A Reconnaissance of Beaches and Coastal Waters From the Border of Belize to the Mississippi River As Habitats for Marine Turtles

By

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A Reconnaissance of Beaches and Coastal Waters From the Border of Belize to the Mississippi River as Habitats for Marine Turtles

There has been no sustained work on marine turtles along the eastern seaboard of Mexico except for Rancho Nuevo, Tamaulipas. Nevertheless there are many fishermen who know their fishing grounds very well, and they are scattered along the entire coast. In addition, there are biologists who have made observations or even carried out projects limited in area and duration on marine turtles, although their results have not been widely disseminated. Consequently, considering the anemic state of marine turtle populations and our knowledge of them, review articles are of limited value. Furthermore, it has been difficult to choose a site for profitable research on any particular species. This project was planned to gather information which could be used to concentrate our research and conservation strategies in more productive areas.

Furthermore, human populations and development have burgeoned along the entire coastal area of eastern Mexico and the northwestern Gulf since World War II. This not only makes the implementation of conservation plans more urgent, but probably, as well, requires constantly changing strategies and emphasis on details.

Methods

I was familiar with the geography of the coast, because I had

flown over it twice on bird censuses and had visited nearly every coastal village which was easily accessible by 4-wheel drive vehicles. My visits to the fishing grounds of the northwestern Gulf started in 1950 and to the southern Gulf, in 1951. As a reconnaissance survey, virtually all the information in this report was gleaned from fishermen, biologists and fishery administrators who worked in the marine area about which they were questioned. In only two cases did I actually handle turtles in the field, but I did see eggs, young and adults in laboratories.

The same interview technique was followed throughout the survey. I chose people arriving at the docks from fishing trips, working on nets or fishing boats, for interviews. In a few cases, fish dealers or other businessmen near the beach were queried. Conversation always opened with questions about octopus, shrimp or finfish fishing and then questions were asked about turtles. If they did not state the species, they were asked to name them in order of abundance. Questions were asked about nesting turtles as well as incidental catch in their gear. All fishermen seemed to be aware of the ban on harvesting turtles. Even though my survey was in no way related to assessing the effectiveness of the ban, I could not expect honest answers if they thought I was trying to entrap them. I never asked their name and they never volunteered it. Furthermore, I tried to schedule most of my trips during the nonnesting season which was, usually, also the period of minimum turtle abundance.

In order to evaluate the possibility of fishermen encountering

turtles, it was necessary to know the amount and type of gear used. This was determined by visual inspection of the ports or the beach fishing camps. Economic conditions in Mexico since 1982 have increased the artisanal fisheries and decreased the effort with large trawlers on the shrimp grounds.

Discussion by Area and Species

Quintana Roo

Yucatan is an uplifted limestone platform. Quintana Roo forms the eastern boundary of the Yucatan Peninsula. The eastern coast fronting on the Caribbean Sea is long and irregular with coral reefs and islands offshore (see Figs. 1 and 2). The longest barrier reef in the Western Hemisphere stretches from isla Cancun to Zapotilla Keys in southern Belize. The continental shelf is narrow; it is only five kilometers to the hundred-fathom contour off Puerto Morales. The two most prominent indentations are bahias Ascencion and Espiritu Santo. Two slender ridges of sand backed by narrow lagoons were special goals of the survey in Quintana Roo. One of these lagoons opened at its northern edge through Boca Paila, which is the site of a sportsfishing camp for bonefish and tarpon, and its southern end merges with bahia Ascencion at Punta Allen (Rojo Gomez). The southern lagoon merges with bahia Espiritu Santo at Punta Herrero.

According to figures compiled by Polanco (1984), only 32 percent of the mainland Caribbean coast or approximately 135 kilometers are suitable for nesting turtles. In my survey, I was impressed by the extent of rocky or mangrove fringed beach, but I

Figure 1. Study area

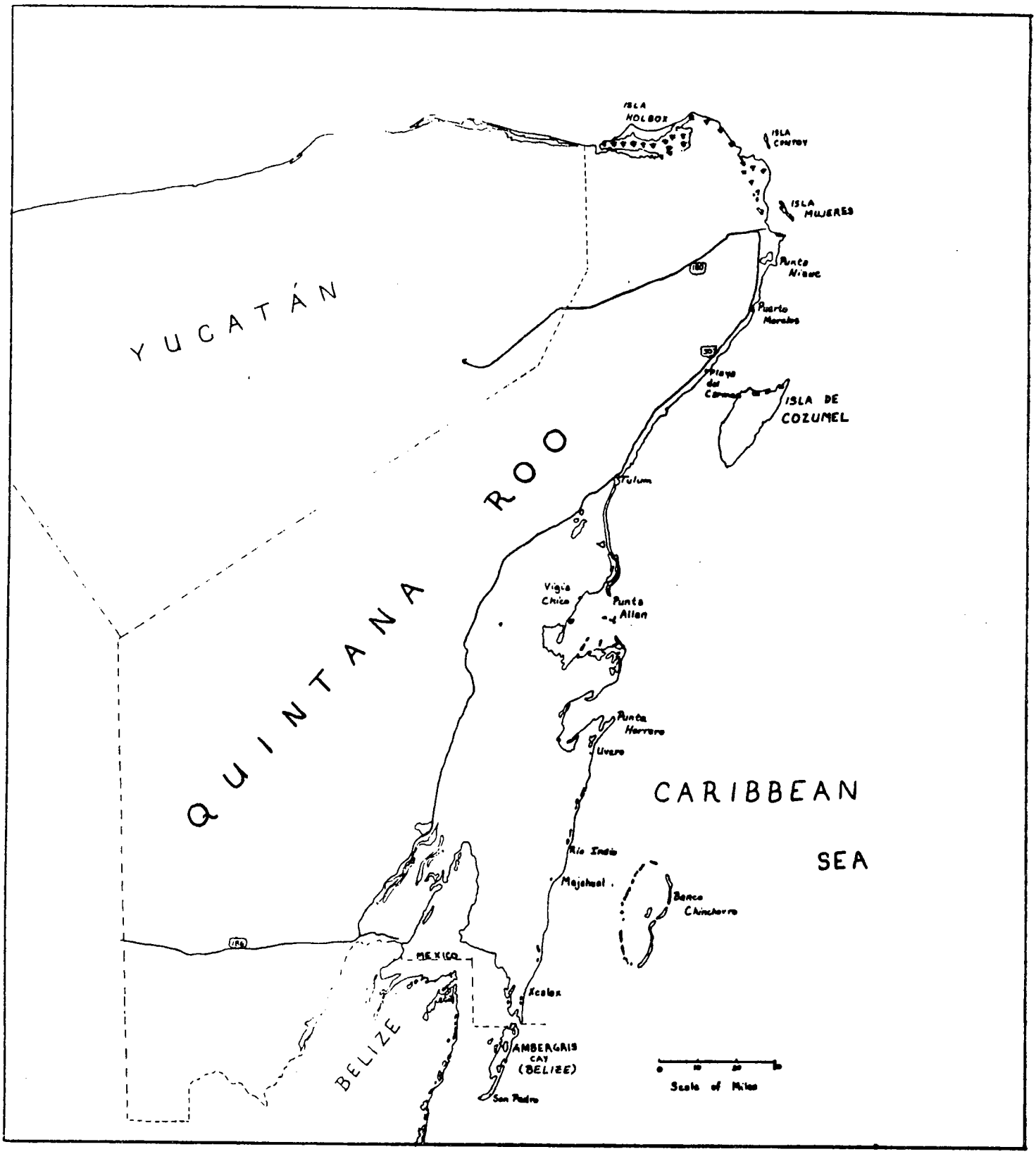

Figure 2. Quintana Roo

was unable to quantify it because the beach was often not visible from the road. Polanco (1984) found even less suitable nesting grounds on the Mexican Caribbean Islands; 18% for Cozumel, 20% for isla Mujeres and 25% for isla Contoy. Tunnell (pers. comm.) found only coral rubble on cayo Lobos during the winter of 1985-86. He told me that banco Chinchorro should be eliminated from the nesting sites for marine turtles. Both Carranza (1959) and Parsons (1962) had included cayo Lobos as a nesting area for the green turtle (Chelonia mydas).

Quintana Roo was an undeveloped territory with few people and no paved roads as recently as the middle 1950s. The first improved airport was built on Cozumel during World War II, and later this became a center for a tourist trade based on the clear blue water of the Caribbean and the sport of scuba diving. Development was slow until the decision of the Echeverria administration to build a major tourist center in Cancun. In 1972 this area had a population of 20 people and in four years a population of 40,000; fifteen years later the area has grown into a metropolitan zone of over 150,000 inhabitants. Other areas of Quintana Roo have shared this growth syndrome but to a lesser degree. In any case the territory was conferred statehood in 1974 and has actively encouraged development and immigration. Most of the development projects have been in tourism, forestry, agriculture and fisheries, but projects in port development and industrialization are now being considered.

In retrospect, it is obvious that turtle conservation has not kept pace. The important turtle fisheries of the 1950s no longer

exist; it is even illegal to kill a turtle for village use. Cancun, an important nesting area according to Carranza (1959) and Parsons (1962), is now a site for large hotels. New strategies must be devised and implemented if the fishery or even a remnant of the once great populations of turtles is to be maintained.

I traveled the coast of Quintana Roo from December 4 to December 10, 1984 and visited several laboratories. In Chetumal I saw two green turtle carapaces used as decorations in a restaurant. These were small (25 and 35 cm. in length) and I was told that green turtles of this size are not uncommon in the bahia de Chetumal. A Mexican biologist later told me that they often encounter the green turtle in the mouth of the rio Hondo. Apparently no mapping of turtle grass beds has been done in Quintana Roo, but my observations indicate that they are common in coastal and lagunal watersof the state.

The coast from Punta Herrero to Xcalak has only recently been connected to the main north-south highway in the state by a good paved road to Majahual; eventually the road will extend along the coast from Xcalak to bahia Espiritu Santo. An all-weather road exists now but much of it was unpaved during my visit. Development is following the roads; some residents of Chetumal are building beach homes. There is also some tourist and commercial fishing development. Nevertheless the region is sparsely populated and will probably remain that way for a long time. Scattered along the coast are pound nets which were introduced from Belize many years ago. Xcalak is noted as a lobster (Palinurus) port because

local fishermen catch lobsters from banco Chinchorro as well as from the barrier reef. They also dive for conch (Strombus gigas) and set monofilament gillnets for finfish. All species of marine turtles are protected by federal law. From Ubero to Xcalak, fishermen agreed that loggerhead, green and hawksbill turtles were present in coastal waters and nested in small numbers every year. The hawksbill was the least abundant species. On the other hand the people living on the coconut plantations near Punta Herrero informed me that the loggerhead and the green were common and the hawksbill rare.

The land is low and swampy around bahias Espiritu Santo and Ascension and it will probably be some years before there will be many access points by road to the bay coastlines. A loop road extends through relatively high country to the lagoon shore opposite the village of Rojo Gomez. The bridging of this gap will allow a coastal traveler to rejoin the Cancun-Chetumal highway without backtracking to Tulum.

The road from Tulum to Rojo Gomez runs close to the coast and I was able to question a number of fishermen. Human activity is high along this beach with the development of tourist facilities and beach homes. I was even solicited to buy beach front lots. Rojo Gomez is the headquarters of the most successful lobster cooperative in the state. Lobster, conchs and horseshoe crabs, all of which have been reported as gourmet fare for loggerheads, are found in bahia Ascencion. C. C. Rosado, a fishery officer in Belize, told me in 1968 that loggerheads were common nesters near

bahia Ascencion and that some were imported into Belize City. I was informed that the loggerhead was the most common nester. The green turtle also nested in the area in small numbers and only an occasional hawksbill nested. Here and elsewhere on the Caribbean coast of the state I was told that leatherbacks commonly occurred offshore; a very few nest every year.

From Tulum north to Punta Sam, the coast is accessible at major cities such as Playa Carmen, Puerto Morales, Cancun and Puerto Juarez. In addition one could enter special tourist districts such as Xel Ha and Akumal by paying a fee or renting rooms. In any case Xel Ha and Akumal are known throughout the tourist community for transplanting turtle eggs. I have found no published data on this activity, but I was told by individuals close to the project that 10 to 15 thousand eggs are transplanted every year. Approximately 80 percent of the eggs are loggerhead and 20 percent green. There is never more than one or two hawkbill nests. The area from which the eggs are gathered begins a few kilometers north of Akumal and extends 30 kilometers to the south. Nests of loggerheads and greens occur elsewhere throughout this broad section of the coast and eggs are also gathered for transplanting at playa Carmen.

I obtained no data from the roadless coast between Cabo Catoche and Punta Sam. According to Polanco (1984), this coast is utilized by small numbers of nesting loggerheads, green, hawksbill and leatherback turtles. The green turtle was most numerous with an estimated 30 nests a year.

On the Gulf coast of Quintana Roo, the main nesting area is Holbox Island and according to fishermen I interviewed at Chiquila in December 1985, green, loggerhead, hawksbill and leatherback nest there. The green turtle is the most abundant nester. Before 1980 the only access to the region was by boat or by a small airplane. In 1985 there was a good paved road to Chiquila and a small car ferry to Holbox. Holbox is recognized as one of the best fishing areas of the state, and now that the fishermen do not have to salt their fish, the fishery will expand.

Carranza (1959) had reports of a fifth species in the waters of Yucatan and Quintana Roo, which was called by the fishermen, "tortugo bastardo" or "champan." He saw no examples but concluded that the fishermen were describing the ridley (Lepidochelys kempi). The presence of the species in the waters of Quintana Roo was confirmed by the capture of a tagged example near Chiquila in 1985.

All the Caribbean islands of the state of Yucatan have probably been nesting sites for marine turtles. I have made a survey only on isla Mujeres. Polanco (1984) reported low concentrations of nesting green (60 nests), loggerhead (36 nests), hawksbill (9 nests) and leatherbacks (6 nests). Isla Mujeres has only 4.1 kilometers of suitable beaches, and it has a very active community which caters to a large tourist trade throughout the year. The same species nest here as on Cozumel but in very small numbers (green 12, loggerhead 9, leatherback 1 and hawksbill 3), according to Polanco (1984). Isla Contoy is a national park so it is protected from the construction of buildings and the despoiling of

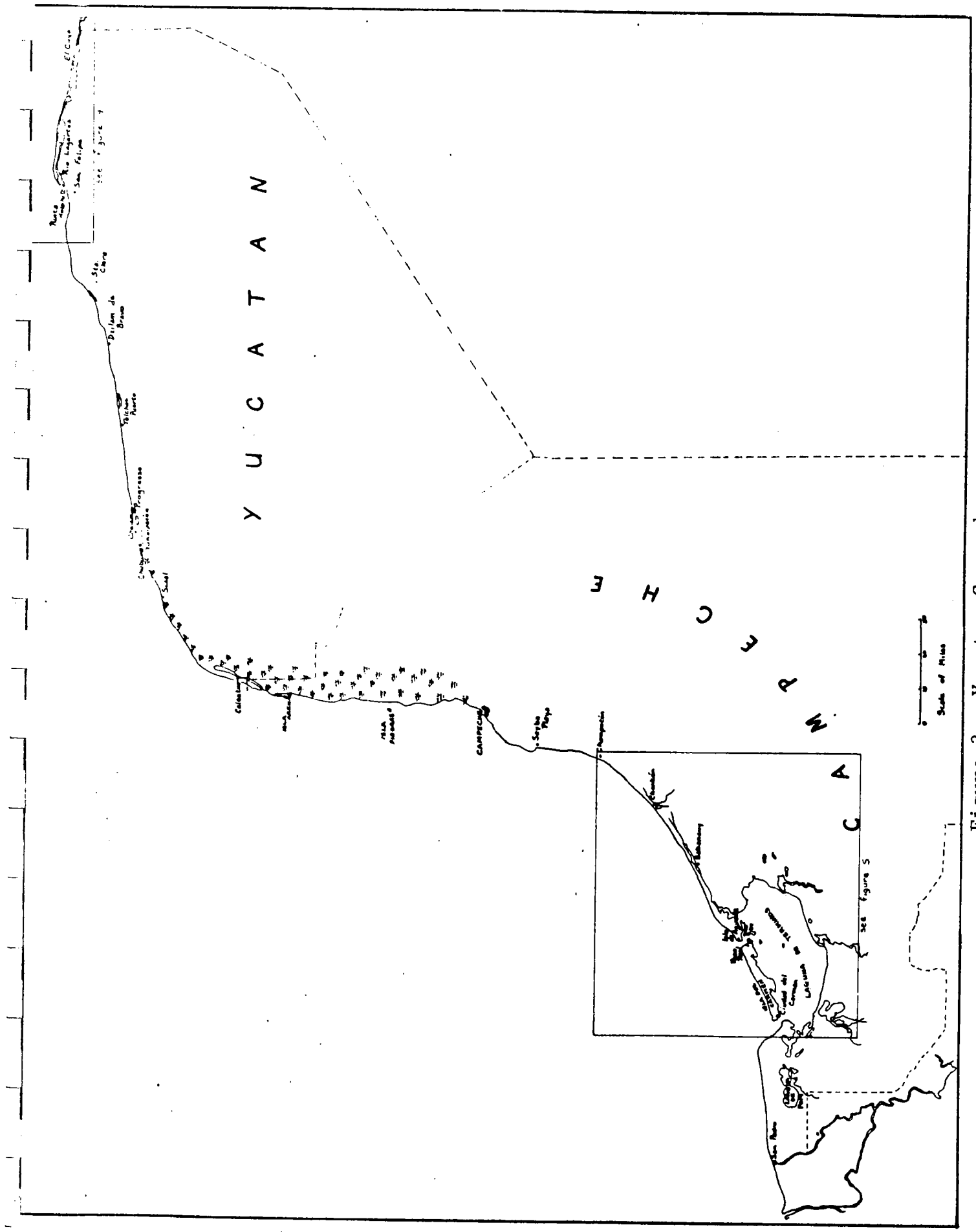

Figure 3. Yucata--Campeche

beaches. However, it is in an area of intense commercial fishing. In any case the same four species nest on the island as on the others. I have been told that records are kept of nesting activity but they have not been published. Polanco (1984) estimates the nests as follows: green 20, loggerhead 15, hawksbill 12, and leatherback 3.

In order to interpret our data it is necessary to examine past records. Carranza (1959), Fuentes (1967) and Montoya (1967) were found to be the best sources of information. The leatherback is not an uncommon species offshore but it is a rare nester as documented in this paper. The main impact of man on this species has been the gathering of eggs, but, even so, no decline is evident from available data. I think the present hawksbill population is extremely small considering the large extent of suitable habitat in the state. I conclude from examining the admittedly scanty data that the population seems to be neither increasing nor decreasing in size over the past 40 years. However, the hawksbill was intensely exploited in earlier times by Cubans, Belizeans and Mexicans. It is probable that the species has not increased in numbers to compensate for the near extermination of the species by these tortoise shell hunters.

Loggerheads have always been important to the local population. The inhabitants prized the oil for medicinal purposes and they utilized the eggs and meat both fresh and dried. Fuentes (1967) found it the most abundant species in Quintana Roo and cited catches of 103, 205, and 172 thousand kilograms for 1960,

1961, and 1962, respectively. After 1962, the rules of turtling were changed to include closed seasons during the most productive time of the year, consequently later statistics are not comparable to earlier ones. On the basis of my information, there seem to be very few nesting females and I believe that the Yucatan population is in serious trouble and should be closely monitored.

In the 1940s and 50s, the most important cash crop for the fishermen in Quintana Roo was the green turtle. This fishery is described by Carranza (1959). Some turtles were caught throughout the state but the vast majority were caught near isla Mujeres. Some were turned on the beach but most were caught in nets. According to Montoya (1967), an average of 193 thousand kilograms were taken each year for the fifteen years between 1947 and 1961. The maximum catch was 343 thousand in 1960 and the minimum was 45 thousand kilograms in 1958. The catch was low for four years after the very destructive hurricane Janet in 1955, and it is probable that the 1958 catch was also affected by the economic recession of the fishing industry that year. Without a fishery in 1987, it is difficult to evaluate the status of the population. Furthermore, it appears obvious that at least a part of the fishery was based on migratory green turtles. I conclude that the resident population of green turtles (i.e., nesters) have declined drastically in recent years and need to be closely watched.

Conservation of turtles in the state has consisted of the following: a) regulating the harvest by passing restrictive laws, b) establishing biotic reserves, c) practicing mariculture.

Two reserves have been established in Quintana Roo, but in neither case were turtles a primary consideration in their designation. Isla Contoy, a national park, has already been discussed. The other is Sian Ka'an, a 1.2 million acre area of land and water in the central part of the state. Included in this reserve are some good turtle beaches, particularly north of Punta Allen and south of Punta Herrero and the turtle foraging grounds of the two large bahias, Ascencion and Espiritu Santo. The reserve will not be a wilderness area, but any development beyond existing units will be planned to protect ecological values and to preserve wildlife.

Fuentes (1967) reviewed some of the early turtle culture experiments in Quintana Roo. Biologists first became involved in supervising the release of hatchlingswhich had been produced by private individuals transplanting eggs. The next step was a series of experiments on hatching oviducal eggs from the commercial slaughter houses; success was achieved in 1965. However, it is my understanding that the laboratory obtained eggs from natural nests and from turtles "borrowed" from fishermen when the commercial harvest was limited during the main nesting season. The turtles were maintained in an enclosure with a beach at the laboratory at isla Mujeres and after they had laid one or two clutches, they were returned to the owner for sale. I observed this operation at isla Mujeres in 1978. Since the complete ban on turtling in 1981, funds for turtle culture have been reduced or eliminated at the laboratories on the Yucatan Peninsula. One program has been

operated with state and private funding at Akumal for the last several years. The concept of farming turtles has been abandoned for now. The experimental farm at Puerto Morales was discontinued in 1982 and the turtles released to the wild. The turtles went to sea but soon returned to be fed. The villagers caught and ate them.

My experiences in Mexico support a program of transplanting the eggs to a protected area, otherwise not one will survive this onslaught of predators. I include man and a host of wild animals in this list.

Yucatan

The coast of Yucatan varies little from end to end. It consists of a series of beach ridges separated from the mainland by a lagoon or a swamp. The swamp vegetation is dominated by mangroves, and the sandy beach ridges by xeric vegetation. In a few places coconut plantations exist, but yellowing disease is prevalent. Most of the beach is readily accessible by car, but there is a roadless area between San Felipe and Dzilam del Bravo. I have traveled all the beach except the roadless area. In general, man's impact on the beach ridge has not been notable. He has been a fisherman, a worker at the salt plants, a tourist or someone providing goods or services to the aforementioned individuals. Miles of beach front housing and tourist facilities exist in some areas. Other structures consist of a few piers, including the giant pier which comprises the port of Progreso. To accommodate small fishing boats, there are shallow water ports cut through or

into the beach ridge at Cuyo, Dzilam del Bravo, Telchac Puerto, Yucalpeten and Celestum.

One can say that the entire coast is suitable for nesting turtles, but the state does not have a history of significant turtle landings. For example, from 1948 through 1959 the landing per year of green turtle was 4,600 kilograms. However, with the opening of a processing plant in Merida, landings in Yucatan were 149 and 204 thousand kilograms in 1960 and 1961, respectively. A big jump in turtle landings occurred throughout most of coastal Mexico at this time (Marquez 1976). I suspect that the increased landings came from intense exploitation of the offshore cays and the foraging grounds on Campeche Bank.

The best area for nesting turtles in modern Yucatan is the narrow sliver of sand which forms the seaward boundary of rio Lagartos (see Figs. 3 and 4). This peninsula is not named on any chart available to me, and I have designated it as rio Largartos Peninsula. It is approximately 65 kilometers long with one channel dredged across it, opposite the mainland town of Rio Largartos or approximately 6 kilometers from its western end. Except for Cuyo near the eastern base of the peninsula and about 35 kilometers further west, the company town of Las Coloradas (largest producer of solar salt in eastern Mexico), the peninsula is uninhabited. However, there is a dirt road that extends from Cuyo to Las Coloradas, consequently the beach is easily accessible from land as well as by skiff from the sea. Fishermen at Cuyo reported nesting hawksbill, green and loggerhead turtles. The hawksbill was stated to be

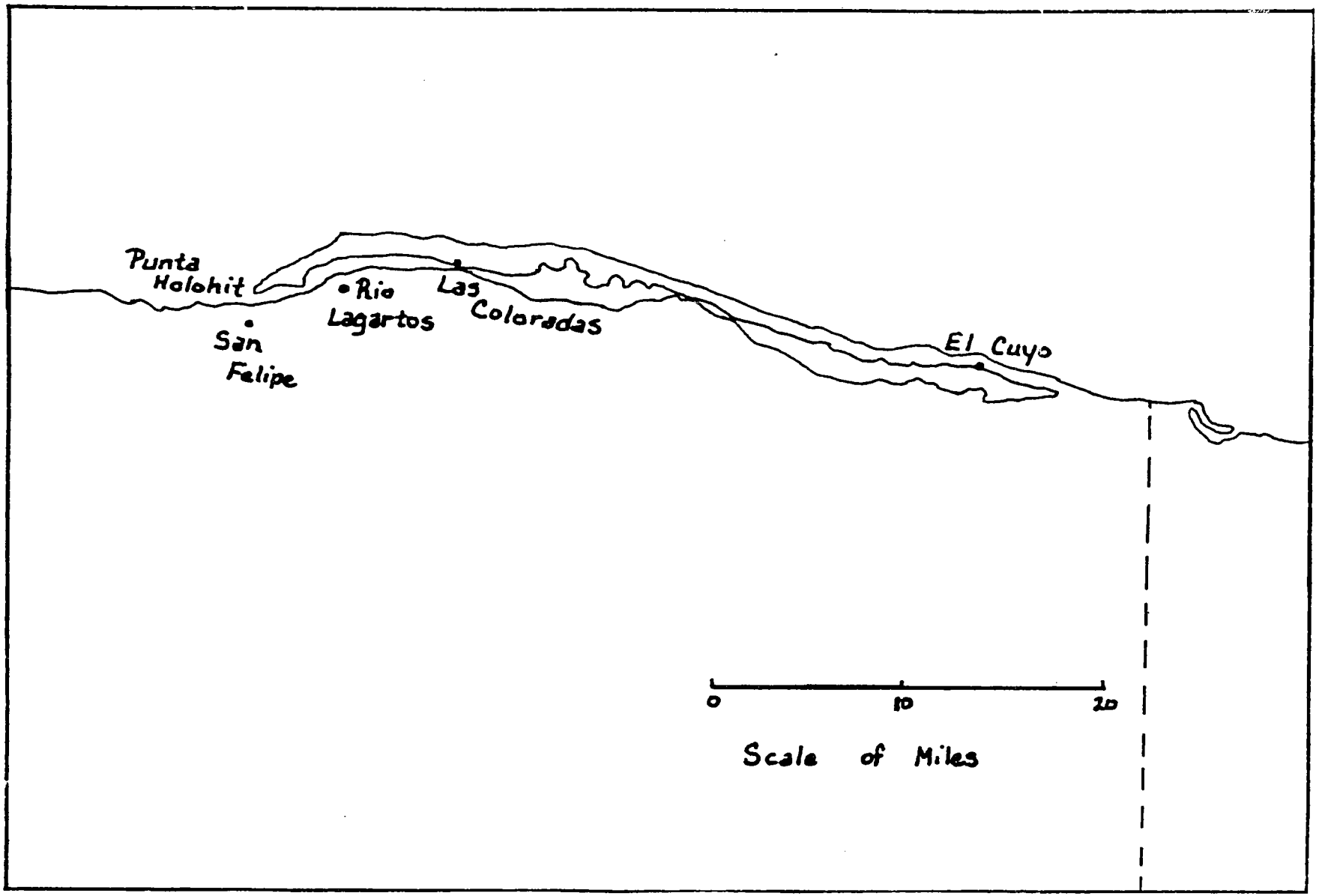

Figure 4. Major nesting ground of hawksbill in Yucatan

abundant. In Las Coloradas, the fishermen reported that hawksbills and greens nested but the loggerhead was very rare. Patricia Castaneda, a biologist at the Yucalpeten Laboratorio of the Departamento de Pesca, transplanted 114 nests of the hawksbill and 61 nests of the green turtle in 1985, and 84 hawksbill and 25 green turtle in 1984. She found no loggerheads in either year nor in 1986, a year of limited field work. She stated that a 17-kilometer stretch adjoining Las Coloradas to the eastward, was the most productive area (pers. comm. 1985-86).

Economic development, aside from the salt plant, is mainly concentrated in commercial fishing at Cuyo, Rio Largartos and San Felipe. Small boat harbors have been developed at each port and seasonally they fish octopus, grouper, Spanish mackerel and king mackerel. I would expect a considerable incidental catch of turtles from offshore foraging grounds, but all fishermen I questioned emphatically stated that they rarely caught turtles. Tourist development is planned for Rio Lagartos with the designation of a reserve for nesting flamingos.

The coastline from San Felipe to Dzilam del Bravo was not accessible by car. I have flown over the area and I doubt that many turtles nest there, but I was unsuccessful in finding a fisherman who knew the beach well.

The "salt" coast stretches for approximately 80 kilometers from Dzilam del Bravo to Progreso and it is easily accessible from a paved road which extends the entire distance. Salt has been extracted here by solar evaporation of seawater for centuries.

At one time it was more of a cottage industry than today and small villages were constructed around the salt works. Most of these ponds have been abandoned and the area is now devoted to commercial fishing and tourism. The major centers are Dzilam del Bravo, Telchac Puerto and Progreso, all of which have ports. Progreso is the only high seaport which receives shipments from abroad. The trend in real estate development is a string of beach front houses, i.e., vacation homes for city dwellers from Merida and other inland cities. Relatively few gaps exist in the wall of houses from Dzilam del Bravo to Progreso.

Fishermen in the closely spaced east to west progression of pueblos, Dzilam del Bravo, Mina del Oro, Santa Clara, La Providencia, Chavihau, San Crisanto and Telchac Puerto were unanimous in stating that nesting turtles were extremely rare--one in Santa Clara went so far as to say, almost extinct here--and most said only hawksbills nested in their pueblo. In Santa Clara it was stated that loggerheads and greens were island nesters and that hawksbills nested on the mainland. Westward from Telchac Puerto through the pueblos of Xtampu, San Bruno, San Benito, Uaymitun, San Miguel and Chicxulub, fishermen reported only the hawksbill nesting in small numbers.

Progreso has a one kilometer long seawall and turtles apparently seldom even try to nest in this urban center. Adjacent to Progreso is the fishing port, Yucalpeten. In Yucalpeten and the two fishing and tourist pueblos to the west, Chelem and Churburna, only a few hawksbill nest. One fishery biologist estimated that the grouper fishermen in Yucalpeten may catch one turtle per trip.

I have never seen a turtle at the docks, but I have been there only four times during the past three years when they were unloading. From Churburna to Sisal, a distance of 20 kilometers, the dune ridge is uninhabited; even the few coconut plantations that once existed here have been abandoned. In Sisal I received conflicting stories: a) a few hawksbills nested in this area or b) hawksbills commonly nested on this beach in "regular" numbers.

High tides during my visits to Yucatan in 1983-84-85-86 prevented me from driving the beach between Celestum and Sisal. I did drive the beach in 1968. The sole inhabitants were the lighthouse keeper and fishermen in temporary camps. The entire beach is suitable for nesting turtles. Information on nesting turtles is unsatisfactory. At Sisal the fishermen stated that only hawksbill nested while at Celestum, they said that hawksbill and a few green turtles nested. They also told me that they occasionally caught small turtles in their gill nets offshore. The fishermen want a quota of sea turtles for commercialization at Celestum. In their attempts to convince the authorities that there are enough turtles for a harvest, they have constructed turtle crawl tracks in the beach sand, according to Bill Fable, an NMFS biologist (pers. comm.).

All the offshore cays, Triangulos, Arenas and Arcas, have served as nesting sites for marine turtles, particularly the green turtle (Carranza 1959) and apparently all still do. In 1959 I saw a heap of carapaces on isla Desertora in Arrecife Alacranes, and all intact enough for identification were green turtles. The

next year (1960) Glenn Cosh, a member of The University of Texas expedition, told me that he had camped on the island several times and each time a large green turtle came ashore to nest, a Cuban fisherman would run through their camp to turn over the turtle. In 1986, during the nesting season, J. W. Tunnell was on arrecife Alacranes and he found two nests on isla Desertora and 26 on isla Desterrada (pers. comm.). Galo Escanero transplanted turtle eggs from cayo Arcas in 1985 and 1986. He found 96 green turtle nests and 41 hawksbill nests. However, 60% of the nests had been robbed by poachers (Escanero 1985).

In conclusion, Yucatan probably has more kilometers of suitable sandy beach than any other state on the peninsula, but it has fewer nesting turtles. Nevertheless, the Rio Lagartos Peninsula is an important nesting area for hawksbill and nowadays, to a lesser extent, for green turtles. The protection plan is good, but there are severe budgetary problems. Any lapse in the program will delay the recovery of the turtle population. Yucatan also has extensive beds of turtle grass and reefs, consequently foraging areas for green and hawksbill are adequate for a much greater population of turtles than now exists.

Campeche

Campeche has developed rapidly since the end of World War II. and the state is still changing. First was the development of Carmen as a shrimp port, mainly for white shrimp, and this was followed by the even richer pink shrimp grounds. Campeche joined Carmen as a major fishing port in 1951. In the 1970s oil was

discovered on the shelf off Carmen and the city became home to the offshore drillers and their suppliers. From 1960 to 1980 the state more than doubled its population.

All five species of sea turtles occur in the offshore waters of the state. I discussed cayo Arcas with the similar offshore islands and reefs of Yucatan, but it is located in the shelf waters of Campeche. In any case, turtles nest on this offshore cayo as well as on the mainland beaches of the state. It is interesting that only the green turtle appears in the statistics in all years, and this is probably due to its high value as an export item from the peninsula. In the fifteen year period from 1947 to 1961, Campeche produced an average of 19,000 kilograms of green turtle per year with a maximum catch of 39,000 kilograms in 1950 and a minimum of 1,500 kilograms in 1961. Landings of loggerheads were recorded for only 1953-54-55-56 and the maximum catch in any one year was 1,312 kilograms (Montoya 1967). Carranza (1959) does not discuss the occurrence of the loggerhead in Campeche, but he does emphasize that it is consumed locally in the peninsula. Fuentes (1967) specifically states that the loggerhead is utilized for domestic consumption in Campeche and he estimated an average of one loggerhead per day was sold in the municipal market. The presence of Kemps ridley in Campeche was not in the literature until the capture off Carmen of a ridley tagged at Rancho Nuevo, Tamaulipas (Chavez 1967). Fuentes (1967) was of the opinion that the capture of the ridley in Campeche was on the same scale as the loggerhead, i.e., one ridley per day utilized for domestic

consumption.

Campeche has a varied coastline. The nine kilometers at the extreme northern tip of the state are a continuation of the Yucatan beach ridge and even though the beach sands are suitable as nesting grounds for turtles, there is too much human activity from Celestum. From the city of Campeche north to Punta Nimun at the end of the Yucatan beach ridge, the coastline is low and can be classified as a submergent coast. The coastline is irregular and fringed with vegetation, chiefly mangroves. There are two access points. One recently constructed leads almost due west from Tenabo to the Gulf. A shrimp aquaculture facility is under construction on the Gulf shores. The other access point is opposite isla (Punta) Arenas. This section of the beach has very few sand beaches and although I went to the Gulf on both access roads, there were no fishermen to interview on incidental catch. The beach from Campeche to Chenkan is rocky and cliffed. There are some pocket beaches which would be suitable for nesting turtles, particularly for the hawksbill. However, all the fishermen that I interviewed said either that turtles never nested in the area or that they were extremely rare.

A sandy beach exists from Chenkan to Paso Real, a distance of 80 kilometers. The best nesting area is the Gulf shore of the narrow peninsula which extends from Varadero to isla Aguada, or roughly 40 kilometers (see Fig. 5). This peninsula has been cut by a dredged canal at Sabancuy. This canal provides the fishermen access to the Gulf and also the turtle beach. There is a main

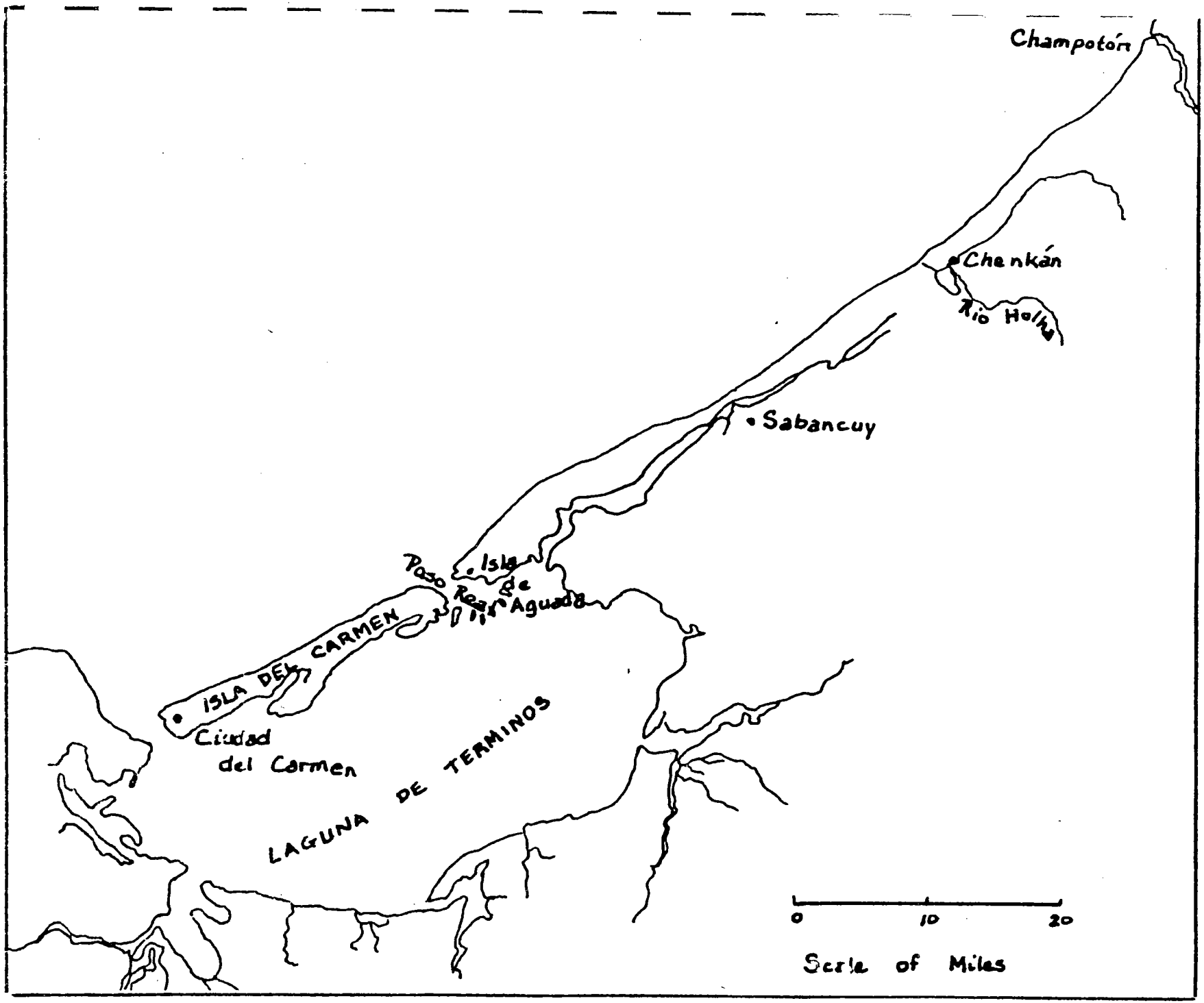

Figure 5. Major nesting ground of hawksbill in Campeche

highway the entire length of the peninsula but except for some scattered coconut plantations, it is not inhabited. Isla Aguada was tied to the peninsula by the silting of an inlet a long time ago. Isla Aguada is a busy fishing village with a few tourist facilities for sportsfishermen. There has been a proposal to dredge two more small boat passes through the peninsula and one may be dredged soon. The major threat to the peninsula is the extraction of sand by the construction industry. This will in time greatly restrict the area available to the turtles. According to my informants, the hawksbill was the most abundant nester followed by the green. One individual said the ridley occasionally nested but his companion disputed it. However, one ridley nested at isla Aguada in 1984 (Marquez pers. comm.) and perhaps two in 1985 (Victor Gonzalez pers. comm.). Hildebrand (1981) and Polanco (1984) reported nesting loggerheads, apparently in both cases on fishermen's reports. This was not confirmed by my recent interviews nor by extensive field work during 1984 and 1985 by biologists at the Laboratorio del Instituto Nacional de Pesca in Ciudad del Carmen (Escanero 1985). The major species were the hawksbill (273 nests) and the green turtle (98 nests). However, eggs were recovered from only 53% of these nests; the rest had been robbed. This is the most important nesting ground for the hawksbill in the western Atlantic. A conservation program has been in operation at Ciudad del Carmen since 1977, but in some years it has been very limited because of budgetary problems. A turtler with long experience at Sabancuy told me that 20 to 30 years ago one could see

12 to 15 turtles on the beach in one night; nowadays one would be lucky to see 3 or 4.

Isla Carmen is approximately 35 kilometers long, and historical accounts indicate that it teemed with nesting turtles--so abundant that they used turtle oil in the town's lamps. Today it is too heavily populated at the western end and eastward, the beach is eroding badly; consequently there is little suitable beach for nesting turtles.

The mainland shore of Campeche from Zacatal to Campechita is a part of the riverine lowlands. Many areas are eroding back into the mangroves and I obtained no reports of turtles nesting there. However, hawksbills do nest in small numbers on the mainland shore of laguna Terminos, but only in its eastern portion.

The problem of incidental catch of the lora (cotorra), Lepidochelys kempi, could not be adequately addressed in a survey of this type. There are two groups which have caught the offshore tagged ridley, according to published accounts (Pritchard et al. 1973), shrimpers and gillnetters for shark. Chavez (1968) states that four of five tagged Ridleys were caught in the gill nets of shark fishermen; it is not known how the other was captured. In a list (anon. 1985) of recaptures of Rancho Nuevo turtles, there are 25 recoveries from the state of Campeche without further information than home port and date of capture. There is published data on 7 of the 25 tags (Vargas M. 1970); Ciudad del Carmen 21, isla Aguada 2, Sabancuy 1, Lerma 1. On the basis of this information one would conclude that more turtles were recovered in shark nets than in shrimp trawls. and that shark fishermen encountered

them most frequently in 2 to 7 fathoms of water off isla Aguada.

It is significant, I believe, that except for a single tag, only fishermen from the southern part of the state landed tagged turtles. The Campeche fleet fishes mostly west of the city in the cayo Arcas area, and the Carmen fleet fishes south and westward from Punta Morro in water less than ten fathoms deep. I was told by a biologist in Campeche that he knew of only a single tag of a turtle in that area (Campeche-Lerma) and the shrimper caught the turtle near Arcas. All reports on small turtles are vague as to species, and fishermen say few are caught. One would conclude from these scanty reports that the waters off the western two-thirds of isla del Carmen are most productive. The turtles occur in a shallow depth range of 2 to 6 fathoms. I can only surmise that the population of the ridley is very small in the area.

The shrimp fleet was purchased from private owners in 1982 (nationalized, according to the former owners) for resale to fishery cooperatives on the basic premise that the government would provide the latter the means of production having received exclusive rights to harvest shrimp. For a variety of reasons, the fleet has diminished and the seaworthiness of the remaining vessels has deteriorated. No official statistics on the present size of the fleet have been published, but local observers estimate that only 50% remain, e.i., a decline from 650 to 300 shrimp boats. U.S. shrimp dealers familiar with the Mexican fishery place it at 20 to 30 percent.

In conclusion, we can still maintain that Campeche is

important as a foraging ground for all five species of marine turtles. Little is known about the leatherback, but one tagged at Jupiter Beach, Florida, was recaptured near cayo Arcas. Very significant nesting grounds for the hawksbill exist at cayo Arcas and Palmar-isla Aguada Peninsula. There is still a remnant population of green turtles which use the same beaches as the hawksbill, but at a different time. Finally, the southern part of the state was and is still a foraging ground for Kemps ridley.

Tabasco

The lowlands of Tabasco are a part of the same physiographic province which includes the western lowlands of Campeche and the Coatzacoalcos and Tonala deltas of southern Veracruz (see Fig. 6). The region is characterized by the joint delta of the two largest rivers of Mexico, the Usumacinta and the Grijalva. Although in most of the area the land behind the beach ridge is a giant marsh, the beach ridge is sand or muddy sand and could be utilized by turtles. The concensus of all people interviewed was that nesting marine turtles are extremely rare, but an occasional hawksbill, green and loggerhead nested there. There is also one record of Kemps Ridley nesting at Dos Bocas, Tabasco (Marquez pers. comm.).

The fisheries of the state are not well developed, but the state has pushed fisheries development with the increased revenue from the oil boom. The infrastructure has been improved with port development in Frontera, Chiltepec and Sanchez Magallanes. The trawler fleet will be increased by new or renovated fishing vessels. There are nine recaptures of tagged ridleys in Tabasco,

but no method of capture is given in the data available to me. Five have definite locality records and on the basis of the landing site I would assume they were caught in gill nets. These records are as follows: off Chiltepec 2, off Barra de San Pedro 2, and off Dos Bocas 1. It is my belief that the shallow Gulf off the deltaic lowlands of southern Veracruz (Coatzacoalcos) to western Campeche (Sabancuy) are the foraging ground for the ridley in the southern Gulf. This is based on tag returns in all seasons of the year and the examination of an immature carapace at Dos Bocas, Tabasco. In addition, fishermen say they sometimes encounter small turtles in their net.

In summary, information from Tabasco is very scanty, and this can be explained by the small fishery and lack of any sustained marine investigations, except on oysters. The state, particularly the seaward edge of the delta which it shares with Campeche, may be an important ridley turtle habitat.

Veracruz

Veracruz is elongated along its north-south axis and contains slightly more than 600 kilometers of coastline. The short coastal lowlands from the Coatzacoalcos to Tonala have been discussed with the Tabascan lowlands. I obtained no positive statements on the occurrence of turtles from fishermen at Coatzacoalcos; even so the ridley must pass through the area in going to and from the nesting grounds. Indeed, 7 tags have been obtained from Coatzacoalcos.

The next physiographic unit is the Tuxtla uplift (see Fig. 6). This short section of the coastline is characterized by rocky capes

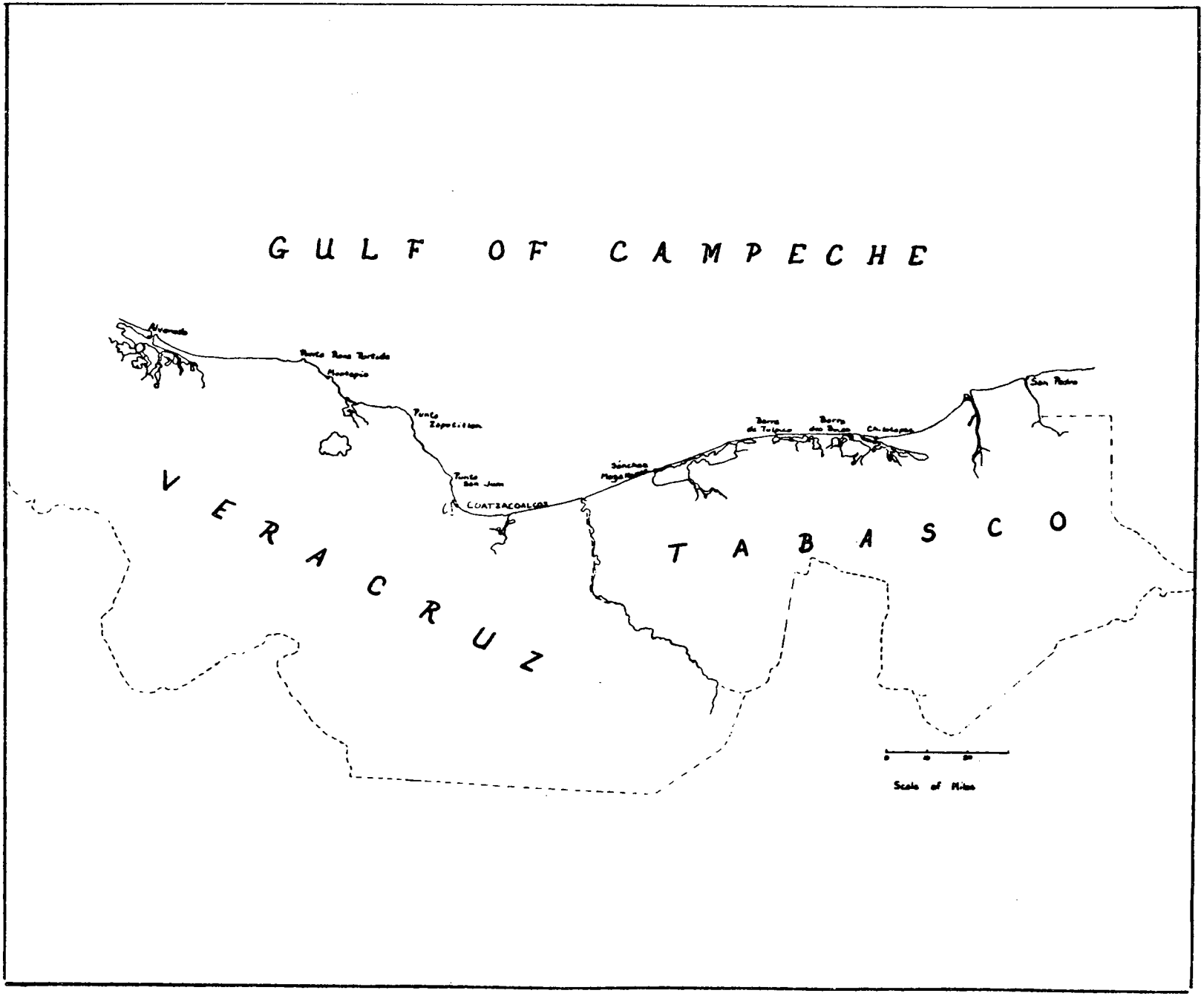

Figure 6. Southern Veracruz--Tabasco

and pocket beaches at the mouths of the short streams. The shelf is very narrow in this region. Much of the beach is accessible only by boat and even where roads are available, they are new. The volcanic tuxtlas are heavily populated and many of the coves harbor fiber glass skiffs with outboard motors.

During the period of this survey I made four trips to the Tuxtlas. I visited Montepio, Sontecomapan, Salina and Jicacal. The response to my inquiries was nearly all the same: nesting turtles are rare, sporadic on any given beach; the commonest was the hawksbill followed by the green turtle. In 1955 old Veracruz fishermen told me that Montepio was noted for mass nesting of sea turtles. If this was true, it has not been possible to verify it. Furthermore, for the last several years no one has reported a ridley on the beach or in the water in the Sontecomapan area to the two field biologists in the area, Dick Vogt, a herpetologist at La Estacion de Biologia Tropical "Los Tuxtlas," Universidad Nacional Autonoma de Mexico and William Schaldach, mammalogist.

Mr. Schaldach informed me that there is a fringing reef 22 kilometers long and that he always sees hawksbill when he fishes it. Attila Beke, a young scuba diver, said that he was amazed at the number of hawksbills he sees. He has explored about 600 feet of the reef. One clear day he saw 10 hawksbills per 100 linear feet of the reef. If this was an average concentration for the entire reef, then there is a population in excess of 7,000 hawksbills. Although admittedly these hawksbills were varied in size, the number seems excessive considering the few reported nesters in the Tuxtlas. Fortunately, the turtles are

somewhat protected by poor diving conditions during most of the year.

North of the Tuxtlas and extending to La Mancha is the Veracruz embayment, the most densely populated coastal zone in the state (see Fig. 7). The beach is sandy and it is backed by high sand dunes nearly everywhere. Hatchling ridley turtles were first reported in Mexico from Alvarado (Fugler and Webb 1957). I have fishermen's reports of ridleys nesting at Arbollilos, Salinas, Los Barrancos, Anton Lizardo and Boca Chachalacas (see Fig. 8). I believe that the ridley historically nested as isolated individuals or small groups throughout the length of the Veracruz embayment. However, the only place that I received an affirmative response about nesting ridleys during 1984-85-86 was in Boca Chachalacas. The hawksbill is the most common nester and it nests on the small offshore islands, particularly Salmedano and isla de En Medio near Anton Lizardo. The numbers are always very small; one fisherman estimated the number of nesters as 7 to 15 in the Anton Lizardo area in 1985. However, in 1986 the same fisherman said the hawksbill did not nest that year in the area. Fishermen aver that the hawksbill prefers stormy rainy nights for nesting. Perhaps this explains how the animal has persisted under intense human persecution in a densely populated area. The green and the loggerhead also occur in the area but in small numbers. The green nests on the deltas of the rio Antigua, rio Actopan and probably the rio Juan Angel at the northern edge of the Veracruz embayment (see Fig. 9).

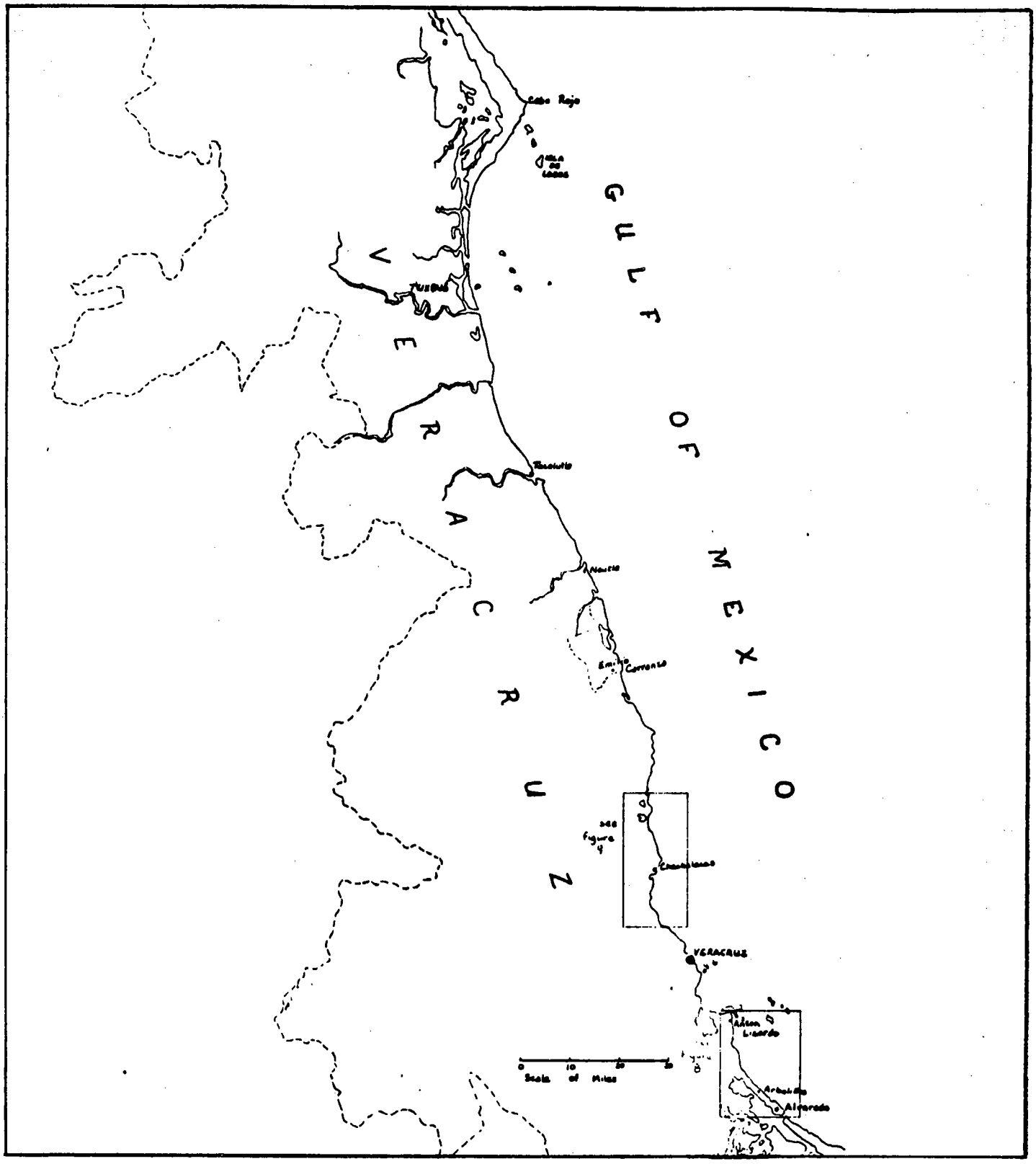

Figure 7. Central Veracruz

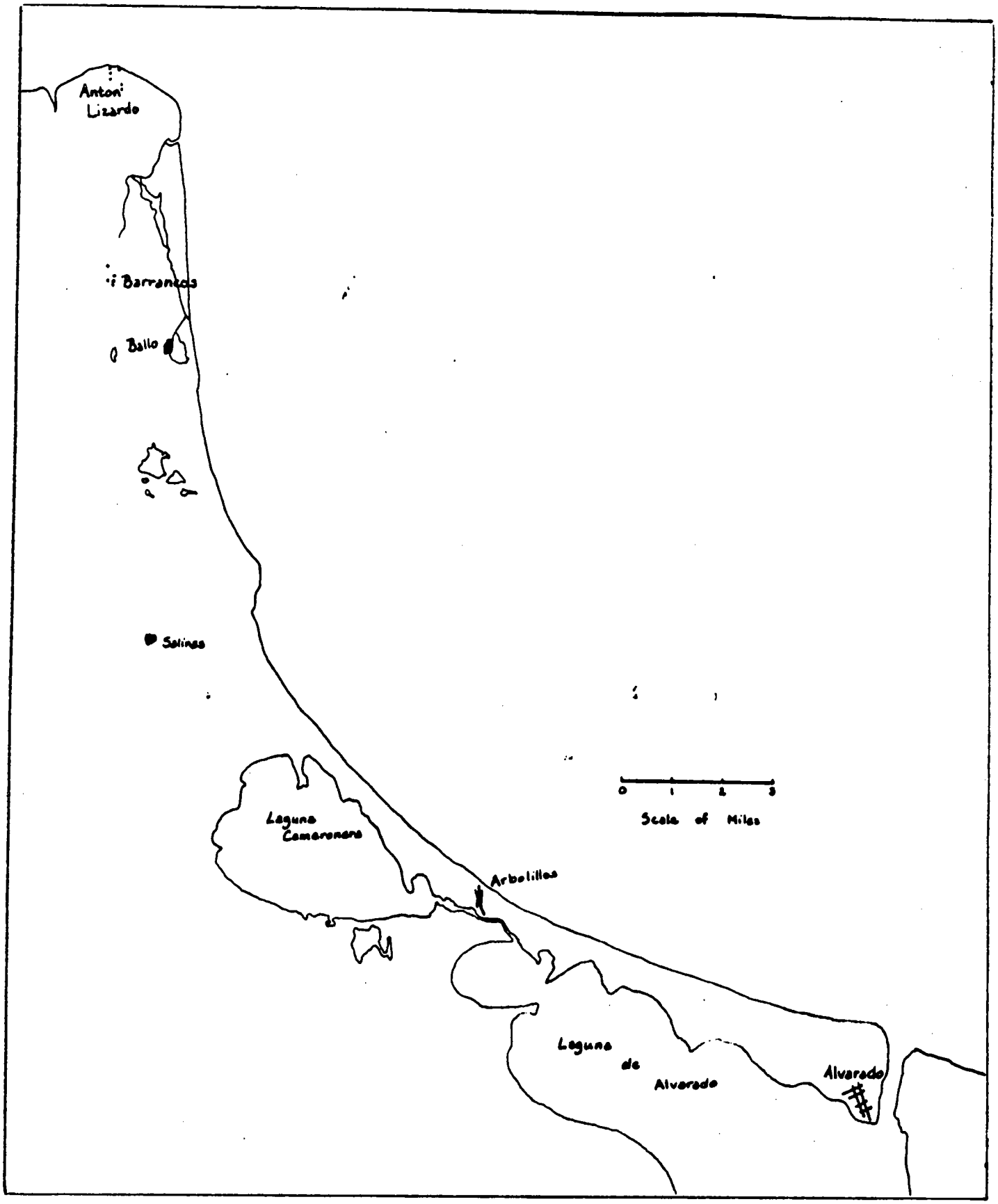

Figure 8. Anton Lizardo--Alvarado Area

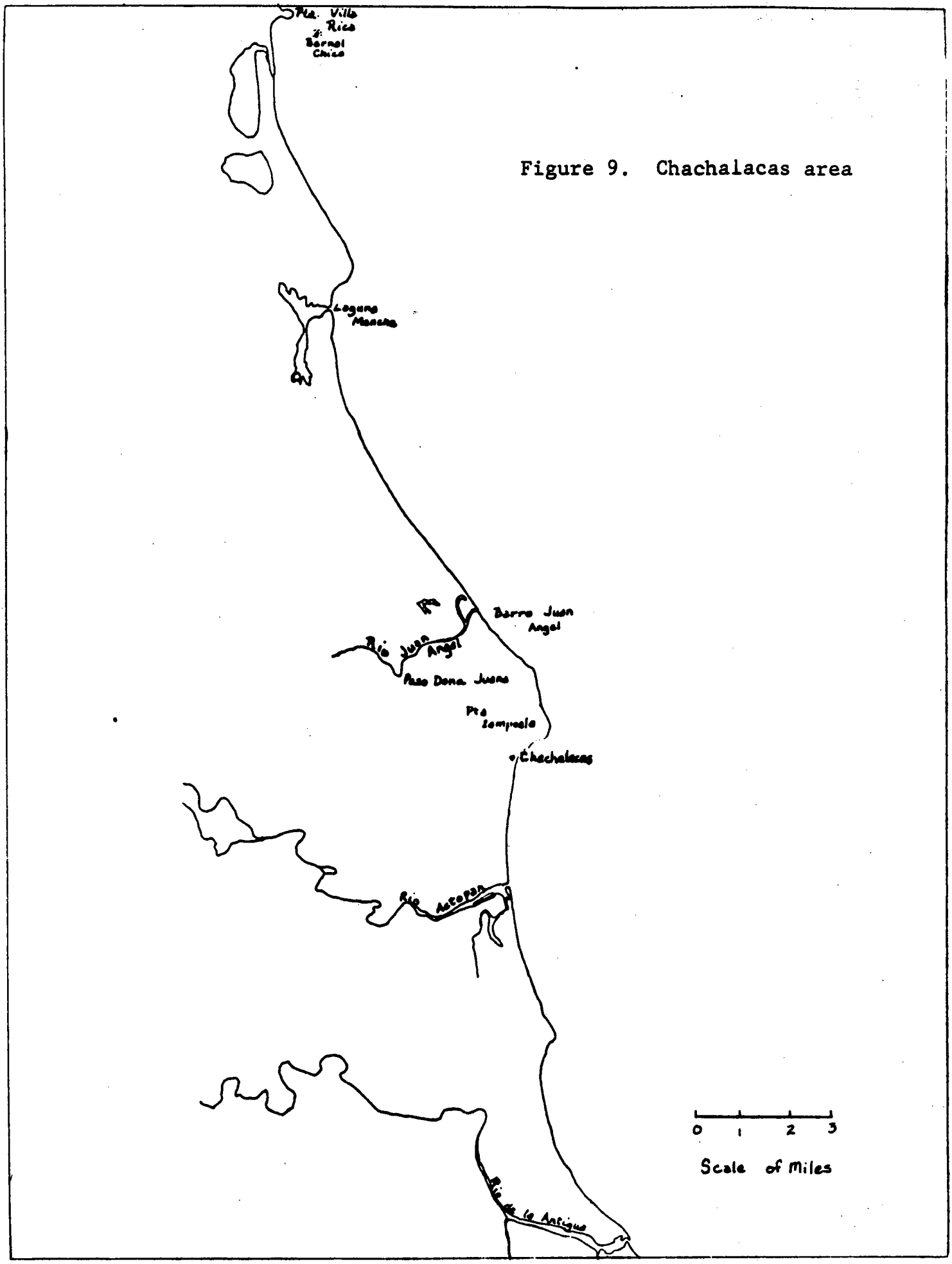

Figure 9. Chachalacas area

The shrimp fleet in the Veracruz embayment is based entirely in Alvarado. Official figures on the number of operating shrimp vessels were not available. I estimate, on the basis of conversations with local inhabitants of Alvarado, that there were approximately 110 vessels in 1981, and that today 40 to 50 are still utilized for shrimping. The shrimping grounds for this fleet is from Punta San Juan to Punta Delgado. The shelf is narrow with reefs and rocks, consequently there are only scattered patches of trawlable bottom. Six tagged turtles were caught in this area during the migration season. Three of these turtles were captured by shrimp trawl; the method of capture for the other three was not specified.

The transverse volcanic cordillera, or volcanic axis, forms the coast between Nautla and La Mancha. There are seven rocky points with the highest cliff at Boca Andrea. The beaches are black volcanic sands and 90% is suitable for nesting turtles. I visited Villa Rica, Boca Andrea, Palma Sola, Boca de Oveja, Barra de rio Colija and Nautla. Everywhere the answer was much the same; nesting turtles had once been common, they were now scarce. Green, hawksbill and loggerhead were the nesting species. Fugler and Webb (1957) obtained a hatchling ridley from Nautla and I was told in Chachalacas that the ridley also nested in the municipio de Vega a la Torre (rio Colija). This section of the coast needs further study.

The Tampico embayment begins at Nautla, Veracruz and ends at Punta Jerez in Tamaulipas. Much of this beach was not covered

in this survey because there is no adequate road access, e.g., the high dune ridge that separates Laguna Tamiahua from the Gulf and the coastline from Tuxpan to Tecolutla. In other years, I have visited Tampachichi and Cabo Rojo on the dune ridge and the mouth of the rio Cazones between Tuxpan and Tecolutla. I received no information of significant nesting of turtles in these two areas. The most important nesting area is around Tecolutla. In the late 1970s and early 80s there was a transplant operation of ridley eggs to a corral for hatching. Each year 700 to 1500 hatchlings were released. In 1979 fishermen reported that they would see as many as 150 turtles at a time off the nesting beach (Schultz pers. comm.). Mass nesting did not occur; the nests incubated were recovered on approximately 32 kilometers of beach. The green turtle has been reported to nest sporadically throughout the embayment. I was told that greens nested at Casitas in 1985, and this was my only positive report for the green. The hawksbill nests on Lobos Island. I have no other nesting report for this region.

Although there is considerable shrimp trawling near isla Lobos and north of Cabo Rojo, there are no tag returns from the Veracruz portion of the embayment. Presumably, it is related to trawling pressure during the migration seasons.

Tamaulipas

No interviews were conducted in the Tamaulipan portion of the Tampico embayment. Information was relayed to me from biologists at the Universidad del Noreste in Tampico. On March 12, 1985, a

snapper fisherman passed through a group of hawksbill turtles near Barra de Chavarria. He captured two of them which had carapace lengths of 60 cm. The fisherman stated that he commly encountered hawksbill turtles in the area.

The snapper fishermen at Barra del Tordo are familiar with the ridley turtle. They say that they often see them mating around the reefs. (see Figure 10).

There is only one shrimping port in the state of Tamaulipas. For some time the state has been constructing ports of refuge at La Pesca and Mesquital, but in these days of austerity budgets, little visible progress is made from year to year. Consequently, the fleet has had to operate exclusively from Tampico. However, the active Tampico fleet of about 100 boats is augmented by a migrant fleet from Campeche and Carmen during the summer and fall brown shrimp season. In 1985, during the summer months, 168 vessels made 450 trips to the shrimp grounds off Tamaulipas and in 1986, 192 shrimp boats made 640 trips (Sheridan and Patella 1987). The boat captains were not queried specifically regarding any incidental catch of turtles because it was not authorized. I, however, questioned the official interviewers to learn if any one had reported taking a tagged turtle. One shrimper said that in 1985 he took a tagged turtle but threw the animal overboard without reading the number. There were no reports in 1986. Twenty-eight tags have been recovered from Tamaulipas since the start of tagging in 1966 to June 1, 1985. Information on the area of capture is not available to me for most of the tag returns but

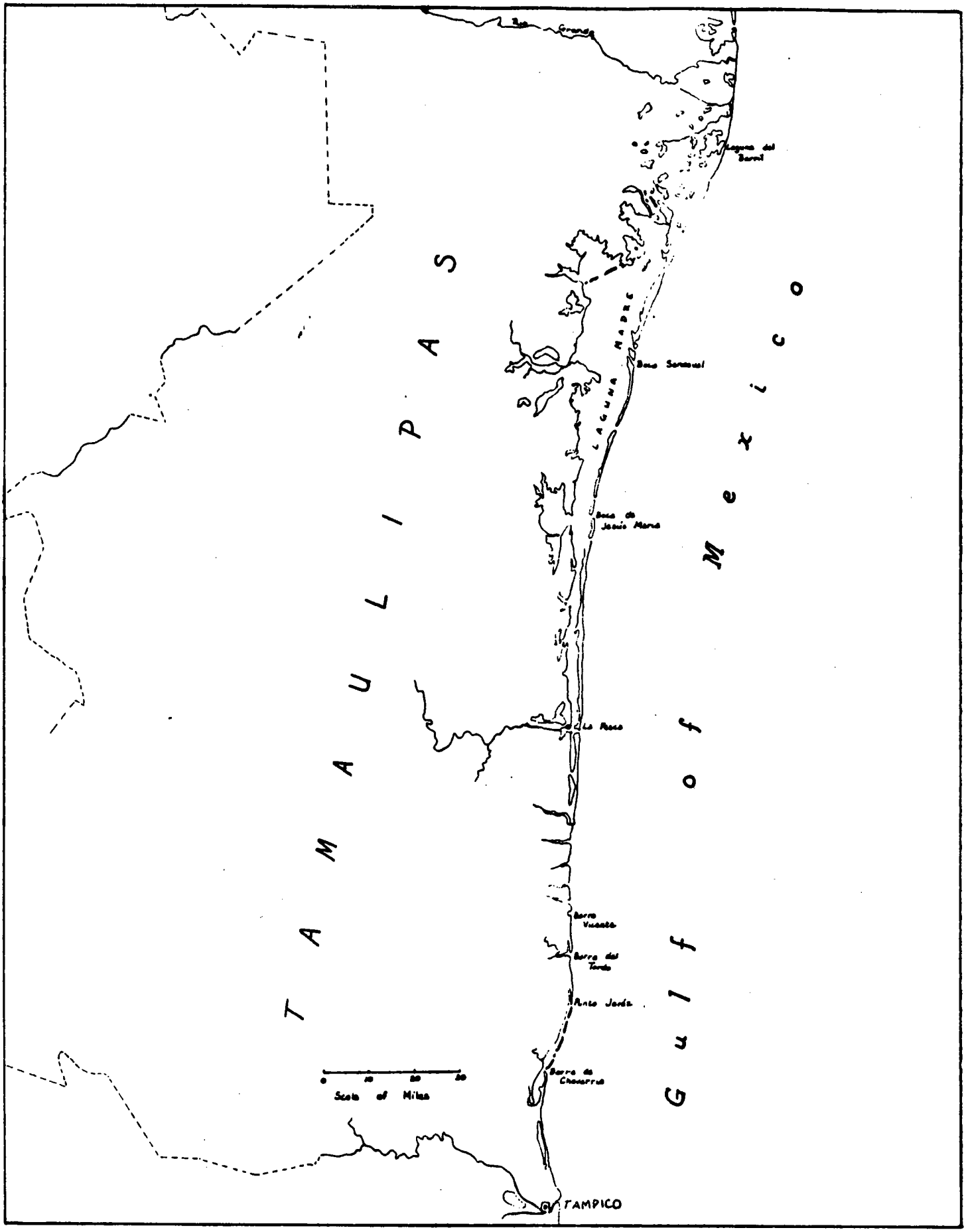

Figure 10. Tamaulipas

there is enough data to show captures in all parts of the coast. The number captured by the shrimp fleet is unknown. Marquez (1976) estimated the incidental catch of ridley, loggerhead and green turtles at ten tons annually. The size of the shrimp fleet fishing Tamaulipan waters is probably one-fourth the size it was in 1974. This is due not only to closing Mexican waters to U.S. trawlers, but to a drastic reduction in the size of the Mexican fleet. However, there has been a large increase of gillnetters, longliners and snapperfishermen, all of whom may take turtles at times.

The Tamaulipan Arch noses to the coast between Punta Jerez and Barra Ostiones. The rivers coming out of the Sierra Tamaulipas are short and they close at the bar during dry years, forming blind estuaries. Offshore there are rock reefs, particularly near Punta Jerez. Rancho Nuevo, the major breeding ground of Kemps ridley, is located here. I visited Rancho Nuevo in 1986. I merely want to stress that the same pattern of sporadic nesting of the loggerhead, leatherback and green turtles occurs here as elsewhere in Tamaulipas.

The Rio Grande embayment extends northward from Ostiones into Texas. It has a broad, sandy beach with a dune ridge behind it and, except for the delta of the Rio Grande, a near-continuous lagoon separating the dunes from the mainland. Everywhere the beach is suitable for nesting turtles, but few use it. From the air, in July and August, one sees scattered tracks of nesting greens and loggerheads. From my experiences and conversations

with fishermen, I would estimate 20 nesting green turtles and 5 loggerheads in this entire stretch. I do not have enough information to arrive at the number of ridleys. An isolated nesting ridley may come ashore anywhere along this beach. The only mass nesting attempt was one reported by Pedro Mercado, a biologist with the Instituto Nacional de Pesca. In the late 1970s a group of about 80 ridleys started to ascend the shore near Washington Beach, a locality approximately 12 miles south of the Rio Grande, but the turtles were frightened back into the water by the crowd attending a redfish tournament (Marquez pers. comm.).

The entire coast is uninhabited but there are two beaches developed for tourism; one at La Pesca and the other at Playa Lauro Villar (Washington Beach), near Matamoros. Ports of refuge are under construction at La Pesca and Mesquital; upon completion, these fishing villages behind the dune ridge should increase in size. A paved road connects both villages to the main highway. In addition to the shrimp fleet based in Tampico, there are many fiberglass skiffs which operate either from the beach or the navigation channels, i.e., Barra del Tordo, rio Soto la Marina, Boca Catan, and Boca Mesquital. These fishermen fish with hook and line for snapper or shark, long lines for shark or gillnets for mackerel, seatrout or redfish. Experienced fishermen all have seen the ridley. Stories of individual ridley turtles nesting on the beach are prevalent among fishermen in the camps near Washington Beach. Out at sea, there are sometimes 5 to 6 in a wave. Fishermen also relate that the turtles are usually seen

in March, the time of their southward migration.

My interviews and published information lead to the conclusion that the ridley, green, loggerhead and the leatherback nest mostly as isolated individual throughout coastal Tamaulipas. Only the ridley nests in significant concentrations in a single sector of the beach, Rancho Nuevo (Hildebrand 1963). The leatherback may not nest every year. I have only secondhand reports of the hawksbill nesting in the state, but it is possible that the species nests in the Punta Jerez area. The number of small fishing boats is still increasing while the shrimp fleet is declining in Tamaulipas. Incidental catch occurs in both fleets. An area of special concern may be Washington Beach due to the possibility of its being a "staging" area on the spring migration to Rancho Nuevo. Most reports are of adult turtles in Tamaulipan waters. Small greens occur in Laguna Madre; I encountered a fresh carapace, 35.5 cm. curved length, on an island a few miles from Boca Ciega Pass on April 29, 1986. Subadult loggerheads occur, at least, off northern Tamaulipas as they do in Texas. I have seen dead ones on the beach 40 and 50 miles below the Rio Grande. Presumably, small hawksbills occur around the jetties and reefs, but I have no definite record. Only adult ridleys and hatchlings have been reported from the waters of the state.

Texas

I maintained contact with the laboratories and the shrimp statistical agents. I traveled the entire coast several times.

I will discuss information gleaned and my interpretation by species.

Records of leatherbacks are always rare in the beach strandings. The number per year in Texas for the past three years has ranged from 1 to 7. Recently there has been a big upsurge in longlining for tuna in the northern Gulf, including Texas. The leatherback is attracted to these lights and either gets entangled in the gangion or is caught on the hook. I visited a tuna boat once, but obtained no information on turtles. G. De Metrio et al. (1983) reviews turtle catches and tuna longlining off the Italian coast.

The green turtle recoveries are always few, particularly on the Gulf beach. The green is a resident of the grassflats in bays and lagoons of south Texas (Hildebrand 1981). Over the years I have received a number of calls about turtles in the bay and sometimes the living or dead animal has been brought to my office. In nearly all cases I have identified them as green turtles. I received one call in 1985 of a small turtle in a gill net in Corpus Christi Bay. It was a small green. I examined the stranding and sighting records in the office of the National Seashore; one is struck with the question, where are the subadult and adult greens. Virtually all the green turtles are 18 to 35 cm. in carapace length, very close to the size at which they enter the bays for the first time. I have never seen an adult in bay waters. However, the waters are obviously suited for them because a fishery once existed for the adults (Hildebrand 1981).

I consider the hawksbill a rare species on the Texas coast. During more than 36 years of residence on the Texas coast I have never seen an adult, but I have observed a number of small juveniles gathered by Tony Amos and others over the last ten years. These tiny juveniles--most 4.9 to 7.5 cm. in curved carapace length; a few reach 9.5 cm.--are difficult to find; nearly all recoveries are from areas of heavy human use. Other factors which must influence the strandings from year to year are variations in currents and meteorologic conditions. Biotic factors also play a role, particularly predator fish--many turtles come ashore with portions of their fins bitten off. This of course affects their swimming ability and may lead to stranding. Another factor may be availability of cover for the hawksbill. Sargassum is a good possibility but according to Amos (1987) it was not available. In 1980, when these small juveniles were coming ashore, I found only large patches and streaks of Trichodesmium offshore. This was certainly also true in 1986, but a red tide outbreak was occurring at the same time, although not necessarily when the bulk of the stranding took place at Port Aransas. I hypothesize that these hawksbill come from the nesting beaches of Campeche. Based on the pattern of the Ixtoc oil spill which occurred offshore from the nesting site, the hatchlings, propelled by their swimming frenzy at birth, should get into the northward flow of the current during the warm months and when it switches direction, travel southward in the colder months. This may be the treadmill in which the pelagic young live using sargassum or

Trichodesmium for cover. At a later age, the turtle has grown into a benthic animal which seeks the reefs alongshore.

There are a few records of hawksbill from the bays or jetties. For example, there are two in the stranding data sheets: one, 24.6 cm. curved carapace length, from the East Flats in Corpus Christi Bay and the other, 27.5 cm., from Rockport in Aransas Bay. Did these turtles enter the bay at that size, or did they grow from juveniles that entered the bay at the size (6 cm.) when they usually strand on the outer beaches?

The loggerhead strandings were higher in 1986 than in the preceding three years; 130 compared with an average of 88 per year for the last four years. It was a very poor shrimp year in 1983 (strandings of loggerheads 52) while 1986 was a good year with favorable weather (strandings of loggerheads 130). Eleven of these 130 turtles were over 85 cm. curved carapace length. The largest class was comprised of subadults 50 to 80 cm. The same pattern was observed by Rabalais and Rabalais (1980). Six loggerhead hatchlings stranded on the beach and were reported to the stranding network by Tony Amos and Ila Loetscher. The two reported by Amos the first two days of October measured 5.2 and 4.9 cm., very young, at the most a few days old. Caldwell (1959) found that the carapace length of newly hatched young varied from 3 to 5 cm. with a mean of 4.5 cm. The third hatchling recovered toward the end of the month on Mustang Island measured 7.7 cm. and probably was no more than a month old. Ila Loetscher picked up two living and one dead hatchlings on the beach on October 16,

1986. One measured 6.5 cm. and the other, 5.5 cm. carapace length. Both these Mustang and South Padre Island strandings occurred during a red tide outbreak. Whether or not these two events were related is unknown, but the red tide was pushed down from Mustang Island into the Rio Grande area by a northwind. It is possible that all these young came from an undiscovered nest in Texas, near Port Aransas; however, this is pure speculation based on the size of the hatchlings.

Two other mysteries are, the origin of the subadult loggerhead population in Texas and, where they winter. It would be worthwhile to do some electrophoresis studies to see if they belong to the Florida or the Yucatan nesting population. I have always supported the fishermen's belief that the turtles go south to Mexico. This is based on Padre Island pier fishermen statements that the turtles are predominantely swimming north in the spring and south in late fall; and secondly, that I have found stranded carcasses on the beach south of the Rio Grande during January at a time when they are absent further north. I also have several reports of large adults occurring offshore in deep water during the winter.

The ridley has been a solitary nester, or at best, has nested in small groups on the Texas coast during this century. It is difficult to detect the nest of a small turtle, which usually emerges on a windy day, if you are not there watching it ascend or descend the beach. There are about 125 miles of sand beach between Port Aransas and the Rio Grande and much of it is uninhabited. Ms. Dellinger, who photographed the nesting sequence of a solitary

ridley on May 21, 1962, on the outskirts of Port Aransas, told me that only three cars passed by during those 30 minutes. I firmly believe that one or two turtles nest every year somewhere between Port Aransas and the Rio Grande. We have definite proof of one nesting ridley on Padre Island on June 13, 1985, and the probable nesting or another on Mustang Island. In the latter case, an individual reported uncovering ping pong ball-sized eggs in the dunes near a condominium. The nest could not be relocated after word of the discovery reached a biologist on July 8, 1985; however, in mid-August in that same vicinity on the beach, Tony Amos found two hatchling ridleys. In 1986, there were no confirmed nests although there were at least two reports by tourists of turtles on the beach.

The controversy still continues in Texas as to whether or not the ridley is an estuarine turtle. I have been unable to substantiate a historical presence anywhere except offshore and in the inlet-influenced area at the mouth of the bays. There is no doubt that the headstart turtles enter the bays and may be found anywhere. Experiments in transplanting them in the bays have been disastrous because of heavy trawling pressure. These captures are incidental, not deliberate, but the endangered species law makes no distinction. I was unable to obtain data from fishermen regarding movement of headstart turtles after they had been released in Copano Bay. However, one statement is, I think, significant--"Why did you release turtles in Copano and Lavaca Bay?" When I replied that none had been released in Lavaca Bay, their comment was that the shrimpers

were smart enough to keep their mouth shut about recaptures there. Amos (1986) experimented with drift cards at the time and place of the offshore release of turtles. This revealed a northwest drift to San Jose Island which would indicate that the headstart turtles could have easily entered Matagorda Bay. No offshore tagged turtle of the 1986 release was reported from Matagorda in contrast to several reports in previous years. It is apparent that many shrimpers do not report tagged turtles, therefore a monitoring system is necessary for bayshores on the down drift side of the offshore release point.

There were 151 non-headstart ridley turtles on Texas beaches, according to my tally of the stranding data sheets for 1986. This is more than double the strandings in any one of the three preceding years. More stranded (54%) in the Bolivar Roads to Sabine Pass stretch of beach than in any other comparable sized beach on the Texas coast. The turtles ranged in curved carapace length from 8 to 26.5 inches but only 30 percent were over 15 inches--ranges and percentage were derived from 28 turtles measured by Jim Shelton in Jefferson and Chambers counties. Excluding hatchlings and headstart turtles, the ridleys which strand on the south Texas coast are always larger in average size; many of them are adults.

I paid particular attention to two sectors of the coast, although all beaches were visited and I maintained contact with individuals in all areas. One sector was the west side of the delta of the Brazos. Even though there are tag returns for several headstart turtles, my inquiries among the shrimpers produced negative

results. Offshore Sabine-High Island was the other area of focus due to the large number of strandings of juvenile turtles in this area (see Fig. 11).

In the Sabine area I spoke with several people, but most helpful was a shrimper who had fished the shallow shrimp grounds between Cameron, Louisiana and Galveston, Texas. He trawls more between the jetties and Sea Rim Park than elsewhere. He made the following observations. He catches from 5 to 12 small turtles per year and releases most of them alive. In 1985 he caught the lower number. He usually catches only a single turtle in a drag, but there have been as many as 3 or 4. The turtle is strictly a warm weather visitant, i.e., March-April to October-November. The appearance and disappearance dates from the shrimping grounds are related to the temperature pattern of the particular year. He assumes that the turtles migrate to Mexico in the winter. In regard to abundance, he believes the turtles are more numerous on the Texas side of Sabine Pass than on the Louisiana side. He places the greatest concentrations between the shore and two fathoms in the stretch from Sea Rim Park to the Sabine Jetties. Jim Shelton, a biologist with the USFWS at Sabine Pass, has run beach patrols to count turtles for several years between the jetties and High Island. The number of turtle strandings can be correlated with the size of the shrimp fleet operating near shore. Some turtles come into the surf zone and are caught by fishermen on cut mullet. In 1986, he had no reports of turtles in the surf zone, nor did he have any strandings of headstart turtles (Shelton pers. comm.).

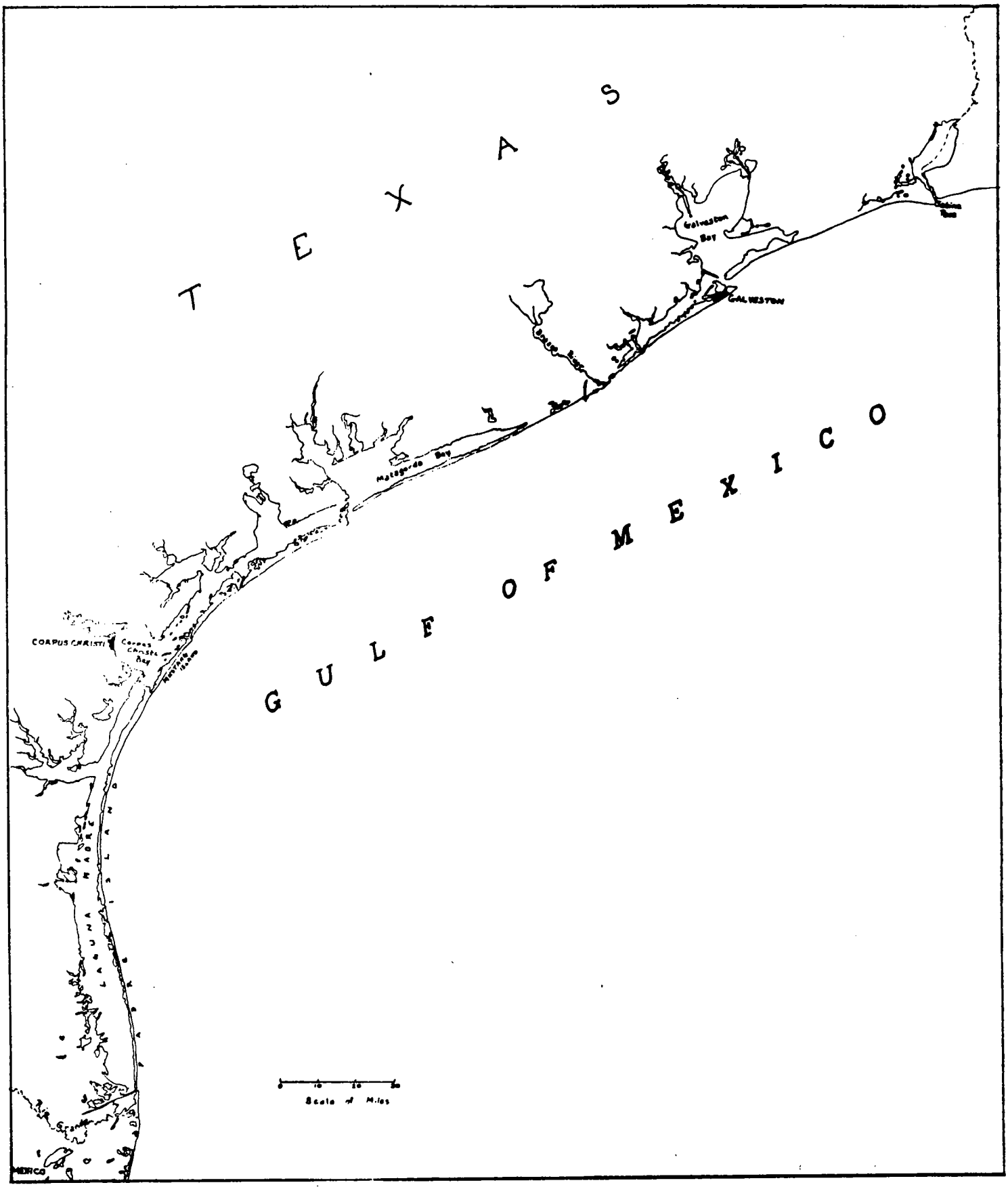

Figure 11. Texas

The few reports from fishermen of marine turtles in Sabine Lake have locations near the mouth. However, two ridleys have been discovered on the intake screens of the Neches power station, so they certainly can and occasionally do swim throughout the lake.

The geology of the Sabine-High Island has been discussed by Nelson and Bray (1970). An examination of Fig. 12 shows three features which I want to emphasize: Heald Bank, Sabine Bank and the shallow, broad flat between the jetties and McFadden Beach. Sabine and Heald Bank are the southwest end of a chain of similar banks located off Louisiana to the east (Ship Shoals is the easternmost member of this chain). These banks are an elongated mass of sand. Heald Bank has a straight line length of 25 miles and is 4 to 11 miles wide. It has a maximum relief of 25 feet. The shallowest water depth over Sabine Bank is 20 feet; the greatest depth, at the base of the reef, is 50 feet.

If, indeed, the concentrations of ridleys are greater on the flat to the west of the Sabine, it may be related to the food supply. However, there appears to be no specific study of the biota of this area. In any case, I hypothesize that the juxtaposition of broad, shallow flats and banks in waters of less than 10 fathoms provides a superior habitat for the ridley--inshore in warm months and offshore in the winter.

There are only 10 tag returns from Texas of Rancho Nuevo turtles, from 1966 to mid-1985. Seven of these tags were recovered within 90 days of tagging at the nesting grounds and it is probable that they were in transit to Louisiana, when captured in Texas.

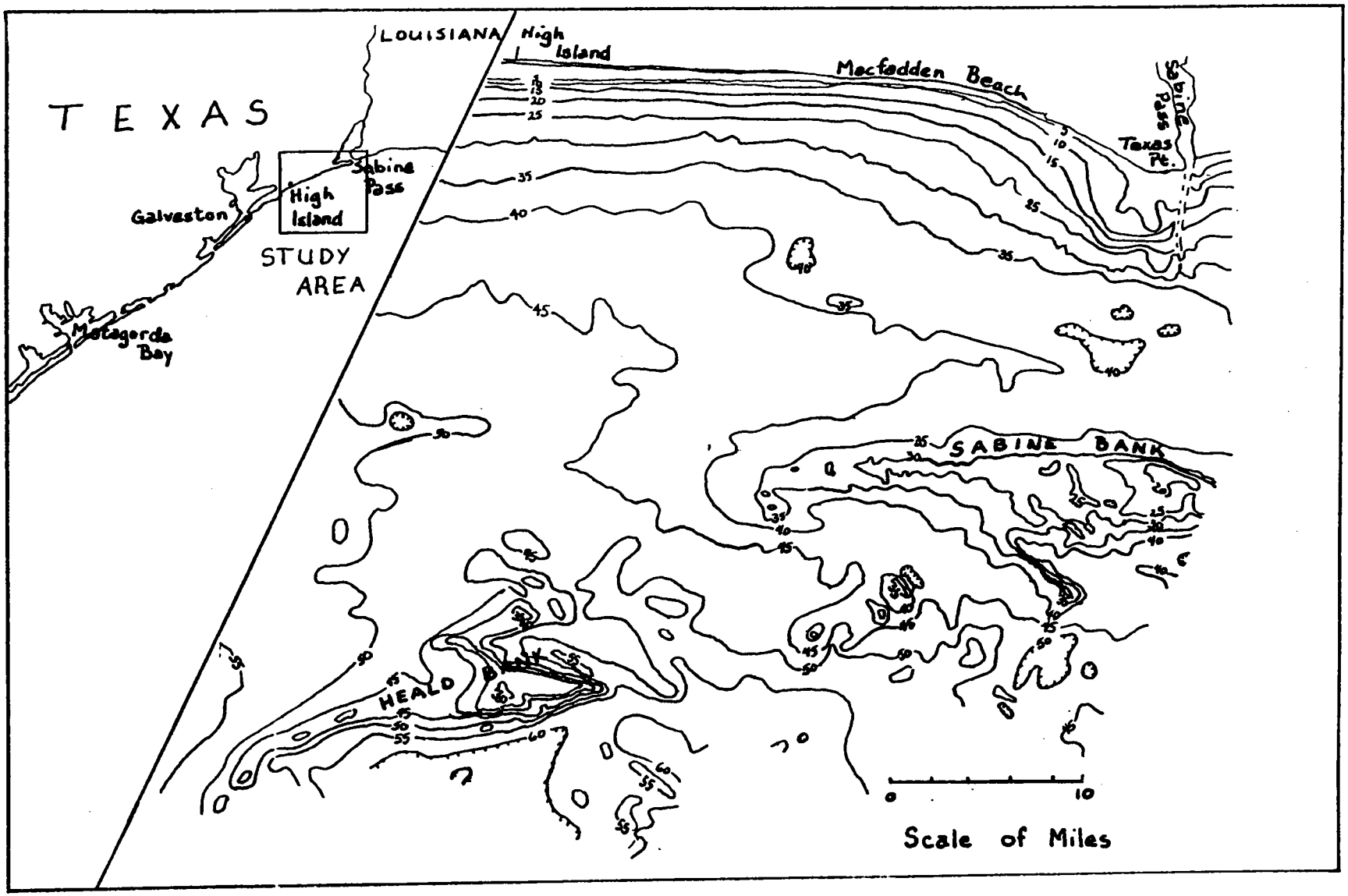

Figure 12. High Island--Sabine area

Two were retaken one to two years after marking. They were undoubtedly en route to Rancho Nuevo since one was found to have oviducal eggs. The tenth turtle was taken on November 18, 1979, off Brazos Santiago. It had been tagged on June 27, 1979. Several possibilities exist, providing that it was a healthy, uninjured animal. The most logical ones are a feeding ground for resident turtles, or a wintering ground for migratory turtles off the Rio Grande.

In summary for Texas, we need to consider each species separately. No significant data are available on the leatherback but the impact of tuna longlining should be monitored. The dinner plate-size green turtles enter the grass beds of the bays in small numbers but adults are unknown from there in recent years. Small hatchling hawksbills drift ashore in varying numbers from year to year. It is assumed that they pass their pelagic stage in the same current that brought the Ixtoc oil spill to Texas in the summer, then reversed direction and carried it southward during the cold months. The loggerhead population is impacted by shrimp trawling and strandings are most common on Padre. This is primarily a group of subadult turtles, and their origin (where hatched) is unknown. The ridley strandings increased in 1986; the major stranding area is the stretch of beach from Bolivar Roads to Sabine Pass. The shallow waters between Sabine Pass and McFadden Beach are an important feeding area. The adults migrate through Texas to and from the nesting grounds, but if recapture data are correctly interpreted, they make a rapid transit except for the area around the Rio Grande delta.

Louisiana

Hildebrand (1981) placed the major foraging ground for adult and juvenile ridley turtles in the waters of Louisiana. Information, which I have accumulated since that date, reenforce my original opinion. The ridley is the dominant marine turtle and, in most areas, the only one inside the ten-fathom contour from the shrimp grounds around the eastern passes of the Mississippi River westward to Sabine Pass, Texas (see Figure 13).

I have done little work in Louisiana during the past three years. I have talked to a number of shrimpers and others interested and familiar with the waters. In the western area of the state, young ridleys are occasionally taken in beach seines at Holly Beach. They are seen in West Cove of Calcasieu Lake, but not further up the lake. In the early 1970s, it was not unusual to see several small black ridleys, perhaps a year old, in the aquarium of the Zoology department at Southwestern Louisiana University. I was told that they were caught off the mouth of the Mermenteau River.

The best known, and perhaps the largest concentration of ridleys, both young and adult, is in Terrebonne Parish, particularly between Ship Shoal and the mainland. Ridleys were first reported from here by Liner (1954). The common presence of adults was indicated by tag returns from tagging done in Rancho Nuevo (Vargas M. 1973), and information supplied by shrimpers. The geology of this area has recently been restudied by Suter et al. (1985) and Fig. 14 is redrawn from their work. Offshore of Wine

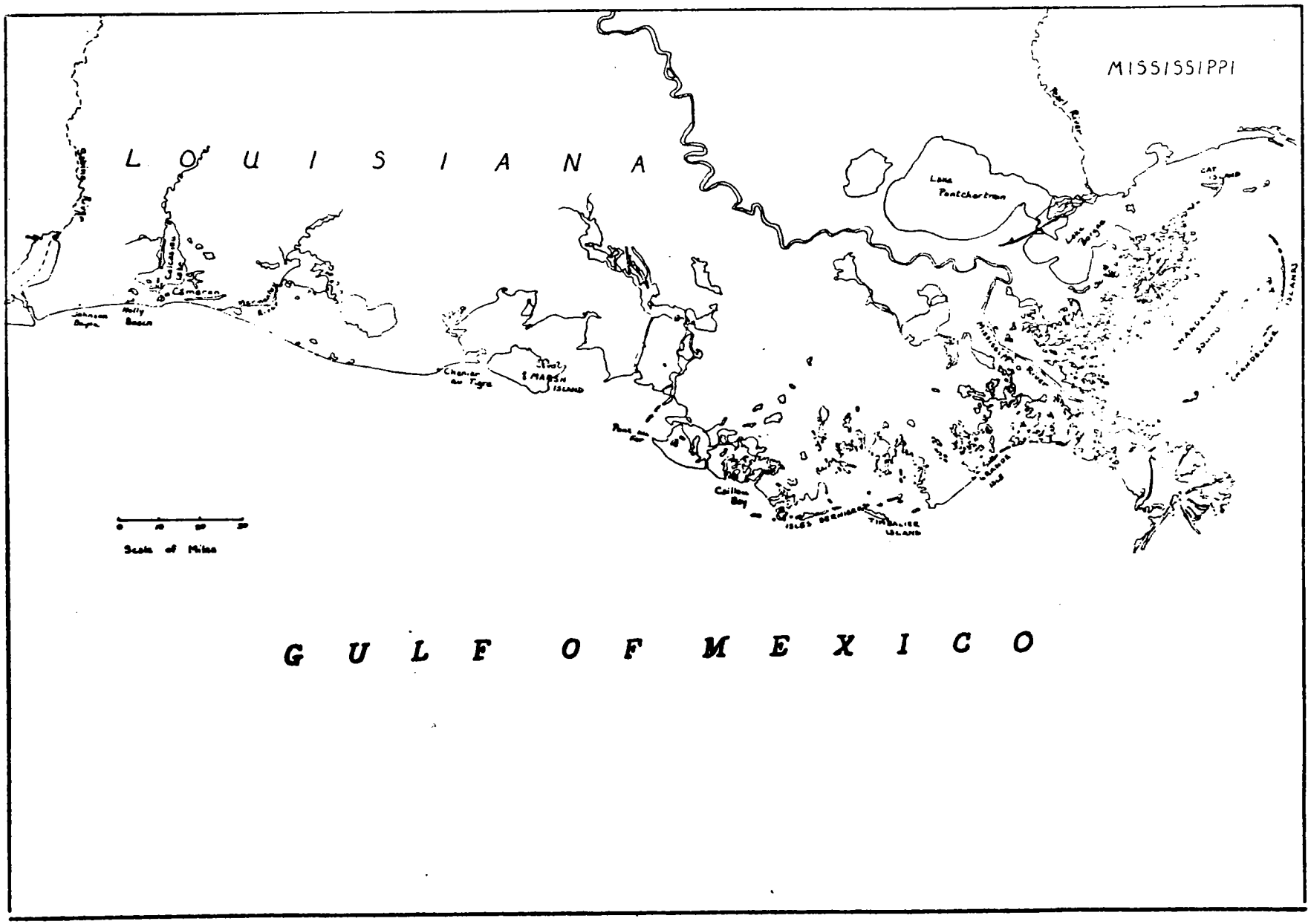

Figure 13. Louisiana

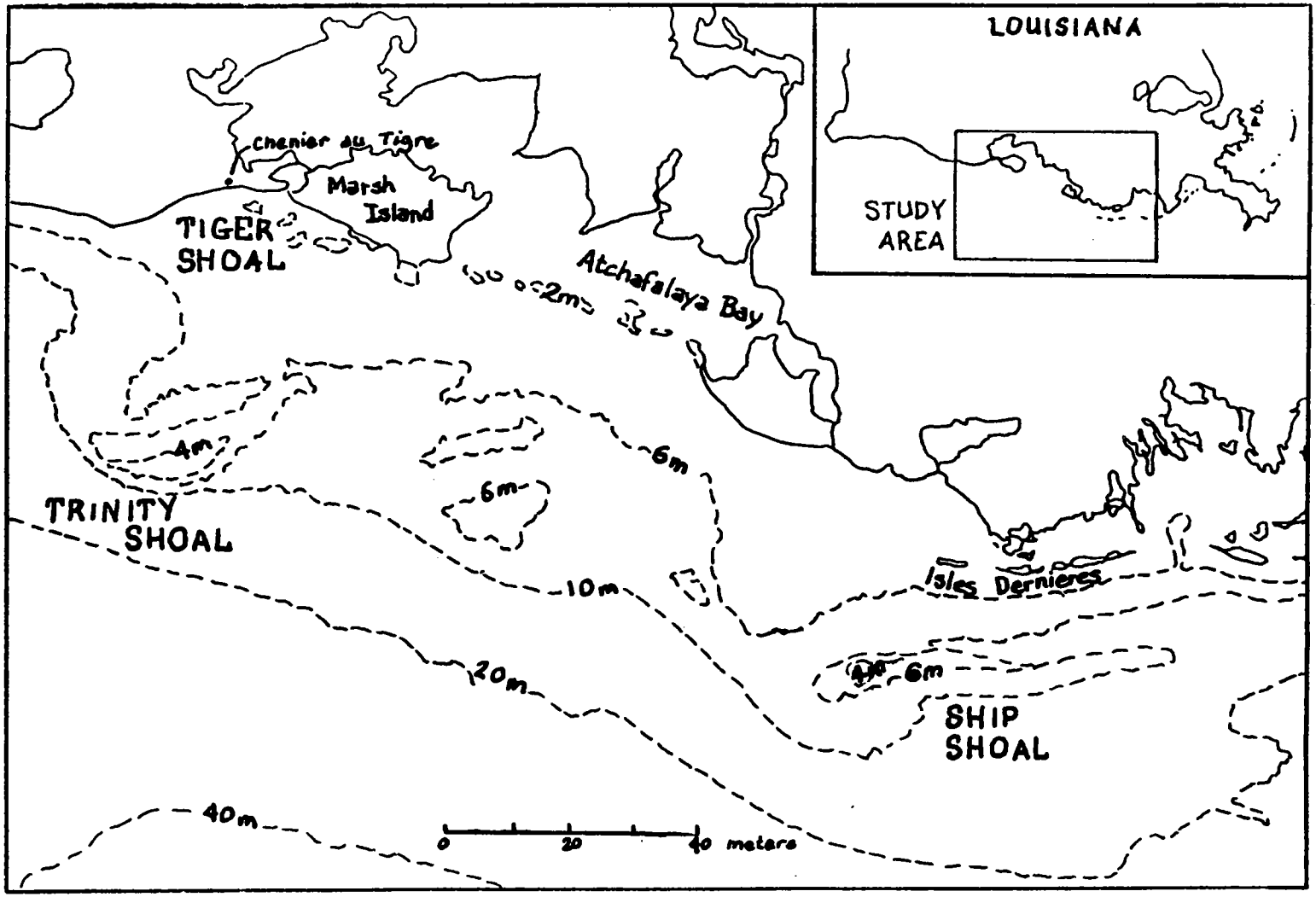

Figure 14. Ship Shoal

Island, Isla Dernieres and especially the broad flat, inside the 6-meter contour to the west of Caillou Bay, are the productive areas.

I examined the original letters of transmittal of tag information from Louisiana in the files of the Instituto Nacional de Pesca at Manzanillo. There are 34 tags with location data. Eight of these tags are from Louisiana waters east of the Mississippi River; except for one from Breton Sound and another from the Chandeleur Island, all of the respondents use one or the other of the Mississippi passes to designate trawling grounds. There are 7 returns which use place names on the west side of the delta to locate the capture site. Twelve tags were recovered in the sector of coastal waters which encompasses Trinity and Ship Shoal. All recoveries are in depths of 10 fathoms or less but only one, strictly speaking, was recovered in inside waters (Barataria Bay). The ridley is apparently not uncommon in the waters surrounding the Isles Dernieres, and enters Caillou Bay which is without a barrier island across its mouth.

Where do the adult turtles go in winter? There is one definite record for 14 fathoms south of Morgan City, Louisiana (lat. 28°36'N, long. 90°11'W) on January 14, 1939 (Carr and Caldwell 1958). In the tag returns there are two January captures off the Atchafalaya, but only one has a recorded depth (10 fathoms). There is also one February capture in 9 fathoms south of Wine Island Pass. This scanty data would indicate an offshore movement during the winter; all summer captures of this section of the

coast are invariably in shallow water. There may be a southward movement in winter but supporting catch data are not now available. The two tag recoveries in the Florida Keys were both taken in the winter, one in January and the other in February. However, these animals could have been residents of the keys as adults have been known from there for more than a hundred years. There are no winter records for Texas, but there is one for 24 fathoms off Washington Beach on December 19, 1968. I reported a dead ridley on the Tamaulipas beach, approximately 30 miles south of the Rio Grande, on January 1964. I would hypothesize that both adults and immatures move offshore in the winter, and that some adults which will nest the coming summer move southward in this deeper water. The mouth of the Rio Grande may be a staging or feeding point for these turtles.

Nearly all records available to me indicate that the turtles are caught sporadically and one at a time. There is one entry in the tag returns for a drag by a trashfish trawler to the west of the mouth of the Mississippi on March 2, 1968, reporting the capture of 4 other turtles beside the tagged one in the same drag. I have had reports of multiple captures after hurricanes, e.g., 7 turtles were reported from a drag off Port O'Connor after Hurricane Carla in 1961.

Conclusions and Summary

The green turtle nests throughout the length of the Mexican coast. The small nesting aggregations, which stil exist near Isla Aguada, rio Largartos Peninsula, the cayos of Campeche Bank,

the Mexican Caribbean Islands and the diffuse colonies on the mainland of Quintana Roo should have increased protection. The small green turtles, which enter the bays of Texas each year, warrant further study since no adults are known to arise from this yearly recruitment.

Two major hawksbill colonies still exist in the Gulf of Mexico, but their survival depends on transplanting the eggs by a nation on an austerity budget. These colonies are located between Isla Aguada and Chencan, Campeche and the Peninsula of rio Lagartos near Las Coloradas, Yucatan. In addition, there are indications of a major foraging group near Sontecomapan, i.e., a nearby fringing reef may have as many as 7,000 hawksbills. Very young posthatchling hawksbills come ashore on the Texas coast--an indication of the need to study currents and meteorological conditions between the nesting ground and the Texas coast.

The loggerhead populations appear to be declining in eastern Mexico and probably in Texas as well. Nesting, from my inquiries, appears to be restricted to Quintana Roo, except for occasional nests by solitary individuals or very small groups elsewhere. I think we are in danger of losing the Yucatan nesting population of the loggerhead. The origin of the foraging population of subadults on the Texas coast needs to be determined. This group sustains heavy losses every year due to mortality in fishing gear.

Ridley turtles have been declining in numbers for several decades. I can report nothing encouraging from my travels and

interviews. In regard to Campeche, the ridley appears to be strictly a shallow water turtle, 7 fathoms or less in depth. This means that the main conflict with fishing gear must be with shrimpers and shark fishermen operating from ports between Sabancuy and Campechita. Shrimpers out of the port of Campeche, fishing deeper waters near cayo Arcas, do not impact the ridley. There may be staging or resting areas on the migration to Rancho Nuevo, at least the turtles are said to appear and to linger at these points--a few even nesting. I have identified these as Alvarado, Boca Chachalacas, Tecolutla (possibly also the Barra del rio Cazones and Moralones) and the Rio Grande. On the north Gulf coast, I stress the value of the banks, and the waters inshore from the banks, as a habitat for turtles. Specifically, I refer to about 6,000 square miles of water extending from Heald Bank to Ship Shoal. The value of the waters around the delta of the Mississippi to the adults is also recognized.

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