

Status and Management of Sea Turtle Populations in Central America
with Special Emphasis on turtles in Honduras

by

Enoc Burgos

A Special Project

submitted to

Oregon State University

in partial fulfillment of

the requirements for the

degree of

Master of Science

August 1984

Commencement 1985

ACKNOWLEDGMENTS

I sincerely thank my major professor, Dr. Victor T. Neal, for providing most of the professional support during my graduate studies. Many useful comments and assistance have been contributed by my friends, Kathryn Boeckmann, Peter Howd, David Ham, Romy Pelayo, Dick Merrick, Bruce Southerland, and specially in memory of Geoffry R. Dimmick.

I, especially, wish to thank Mr. Frederick H Berry, of the Southeast Fisheries Center, National Marine Fisheries Service, Miami, Florida, for inviting me to participate in Center turtle work and the opportunity to share with him his profesional guidance for this work, without his help this work would have been more difficult.

I am indebted to my wife, Lilly, and my parents, Nina and Angel, for their patience and encouragement during my graduate studies.

" To my children Dacil, Alejandro, and Geoffry
with my love".

TABLE OF CONTENTS

	page
I Introduction	1
II Distribution of ecological and developmental stages of species composition of sea turtles of Central America	3
Family Cheloniidae	3
<u>Caretta caretta</u>	3
<u>Chelonia mydas</u>	6
<u>Lepidochelys olivacea</u>	9
<u>Eretmochelys imbricata</u>	11
Family Dermocheliidae	14
<u>Dermochelys coriacea</u>	14
III Historical review and socioeconomic significance of the sea turtles along the Caribbean and Pacific coasts of Honduras.	17
Socioeconomic significance of sea turtles	21
IV Recommendations for sea turtle management	24
Conservation	25
Habitat protection	25
Management of eggs, hatchlings, and adults	26
Control of exploitation	27
Conservation education	28

	Management options	29
	Beach patrol	30
	Closed season or closed areas	31
	Protection of foraging areas	31
V	Recommendations for the preservation of sea turtles of Rio Platano Wildlife National Park	32
	Sea turtle protection project	33
VI	National and International laws, treaties, and conventions related to sea turtles	37
	Turtle laws and regulations in the Caribbean area	38
	International laws, treaties and conventions	38
VII	International trade in sea turtle products	41
VIII	Bibliography	46

List of Tables

Table

- 1 Annual landings for turtle products (kg) for some Caribbean countries.
- 2 Japanese imports of raw tortoise-shell (kg) from some countries in the Caribbean area.

List of Figures

Figure

- 1 General characteristics of relief and composition of the continental shelf of Honduriras.
- 2 Eastern Atlantic coast of Honduras (Mosquitia area).
- 3 Eastern Atlantic coast of Honduras (Biosphere " Rio Platano).
- 4 Atlantic coast of Honduras (Protected archaeological area).

Appendix

- I Legal and regulatory prohibitions of sea turtles in the Caribbean area.
- II International agreements.

STATUS AND MANAGEMENT OF SEA TURTLE POPULATIONS IN CENTRAL AMERICA

WITH SPECIAL EMPHASIS ON TURTLES IN HONDURAS

I. Introduction

The Caribbean region contains some of the largest known sea turtle nesting aggregations in the world. Unfortunately, a variety of complex factors have accelerated an increasing sea turtle mortality rate. Several sea turtle stocks have been fully exploited, and several are in a critical biological situation.

Numerous authors have cited a persistent sea turtle population decline in Honduras (Carr 1950, 1980; Craig 1966; Parsons 1962; Bacon 1973; Burgos and Perez 1975; Nietschmann 1981, 1972; Cornelius 1981). From 1981 to 1984, new information has been compiled by the National Report for Honduras to WATS (Western Atlantic Turtle Symposium) including the presence of five species of sea turtles, and sea turtle feeding and nesting grounds. This new information showed a high predation of turtle eggs, habitat destruction, and turtles being caught incidentally by shrimp vessels.

The management of our marine resources to ensure the best use of our limited oceanic supply includes a complex mixture of economic, social, and political problems. The application of marine turtle management to a country's economic condition and social condition is questionable, when the biological structure is almost unknown and the decline of the sea turtle resource is very real. The balance between appropriate objectives and time is the key for the recovery of these diminishing stocks and their protection and management.

Many management objectives are possible. The most widely used is maximum sustainable yield (MSY). This abstract concept provides an ideal theoretical guide to management. Other objectives include conservation measures and different types of explicit regulations which can be introduced to achieve this purpose. For the Honduran sea turtle population, the MSY concept is not possible at this time because of the lack of biological information, models of turtle population, feasible statistical data, and catch effort.

Conservation measures and some management techniques are also needed in order to permit the recovery of these sea turtle populations. This last approach looks to be more feasible in the Honduran case.

The purpose of this study is to update Honduran sea turtle information and to recommend alternatives for managing this resource.

II. Distribution of ecological and developmental stages of species composition of sea turtles in Central America.

Five species of sea turtles are found along the Honduras coasts: loggerhead (Caretta caretta), green turtle (Chelonia mydas), hawksbill (Eretmochelys imbricata), leatherback (Dermochelys coriacea), and Pacific olive ridley (Lepidochelys olivacea). Although information about these species in Honduran waters is limited, a few scientific papers are available.

Some basic biological data for each species are given to describe the status of the sea turtles in Honduras and to relate them to the rest of Central America. The historical background of drastic reduction of most populations results from almost 300 years of exploitation of the turtles and the destruction of some of their natural habitats.

Family Cheloniidae

Caretta caretta (Linnaeus)

Vernacular names

Atlantic loggerhead (English); Tatue caouane de L'Atlantic (French); Tortuga caguama del Atlantico, Tortuga cuero, cabeza (Spanish).

Description

Carapace heart-shaped, depressed, its width about 76% of the length.

Head about 28% of the carapace length. Two pairs of prefrontals shields between eyes; 5 pairs of lateral scutes, the first always touching the precentral scutes. Forelimbs paddle-shaped with two claws; 3 pairs of inframarginal scutes on plastron. Predominantly reddish brown to brown carapace and yellowish plastron. Mature males have tails longer than the hind flipper (Marquez 1978; Schwartz 1977; Nietschmann 1977; Hildebrand 1981). Carapace maximum straight length 125 cm; common to 110 cm. Weight of 140 kg. Record size 274 cm and 386 kg (Schwartz 1975).

Distribution

The loggerhead is a circumglobal, tropical-subtropical species. It occurs throughout the western hemisphere, extending northward to Nova Scotia, Canada, and southward to Rio de la Plata, Argentina. In the Pacific ocean, it ranges from Baja California to Peru. The loggerhead frequents the open ocean, coastal bays of moderate depth, and estuaries. It is believed to be a very migratory species.

Reproduction

The loggerhead's life cycle, like other species of sea turtles, has terrestrial and pelagic stages. The pelagic one is almost unknown, and currently only the terrestrial has been measured. Adult females appear off nesting beaches from March to April, where mating takes place, with oviposition from May to September. The incubation period ranges from 45 to 65 days. Females lay from one to seven clutches of eggs per season at

approximately 15 day intervals and females usually return to nest at every 2 or 3 year intervals. The clutch size from 60-150 with an average clutch of 120 eggs (Schwartz 1977; Marquez 1978; Hildebrand 1981; Nietschmann 1977).

Nesting areas

Nesting occurs just above high water on open beaches. The most important nesting concentrations in the western Atlantic are on the south Atlantic coast of the United States, Cuba, Mexico, and Colombia (Marquez 1978). Minor concentrations are around Nicaragua, Costa Rica, Honduras, Panama, Belize, French Guiana, Grenada, Guadalupe, and the Jamaican coast. On the Pacific coast the major concentrations are in Nicaragua, Panama, and Peru (Cornelius 1981; Brown and Brown 1981; WATS 1983).

Feeding areas

Little is known about the diet of wild juveniles and subadults. The adults are predominantly carnivorous, feeding on molluscs, crabs, fish, jellyfish, sponges, squid, and other animals, and also on several marine plants. Habitat and feeding areas include open ocean, lagoons, estuaries, coral reefs, and along shore (Marquez 1978).

Population status

Threatened. The designation status of this species is based largely on the opinions of authors rather than on actual counts of nesting or

foraging populations. The accelerated destruction of beach nesting sites and heavy nest predation, especially by raccoons and humans, has contributed significantly to the population decline.

Chelonia mydas (Linnaeus)

Vernacular names

Green sea turtle (English); Tortue verte de L'Atlantique (French); tortuga verde, tortuga blanca (Spanish); Tartaruga verde (Portuguese). The east Pacific green turtle population is often listed as a separate sub-species, Chelonia mydas agassizi, or a separate species, Chelonia agassizi, and is called caguama negra or caguama prieta (Spanish).

Description

Carapace oval, depressed, its width about 78% of the length. Head small, with a single pair of prefrontal scutes; 4 pairs of lateral scutes, the first never touching the precentral scute. Limbs paddle-shaped with one claw; the edge of the lower jaw is coarse textured, and the upper jaw has strong ridges on the inner surface: Predominantly brownish carapace, sometimes with olive or black spots and streaks, and whitish plastron.

Mature males with shell more elongate than those of the females (Marquez 1978; Schwartz 1977; Hirth 1971; Carr 1952; Halstead 1978; Nietschmann 1977). The maximum adult size reached by the green turtle is 300 kg, but the common weight is 100 kg. with a maximum straight carapace length of 105 cm (Schwartz 1977; Hirth 1971; Marquez 1978).

Distribution

The green sea turtle is a circumglobal, tropical-subtropical species. On the American side of the Atlantic ocean it has been captured or sighted as far north as New England, U.S.A. and southward to Rio de la Plata, Argentina. Distribution of adults is determined to a large extent by the location of their nesting beaches and the optimum habitat of shallow waters with an abundance of submerged vegetation for feeding.

Reproduction

Age at maturity has not been determined, but some authors estimate it to be 4 to 13 years. Copulation usually occurs off the nesting beaches, usually one kilometer offshore. It is plausible that some mating takes place at the feeding grounds, or at other areas away from the nesting beaches. Most nesting take place at night, although day time nesting rarely occurs. Mating throughout the Caribbean area takes place from May to July and oviposition from June to September, with a incubation period ranging from 45 to 60 days. The female may nest several times in a single season and the clutch size varies from 20 to 193 eggs, with a reported and apparently unusual maximum of 226 (Schwartz 1977; Carr and Hirth 1962; Hirth 1971; Marquez 1978; Carr et al 1978; Carr 1980; Nietschmann 1977; Bjorndal 1980; Brongersma 1968).

Nesting areas

The main nesting areas in the Western Hemisphere are located along

the western Caribbean coast, Isla Aves, Costa Rica, Panama, Brasil, and along less quantity in some islands of the Antilles, Honduras, and Nicaragua. Along the Pacific coast it nests in Baja California, Peru and Galapagos (Carr 1965; Carr et al. 1978; Carr and Mylan 1980; Carr and Carr 1977; Hirth 1971; Marquez 1978; Nietchmann 1977; Parsons 1962).

Feeding areas

The green sea turtle usually inhabits waters less than 25 m in depth and prefers areas sheltered by reefs, lagoons, and shoals of the continent near sand or areas of vegetation. The best feeding areas are covered with turtle grass or other vegetation. This species is omnivorous, but primarily feeds in shallow waters with extensive marine vegetation. In many instances the distribution of green turtles coincides with distribution of sea grasses (Carr et al. 1978; Hartog 1980; Hirth 1971; Nietschamann 1977; Schwartz 1977).

Population status

Currently the only valid numerical assessment of sea turtle populations is to count female turtles or their tracks on their nesting beaches. Even this procedure is beset with obstacles: The natural sex ratio in green turtles population is not known (Hirth and Carr 1970; Carr and Giovannoli 1951; Caldwell 1959).

It is estimated that about 2,500 females nest in Surinam (Schulz 1969); about 6,000 females nest annually at Tortuguero (Carr 1969), a few small breeding populations occur at Honduras, Nicaragua, and Yucatan.

Breeding sites in the Caribbean have been depleted by man and predators. The Florida (U.S.A.) breeding population is endangered and the rest of western Atlantic is threatened under the U.S. Endangered Species Act of 1978. Central America's breeding population endangered, especially Costa Rica and Nicaragua.

Lepidochelys olivacea (Eschscholtz)

Vernacular names

Pacific ridley turtle (English); Tortue ridley du Pacifique (French); Tortuga golfina, tortuga lora (Spanish).

Description

Carapace circular, depressed, its width about 90% of the length. Small head, with 2 pairs of prefrontal scutes. More than 5 pairs of coastal scutes, the first pair touching the precentral scute; 4 pairs of inframarginal scutes, each one with a pore toward its hind margin. One claw on each flipper. Predominantly olive brown and yellowish plastron (Marquez 1978). The maximum adult size is 76 cm (straight line); maximum weight 55 kg.

Distribution

The olive ridley turtle has a tropical distribution. It occurs on the coast of South America, Brazil, Guyana (WATS, national reports).

A few records exist from Cuba, Puerto Rico, Guiana, and Trinidad (Pritchard 1976). The olive ridley is the most abundant turtle on the Pacific coasts of El Salvador, Honduras, Nicaragua, Costa Rica, Mexico, and Ecuador (Burgos and Perez 1975; Cornelius 1981; Marquez 1976).

Reproduction

The olive ridley is found in shallow coastal waters as well as the open ocean. Copulation usually occurs off the nesting beaches. Most nesting occurs at night, but in some areas where huge concentrations occur, the nesting may be extended until the first hours of the day. Oviposition take place from April to August on the Atlantic coast and from April to October on the Pacific, with a incubation period ranging from 45 to 50 days. The females may nest several times during the season and clutch size range from 60 to 130 (Burgos and Perez 1975; Cornelius 1975; Marquez 1978; Robinson et al. 1973).

Nesting areas

The olive ridley is the most extreme example of the strategy of aggregated nesting. This species nests in huge localized concentration along the Pacific coast, especially in Pacific Mexico and Central America. Sixteen important nesting sites are reported in the Pacific Ocean. Some of the huge concentrations include Nancite, Costa Rica with 200,000 nesting females per year ; Ostional, Costa Rica, 100,000/year; Escobilla, Mexico, 150,000/ year; Orisa, India 150,000/year. There are large concentration in Suriram, but they are declining. Small nesting populations are

reported from Honduras, Nicaragua, El Salvador, and Venezuela (Burgos and Perez 1975; Robinson et al. 1973; Cornelius 1975; Novak 1974).

Feeding areas

Recapture of tagged olive ridleys in the Atlantic are mainly from the northern coast of South America (eastern Venezuela and northern Brasil). Some authors suggest that the presence of a rich food source at the north of South America could be one of the biggest feeding areas for the Atlantic population (Pritchard 1973, 1976; Schultz 1975). Tag recoveries from the Pacific coast of South America are mainly from Ecuador, suggesting rich food source on the South America Pacific platform (Marquez et al 1976; Vargas 1973).

Population status

Along the Central American Atlantic coast, the breeding population is endangered. North of South America the breeding population is also endangered. Along the Pacific coast of Central America and South America, the breeding populations are threatened (Cornelius 1981; WATS 1983).

Eretmochelys imbricata (Linnaeus)

Vernacular names

Hawksbill (English); Tortue caret de L'Atlantic (French); Pico de halcon, Tortuga de carey (Spanish).

Description

Medium-sized turtle, oval carapace, depressed, with juxtaposed scutes in the very young turtles, imbricate scutes in adult and juxtaposed again in the older specimens. Four pair of lateral scutes, anterior pair not touching the precentral scute; 4 pairs of inframarginal scutes in the plastron; 2 claws for limb; 2 pairs of prefrontal scutes (Marquez 1978; Schwartz 1977; Witzell 1983). Hatchling coloration uniform, but the color variation starts when the turtles are five to six months old. The adult has a predominantly dark brown, with yellow and reddish streaks on the upper side, and yellowish in the plastron. Hawksbill coloration is highly variable and may be due to either genetic or environmental factors (Carr et al 1966; Nietschmann 1977; Witzell 1983). The maximum adult size reached by the hawksbill is 90 cm and 120 kg; the average size of adults is about 80 cm and 60 kg (Marquez 1978; Nietschmann 1977; Schwartz 1977).

Distribution

The hawksbill is a circumglobal, tropical subtropical species that inhabits coastal reefs, bays, estuaries and lagoons. It occurs throughout the western hemisphere, northward to Massachusetts, U.S.A., and southward to Brasil. It is uncommon in the northern Gulf of Mexico (Hildebrand 1981; Marquez 1978; Nietschmann 1977; Witzell 1983). National reports include the hawksbill on the coasts of Belize, Honduras, Nicaragua, and Costa Rica (Carr et al. 1966; Niechsmann 1977; Marquez 1965; Parson 1972; WATS

1983). In the Pacific Ocean, it has been reported in Guatemala, El Salvador, Honduras, Nicaragua, Colombia, Peru, and Ecuador (Brown and Brown 1981; Cornelius 1981; Pritchard 1971).

Reproduction

Age at maturity is about 3 to 5 years. Mating usually occurs in shallow waters off nesting beaches. Most nesting take place on isolated beaches, especially those surrounded by reefs. The nesting season in the Caribbean is from April to October, with an incubation period ranging from 45 to 55 days (Carr et al. 1966; Marquez 1978; Schwartz 1977; Witzell 1983). The clutch size ranges from 53-206 eggs (Carr et al 1966).

Nesting areas

Nesting occurs around the tropics without specific concentrated areas; Nesting seems to take place periodically or sporadically on all undisturbed Caribbean shores.

Feeding areas

Evidence indicates that the hawksbill inhabits reefs and rocky places, lagoons or areas with vegetation. Several specific feeding grounds include Blufields, Nicaragua, Bocas del Toro, Panama, Coral Ledges, Vivaricos Cays, and Islas de la Bahia in Honduras and off the Belize coast.

Population status

This species has been exploited extensively for its carapace scutes. Its eggs are hunted for food. The nesting populations have declined due to over-exploitation and destruction of its natural habitat. Its status is endangered.

Family Dermocheliidae

Dermochelys coriacea (Linnaeus)

Vernacular names

Siete filos, baula, tora, tinglada, tortuga cuero, garapacho (Spanish); leatherback, trunkback, leathery turtle (English); totue cuvree (French).

Description

The largest turtle species. Lacks the horny carapace scutes of other species. Body covered by a leathery skin. The carapace deep and barrel-shaped, raised into a series of seven longitudinal ridges on the caparace, and tapers posteriorly to a blunt point. Dorsal coloration is black, blue, or brown, usually heavily spotted with white. Frequently the spots on the soft parts are pinkish and sometimes bluish. Plastron is whitish. Upper jaw bearing two tooth-like projections, flanked by deep cusps at the maxillary sutures. Eyelids arranged in an almost vertical plane, so that the closed eye have the appearance of vertical slits (Pritchard 1971; Schwartz 1977; Bacon 1970).

The maximum adult size reached by the leatherback has been confused by variations in the methods of measurement (Pritchard 1971). A series of carapace measurements of adults available in the Caribbean were taken by Pritchard in French Guiana (192 adults); Bacon (1969) in Trinidad (20 adults); Fretey (1978) in French Guiana (834 adults). The lengths range from 120 to 181 cm. The weight records for adult leatherback fall within 295 to 863 kg.

Distribution

The leatherback is a circumglobal, tropical-subtropical species. They are found throughout the Caribbean, northward to Nova Scotia, Canada, and southward to Rio de la Plata, Argentina. Along the Pacific coast they have been reported in Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, and Ecuador (Cornelius 1981; Green and Crespo 1981). Other populations occur in the Pacific and Indian Oceans (Marquez 1978). Sometimes listed as a separate subspecies.

This is predominantly a pelagic and highly migratory species that seasonally moves into shallow bays and estuaries. The species feeds extensively on jellyfish and also eats algae and crustaceans.

Reproduction

Very few observations of copulation have been reported, but mating likely occurs during the early part of the nesting season off the coast of nesting beaches (Pritchard 1971; Schwartz 1977). The clutch size varies from 50 to 150 eggs, and the incubation period is between 53 to 74 days.

Nesting areas

In the western Atlantic the most important nesting areas are found in Costa Rica, Panama, French Guiana, and Surinam. Others less important areas are Trinidad, Grenada, St. Thomas, Yucatan, Nicaragua, and Honduras. The leatherback appears to show preference for mainland nesting (Pritchard 1971). During 1981-1984, leatherback nesting was recorded in Honduras and Nicaragua, with the season extending from May to August (Carr 1980; Nietschmann 1977; Pritchard 1971; WATS 1983).

Population status

Endangered. Although more than 4,000 leatherbacks around the world have been tagged at nesting during 1979 to 1982, no single individual has ever been recovered at sea (Pritchard 1976). Based on counts of the breeding females and considering unknown or uninvestigated beaches, an estimate of 150,000 breeding female leatherbacks in the world has been made (Pritchard 1982).

Egg collectors are probably the major threat for this species around the world, although on some beaches the females are slaughtered for meat.

III. Historical review and socioeconomic significance of sea turtles along the Carribbean and Pacific coasts of Honduras.

The Atlantic coast of Honduras has a coastline of 560 km. In the west, the coastline is covered with beaches, with a narrow continental shelf where the sea floor drops abruptly. The central portion includes some combination of sand beaches and small lagoons. On most of them the sand is a combination of crushed shells derived from a long evolutionary process of the reef areas. Along the eastern coastline, from Bahia de Trujillo, the continental shelf expands into a continental platform of about 20,000 km² and not deeper than 25 fathoms (Fig. 1). The beaches are characterized by fine silicious sand and coarse shells, with lagoons and swampy areas behind them.

The Pacific coastline is about 167 km. long and is a combination of beaches and mangrove areas. The beaches are a combination of fine sand from pulverized lava, volcanic ash, and black sediment derived from mangrove and estuarine areas. The continental shelf is very narrow and deep, due to the adjacent subduction zone.

A fundamental change in human society was the migration of people to the coastal areas to take advantage of marine trade. With this movement, people used sea products more frequently, and sea turtles have not been the exception. These reptiles have played an important role in the cultural and nutritional life of these coastal people, who have used turtles for thousands of years. They should have priority for their use today, according to some opinions.

Among the traditional people still depending on turtling for part of their subsistence are the Miskito Indians of Honduras and Nicaragua, who comprise the oldest known Central American turtling society. Other native groups still exploiting turtles are the Rama of Nicaragua; Mayan along the northeastern coast of Yucatan and Belize, and black carib (Garifuna) in the Honduras coast-bay Island area (Rebel 1974; Nietschmann 1977). Many other people in the Caribbean and South America have also historically exploited sea turtles.

The Miskitos are the most widely distributed Indian people in Central America. They are water-side people, whose settlements are principally located along rivers, lagoons or coastal beaches. The Miskitos are settled along 600 kilometers of Caribbean coast and almost 800 km up the Rio Coco and Rio Patuca (Nietschmann 1972).

Sea turtles have always played a conspicuous role in their lives economy. As early as 1519, Juan de Grijalva's expedition encountered Indians carrying turtle-shell shields on the Mexican coast. According to Urig (1726), explorers and early settlers along the Yucatan and Honduras coast depended heavily on turtle fishermen to provide them with fresh meat. "The first clear documentation of the presence of turtle trading between Miskitos and traders was 1633, when a trading station was established among the Miskitos at Cape Gracias a Dios by English adventurers. By 1722, several Jamaican vessels, were annually visiting Central American waters to catch and buy turtles from the Miskito indian" (Parsons 1962).

Throughout most of the colonial period, it is evident that turtles were much more abundant than at present. Harpooning was the principal

method of capturing these animals, but during the eighteenth century, turtle nets were introduced (Craig 1966).

In the latter half of the nineteenth century, the export of shipping turtles was clearly an established practice in the Caribbean area. Some sampling of the records include 5,520 head turtles exported out of Belize by 1869 (Parsons 1962).

The increase in demand for fresh meat in the Caribbean and Europe, and the depletion of the natural hunting grounds around these areas, gradually diverted the Caribbean turtle fleet to new areas. Jamaican settlements turned southward to the Miskito cays, Serrana and, Roncador. Thomas Young, in 1842, noted that Cape Gracias a Dios was often visited by small schooners from the Grand Cayman Island. They supplied England and Jamaica through Belize with the finest green turtle. During the last century, the hawksbill and green turtles were the most valuable cargo on trading vessels bound for New York, Boston, England, and Caribbean from the Central American coast. The intermediate harbor for this trading were Belize and Roatan Island, Honduras (Parsons 1962). Other important shipping areas were Rio Negro and Cape Gracias a Dios in Honduras, and Blufield, Corn Island and Puerto Cabezas in Nicaragua (Nietschmann 1972).

Early this century, under the terms of the treaty of 1916 between the United Kingdom and Nicaragua, a nominal fee was created for the 2,000 to 3,000 green turtles taken annually from these waters and paid to Nicaraguan custom officials at Cape Gracias a Dios (Parsons 1956, 1962; Nietschmann 1971, 1977).

Turtle fishing by Cayman Islanders was discontinued in 1963, but in 1969, new foreign processing plants opened on the Atlantic coast of

Nicaragua. Between 1969 and 1977, intensive commercial turtle exploitation for the export market began to erode the ecological and social heart of Miskito subsistence and culture. During these intensive years of exploitation, about 150,000 green turtles were taken by the two companies that operated on the Nicaraguan coast. In 1977, the Nicaraguan Government closed the turtle companies and the Miskitos were only permitted to continue subsistence turtling (Nietschamann 1977).

Presently time, the general scarcity of turtles, particularly the green hawksbill, has changed some of the commercial patterns, the majority of the shell collected along the Guanaja, Roatan, Cayos Cochinos, Vivarios, Hobbies Cays in Honduras are used locally. Small amounts are sold in La Ceiba, Trujillo, and Puerto Cortez, and in recent years some foreign traders have started illegal export to foreign markets.

On the Pacific coast (Gulf of Fonseca) the major trading of turtle products is eggs. During the last 20 years, it has been estimated that 90 percent of the eggs laid on the beaches were poached and consumed locally or sold to traders of El Salvador and Honduras (Burgos and Perez 1975). The major nesting species is the caguama (Lepidochelys olivacea).

Carr (1948) reported trade eggs of green turtles, hawksbill, and olive ridley in market places of the capital, Tegucigalpa, and observed caguama nesting on several island in the Gulf of Fonseca. At the time of Carr's visit in 1948, egg collected, primarily by Salvadorean poachers, were transported to La Union and La Libertad, El Salvador and offered or sold.

Socioeconomic significance of sea turtles

"Turtling is part of the cultural complex that links people, society, environment and biota. Rooted in culture and followed for generations, it is one of the principal means through which knowledge of the sea and marine life is passed on, technological patterns are maintained, and sea resources procurements are socially rewarded " (Nietschamann 1981).

Sea turtles have been exploited extensively at least since Roman times. Many people around the eastern Pacific developed a symbolic meaning of good life for sea turtle products, and certain religious significance. Among the people that attribute extraordinary medical virtues to turtles products are the Australian Indigenous and some natives people of the New World.

The turtles remain an important socioeconomic resource for the Central American societies. Hawksbill and green turtles have been the two historically most important marine resources for the coastal inhabitants of the Honduran and Nicaraguan Caribbean coast. In Honduras, the Miskitos, Sambos, and Garifunas are among those that utilize sea turtles as a source of protein.

Subsistence provisioning involves occasional production of meat for immediate use and distribution within a discrete social unit. " In Miskito villages, subsistence turtling has supplied up to 70% of animal protein. The social exchange of resources between consanguineal and affinal relationships, spread meat distribution through the community and many households share the results of an individual's skills" (Nietschamann 1972b).

The subsistence catch meat supply is opportunistic and seasonal. The meat consumed in the Miskito villages reaches its highest volume during the dry season, when weather and turtling conditions are optimal. The variability of annual meat yields point out one of the most important ecological relationships between the Miskito and his environment (Parsons 1962; Craig 1966; Nietschmann 1972b, 1977, 1981).

" The actual economic patterns in Miskito villages are changing from a subsistence one to a monetary exchange. The actual economy became monetized and the alterations in the focus of production created economic differences between individuals and households. The original subsistence practices based in generosity and sharing between suppliers of meat and less able, elderly, widowed, sick or injured were changed and the surplus was channeled into market sales. The new economic expansion intensified the pressure over the already decimated resource, changing the socially regulated distribution of meat and decreasing the amount of meat consumed by the turtlemen's family. This economic entanglement changed the total social structure, and made the Miskito hunter dependent on intensive exploitation for sale, rather than their moderate subsistence exploitation" (Nietschmann 1981).

In the Honduran coastal population of Brus Laguna, Cabo Camaron, Punta Patuca and in general the Mosquitia area, the Miskito, instead of giving free turtle products to the community, now sell them for a price. This deprives the community, specially the elderly, widowed, and disabled people of this product. The disruption of Miskito centennial social structures has forced them to offer daughters and wives to the shrimp crews or whoever in a sexual exchange for some goods or money.

The economic systems are becoming more open for economic exploitation, the intensified exploitation of the turtle resource created an imbalance and jeopardized the existence of the turtle species.

Some marine coastal resources of Honduras, which have been over-exploited for commercial purposes, such as shrimp, lobster and turtles, have been so seriously reduced that they will cease to support large or moderate-sized fisheries in another decade, unless recovery is effected.

The decline of the turtle population has alarmed the world's biologists and conservationists. Management programs are being put into action in many countries. National and international conservation led to the closing of foreign markets that trafficked in endangered and threatened species. These actions could help to avoid the collapse of turtle populations and with them the total destruction of the Mesoamerican coastal cultures.

Recommendations for sea turtle management

This is an international fishery where wide-ranging species are captured by fishermen of many countries, and this complicating the management of sea turtle resources. Other management complications include: (a) breeding, nesting, and foraging areas are usually under jurisdiction of many nations. (b) the lack of detailed collection of fishery statistics and standardized survey methods (c) the inadequate knowledge of sea turtle biology. Important aspects of their biology include life cycles, long migrations across international boundaries, unknown growth and mortality rates, nesting cycles of highly variable length, and a very long maturation time.

Management efforts must include aspects of conservation, management techniques, and social, economic, and political scope of the area. These criteria are primary necessities in the management of a resource with wide distributional patterns, especially when they involve countries with different social, cultural, and economic backgrounds.

During the last two decades, some important biological research has been conducted in the Caribbean on sea turtles, but in most countries of the region, conservation programs are still in their initial stages, legislation is inadequate, and international cooperative management efforts are virtually non-existent. Independent of both the desired objectives and the measures chosen to achieve those objectives, machinery is needed to bring the management techniques into effect. In a purely national fishery these responsibilities can be part of a normal administration, but in

multinational fisheries, new formal arrangements are needed. The development of effective national plans depends on formulation of a coordinated regional research and management plan, biological studies, stock measurements, economic and social studies to determine the best choice between different management techniques, and putting into effect management techniques aimed at the recovery and wise utilization of the depleted turtle stocks of the Caribbean area.

Whatever the case, it appears certain that unless some measures are taken now, the wild populations may be reduced to virtual extinction in the near future.

Conservation

The options for conserving sea turtles in developing countries are limited by the inadequacy of national and international laws, and the inability to enforce the laws. This will take time to correct, and conservation programs should be directed to the capabilities of each country. Favorably, the techniques with lowest risk and greatest promise are also those with lowest cost. Highest conservation priorities should be given to: habitat protection, protection of eggs, hatchlings and adults, controlled exploitation, conservation education, and the implementation of management.

Habitat protection

How can we plan for critical habitat protection of the sea turtle? One

method calls for uneven distribution of man's environmental perturbations. (Bacon 1973, 1981; Pritchard 1980; Carr 1971; Felger and Clifton 1977; Shabica 1981).

Habitat protection can be achieved through a variety of managements, such as the creation of national parks and sanctuaries, either by law or by official regulations. Other factors that can be important include: evolution of management technique needs, size of the protected area, and the implementation of regulations to reduce habitat degradation. The size of the area is only the first step, because habitat protection for sea turtles include: nesting beaches, internesting areas, migration routes, feeding grounds, as well as local conservation education.

The planning for the protection and management of aquatic sea turtle habitat must include international agreements between countries that share foraging areas and migration routes. A beginning in the area of international cooperation was made in 1968, when representatives of Panama, Costa Rica and Nicaragua met in San Jose, Costa Rica, in order to insure the protection of the nesting grounds of green turtles. However the expected tripartite ratification did not occur (Carr 1971).

Management of eggs, hatchlings, and adults.

Biological management of nesting beaches includes sea turtle eggs, hatchlings, and adult sea turtles. This beach management can be accomplished by:

- (1) Protecting incubation under natural conditions.
- (2) Short-range nest transplantation with immediate release of hatchlings.
- (3) Manipulation of eggs and hatchlings at nesting beaches for conservation purposes (beach hatcheries, enclosed hatcheries building and head-start).
- (4) Predator control programs. The control of wild and human predation would seem a good viable approach to increase hatchling production.

Beach management should maximize the reproductive potential of sea turtles. The most natural and less expensive in the short run is the protection of eggs and turtles under natural conditions. Nest transplantation and manipulation of eggs is a common practice, but could create adverse effects, such as interference with beach imprinting mechanisms, alteration of sex ratios, and unknown consequences in its natural environment. Hatcheries have been used for many years to prevent predators and erosion losses, and provide semi-controlled hatching conditions for sea turtle eggs. The discovery that incubation temperature can affect the sex ratio of hatchlings indicates the necessity that hatchery operations should mimic the natural environmental conditions as closely as possible.

Control exploitation

The goal of conservation is the application of modern fisheries management techniques to insure the rational sustained use of fisheries resources for human societies. For the sea turtle resource there is a serious limitation imposed by the lack of information on sea turtle population dynamics and catch per unit effort necessary for even rudimentary

fisheries analysis, and this seriously limits sea turtle management efforts. Since overexploitation is responsible for the near extinction of several sea turtle populations, exploitation control is necessary.

The control of international trade in sea turtle products is one of the best tools for management. Unfortunately, concrete actions for cooperative international programs that would benefit sea turtle conservation programs have not yet been achieved. A typical example of international trade is the hawksbill tortoise shell. Some countries that trade with this product are part of CITES (Convention on International Trade in Endangered Species) but still export this species. Another case is the recent growth of the turtle skin trade. Very few countries record turtle skin or leather as a specific turtle product (Mack and Wells 1981).

In recent years, it is being recognized that some international trade could provide a valuable mechanism for regional conservation of sea turtles (Carr 1971; Ehrenfeld 1981; Navid 1981; Shabica 1981; Bacon 1970, 1973, 1975; Goodwin 1971).

The noncommercial hunting of sea turtles is defined as a subsistence way of life practiced by low technology coastal people has minimum impact on turtle populations (Nietschmann 1981).

Conservation education

Conservation problems in developing countries are often aggravated by the lack of public information about the issues. This inadequate information may extend to government officials in different parts of a government, who may unwittingly contribute to the negation of conservation measures.

There is a need to develop broad-based public support in order to attain the cooperation necessary for recovery. Conservation education will be enhanced through cooperation of local fishermen, different local groups and government agencies. Several methods of implementing education programs include; (a) enforcement of regulation and collection of information by those who enlist the interest, understanding, and sympathy of the fishermen and local communities by showing them the benefits of conservation measures; (b) a brief, well-illustrated and simply worded poster, distributed through local officials and school teachers, would bring considerable changes in the attitude of the public toward conservation programs. (c) development of recommendations for children's literature on the subject of sea turtle and the value of a wildlife heritage. (d) maintain sea turtle populations records, trade, tagging programs, survey activities to facilitate year to year comparisons.

Management options

The management of marine resources should ensure better use of what are now recognized as the limited resources of the ocean. A comprehensive management plan is necessary to control all the factors influencing a resource. Resuscitating diminished turtle stocks and preventing conflicts with coastal zone development activities are of major importance.

Management options must be selected to serve the most critical needs and objectives of each country, because inevitably the research and management responsibilities will fall on the nations possessing these resources.

Sea turtles are usually outside the limits of national jurisdiction and are often exploited by several countries. Therefore, implementation of the most effective management measures requires more than the response of a single national administration for optimum effectiveness. International agreements and cooperation between countries sharing these resources are also important. However, most protection measures must start within each country. Following are activities that can be used to increase sea turtle protection and recruitment.

Beach patrol

Nesting beach protection depends on the particular conditions of the site. In most developing countries, the nesting beach protection is against human predation.

The beach patrol is the key to any conservation program. It is essential and ideal, but needs public awareness and manpower. The main problem with beach patrols is the extensiveness of the area to be patrolled. This management technique should be complemented with conservation education.

In Honduras the beach patrol must work in accord with the nesting season and especially where nesting beaches are close to villages and small towns.

Closed season or closed areas

Closed season and areas are defined as a period and area legally protected for taking turtles and their products. Closed season and closed areas have the major advantage of being less complicated to enforce and easily seen to be enforced. They are also very simple for the fishermen or others to understand, and are therefore often introduced and widely accepted. The closed season has been a widespread measure for protecting sea turtles during their nesting season in the Caribbean area. Several nations have established turtles laws that protect the younger turtles and allow exploitation of the adults. The problem with this measure is the temptation to remove nesting females from the beaches.

Protection of foraging areas

Foraging areas are defined as a developmental habitat in which turtles feed and grow (Carr 1971). These typical areas have been widely reported around Campeche Bank in Mexico, the eastern part of Cuba, Belize, Honduras, Nicaragua, The Caribbean Islands and the continental platform of South America. Normally these are shallow water areas, with high productivity. The control of these areas will be difficult because they are habitat for other fisheries, and sometimes are located in international boundaries. Turtles in these areas could be protected by reducing the incidental catch by using the TED (Turtle excluder device) or other new devices.

V. Recommendations for the preservation of sea turtles of Rio Platano Wildlife National Park.

The eastern Atlantic coastline of Honduras from Bahia de Trujillo expands into a continental platform of about 20,000 km² and not deeper than 25 fathoms (Fig. 1). These coastal waters border a diverse assemblage of sandy beaches, shallow bays and lagoons, mangrove stabilized estuaries, river deltas, canals, and offshore reef areas. The inland areas contain a plain and mountainous area with tropical and sub-tropical forests. The biota is both diverse and abundant. Many endangered species live in, breed on, or visit this area. Sea turtles, manatees, eagles, leopards, and monkeys are abundant here. Mahogany, coconut, pinus, bamboo, cedar, and others trees are a common part of the flora of the eastern inland part of Honduras. Eagles, osprey, quetzals, trogons, and several species of pigeons nest here, and migratory birds use this area as feeding and resting areas during their migrations.

The Honduras Mosquitia is located in the northeastern part of Honduras and lies between 14 35' and 16 00' north and between 83 6' and 85 6' west (Fig. 2). The biosphere "Rio Platano" is a reserve area of 250,000 hectares, located in the Honduras Mosquitia and lies between 15 5' and 15 57' north and 85 35' and 85 30' west (Fig. 3).

The plains constitute 25% and mountains 75% of the reserve. The coastal plain is a swamp and savanna area, with a high diversity of flora and fauna. The dominant trees in the reserve are: Cocos nucifera, Coccoloba

uvifera, Pinus caribea, Inga sp, Lonchocarpus sp, Ceiba pentandra, Swietenia macrophylla, Tabebuia sp, Cedrella odorata, Bursera simaruba, Cecropia sp, Albizzia carbonaria, Bambusa sp, Chusquea sp, Chamaldorea sp and Clusia salvinii. The fauna includes 395 species of mammals, 377 species of birds and 126 species of herpetofauna (Molina 1975; Monroe 1968; Carr 1950).

The first historical documentation of the "Rio platano" area was during the landing of Christopher Columbus in Rio Tinto in 1502. Early maps of this area, in 1625, show the coastal plain areas of the Mosquitia labeled "Taguzgalpa" (Mayan derivation of green plain). Plain areas of the Mosquitia were settled by Zambos, Payas, Xicaques, Tawira, Walkies, Sumos, and Misquitos. Today the Misquitos are the more widely distributed indian people in the area (Nietschmann 1977; Renare 1978).

The biosphere Rio Platano is located in a legal archeological protected area (Fig.4). which has about 100 kilometers of nesting beaches for the sea turtle. The Rio platano reserve has itself about 20 km of beaches, where Caretta caretta and Dermochelys coriacea normally nest and Chelonia mydas nests less frequently.

Sea turtle protection project

Habitat destruction, incidental catch by shrimp fleet, and illegal commercial taking of turtle eggs has seriously threatened the sea turtle population along the Honduras Atlantic coast.

The National Honduras Report of 1984 cites four species of turtles nesting in this area: C.caretta, D.corriacea, C. mydas, and E.imbricata.

Caretta nests in Tabauspauni and Kuri; Dermochelys in Rio Platano, Brus Laguna, Utlat Muk, Graspis and Tocamacho; and Chelonia is reported feeding in small groups of 2-10 individuals in the Mosquitia area. The National Report emphasizes the critical situation of habitat destruction and killing of these turtle populations. It is estimated that each shrimp boat drown between 10-40 turtles per season (during the 1983 shrimp season, 225 shrimp boat were working in the area). Other problems which threaten these species are the poaching of eggs and killing of turtles in the nesting areas.

The existence of a legal archaeological protected area in the Mosquitia which has about 100 kilometers of turtle nesting beaches, include the Biosphere reserve of Rio Platano affords the opportunity for development of a sea turtle protection project in this area. The central objective will be protection and research. Besides the protection of critical habitat, additional research will be necessary to implement any effective management. Involved in the research will be determination of number, distribution, and seasonality of the breeding, resident and developmental colonies of sea turtle in the Rio platano area. This information is urgently needed for accurate delimitation of the sea turtle's critical habitat and for developing management programs that will improve the survival of this species.

Research should be divided into short-range and long-range studies. However, research efforts must be done in accord with Honduran capabilities to ensure the life of the program.

The program should follow the following guidelines:

Conservation efforts.

- (a) The passage of more specific sea turtle protection laws in Honduras.
- (b) Sea turtle habitat protection.
- (c) Conservation education.
- (d) Protection of nesting females and nest monitoring.
- (e) Protection of subadults and adults in foraging areas.

The legal situation of the protection of the turtle resource in Honduras has not been satisfactory, the existing legal foundations are inadequate, and measures are necessary in order to protect this species, especially in the breeding and foraging areas. Any attempts to protect sea turtle critical habitats must be followed by a well-developed conservation educational program, which is the key for habitat protection.

Other critical problems are related to the protection of nesting females in breeding areas, and the protection of subadults and adults in foraging areas. The implementation of legal assessments and the location and delimitation of those specific areas will be needed, however the TED will be useful to reduce the mortality rate caused by shrimp boats.

One of the serious obstacles to the effective management of sea turtles is the lack of quantitatively reliable data on their ecology and population levels. Although the Mosquitia appears to be an important nesting and foraging area for sea turtles, we do not know the relative density of sea turtle nesting and the total population estimate for each species.

New information has been obtained in 1981-82 by aerial and terrestrial surveys, but those data are not complete. The main effort for short term research must be to build a quantitative understanding of the breeding density and distribution of critical habitat for management options.

Short-term research.

- (a) Survey the species of sea turtles nesting at Biosphere of Rio Platano including the evaluation of hatching success.
- (b) Survey foraging areas for species nesting at Rio Platano.
- (c) Tagging program to determine movement patterns and migration routes.
- (d) Study of social and economic impact of human population on sea turtles at Biosphere of Rio Platano.

The short-term research are necessary in order to determine the expansion and goals of long-term research. Surveying sea turtling nesting and movement patterns are essential to more complex programs such as hatcheries, head-start, mariculture and ranching experiments.

Long-term research.

- (a) International agreements.
- (b) Establishment of hatcheries or artificial incubation projects.
- (c) Headstart programs.
- (d) Mariculture, such as ranching experiments.

VII. National and international laws, treaties and conventions related to sea turtles.

The commercial utilization of the sea turtle resource in the Caribbean area began with the earliest explorations and continued for almost 400 years. The continued exercise of these traditional practice had not been a threat for these species, except that within the last 60 years ago the coastal populations of these countries have increased so much that exploitation, international trade, habitat destruction and development of coastal areas had contributed with the alarming decline of sea turtles that today sea turtles have reached dangerous levels.

This threat has been a result of juridictional ambiguities, inadequacy of sea turtle conservation laws and the lack of international cooperation programs. Juridictional ambiguities usually result in poor enforcement, especially if the wrong agency is given the jurisdiction. In some countries different departments are in charge of the conservation, management, development, and international trade programs related with sea turtles. There may not be specific conservation laws for turtles, or the laws may be inadequate in terms of scope or penalties. For example, Costa Rica, Nicaragua, Honduras and El Salvador law only protect the eggs, and little or no regulations exist for turtle catch.

Sea turtles are migratory species, occupying national and international waters; Therefore, a comprehensive management plan, including many nations throught the Caribbean area is necessary.

Turtle laws and regulations in the Caribbean area.

A listing of all sea turtle conservation legislation in the Caribbean area is given in appendix I. The tabulated information emphasizes a variety of legal provisions related to sea turtles, but some of these are not specific, others are obsolete and not effective with the current knowledge of sea turtle biology.

The legal aspects of management of this resource has not been satisfactory, the existing legal foundations to support national and international turtle survival is inadequate, and mechanisms for measures have been taken predominately at national the level. These appear to be insufficient when the total range of the various turtle species is concerned.

International laws, treaties and conventions.

There are few regional and global conventions which are directly relevant to the conservation of sea turtles.

(A).- Convention on International Trade in Endangered Species (CITIES 1973).

It is not a comprehensive wildlife conservation convention, but is important in the control of international trade on endangered and threatened species. The convention has three levels of protection. Appendix I include all species of wildlife threatened with extinction which are or may be affected by the trade. Trade in specimens of these species must be subject to particularly strict regulation and must only be authorized in exceptional circumstances. In appendix I includes two species of sea turtles, Eretmochelys imbricata imbricata and Lepidochelys kempi.

The appendix II includes (a) all species, which, although not necessarily threatened with extinction at the present time may become so unless trade of such species is subject to strict regulations. (b) species which must be subject to regulation in order that trade may be brought under effective control. This appendix includes all the sea turtles of the world. The appendix III include all species that any party identified as being subject to regulation within its jurisdiction in order to prevent or restrict exploitation.

(B).- The Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere (1940).

This regional convention has the purpose of protection and preservation of the flora and fauna of the western hemisphere, in order to prevent their extinction. The only species of turtles currently appointed in this convention is Chelonia mydas.

(C).- The Convention on the Conservation of Migratory Species of Wildlife Animals (1979).

This convention, negotiated and signed in Germany, makes all migratory species and regions of the world eligible for further migratory species conservation agreements. In this convention all species of the family Cheloniidae and Dermocheliidae are included.

(D).- Other regional and global conventions and treaties related with turtles are:

The convention on fishing and conservation of living resources of the high seas (1958).

The convention concerning the protection of the world cultural and natural heritage (1972).

The law of the sea treaty (1982).

International union for conservation of nature and natural resources
(IUCN 1975).

Conferencia de plenipotenciarios sobre la proteccion y el desarrollo
del medio marino en la region del Caribe (1983).

Protocolo de cooperacion para combatir los derrames de hidrocarburos
en la region del gran Caribe (1983).

International agreements, although ultimately necessary to avoid the
extinction of some species, should not be considered as the only answer
for the future conservation of sea turtles. Many of the implementations
are only part of the complicated scheme of conservation.

The appendix II contains a list of some of the international laws
discussed above with a designation showing which countries in the Caribbean
are party to them.

VII. International trade in sea turtle products.

Sea turtles have always played a conspicuous role in the lives and economy of the people of the Caribbean area. Although turtles were important for the pre-Columbian populations, it was the early settlers and particularly the British who organized the intensive exploitation of the Caribbean turtle fishery. The first clear documentation was in 1635, when some London companies started turtling activities in the area (Parsons 1956, 1962, 1972).

Among the seven species of sea turtles present in the area, only three have been heavily exploited for trade: the green turtle (Chelonia mydas), hawksbill turtle (Eretmochelys imbricata), and the olive ridley turtle (Lepidochelys olvacea). The green is exploited for its meat, oil, calipee and skin. The olive is harvested mainly for skin and oil, and the hawksbill for its shell (Mack et al. 1981).

Turtle are valuable not only for the international trade market, but also as a source of protein for many tropical countries. The traditional use of turtle for local consumption has probably not had a major effect on turtle populations, but the conflict started when the exploitation of these species became selective, predominately for luxury items.

The hawksbill turtle has probalbly sustained the more largest commercial exploitation for its shell. The tortoise-shell trade at one time provided a small but significant boost to the coastal and local economies. With the advent of plastics the tortoise-shell market has declined, but the commercial trade is still large enough to threaten this species with extinction.

There are few reliable records of the numbers of turtles killed in the Caribbean for trade. The commercial trade in tortoise shells, stuffed turtles, sea turtle meat, and turtle skin has declined worldwide since CITIES came into force in 1975 (Mack et al 1981).

The table 1 shows the total landings of turtle products for some Caribbean countries in the last 3 years. This information is in the National Reports for the WATS Symposium (1983. Much of this is not accurate and some countries do not have statistics available for these products. The normal tendency has been toward increased utilization of these products.

The two largest exporters of turtle skins during the 1970's were Ecuador and Mexico. From 1970 to 1981, almost 1,525,000 olive ridleys were killed in these two countries for skin utilization. For the hawksbill turtle, the general trend shows that Asia and the New World account for most of the tortoise-shell imported by Japan. The largest exporters in the Caribbean area during 1977-1981 were: the Cayman Island, Cuba, Haiti, Nicaragua and Panama (shown in table 2). In general the exploitation of the hawksbill to Japan, from the wider Caribbean, decreased during 1977-1981 relative to the preceding 12 year period. However, countries such as Honduras, Bahamas, Belize, Cayman Islands and St. Lucia have increased their exports. (Mack et al. 1981).

In Central America, turtle egg collecting appears to be a thriving business. In 1976, Nicaragua exported 648,000 eggs to El Salvador. In Costa Rica, Panama, Honduras, and Guatemala, eggs are collected and sold in the open markets (Cornelius 1981; Burgos and Perez 1975).

Many of the countries in Central America that exploit and export turtle products are CITIES parties, but do not take reservations on sea turtle trade. Some exports have reduced but for others, the illegal trade has increased.

If the commercial taking of eggs and meat continues in the next 5 years, the green turtles, hawksbills, and olive ridleys are likely to be extinct as nesting populations in some areas of Central America.

Table 1 Annual landing for turtle products (Kg) for some Caribbean countries.

Country	Year		
	1980	1981	1982
Bahamas	29,290.5	26,208	11,052.4
Belize	1,125	1,120	1,005
British Virg. Isl.	-----	900	-----
Cayman Islands	329	915	170
Haiti	186.9	572.22	742.0
Jamaica	-----	-----	42,025
Grenada	-----	-----	10,000
Mexico	17,227	100	-----
Nicaragua	24,156	577.2	720.0
Turks-Caicos	-----	-----	4,400
Total	72,314.4	30,392.4	70,114.4

* Source National Reports for WATS Turtle Symposium, 1983

Table 2 Japanese import of raw tortoise-shell (Kg) from some countries in the Caribbean area.

Country	Year				
	1977	1978	1979	1980	1981
Bahamas	922	1,018	1,886	767	29
Barbados	---	23	---	---	---
Belize	40	---	---	---	---
Cayman Islands	3,863	7,500	6,100	2,505	3,022
Costa Rica	260	47	89	---	234
Cuba	3,984	6,600	3,725	7,338	2,650
Grenada	59	---	---	---	---
Haiti	1,173	1,004	1,689	1,020	892
Honduras	71	9	9	1,132	481
Jamaica	1,136	128	58	---	---
Nicaragua	1,573	1,014	949	7	475
Panama	4,450	6,505	4,810	3,360	3,011
Puerto Rico	264	25	18	---	---
Others countries	170	98	1,499	1,934	1,341
Total	17,965	23,971	20,832	18,063	12,135

* Source Mack et al 1981; Mack, Duplaix 1979; National Reports.

BIBLIOGRAPHY

- Bacon, P.R. 1970 a. Studies on the leatherback turtle, Dermochelys coriacea, in Trinidad, West Indies. Biol. Cons.2(3):213-217
- _____ 1970 b. Political restrictions make safe nesting possible. Int. Turtle & Tortoise Soc. J.4(3):6-7
- _____ 1973 a. The status and management of the sea turtles resources of Trinidad and Tobago. Rept. to the Ministry of Agric. Trinidad. 40 pages
- _____ 1973 b. Appraisal of the stocks and management of the sea turtles in the Caribbean and adjacent regions. Report to the working group on fisheries resources at the VIth Inter. Coordinating group meeting of C.I.C.A.R., Cart.Colombia. 27 p.
- _____ 1975. Review on research, exploitation and management of the stocks of sea turtles. FAO Fish.Cir.No.334., 19 pages
- _____ 1981. The status of sea turtle stocks management in the western central Atlantic. WECAF studies, No.7:38 pages.
- _____ 1984. Annotated Bibliography of sea turtle research in the western central atlantic. Proc. of the Western Atlantic turtle symposium. WATS (edit.) 318 pages.

Bacon, P.R., Berry, F., Bjorndal, K., Hirth, H., Ogren, L. and Weber, M.
(edit.) 1984. Proceeding of the Western Atlantic Turtle
Symposium. (Cited in text as WATS). Vol. I, II, III.

Bjorndal, K.A. 1980. Demography of the breeding population of the green
turtle *Chelonia mydas*, at Tortuguero, Costa Rica. *Copeia* (3)
:525-530

Brown, H.C. and Brown, M.W. 1981. Status of the sea turtles in the south-
eastern Pacific: Emphasis on Peru. *Biol. and Conserv. of the
sea turtles*. K.Bjorndal (Edit.) Smithsonian Inst. press. 583 p.

Brongersma, L.D. 1968. Notes upon some turtles from Surinam. *Kon.Ned.Akad.
Wetensch. Proc.Serv.C.Biol.Med.Sci.*, 71(2):114-127

Burgos, E. and Perez, D.E. 1975. Algunas observaciones sobre la tortuga
marina *Lepidochelys olivacea* en la costa Pacifica de
Honduras. *DIGERENARE*, Tegucigalpa, Honduras. 14 pages

Caldwell, D.K., Carr, A., and Ogren, L. 1959. Nesting and migration of the
Atlantic loggerhead turtle. *Bull. Florida State Mus.* 4(10):294-
317

Caldwell, D.K., Berry, F.H., Carr, A. and Ragotki, R.A. 1959. Multiple and
group nesting by the Atlantic loggerhead turtle. *Bull. Florida
State Mus.* 4(10):309-318

- Carr. A.F. 1948. Sea turtle on a tropical island. Fauna 10:50-55
- _____ 1950. Outline for classification of animal habitat in Honduras, Bull. Am. Mus. of Nat. Hist. 94(10).
- _____ 1952. Handbook of turtles: Turtles of the United States, Canada and Baja California. Comstock Publishing Assoc., Ithaca, N.Y. 542 pages
- _____ 1965. The navigation of the green turtle. Scientific Ame. 212(5):78-86
- _____ 1969. Sea turtles resources of the Caribbean and Gulf of Mexico. IUCN Bull. Jan-March 1969.2(10):74-84
- _____ 1971. Research and conservation problems in Costa Rica. Marine turtles, IUCN publ. New Ser. Suppl. Paper No.31:109
- _____ 1980a. Some problems in sea turtle ecology. Amer. Zool., 20 :489-498
- _____ 1980b. Survey and preliminary census of marine turtles populations in the western Atlantic. Caribbean Conserv. Corporation Final Report to National Marine Fisheries Service. Contract. 03-78-008-0025. 124 pages

- Carr, A. and Carr, H. P. 1977. Survey and reconnaissance of nesting shores and coastal habitat of marine turtles in Florida, Puerto Rico, and The U.S. Virgin Islands. National Marine Fisheries Service report,. 35 pages
- Carr, a. and Giovannoli, 1951. The ecology and migrations of sea turtles. 2nd results of field work in Costa Rica, 1955. Am. Mus. Novit. (1835); 32 pages
- Carr, A., Harris, C.M. and Mylan, A.B. 1978. The ecology and migrations of sea turtles, 7. The west Caribbean green turtles colony. Am. Mus. of Nat. Hist. 162(1)., 46 pages
- Carr, A. and Hirth, H. 1962. The ecology and migrations of sea turtles, 5. comparative features of isolated green turtle colonies, Am. Mus. Novit (2091); 42 pages
- Carr, A., Hirth, H. and Ogren, L. 1966. The ecology and migrations of sea turtles, 6. The hawksbill turtle in the Caribbean sea. Am. Mus. Novit. (2248); 26 pages
- Carr, A. and Myland, A.B. 1980. Evidence of passive migration of green turtle hatchlings in sargassum. Copeia (2): 366-368
- Craig, A.K. 1966. Geography of fishing in British Honduras and adjacent coastal areas. Louisiana State University press, Baton Rouge, Coastal Studies series, No. 28; 40-131

Cornelius, S.E. 1975. Marine turtle mortalities along the Pacific coast of Costa Rica. *Copeia* (1):186-187

Cornelius, S.E. 1981. Status of sea turtle populations in Central eastern Pacific. *Biol. and Conserv. of sea turtles*. K.Bjorndal(edit). Smithsonian Institution Press, Washington. D.C; 221-234

Ehrenfeld. D. 1981. Options and limitations in the conservation of sea turtles. *Biol. and Conserv. of sea turtles*. K.Bjorndal (edit.) Smithsonian Institution press, Washington,D.C;583

Felger,R.S. and Clifton, K. 1977. Conservation of the sea turtles of the Pacific coast of Mexico. I.U.C.N./W.W.F. project No.1471., 52 pages

Green, D. and Crespo,Q.F. 1981. Status of sea turtle population in the Central Eastern Pacific. *Biol. and Conserv. of sea turtles* K.Bjorndal(Edit.) Smithsonian Inst. Press, Wash. D.C. 583 p.

Goodwin, M.M. 1971. Some aspects and problems of the use and exploitation of marine turtles. *Marine Turtles*. IUCN publ. New Ser. Suppl. paper No. 31., 109 pages

Halstead, B.W. 1978. Poisonous and venomous animals of the world. The Darwin Press Inc. Princeton, New Jersey., 978-989

- Hartog, L. 1980. Notes on the food of sea turtles: Ertemochelys imbricata (Linnaeus) and Dermochelys coriacea (Linnaeus)
Neth. J. Zool., 30(4):595-610
- Hildebrand, J. 1981. A historical review of the status of sea turtle populations in the western Gulf of Mexico. Biol. and Conserv. of sea turtles. J. Bjorndal (Edit.) Smithsonian Institution Press, Washington D.C., 583 pages
- Hirth, H.F. 1971. Synopsis of Biological data on the green turtle Chelonia mydas (Linnaeus, 1758). FAO Fisheries synopsis No. 85; 37 pages
- Hirth, H.F. and Carr, A. 1970. The green turtle in the Gulf of Aden and the Seychelles Islands. Verh. K. Ned. Akad. Wet (Afd. Nat. Tweede Sect. 58; 1-44
- Marquez, R. 1965. Algunas observaciones sobre las tortugas marinas de importancia comercial en Mexico. Inst. Nac. Inv. Biol. Pesq. Contrib. 11; 13 pages
- _____ 1976. Reservas naturales para la conservacion de las tortugas marinas de Mexico. Inst. Nac. Pesca. Mexico, No. 83., 22 pages
- _____ 1978. Tortugas marinas- Terminologia tecnica in fisheries. FAO species identification sheets for fisheries purposes, Western central Atlantic (Fishing area 31) Vol 1-7

- Mack, D. Duplaix, N. and Wells, S. 1981. The sea turtle: An animal of divisible parts. International trade in sea turtle products. Biol. and Conserv. of sea turtles. Smithsonian Institution, Washington D.C., 545-563
- Monroe, B.L. 1968. A distributional survey of birds of Honduras. Ornit. Monograph No. 7 The American Ornithological Union. 458 pages
- Molina, R.A. 1975. Enumeracion de las plantas de Honduras. Ceiba 19(1) Tegucigalpa, Honduras.
- Navid, D. 1981. Conservation and management of sea turtles: A legal overview. Biolog. and Conserv. of sea turtles. K.Bjorndal (edit.) Smithsonian Institution Press, Washington D.C., 583
- Nietschmann, B. 1971. The exploitation of hawksbill turtles, east coast of Nicaragua: Results and recommendations from preliminary study. Ms. submitted to Dept. Rec. Nat. Managua, Nicaragua, 10p
- _____ 1972a. Hunting and fishing focus among the Miskito Indians, eastern Nicaragua. Human Ecology 1(1):41-67
- _____ 1972b. The exploitation and conservation of hawksbill sea turtles, eastern Nicaragua. The University of Michigan. 15p

Nietschmann, B. 1977. Memorias de arrecife tortuga. Historia Natural y economica de las tortugas en el Caribe de Centro America. Serie Geografia y Naturaleza No.2 . Managua, Nicaragua.

_____. 1981. The cultural context of sea turtle subsistence hunting in the Caribbean and problems caused by commercial exploitation. Biolg. and Conserv. of sea turtles. Smithsonian Inst. Washington D.C., 439-453

Novack, R.M. 1974. Status of green sea turtle, loggerhead and olive ridley turtle. Report to the U.S. office of endangered species. 56 p

Parsons, J.J. 1956. San Andres and Providencia. Univ. Calif. Publ. Geogr. 12(1)., 84 pages

_____. 1962. The green turtle and Man. Univ. Florida Press., 126 pags

_____. 1972. The hawksbill turtle and the tortoise-shell trade. Etudes de Geogr. Trop. Offer. a pierre Gourou., 45-60

Pritchard, P.C.H. 1971. The leatherback or leathery turtle Dermochelys coriacea IUCN Monograph, No. 1., 39 pages

_____. 1971. Galapagos sea turtles, preliminary findings. J. Herp. 5(1-2):1-9

Pritchard, P.C. 1973. International migrations of South American sea turtles, Cheloniidae and Dermocheliidae. Anim. Behav., 21(1):18-27

1976. Post-nesting movements of marine turtles (Cheloniidae and Dermocheliidae) tagged in the Guianas. Copeia. 746-754

1980. The conservation of sea turtles: Practice and Problems. Amer. Zool., 20; 609-617

1982. Nesting of the leatherback turtle, Dermochelys coriacea in Pacific Mexico, with a new estimate of world population status. Copeia; 741-747

P. Bacon., F. Berry., A. Carr., J. Fletemeyer., R. Gallagher., S. Hopkins., R. Lankford., R. Marquez M., L. Ogren., W. Pringle, Jr., H. Reichart and R. Witman. 1983 Manual of sea turtle research and conservation techniques, Second edition. K.Bjorndal and G.H. Balazas (Edit.). Center for environmental Education, Washington, D.C. 109 pages.

Rebel, T.P. 1974. Sea turtles and the turtle industry of the West Indies, Florida and Gulf of Mexico, Coral Gables, Florida. University of Miami Press., 250 pages

Renare 1978. Informacion acerca de la propuesta reserva de biosfera Rio Platano. Recursos Nat. Renovables. Honduras. 6 pages.

Robinson, D.C., Mc. Duffie. and S.E. Cornelius. 1973. Observations of reproductive behavior of the Pacific ridley turtle (Lepidochelys olivacea) abstract. 53rd annual meeting of the society of Ict. and Herp. San jose, Costa Rica.

Shabica, S. V. 1981. Planning for protection of sea turtle habitat. Biol. and Conserv. of sea turtles. K.Bjorndal (Edit.) Smithsonian Institution Press, Washington D.C., 513-518

Schwartz, F. 1975. A chech list of West Indian amphibian and reptiles. Carnegie Mus. N.H. Spec. Publ. No.1., 216 pages

1977 Reptilia; Testunines: Chelonidae (Modern sea turtles)
J.E., Robinson, S.S. & Funderburg, J.B. (edit.) Endangered and threatened plants and animals of North Carolina. N.C. State Mus. Nat. Hist., Raleigh, N.C., 303-308

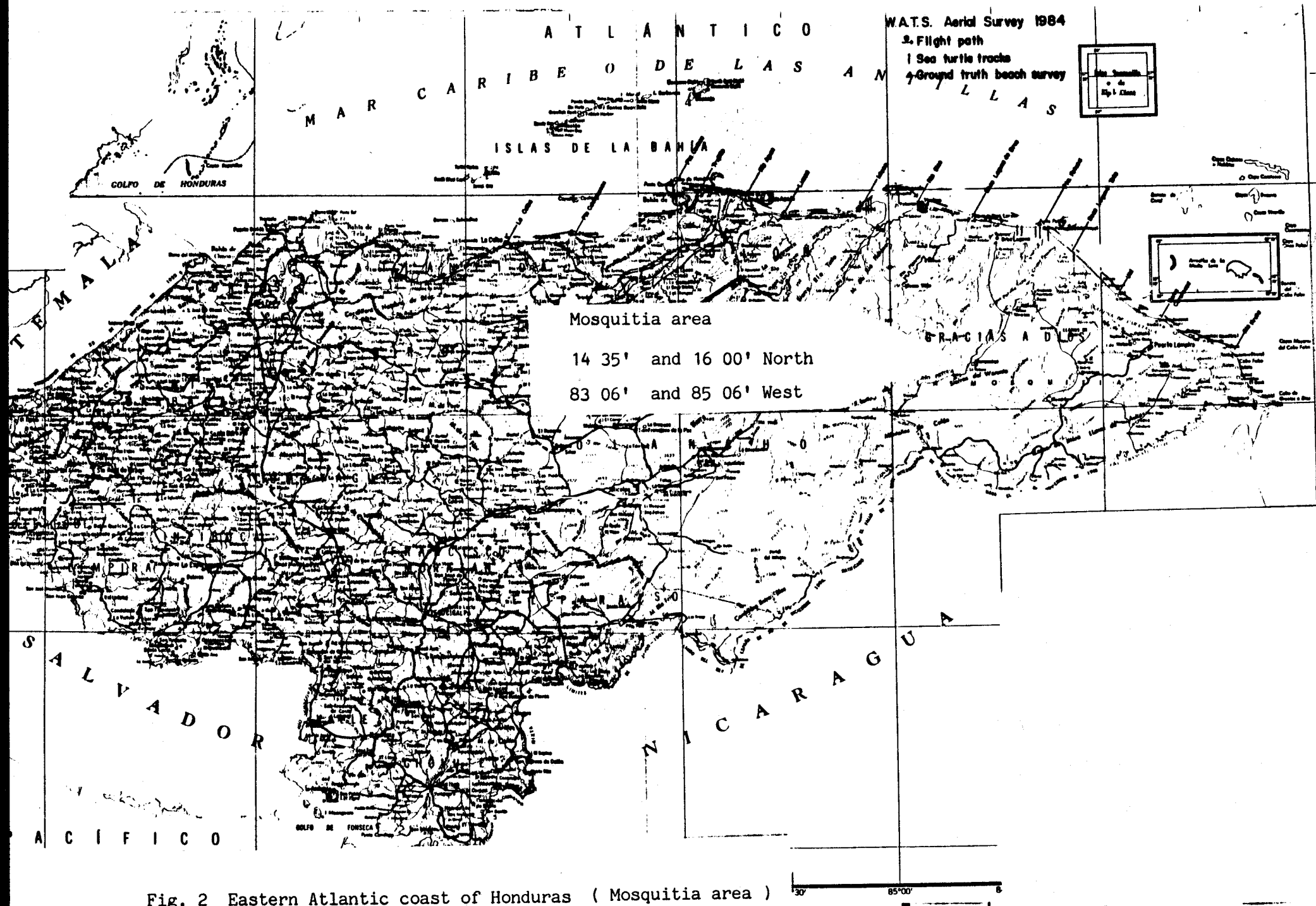
Schulz, J.P. 1969. National situation report marine turtles in Surinam, Marine Turtles, IUCN publ. New Series Suppl. paper No. 20

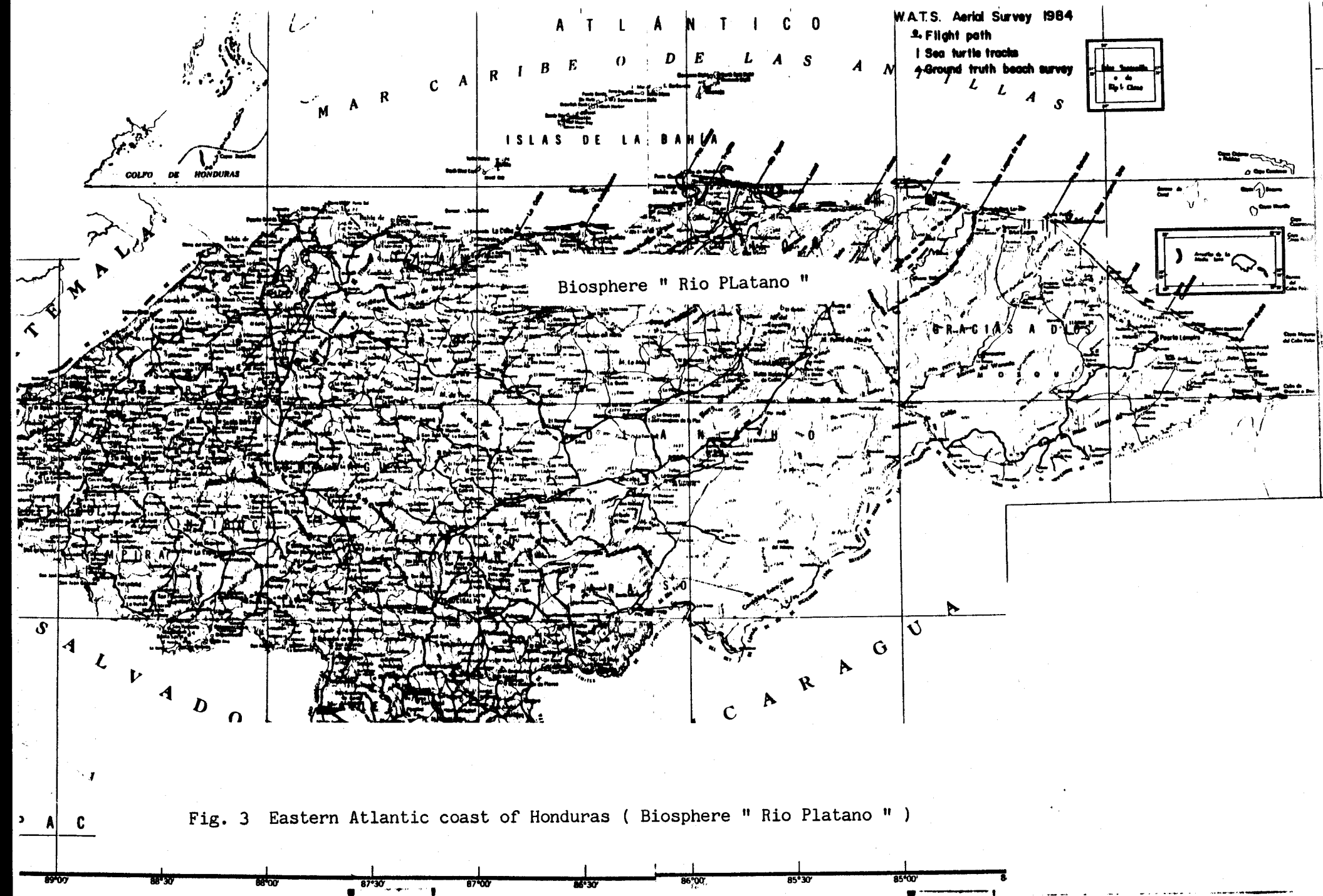
1975. Sea turtle nesting in Surinam. Meded. Nederl. Comm. Intern. Natur. 23., 143 pages

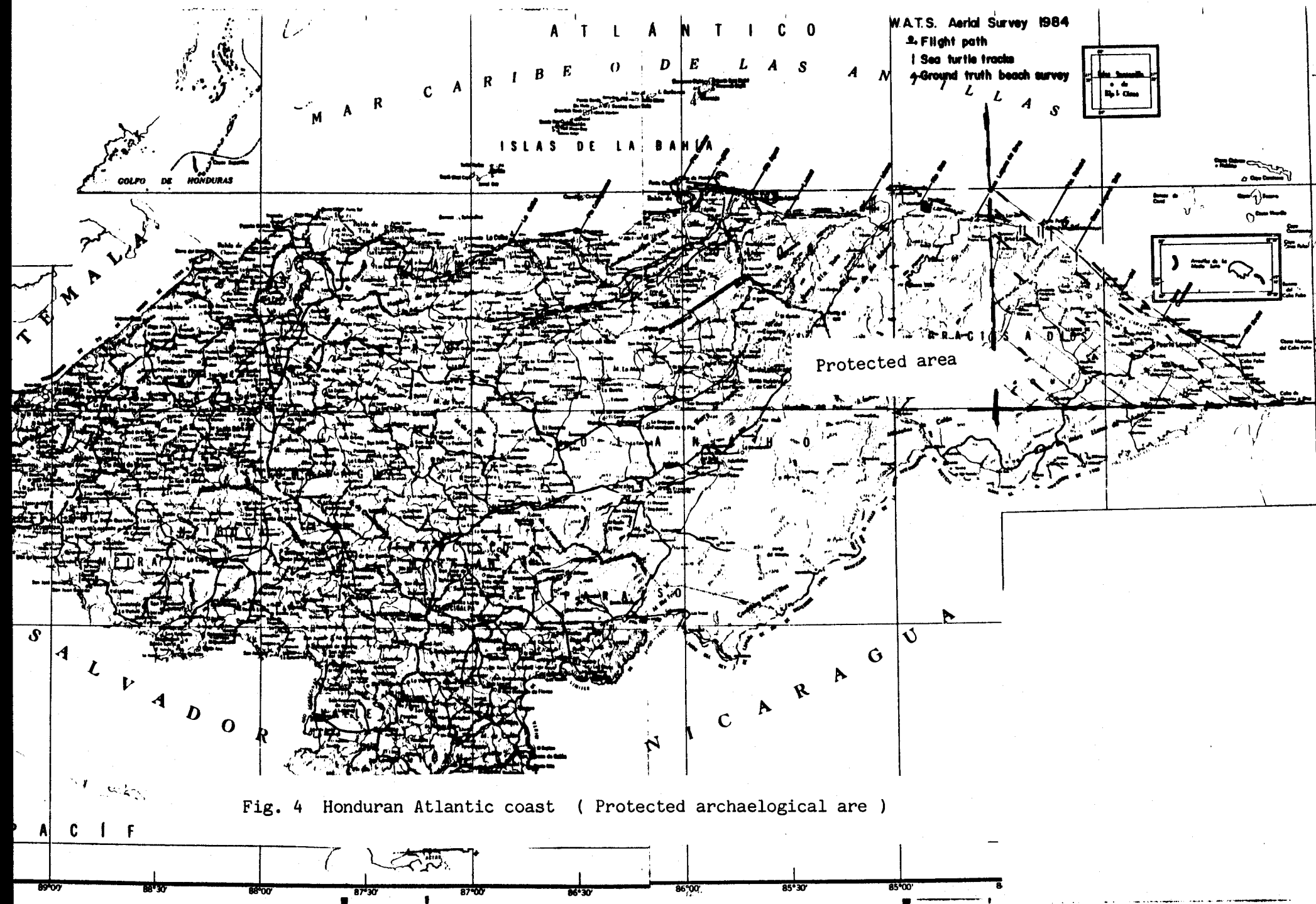
Vargas, T.P.E. 1973. Resultados preliminares del mercado de tortugas marinas en aguas Mexicanas (1966-1970). Inst. Nac. Pesca, Serie Inf. 1-27 pages

WATS 1983. Proceedings of the Western Atlantic turtle symposium. San Jose, Costa Rica. July 1983. Vol. 1, 2, 3.

Witzell, W.N. 1983. Synopsis of biological data on the hawksbill turtle Eretmochelys imbricata (Linnaeus, 1766) FAO fisheries synopsis No. 137., 77 pages







Appendix I. Legal and regulatory prohibitions of sea turtle in the Caribbean area.

Country	Regulations	Protection of			Observations
		eggs	Juv.	adults	
Anguila	Turtle Ordinance	No Information			----
Antigua	Turtle ordinance No.17 of 1927	X	X	X	Close season between 1 Jun- 30 Sept. No taking turtles under 20 lbs. at any time.
Bahamas	Fishery act.1969	X	X	X	Close season between 1 April- 30 Jun. Minimal size 25 cm Carp. length.
Barbados	No Information	No Information			-----
Belize	Statutory Instrument No.66 of 1977	X	X	X	Close season between 1 Jun- 30 August. No taking turtles under 50 lbs.
Bermuda	Fishery act 1972 Fishery proct.Sp.act.1977	X	X	X	Prohibits taking or molesting turtles on nesting beaches.
Brasil	Law No. 5197 of 1967 Portario No. 3-481 Portario No.18 of 1976	x	no.inf.	X	Prohibits taking sea turtles.
British Virg. Islands	Marine parks and protec. areas ordinance of 1979 Ordinance of 1975	no.Inf. X		X	Close season 1 July-30 Aug.

Appendix I. Cont.

Country	Regulations	Protection of			Observations.
		Eggs	Juv.	Adults	
Cayman Isls.	Marine Cons. Law of 1978 Mar. Cons. Reg. of 1978 End. Sp. Prot. Act 1978	-	-	-	Close season 1 July-30 Aug.
Colombia	National decree No.1681 of 1978	No Information			Protection of all aquatic resources.
Costa Rica	Ley de caza y pesca maritima de 1949	-	-	-	Little enfoc. The actual reg allows commerci catch of turtles.
Cuba	-	No Information			M.I.P. is in charge of reg.
Dominica	Forestry and Wildlife act of 1976.	X	X	X	Close season between 1 Jun- 30 Sept.
Dominican Republic	Presidential decree No.600 and No.1580.	No Information			Close season 1 May-30 Oct.
French Guiana	Arrete No.69-239 of 1969	X	X	X	Close season 1 May-30 Oct.
Grenada	Birds and Wildlife Ordin. of 1957.	-	-	-	Prohibits tak turtles durin close season.

Appendix I. Cont.

Country	Regulations	Protection of			Observations
		Eggs	Juv.	Adults	
Guadalupe	Arrete No.79-A03/3 Of 1979.	-	-	-	-
Guatemala	Acuerdo Gov. No.69 of 1981	X	X	X	Close season 1 Jul-30 Sep.
Guyana	Fisheries Regulations 1966	-	-	-	-
Haiti	—	-	-	-	-
Honduras	Decree Law 154 of 1959 Fishing Law	X	X	X	Prohibits taking turtles produce 112 days each year.
Jamaica	Wildlife Protection Law of 1960.	X	X	No. Inf.	Mailand-eggs totally protc.
Mexico	Fishery Legislation of 1968, and 1972.	-	-	-	Turtle Expl. under Regis. cooperatives.
Nicaragua	Decree No. 937	-	-	-	Close season between 15 May 15 July.
Panama	Decree No.104;23 of 1974	X	X	No.Inf.	Close season 1 May-30 Sept.
Puerto Rico	1948 Fisheries Regulations U.S.End. Sp. Act 1973.	-	-	-	-
St. Lucia	Fisheries Ordinance	X	X	-	Close season 1 May-30 Aug. Minimum size 6.75 kg.

Appendix I. Cont.

Country	Regulations	Protection of			Observations
		Eggs	Juv.	Adults	
Trinidad & Tobago	Protect. Of turtle Reg. of 1975.	X	-	-	Close season 1 May- 30 Sept No female take within 300m. c shore.
U.S.A.	End. Sp.Act. 1973 Local State Regulations.	X	X	X	-
Venezuela	Wildlife Protection Law of 1970.	-	-	-	-

* Source WATS 1984 (National reports).

Appendix II . International agreements.

Country	CCMA	NPWPWH	PWCNH	Law of the sea treaty	CITIES	IUCN
Antigua & Barbuda	-	X	-	-	-	-
Bahamas	X	-	-	X	X	No.807580(j-954092300)
Barbados	-	-	-	-	-	-
Belize	-	-	-	X	X	No.811990(j-967000000)
Bermuda	-	-	-	X	X	No.808700(j-972051200)
Brasil	X	X	X	X	X	No.810920(j-967010300)
British Virg. Islands	X	-	-	X	X	-
Cayman Isl.	X	-	-	X	-	No.8173300(H-97091900)
Colombia	-	X	-	X	-	-
Costa Rica	-	X	-	X	X	No.826150(I-949011100)
Cuba	-	X	X	X	-	-
Dominica	-	-	-	X	-	No.827770(H-976062200)
Dominican Rep.	-	X	-	X	-	-
French Guiana	X	-	-	X	X	No.835060(j-969022600)
Grenada	-	-	-	X	-	No.848540(H-957012600)
Guadalupe	X	-	-	X	X	No.836050(j-979032600)
Guatemala	-	X	-	X	X	-
Haiti	-	X	-	-	-	-
Honduras	-	-	-	X	-	No.851700(j-959051900)
Jamaica	-	-	-	X	-	-

Appendix II . Cont.

Country	CCMA	NPWPWH	PWCNH	Law of the sea treaty	CITIES	IUCN
Mexico	X	X	X	X	-	No.883680(H-968090000)
Montserrat	-	-	-	X	X	No.885760(H-951000000)
Nicaragua	-	X	-	X	X	No.891690(j-958082000)
Panama	-	X	X	X	X	No.897020(H-974090400)
Trinidad & Tobago	-	X	-	X	-	No.926880(H-975090800)
U.S.A.	X	X	X	-	X	No.933000(H-973122800)
Surinam	-	-	-	X	-	No.887590(I-954000000)
Venezuela	-	X	-	-	X	-

CCMA.- Convention on the Conservation of Migratory Species of Wild Animals

NPWPWH.-Convention on Nature Protection and Wildlife Preservation in Western Hemisphere.

PWCNH.- Convention Concerning the Protection of World Cultural and Natural Herit.

CITIES. Convention on Intern. Trade in Threatened and Endangered Species of Flora and Fauna.

IUCN.- International Union for Conservation of Nature and Natural Resources.