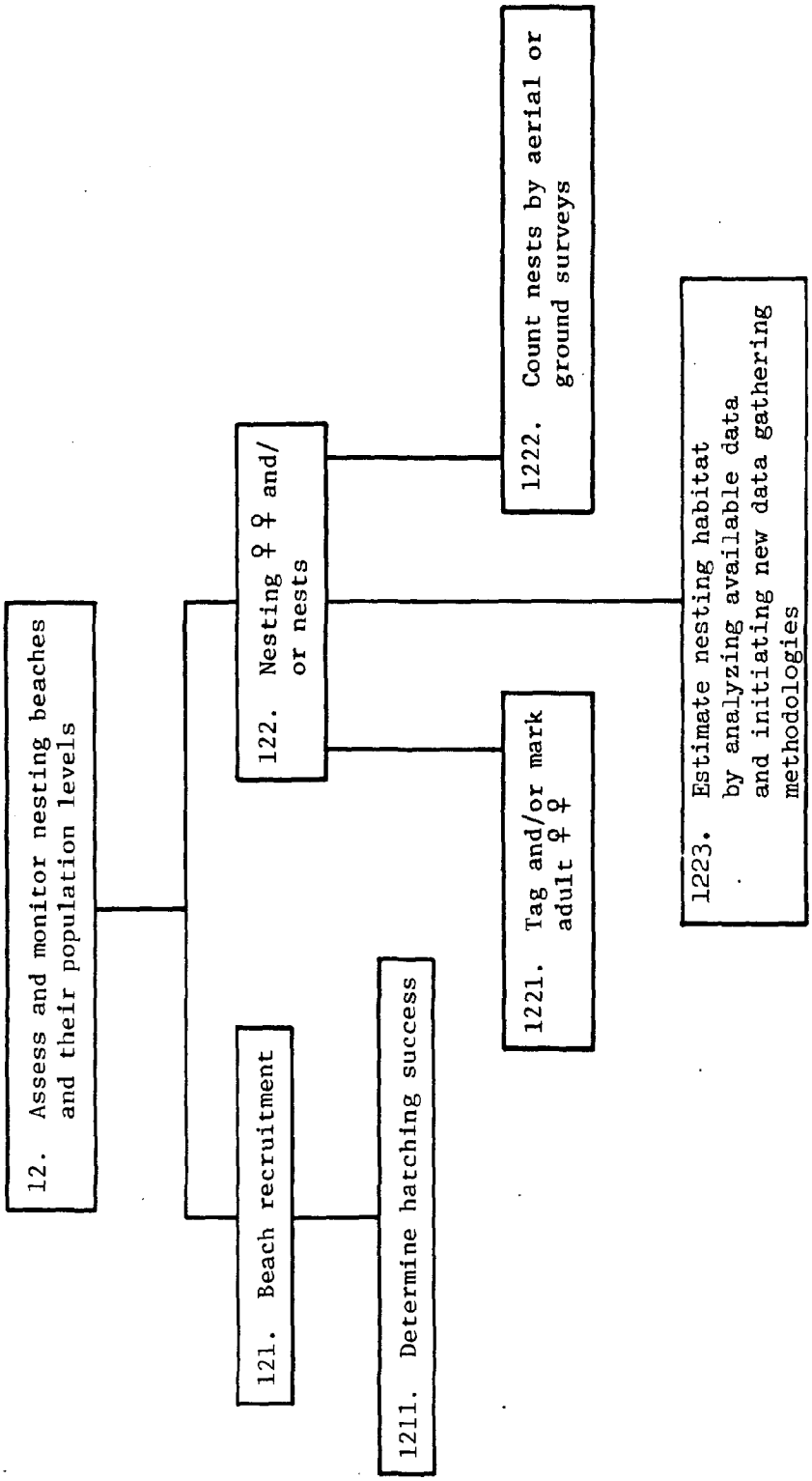
Protect hatchlings, as they emerge on the St. Croix nesting beaches, with beach patrols.

11311. Promote legal protection throughout range of the species by encouraging protective management by means of treaties, conventions, or councils with other nations.

See Loggerhead step 11311. The Virgin Islands Code should be amended to conform with federal law.

11321. Provide active law enforcement to protect eggs and adults.

In the U.S. Virgin Islands and Puerto Rico, efforts of FWS agents and NMFS agents can be greatly enhanced by cooperating with the local environmental enforcement staffs. See 11311 above for the need for legislative change.


12. Assess and monitor nesting beaches and their population levels
121. Beach recruitment
1211. Determine hatching success
122. Nesting ♀♀ and/or nests
1221. Tag and/or mark adult ♀♀
1222. Count nests by aerial or ground surveys
1223. Estimate nesting habitat by analyzing available data and initiating new data gathering methodologies

12. Assess and monitor population levels on beaches.

The beach at Sandy Point, St. Croix, offers the best opportunity for an intensive population study because of its location and the resources that are available to do the work. It is recommended that the population using this beach be used as an "index" for the success of such efforts. Other beaches in the U.S. Caribbean must be surveyed.

1211. Determine hatching success.

Implement a long term project on Sandy Point:

1221. Tag and/or mark adult females.

A. Tag or mark all nesting females on St. Croix.

B. Compile tagging and recapture data.

C. Tag turtles, if possible, that are in the marine Critical Habitat area.

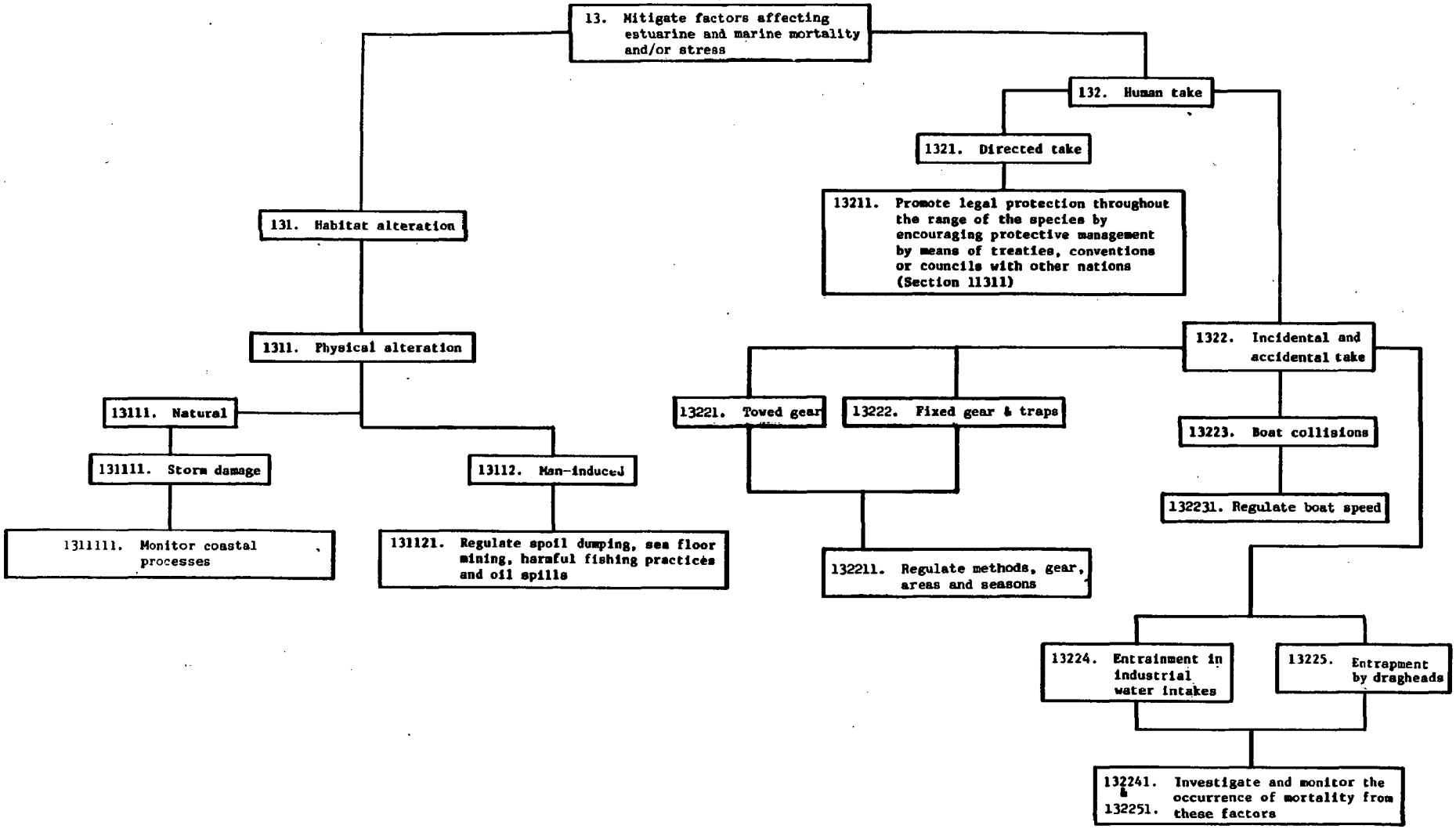
1222. Count nests by aerial or ground surveys.

Aerial counts may be the most cost effective way to count nests in some other geographic areas. The technique has been tried on the Virgin Islands, and an analysis of its effectiveness should be carried out.

A. Survey remote beaches in U.S. jurisdictional area for presence of nesting.

B. Survey Vieques Island to document all leatherback nests and to evaluate Naval activities upon nesting success.

1223. Estimate available nesting habitat by analyzing available data and initiating new data gathering devices.


13. Mitigate factors affecting estuarine and marine mortality and/or stress
131. Habitat alteration
1311. Physical alteration
13111. Natural
131111. Storm damage
1311111. Monitor coastal processes
13112. Man-induced
131121. Regulate spoil dumping, sea floor mining, harmful fishing practices and oil spills
132. Human take
1321. Directed take
13211. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, conventions or councils with other nations (Section 11311)
1322. Incidental and accidental take
13221. Towed gear
13222. Fixed gear & traps
132211. Regulate methods, gear, areas and seasons
13223. Boat collisions
132231. Regulate boat speed
13224. Entrainment in industrial water intakes
13225. Entrapment by dragheads
132241. & 132251. Investigate and monitor the occurrence of mortality from these factors

13. Mitigate factors affecting estuarine and marine mortality and/or stress.

1311111. Monitor coastal processes of critical habitat area.

Determine the beach dynamics (lateral sand transport, source of beach renourishment, etc.) of critical habitat areas to allow prediction of time necessary for beach rebuilding after destructive effects of sand mining and hurricanes.

131121. Regulate spoil dumping, dredging, seafloor mining, harmful fishing practices and oil spills.

The large industrial complexes upstream from critical habitat require channel dredging, maintenance dredging, and spoil disposal. They also produce large amounts of hot water effluents and occasional oil spills.

A. Prepare a contingency plan between sea turtle programs and existing plans which have been prepared by the industries.

B. Enforce the Virgin Islands Code prohibiting the use of explosives for fishing.

C. Monitor the use of explosives which might occur in the industrial areas.

13211. Promote legal protection throughout the range of the species by means of treaties and conventions or councils shared with other nations

(See section 1.2, and section 4).

132211. Regulate methods, gear, areas and seasons.

There are no known interactions between leatherbacks and fishing gear in the American Caribbean since there is virtually no fixed gear and no towed gear used in the local fisheries. However, interaction with fixed gear such as long lines, pot warps and fish traps have been demonstrated in many other areas, such as New England.

Address the problems on an international scale (see Sec. 13211).

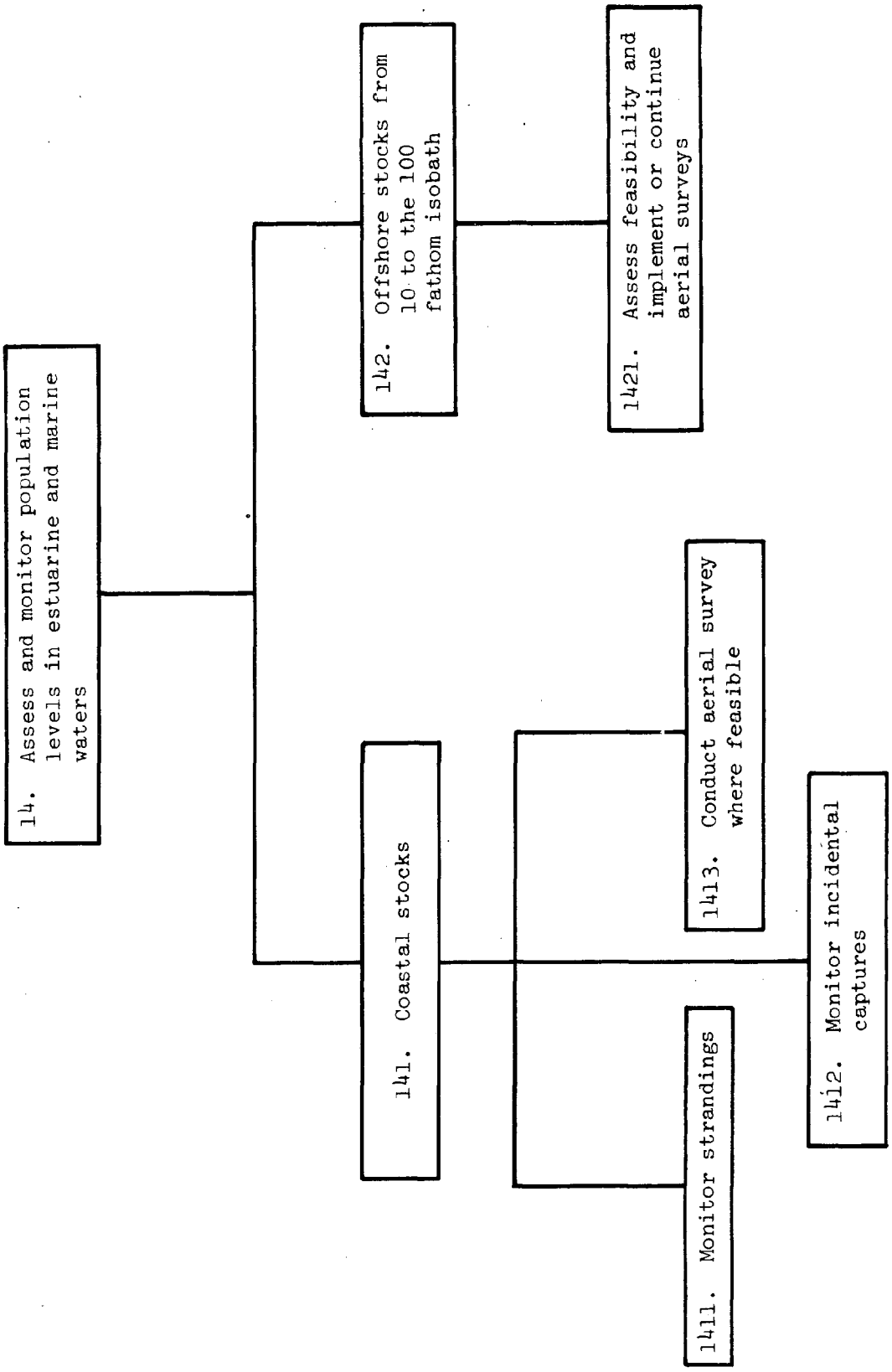
132231. Regulate boat speed.

It is known that boats sometimes kill marine turtles, although incidents involving leatherbacks in the American Caribbean are not documented.

Control the speed of boats within the critical habitat area during the main nesting period.

132241. Investigate and monitor the occurrence of mortality from
& entrainment and entrapment.

132251. Although both industrial water intakes and the use of drag heads exist near the critical habitat, no turtle mortalities from them are documented, but monitoring should take place, as entrainment of live leatherbacks has been reported in Florida.


14. Assess and monitor population levels in estuarine and marine waters
141. Coastal stocks
1411. Monitor strandings
1412. Monitor incidental captures
1413. Conduct aerial survey where feasible
142. Offshore stocks from 10 to the 100 fathom isobath
1421. Assess feasibility and implement or continue aerial surveys

14. Assess and monitor population levels in estuarine and marine waters.

No true estuaries occur in the American Virgin Islands, but some do exist in Puerto Rico. The clarity of the oceanic waters in the region makes the possibility of such monitoring more feasible than in some regions.

1411. Monitor strandings.

Few strandings are observed, but the efforts in sea turtle conservation by FWS/NMFS and local governments should include a system for recording these.

1412. Monitor incidental captures.

There is very little chance that a turtle on-board any boat in the American Caribbean would be there "accidentally."

Enforce laws.

1413. Conduct aerial survey where feasible.

Over much of the region the 10 fathom isobath occurs within a few yards of shore.

A. Evaluate the effectiveness of aerial surveys.

B. Combine all available data sources to quantify and map available feeding areas.

1421. Assess feasibility and continue (or complement) aerial surveys.

The entire shelf area within the 100 fathom isobath occurs within a few miles of shore in the American Caribbean, and it might well be feasible to utilize such means.

Evaluate the data from previous aerial surveys conducted by the government of the Virgin Islands.

Leatherback Implementation Schedule

Section		Lead Agency	Cooperators	Priorities
111111	Manage nesting beaches	FWS	DCCA, NMFS, HOVIC, M/M, DNR	2
111221	Inform and educate beach users and residents	DCCA	DCCA, NMFS, HOVIC, M/M, DNR	2
111222	Control lighting on nesting beaches	DCCA	FWS, NMFS, HOVIC, M/M, DNR	3
1121	Protect during emergences	DCCA	FWS, NMFS	1
11311	Promote legal protection throughout range of the species by encouraging protective management by means of conventions, treaties, or other councils with other nations.	USDOS	FWS, NMFS	1
11321	Provide active law enforcement to protect eggs and adults	FWS	NMFS, DNR, USDOS, DCCA	1
1211	Determine hatching success	DCCA	FWS, NMFS	1
1221	Tag and/or mark adult females	DCCA	FWS, NMFS, DOS	1
1222	Count nests by aerial or ground surveys	DCCA, DNR	FWS, NMFS, DOS	1
1223	Estimate available nesting habitat by analyzing available data and initiating new data gathering methodologies	DCCA, DNR	FWS, NMFS, DOS	1

Section		Lead Agency	Cooperators	Priorities
1311111	Coastal processes of critical habitat area	DCCA, DNR	FWS, NMFS	3
131121	Regulate spoil dumping, dredging seafloor mining harmful fishing practices and oil spills	DCCA, DNR	FWS, NMFS, HOVIC, M/M, ACE, EPA	2
13211	Promote legal protection throughout the range of the species by means of treaties and conventions or councils shared with other nations	USDOS	NMFS, FWS	1
132211	Regulate methods, gear areas and seasons	DCCA, DNR	NMFS, USCG,	4
132231	Regulate boat speed	DCCA, DNR	NMFS, USCG,	4
132241 + 132251	Investigate and monitor the occurance of mortality from entrainment and entrapment	DCCA, EPA, DNR	ACE, I	2
1411	Monitor strandings	FWS, NMFS	DCCA, DNR	4
1412	Monitor incidental captures	DCCA, DNR, NMFS	USCG	3
1413	Conduct aerial survey where feasible	DCCA, DNR	NMFS, FWS, USCG	2
1421	Assess feasibility and continue (or complement) aerial surveys	DCCA, DNR	USCG	4

DEFINITIONS

PRIORITIES ranked 1-4 with 1 being the highest

NMFS = National Marine Fisheries Service

FWS = Fish and Wildlife Service

USCG = U.S. Coast Guard

DCCA = Department Conservation & Cultural Affairs
Virgin Islands Government

DNR = Department of Natural Resources
Government of Puerto Rico

HOVIC= Hess Oil Virgin Islands Corporation

M/M = Martin Marietta

USDOS= U.S. Department of State

ACE = Army Corps of Engineers

USN = U.S. Navy

EPA = Environmental Protection Agency

Explanatory note for nesting distribution maps and tables:

1. Density symbols on maps are based on data through 1980. Additional years of data were added to tables, where possible.
2. Densities which are defined as nests/km on maps should be interpreted as nests/km year. Densities which are defined as Density km in tables should also be interpreted as nest/km year.

TABLE 7. FLORIDA
Leatherback Turtle Nesting Activity

Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Reference and Remarks
Indian River-St. Lucie Co.	1980	36.8	36.8	2	-	Witham (*)
Sebastian Inlet S.P.	1975	13.7	13.7	1	1	Caretta Research, Inc.
Hutchinson Island	1975	36.3	36.3	1	1	Applied Biology, 1979
	1977	36.3	36.3	2	2	"
	1979	36.3	36.3	7	7	"
	1980	11.3	11.3	4	4	Florida DNR, 1980
Hobe Sound NWR	1977	6.4	6.4	4	4	Hobe Sound NWR
	1978	6.4	6.4	2	2	"
Jupiter Island	1979	12.3	12.3	3	3	F. Lund, unpub.
	1980	12.3	12.3	1	1	"
Juno Beach	1979	1.6	1.6	2	2	Florida DNR, 1980
	1980	1.6	1.6	1	1	"
Boca Raton	1977	4.2	4.2	1	1	Wagner, 1978
	1979	4.2	4.2	7	7	Florida DNR, 1980
Lost Tree Village	1980	2.8	2.8	3	3	"

(*) R. Witham, pers. comm. Nest counts every two weeks; not estimated.

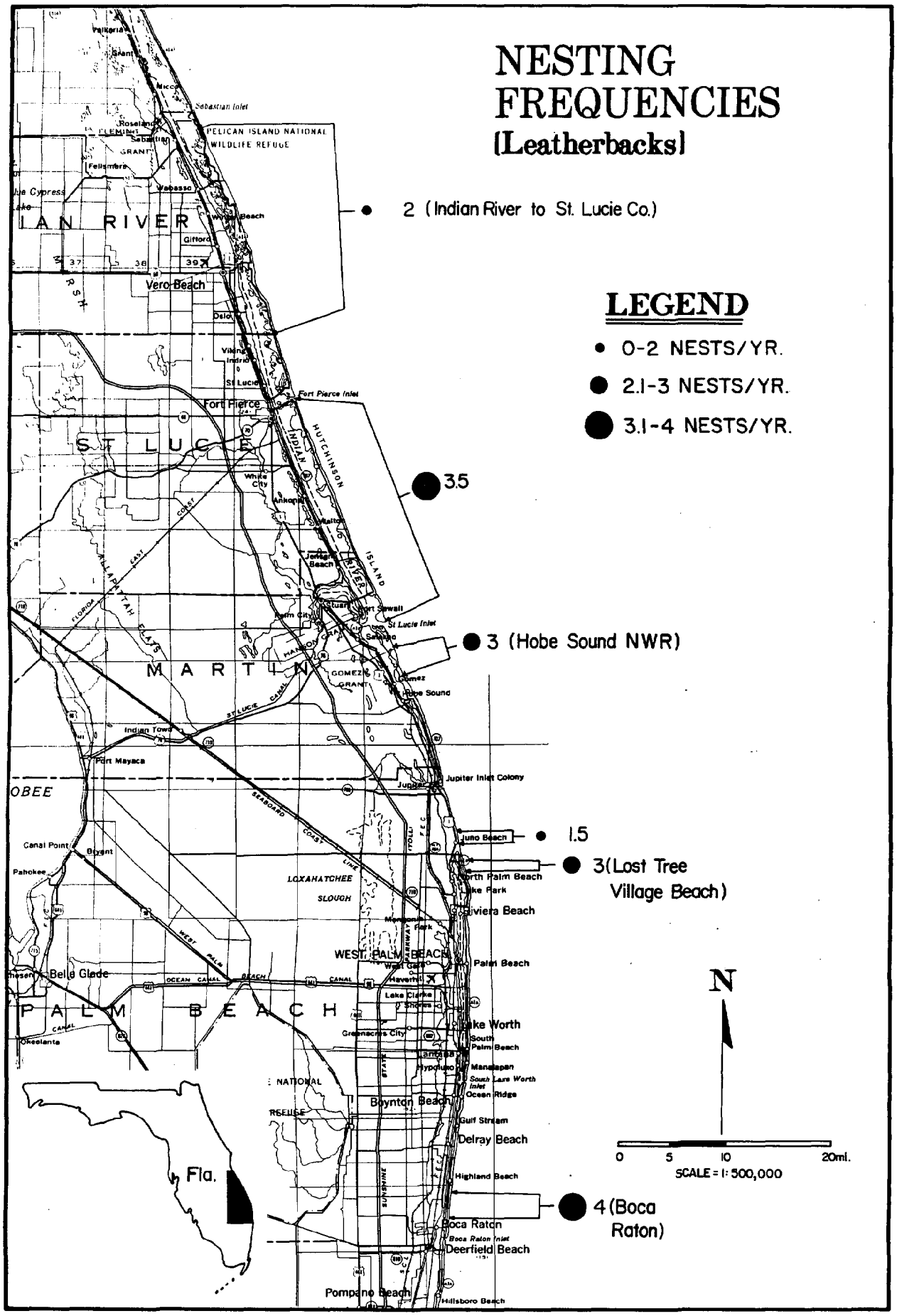

NESTING FREQUENCIES
(Leatherbacks)
2 (Indian River to St. Lucie Co.)
LEGEND
0-2 NESTS/YR.
2.1-3 NESTS/YR.
3.1-4 NESTS/YR.
3.5
3 (Hobe Sound NWR)
1.5
3(Lost Tree Village Beach)
4(Boca Raton)
PELICAN ISLAND NATIONAL WILDLIFE REFUGE
INDIAN RIVER
ST LUCIE
MARTIN
PALM BEACH
OBEE
Vero Beach
Fort Pierce
Fort Pierce Inlet
St Lucie Inlet
Hobe Sound
Jupiter Inlet Colony
Juno Beach
Riviera Beach
WEST PALM BEACH
Palm Beach
Lake Worth
Boynton Beach
Delray Beach
Highland Beach
Boca Raton
Deerfield Beach
Pompano Beach
Hillsboro Beach
Belle Glade
Fla.
N
0 5 10 20mi.
SCALE = 1:500,000

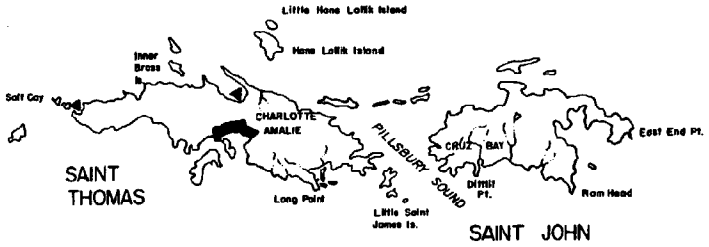
TABLE 8. PUERTO RICO AND U.S. VIRGIN ISLANDS
Leatherback Turtle Nesting Activity

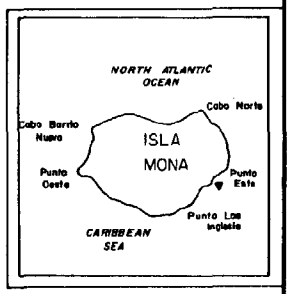
Area	Years	Km of Beach	Km Monitored	# Nest Observed	# Nest Est.	Reference and Remarks
Sandy Point, St. Croix, USVI	1981	2.4	2.4	31	129	Eckert, S.A., et al. 1983
	1982	2.4	2.4	86*	86	"
	1983	2.4	2.4	113*	113	Eckert, S.A., and K.L. Eckert pers. comm.
Playa Brava Culebra NWR	1983	1.6	1.6	37**	-	Caribbean Islands NWR memorandum of 5 Dec. 1983
Playa Resaca Culebra NWR	1983	1.6	1.6	22**	-	"
Isla Mona Puerto Rico***	----	---	---	--	-	Pritchard, P.C.H., pers. comm.
Isle Vieques*** Puerto Rico	----	---	---	--	-	Pritchard, P.C.H., pers. comm.

(*) continuous nightly patrols

(**) 22 daytime patrols distributed from 31 March to 10 July

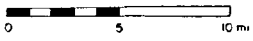
(***) detailed information on nesting is unavailable

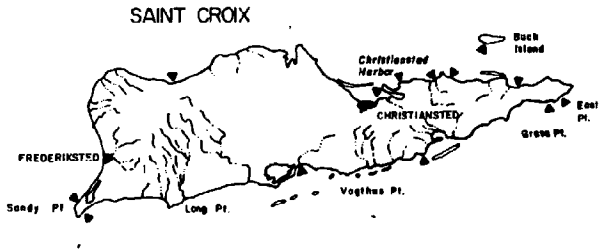




The VIRGIN ISLANDS NESTING LOCATIONS for LEATHERBACKS

N





3.4

HAWKSBILL TURTLE RECOVERY PLAN

Introduction

The hawksbill has a circumglobal distribution, with separate though inadequately defined subspecies occurring in the tropical waters of the Atlantic and Indo-Pacific Oceans, mostly on coral reefs. Within the region, it is extremely rare north of southern Florida.

This small turtle averages about 45 kg when mature and uses its strong, narrow beak to feed on both plant and animal material. Like other marine turtles, it sometimes feeds on jellyfish and often on sponges and other sessile organisms.

The hawksbill, more than any other species, has been implicated in poisonings of people who eat turtle flesh both in the Atlantic and Indo-Pacific regions. The clinical symptoms as well as the temporal and geographic distribution of such outbreaks are very similar to the fish poisoning known as ciguatera. Most researchers hypothesize that some item (algae or sponges) in the diet of the turtle produces the toxin.

Hawksbill migrations are poorly known. Carr and Stancyk (1975) suggest that at Tortuguero beach in Costa Rica the female hawksbill "probably nests at least twice during a given season and then returns to foraging grounds." The scarce data do not permit estimation of the internesting period but do suggest that the period may be more than two weeks, longer than the internesting period of any other sea turtle. Carr's tag recoveries indicate female hawksbills move long distances, but recoveries are too few to answer questions about migrations.

Hawksbills throughout most of their range (at least in the Atlantic subspecies) nest on small islets and on isolated mainland shores. Females may clamber over reefs, rocks or rubble to nest among the roots of trees and bushes on the chosen beach. This isolated nesting offers some degree of protection from predation. Few large, easily discernible nesting colonies are known. Somewhat heightened nesting density, amounting to incipient aggregation, occurs in a few places, such as the San Blas Islands and Bastimento region of Panama (Carr et al., 1982 and Tovar, 1971), islets off the Coast of Nicaragua (Nietschmann and others, pers. comm.), Isla de Pinos, Cuba (Ubeda, 1973), perhaps Mona Island off Puerto Rico (T. Carr, 1974; Jean Thurston, pers. comm.) and the Grenadines (Melvin Goodman and others, pers. comm.). At Tortuguero, Costa Rica, nests are somewhat less frequent than they are to the south between Puerto Limón and the Panamanian border, but the Tortuguero nesting ground is fairly typical of the Caribbean shore as a whole.

The demand for the highly attractive shell is the most serious threat to the hawksbill. The most intensive threat to the hawksbill comes from the harvest of adult hawksbills for the Japanese tortoise shell trade, (T.Carr, 1974). Since 1965, the Japanese imported a minimum of 370,000 kg of hawksbill shell from wider Caribbean countries. Between 1981 and 1983, over 45,000 kg were imported from 21 different countries (see Table 9). Prices paid for preferred shell in Japan have been as high as $225 per kilogram. The shell of one adult hawksbill weighs between 1.5 and 205 kg. A more recent threat comes from the growing curio trade in stuffed juvenile hawksbills.

The meat and eggs of hawksbill are eaten almost everywhere, but it is the international demand for the shell and whole, stuffed specimens that threatens the existence of this species.

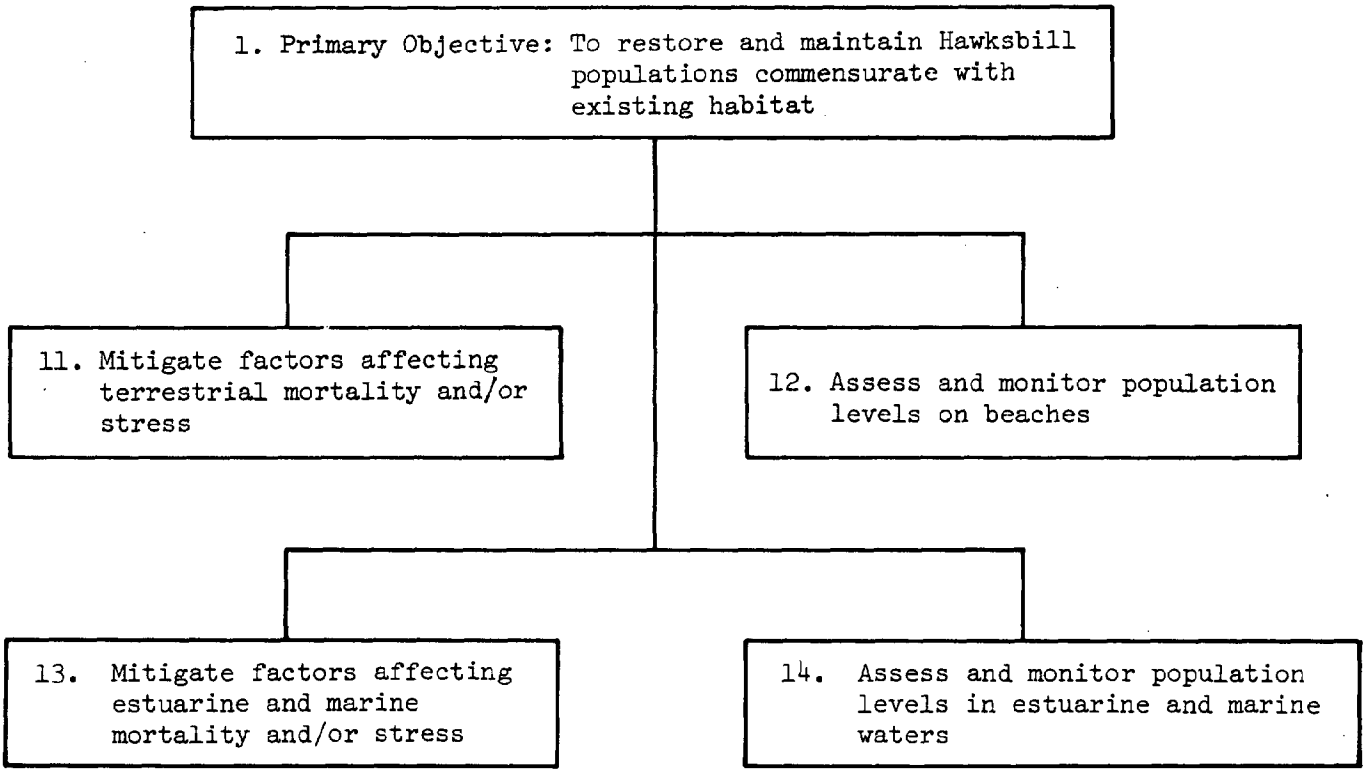
Table 9

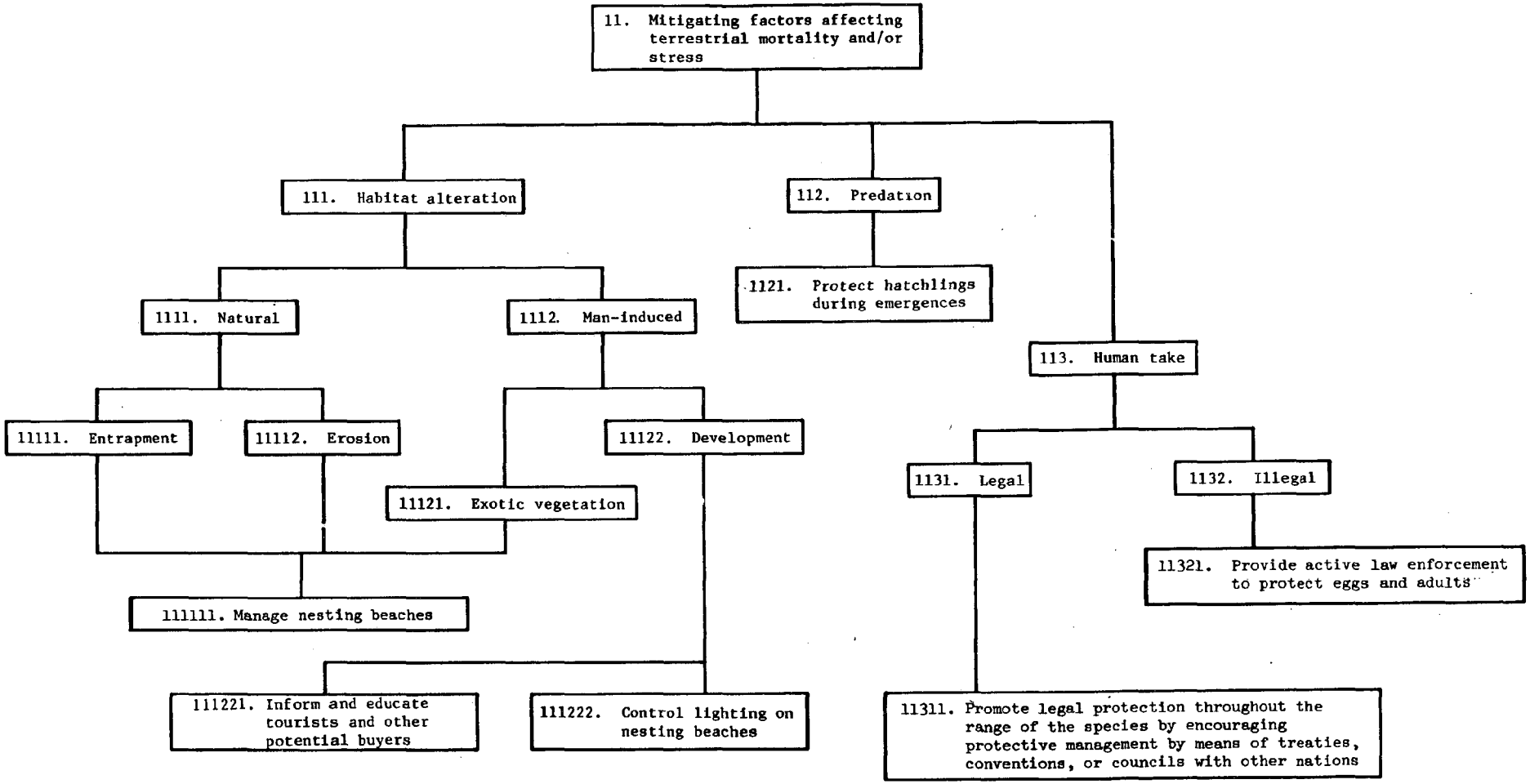
Japanese and West German Imports of Raw Hawksbill Shell
from Wider Caribbean Countries*

	Quantity (kilograms)			
Country of Export	1981	1982	1983	Total
Antigua and Barbuda	0	0	49	49
Bahamas	29	728	0	757
Barbados	0	11	0	11
Belize	0	702	538	1,240
Cayman Islands	3,022	2,258	0	5,280
Dominica	60	39	40	139
Costa Rica	234	79	5	318
Cuba	2,650	6,933	5,017	14,600
Dominican Republic	357	872	248	1,477
Fr. West Indies	231	215	0	446
Grenada	7	0	0	7
Haiti	892	1,188	1,788	3,868
Honduras	481	636	1,886	3,003
Jamaica	487	1,652	709	2,848
Mexico	0	0	36	36
Nicaragua	475	417	0	892
Panama	3,011	2,243	3,889	9,143
St. Lucia	267	270	362	899
St. Vincent	4	85	108	197
Trinidad	0	0	329	329
United States	0	0	22	22
Total	12,207	18,328	15,026	45,561

*Sources: Boeki Geppyo, Ministry of Finance, Japan
1981 and 1982 West German CITES Annual Report**

** 1981 West German CITES Annual Report listed imports of 4 kg. from St. Vincent and 68 kg. from Jamaica.
1982 West German CITES Annual Report listed imports of 49 Kg. from St. Vincent and 153 kg. from West Germany.


1. Primary Objective: To restore and maintain Hawksbill populations commensurate with existing habitat
11. Mitigate factors affecting terrestrial mortality and/or stress
12. Assess and monitor population levels on beaches
13. Mitigate factors affecting estuarine and marine mortality and/or stress
14. Assess and monitor population levels in estuarine and marine waters


11. Mitigating factors affecting terrestrial mortality and/or stress
111. Habitat alteration
112. Predation
113. Human take
1111. Natural
1112. Man-induced
1121. Protect hatchlings during emergences
11111. Entrapment
11112. Erosion
11121. Exotic vegetation
11122. Development
1131. Legal
1132. Illegal
11321. Provide active law enforcement to protect eggs and adults
111111. Manage nesting beaches
111221. Inform and educate tourists and other potential buyers
111222. Control lighting on nesting beaches
11311. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, conventions, or councils with other nations

HAWKSBILL STEPDOWN PLAN

1. Primary Objective: To restore and maintain hawksbill populations commensurate with existing habitat.

   The attainment of this objective requires the following information: 1) The amount of existing habitat in terms of feeding areas and/or nesting areas, 2) the carrying capacity of the habitat and 3) population estimates that indicate the relationship of populations to the habitat.

11. Mitigate factors affecting terrestrial mortality and/or stress.

111111. Manage nesting beaches.

   Hawksbills probably are naturally resilient to entrapment, erosion and other natural habitat alterative factors.

   Monitor the extent to which entrapment and erosion occur in a manner that affects the hawksbill.

111221. Inform and educate tourists and other potential buyers.

   (See section 2.7).

111222. Control lighting on nesting beaches.

   (See leatherback step 111222).

1121. Protect hatchlings with beach patrols during emergences.

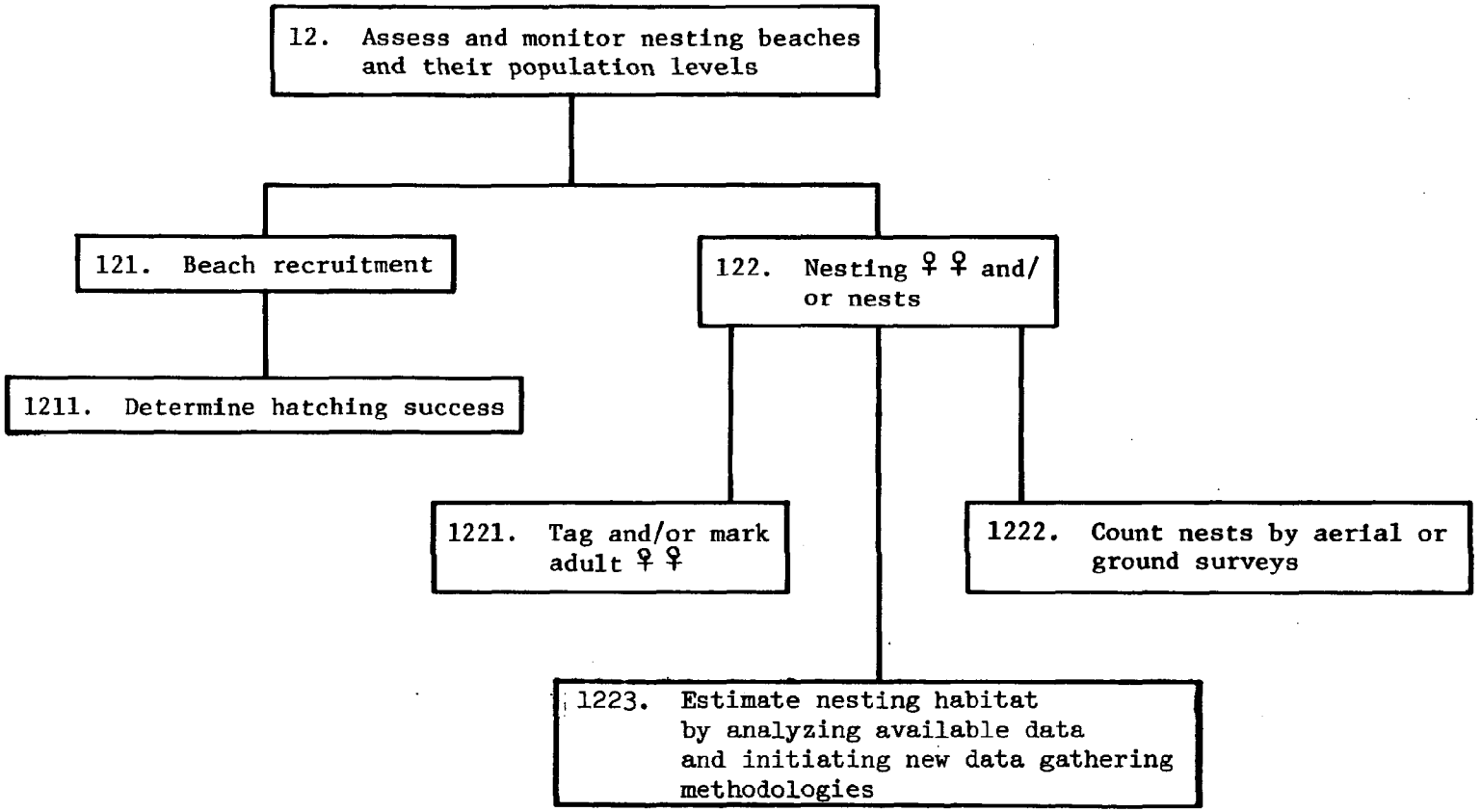
   (See leatherback step 1121).

11311. International Efforts.

Human take is the single most devastating factor in the decimation of hawksbills. The economic value of its shell is such that controlling its commercialization in foreign countries will be even more difficult than controlling the poaching of ivory (see sections 1.2, 2.7, 2.8 and 4).

11321. Provide active law enforcement to protect eggs and adults.

In Puerto Rico and the U.S. Virgin Islands, as well as the continental U.S., local enforcement officers are well equipped to cooperate with Fish and Wildlife Service and National Marine Fisheries Service special agents in the field. The most important and cost effective protection can be provided by U.S. Customs Agents. In areas which are not under the U.S. jurisdiction, the problems are much more complex and must be solved through regular diplomatic channels.


12. Assess and monitor nesting beaches and their population levels
121. Beach recruitment
1211. Determine hatching success
122. Nesting ♀♀ and/or nests
1221. Tag and/or mark adult ♀♀
1222. Count nests by aerial or ground surveys
1223. Estimate nesting habitat by analyzing available data and initiating new data gathering methodologies

12. Assess and Monitor Nesting Beaches and Their Population Levels.

1211. Determine hatching success.

A. Select certain "indicator" sites where resources exist to carry out long range monitoring programs in the American Caribbean and at Tortuguero (Costa Rica).

B. Incorporate monitoring efforts with research programs in the American Caribbean and at Tortuguero and Panama.

1221. Tag and/or mark adult females.

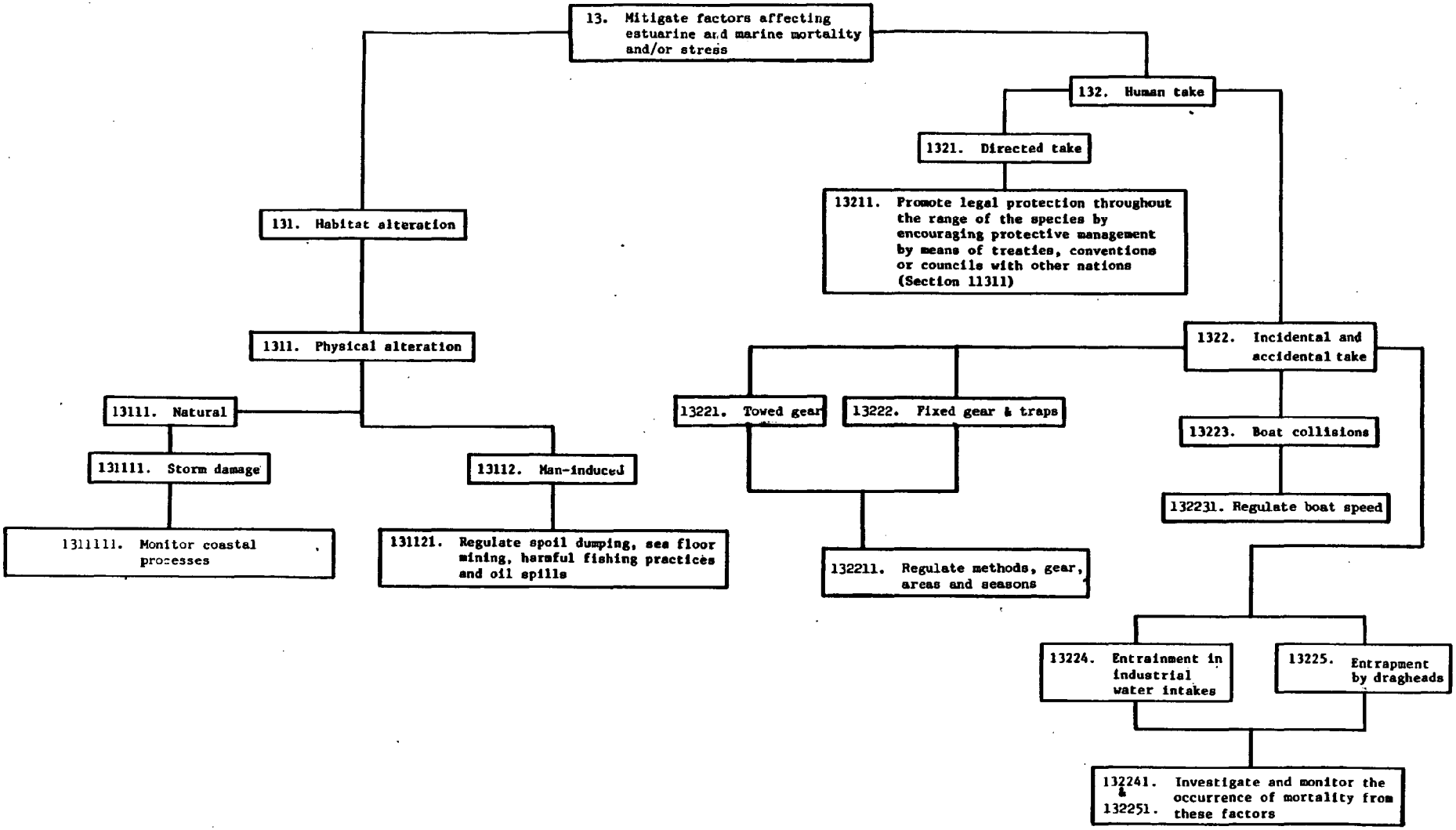
(See 1211 above).

1222. Count nests by aerial or ground surveys.

1223. Estimate available nesting habitat by analyzing available data and initiating new data gathering methodologies.

A. Gather statistical information through international conferences.

B. Investigate remote sensing techniques (satellite and aircraft) to inventory habitat.


13. Mitigate factors affecting estuarine and marine mortality and/or stress
131. Habitat alteration
1311. Physical alteration
13111. Natural
131111. Storm damage
1311111. Monitor coastal processes
13112. Man-induced
131121. Regulate spoil dumping, sea floor mining, harmful fishing practices and oil spills
132. Human take
1321. Directed take
13211. Promote legal protection throughout the range of the species by encouraging protective management by means of treaties, conventions or councils with other nations (Section 11311)
1322. Incidental and accidental take
13221. Towed gear
13222. Fixed gear & traps
132211. Regulate methods, gear, areas and seasons
13223. Boat collisions
132231. Regulate boat speed
13224. Entrainment in industrial water intakes
13225. Entrapment by dragheads
132241. & 132251. Investigate and monitor the occurrence of mortality from these factors

13. Mitigate factors affecting estuarine and marine mortality and/or stress.

1311111. Monitor coastal processes affecting critical habitat areas.

See leatherback section 1311111.

131121. Regulate spoil dumping, seafloor mining, harmful fishing practices and oil spills.

(See leatherback step 131121).

13211. Enhance local law enforcement efforts and promote legal protection throughout the range of the species by means of treaties and conventions or councils with other nations.

Taking of hawksbill for shell products is the most serious factor in the depletion of this species. In much of its range, its economic value is a major component of fishing efforts. In the American Caribbean, the high value of the shell encourages poaching and smuggling. The nearby non-U.S. islands offer easy markets for illegal shell (see sections 1.2, 2.8 and 4).

132211. Regulate methods, gear, areas and seasons.

A. Investigate incidental catch and other potential losses.

B. Take appropriate actions at local and international levels, as needed.

132231. Regulate boat speed.

Sea turtles are sometimes killed in nearshore waters.

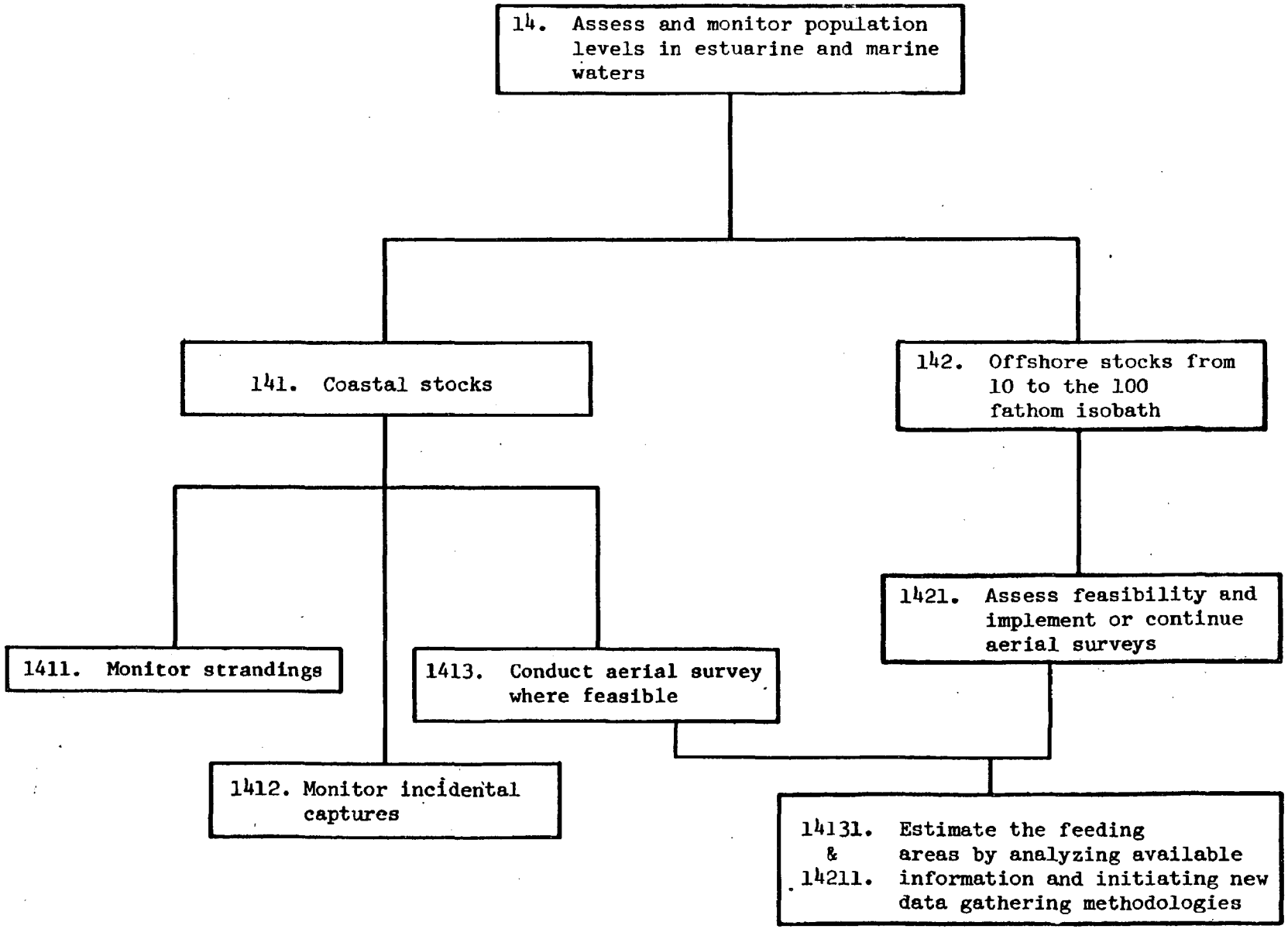
Enforce harbour and inland water regulations on boat speeds.

132241. Investigate and monitor the occurrence of mortality from

\+ entrainment and entrapment.

132251. All states with approved Coastal Zone Management Plans should investigate entrainment and entrapment.

Modify structural designs and initiate control measures, as needed.


14. Assess and monitor population levels in estuarine and marine waters
141. Coastal stocks
142. Offshore stocks from 10 to the 100 fathom isobath
1411. Monitor strandings
1412. Monitor incidental captures
1413. Conduct aerial survey where feasible
1421. Assess feasibility and implement or continue aerial surveys
14131. & 14211. Estimate the feeding areas by analyzing available information and initiating new data gathering methodologies

14. Assess and monitor population levels in estuarine and marine waters.

1411. Determine the need to monitor strandings.

1412. Determine the need to monitor incidental captures.

1413. Conduct surveys if feasible.

Of all marine turtle species this one offers the best chance for such assessment and monitoring. The shallow reef habitat and unusual clarity of reef waters, coupled with narrow insular shelves, lend themselves to the possibility of assessment from the air and in estuarine and marine waters, particularly the reefs off West Palm Beach, Florida, the waters off Mona Island, Puerto Rico, and the Magens Bay area off Saint Thomas in the U.S. Virgin Islands (see step 1223 and leatherback plan).

1421. Assess feasibility and implement or continue aerial surveys (see leatherback steps 1413 and 1421).

14131 + 14211. Estimate the feeding areas by analyzing available information and initiating new data gathering methodologies.

Hawksbill Implementation Schedule

Section		Lead Agency	Cooperators	Priorities
111111	Manage nesting beaches	FWS	DCCA, DNR, HOVIC, M/M	4
111221	Inform and educate tourists and other potential buyers	FWS	NMFS, DCCA, DNR, HOVIC/ DOS, M/M	1
111222	Control lighting on nesting beaches	FWS	NMFS, DCCA, DNR, HOVIC DOS, M/M	3
1121	Protect hatchlings with beach patrols during emergencies	FWS	NMFS, DCCA, DNR, DOS	1
11311	International efforts	DOS	NMFS-FWS	1
11321	Provide active law enforcement to protect eggs and adults	FWS	NMFS-DCCA, DNR, DOS	1
1211	Determine hatching success	FWS	NMFS-DCCA, DNR-DOS	1
1221	Tag and/or mark adult females	FWS	NMFS-DCCA, DNR-DOS	1
1222	Count nests by aerial or ground surveys	NMFS	FWS-DCCA, DNR-DOS	1
1223	Estimate available nesting habitat by analyzing available data and initiating new data gathering methodologies	NMFS	FWS-DCCA, DNR-DOS	1
1311111	Monitor coastal processes affecting critical habitat areas.	NMFS	FWS-DCCA, DNR	3

131121	Regulate spoil dumping, seafloor mining, harmful fishing practices and oil spills	DCCA-DNR	NMFS-ACE	2
13211	Enhance local law enforcement efforts and promote legal protection	DOS	NMFS-FWS	1
132211	Regulate methods, gear, areas and seasons	NMFS	DCCA-FWS	4
132231	Regulate boat speed	NMFS	DCCA-FWS	4
132241	Investigate and monitor the occurrence of mortality from entrainment & entrapment	NMFS	DCCA, DNR, ACE	4
1411	Determine the need to monitor strandings	NMFS	DCCA-DNR	4
1412	Determine the need to monitor incidental captures	NMFS	DCCA-DNR, DOS	4
1413	Conduct surveys if feasible	NMFS	DCCA-DNR, DOS	1
1421	Assess feasibility and implement or continue aerial surveys	NMFS	DCCA-DNR,DOS	1
14131 + 14211	Estimate Feeding Areas	NMFS	DCCA-DNR, DOS	3

Acronyms

PRIORITIES ranked 1-4 with 1 being the highest.

NMFS = National Marine Fisheries Service

FWS = Fish and Wildlife Service

USCG = U.S. Coast Guard

DCCA = Department Conservation & Cultural Affairs
Virgin Islands Government

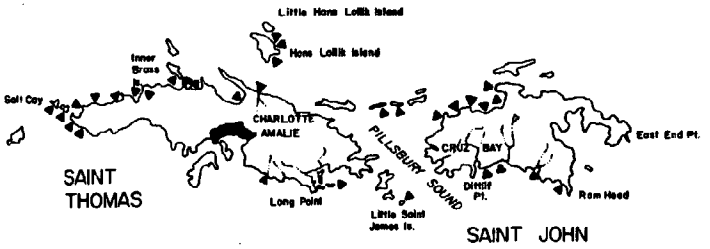
DNR = Department of Natural Resources
Government of Puerto Rico

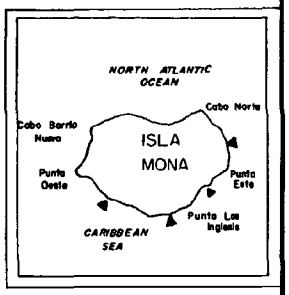
HOVIC = Hess Oil Virgin Islands Corporation

M/M = Martin Marietta

DOS = U.S. Department of State

ACE = Army Corps Engineers





The VIRGIN ISLANDS NESTING LOCATIONS for HAWKSBILLS

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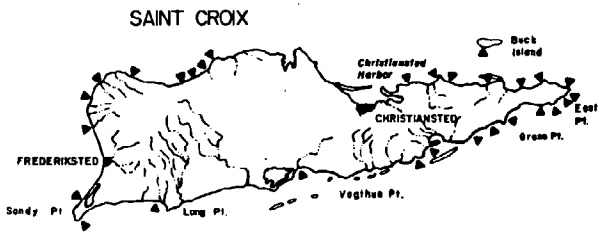
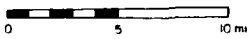




3.5

KEMP'S RIDLEY TURTLE RECOVERY PLAN

Introduction

Nesting Kemp's ridleys concentrate at a single beach. This beach is adjacent to Barra Coma, a sandbar on the coast of the Mexican State of Tamaulipas near the village of Rancho Nuevo, Municipio de Aldama. Almost the entire reproductive effort of Kemp's ridley occurs within four miles north and one mile south of Barra Coma. The location of the nesting beach at Rancho Nuevo is 23°10'00" to 23°18'10" north, 97°45'30" to 97°45'45" west.

Records of nesting away from this area are rare. However, a few individuals have nested on Padre Island, Texas (e.g. Werler 1951), and Carr (1961) reported sporadic nesting in the vicinity of Alvarado, Nautla, Anton Lizardo, and Montepio, Veracruz, Mexico. Even though an individual, tagged while nesting at Rancho Nuevo on 28 May 1966, atypically nested again on 16 June 1971 at Playa de Guachaca, Colombia (Chavez and Kaufmann, 1974), there is considerable doubt about this record and the nesting range of Kemp's ridley undoubtedly is effectively limited to the immediate vicinity of Rancho Nuevo, Tamaulipas, Mexico as described above. No concrete data indicate that Kemp's ridleys ever nested except rarely at Padre Island; however, Hildebrand (pers. comm.) reported unsubstantiated rumors of aggregated nesting at that location around the turn of the century. In exceptional years, when the population of this species numbered at least in the tens of thousands, sections of the main nesting aggregation--or even the entire aggregation--possibly responded to unusual current or climatic conditions or simply missed the usual cues and beached on Padre Island. However, Padre Island probably never harbored a discrete nesting colony genetically isolated from the group that nests near Rancho Nuevo.

The abiotic environment of the nesting beach appears conducive to nesting success. In a few areas, turtles probably encounter and have difficulty ascending low cliffs. Some parts of the beach are scattered with small rocks and boulders, but these are minor factors and probably never prevent eventual egg laying. Similarly, the offshore environment appears satisfactory. The beach is generally stable, and loss of eggs by erosion is not known.

The vegetation of the berm of the nesting beach at Rancho Nuevo consists of railroad vine (Ipomoea) and other primary succession species. The dune itself is well vegetated with a climax community of shrubs, scrub and some small trees. However, neither berm nor dune vegetation appears to hinder nesting turtles.

No data are available on destruction of Lepidochelys nests by excessive rainfall or saltwater inundation at Rancho Nuevo, but hurricane generated tides flooded the hatcheries in 1982 and 1983. Mexican conservation crews have at times felt that eggs in the kempi hatchery were liable to suffer from dehydration when surface sand became exceedingly desiccated during drought conditions, and in some cases applied fresh water to the sand surface to remedy this. But both the problem and the solution were intuitive rather than demonstrable.

The two primary biotic factors affecting the nesting success of turtles on the beach are: 1) egg predation, especially by coyotes (Canis latrans) and 2) egg predation by humans. Efforts to mitigate both of these factors began about 1965. Since 1978 U.S. personnel and equipment have assisted with these efforts. If a nest is not translocated to the protected hatchery area, one of these predators is

likely to destroy the nest. However, under appropriate wind conditions, some natural nests survive at Rancho Nuevo. For example, in 1979, 23 nests could not be located for transplant and apparently were not destroyed by predators.

Rancho Nuevo is a wilderness beach, so there are no problems with beach clean-up equipment, beach nourishment or human foot traffic. Under the present management policies of moving eggs, problems with roots of plants encroaching on nest cavities, or nest destruction by later nesting turtles, do not arise. Presently there are no buildings on the beachfront except the turtle conservation camp at Barra Coma, situated behind a high sand dune. Agricultural practices, grazing and charcoal burning near the beach have not affected the suitability of the beach for turtle nesting. Cattle walking on the beach, however, may represent a sporadic or localized effect to nests still in situ.

The present management technique of moving eggs to a protected hatchery and maintaining beach patrols every day of the season appears to be adequate, but such measures cannot be relaxed in the foreseeable future. For example, when observers were late getting to the beach in 1983, poaching again became a problem until the patrols were set up and aerial flights were again used to monitor the beach.

Juveniles of Kemp's ridley are more often seen in U.S. waters than the adults. Indeed, for many years only subadults were known to the scientific world. Young Kemp's ridleys are sometimes lost when

they fail to remain in or close to the Gulf Stream and drift across the Atlantic, where they may be washed up on the shore of Ireland, Great Britain, and northern Europe (Brongersma, 1972). Such individuals probably never return to the breeding population, and although live specimens are sometimes found, the majority are feeble or dying, particularly in the winter months. Some areas of regular occurrence of juvenile Kemp's ridley in U.S. waters are known, but this phase of the life history requires extensive further investigation.

Juvenile and subadult Kemp's ridleys may die during cold spells, though quantitative information on natural cold-stunning on this is not currently available. However, Ehrhart (in press) documents the hypothermic stunning of two Kemp's Ridleys, in Banana River and Mosquito Lagoon, Florida, in 1977 and 1981. Lazell (1976) attributes mortality of several juvenile ridleys in New England waters to trawler drownings, and Carr (1957) mentions a virtual hegira of subadult ridleys from Vineyard Sound in the 1930s, dozens of which died on Woods Hole beaches.

Juvenile ridleys probably are caught regularly by shrimpers, but recent data on this are hard to quantify since shrimpers stand in violation of the law even if they catch a ridley accidentally. Offshore essential habitat--a "no-trawling zone"--is vitally important. Such a zone was declared off of Rancho Nuevo in 1978, but its limits were arbitrary and violated frequently. Fewer trawlers have been seen in recent years, a probable reflection of economic conditions.

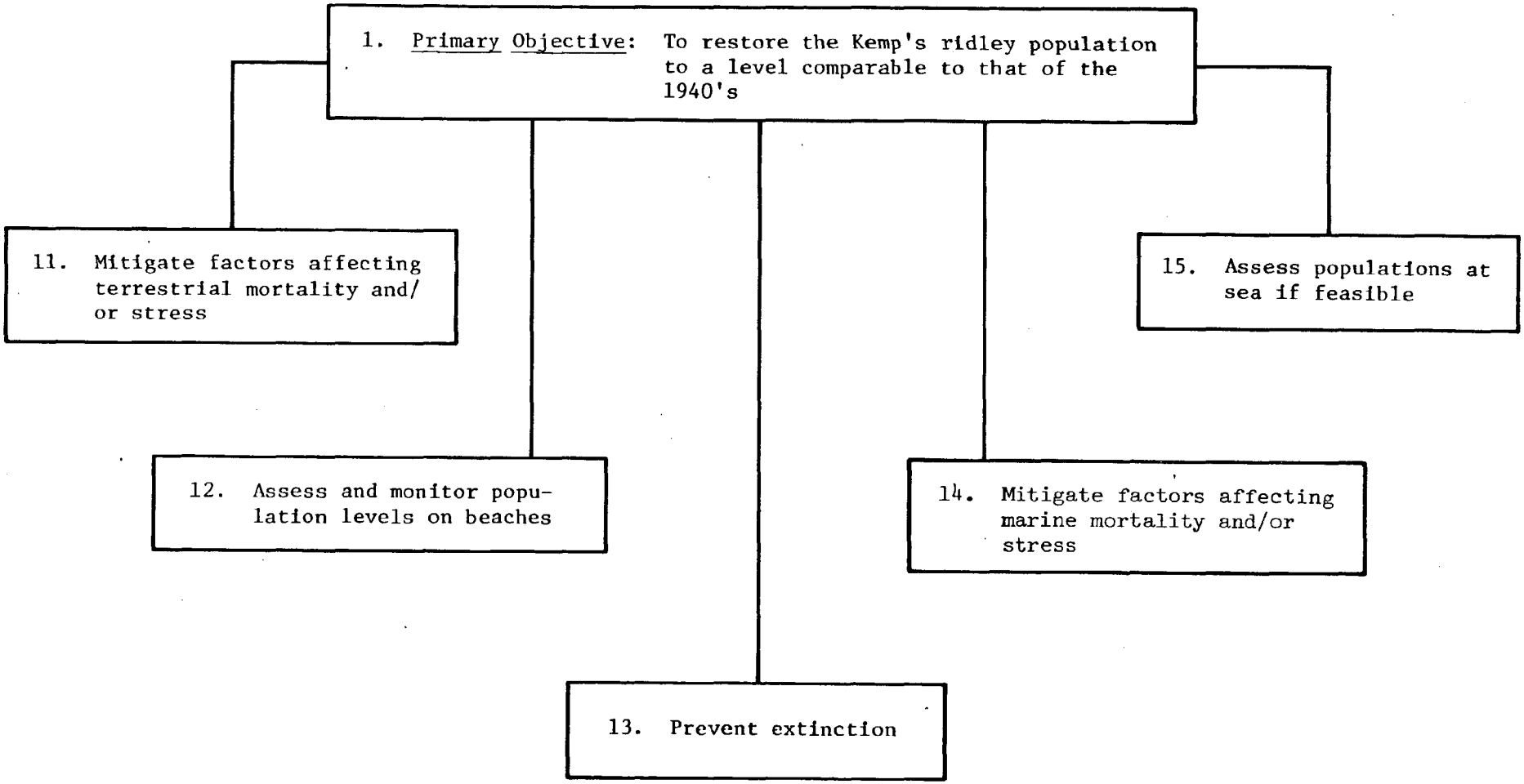
Lepidochelys kempi enjoys complete legal protection in both countries in which it occurs (Mexico and the United States). Stray individuals may be found in other countries. However, these are never adult, are few in number, and probably are irrelevant to the overall species and its survival.

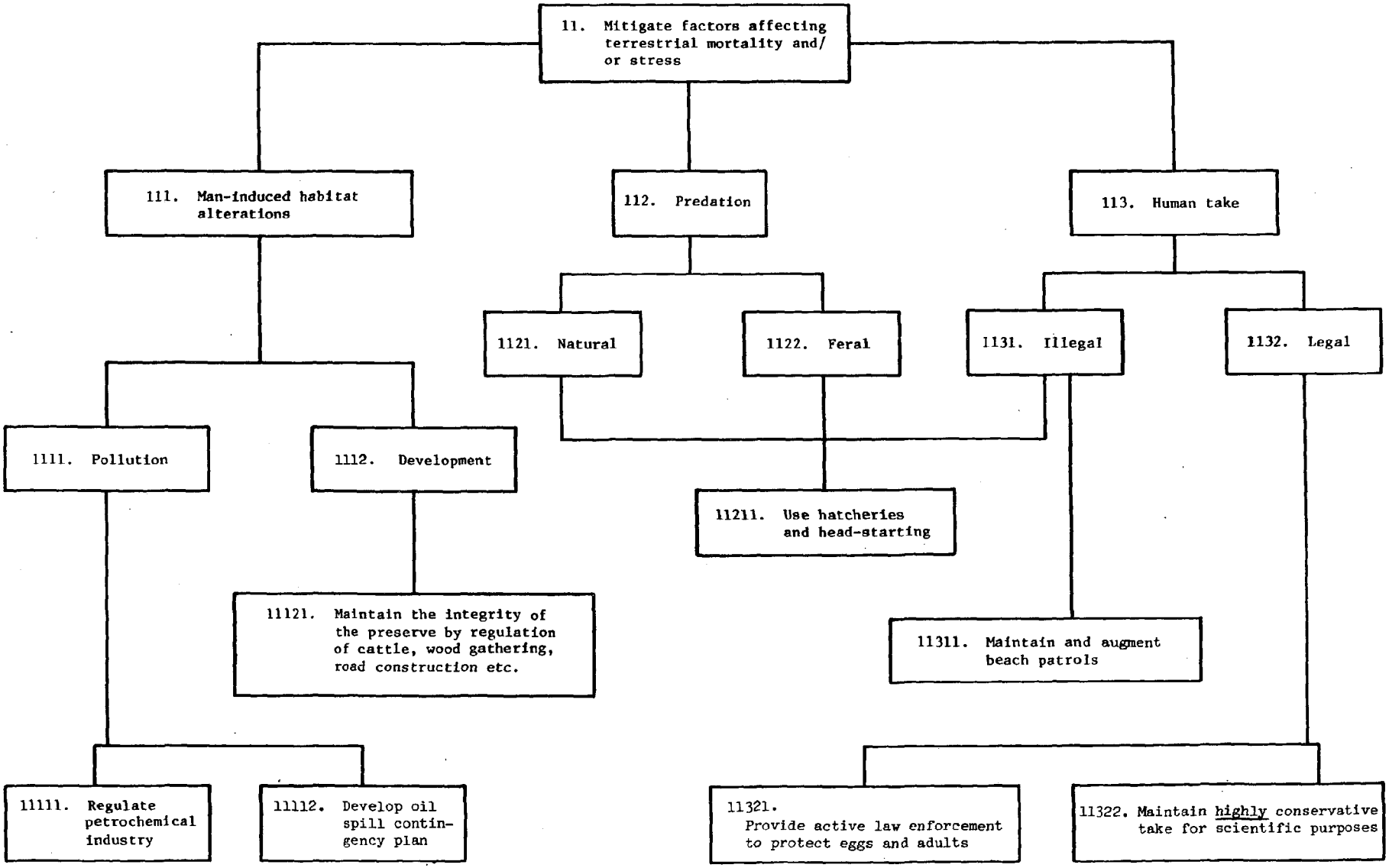
Since the sole nesting beach at Rancho Nuevo is patrolled, poaching of nesting turtles is rare. However, a few individuals, possibly totaling less than ten altogether, were taken by poachers on the beach during the 1978-1979 seasons. Adults of kempi also may be sold in very small numbers in markets of cities along the Gulf Coast, e.g., Ciudad del Carmen, Campeche. Nevertheless, the directed catch of adult kempi appears extremely low. Few individuals have been found dead of natural causes on the beach at Rancho Nuevo. Natural but undocumented predation on the adult turtles doubtlessly occurs. Probably the greatest documented loss of adults in recent years has been accidental drowning in shrimp trawls. Recent trawl captures of tagged ridleys have not been published, but data as of 1973 are summarized by Pritchard and Márquez (1973) and Márquez (pers. comm.).

The Mexican equivalent of Critical Habitat Designation would be important for future protection of both the Rancho Nuevo nesting beach and offshore waters. A proposal of this kind was made by Rene Marquez, head of the Mexican turtle conservation program, in 1976. Its current status and enforceability need clarification.

Tag returns have shown that the coast of Campeche, Mexico, is an important destination for post-nesting Kemp's ridleys. The catastrophic blow-out of the offshore oilwell IXTOC 1 in 1979 may have caused serious negative impact upon adult Kemp's ridleys either returning from Rancho Nuevo or resident there throughout a nonbreeding year. However, documentation of this is lacking.

Since the present document will not be updated annually, the Kemp's ridley recovery plan described on pages 226, et. seq., describes recovery actions in relatively general terms. It is included primarily to describe actions already started under binational agreements between U.S. and Mexican agencies, and to establish a policy framework under whose aegis a binational committee will prepare detailed work plans each year for restoration of this critically endangered species.


1. Primary Objective: To restore the Kemp's ridley population to a level comparable to that of the 1940's
11. Mitigate factors affecting terrestrial mortality and/or stress
12. Assess and monitor population levels on beaches
13. Prevent extinction
14. Mitigate factors affecting marine mortality and/or stress
15. Assess populations at sea if feasible


11. Mitigate factors affecting terrestrial mortality and/ or stress
111. Man-induced habitat alterations
112. Predation
113. Human take
1121. Natural
1122. Feral
1131. Illegal
1132. Legal
1111. Pollution
1112. Development
11211. Use hatcheries and head-starting
11121. Maintain the integrity of the preserve by regulation of cattle, wood gathering, road construction etc.
11311. Maintain and augment beach patrols
11111. Regulate petrochemical industry
11112. Develop oil spill contingency plan
11321. Provide active law enforcement to protect eggs and adults
11322. Maintain highly conservative take for scientific purposes

Kemp's Ridley - Stepdown Plan

Recognizing that Kemp's Ridley nests entirely within the Mexican jurisdictional area, the following recommendations are made in hopes of furthering the on-going Mexican-American cooperative activities.

1. Primary Objective: To restore the Kemp's ridley populations to a level comparable to that of the 1940s.

   The decline of Kemp's ridley, from an estimated 40,000 turtles in one nesting arribada in 1947 to approximately 1000 nests per season at present, is more clearly defined than that of any other sea turtle species. The objective is therefore to restore the population to a level comparable with that observed in the photographically documented nesting group of June 18, 1947.

11. Mitigate factors affecting terrestrial mortality and/or stress.

11111. Regulate petrochemical industry (see loggerhead step 111211).

11112. Develop oil spill contingency plan.

   The IXTOC I oil spill in 1979 demonstrated the susceptibility of the Rancho Nuevo nesting beach to oil pollution. Measures to prevent recurrence of such an event, plus maintenance of clean-up and "turtle rescue," are vital.

   A. Develop contingency plan for transferring nests to clean sand areas or artificial incubation in the event of a major oil spill at Rancho Nuevo.

   B. Develop contingency plans for protected captive maintenance or air-lifting of hatchlings to clean release areas.

11121. Encourage the regulation of cattle, wood gathering and road construction, and maintain the integrity of the preserve.

The Rancho Nuevo nesting site is free of any form of beach-front development, and none is foreseen in the immediate future since the beach and its vicinity currently have reserve status.

A. Recommend posting the reserve area.

B. Eliminate habitat destruction of the dunes and adjacent land areas by prohibiting herding cattle on the beach during the nesting season.

C. Discourage access to the beach by eliminating road improvements.

11211. Use hatcheries and head-starting.

There is intensive predatory pressure on ridley eggs at Rancho Nuevo from coyotes, other animal predators, and local people.

A. Continue egg transfers to safe nesting sites (either a beach hatchery or to incubation boxes) until natural nests can be protected in situ.

B. Determine sex ratios to evaluate hatchery techniques by minimizing destructive sampling and/or rearing captive animals.

C. Continue headstarting program with a percentage of the annual production from Rancho Nuevo (5% or less).

11311. Maintain and augment beach patrols.

Poaching pressures are such that a single season's laxity in patrols would be a serious setback to the restoration effort.

A. Maintain a thorough patrol of the beach through binational efforts.

B. Utilize aircraft to spot single or grouped nesting turtles well away from the main beach.

11321. Maintain total ban on commercial, recreational or subsistence take.

Both the United States and Mexico currently offer total legal protection to Kemp's ridley.

Continue ban on all types of take.

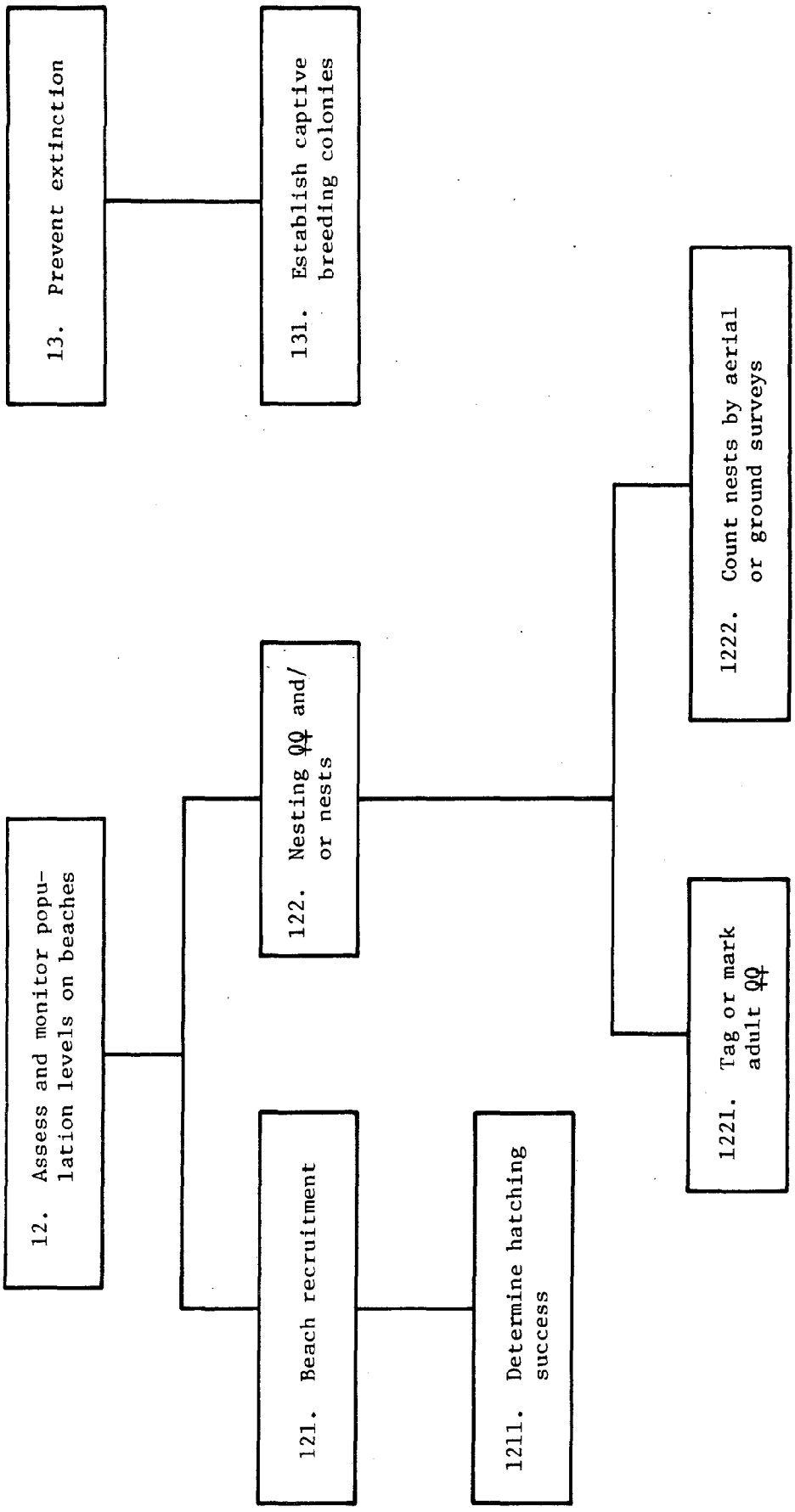
11322. Maintain highly conservative take for scientific purposes.

While certain experiments on Kemp's ridley that have relevance to the development of restoration techniques should be permitted, issue of such permits should be extremely conservative.

A. Maintain tight control of numbers of hatchlings submitted to "head-starting".

B. Restrict biochemical studies on adult turtles to the careful extraction of fluid samples from live animals by highly skilled personnel.

C. Prohibit experiments on this species that do not have a direct or indirect relevance to development of recovery techniques.


13. Prevent extinction
131. Establish captive breeding colonies
12. Assess and monitor population levels on beaches
122. Nesting ♀♀ and/or nests
1222. Count nests by aerial or ground surveys
1221. Tag or mark adult ♀♀
121. Beach recruitment
1211. Determine hatching success

12. Assess and monitor population levels on beaches.

Monitoring of all aspects of the terrestrial activities of Kemp's ridley on the nesting beach at Rancho Nuevo, Tamaulipas, Mexico, must be continued.

1211. Determine hatching success.

Monitor nests annually as an index to the population and to quantify productivity by hatching success.

1221. Tag or mark adult females.

Monitor the number of different females tagged each season as an index to the population.

1222. Count nests by aerial or ground surveys.

A. Record nestings away from the Rancho Nuevo environs.

B. Conduct interviews regularly with residents of western Gulf shores from Padre Island, Texas, south to southern Veracruz.

C. Survey by aircraft during the nesting season (mid-April to late June) to document additional nesting or strandings.

13. Prevent extinction.

131. Establish captive breeding colonies.

Kemp's ridley is the one sea turtle species that is now so rare and so localized in its breeding habits, that the possibility of total extinction of the wild population cannot be discounted.

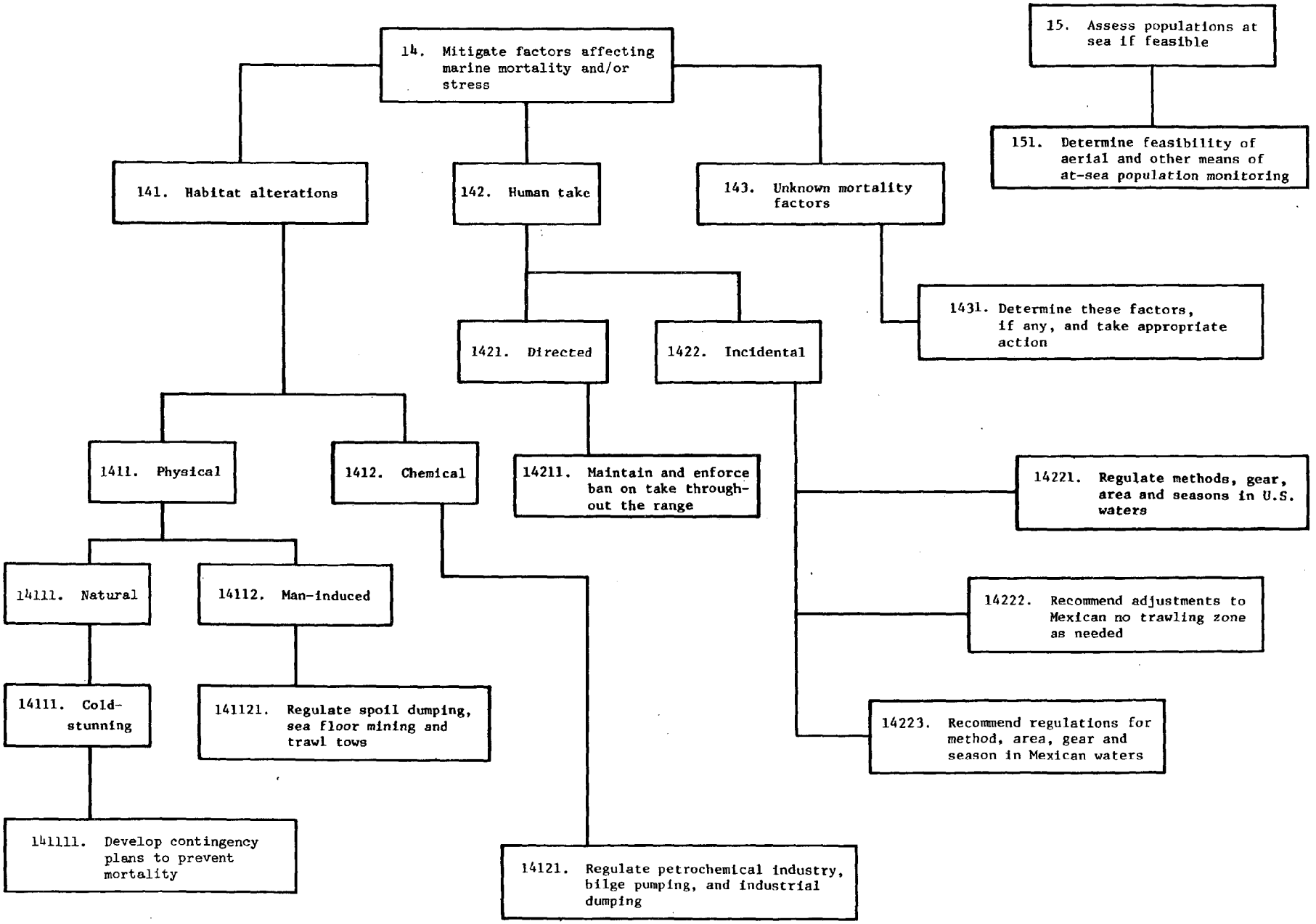
The closed-cycle captive-breeding project for the Kemp's ridley is considered to be a priority 1 activity in view of the extremely depleted status of this species and the impossibility of offering the wild stock adequate protection except while the adults are actually on the nesting beach. Despite full legal protection by both the United States and Mexico, factors such as incidental catch, the IXTOC oil spill, and other stresses make the future of the species questionable even if the beach patrols result in good protection of both nesting turtles and their eggs.

Because of the prolific nature of sea turtles, initial stock for captive breeding can be obtained with minimal impact upon wild populations by taking hatchlings rather than adults, and perfecting captive culture techniques as these hatchlings mature. Various options are available once the colony starts to produce fertile eggs. These can be hatched and the young raised in captivity; they can be hatched and the young released either immediately or head-started before release; or the eggs can be taken to the natural nesting beach at Rancho Nuevo before they hatch so the young turtles can enter their natural post-hatching ecosystem immediately, and presumably

follow normal developmental movements and habitat changes subsequently. Even with relatively few captive-produced nests annually, it may be possible to pursue each of these different options simultaneously.

A. Establish captive breeding colonies at suitable facilities provided with aquatic and artificial nesting beach facilities, expert curatorial personnel, and prospects of long-term existence.

B. Utilize existing captive animals or modest numbers of wild hatchlings or head-started animals for initial stock.


14. Mitigate factors affecting marine mortality and/or stress
15. Assess populations at sea if feasible
151. Determine feasibility of aerial and other means of at-sea population monitoring
141. Habitat alterations
142. Human take
143. Unknown mortality factors
1431. Determine these factors, if any, and take appropriate action
1421. Directed
1422. Incidental
1411. Physical
1412. Chemical
14211. Maintain and enforce ban on take throughout the range
14221. Regulate methods, gear, area and seasons in U.S. waters
14222. Recommend adjustments to Mexican no trawling zone as needed
14223. Recommend regulations for method, area, gear and season in Mexican waters
14111. Natural
14112. Man-induced
14111. Cold-stunning
141121. Regulate spoil dumping, sea floor mining and trawl tows
141111. Develop contingency plans to prevent mortality
14121. Regulate petrochemical industry, bilge pumping, and industrial dumping

14. Mitigate factors affecting marine mortality and/or stress.

1411111. Develop contingency plans to prevent mortality.

Winter behavior of ridleys is poorly known, but juveniles of the species are regularly found as far north as New England waters.

Implement procedures for enhancing survival of cold-stunned sea turtles (see section 2.6).

141121. Regulate spoil dumping, sea floor mining and trawl tows.

The effects of these activities on Kemp's ridley habitat have not been documented, but common sense precautionary measures should be taken before any such activities are permitted in the known habitat of Kemp's ridley. See loggerhead account for details (step 121121).

14121. Regulate petrochemical industry, bilge pumping and industrial dumping.

This is an international problem which should be addressed within the context of the Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean of the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region. The primary feeding areas of adult ridleys (in the Louisiana coast in the USA and the Campeche coast in Mexico) are areas of intensive offshore oil drilling, with regular and occasionally massive spills having unknown effects on the turtles (See Loggerhead Section 13121).

A. Undertake spill control technology exchange between oil companies in the US and Mexico.

B. Enforce safety inspections to avoid oil spills in the Gulf of Mexico.

14211. Maintain and enforce ban on take throughout the range.

See step 11321.

14221. Regulate methods, gear, area and seasons in U.S. waters.

Documentation of the degree and location of incidental capture of Kemp's ridleys by the U.S. fishing industry (especially shrimp trawlers) is lacking. Such data are essential if appropriate protective measures for the species are to be prepared.

A. Provide a legal solution to the incidental take problem as soon as possible (see section 2.4).

B. Obtain anonymous reports from fishermen as to location and times of incidental catch of ridleys.

14222. Recommend adjustment to Mexican "no-trawling" zone as needed.

It is possible that the present "no-trawling" zone is adequate, since dead ridleys have not been recorded stranded at Rancho Nuevo in recent years, though the possibility of incidentally caught turtles being retained for food cannot be discounted.

A. Continue radio-tracking experiments at Rancho Nuevo to define the area frequented by turtles between their nesting emergences.

B. Recommend adjustments to the "no-trawling" zone to include as much of this zone as possible.

14223. Recommend regulations for methods, area, gear and season in Mexican waters.

Those regulations will be of the type described in loggerhead section 122211, but their development and implementation in Mexico will depend upon political and economic factors in Mexico entirely beyond the control of the United States. Recommendations can only be made.

1431. Determine unknown mortality factors, if any, and take appropriate action.

Obviously, no specifics can be recommended in this area. However, the decline of Kemp's ridley during the last thirty years has been so massive that it remains possible that other factors than the known causes of decline have been at work.

151. Determine feasibility of aerial and other means of at-sea monitoring.

Based on two seasons of aerial surveys, aerial monitoring of Kemp's ridley populations is unlikely to be very productive since this species does not appear to spend significant amounts of time at the surface at any stage of its life cycle (Pritchard, 1980).

A. Gather information from shrimp trawlers, recreational fishermen, and others who may catch ridleys incidentally to fishing efforts for other species.

B. Monitor both population trends and magnitude of overall mortality by incidental capture.

Lepidochelys kempi

Implementation Schedule

Plan Section		Lead Agency	Cooperators	Priority
11111	Regulate petrochemical industry	NMFS, FWS LG, PE, USCG	MMS, DOE, SCA,	3
11112	Develop oil spill contingency plan		NMFS	2
11121	Maintain integrity of the preserve	DP	FWS, SCA, CG	1
11211	Use hatcheries and head-starting	NMFS	FWS, CEM, CG, TPWD, NPS	1
11311	Maintain and augment beach patrols	FWS, INP, SEDUE		1
11321	Maintain total ban on commercial, recreational or subsistence take	NMFS, DP, FWS,	SCA	1
11322	Maintain highly conservative take for scientific purposes	FWS, INP, SEDUE	NMFS	2
1211	Determine hatching success	INP	FWS, CG	2
1221	Tag or mark adult females	INP	FWS, CG	2
1222	Count nests by aerial or ground surveys	FWS, INP, SEDUE	CG	2
131	Establish captive breeding colonies	NMFS	CEM	1
141111	Develop contingency plans to prevent mortality	FWS, INP, SEDUE	NMFS, U, SCA, CG, PI	2

Plan Section		Lead Agency	Cooperators	Priority
141121	Regulate spoil dumping, sea floor mining and trawl tows	NMFS, EPA	DP, FI, MMS, USCG	1
14121	Regulate petrochemical industry, bilge pumping and industrial dumping	USCG	MMS, FWS, NMFS, CZM, I	2
14211	Maintain and enforce ban on take throughout the range	NMFS	DP, FWS, SCA	1
14221	Regulate methods, gear, area and seasons in U.S. waters	NMFS		2
14222	Recommend adjustment to Mexican "no-trawling" zone as needed	FWS	DP, NMFS, CG	2
14223	Recommend regulations for methods, area, gear and season in Mexican waters	NMFS	DP, DS	2
1431	Determine unknown mortality factors, if any, and take appropriate action	NMFS	FWS, U, FI, PI, SCA	3
151	Determine feasibility of aerial and other means of at-sea monitoring	NMFS	U, CG, USCG	2

DEFINITIONS

NMFS = National Marine Fisheries Service

MMS = Minerals Management Service

SCA = State Conservation Agencies

LG = Local Governments

INP = Instituto Nacional de Pesca

DP = Departmento de Pesca (Mexico)

TPWD = Texas Parks and Wildlife Department

U = Universities

FI = Fishing Industry

I = Industry

FWS = U.S. Fish and Wildlife Service

DOE = Department of Energy

PE = PEMEX (Mexican Oil Industry)

USCG = United States Coast Guard

CG = Conservation Groups

CEM = Commercial Exhibit and Mariculture

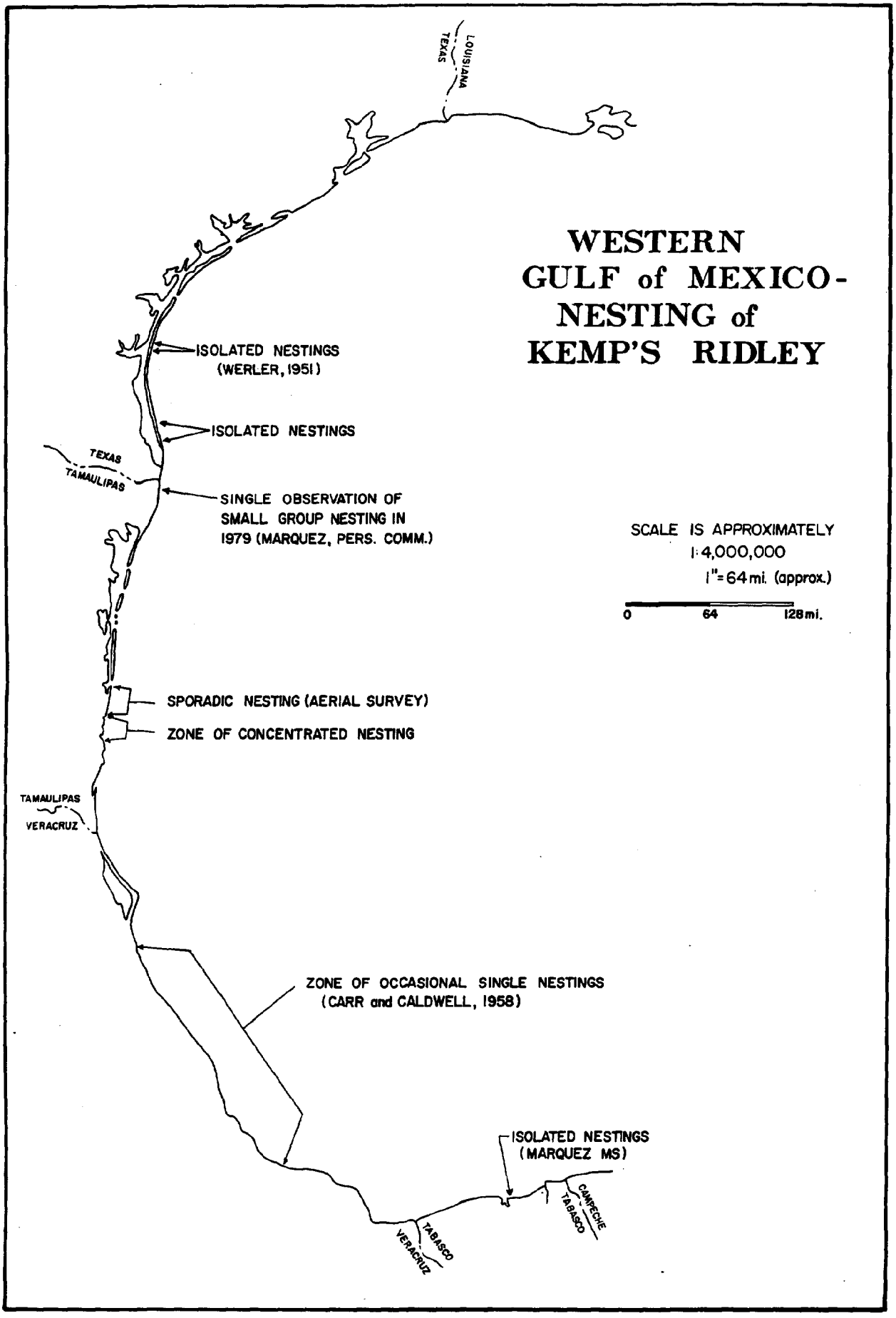
NPS = National Park Service

PI = Private Individuals

CZM = Coastal Zone Management

DS = Department of State

SEDUE = (Mexico's) Secretary for Ecology and Urban Development


WESTERN
GULF of MEXICO-
NESTING of
KEMP'S RIDLEY
LOUISIANA
TEXAS
ISOLATED NESTINGS
(WERLER, 1951)
ISOLATED NESTINGS
TEXAS
TAMAULIPAS
SINGLE OBSERVATION OF
SMALL GROUP NESTING IN
1979 (MARQUEZ, PERS. COMM.)
SCALE IS APPROXIMATELY
1:4,000,000
1"=64 mi. (approx.)
0
64
128 mi.
SPORADIC NESTING (AERIAL SURVEY)
ZONE OF CONCENTRATED NESTING
TAMAULIPAS
VERACRUZ
ZONE OF OCCASIONAL SINGLE NESTINGS
(CARR and CALDWELL, 1958)
ISOLATED NESTINGS
(MARQUEZ MS)
CAMPECHE
TABASCO
TABASCO
VERACRUZ

4. INTERNATIONAL COOPERATION

4.1 INTRODUCTION

Sea turtles are migratory, occupying national and international waters; therefore, a comprehensive recovery plan including many nations throughout the western Atlantic area is desirable. The range of each population needs to be cooperatively treated as a geographic management unit by countries within the range.

All conservation actions which have been identified in this plan are consistent with the intergovernmental and international documents listed below:

1. World Conservation Strategy.
2. IUCN Strategy for the Conservation of Living Marine Resources and Processes in the Caribbean and the IUCN Program Document.
3. The Caribbean Action Plan for the Caribbean Environment Program. UNEP Regional Seas Program.
4. Action Plan, World Sea Turtle Conservation Meeting.

Effective international planning and cooperation requires a foundation of international and related national law. The existing legal foundation to support national and international sea turtle survival actions is inadequate. Insufficient use has been made by nations of existing relevant international conventions to develop national and international agreements, statutes, and regulations. National legislation is frequently nonexistant or insufficient to cope with the problem. Where it does exist, mechanisms for international cooperation have not been adequately developed. Enforcement is particularly difficult due to

turtle exploitation taking place at sea or on remote beaches, and trade in turtle products under The Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) is inadequately controlled.

The purpose of this section is to identify recovery actions designed to fill lacunae in the existing legal structure as well as to strengthen existing law. The objective of this plan section is to outline what is needed to bring into existence the legal foundation for recovery of sea turtles in the Western North Atlantic, Gulf of Mexico and the Caribbean Sea which includes many political entities.

As appropriate, this section discusses each international agreement as it relates to legal mechanisms for sea turtle protection and recovery. Needed actions and responsible entities are identified.

4.2 INTERNATIONAL LAW

An important element of the U.S. "Caribbean Initiative" should be support of a Wider Caribbean environmental protection program. This should include: (1) U.S. active participation (as a Party) in the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region and (2) U.S. support for the negotiation of a Wildlife Conservation Protocol (with a Marine Turtle Annex) to the Convention.

Twenty countries in the Plan Region signed. This Plan, the scientific proceedings of the International Oceanographic Commission Association for the Caribbean and Adjacent Regions (IOCARIBE) intergovernmental Western Atlantic Turtle Symposium (July, 1983) and other relevant Wider Caribbean marine turtle documents, can provide an informational and conceptual base for the development of a draft Wider Caribbean Marine Turtle Conservation Annex to a Wider Caribbean Wildlife Conservation Protocol.

In addition there are in force two global conventions and a regional convention which are directly relevant to conservation of sea turtles in the Plan area: (1) The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), (2) the Convention on the Conservation of Migratory Species of Wild Animals, and (3) the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere. The U.S. is a party to the first and third but not the second. Other existing international agreements relevant to marine turtle conservation are discussed in this Section.

1. Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere.

Scope and Provisions: This regional Convention has as its purpose the protection and preservation in their natural habitat of representatives of all species and genera of the native flora and fauna of the American Republics in sufficient numbers and over areas extensive enough to assure them from becoming extinct. It is designed to be applicable to the conservation of species identified in the Annex to the Convention. This Annex lists species whose protection is declared to be of "special urgency and importance." "Species included therein shall be protected as completely as possible, and their hunting, killing, capturing, or taking shall be allowed only with the permission of the appropriate government authorities." The Convention also provides for the establishment of necessary measures, such as the issuing of permits "to control and regulate the importation, exportation and transit of protected fauna of flora or any part thereof." The only turtle species currently on the Species Annex by the U.S. is the green turtle. Other countries such as Mexico have listed other species.

Implementation: This Convention has been in force since 1940, and ten countries in the Plan region are party members of the Convention. During its 40 years of existence, little has been done until recently to implement the Convention; however, there have been developments since 1976. The Endangered Species Act of 1973 directed the President to take appropriate U.S. initiative to begin to implement the Convention of Nature Protection and Wildlife Preservation in the Western Hemisphere.

Subsequent amendments have provided further emphasis to implement the convention. During the period 1977-1979 the Organization of American States (OAS) convened five technical meetings designed to activate the Convention. At one of these meetings it was stated:

> "The chief causes of the continued decline of sea turtle populations are (1) over-exploitation generated by inadequate laws and regulations; (2) defective enforcement of existing laws and regulations; and (3) the incidental taking of turtles in trawls by the expanding shrimping industry." 1/

This regional Convention has a great potential for furthering marine turtle survival and recovery, and every effort should be made to resume the momentum developed since 1976 by the five Organization of American State (OAS) Technical Meetings.

In summary, this Convention, along with the new Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, seems to have the potential for providing the best international law foundation to undergird sea turtle conservation in the Plan area.

Actions Required: State Department

Explore with Parties to the Convention and other states in the area the feasibility of negotiating bilateral and/or multilateral agreements on survival and recovery of sea turtles under the umbrella of the Convention. The agreements should seek to be consistent with this Recovery Plan and the Sea Turtle Conservation Strategy Action Plan, World Conference on Sea Turtle Conservation held at State Department, Nov. 26-30, 1979, Washington, D.C. 2/

1/ P. 49 OAS, Technical Meeting on Conservation of Migratory Animals of the Western Hemisphere and their Ecosystems, Panama, Republic of Panama, June 4-8, 1979.

2/ Sea Turtle Conservation Strategy, World Conference on Sea Turtle Conservation, Nov. 26-30, 1979, Washington, D.C.

Encourage Organization of American States (OAS) Parties to implement the recommendation of the five OAS Technical meetings utilizing the International Union for the Conservation of Native and Natural Resources and other international entities as appropriate.

U.S. Embassies should work to increase perception among Caribbean countries of the biological, economic and social realities of declining, threatened and endangered stocks of sea turtles and the consequent disappearance of remaining turtle resources.

Actions Required: Department of the Interior

Establish National Park Service and Fish and Wildlife Service cooperative sea turtle scientific research, management, training and informational exchange programs with other countries in the Plan area.

Actions Required: Department of Commerce

Seek to add all sea turtle species in the Plan area to the Annex to the Convention.

As a top priority, work cooperatively with the International Union for the Conservation of Nature (IUCN) to insure rapid technology transfer through United Nations Environment Program (UNEP) and Food and Agriculture Organization (FAO) on National Marine Fish Service trawling efficiency device modifications to all countries with trawl net fisheries in the Plan area.

2. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

Scope and Provisions:

The Convention is not a comprehensive wildlife conservation convention but is limited to controlling international trade in species threatened with extinction or species potentially threatened with extinction. Within this important functional area of controlling international trade in sea turtles and international agreement. However, unlike the previous convention, it has nothing to say about protection within national territories and waters and protection of habitat.

Species protected by CITES trade controls are placed on one of three appendices, only two of which are commonly used. Appendix I species are those species threatened with extinction, which may or may not be affected by trade. Accordingly, Appendix I species are provided with the strongest protection; with very limited exemptions, commercial and tourist trade is prohibited. All sea turtle species are on Appendix I. Species on Appendix II are those species which are not necessarily now threatened with extinction but may become so unless trade in such species is subject to strict regulation in order to avoid utilization incompatible with their survival. International trade in Appendix II species is allowed provided that the country of export grants approval for such trade. Species not fitting the above criteria may also be included in the Appendices in order to ensure that trade in more vulnerable species is brought under effective control (e.g., look-alike-species).

Implementation:

CITES came into force in 1975 and has become an effective mechanism for controlling international trade in most endangered species. However, trade in products derived from hawksbill and olive ridley, and to a much lesser extent, green sea turtles still continues in the wider Caribbean region because of three major factors:

1. Only 18 of the 32 geopolitical units in the region are members of CITES. Some of the non-member geopolitical units trade internationally in sea turtle products.

CITES Members	Non-members
Brazil	Antigua
British Virgin Islands	Barbados
Cayman Islands	Belize
Colombia	Dominica
Bahamas	Dominican Republic
Bermuda	Cuba
Guyana	Grenada
Costa Rica	Honduras
French Guiana	Jamaica
Guadeloupe	Mexico
Martinique	Haiti
Montserrat	St. Kitts, Nevis, Anguilla
Nicaragua	St. Vincent
Panama	Turks and Caicos
St. Lucia	
Surinam	
Venezuela	
United States	

2. Some member countries have taken "reservations" on sea turtles. Surinam has a reservation on green and leatherback sea turtles. Until January 1984, France, and France's overseas departments (French Guiana, Martinique, Guadeloupe) had reservations on hawksbill and green sea turtles.

3. Some member countries have not effectively enforced CITES trade controls.

Actions Required: State Department

Encourage all sea turtle trading countries in the plan area, not yet party to CITES, to join without reservation (e.g., Mexico, Dominican Republic, Cuba, Haiti).

Encourage Surinam to withdraw its CITES reservations for sea turtles.

Encourage all Parties to CITES to fully implement and enforce CITES import and export controls (e.g., Panama, Cayman Islands).

Actions Required: Departments of Commerce and Interior

Determine major markets and sources of turtle products, and discourage nations conducting this trade with trade tariffs, quotas, stiff penalties for violations, etc.

3. Convention on the Conservation of Migratory Species of Wild Animals

Scope and Provisions:

The Migratory Species Convention was negotiated and signed by 22 nations in Bonn, Germany, in June, 1979. The U.S. did not sign. The only countries with territories in the Plan area who signed are the United Kingdom and France.

This convention makes all migratory species and regions of the world eligible for consideration and is designed to stimulate the negotiation of further migratory species conservation agreements, as well as obligating member states to unilaterally protect endangered migratory species.

Appendix I lists endangered species. Parties that are range states agree to prohibit the taking of endangered animals (with some exceptions) within their national jurisdictions. Appendix II lists migratory species which have an unfavorable conservation status and which require international agreements for their conservation and management. Parties which are range states of Appendix II species agree to endeavor to conclude agreements covering these species. Appendix I currently lists Kemps ridley and leatherback and Appendix II includes all Cheloniidae and Dermochelyidae. Thus, all Parties within the actual range of these species are obligated to participate in their conservation.

Because there is no immediate prospect that most of the countries in the Plan area will ratify this Convention, and only three are Parties, its potential value lies in providing principles and concepts which can be used in developing bilateral and multilateral agreements for the Plan area under the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere and the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region. During the negotiations, the U.S. agreed to the inclusion of sea turtles on Appendix I and II and expressed a desire to cooperate with the Convention Parties.

Actions Required:

Same as for previous convention.

4. Draft Law of the Sea Treaty

Scope and Provisions:

The draft Law of the Sea has already changed concepts of international law relating to the sea, and coastal states are now claiming

jurisdiction for two hundred miles out from their coasts to include marine species. Conservation of marine species has not been a major objective of the Law of the Sea negotiations; however, a coastal state now has the option of unilaterally putting into effect conservation measures within its exclusive economic zone.

Implementation:

The U.S. has not signed the Convention.

5. Convention Concerning the Protection of the World Cultural and Natural Heritage

Scope and Provisions:

The objective of the Convention is to preserve natural areas having "universal value" and the preservation of cultural monuments. One category of natural area included in a "precisely delineated area which constitutes the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation." It is the responsibility of a Party to unilaterally designate such areas and to issue regulations.

A World Heritage Committee is established by the Convention which has the power to provide assistance to Parties which designate natural areas. This ability to provide financial aid to less developed countries is an important provision of the Convention. Otherwise, it is of minor value for sea turtle protection because of the lack of protective standards.

Implementation:

Brazil, Guyana, Costa Rica, Panama and the U.S. have ratified the Convention.

Actions Required: State Department

Encourage other states in the Plan area to ratify the Convention.

Actions Required: State, Commerce and Interior Departments

Identify sea turtle nesting beaches and water habitat areas that are candidates for being designated as "natural areas" under the convention, and encourage the World Heritage Committee to enter into discussions with Parties to achieve such designation and provide financial support as appropriate.

6. International Fisheries Agreements

Scope and Provisions:

Existing international fisheries agreements do not address the problem of incidental take or the need to conserve sea turtles as a natural resource.

The following organizations have the potential for supporting sea turtle recovery: The Western Central Atlantic Fisheries Commission (WECAFC), International Oceanographic Commission Activities in the Caribbean (IOCARIBE), Gulf and Caribbean Fisheries Institute (GCFI), Man and the Biosphere Program (UNESCOMAB) and the National Marine Fisheries Service International Fisheries Program in the Western Central Atlantic, the Caribbean and the Gulf of Mexico have the potential for supporting sea turtle recovery.

Actions Required:

These programs need to focus on and expand their activities directly or indirectly toward sea turtle conservation. Negotiations should be entered into as necessary to amend terms of reference or agreements to permit these actions to be taken.

INTRODUCTION

This Recovery Plan deals only with populations of Olive Ridley in the Western Atlantic. Since this population is of recent discovery (Schulz, 1964; Pritchard, 1966), it is not possible to assess the former breeding range of the species in the area.

Almost all Western Atlantic olive ridleys nest at Eilanti Beach, Surinam, 5° 50'N, 54° 3'W, near the mouth of the Marowijne River. This beach is only about one km in length and is bordered by mangroves at the eastern end and by a lagoon at the western end. The topography and outline of the beach vary greatly from year to year (Schulz, 1975).

Some olive ridleys nest in other parts of Surinam, including larger beaches towards and in the mouth of the Marowijne River, east of Eilanti. These beaches are Pruimenboom, Galibi and Baboensanti. Other olive ridleys nest on Bigisanti, 6°00'N, 54°50'W. Bigisanti is one of the most mobile beaches known, and its sandy areas move toward the west at a rate of several kilometers per year. Nesting has also been reported from Shell Beach, Guyana (Pritchard 1969), and from the beaches in western French Guiana (Point Isère, Silébache).

To the casual eye, Eilanti appears to be an extremely marginal sea turtle nesting beach. The sand stretch is so short that egg destruction by later-nesting turtles is potentially a serious problem. Beach erosion is so severe that many nests are likely to be lost, and the beach is fronted at low tide by at least a kilometer of exposed soft mud. Thus, turtles are forced to nest by high tide, and those that linger too long on the beach face a seaward trek of hundreds of meters over the mudflat.

Agencies in Surinam (Landsbosbeheer and Stinasu) maintain beach patrols, and eggs laid too close to the sea are moved to more protected locations. Turtles found nesting so late that they will have to return to the sea over the mud flat are kept in the shade until rising tide. The real threats to this population appear to lie in the marine phase of the turtles' existence rather than on the nesting beach.

Eggs of the olive ridley at Eilanti, when allowed to hatch in situ, are subject to the usual tropical beach predators - ghost crabs, crab-eating raccoons, etc. However, these are probably not a serious factor. Until 1967, predation on the eggs by local Carib Indians, who gathered them for sale primarily to Indonesians in Albina and Paramaribo, was virtually 100%. However, this devastating loss has now been curtailed, and the beach is fully protected by the Surinam Forest Service.

Existing beach protection and patrols in Surinam appear adequate, and it is essential that they continue. The TED (turtle excluder device) should be demonstrated to government fishery departments in the countries of northern South America, especially Surinam and Guyana, so that recommendations can be considered for trawlers operating in those waters.

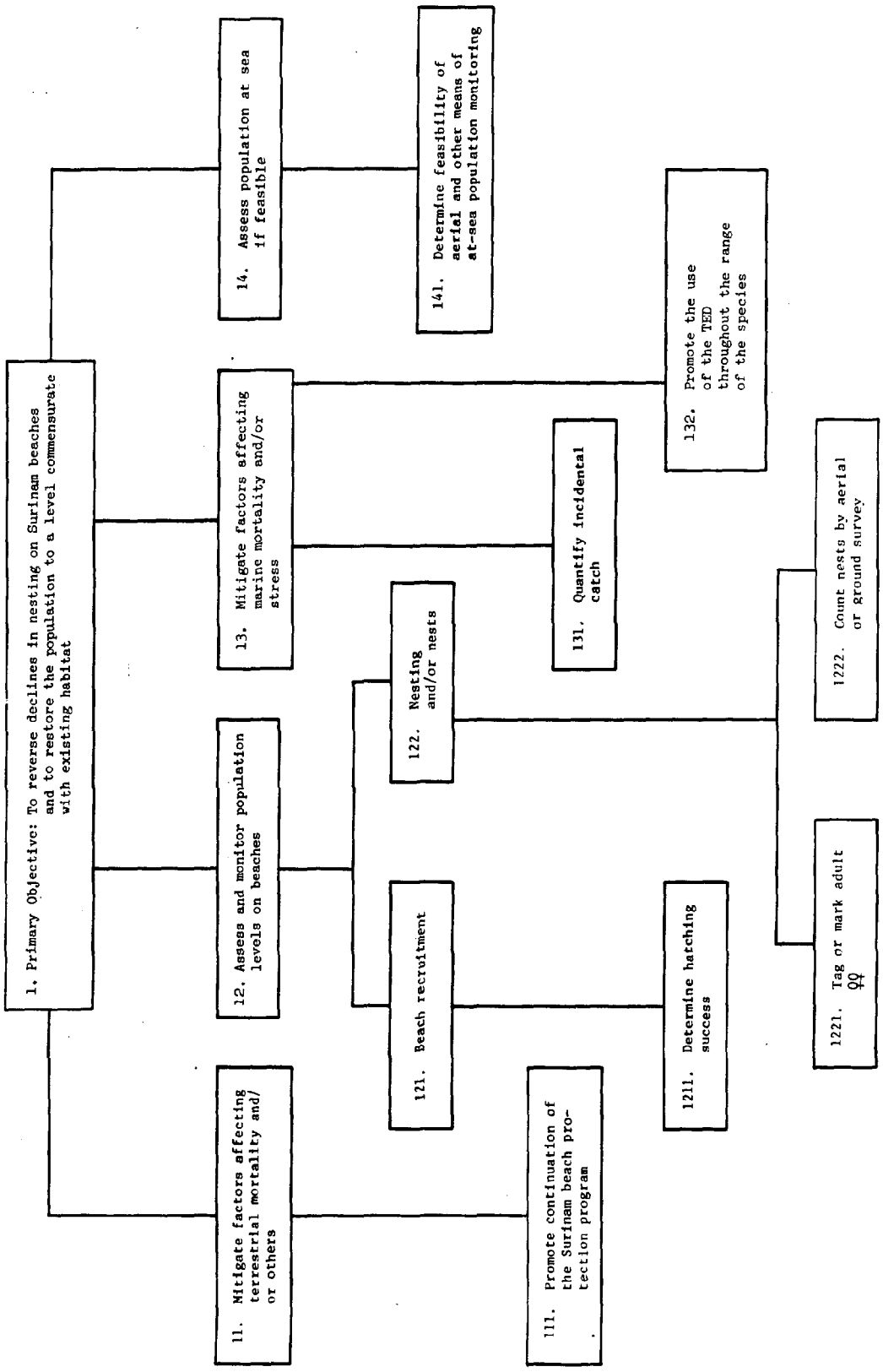
Live juvenile olive ridleys are virtually unknown, in spite of the vast populations of this species in parts of the East Pacific. As long as this phase of the life cycle remains cryptic, no data can be given on mortality of subadult olive ridleys.

Lepidochelys olivacea has been legally protected in Surinam since 1967. Adults are not known to suffer anthropogenic or natural mortality on or close to the nesting beaches. However, in neighboring Guyana, ridleys nesting on Shell Beach are regularly killed by people from the

Pomeroon and Waini areas for food.

Adult olive ridleys are also caught in the French West Indies (especially Guadeloupe) where the shells are sold as souvenirs. However, the magnitude of this catch is not known.

The greatest source of loss to adult individuals is incidental catch by trawlers. Of the 3359 olive ridleys tagged in Surinam by Pritchard (1976), nearly all of the 72 tag returns were made by trawlermen, and in most such cases the turtle was dead. Capture of Surinam ridleys at sea by both commercial and research trawlers is further documented by Caldwell et al. (1969). It is probably this loss, combined with recruitment failure following years of almost total egg collection, that caused the population at Eilanti to decline precipitously even following complete protection since 1967.


1. Primary Objective: To reverse declines in nesting on Surinam beaches and to restore the population to a level commensurate with existing habitat
11. Mitigate factors affecting terrestrial mortality and/or others
111. Promote continuation of the Surinam beach protection program
12. Assess and monitor population levels on beaches
121. Beach recruitment
1211. Determine hatching success
122. Nesting and/or nests
1221. Tag or mark adult ♀♀
1222. Count nests by aerial or ground survey
13. Mitigate factors affecting marine mortality and/or stress
131. Quantify incidental catch
132. Promote the use of the TED throughout the range of the species
14. Assess population at sea if feasible
141. Determine feasibility of aerial and other means of at-sea population monitoring

Olive Ridley - Stepdown Plan

The team recognizes the efforts that are already underway in Surinam to protect the Olive Ridley. The following recommendations may be redundant to those efforts, but they are included here for information and because this species appears on the U.S. Lists of Endangered and Threatened Flora and Fauna.

1. Primary Objective: To reverse declines in nesting on Surinam beaches and to restore the population to a level commensurate with existing habitat.

11. Mitigate factors affecting terrestial mortality and/or stress.

111. Promote continuation of the beach protection program. The beach protection efforts at Eilanti and Bigisanti, Surinam, are considered adequate but must be continued since the protection of eggs for the last thirteen years has not resulted in measurable increase in recruitment to the nesting population.

A. Protect nesting females and their eggs on the beaches in Guyana.

B. Continued good protection of the Surinam colony.

12. Assessment of population status by terrestrial monitoring.

1211. Determine hatching success.

A. Continue to monitor Eilanti Beach, Surinam.

B. Monitor and make estimates of numbers of nesting ridleys on other beaches including Shell Beach (Guyana), Silebache Beach (French Guiana), and Bigisanti (Surinam).

C. Investigate additional beaches in Surinam which are rumored to have nesting olive ridleys.

D. Evaluate hatching success at Eilanti and elsewhere in the South Atlantic.

1221. Tag or mark adult females.

1222. Count nests by aerial survey.

13. Mitigate factors affecting pelagic mortality and/or stress.

131. Quantify incidental catch.

Most of the tag returns from Surinam have been obtained by shrimp trawlers operating in the area between Trinidad and the Oyapoque River. It is possible that incidental catch has been a significant factor in the decline of the species from 1967 to the present.

Quantify and document, by interviews with shrimp captains and other techniques, the capture and fate of olive ridleys in trawls.

132. Promote the use of proven excluder trawl technology throughout the range of the species.

The need for this is obvious if step 131 (above) reveals ongoing significant levels of incidential catch mortality.

14. Assess populations at sea if possible.

141. Determine feasibility of aerial and other means of at-sea monitoring.

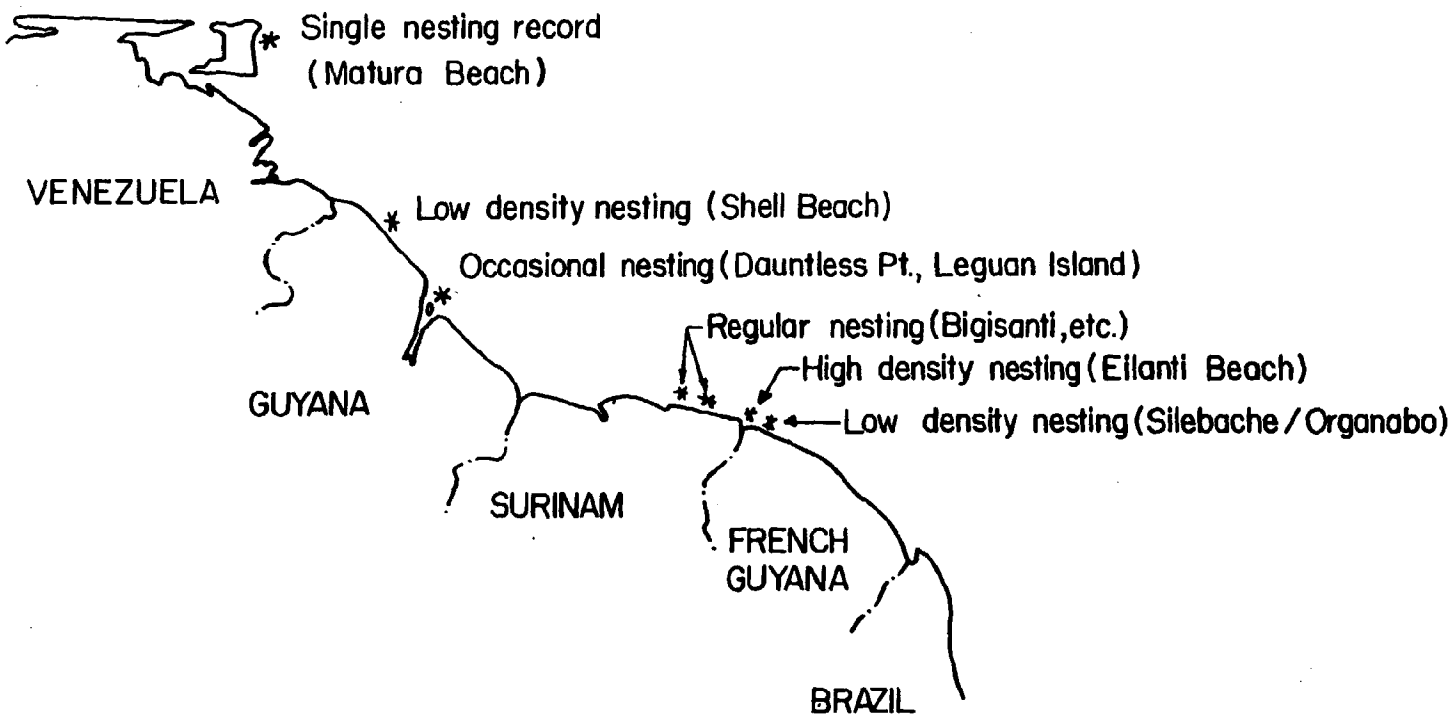
Routine monitoring of olive ridleys at sea in the Western Atlantic may prove infeasible because they are only caught sporadically and usually incidentally to other fishery operations (e.g., by shrimp trawlers). The olive ridley in the East

Pacific spends a great deal of time floating on the surface in a potentially countable fashion, although there is no evidence that olive ridleys in Surinam and adjacent waters do this.

A. Conduct exploratory surveys to confirm pelagic basking behavior.

B. Record and assess data from observations and catches of olive ridleys at sea.

NORTHERN SOUTH AMERICA
NESTING of the OLIVE RIDLEY
in WESTERN ATLANTIC



4.4 STATUATORY AND REGULATORY PROHIBITIONS PURSUANT TO SEA TURTLES

Political Entity	HARVESTING OR TAKING				EXPORT	IMPORTATION		Notes on Nesting, Foraging, Density, etc.
	Turtles on Beach	Eggs on Beach	Territorial Sea	Exclusive Economic Zone		from Other Countries	International Waters	
Antigua	Partially prohibited	Partially prohibited	Partially prohibited	-	-	-	-	Some Hawksbill nesting A few Greens ocassionally nesting.
Barbados	-	-	-	-	-	-	-	Some Hawksbill nesting. A few Greens occasionally nesting.
Belize (Br.)	-	-	-	-	Prohibited	Prohibited	Prohibited	Belizeans take eggs assiduously for aphrodisiacs. Belizean Government has no effective patroling capability. Turtle jaws sold to tourists. Loggerhead, Hawksbill and Greens nest at low densities.
Bermuda	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Nesting beaches restocked with Costa Rican eggs since late 1960s. Caribbean Conservation Corp assisting gov't of Bermuda. Major problem: dwindling stretches undeveloped coastline. Intermittent poaching. Green foraging in area. Hawksbill foraging, no nesting.
Brazil	-	-	-	-	Prohibited	Prohibited	Prohibited	Green foraging; nests on Trinidad. Loggerhead nests in southern Brazil (Espirito Santos); otherwise sporadic nesting only. Hawksbill and Olive Ridley are rare.

4.4 STATUATORY AND REGULATORY PROHIBITIONS PURSUANT TO SEA TURTLES

Political Entity	HARVESTING OR TAKING				EXPORT	IMPORTATION		Notes on Nesting, Foraging, Density, etc.
	Turtles on Beach	Eggs on Beach	Territorial Sea	Exclusive Economic Zone		from Other Countries	International Waters	
British Virgin Islands (Br.)	-	-	-	-	Prohibited	Prohibited	Prohibited	Hawksbill nests
Canada	-	-	-	-	Prohibited	Prohibited	Prohibited	Leatherback - regular, no nesting. Other species - accidental
Cayman Islands (Br.)	Partially Prohibited	Partially Prohibited	Partially Prohibited	-	Prohibited	Prohibited	Prohibited	Possession of eggs, taking or molesting a female in any way (May through Sept.) prohibited. Licensee may have eggs of turtle bred in captivity or eggs taken in accordance with license or female turtle bred in captivity under license. Subsistence taking in territorial sea permitted. Little enforcement of taking of nesting turtles and eggs.
Colony of the Turks and Caicos Islands (Br.)	Prohibited	Prohibited	-	-	-	-	-	Probably Green and Hawksbill. No high density nesting. U.K. excluded Turks and Caicos in ratifying CITES.
Colombia	-	-	-	-	Prohibited	Prohibited	Prohibited	Loggerhead nests Santa Marta. Hawksbill nests on San Andres. Leatherback nests. Green foraging in area.
Commonwealth of Bahamas	Prohibited	Prohibited	Partially Prohibited	Partially Prohibited	Prohibited to U.S.	-	-	Low density nesting of green, hawksbill, loggerhead, extensive foraging.

4.4 STATUATORY AND REGULATORY PROHIBITIONS PURSUANT TO SEA TURTLES

Political Entity	HARVESTING OR TAKING				EXPORT	IMPORTATION		Notes on Nesting, Foraging, Density, etc.
	Turtles on Beach	Eggs on Beach	Territorial Sea	Exclusive Economic Zone		from Other Countries	International Waters	
Commonwealth of Dominica	-	-	-	-	-	-	-	Some nesting of Hawksbill
Dominican* Republic	-	Prohibited	Partially Prohibited	-	Special Certificate Required	-	-	Leatherback, possibly Green in area. Hawksbill, some nesting.
Cooperative Republic of Guyana	-	-	-	-	Prohibited	Prohibited	Prohibited	Green nests. Leatherback nests. Hawksbill nests. Olive Ridley nests.
Costa Rica**	Prohibited	Prohibited	Partially Prohibited	Partially Prohibited	Prohibited	Prohibited	Prohibited	Green nests. Hawksbill nests. Leatherback nests.
Cuba	-	-	-	-	-	-	-	Hawksbill nests. Olive Ridley nests. Loggerhead nests.
Dept. of French Guiana	Prohibited	Prohibited	Partially Prohibited Taking leather-backs prohibited	-	Prohibited	Prohibited	Prohibited	Leatherback nests. Green nests. Hawksbill nests, very rare. Olive Ridley nests.
Guadeloupe	Prohibited	Prohibited	Partially Prohibited Taking leather-backs prohibited	-	Prohibited	Prohibited	Prohibited	Olive Ridley foraging. Hawksbill, Green nests occasionally.

* Size limit of $\geq$ 50 cm shell length. Closed seasons May-July; Sept-Oct.
**All types protected by international treaties except green.

4.4 STATUATORY AND REGULATORY PROHIBITIONS PURSUANT TO SEA TURTLES

Political Entity	HARVESTING OR TAKING				EXPORT	IMPORTATION		Notes on Nesting, Foraging, Density, etc.
	Turtles on Beach	Eggs on Beach	Territorial Sea	Exclusive Economic Zone		from Other Countries	International Waters	
Martinique	Prohibited	Prohibited	Partially Prohibited Taking leather-backs prohibited	-	Prohibited	Prohibited	Prohibited	Hawksbill, Green nest occasionally
Guatemala	-	-	Prohibited	-	Prohibited	Prohibited	Prohibited	Very short Caribbean Coast
Grenada	-	-	-	-	-	-	-	Grenada one of Grenadines. Hawksbill throughout. Grenadines. Green less common.
Guyana	Prohibited	Prohibited	-	-	Prohibited for CITES Appendix 1 species	-	-	Nesting reported by hawks-bill, olive ridley, leather-back and green sea turtles.
Honduras	Prohibited	Prohibited	Prohibited	_	Prohibited	-	-	Hawksbill, leatherback nests.
Jamaica	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	-	Hawksbill nests. Leatherback nests rarely. Populations concentrated on west and south coast.
Mexico	-	-	-	-	-	-	-	Olive nests (possibly). Green nests - Quintana Roo Hawksbill nests - Yucatan peninsula. Leatherback nests - extremely rare. Loggerhead nests Yucutan, Campeche.
Montserrat (Br.)	-	-	-	-	-	-	-	-

4.4 STATUATORY AND REGULATORY PROHIBITIONS PURSUANT TO SEA TURTLES

Political Entity	HARVESTING OR TAKING				EXPORT	IMPORTATION		Notes on Nesting Foraging, Density, etc.
	Turtles on Beach	Eggs on Beach	Territorial Sea	Exclusive Economic Zone		from Other Countries	International Waters	
Nicaragua	-	-	No harvest	-	Prohibited	Prohibited	Prohibited	Leatherback nests commonly. Green-feeding grounds. Hawksbill nests. Loggerhead nests rarely on Pacific coast.
Panama	Restricted	Prohibted May 11-Sept	Restricted	Restricted	Prohibited	Prohibited	Prohibited	Hawksbill nests on San Blas Islands. Turtles nest in Colon, Veraguas, and Bocas del Toro provinces.
Portugal-Azores, Madeira	-	-	-	-	-	-	-	Leatherback and some Green foraging.
Republic of Haiti	Prohibited	Partially Prohibited	Partially Prohibited	-	-	-	-	Green foraging. Hawksbill foraging. Sea turtle population very low due to previous nonapplication of conservation laws.
Republic of Trinidad & Tobago	All harvesting prohibited Mar. 1 - Sept. 15.			-	Prohibited	Prohibited	Prohibited	Leatherback nests. Green nests rarely. Loggerhead Ridley-occasionally at sea. Hawksbill nests occasionally.
St. Kitts Nevis Anguilla	Prohibited	Prohibited	Partially Prohibited	-	Partially Prohibited	Partially Prohibited	Partially Prohibited	Hawksbill nests. Green nests rarely. Leatherback nests very rarely.
St. Lucia	Partially Prohibited	Prohibited	Partially Prohibited	-	Prohibited	Prohibited	Prohibited	Some Hawksbill, fewer Green in area.

4.4 STATUTORY AND REGULATORY PROHIBITIONS PURSUANT TO SEA TURTLES

Political Entity	HARVESTING OR TAKING				EXPORT	IMPORTATION		Notes on Nesting Foraging, Density, etc.
	Turtles on Beach	Eggs on Beach	Territorial Sea	Exclusive Economic Zone		from Other Countries	International Waters	
State of St. Vincent and the Grenadines	-	-	-	-	-	-	-	Probably some Hawksbill in area.
Surinam	Prohibited	Partially Prohibited	Prohibited	-	Prohibited	Prohibited	Prohibited	Olive nests. Green nests. Leatherback nests. Hawksbill nests very rarely.
Venezuela	-	-	-	-	Prohibited	Prohibited	Prohibited	Leatherback in area. Loggerhead nests. Hawksbill nests on islands off shore. Green nests on Aves Island; abundant foraging near mainland, especially in west. Olive Ridley foraging in east, Isla Margarita and Trinidad area.

4.4 continued

POLITICAL ENTITY	STATUTES AND/OR REGULATIONS	INTERNATIONAL AGREEMENTS	NOTES
Antigua	The Turtle Ordinance, 1927; No. 17 of 1927	NPWPWH	Prohibits taking or selling of turtles or eggs 1 June-30 Sept. No taking of turtles under 20 lbs. at any time.
Barbados			
Belize (Br.)	Fisheries Regulations 1967		
Bermuda	1972 Fisheries Act		1972 Fisheries Act prohibits taking or molesting turtles on nesting beaches. 1978 order extends prohibition to 200 mile exclusive fishing zone.
Brazil	Law No. 5197 1967 - Protection of the Fauna Portario, No. 3 481 -DN Lista Oficial De Especies Animals	NPWPWH CITES PWCNH	
British Virgin Islands (Br.)	Marine Parks and Protected Areas Ordinance, 1979. Endangered Animals and Plants Ordinance, 1975	CITES CCMA	Makes provisions for establishment of Marine parks which may afford turtle protection. Has potential value for future.

TPGST = Tripartite Agreement to Protect Green Sea Turtles. (Not in force)
CITES = Convention on International Trade in Threatened and Endangered Species of Fauna and Flora.
NPWPWH = Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere.
PWCNH = Convention Concerning the Protection of World Cultural and Natural Heritage
CCMA = Convention On the Conservation of Migratory Species of Wild Animals (Signed - Convention not in force)

4.4 continued

POLITICAL ENTITY	STATUTES AND/OR REGULATIONS	INTERNATIONAL AGREEMENTS	NOTES
Canada		CITES	As party to CITES, Canada denies all nonscientific turtle permit applications.
Cayman Islands (Br.)	The Marine Conservation Law, 1978 (Law 19 of 1978) The Marine Conservation (Turtle Protection) Regulations, 1978. The Marine Conservation Regulations, 1979 The Endangered Species Protection Law, 1978 (Law 21 of 1978)	CCMA CITES	Possession of eggs, taking or molesting a female in any way (May through Sept.) prohibited. Licensee may have eggs of turtle bred in captivity or eggs taken in accordance with license or female turtle bred in captivity under license. Subsistence taking in territorial sea permitted. Little enforcement of taking of nesting turtles and eggs.
Colony of the Turks and Caicos Islands (Br.)	Fisheries Protection Ordinance, 1949. Fisheries Protection Regulations, 1976.	CCMA	Prohibited from taking Hawksbill under 17" a.l., Green under 15"c.l. Taking of any marine life requires license. Ordinance provides authority for establishing a closed season.
Colombia		CITES	
Commonwealth of Bahamas	Chapter 25, Subsidiary Legislation, Revised Edition 1965 - The Marine Fisheries Products (Fisheries) Rules	CITES	GCOB states implemntation should stop importation and exploitation of sea turtles and products. Proposed regulations will establish from April 1 to end July closed season for all sea turtles, coinciding with closed crawfish season.
Commonwealth of Dominica			
Dominican Republic	Executive Degree No. 600	NPWPWH	Prohibited from taking turtles less than 50cm in territorial waters.

4.4 continued

POLITICAL ENTITY	STATUTES AND/OR REGULATIONS	INTERNATIONAL AGREEMENTS	NOTES
Cooperative Republic of Guyana	Fisheries (Aquatic Wildlife Control) Regulations, 1966, 1973, issued under Section 33, Chapter 71.08 of the Fisheries Act. Maritime Boundaries Act, 1977	CITES PWCNH	Informal cooperation with Surinam on research and conservation. License required under Fisheries Act to take any "prescribed aquatic wildlife" which includes sea turtles
Costa Rica	Ley De Pescay Caza Maritimas 1949	CITES NPWPWH	Massive poaching has been reported. President taking security measures. Reportedly, turtles are taken under guise of allowed taking for domestic consumption and illegally exported to Panama. Hunting beyond 12 mile limit permitted for domestic consumption.
Cuba			
Dept. of French Guiana		CITES CCMA	
Guadeloupe	Arrete Portant Reglementation De L'Exercise De La Peche Marine Cotiere Dans Les Eaux Du Departement De La Guadeloupe (1979) No 79-6 AO/3/3	CITES CCMA	
Martinique		CITES CCMA	
Guatemala		CITES NPWPWH	
Grenada	Birds and Other Wildlife (Protection of) Ordinance (1957) (As amended)		

4.4 continued

POLITICAL ENTITY	STATUTES AND/OR REGULATIONS	INTERNATIONAL AGREEMENTS	NOTES
Honduras	Decree Law 154 Honduras 1959 Fishing Law. Resolution No. 007-78 of Honduran Directorate General of Renewable Natural Resources, March 7, 1978.		Honduran Fishing law bars taking sea turtles 112 days each year. Bans commercial taking of eggs and offspring. Resolution No. 007-78, bans capture, industrialization, trade of sea turtles for indefinite period of time. Enforcement capabilities of Honduran authorities at best limited. Not party to intergovernmental agreements. Permission to export required from Direccion General de Recursos Renovables, Min. Nat. Res.
Jamaica	Wildlife Protection Law, 1960		Ban on taking, selling, possessing turtle eggs. Jamaica may ban taking of all turtles throughout year. Apparent decline in turtle catches.
Mexico		NPWPWH	
Montserrat (Br.)	Decreto Regiemento La Explotacion Y Prohibe La Destruccion De La Tortugas (1958)	CITES	
Nicaragua	Fishing Laws, Chap. V Pages 16, 51 Closed Season, P. 66	NPWPWH CITES TPGST	Closed season Licensing required during open season.
Panama	Decreto Ejecutivo No. 104 Por El Cual Se Adiciona; 1974 El Decreto Ejecutivo No. 23; Jan. 30, 1967; Resolution Dir. - 002-80; Law 14 of Oct. 28, 1977	NPWPWH CITES PWCNH TPGST	
Portugal-Azores, Madeira			

4.4 continued

POLITICAL ENTITY	STATUTES AND/OR REGULATIONS	INTERNATIONAL AGREEMENTS	NOTES
Republic of Haiti	Comprehensive GOH Fishing Law, Oct. 27, 1978	NPWPWH	Enforcement lax. Hawksbll taking prohibited May to Oct. (egg laying season) Gathering of Green eggs within territorial waters. Taking Hawksbill and Green on shore.
Republic of Trinidad and Tobago	Fisheries Ordinance (1916 as Amended to 1975)	CITES NPWPWH	
St. Kitts Nevis Anguilla	Turtle Ordinance, 1948		Ban on taking turtles or eggs June through Sept. Total ban on taking turtles under 20 lbs. Ban June through Sept. on killing, selling, possessing turtles, meat or eggs.
St. Lucia	Turtle, Lobster and Fish Protection Act 1971	CITES	Enforcement not possible due to budgetary constraints.
State of St. Vincent and the Grenadines	Birds and Fish Protection Ordinance (1901)		Ban on taking turtles and turtle eggs May through Aug. Ban on turtle nets within 100 yds. of shore. Ban, same same period, on sale, disposal, buying or possessing turtles, meat or eggs.
Surinam	Hunting Act (1954)	CITES (Reservations on greens & leatherbacks)	Taking of turtle on beach prohibited and enforced within beach preserve. Controlled taking of eggs is permitted in some areas.
Venezuela		NPWPWH CITES	

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APPENDIX

Agency review comments were received from:

The Fish and Wildlife Service

Minerals Management Service

U.S. Army Corps of Engineers, Jacksonville District

National Aeronautics and Space Administration (Washington)

National Aeronautics and Space Administration (Kennedy Space Center)

National Ocean Service

Environmental Protection Agency

National Science Foundation

Florida Department of Natural Resources

Georgia Department of Natural Resources

South Carolina Coastal Council

Texas Parks and Wildlife Department

Virginia Institute of Marine Science (Musick & Byles)

NOVA Oceanographic Center (Menzies & Kochinsky)

University of Toronto (Mrosovsky)

The Center for Environmental Education, Sea Turtle Rescue Fund

Environmental & Chemical Sciences, Inc.

Kenneth Dodd, Jr.

Orren Merren

Fred Berry

Edward F. Klima

Most of the comments were incorporated into the plan. Those that were not would have required substantial rewriting of the plan or were considered not to be substantive enough to require a plan revision. Comments are included here so that readers will have the benefit of any divergent views.

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

APR 20 1984

Mr. Charles Oravetz
National Marine Fishery Service
9490 Koger Blvd.
St. Petersburg, Florida 33702

Dear Chuck:

Subject plan has been reviewed by a wide spectrum of Fish and Wildlife Service (FWS) offices and individuals. I have attempted to assemble these comments in a logical manner to assist the National Marine Fishery Service (NMFS) and the Recovery Team in reviewing and deliberating FWS comments.

I believe I'm correct in assuming this current draft is in the "Agency Review" stage, the technical review having already occurred. However, you will find that a number of our comments are of a technical nature and hope you will give these full consideration and, whenever possible, incorporation into the appropriate sections of the draft.

The plans organization is quite different than that used by the FWS for the past 9 or 10 years and, frankly, we believe that certain reorganizations of the plan would help considerably to focus more attention on recovery tasks rather then general type information or details of implementation. The plan should state what needs to be done, not how. Today's methodology will not necessarily be tommorrow's. It will save time and effort on future plan revisions if we stay away from the "how." We suggest the following oranizational changes which we believe will help to better focus the plan on the primary purpose of identifying and justifying recovery tasks.

1. Section 1.5, "Population Estimates of Relevant Stocks" should be deleted and the information incorporated into the appropriate species section.

2. Sections 2.1 - 2.6 and 2.8 provide excellent information but should be included in the plan as appendices and referenced in the appropriate species sections. Section 2.7 should be deleted and some of the narrative used in the Step-down Outline to justify various public education/ information tasks.

3. The Step-down Outlines are complex and difficult to use. Attached is a Step-down Outline for the loggerhead which we prepared and feel more logically displays needed recovery actions. This same format could be used for all the other sea turtles with minor modifications. Each task should have a narrative explanation which briefly justifies the need and importance of the task.

We still have a major concern with the scope of the plan in that it covers populations outside of the U.S. While it is logical and helpful to a population throughout its range, we feel it is presumptuous and perhaps counterproductive to specify recovery actions in other countries that have had no input into the plan. It would be more appropriate for the plan to identify a recovery task to develop agreements or encourage cooperation with particular countries to address populations which have life stages in other countries. Actually, recovery efforts in these instances should, perhaps, be identifed and contained in the Wider Caribbean Sea Turtle Recovery Plan.

It is also for these reasons that we recommend the plan not include sections for the olive and Kemp's ridley. We believe a recovery plan for the Kemp's ridley should be developed jointly with the FWS, NMFS, and Mexican participation. Since olive ridleys do not occur in U.S. waters in any abundance, there is no reason to include it in the plan; in any case it will likely be addressed by the Wider Caribbean Sea Turtle Recovery Team.

We also note that the recovery plan priority system for recovery actions is different from the one employed by the FWS. It cannot be used for comparing priorities between sea turtle species or any other species, which is a distinct shortcoming. Therefore, we suggest that this plan utilize the FWS recovery action priority system to enhance its usefulness for budgetary or other planning purposes (FWS Endangered and Threatened Species Recovery Planning Guidelines).

Section 3 should incorporate the population data from Section 1.3 for the respective species. The species accounts need to clearly address specific threats to the U.S. populations. We also feel that the Step-down Outline does not adequately address some specific habitat protection and research needs of some species (see attachment).

Certain management practices and needs, including R&D, are common to all sea turtle species. Many of these needs are touched on prior to getting into the individual species plans, but no where are these needs pulled together, prioritized, and assigned, nor do they appear in species plans. This is a shortcoming and we would suggest that this common factor be addressed, probably as an addendum and referenced in the appropriate species sections. As an example, we have no way to age any wild population of sea turtles. Until this question is solved, we have little or no basis upon which to intelligently understand or manage most species, much less rationally judge impacts of commercial harvest or analyze recruitment and turnover. Any population models remain little more than conjecture.

The discussion on tags and associated marking problem is a similar universal need. The plan discusses plastics, monel, inconel, etc., but none of these have really proven satisfactory except in very short term instances (we note that the draft discussion on tags does not mention titanium tags). R&D needs in this aspect are not really identified, yet thousands of hours and dollars are spent annually with too often questionable results—due to the lack of a reliable marking technique.

Following are a number of items, by page number, which we submit for consideration:

P.1 The definitions of endangered and threatened given here are not precise in terms of the Endangered Species Act. For instance, the word "race" should not be used, as the Act uses "subspecies." This should be rewritten to reflect the legal definitions.

P.1 The secretaries must review the status of listed species every 5 years, but recommendations for reclassification or delisting are made only if the biological data warrant such. This should be clarified in the next to last paragraph.

P.12 The references to Dodd (1981) are incorrect both on this page and in the literature cited. The date should be 1982 (the reprints had the incorrect date).

P.13, paragraph 4, line 2 - Typographical error - "Surinan should be "Surinam."

P.14 The population data needs to be updated on the number of leatherbacks nesting in the USVI. Scott Eckert gave slightly different figures at the Widecast meeting in Puerto Rico. Culebra Island was omitted, sentence should read: "Nesting on Vieques and Culebra is less.....".

P.16 Add coatis to the list of predators. Vertebrate predators also include foxes in North Carolina.

P.19 (Top) Add the numbers of adult males as an elusive parameter.

P.19 Both Marquez and Van Dissel (1982, Netherlands J. Zool. 32:419-425) and Steve Cornelius (various reports to USFWS) have also described their methods to estimate the number of females nesting on the beach, although with olive ridleys. These should also be referenced.

P.34 Aerial survey of nesting beaches: While some states have well organized, comprehensive aerial surveys, others participate only sporadically and do not obtain complete coverage; for instance, in some area aerial surveys are done by several different agencies without coordination of efforts. The resulting inconsistency of results could be avoided if efforts were aimed at coordinated surveys of an entire State or region's nesting beaches.

P. 64-65 We believe that the discussion under the heading, Man's Impact, in section 2.5 (Nesting Beach Management Techniques) should be strengthened to include (1) a broader list of potential adverse

impacts resulting from beach nourishment projects, and (2) address the basic issue of reserving valuable undeveloped nesting beaches in a natural state. We suggest the following language:

Add to the paragraph heading Beach Nourishment Projects:

> "Additional adverse effects which may potentially result from beach nourishment projects include: (1) near shore turbidity resulting in disorientation or interference with nesting attempts, (2) scarp development at the edge of the beach fill rendering the beach inaccessable to nesting turtles, (3) entrapment of hatchlings in vehicle tracts, (4) compaction or cementation of beach sediments, (5) alterations in moisture levels or other aspects of the microhabitat within the nest cavity, (6) alteration of unknown beach signature components which may disrupt nest site fidelity, (7) alteration of the native physical beach characteristics (slope, dome shape, etc.) such that nesting attempts are reduced, and (8) the possibility of short repetitive maintenance intervals which could effectively eleminate all natural nesting for a given beach."

Add a paragraph to the section, Man's Impact, which begins on page 64:

> "Beach Development: Intensive development of ocean front property on high density nesting beaches results in an eventual "need" for erosion control measures such as beach nourishment, construction of groin fields, riprap, etc., and in manifestation of intensive human beach uses such as mechanized beach cleaning. Impacts resulting from these types of activities could be controlled or eliminated if ocean front development can be directed in such a way as to be compatible with the physical dynamics of barrier islands and their natural erosion and accretion processes."

This will then support paragraphs 111111 (F) and 111221 (E,F,G,H) in the loggerhead step-down outline and similar sections for other species.

P.68 Increased Law Enforcement, should address not only egg poaching, but the unlawful taking and sale of meat, shells and skulls, the importation of sea turtle products from foreign countries, the taking of marine turtles by trawlers and other commercial means and the harassment of egg-laying turtles on the beaches.

P. 68 , line 26 - Typographical error - "is" should be deleted.

P. 79 - 82 It is advisable to include the Lacey Act. The Lacey Act is a catchall federal statute which makes it unlawful to import, export, transport, sell, etc., in interstate or foreign commerce any unlawfully taken, transported or acquired wildlife. These prohibitions apply to violations of Federal, State or foreign laws. The statute also makes it unlawful to transport any wildlife taken in violation of any Federal law. In this case, no interstate commerce is required.

In recognizing the importance of enforcing the international trade laws, import and exports, Customs is referred in the plan as having the greatest impact on unlawful trade in turtle products. It should be recognized that the wildlife inspection program of the FWS with the cooperation of the U.S. Customs Service, has been instrumental in curtailing the unlawful importation of turtle products and continues to seize illegal shipments at the designated parts for the importation of wildlife. Prosecutions of such cases are handled by the FWS.

In addition to the above, we are enclosing approximately 50 pages from the draft where we are recommending changes, corrections, or additions. We ask that you carefully consider these in the revisions. We note that a number of comments submitted in the technial review stage have not been incorporated or addressed in this agency review draft. Many of these comments we deemed appropriate to both technically strengthen and clarify the plan.

We note that sections of the plan appear dated—it does not incorporate more recent management efforts, research, and problems. This and certain other oversights are more a problem of the plan being somewhat "dated" due to the 5 years or so it has been in preparation. It's not deemed necessary to include many of the latest developments unless NMFS decides to maintain those general informational sections which we have suggested are more appropriate as appendices.

A major concern of the FWS is that, other then Kemp's ridley, no measure of recovery is given. Even in the Kemp's plan we don't agree that recovery will not have occurred until we again have single arribadas of 40,000 females. If we could ever reach 5,000 nesting Kemp's in a season, we would certainly consider a down listing, other factors being equal. Those agencies and others involved in recovery efforts must have an idea of what they are shooting for—population/habitat objectives must be established to clearly state when a species/population has recovered to the point of down listing to threatened or delisted entirely, depending on the current listing status. Certainy Kemp's does not have to reach numbers projected for the mid 1940's to biologically be eligible for down listing to threatened status. This holds true for all the populations under the team's purview. As an agency, FWS must know what numerical or other definable objectives are for each species or population. Recovery must be defined and measurable.

We do appreciate this opportunity to again review and comment on the draft. The team has put a tremendous amount of work into preparation of the document and certainly deserve all our thanks for this monumental effort. Please convey our compliments to all the team members for a basically very good document.

Sincerely yours,

Jack B. Woody
National Sea Turtle Coordinator

Enclosures:
1. Suggested Step-down
2. Recovery Plan Mark-up

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
RESTON, VA. 22091

In Reply Refer To:
LMS-Mail Stop 644

MAY 21 1984

Mr. Jack T. Brawner
Regional Director, Southeast Region
U.S. Department of Commerce
9450 Koger Boulevard
St. Petersburg, Florida 33702

Dear Mr. Brawner:

We appreciate the opportunity to comment on the draft Marine Turtle Recovery Plan. The document represents a serious attempt by the Marine Turtle Recovery Team at examining the many possibilities for rehabilitating the populations of the various endangered and threatened marine turtle species. We offer the following to aid in improving the Plan.

In general, the Table of Contents and information discussed under most of the subheadings adequately cover the relevant topics and the steps needed to allow for recovery of these species. In particular, the Stepdown Plans and Implementation Schedules give more detailed guidance on Agency responsibilities than we have seen in most documents of this kind. On the other hand, the responsibilities or support functions indicated for the Minerals Management Service (MMS) and presumably other Agencies require clarification before a fair evaluation can be made and concurrence obtained. We do concur with the basic concepts and major objectives, but headings in the Implementation Schedules such as "Regulate Petrochemical Industry" are not well-defined, nor are Agency responsibilities indicated in the text of the plan.

On a more specific level, all references to the Bureau of Land Management (BLM) should be changed to MMS. In May 1982, components of BLM with Outer Continental Shelf (OCS) responsibilities were transferred to a new Agency, MMS, which now has all OCS responsibilities within the Department of the Interior. We also note a lack of Agency responsibilities in the Implementation Schedules for the Environmental Protection Agency (EPA). It is the responsibility of the Federal Government under the Federal Water Pollution Control Act of 1948, the Ocean Dumping Act Amendments of 1972, and the Clean Water Act Amendments of 1977 to preserve, protect, and restore ocean water quality and to regulate dumping of all materials into the ocean. The EPA is the lead Agency in these mandates and should have some role in the Recovery Plan.

The Implementation Schedules are actually Agency responsibility assignments and do not indicate timing of actions. The Plan would be enhanced by infusing some type of temporal perspective on the various objectives and tasks. An Implementation Schedule was not included for the Olive Ridley Turtle.

Our final point relates to the research and regulatory role that MMS currently performs. We feel that MMS is currently meeting, in whole or part, the first five objectives on page 3 of the draft Plan through its Environmental Studies Program and through the development of lease sale-specific mitigating measures. We have conducted aerial surveys and methodology assessments in the North Atlantic in the Cetacean and Turtle Assessment Program conducted by the University of Rhode Island. Field population estimation has its drawbacks, and we have decided to invest our research money in studies that can give us specific technical answers. For instance, it is alleged on pages 72 and 73 of the Plan that turtles ingest floating tar. The extent and effect of such activity is poorly understood, and we are currently conducting a study with the University of Florida to examine this possibility. We intend to continue to direct research funds at specific issues helpful to our regulatory decisionmaking requirements. Conducting field surveys is a low priority for MMS right now, and we note that the Plan also assigns lower priority to surveys and methodology assessment.

We hope these comments provide some help in revising the draft Recovery Plan and look forward to reviewing the next version. If we can be of further help, please feel free to contact us.

Sincerely,

Director

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232

June 7, 1984

REPLY TO
ATTENTION OF

Environmental Resources Branch
Planning Division

Mr. Jack T. Brawner
Regional Director
National Marine Fisheries Service
9450 Koger Boulevard
St. Petersburg, Florida 33702

Dear Mr. Brawner:

We have examined the Agency Review Draft of the Recovery Plan for Marine Turtles and offer the following comments:

1. The recovery plans for loggerhead turtles and green turtles are inconsistent. For the former, a recommendation is made (page 96) to "Prohibit all beach nourishment projects on nesting beaches during the nesting and hatching season." The green turtle plan (page 154) includes the same recommendation, but also allows an agency to "Relocate eggs to a safe area or hatchery if beach nourishment during (the) nesting season cannot be prevented."

2. A rationale and statutory authority should be provided for recommending prohibition, since State and Federal wildlife agencies have been accepting nest relocation as adequate mitigation for some time. If nest relocation is fraught with hazards, should not "head-start" programs also be circumscribed?

3. The Corps attempts to schedule beach nourishment outside the turtle nesting and hatching season. However, it should be recognized that, for many beaches in Florida, nourishment would be excessively expensive and perhaps not economically feasible except during summer months, when seas are calm enough for a pipeline dredge to work. A prohibition during this period could eventually result in a severely eroded beach incapable of supporting any turtle nesting. "Prohibit" and "prevent", therefore, seem unnecessarily dogmatic choices of words. Nothing in the Endangered Species Act or other legislation cited in the document authorizes such a general prohibition. In fact, the governing regulation (50 CFR 402.04(g)) specifically makes it the "responsibility of the Federal agency to determine whether to proceed with the activity or program as planned."

4. The recovery plan (pages 96 and 153) recognizes that "Hydraulic pumping may create or improve nesting beaches", but then goes on to state that "however, this activity is not advocated." Without conditioning this statement, the plan presents the position that no efforts should be made to maintain, restore or manage beaches for increased turtle nesting. By ignoring this opportunity to create, maintain, restore or manage nesting habitat the recovery plan is much less than it could have been.

Thank you for the opportunity to comment.

Sincerely,

A. J. Salem

A. J. Salem
Chief, Planning Division

June 7, 1984

Environmental Resources Branch
Planning Division

Mr. Jack T. Brawner
Regional Director
National Marine Fisheries Service
9450 Koger Boulevard
St. Petersburg, Florida 33702

Dear Mr. Brawner:

We have examined the Agency Review Draft of the Recovery Plan for Marine Turtles and offer the following comments:

1. The recovery plans for loggerhead turtles and green turtles are inconsistent. For the former, a recommendation is made (page 96) to "Prohibit all beach nourishment projects on nesting beaches during the nesting and hatching season." The green turtle plan (page 154) includes the same recommendation, but also allows an agency to "Relocate eggs to a safe area or hatchery if beach nourishment during (the) nesting season cannot be prevented."

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Thank you for the opportunity to comment.

Sincerely,

A. J. Salem
Chief, Planning Division

National Aeronautics and
Space Administration

Washington, D.C.
20546

Reply to Attn of: EBT(84-38)

Mr. Jack T. Brawner
Regional Director, Southeast Region
National Marine Fisheries Service
National Oceanic
and Atmospheric Administration
9450 Kroger Boulevard
St. Petersburg, FL 33702

Dear Mr. Brawner:

In response to your request of February 22, 1984, the following comments are provided concerning the proposed Marine Turtle Recovery Plan and NASA's participation in the Plan. The need to take action to promote the survival and recovery of these turtles is clear, and I applaud the efforts of those involved in initiating the program described in the proposal.

I agree with the feasibility and suitability of the outlined proposal in terms of the goal of aiding the survival of these animals, and assume a more complete management plan and schedule of activities will be developed once you have identified the participants' roles.

In your proposal, you have identified NASA as a "cooperative" agency in the protection of two turtle species, Caretta caretta and Chelonia mydas, that nest on beaches that include those in the Kennedy Space Center (KSC) area. KSC has been involved in marine turtle survey efforts to a limited degree for the past several years as an element of the ongoing NASA environmental impact assessment of Shuttle launches at KSC. The NASA-sponsored activities consist of monitoring two to three miles of KSC beach during the summer to assess any adverse effect of Shuttle launches on turtle nesting habits or numbers. This information has been, and will continue to be, provided to interested groups--the National Marine Fisheries Service and the Fish and Wildlife Service and others--for integration into their overall tracking data and turtle protection plans. Other activities proposed in the draft plan for possible NASA support, including protecting nests, managing beaches, tagging animals, etc., are neither within NASA's scope nor capability.

I, therefore, offer the continued use of the KSC beaches, as well as the data we continue to collect, as part of Shuttle environmental impact assessment activities to any of the participants in your "Recovery Plan" when it is implemented.

Sincerely,

B. I. Edelson
Associate Administrator for
Space Science and Applications

National Aeronautics and
Space Administration

John F. Kennedy Space Center
Kennedy Space Center, Florida 32899

312

APR 17 1984

Reply to Attn of DF-EMS

National Marine Fisheries Service
Attn: Mr. Jack Brawner, Regional Director,
Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

Subject: The Marine Turtle Recovery Plan

This office concurs with the basic plan as outlined in the document, and has had the U.S. Fish and Wildlife Service, (FWS) under a land management agreement, review the draft. The USFWS comments that are enclosed represents the concerns of Kennedy Space Center (KSC) on this matter.

Currently, portions of KSC are managed as a wildlife refuge by the USFWS. Any recovery activities that may take place on KSC land must be reviewed by both this office and the USFWS. If we can be of further assistance in this matter, please contact Mr. Kirby K. Key at AC 305 867-4049.

Peter A. Minderman
Director of Engineering Development

Enclosure

DATE: March 22, 1984

REPLY TO ATTN OF: Refuge Manager, Merritt Island NWR Complex

313

SUBJECT: Review of the Marine Turtle Recovery Plan

TO: Regional Director, FWS, Atlanta, GA (SE)

With the understanding that marine turtle ecology is in its infancy, overall the recovery plan provides a very good understanding of the problem, and some broad strategies on accomplishing recovery. One obvious weakness throughout is a non-standardization of methods and non-coordination of activities. Interest in sea turtle management has significantly increased in the past eight years. With this interest has been the implementation of many research and management projects most of which are site specific. Coordination of these projects into a systematic approach would be very valuable. This recovery plan may help in the coordination effort, however it is only a strategic plan of the overall recovery effort.

Following approval of the recovery plan it may be beneficial to develop some action plans dealing with each section of the implementation schedule. These action plans could standardize management and research projects, coordinate activities, and organize section recovery efforts. The lead agency responsible for each plan section would develop these action plans.

The implementation schedules correctly identifies lead agency responsibility as related to jurisdiction. Past experience has shown however, that the agency which is most concerned about a problem or which is geographically closest to the problem takes the lead (i.e. 1977 and 1981 cold-stunning episodes on MINWR). The above mentioned action plans may help. The priority levels established conform to those mentioned in the Regional Resource Plan and being implemented on the MINWR with respect to the loggerhead and green sea turtle.

Although most recovery plans provide cost estimates, none were provided in this draft. It may be beneficial for these cost estimates to be developed. The Regional Resource Plan does provide some annual cost estimates for each preferred strategy. Time schedules for accomplishments would also be helpful.

Marine turtle ecology is a complex problem. The recovery plan is a good initial step in that it recognizes basic problems and assigns responsibilities. Perhaps more complex than the marine turtle ecology is the systematic organization and coordination of all federal, state and private organizations to carry out the plan.

Stephen R. Vehrs

cc. KSC - EMS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Washington, D.C. 20235

N/ORM4:VA

March 26, 1984

Mr. Jack T. Brawner
Southeast Regional Director
National Marine Fisheries Service
9450 Koger Blvd.
St. Petersburg, Florida 33702

Re: Marine Turtle Recovery Plan

Dear Mr. Brawner:

The Office of Ocean and Coastal Resource Management (OCRM) appreciates the opportunity to review this Plan. Our comments are limited to Part 2.8.3, page 80, on the Coastal Zone Management Act (CZMA) of 1972. This section is badly outdated. We cannot require state CZM programs to designate sea turtle nesting areas as areas of particular concern (APCs). All we have ever required is that states develop an approvable process and criteria for designating APCs. The use of this process to designate specific areas is up to each state CZM program.

With these points in mind, we suggest the following rewording of this section:

3. Coastal Zone Management Act of 1972

Scope and Provisions:

The Coastal Zone Management Act (CZMA) was enacted to encourage and assist coastal states and territories in dealing with the increasing and competing demands for the use of the Nation's coastal resources. The Act has as its objective "to preserve, protect, develop, and where possible, to restore or enhance the resources of the Nation's coastal zone for this and succeeding generations." To achieve this objective, it provides Federal financial and technical assistance to coastal state and territorial governments to establish and administer Coastal Zone Management (CZM) programs that meet Federal objectives, including protection of natural resources.

Implementation:

All 35 coastal states and territories have participated in the CZM program. Of these, 28 have Federally-approved management programs and one, Virginia, is expected to submit a program for approval in FY 1984.

Required Action:

The National Oceanic and Atmospheric Administration should encourage coastal states and territories with Federally-approved CZM programs to develop and implement measures to protect sea turtle nesting areas and foraging water areas within their coastal zones.

If you have any questions concerning these comments, please do not hesitate to contact us again.

Sincerely,

Peter L. Tweedt
Director

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

MAR 0 6 1984

4PM-EA/RG

Mr. Jack T. Brawner
Regional Director
National Marine Fisheries Service
9450 Koger Blvd.
St. Petersburg, Florida 33702

Dear Mr. Brawner:

The Environmental Protection Agency, Region IV has reviewed the subject report titled "Recovery Plan for Marine Turtles." Most of the programs over which we have immediate purview should not negatively impact populations of the involved species. However, certain industrial and domestic discharges over which EPA has either direct or indirect permitting authority could impact turtles in the coastal portion of their range. From a practical standpoint the utilization of specific estuaries and bays by turtles should be determined before modifications to discharge permits are considered. If it is or becomes known that certain coastal waters exhibit significant utilization by marine turtles, the effects of the permitted discharges there on these species should be examined.

We appreciate the oppotunity to review and comment on this important issue.

Sincerely yours,

Sheppard N. Moore, Chief
Environmental Review Section
Environmental Assessment Branch

NATIONAL SCIENCE FOUNDATION
WASHINGTON D.C. 20550

March 20, 1984

Mr. Jack T. Brawner
Southeast Regional Director
National Marine Fisheries Service
9450 Koger Boulevard
St. Petersburg, Florida 33702

Dear Mr. Brawner:

In response to your request of 22 February 1984 for comments on the implementation aspects of the draft Recovery Plan for Marine Turtles, I have had the draft reviewed in our Division of Biotic Systems and Resources, which handles endangered species matters for the Foundation.

Our review finds that the distinguished co-leaders of the Recovery Team (Ms. Sally Hopkins and Dr. Peter Pritchard) and the other equally knowledgeable members and consultants of the team have done a commendable job. They established a reasonable and realistic implementation plan for protecting and enhancing the populations of the six threatened and endangered species of sea turtles occurring within U.S. boundaries. The plan fully summarizes all of the relevant data on sea turtle stocks and the probable causes for the declines thereof, while offering feasible plans for protection and recovery of the stocks with the least disturbance to legitimate commercial marine activities. Both the implementation and step down schedules are well considered and based on the best available information and analyses.

We congratulate the Recovery Team and its consultants on a job well done.

Sincerely yours,

Robert Rabin
Acting Assistant Director
Biological, Behavioral,
and Social Sciences

State of Florida

Department of Natural Resources Interoffice Memorandum

16 March 1984

TO: Jack Brawner

FROM: Ed Joyce

RE: Attached comments on Turtle Recovery Plan.

I thought you might like to see Ross Witham's comments. Thanks for letting us review the plan.

Best regards.

EJ/hj

Attachment

12 March 1984 319

MEMORANDUM

To: Ed Joyce

From: Ross Witham

Subject: Recovery Plan Comments.

Having read the plan several times, including the attached version, I think that it is generally a good work. My suggestions for modification are as follow.

1. With the development of Seascape and other such beach erosion control techniques, there is a need to include a new part in the 2. GENERAL TOPICS section. This should probably replace the present 2.6 section and be entitled Nearshore Installations Designed for Beach Erosion Control. The present nos. 2.6, 2,7 & 2.8 would then become 2.7, 2.8 & 2.9.

   Wording suggested for the new 2.6 is: There is considerable interest in attempting to control beach erosion by the use of wave attenuation techniques. These techniques may include plastic seaweed, or, conceivably, "hard" materials such as concrete. Each suggested material should be evaluated for its possible impact upon sea turtles. Impact might involve eating, attempting to eat, or becoming a physical barrier to beach access.

2. The 3.5 Kemp's Ridley Turtle Recovery Plan is viewed by some as an intrusion into the Mexican government's area of concern. While Kemp's ridleys in U. S. waters should be provided as much protection as possible, discussion of matters pertaining to nesting beach management in Mexico might better be avoided.

CRF

Department of Natural Resources
COASTAL RESOURCES DIVISION
1200 GLYNN AVENUE
BRUNSWICK, GEORGIA 31523-9990
(912) 264-7218

Joe D. Tanner
COMMISSIONER

Duane Harris
DIRECTOR

20 April 1984

Mr. Charles A. Oravetz
Chief, Protected Species Management Branch
9450 Koger Boulevard
St. Petersburg, Florida 33702

Dear Mr. Oravetz:

I have reviewed the "Recovery Plan for Marine Turtles" and wish to congratulate the writers for their thorough job. As the loggerhead, leatherback and green are known to occur in my local, I've restricted my comments to these species.

Page Number	Comment
94	Item 111211. Probably helpful; however, why not develop clean-up methods that are effective yet don't harm developing eggs?
94	Item 111221. Good item, but idealistic. Would require a very strong, active lobby to go up against the developers and a lot of public education for support.
102	Items 131121 and 13121. Lobby for a stronger, more potent EPA.
103	Item 132211. Stress use of TEDs; doubtful on success of prohibiting fishing due to incidental turtle catch.

As the recovery plans for the other species are so similar, these comments pertain to the appropriate sections of their plans too. If you have any questions or further requests, please don't hesitate to contact me.

Sincerely,

Nick Nicholson

Nick Nicholson
Sanctuary Coordinator

NN/lw

South Carolina Coastal Council

James M. Waddell, Jr.
Chairman

H. Wayne Beam, Ph.D
Executive Director

May 16, 1984

Mr. Jack T. Brawner
Regional Director
U.S. Dept. of Commerce
National Marine Fisheries Service
9450 Koger Boulevard
St. Petersburg, Florida 33702

Dear Mr. Brawner:

The South Carolina Coastal Council appreciates the opportunity to review the Recovery Plan for Marine Turtles and will support the management plan for nesting areas on the beaches of South Carolina. The staff of the Council will work closely with the South Carolina Wildlife and Marine Resources Department to utilize the best management practices to protect critical nesting habitat in South Carolina. However, the Council has the responsibility to weigh the public benefits and all aspects of a project and consequently, must retain final authority in permit action.

Sincerely,

Duncan C. Newkirk
Permit Administrator

DCN:0032J
cc: Senator James M. Waddell, Jr.
Dr. H. Wayne Beam

TEXAS
PARKS AND WILDLIFE DEPARTMENT
4200 Smith School Road Austin, Texas 78744

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CHARLES D. TRAVIS
Executive Director

May 18, 1984

Mr. Jack T. Brawner
Regional Director
United States Department of Commerce
Southeast Region
9450 Koger Boulevard
St. Petersburg, Florida 33702

Dear Mr. Brawner:

This is in response to your letter of February 22, 1984 regarding the agency review draft "Recovery Plan for Marine Turtles."

The recovery plan appears to be a well-conceived portrayal of the strategies needed to ensure marine turtle survival and hopefully return these species to their former numbers. An elucidation of the authors' definition of State Conservation Agency (SCA) would help. Many of the actions assigned to SCA on implementation schedules for the loggerhead, green, and ridley segments are under the jurisdiction of other agencies or are not authorized under current State legislation. Moreover, several of the actions would seem appropriate for the Environmental Protection Agency (EPA), but it is not listed either as a lead agency or a cooperator.

Reference to this agency on pages 239 and 241 should be Texas Parks and Wildlife Department or TPWD as appropriate. Also on pages 239 and 240, the column heading "Assisting Agency" should read "Lead Agency" so as to be consistent with other segments of the recovery plan.

Finally, we were disappointed to learn that National Marine Fisheries Service (NMFS) was terminating its ridley-rearing activities at the Galveston Laboratory. Some clarification of the lead role assigned NMFS in the Priority 1, Step 11211, page 239, is needed concerning this project.

We appreciate the opportunity to comment on the "Recovery Plan for Marine Turtles." Let us know if we may be of further assistance.

Sincerely,

Charles D. Travis
Executive Director

CDT:FEP:aeh

CHARTERED 1693
COLLEGE OF WILLIAM AND MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE
SCHOOL OF MARINE SCIENCE

Gloucester Point, Virginia 23062

8 May 1984

Phone (804) 642-2111

Andy Majors
NOAA
NMFS Regional Office
9450 Kroger Blvd.
St. Petersburg, FL 33702

Dear Andy:

Sorry we became so late with the response to the Draft Recovery Plan. We hope our comments will still be useful.

General comments have been made by others and we will not echo them now. A few specific comments by page number follow and we are enclosing a copy of our recent summary report and recommendations to NMFS Northeast Region for your perusal.

We would appreciate any publication of the comments and copies of the Final Plan.

Comments:

PP. 48 Leatherback, Incidental Catch Overview

It is stated that capture rates are low because of "low relative abundance in this region and because of their preferred habitat... usually pelagic." Recent reports (CETAP) have shown leatherbacks to be much more coastally oriented than thought before and no one knows the relative abundance of leatherbacks migrating or foraging along the Atlantic Coast of North America.

PP. 103, Section 13221 of the Loggerhead Stepdown Plan

This section addresses fishing methods, gear, areas and seasons yet completely ignores the problems and potential solutions for fixed gear. Poundnets and gill nets have been implicated in turtle mortalities, especially in the Chesapeake Bay, yet only towed gear is mentioned. The habitat section is too general. No problem areas have been specifically identified except Canaveral Channel.

PP. 107, Section 1421, Loggerhead Aerial Survey Assessment

There is a need to stress the importance of behavioral studies to determine the surface/submergence time ratios of turtles. These data are invaluable in providing better population estimates from aerial surveys by estimating the numbers of unseen, diving turtles along the flight path.

PP. 190, Section 132211, Leatherback Stepdown

This section ignores incidental captures along the New England coast. In fact, the entire Section 14 ignores the New England seasonal foraging stocks of leatherbacks and limits areal comments to the American Caribbean.

PP. 221-240 Kemp's Ridley Stepdown

There are no recommendations that studies be supported on life history, and immature stages and habitats are largely ignored. No mention is made regarding developmental habitats, nursery areas or the migratory behavior patterns of juveniles.

For all the species covered in the plan, crucial data concerning the life histories, migratory behavior patterns and preferred habitat is lacking for immature life stages. How effective can any management be if you don't know where or how the species live for major portions of their lives?

Sincerely,

John A. Musick /gbr

John A. Musick
Professor of Marine Science

Richard Byles

Richard A. Byles
Graduate Research Assistant

RAB/gbr

Enclosure

Dr. Jack Brawner
Regional Director- Southeast Region
National Marine Fisheries Service
9450 Koger Blvd.
St. Petersburg, Fl. 33704

Dear Dr. Brawner,

We have received the "Recovery Plan for Marine Turtles" and find it thorough but not without some omissions. The most important in our eyes is described below.

Commentary on "The Recovery Plan For Marine Turtles":

The plan is basically comprehensive considering most of the known facts on sea turtle biology. In some cases however there is a tendency to lean on anecdotal and circumstantial information. An important case is consideration of the colonization potential of various sea turtle species. Consider the following; although it is known that migration distances are great and turtles tagged at diverse locations share common foraging grounds, it is also known that females are repeat nesters on the same beach year after year. The latter information is given more weight in the Recovery Plans' reccomendations for handling and brooding clutches as well as handling hatchlings. That is, "repeat nesting" behavior is taken as a reflection of natal beach homing of both sexes. This is clearly the more conservative approach. However, since the colonization question may be one of the most important to restocking activities it should have been given greater attention in the plan. While activities such as headstarting, temperature determination of sex and various monitoring activities such as aerial surveys

are clearly important, there is a clear need to know whether natal beach imprinting occurs in both sexes and if it is possible to subdivide turtles into discrete management units. Thus far tagging approaches have not provided this information. Therefore at least one item of high priority should be the need to develop alternative methodologies to answer this key question to both an understanding of turtle biology and to the design of management and recovery plans.

We would like to suggest genetic approaches as a possibility. These could include protein electrophoresis, immunological methodologies or DNA sequence or fingerprinting techniques. The first has been in use in our laboratory for a number of years and has been successful in distinguishing between populations of spiny lobsters, alligators and crocodiles. Preliminary studies aimed at the assessment of gene flow between green turtle populations has suggested differences between animals from Atlantic Costa Rica and Florida (see enclosed abstract). These results are consistant with the observations of Smith et. al. (Trans 41st North Amer. Wildlife Nat. Res. Conf.,(1976)p119).

The study with green turtles has been ongoing in our laboratory since 1979 along with similar studies with Pacific olive ridley and Atlantic loggerhead turtles. In the former case we have collections from both Mexico and Costa Rica. For loggerheads we are completing collections from various U.S. populations from South Carolina to the Gulf of Mexico.

We would be most happy to cooperate with the Recovery Team

in the pursuance of this and related questions.

Sincerely yours,

Robert A. Menzies
Professor of Biochemistry
and Oceanography

Lyle Kochinsky
Research Associate

University of Toronto
DEPARTMENT OF ZOOLOGY

RAMSAY WRIGHT ZOOLOGICAL LABORATORIES
:5 HARBORD STREET
'ORONTO M5S 1A1, ONTARIO, CANADA

March 13, 1984

Dr. Jack T. Brawner
United States Department of Commerce
Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702
U.S.A.

Dear Mr. Brawner:

With respect to your letter of February 22, 1984, p. 66-67 of the recovery plan for turtles discusses effects of hatcheries on sex ratio. There are now actual data on this point (reprint enclosed), as opposed to speculations, and you may wish to refer to them.

It is always a problem keeping abreast of recent work. I do feel that some reference to the existence my book (Converving Sea Turtles, see enclosed notice) should be included for the sake of completeness. It is one of the few attempts to look critically at some of our conservation techniques, whether one agrees with it not.

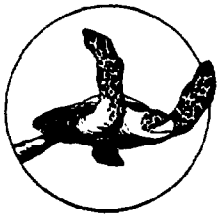
Yours sincerely,

Nicholas Mrosovsky

P.S. Methods (i.e. formulae) for estimating tag loss in double tagging studies might be given somewhere.

NM/wl

Encl.



Sea Turtle
Rescue
Fund

May 8, 1984

Chuck Oravetz
NMFS-SE
9450 Koger Blvd., Durval Bldg.
St. Petersburg, Florida 33702

Dear Chuck:

RE: Review comments for A Recovery Plan for Marine Turtles

page 1. Perhaps plants should be included in the definitions of endangered and threatened species.

page 2. (para 2 line 9) Perhaps "foster" should replace "assure".

page 20. (para 2, last sentence) This sentence can be omitted as it is not relevant at this time.

page 50. (para 3, line 4) Should include the number of trawls in the fleet.

page 58. (para 1, line 8) Easley, 1982 not included in biblio.

page 58. Perhaps include a discussion on Section 10A of the ESA. (see attachment)

page 79. (para 1)

Correction: (line 2) ESA does not provide for the establishment of marine sanctuaries.

Add: ESA also protects endangered and threatened species from import, export, sale, offer for sale, take, transport, etc. The only exemptions to the above for endangered species are for scientific research and enhancement of survival of the species. For threatened species exemptions include scientific research, enhancement of survival of the species, zoological exhibition, educational purposes, and special purposes that are consistent with the Act.

Add: All species of sea turtles, except the Australian flatback are protected in the United States under the ESA.

page 80. (para 3) Not all 30 coastal states have begun planning for the development of their management programs.

page 81. (para 3, line 2) delete "as required by the ESA".

(para 5) Four marine santuaries :add La Parguera, Puerto Rico, to be designated.

page 86. Add: The loggerhead sea turlte was listed as a threatened species by the U.S. Department of Interior in 1979. It is also on Appendix I of the Convention on International Trade In Endangered Species of Wild Fauna and Flora (CITES).

page 97. 11311 add sections 4.1, 4.2, 4.3
change to "Promote and maintain legal protection and..."

page 103. 13211 add sections 4.1, 4.2, 4.3
change to "Promote and maintain legal protection and..."

page 108. 11311 change priority from 4 to 2.

13211 change priority from 3 to 2.

page 147 (last para) This paragraph should be expanded. (see enclosure).

page 154. 11311 add sections 4.1, 4.2, 4.3
change to "Promote and maintain legal protection and..."

page 160. 13211 add sections 4.1, 4.2, 4.3
change to "Promote and maintain legal..."

page 166. 11311 change priority from 4 to 1*.

13211 change priority from 3 to 1*.

* Historical evidence attributes the tremendous decline in green sea turtle populations in this region to international trade. Maintaining and promoting international protection (such as CITES) for the green turtle should be a number one priority for this species.

page 183. leatherback stepdown plan should mention the plastic bag problem.

page 184. 11311 change "See loggerhead step 11311" to "See section 1.2, 2.8, 4.1, 4.2, 4.3, 4.4")

change to "Promote and maintain legal..."

page 189. 13211. change to "Promote and maintain legal..."
add section 2.8

page 203. (para 3)

Correction: The most intensive threat to the hawksbill comes from the harvest of adult hawksbills for the Japanese tortoiseshell trade.

Omit: "Turtles and tortoiseshell have traditional ceremonial value in Japan, and the rise in prosperity has increased the demand for the shell." This statement is misleading; while some tortoiseshell artifacts do have traditional value in Japan, the majority of crafts produced today in Japan are modern day articles void of traditional value (eyeglass frames, western wear jewelry, etc.).

Add: Since 1965, the Japanese imported a minimum of 370,000 kg. of hawksbill shell from wider Caribbean countries. Between 1981 and 1983, over 45,000 kg. was imported from 21 different countries (see table 9).

Correction: Prices paid for preferred shell in Japan have been as high as $225 per kilogram. The shell of one adult hawksbill turtle weighs between 1.5 to 2.5 kilograms.

Omit: Reference to Table 8 here, incorrect.

Add: A more recent threat comes from the growing curio trade in stuffed juvenile hawksbills.

Enclosed is an updated table 9.

page 207. 11311 Add section 2.8.

page 212. 13211 Add section 2.8.

page 216. 111221 Priority 1 ???

page 233. (para 3) This paragraph needs clarification. The wording in this paragraph gives no indication that it may be impossible to captive breed the Kemp's ridley altogether or in large numbers. The Cayman Turtle Farm, for example has not been able to breed any F2 hatchlings of green sea turtles and F1 production has been much lower than wild eggs hatched under the same conditions. In addition, F1 production from eggs that were originally taken from the wild (Captive-reared animals) has been extremely low; most of the Farm's productivity comes from adults taken from the wild. This evidence does not support the statement "initial stock for captive breeding can be obtained.... by taking hatchlings rather than adults." A better title for this section may be "Establish the Feasibility of Maintaining Viable Captive Breeding Colonies."

page 239. 131. Change to Establish the Feasibility of Maintaining Viable Captive Breeding Colonies.

page 240. 14221 and 14223 should be changed from Priority 2 to Priority 1.

page 248. Many errors. Below I have rewritten this section using the same format.

2. Convention.....Flora (CITES) (also known as the Washington Convention, or the Convention)

Scope and Provisions:

The Convention is not a comprehensive wildlife conservation convention but is limited to controlling international trade in species threatened with extinction or species potentially threatened with extinction. Within this important functional area of controlling international trade in sea turtles and their products, this Convention currently is the strongest and most detailed international agreement. However, unlike the previous convention, it has nothing to say about protection within national territories and waters and protection of habitat.

Species protected by CITES trade controls are placed on one of three appendices, only two of which are commonly used. Appendix I species are those species threatened with extinction, which may or may not be affected by trade. Accordingly, Appendix I species are provided with the strongest protection; with very limited exemptions commercial and tourist trade is prohibited. All sea turtle species are on Appendix I. Species on Appendix II are those species which are not necessarily now threatened with extinction but may become so unless trade in such species is subject to strict regulation in order to avoid utlization incompatible with their survival. International trade in Appendix II species is allowed provided that the country of export grants approval for such trade. Species not fitting the above criteria may also be included in the Appendices in order to ensure that trade in more vulnerable species is brought under effective control (e.g. look-alike-species).

Implementation:

CITES came into force in 1975 and has become an effective mechanism for controlling international trade in most endangered species. However, trade in products derived from hawksbill and olive ridley, and to a much lesser extent, green sea turtles still continues in the wider Caribbean region because of three major factors:

1. Only _____ of the 26 countries in the region are members of CITES. Some of the non-member countries trade internationally in sea turtle products.

> Chuck I think you should change countries to geopolitical units, as not all British territories and colonies are members of CITES. I am waiting for verification on Montserrat and the British Virgin Islands and will call you next week with this information.

CITES Members	Non-members	Unsure
Brazil	Antigua	British Virgin Islands
Cayman Islands	Barbados	Montserrat
Colombia	Belize	
Bahamas	Bermuda	
Guyana	Dominica	
Costa Rica	Dominican Republic	
French Guiana	Cuba	
Guadeloupe	Grenada	
Martinique	Honduras	
Nicaragua	Jamaica	
Panama	Mexico	
St. Lucia	Haiti	
Suriname	St. Kitts, Nevis, Anguilla	
Venezuela	St. Vincent	
Canada	Turks and Caicos	

2. Some member countries have taken "reservations" on sea turtles. Suriname has a reservation on green and leatherback sea turtles. Until Janaury 1984, France, and France's overseas departments (French Guiana, Martinique, Guadeloupe) had reservations on hawksbill and green sea turtles.

3. Some member countries have not effectively enforced CITES trade controls.

Actions Required: State Department

Encourage all sea turtle trading countries in the plan area, not yet party to CITES, to join without reservation (e.g. Mexico, Dominican Republic, Cuba, Haiti).

Encourage Suriname to withdraw its CITES reservations for sea turtles.

Encourage all Parties to CITES to fully implement and enforce CITES import and export controls (e.g. Panama, Cayman Islands).

Actions Required: Departments of Commerce and Interior (leave as is)

page 261-269. (see attachment).

I hope you find these comments useful.

Best regards,

Emily Roet
Associate Director

ECS / ENVIRONMENTAL & CHEMICAL SCIENCES, INC.
P.O. Box 1393 • Aiken, South Carolina 29802 • (803) 652-7450 • (803) 652-2206

March 26, 1984

Charles A. Oravetz, Chief
Protected Species Management Branch
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

Dear Chuck:

I have reviewed the recovery plan prepared by the Marine Turtle Recovery Team. I would like to compliment the recovery team and particularly Sally Hopkins and Peter Pritchard for an excellent and comprehensive document. This effort should be followed by sufficient agency commitment to establish funding for the recommended programs.

I was delighted to see, on page 58, a statement regarding the paradox created by the Endangered Species Act which purports to protect the species but prohibits individuals from taking life-saving actions. This paradox has existed for years and the NMFS/FWS has been negligent in not resolving the problem.

Section 2.7 of the recovery plan deals with public education about the life history and protection of sea turtles. There is obvious advantage to having a public awareness of the adverse affects that humans can have on the sea turtle populations. However, too often public awareness leads to increased beach traffic which can influence nesting behavior of the turtles. For example, beach parks, such as Edisto Park in South Carolina, have tours, led by knowledgeable staff, taking large groups along the beach to find nesting turtles. The benefit of this educational process is obvious. The cost, in terms of nesting disturbance, is unknown. Another example: I understand there is a town in Florida that advertises itself as a sea turtle capital and has radio announcements directing people to the nesting beaches. In this instance, the educational benefit is quite low compared to the potential influence of numerous people wandering the beaches.

On page 88 of the recovery plan, the statement is made that during egg-laying and incubation, eggs may be examined. I think it is misleading to imply that examination and disturbance during egg incubation is not harmful. I recommend deleting reference to disturbing nests during the incubation period.

The loggerhead implementation schedule is a good one. However, I think some priorities should be changed to better reflect our present knowledge. The present beach surveys which mark adult females is a labor intensive effort conducted by numerous organizations which yields volumes of data of questionable value. The marking and mutilation of adult female turtles with tags that may last anywhere between 1 day and 7 years cannot yield reliable data. While the survey methodologies referenced in section 1421 are aerial surveys, it is all beach surveys being conducted in many ways by many people that need to be standardized and evaluated. I agree that long-term marking programs should be maintained, if only for data continuity. The plan section 1421 should be moved to the highest priority and implemented in connection with a program to develop both adult tags and a hatchling tagging method.

Sincerely,

James O'Hara, Ph.D.
Vice President

JOH:mg

February 9, 1984

Dr. C. Kenneth Dodd Jr.
1530 Northgate Square, Apt. 22B
Reston, VA. 22090

Mr. Charles Oravetz
National Marine Fisheries Service
9490 Koger Blvd.
St. Petersburg, FL. 33702

Dear Chuck:

I have finally had the opportunity to review the Sea Turtle Agency Review draft that you gave me in Puerto Rico. I appreciate the opportunity to look it over since I really wasn't involved in the technical review. I would have to state that the following comments are solely mine and do not represent any Fish and Wildlife Service positions; I assume that FWS will submit comments through the Regional office.

In general, I was rather impressed with the first section of the plan, although it is somewhat uneven in the depth into which topics are covered. Given the scope of the plan, perhaps this is not too serious a problem. The discussion involving the use and limitations of models (p. 27), population estimates (p. 18), and the uniqueness of individual populations (p. 15) are important points that should be retained, and even could serve as references for other recovery plans.

I was less than enthusiastic about the individual species recovery plan sections as they are often far too vague about necessary recovery actions, including land acquistion, critical habitat designation, research, and management. Again the scope of the plan may inhibit the type of detailed recommendations that we often see in our FWS recovery plans; however, there are other instances where specific actions could be recommended without seriously lengthening the plan. In the long run, in my opinion, it may indeed be necessary to rewrite the individual species accounts to reflect priorities for various conservation activities. That is, we may have to recommend that Kemp's ridley be headstarted X amount of years, that critical habitat should be designated for the loggerhead on the east coast of Florida, that FWS and NMFS increase their law enforcement personnel in the Caribbean, and that trawling be restricted in certain areas during certain times of the year. I realize that we don't have all the answers as yet; but we do have some and these should be incorporated.

To begin with, I make two recommendations. The first is that the Recovery Team review the sea turtle action plan developed by the World Conference on Sea Turtle Conservation in Washington to determine if any of these actions should be incorporated into the plan. The second is to recommend that the WATS Manual of Sea Turtle Research and Conservation Techniques be adopted by US, State, Territorial, and private researchers to lend some degree of standarization to sea turtle research. I might also add a strong recommendation be included in the plan that people who have endangered species permits be required to make their data available, either through publication in an appropriate medium, or in reports submitted to a central sea

turtle coordinating center (Univ. of Florida, NMFS, or ?) so that we are not faced with the situation where data are taken for many years, yet no one sees any results, and hears only rumors. We need not point to names to know that this has been a chronic problem, and continues to be so in certain areas.

I was very glad to see the Plan call for the development of critical habitat for sea turtles, both in marine and on beach areas. There has been a strong pitch within FWS to do away with critical habitat, and while I readily agree that it is not advantageous in all circumstances to have it formally declared, I still think it works well for species like sea turtles which may be present in a particular habitat on a seasonal basis. In 1978 I published what I think was the first attempt to tell where the various species nested (not referenced in the Plan I might add); I think this needs to be updated since we now have much better information, and I definitely think that certain areas need to be recommended for critical habitat designation: the marine areas around Culebra, Isla Mona, and certain areas around the US Virgin Islands; the lagoonal system on the Florida east coast; and nesting beaches at Cape Romain, Cape Canaveral, Hutchinson Island, Hobe Sound, between Melbourne Beach and Sebastian Inlet, Cape Sable, and I'm sure a few others that I've left off in this brief list. I would like the Plan to give specific recommendations in this area.

As to specific comments on the Plan, there are a few typos that need to be corrected, but I'm sure that you will find them in the course of your review. I will make comments by page number as indicated below.

P. 1. The definitions of endangered and threatened given here are not precise in terms of the Endangered Species Act. For instance, the word "race" should not be used, as the Act uses "subspecies." This should be rewritten to reflect the legal definitions.

P. 1. The Secretaries must review the status of listed species every five years, but recommendations for reclassification or delisting are made only if the biological data warrant such. This should be clarified in the next to last paragraph.

P. 12. The references to Dodd (1981) are incorrect both on this page and in the literature cited. The date should be 1982 (the reprints had the incorrect date).

P. 14. The population data needs to be updated on the number of leatherbacks nesting in the USVI. Scott Eckert gave slightly different figures at the Widecast meeting in Puerto Rico.

P. 16. Add coatis to the list of predators.

P. 19.(Top) Add the numbers of adult males as an elusive parameter.

P. 19. Both Marquez and Van Dissel (1982, Netherlands J. Zool. 32:419-425) and Steve Cornelius (various reports to USFWS) have also described their methods to estimate the numbers of females nesting on the beach, although with olive ridleys. These should also be referenced.

P. 22. I might question the statement that most reptiles reproduce on an annual cycle, as many factors may influence reproduction, including temperature regimes and food quantity and quality. Certainly not all the female crocodiles in a population reproduce annually, and I doubt that many turtles do either. Lizards and snakes may be another matter however. Is there really any data to substantiate the "most" in this statement?

P. 28. I understand the desire to have programs continue a minimum of six years- the females in at least one Georgia population "turn over" at this rate. However, six should be a minimum figure, and it could perhaps differ in other populations or with other species (as in greens discussed later). Useful data would only begin to be available at the end of six years, and it would be hoped that tagging programs really have a longer period in mind, say 10 years at least, as a target for operation. Six is thus only a minimum baseline figure, and may actually be too few years in some circumstances.

P. 45. The Plan should note that Richard Byles of VIMS is also using radio and sonar tracking in monitoring the sea turtles of the Chesapeake Bay. (As long as all the others are mentioned.)

P. 59. The problem of incidental catch and endangered species is not a question that can be addressed by FWS/NMFS through regulation. By law, you cannot have special regulations for species listed as endangered, even for conservation or research purposes. Therefore, to resolve the question, there would have to be a change in the Act to accommodate incidental catch, and that has serious implications both for sea turtles and other species. Jack Woody came up with an idea concerning incidental catch and how to handle it, but even with OES support, it got nowhere. Perhaps you should let Jack tell you about it. Otherwise, perhaps the Team should address the question of amending the Act to address the incidental catch question. It is indeed a bit thorny and volatile issue.

P. 64. I note that the increase in organic content of the nesting beach not only increases the number of microbes but also increases the potential for fungal contamination.

P. 65. ORVs should be mentioned specifically as a growing threat to nesting beaches. Cite paper by Hosier et al. (1981, Environ. Conserv. 8(2): 158-161) and note the papers cited by that paper.

P. 68. Suggest this wording "...costly program which should be used for only clearly..."

P. 72. Should cite the paper by Fritts and McGehee (1981, Contract 14-16-0009-80-946 [FWS/OBS- 81/37]) when discussing potential threats of oil.

P. 79. The Endangered Species Act does not per se provide for the establishment of marine sanctuaries. Perhaps the marine sanctuaries program of NMFS is more what they mean. We can declare marine critical habitats however.

P. 81. At one time, NMFS had several areas in Puerto Rico proposed as marine sanctuaries. What ever happened to them? Are they still pending? As I recall, OES supported the designation of these areas as sanctuaries because of their potential importance to the hawksbill sea turtle.

P. 102. Petroleum products may result in reduced reproductive effort; I know of no data yet that conclusively proves this in sea turtles.

P. 104. Modifications concerning intake pipes (high pitched sounds) have been used with some degree of success by the Florida Power and Light Company. I think Jim O'Hara has data on this but I have not been able to get a hold of his report. It might be worth referencing depending on the results.

P. 106. Section 1411. A. may be realistically impossible for the near future. I would add in section 1411.C.: Publish or otherwise make such data generally available to those with an interest in sea turtle conservation.

P. 108. I like and endorse these priorities.

P. 147. "... from as low as one to over two hundred eggs." could be interpreted as 1-200 or 100-200. Clarify.

P. 157. As I stated earlier, green turtles may have a different turnover rate than Georgia loggerheads. Therefore, what is the biological basis for this minimum rate? I think (without good data, just intuition) that this is too conservative and recommend at least 10 years for greens.

P. 164. I agree with the statements on monitoring green turtle populations on board fishing trawlers. But again, how do we deal with the Endangered Species Act and its restrictive provisions?

P. 183. The Plan should come right out and say: We recommend that the FWS purchase Sandy Point as a refuge for nesting leatherbacks as soon as possible. As Sean Furness noted, there could be some hitches that need to be resolved in the immediate future if we are indeed going to pick up this important nesting beach.

P. 199. Nesting of leatherbacks does occasionally occur on Isla Mona as well. Tom Wiewandt reported this to me, and Peter Pritchard claimed to have seen leatherback tracks on Mona this January. The beach certainly seems a likely place for occasional nesting.

P. 202. The notion that hawksbills form demes in the Torres Straits has indeed been mentioned in the literature primarily by Bustard (not cited in Plan) and Carr and Stancyk (1975). However, this is probably not correct as Limpus et al. (1983, Australian Wildl. Res. 10:185-197 and pers. comm.) have pointed out. When an adequate sample size from a variety of locations throughout the year is available, the deme notion based on variations in scute colors breaks down.

P. 204. I don't understand why these old data are included. Emily Roet has much more up to date information which should have been available to the authors of the Plan; these current data should be incorporated.

P. 215. This is an example of where the Plan could have been made stronger by the inclusion of specific recommendations, such as ".... in estuarine and marine waters, particularly the reefs off West Palm Beach, Florida, the waters off Mona Island, Puerto Rico, and the Magens Bay area off Saint Thomas in the US Virgin Islands."

P. 223. Kemp's ridleys are more familiar? To whom? Each other? Purely a semantic observation. Juveniles are most often observed by people.

P. 224. Poaching can still be a serious problem at Rancho Nuevo, despite the optimistic prose of the Plan. The Plan cites data from the late 70s, but when US observers were late getting on the beach in 1983, poaching again became a serious problem until the patrols were set up and aerial flights were again used to monitor the beach. This underscores the still great importance of timely access to the beach immediately prior and during the nesting season.

P. 246. I note that the only sea turtle listed by the US on the Western Hemisphere Convention is the green turtle. However, other Latin countries, particularly Mexico, have listed other species. See Dodd (1978, Herpetol. Rev. 9:52-53). Also worth noting is that the 1982 amendments to the Endangered Species Act gave further impetus to the US implementing the Convention, although I am not aware of any particular action.

P. 248. Suggest "...of the biological, economic, and social realities..."

P. 248. I am not aware of the NPS-FWS Cooperative Program. What I would like to see is a cooperative program that brings latinos to the US to be trained in sea turtle biology and conservation techniques, similar to the program underway to train Latin Americans in crocodilian biology.

P. 249. France, as part of the EEC, has now to my knowledge dropped its sea turtle reservations under CITES. Check with Emily Roet for update, but this section should be brought up to date.

P. 267. Add Kemp's ridley to the Mexican section.

P. 269. Venezuela section. Sea turtles forage near the mainland, not on it.

Literature Cited. I recommend referencing the extensive bibliography prepared by Peter Bacon for WATS as a source of many additional references to the published and unpublished literature on the sea turtles of the Western Caribbean. You might also mention my two bibliographies published by the Smithsonian Herpetological Information Service as sources of information, and definitely include the WATS symposium and manual. Finally, I'll show my bias by saying please include my critical habitat paper on sea turtles in the US areas of jurisdiction (Bull. MD. Herp. Soc. 14: 233-240, 1978); for a first try at delineating sea turtle nesting, it wasn't a bad little paper (personal bias not perhaps shared by others!).

Well, I guess that those are my major points on specific matters. The plan can serve as a basis for meaningful action, especially more so if it centers on certain items that should be accomplished as soon as possible. I wish I would have had more imput into the plan, but that is the way it goes.

In any case, if I can be of further help, or if you need clarification of any of my comments, please let me know. Glad I could be of assistance.

Sincerely

Ken

C. Kenneth Dodd Jr. Ph.D.

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1 June 1984

Ms. Patricia Carter
NOAA
National Marine Fisheries Service
Page Building #2
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

Dear Pat:

Enclosed please find a copy of some suggested text for your consideration to be added to the draft Marine Turtle Recovery plan for sea turtles that I understand you will be finalizing shortly.

As counsel for the Cayman Islands Government, I was given a copy of the Marine Turtle Recovery Plan as guide to the development of a U.S. - U.K (Cayman Islands) cooperative agreement on sea turtle conservation.

The suggested text should be treated in light of that objective and should be treated as addressing the obvious omission in the draft Plan to deal with sea turtle culture in a balanced way. Once the finalized Plan is open for public comment, the Cayman Islands Government as well as the Caymen Turtle Farm (1983) Ltd. may wish to submit comments at that time.

Very truly yours,

ORREN MERREN
Barrister & Attorney

Enc.

cc:
Mr. James Winchester
Mr. G. Ray Arnett
Mr. Robert Janzen
Hon. John B. McLean

Suggested Text to Add to Draft U.S. Recovery Plan for Marine Turtles

1) At the bottom of page 148, add the following:

Green turtles, because they are very desirable for their meat, shell and other products and because they are herbiferous and relatively nonagressive toward one another, are considered to be the best sea turtle species for culturing. A green turtle ranch, which collects fertilized eggs from the wild for hatching and rearing in captivity, is located in Surinam. The pioneer of sea turtle culture, the Cayman Turtle Farm, is located on Grand Cayman Island; since 1978, all of its green stock has been produced through the captive propagation of its breeding herd, without any further augmentation of turtles or eggs from the wild. Both operations release a portion of their hatchlings to the wild, with the balance of their production being used for research or for commercial purposes.

The potential for commercial trade from these facilities either to replace wild turtles in trade or to stimulate demand for wild turtles, and under what conditions, needs to be explored further. Potential enforcement problems stemming from commercial trade in cultured green turtle products also need to be examined further, along with proposed safeguards and solutions. However, the very significant potential for research, wild and captive hatchling releases, training as well as all other aspects of recovery efforts for green turtles at sea turtle culture facilities such as these should not be overlooked or ignored.

2) Just above the word "Implemenation" on page 249, add the following:

Appendix I species bred in captivity for commercial purposes are deemed to be Appendix II species. Populations of Appendix I species which are deemed by the Parties to CITES to be no longer endangered and to benefit by ranching (i.e., rearing in capitivity specimens taken from the wild) may be moved to Appendix II. Green turtles in Surinam and on Grand Cayman Island are the populations most likely to be affected by these provisions that allow regulated trade under the Convention.

3) Replace the text immediately under the heading "Actions Required: Departments of Commerce and the Interior" on page 250 with the following:

Determine major markets and sources of turtle products, and discourage with trade tariffs, quotas, stiff penalties for violations, etc. nations not conducting this trade in accordance with the Convention.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Fisheries Center
75 Virginia Beach Drive
Miami, FL 33149-1099

June 22, 1984

TO: F/SER64 - Chuck Oravetz

FROM: F/SECx4 - Fred Berry

SUBJECT: Sea Turtle Recovery Plan, Agency Review Draft of February 1984 — Suggestion

Three Attached pages show discrepancies in data on sea turtle nests for Florida (only state so far compared) between subject plan and the U.S.A. National Report to WATS.

These should be fixed, or ameliorated, or explained, or excused.

Attachments

cc: Sally Hopkins, w/Attms.
F/SEC5 - Larry Ogren, w/Attms.
F/SEC11 - Nancy Thompson, w/Attms.
Ross Witham

FLORIDA: ESTIMATED NUMBER OF SEA TURTLE NESTS PER SEASON, BY EACH, BY SPECIES--
COMPARING WATS USA NATIONAL REPORT (1st number in block) AND "MARINE" TURTLE
RECOVERY PLAN DRAFT (2nd number in block, in parentheses).

NAME OF BEACH	LENGTH (km)	LOGGERHEAD	GREEN	LEATHERBACK
FLORIDA:				
1. Ft. Walton Beach (incl. Eglin AFB)		6		<1
2. T.H. Stone Memorial St. Joseph State Pk.	19.2	11		
3. St. George Island Recreation Area		17		
4. St. Vincent Island National Wildlife	11.3	10		
5. Northern Longboat Key	8.0 (5.8)	20 (16)		
6. Casey Key	7.6 (6.4)	50 (48)		
7. Manasota Key	12.9 (16.1)	170 (150)		
8. Cayo Costa State Preserve	8.0	6		
9. Sanibel Island	18.5	100 (100)		
10. Wiggens Pass State Recreation Area	13.4	22		
11. Vanderbilt Beach	8.0	39 (38)		
12. Bonito Beach	9.7	42 (42)		
13. Naples Area Beaches	8.0 (6.4)	50 (40)		
14. Cape Romano	4.8	40 (40)		
15. Fort Jefferson National Monument	4.8	65		
16. Everglades Nat'l Park Beaches	56.6 (56.5)	1200 (1350)		

NAME OF BEACH	LENGTH (km)	LOGGERHEAD	GREEN	LEATHERBACK
FLORIDA:				
17. Bahia Honda State Recreation Area	0.8	1		
18. Soldier Key	Not Recorded			
19. Bill Baggs Cape FL State Rec. Area	2.4	57	2	
20. Northern Key Biscayne	9.6	39 (67.)	2	
21. Miami Bch. Surfside Bar Harbour Haulover	16.1	30	1	
22. Broward County Beaches	36.6 (37)	1193 (1021)	18 (32.9)	6
23. Boca Raton Public Beach	4.2	370	8 (6.9)	1 (4)
24. Highland Beach	4.5	507	7 (34.2)	6
25. Palm Beach Shores	0.9	54		
26. Lost Tree Village	2.8	215	7 (17.)	3 (3)
27. Juno Beach	1.6	340 (339.2)	3 (4.5)	1 (1.5)
28. Jupiter Beach	12.3	2108 (2238.6)	10 (25.8)	7
29. Hobe Sound Nat'l Wildlife Refuge	5.6 (6.4)	1108 (1086.7)	8 (13.2)	3 (3)
30. St. Lucie Inlet State Rec. Area	3.4			
31. Hutchinson Island	36.0 (36.3)	3115 (4080.1)	10 (28.8)	11 (3.5)
32. Ft. Pierce Inlet State Rec. Area	3.2	26		
33. Sebastian Inlet State Rec. Area	5.0	297	2	

NAME OF BEACH	LENGTH (km)	LOGGERHEAD	GREEN	LEATHERBACK
FLORIDA:				
34. St. Lucie & Indian River Counties	28.6 (36.8)	726 (1012)	65 (66.2)	2 (2)
35. South Brevard County	50.2	7000	60 (126.6)	3
36. Indialantic & Melbourne Beach	9.3	2000		
37. North Brevard Co. (Cape Canaveral)	50.0	2367 (2175)	10 (20.)	
38. South Volusia County	8.0	392 (392)	(4.)	
39. Flager Beach State Rec. Area	0.7	9	1	
40. St. Johns County Beaches	66.0	50		
41. Ft. Matanzas National Monument	1.2 (0.8)	2 (13)		
42. Anastasia State Recreation Area	4.0	2		
43. Big Talbot Island	3.2	9		
44. Little Talbot Island	8	32		

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
SEFC Galveston Laboratory
4700 Avenue U, Galveston, TX 77550

June 19, 1984

To: F/SEC - Mr. Fred Berry

From: F/SEC6 - Edward F. Klima, Ph.D.

Subject: Sea Turtle Recovery Plan

Per your verbal request, the following comments are submitted and focus on Section 3.5 (Kemp's Ridley Turtle Recovery Plan), p. 220-242:

1. p. 221 - There is a great deal of speculation in the second paragraph concerning past importance of Padre Island as a nesting site. To down-play the past, albeit poorly documented, nesting activity of Kemp's ridleys on Padre Island, using speculations about unusual currents, unusual climatic conditions, or failure of turtle guidance mechanisms, is counter-productive and could seriously misguide the uninformed reader. This is a plan for recovery of a seriously endangered species, and no clues to former nesting areas should be down-played. In fact, much of the current head-start project is focused on re-establishment of a nesting population on Padre Island. Such focus does not preclude consideration of other possible locations. The paragraph should be reworded.

2. page 222 - The abiotic environment may be seriously threatened by petroleum pollution (see items 1111, 11111 and 11112 on page 227). Contamination of the western Gulf of Mexico and its beaches with oil and tar is documented. Because of concerns about possible impacts of such pollution on endangered species, MMS has initiated a series of studies on effects of petroleum on sea turtles. The Coast Guard at Corpus Christi, Texas, claims that the tar coming onto the beaches near Corpus Christi in spring and early summer each year originates from the Ixtoc blowout (mentioned on page 225). Reports of oiled turtle strandings are increasing. The effects of chronic petroleum pollution of the nesting beaches is not known, nor are the effects of oiling of hatchlings, yearlings and adults. It is documented that Kemp's ridleys die with tar in the esophagus. This has been observed in turtles from two releases off Padre Island so far. One release (1982 year-class) was made about 4 miles off the coast of Mustang and Padre Islands, and the other (1983 year-class) about 20 miles off Mustang Island.

The plan also should mention concern about the impacts of petroleum pollution (from whatever sources) on the Rancho Nuevo nesting beach (as well as future nesting beaches) and on the turtles themselves. For example, apart from the acute effects of such pollution, it is well documented that hydrocarbons can interfere with sensory mechanisms in marine fauna. Chronic pollution of the gulf by petroleum could interfere with chemical sensory mechanisms that the Kemp's ridleys may use to locate the nesting beach. The paragraph should be changed to reflect such concerns and considerations.

3. page 223 - Last paragraph - Archie Carr believes that Kemp's ridleys that leave the gulf are lost from the population, whether or not they cross the Atlantic to Europe. Yet, the question is still open to debate, pro and con. Head-started, tagged, and released Kemp's ridleys have shown a recovery pattern along the Atlantic coasts of North America and Europe not unlike that in the published literature. It is probably premature to conclude that none that escape the gulf return to the gulf. The question should remain open, and the paragraph should be changed to reflect this.

4. page 224 - Second paragraph - Because of legal deterrents to capture of sea turtles, the estimates of rates of capture of Kemp's ridleys by shrimp trawlers probably are biased downward. In other words, they are "best case" estimates, both for turtles and for the industry. There may be need for declaring "no trawling zones" in U.S. waters too, especially where Kemp's ridleys are known to congregate.

5. Page 225 - First paragraph - Watson & Seidel (1980) provide some relevant data on mortality rates of trawl caught sea turtles that might be worth mentioning, even though they do not refer exclusively to Kemp's ridleys.

6. Page 231 - item 11322 - This section appears too restrictive. I propose to inject tetracycline, and perhaps other chemicals, into head-started Kemp's ridleys to study their age and growth. Such study would be prohibited under the current wording of this section. The section needs to be less restrictive.

7. Page 233 - The recently reported (by Jim Woods) successful nesting of two 5-year-old, head-started Kemp's ridleys at the Cayman Turtle Farm should be emphasized. This major break through in captive breeding adds significance and importance

to establishment of breeding colonies of Kemp's ridleys, and it can probably be done over a much shorter time period than was earlier supposed. Such breeding colonies could provide a "safety net" for the species, because they could provide a continuous supply of hatchlings to be released into the wild. Head-starting is an ideal source of such brood stock on a continuing basis, because it provides for natural genetic variability (because the source of head-started hatchlings is wild stock). Captive breeding colonies should be established in many suitable locations and their sizes increased. The program to coordinate exchange of animals among breeding colonies should be expanded. These comments should be incorporated into the plan.

8. page 237 - It seems incongruous that the plan calls for studying the incidental take in U.S. waters while recommending more stringent measures (adjustments in the "no trawling zone" and fishing regulations) for Mexican waters. We know that Kemp's ridleys congregate in certain locales within U.S. waters; e.g., Sea Rim State Park, Texas, and Ponce de Leon Inlet, Florida. It is not premature to focus on such areas as possible candidates for "no trawling zones." Our willingness to consider such actions would go a long way in enhancing the interactions between the U.S. and Mexico in the Kemp's ridley recovery program.

9. page 238 - item 151 - I agree that broad-based aerial surveys are not productive. However, aerial surveys of turtles and shrimp trawling activities should be conducted at carefully selected sites where Kemp's ridleys and shrimpers are known to congregate (e.g., Rancho Nuevo, Sea Rim State park, Ponce de Leon Inlet, and perhaps others). A "rifle" approach, not a "shotgun" approach, is needed. Coupled with ship-board observer surveys, site-specific surveys would be very productive in assessing Kemp's ridley abundance and catch rates where ridleys congregate.

10. p. 239 - Lead agencies should be corrected and priority rankings added to the implementation schedule (from recovery plan) as follows:

Activity	Priority Ranking	Lead Agency
Regulate spoil dumping, sea floor mining and trawl tows	1	NMFS
Maintain and enforce ban on take throughout the range	1	NMFS
Use hatcheries and head-starting	1	NMFS
Maintain total ban on commercial, recreational or subsistence take	1	NMFS
Establish captive breeding colonies	1	NMFS
Develop oil spill contingency plan	2	NMFS
Regulate methods, gear, areas and seasons in U.S. waters	2	NMFS
Recommend regulations for methods, areas, gear and seasons in Mexican waters	2	NMFS
Determine feasibility of aerial and other means of at-sea monitoring	2	NMFS (was incorrectly listed as FWS)
Regulate petrochemical industry	3	FWS (was incorrectly listed as NMFS)
Determine unknown mortality factors, if any, and take appropriate action	3	NMFS

11. General - Overall, I suggest a major shift in your Kemp's Ridley Turtle Recovery Plan from a passive approach to an active one. I suggest the following:

    a. Cooperative planning with major partners - Conduct a planning meeting and workshop in July or August 1984, in

Galveston, Albuquerque or Santa Fe, New Mexico, or El Paso, Laredo or Brownsville, Texas, to permit Mexican scientists to engage actively in the planning workshop. It is important that such a cooperative effort be initiated at the onset of planning of this recovery program. Your draft fails to recognize the important contributions made by the Instituto Nacional de la Pesca, the Fish and Wildlife Service, the National Park Service, the Texas Parks and Wildlife Department, the Gladys Porter Zoo and the Florida Department of Natural Resources in the recovery of the Kemp's ridley sea turtle. These organizations play major roles. Without their contributing significantly to the planning effort, it will simply be planning in a vacuum. Participants should include appropriate representatives of the NMFS Southeast Fisheries Center, the Southeast Regional Office and the agencies already mentioned, as well as invited outside turtle biologists such as Drs. Archie Carr, Peter Pritchard, Jim Wood, Dave Owens and John Hendrickson. The product of the workshop would be an agreed upon Kemp's ridley sea turtle action plan.

b. The Kemp's ridley recovery plan should focus on efforts to step-up restoration of the Kemp's ridley population, through cooperative actions between Mexico and the United States. These efforts should include the following:

(1) On-site research and restoration activities at Rancho Nuevo (FWS and INP)

- protecting and tagging adult nesting female turtles.
- protecting nests and eggs.
- protecting and tagging hatchling turtles.
- analysis of Kemp's ridley stock trends.

(2) On-site observations of behavior and distribution of Kemp's ridleys off Rancho Nuevo (NMFS)

- detailed observations using satellite- and radio-tracking devices on adult sea turtles during the nesting season.

- observations on distribution and survival of hatchling sea turtles off Rancho Nuevo.

- on-site collection of data on sea turtles using observers on-board vessels.

- aerial surveys and observations of sea turtles from Tampico to Brownsville during nesting season.

(3) On-site observations of behavior and distribution of Kemp's ridleys at selected sites (e.g., Sea Rim State Park, Ponce de Leon Inlet) (NMFS)

- aerial surveys and observations of sea turtles.
- on-site collection of data on sea turtles using observers on-board vessels and directed fishing activities for collection
- tagging and release of captured sea turtles using flipper tags and radio-transmitters.
- detailed observations using satellite- and radio-tracking.

(4) Head-starting of Kemp's ridley sea turtles (NMFS)

- head-starting of Kemp's ridley sea turtles at Galveston.
- expansion of captive breeding colonies.
- expansion of research on hatchling turtles to determine growth, nutrition, fitness, and health.
- research on proper diets for brood stock turtles.
- develop and test new tagging/marking methods.

(5) Mitigate factors affecting marine mortality and stress (NMFS)

- increase TED technology transfer to Gulf of Mexico waters.

(6) At-sea Kemp's ridley population movements (NMFS)

- coordinate area-wide tagging effort.
- develop tags that have longer longevity and better recognition for both yearlings and adults.
- test tags for hatchlings.
- use satellite- and radio-tracking.

(7) Collect information on incidental take of sea turtles

- amend permits to shrimp fishermen to allow collection and transfer of incidental capture data to NMFS.

I feel that it is important that we initiate the cooperative phase of action planning for the Kemp's ridley recovery program as soon as possible. The workshop with the other agencies and individuals should be held in either mid-July or mid-August to develop the action plan for the Kemp's ridley recovery program, identifying our partners and what roles they and we will play.

The major thrust of the expanded Kemp's ridley recovery program should be to identify the factors that affect survival and distribution of adults as well as hatchlings at the Rancho Nuevo nesting site. This can be done through a series of experiments that need to be planned cooperatively with the Mexican government and FWS. Further, a major effort needs to be initiated in areas where Kemp's ridleys congregate, such as Sea Rim State Park, Texas, and Ponce de Leon Inlet, Florida. There may be other such sites and these need to be identified. The idea would be to obtain (from strandings, etc.) and to capture turtles, and to hold, tag and release them with radio transmitters and satellite tags, so as to provide additional information on distribution of these animals. The next major effort would be head-starting research, to continue this effort at Galveston and to expand the captive breeding populations and cooperative exchange activities. And finally, and very importantly, transfer of the TED technology to the fishermen in the Gulf of Mexico should be facilitated. Work also should be carefully outlined with the Mexican government to place TED's on-board selected vessel in Mexico.

cc:
F/SECx4 - Dr. Richard Berry
(Attn: Brad Brown)
F/SER - Chuck Oravetz
F/SEC6 - Charles Caillouet
Clark Fontaine
Jorge Leong

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