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REGIONAL MANAGEMENT PLAN FOR THE WEST INDIAN MANATEE

TRICHECHUS MANATUS

UNEP

CARIBBEAN ENVIRONMENT PROGRAMME

Contents

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PREFACE AND OBJECTIVES

The Protocol Concerning Specially Protected Areas and Wildlife (SPAW), adopted by the Governments of the Wider Caribbean Region during the Conference of Plenipotentiaries, Kingston, Jamaica, 15-18 January 1990, entails the formulation and implementation of the Regional Programme for SPAW, under the framework of the Caribbean Environment Programme (CEP). In 1991, the Governments adopted the Annexes to the SPAW Protocol which contain the lists of species of flora and fauna of regional concern which require protection under the Protocol.

Preparation of the present document follows the recommendation of Articles 11 and 21 of the SPAW Protocol, which call for the establishment, publication and dissemination of general guidelines and criteria for the management and recovery of endangered and threatened species of regional concern, in the form of regional management plans. The Governments of the region have identified the West Indian manatee, *Trichechus manatus* as one of the priority protected species of regional concern. Consequently they have requested the formulation of this management plan which was prepared by the Regional Co-ordinating Unit (RCU) of CEP of the United Nations Environment Programme (UNEP), in co-operation with the Natural Resources Conservation Authority (NRCA) of the Government of Jamaica.

The Interim Scientific and Technical Advisory Committee (ISTAC) to the SPAW Protocol has met twice since the adoption of the Protocol, to provide guidance for the formulation and implementation of the workplan and budget of the SPAW Regional Programme, including the identification of conservation activities for priority species. The First Meeting of ISTAC was convened from 4-8 May 1992 in Kingston, Jamaica, and a Second Meeting was held from 3-5 May 1993 in French Guiana.

Countries across the manatee range are at various levels of knowledge about the status and distribution of their manatee populations, as well as at various conservation stages. Despite an increasing interest regarding manatees among Wider Caribbean biologists in the past few years, advancements have been sparse due to a reduced level of funding and the fact that a co-ordinated regional network is not yet in place to share information. Prior to developing detailed country-by-country management measures it is necessary to assess manatees' present status, identify priority areas where action should be taken promptly and develop/activate a regional technical network.

The overall objective of this draft Regional Management Plan for the West Indian Manatee is to serve as a framework document for the conservation of the manatee and its habitat in the region. The specific goals of this draft Management Plan are a) to compile information on the distribution and status of West Indian manatee in the manatee-range countries of the Wider Caribbean (Belize, Colombia, Costa Rica,

Cuba, Dominican Republic, French Guiana, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Puerto Rico, Suriname, Trinidad and Tobago, and U.S. Florida) and b) identify priorities for the management of this endangered species. Most emphasis is dedicated to populations in areas other than Florida (USA), as they tend to share similar problems and conservation needs. This plan was discussed and reviewed during the Regional Workshop on the Conservation of the West Indian Manatee in the Wider Caribbean Region, Kingston, Jamaica, 1-4 March 1994, jointly organized by the NRCA of the Government of Jamaica and the CEP of UNEP.

The present document is based on national reports submitted to the RCU by several of the manatee-range countries following the recommendations of the Second Meeting of ISTAC, as well as on information contained in communications received by the author, published literature and unpublished reports.

SUMMARY

As truly aquatic herbivorous mammals, West Indian manatees (Trichechus manatus) occupy a specialized niche in the ecosystem. The uniqueness of their niche render them susceptible to over-exploitation. Manatees are long-lived, but reproductive processes are slow. Their naturally low population growth and present mortality levels hamper the increase of potential populations, and may actually be accelerating their decline. Manatees are present in nineteen (19) countries of the Wider Caribbean but most populations are estimated at below one hundred (100) individuals. Heavily hunted in the past, they have always played an important role in the folklore and traditions of indigenous peoples of the Wider Caribbean. Ecologically, they may play a role in the cycle of nutrients and in the clearing of water ways by feeding exclusively on aquatic plants.

Socio-economic factors affect manatee conservation in the Wider Caribbean. West Indian manatees occur in areas inhabited by some of the most impoverished peoples of the Western Hemisphere. Manatee preferred habitats correspond to areas usually favored by humans for settlement, and more recently by larger enterprises for services, industrial, and development projects. Manatees are susceptible to anthropogenic and natural disturbances, including environmental catastrophes, harassment, and pollution. Although hunting tradition is dwindling, manatees are still taken throughout the Caribbean for subsistence, and newer threats are emerging. Major hazards vary slightly with the country, but incidental take, hunting, and habitat alteration are the most prevalent. The extent of manatees' range hinders continuity of law enforcement activities, and environmental education programmes to stimulate an ecological consciousness are limited in number and scope of action.

Manatees in Florida exhibit flexible behaviour patterns and adapt quickly to actions taken on their behalf. If left alone some populations have the potential to slowly recover. The keys to manatee conservation in individual countries consist of estimating distribution and abundance, conserving manatee habitats and launching an integrated education/conservation/law enforcement programme to ensure the immunity of those populations to human-related threats.

As individual manatees may move along the territorial waters of several countries, their ultimate conservation will be highly dependent on international co-operation. Some systems (e.g. in Belize, Guatemala, and Venezuela) are identified as potential sources of manatees to more depleted areas, but this will be true only if manatees are granted and assured immediate protection throughout their range.

This document is divided in three sections: I) a review of the biology of the species in the Wider Caribbean, II) status of scientific knowledge and conservation efforts in

each country and III) a set of recommended activities to be undertaken by individual countries and the region as a whole.

I. INTRODUCTION

A. REVIEW OF TAXONOMY AND GENERAL BIOLOGY

Common names

Also called sea cow, the manatee is known in most Caribbean countries as vaca marina or manatí. The word probably derives from the Carib Indian word *manati*, meaning breast in allusion to the way manatees nurse their young from teats marginally resembling human breasts (Shaul and Haynes 1986). Other names given in the region are lamantin, zeekoe, amerikaanse lamantijn, and sekoe (Husson 1978) palpa (Miskito Indians) and manatin (mayan).

Taxonomy

Manatees (Family Trichechidae) are members of the Order Sirenia, a unique group of aquatic mammals that feed exclusively on vegetable matter. The genus *Trichechus* is confined to coastal and inland waters of the New World and is comprised by 3 species. *T. inunguis* (Amazonian manatee) is endemic to the Amazon region and lives exclusively in freshwater, *T. senegalensis* (West African manatee) occurs in rivers and estuaries of West Africa, and *T. manatus* (West Indian manatee) is distributed from the southeastern United States to northern South America. The Straits of Florida on one side and the cold temperatures of the northern Gulf of Mexico on the other are believed to have promoted the differentiation of the latter into 2 subspecies identified based on osteological characteristics (Domning and Hayek 1986): *T. m. latirostris* (Florida manatee) inhabits coastal Florida and the northern Gulf of Mexico and *T. m. manatus* (Antillean manatee) occurs along the coasts and rivers from Mexico to northeastern South America including the Greater Caribbean. Manatees seen in Louisiana and east are believed to be from Florida, whereas those found in Texas probably belong to the Mexican population. The only living member of the Family Dugongidae, the dugong (*Dugong dugon*) inhabits Indo-Pacific waters.

Biology

Manatees have a fusiform, gray to black body, a horizontally-flattened tail, and no hindlimbs. Forelimbs are modified into paddle-shaped fins and present nails at the tips. The snout is blunt and the flexible lip pads are provided with sensory bristles. Finer, widely spaced hair covers the surface of the body. The eyes are small. The ears lack external pinnae. Canines and incisives are absent and the cheek teeth move continuously forward in a conveyor belt-like fashion. Bones are extremely dense, and long bones and ribs lack a marrow cavity.

A sample of 33 Antillean manatees captured in Guyana had lengths ranging from 1.0 to 3.4 m; weight of smallest animal was 27 kg and the largest exceeded 400 kg (Bertram and Bertram 1964). Adult Florida manatees range from 400-900 kg in weight and 2.8 to 3.5 m in total length (O'Shea 1992).

Behaviour

Manatees in Florida are arrhythmic (Hartman 1979), but may follow diet patterns in the winter (Bengtson 1981, Kochman *et al.* 1985), leaving warm-water sites to forage during the warm hours or between cold spells (Rathbun *et al.* 1983a, Powell and Rathbun 1984); in Trinidad they may show response to tidal cycles (Boyle and Khan 1993).

Manatees are most active in the evening and early morning, when they are usually feeding (Bertram and Bertram 1963). It is speculated that in certain parts of the Caribbean they became crepuscular or nocturnal in response to hunting (Ackerman 1992, Rathbun *et al.* 1983a, Reynolds *et al. in ms*., Reynolds and Odell 1992). Manatees may be seen occasionally lying at the surface in the middle of the day, apparently basking in the sun, especially in cold weather (Bertram and Bertram 1963,). Despite the large size, manatees are secretive and can disappear quietly, or swim speedily when faced with danger. They usually travel totally submerged, with the help of the pectoral flippers. Flippers may also aid in pushing the body up out of the water as far as the shoulders, while they graze on river bank vegetation (Bertram and Bertram 1964).

When water temperatures drop below about 20oC in autumn and winter, Florida manatees engage in seasonal north-south migrations in search of warm-water sites, where they aggregate during the winter (Moore 1951, Irvine 1983, Irvine and Campbell 1978, Powell and Waldron 1981, Powell and Rathbun 1984, Shane 1983). Movements of up to 600 km have been documented (Rathbun*et al.* 1983b), with males ranging over wider areas than females (Bengtson 1981). Similar movements might allow exchange between manatee populations in Belize (Bengtson and Magor 1979, O'Shea and Salisbury 1991), Mexico (Colmenero *et al.* 1990, Benjamin Morales pers. comm.), and possibly Honduras (Rathbun *et al.* 1983a). During times of flood, manatees move along the large rivers, lagoons and adjacent creeks in Mexico, Costa Rica, Nicaragua, Suriname, Colombia and Venezuela (Mondolfi 1974, Colmenero 1984, Husson 1978, O'Shea *et al.* 1988, Reynolds *et al. in ms*. Montoya and Mingucci, unp. data), whereas during the drought they concentrate in the larger, perennial rivers and lagoons, in search of forage and shelter. In contrast, no evidence was found for such seasonal migratory behavior in Panama (Mou Sue *et al.* 1990).

Reproduction

Reproductive activity occurs throughout the year (Husson 1978, Rathbun *et al.* 1985a), with some indication of mating peaks between March and August (Charnock-Wilson 1968, Gibson 1992, Janson 1977, Rathbun *et al.* 1985a, Quintana 1993). Mating usually takes place in shallow water, in remote and quiet lagoons, inlets and creeks (Bertram and Bertram 1963, Husar 1977).

Manatees in Florida gather in week- to month-long mating herds, where up to 17 males may follow a female for over 150 km, until she mates with several of them in sequence. At times the female may strand herself to prevent male advances (Hartman 1979, Bengtson 1981). Similarly, large groups (12-16) have been observed in Belize and Guyana (Bertram and Bertram 1964, Charnock-Wilson 1968) and described to "fight" for over 2 hours before "beaching" themselves and mating lying on their sides (Bertram and Bertram 1964). Mating herds of about 8 animals were reported for Puerto Rico (Mignucci l989, unp. data).

The gestation period in manatees is approximately 1 year (Hartman 1979, Rathbun *et al.* 1992), and females give birth in shallow sheltered areas (Hartman 1979, Bengtson 1981, Gibson 1992). Small calves are seen throughout the year (Belitsky and Belitsky 1980, Powell *et al.* 1981), although some suggest that most births occur during the rainy season, between September and March/April (Charnock-Wilson 1968, Colmenero *et al.* 1988, Quintana 1993). Usually a single calf is born, but twins have been reported (Charnock-Wilson 1968, Colmenero *et al.* 1988, Gumilla 1745, Husson 1978). Newborns weigh approximately 27-40 kg and measure about 80-130 cm (Gumilla 1745, Husson 1978, Mondolfi 1974, Zárate 1993). The calf may remain with the female for over a year (Husson 1978). Mother-calf pairs spend most of their time in protected areas in proximity to freshwater sources (Colmenero *et al.* 1988, Gibson 1992, Morales et al. 1995 unp. report). In certain areas females may leave their calves among others in secluded places, while they go out to forage (Reynolds 1981, Domning 1990). In Chetumal Bay females have been observed with two calves of different sizes at one time, which suggests that one female may nurse at the same time, two calves of different ages (Morales *et al.* l993 unp. report).

Social structure

Manatees are mostly solitary throughout the range, but may be seen in pairs or small groups of up to 13 individuals at once (Cerrato 1993 unp. report, Estrada and Ferrer 1987, Irvine *et al.* 1982, Mondolfi 1974, Powell *et al.* 1981, Quintana 1993, Rathbun *et al.* 1985, Zárate 1993). Most associations are temporary and seasonal, except between a mother and her calf (Reynolds 1981), which maintain continuous contact by vocal communication (Hartman 1979).

Food and feeding

Essentially herbivorous, manatees are unselective feeders (Bertram and Bertram 1963) consuming submerged, floating or emergent freshwater plants and grasses (*Ceratophylum, Eichhornia*,*Echinochloa*, *Hydrilla*, *Panicum, Paspallum*, *Phragmites*, *Pistia*, *Pontederia*, *Potamogeton*, *Vallisneria*), and shoots and leaves of mangrove *Avicennia*, *Rhizophora*, *Laguncularia*, moko-moko*Montrichardia*, and leaves of *Ipomoea* (Mondolfi 1974, Duplaix and Reichart 1978, Husson 1978, Hartman 1979, Bengtson 1981, Hurst 1987, Lefebvre *et al.* 1989, Mou-Sue *et al.* 1990, Augusta 1992, Boyle and Khan 1993, INDERENA 1993 *in litt.*, Reynolds *et al. in ms.*). In the marine habitats of Puerto Rico, Dominican Republic, Cuba and Florida manatees feed on *Ruppia* and seagrass beds of *Syringodium*, *Halodule*, and *Thalassia* (Belitsky and Belitsky 1980, Packard 1981; Powell *et al.* 1981, Rathbun *et al.* 1983a, Estrada and Ferrer 1987, Colmenero *et al.* 1988). Episodes of manatees taking fish from fishermen's nets have been documented in Jamaica (Powell 1978).

Manatees may consume approximately 8% of their total body weight in aquatic plants every day (Best 1981). They have an elevated digestive efficiency, between 45 and 80%, and a very low rate of food passage for a hindgut digester(Best 1981, Lomolino and Ewel 1984, Burn 1985). Hurst (1987) calculated the energy requirements of a 600-kg non-lactating adult manatee at over 4,000 kcal/day or approximately 29.5 and 45 kg *Ceratophyllum* per day.

Habitat

Manatees use rivers, estuaries and coastal areas, moving freely between fresh, brackish and saltwater areas (Bengtson and Magor 1979, Lefebvre *et al.* 1989); however, they seem to require access to freshwater (Crombie 1975 unpubl. report, Campbell and Irvine 1975, Powell *et al.* 1981, Colmenero *et al.* 1988, Augusta 1992). Additional requirements include abundant aquatic vegetation for feeding, proximity to deep channels for travelling, and quiet coves for shelter (Charnock-Wilson 1968, Hartman 1979, Belitsky and Belitsky 1980, Powell *et al.* 1981, Gallo 1983, Rathbun *et al.* 1983a, 1985, Powell and Rathbun 1984, Cerrato *et al.* 1993, Estrada 1993 *in litt.*, Ferrer 1993 *in litt.*, Zarate 1993, Reynolds *et al. in ms.*). In Florida they further require access to warm water during the winter (Hartman 1979).

In Suriname manatees occur in flooded swamps and swamp savannah belts (Duplaix and Reichart 1978). In Venezuela and Colombia available habitat increases significantly during the rainy season, permitting access to tributaries and lagoons. During the drought manatees may become entrapped in deep water bodies (O'Shea *et al.* 1988, Montoya unp. data).

Interactions with other organisms

Manatees in Mexico share habitat with green sea turtles (*Chelonia mydas*), crocodiles (*Crocodilus acutus*), river otters (*Lutra longicaudis annectens*) and dolphins (*Tursiops truncatus*), picudas or barracudas (*Sphyraena barracuda*), sharks (*Ginglymostoma cirratum*) and rays (*Aetobatus narinaris*). Remoras (*Eheneis neucrotoides*) commonly adhered to manatee bodies (Colmenero *et al.*1988). In Puerto Rico most manatees have a number of remoras associated with them (Mignucci l989, unp. data). In Venezuela manatees share habitat with giant river otters (*Pteronura brasiliensis*) and river otters (*Lutra longicaudis*), river and estuarine dolphins (*Inia geoffrensis* and *Sotalia fluviatilis*), capybara (*Hydrochaeris hydrochaeris*), cayman (*Cayman crocodilus)* and river turtle (*Podocnemis expansa*) (Ojeda *et al.* 1993).

Manatees allegedly serve as shark prey in Costa Rica, Dominican Republic, Guatemala, Honduras, Mexico, and Panama (Belitsky and Belitsky 1980, Colmenero *et al.* 1988, Colmenero and Zarate 1990, Crombie 1975, Gallo 1983, Janson 1977, Mou Sue *et al.* 1990, Reynolds *et al. in ms*.). However there are no documented records of manatees attacked by sharks, crocodiles or barracudas in Chetumal Bay, Mexico (Morales and Olivera 1993). Bertram and Bertram 1964, believed that caiman and big or aggressive fish could take manatees, especially injured specimens.

Life history traits

Manatees are long-lived animals and may reach over 50 years of age. Females mature between 3 and 4 years of age. Early mortality rate is high, but decreases after maturity (Marmontel 1993). These parameters contribute to a low maximum potential rate of population growth in Florida manatees (Packard 1985), and presumably the same can be said for other populations as well.

Diseases

Forrester (1992) reviewed the causes of mortality and morbidity among Florida manatees and pointed out that reported bacterial, viral, and fungal agents, and internal and external parasites are relatively unimportant in terms of pathology and do not cause epizootics. Manatees, especially subadults, are vulnerable to extremely cold winter temperatures and "red tide" organisms have been implicated in Florida in one large die-off of manatees (O'Shea *et al.* 1985, 1991).

B. GENERAL STATUS IN THE REGION

Distribution

The West Indian manatee ranges from northern South America to the southeastern United States, including Trinidad and the Greater Antilles. Normally is not found in the Lesser Antilles. Temperature constraints restrict the dispersal of the species between the northern and southern 24oC isotherms (Whitehead 1977). Present distribution is fragmented due to local extinction or habitat unsuitability (Thornback and Jenkins 1982, Lefebvre *et al.* 1989).

Abundance and legal status

Small manatee populations exist in 19 countries of the Wider Caribbean. Although data on past abundance is unavailable, in most areas numbers are perceived to have decreased in the past two decades. O'Shea and Salisbury (1991) provide a table of maximum counts of West Indian manatees throughout the Caribbean region. Aerial surveys over selected areas in Belize produced the highest counts (n=102) of any Caribbean country.

West Indian manatees are listed as endangered under the "U.S. Endangered Species Act of 1973, as amendad", and vulnerable to extinction by The World Conservation Union (IUCN) (Thornback and Jenkins 1982). Manatees are listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and consequently trade of any manatee product is prohibited. Annex II of the SPAW Protocol includes all the Sirenia species as requiring total protection under Article 11, which prohibits the taking, possession, killing and commercial trade of the species, their parts or products. Additionally, other relevant international agreements serve to protect the manatees and their habitats. The Ramsar Convention for the conservation of wetlands which entered into force in 1975, promotes the designation and management of national wetlands as important species habitats, in particular for waterfowl. Eleven States of the Wider Caribbean are Parties to the Ramsar Convention. The recently adopted Convention on Biological Diversity has as objectives the conservation of biodiversity and the sustainable use of its components. The Convention entered into force on 29 December 1993, it has been signed by twenty-five States of the Wider Caribbean and ten of the manatee-range states have ratified. Table 1 includes the list of manatee-range countries which have signed or ratified the SPAW Protocol and the Ramsar, CITES and Biodiversity Conventions.

Folklore and legends

The most widespread myth related to manatees is that of mermaids, possibly derived from the way manatee cows nurse their calves. Manatees are the subject of 2 very similar Suriname Carib Amerindian legends explaining the origins of manatee, tapir and porpoise (Amazonian gray dolphin) (Duplaix and Reichart 1978).

History of exploitation and utilization

Manatees have been hunted by native peoples and exploited by Europeans. Their high quality meat is said to have 3 flavors (beef, fish, chicken, pork and others), and the oil has multiple uses, from lighting fuel to medicine. In Colombia and Honduras manatee hide was used to manufacture whips. Archaeological excavations of prehistoric sites in Belize have yielded a wealth of manatee remains (Bradley 1983, McKillop 1985); and they have been reported recently in Dominican Republic and Mexico (Mignucci and Morales unpbl. data). The 17th and 18th centuries witnessed a large scale commercial exploitation of manatees in the Guianas and Caribbean region (Craig 1966, Bertram and Bertram 1973). Disillusioned with the search for gold, Spanish, Portuguese, English, French and Dutch sailors found the manatee meat a lucrative substitute. According to de Jong (1961), salted manatee meat was transported from the Guianas to the sugar plantations in the West Indies or northeastern Brazil (Bertram and Bertram 1973).

During his travels, Bartram (1761) came upon Indians in Florida who used manatee ribs as ivory and called them by a name that meant "big beaver". Manatees were hunted by the Seminole Indians in Florida, but the importance of manatee meat in the diet of these indigenous peoples is unclear (Reynolds and Odell 1992). Grinding of the bones is also used for medicinal purposes, menstrual regulation, arthritis, muscle pain, general body pain, epilepsy and whooping cough.

C. ECOLOGICAL IMPORTANCE

Manatee grazing as a form of weed and mosquito control has been investigated in semi-captive conditions (Allsopp 1960, MacLaren 1967). Although manatees help the situation without pollution (Domning 1992, Reichart 1993 *in litt*.), sole systematic use of manatee power has not produced encouraging results (Etheridge *et al.* 1985). It has also been suggested that manatees be raised for meat production (Bertram and Bertram 1968) but their slow reproductive rate, depressed population levels, and endangered status render the idea unfeasible. A role in the recycling of limiting nutrients in the ecosystems seems to be manatees' greatest ecological contribution, by stimulating primary productivity (Lomolino 1977, Best 1981, Domning 1992). Furthermore, manatees may serve as indicators of the general ecological health of the ecosystem they inhabit, and in the long run, their physiology may provide humanity with substances or mechanisms to combat certain types of disease (Domning 1992).

II. NATIONAL STATUS

Belize

Status and distribution

Despite having one of the smallest coastlines of Caribbean countries, Belize contains excellent manatee habitat: extensive mangrove swamps, and numerous lagoons, creeks and rivers opening into the sea are protected by an offshore barrier reef (Charnock-Wilson 1968). Extensive sea grass meadows among the cays provide shelter and pasture for manatees. Belize harbors the largest recorded population of manatees in the region and is considered "one of the last strongholds" for manatees in Central America (O'Shea and Salisbury 1991). Sparse human population and low incidence of illegal take due to a change in feeding habits associated with the loss of hunting tradition contribute to such a privileged situation.

Manatees are seen mainly in the Southern/Northern Lagoon area, including the farther reaches of the lagoon system, e.g., Quamina Creek, Cornhouse Creek, Wagoner Creek, Tum Tum Creek. The largest reported concentration of manatees occurs in the Southern Lagoon (the 1987 aerial survey counted fifty five manatees in the Southern and Manatee lagoons, O'Shea and Salisbury 1989) in the Belize District. This area provides undisturbed habitat, ready access to the sea through the Manatee Bar river, prime feeding grounds and freshwater sources such as the upwelling at Tarpon Hole. Smaller concentrations are also seen in Chetumal Bay, the region west of Ambergris Cay, the Belize City area, Placencia Lagoon and the Port Honduras area (Gibson 1992). Important travel routes include the Manatee Bar River, and its connecting creeks, and Main Creek. Manatees are known to enter the Sibun River but it is not clear to what extent they use the lower Sibun and Radigan Creek as access to the large lagoons (Augusta 1992).

A census based on first-hand observations and interviews with local residents in the late 1960's (Charnock-Wilson 1968) indicated that manatees were common in Belize. Two aerial surveys have been conducted since, with a 12-year interval: Bengtson and Magor (1979) counted 101 manatees in 5 comprehensive flights; O'Shea and Salisbury counted 102 individuals in five flights over selected areas. Despite differences in methodology and the qualitative nature of a comparison, the counts suggest no apparent decline in population size. The percentage of calves observed in both surveys (8.9 and 10.6% respectively), comparable to the 7% for a growing manatee sub-population at Crystal River, Florida (Rathbun et al. 1990) suggests a healthy population. Based on their survey O'Shea and Salisbury (1989) provide an estimated guess of 300-700 manatees in Belize.

Major threats and conservation problems

The manatee population in the Manatee Special Development Area (MSDA) seems to presently be stable but the completion of the New Manatee Road, increasing boat traffic, and a myriad of development schemes may play a major role as far as manatee deaths in coastal waters (Augusta 1992, Matola 1993 *in litt.*).

The largest and most varied threat is habitat destruction and degradation. The shallow lagoons and waterways of the MSDA are very susceptible to significant alterations, and the unique karst limestone topography of the watershed underscores the interconnectedness of all aspects of the watershed and lagoon system (Augusta 1992). Approximately 50% of the mangroves in the Belize City area have been cleared, primarily for housing projects, affecting natural run-off filtering and drainage patterns of the area, and several large housing and tourism development projects are presently being developed in Chetumal Bay (Gibson 1992). The rapid expansion of citrus and banana plantations in the major watersheds of Southern Lagoon and runoff from sugar plantations and sugar factories into the New River and then into the Chetumal Bay are also a cause of concern (Gibson 1992). Quamina Creek, the drinking water source of Gales Point and a probable freshwater source for manatees has reportedly received agricultural runoff (Augusta 1992).

The tourism industry has grown tremendously in Belize over the past 10 years with an increase of over 300% in the number of visitors between 1980 and 1990 and of 75% in the hotels located on the coastal zone (Gibson 1992). At this point, most travel in the village of Gales Point is done in large dugout canoes with relatively slow 6-30 HP outboard engines. However, the number of faster speedboats visiting Gales Point through the lagoon system from Belize City has been increasing. There has been at least one verified collision with a manatee, and another died allegedly from wounds inflicted by an outboard propeller; several villagers have reported a decline in what they believed to be mating in the shallow waters along the eastern shore of the village (Augusta 1992). The proposed park in Southern and Northern Lagoon will attract more nature tourists and increase high speed boat traffic to the village (Boardman 1993 *in litt.*).

The use of gill nets in the Manatee Special Development Area, both legally and illegally set, has been increasing in the past years, causing the drowning of manatees, especially young individuals (Augusta 1992). Laws forbidding deployment of gill nets within 1/2 mile of a river mouth are rarely obeyed. On occasion live animals found entangled are clubbed to death (O'Shea and Salisbury 1991). It is also possible that Honduranian shrimp trawlers operating in the shallow trench between the reef and the coastline, cause the entanglement of manatees, although records are nonexistent (Boardman 1993 *in litt.*).

Despite the protected status, some illegal killing occurs at Ambergris Cay, Dangriga and Punta Gorda. Meat is occasionally offered at markets such as Corozal (O'Shea and Salisbury 1991), and scrimshaw pendants of manatee bone sold to tourists on Ambergris Cay (O'Shea and Salisbury 1991).

Socio-economic significance of the species to local communities

Manatees were abundant in Belize both before and after the European arrival. Artifacts found on several cays suggest that ancient Mayans used manatee meat for food and bones for carvings. Tonnes of manatee bones have been excavated from middens (400-700 A.D.) on Moho Cay, a present-day major habitat for manatees, and old slaughtering site at the mouth of the Belize River (McKillop 1985). Remains have also been retrieved from several other coastal and inland archaeological sites (Bradley 1983). During the 17th century smoked, dried and salted manatee meat represented a food source for buccaneers and pirates (Craig 1966).

A long-term historical association exists between villagers of the Manatee Special Development Area and its rivers, lagoons and manatees. The word "Manatee" (locally pronounced "Malantee") is often used to describe the whole Southern Lagoon area and specifically the village of Gales Point. Villagers of Gales Point are proud of their sailing and fishing heritage, and present a good level of awareness about the uniqueness of their manatee population, often referring to an adult villager as a "malantee" man or woman, or as a "malantaranian". The large federal forest reserve to the west of Southern Lagoon is called the Manatee Forest Reserve (Augusta 1992). Although past populations used to eat manatee meat, younger generations of Belizeans have access to domestic fresh, salted and tinned meat, have not acquired the taste (Charnock-Wilson 1968), and rarely hunt manatee nowadays.

Manatees' greatest potential economic value may be as a tourist attraction. However, caution must be exercised when promoting manatee tourism activities to ensure that these will not have negative impacts in the species and their habitats. In recent years guided nature trips have been planned to observe manatees from small boats in Southern Lagoon and the lower Belize River (O'Shea and Salisbury 1991) and Ambergris Cay or swim with the animals off of Drowned Caye off Belize City (Boardman 1993 *in litt.*).

National legislation and conservation measures

Manatees are fully protected under Belizean law by the Wildlife Protection Act No. 4 of 1981, administered by The Forestry Department, Ministry of Natural Resources, which prohibits hunting of manatees. Trading of any manatee product is illegal under

Appendix I of the CITES Convention, of which Belize is Party. Gill-netting in rivers is illegal. Belize has not yet signed the SPAW Protocol.

A Manatee Special Development Area (MSDA) including Northern and Southern lagoons, has been declared under the Land Utilization Act. Under that designation a zoning scheme is being implemented to regulate coastal development projects, fishing activity, and boat traffic. There are plans to turn Southern Lagoon into a Manatee Sanctuary. The Coastal Zone Management Unit administers a large-scale monitoring programme on water quality in the lagoon system (Boardman 1992, Gibson 1992).

The level of awareness about manatees and their protected status is high among Belizeans, partially because manatees are relatively common in that country but undoubtedly due to the efforts of many active non-governmental organizations. Especially noteworthy is the Belize Zoo Outreach/Future in the Wild, a wildlife conservation education programme established in 1984 by the Belize Zoo, possibly one of the strongest efforts by a local organization in the Caribbean (Matola 1986, 1993 *in litt.*, O'Shea and Salisbury 1991). The programme consists of a traveling exhibit with slide presentations to schools and distribution of posters, the production of a video and a booklet on manatees, and airing conservation films (some donated by Save the Manatee Club, of Florida) on the local national television network. The Coastal Zone Management Project, through the Belize Audubon Society presently conducts a comprehensive coastal environmental education on manatees and their habitat, mainly targeted at school children (Gibson 1992). Manatees are also featured in weekly radio talks and newsletters by The Belize Audubon Society (Matola 1986). Educational materials (posters, brochures) are being prepared by the Coastal Zone Management Project in collaboration with Centro de Investigaciones de Quintana Roo, Chetumal, Mexico (Gibson 1993 *in litt.*). Educational programmes targeted at local communities and visitors will be a component of the proposed Manatee Sanctuary in Southern Lagoon (Gibson 1992).

In Gales Point, ecotourism has fomented an interest in better protection of manatee in Southern Lagoon (Matola 1993 *in litt*).

Colombia

Status and distribution

The scientific information available on amounts and current status of manatees in Colombia is scarse. Previous knowledge and traditional use of the species is suggested by the fact that a town near the Atlantic coast was named 'Manatí'. Manatee habitat in Colombia is characterized by and including areas of swamps, coastal lagoons and creeks and turbid, sluggish rivers with abundant floating meadows (INDERENA 1993

unpbl report). Manatees occur in isolated pockets in major rivers and estuaries away from human presence (Powell and Gicca 1975 unpubl. report, Husar 1977). Their approximate area of distribution includes the Colombian Caribbean (middle and lower Atrato river, lower Sinu river, middle San Jorge river (Ciénaga de Ayapel), lower Cauca river, middle and lower Magdalena river, lower Frio river and some rivers of the eastern plains (middle and lower Meta river, lower Guaviare river, lower Tuparro river, middle Arauca river, middle Orinoco river) (INDERENA 1993 unpbl. report). Individuals inhabit swamps all year round in Ciénaga de Ayapel (middle basin of San Jorge river) (Prieto l988) while in the lower reaches of Sinu river they migrate as food availability varies (INDERENA 1993 unpubl. report). A number of specimens are maintained in large man-made lakes (e.g., Magangue, Bolivar district). At the end of l993 INDERENA started investigations on status, habitat, education, movements and feeding areas in the Colombian Amazone (Montenegro l994), and equally during l994, INDERENA and the Banco de la Republica undertook a study on Cienaga de Paredes (Santander State), to assess its potential as a habitat for the manatee population in this part of the midle Magdalena River (Montenegro, l995).

Major threats and conservation problems

Illegal hunting represents the major threat to manatees in Colombia, followed closely by habitat deterioration. Manatees are killed for their meat by natives and fishermen of coastal and riverine zones (INDERENA 1993 unpbl. report). There have been an estimated 4 annual deaths in the past 5 years but the numbers could be larger if forested areas were considered where its exact distributiton is unknown. (INDERENA 1993 unpbl. report).

Manatee habitat in Colombia is under continuous degradation due to increasing human settlement in coastal areas, transformation of certain areas into agricultural and cattle-raising land, contamination and eutrophication, drainage and rerouting of water bodies and subsequent sedimentation of creeks and rivers, which impairs natural migration of the aquatic species in the area. The construction of dams may considerably affect natural habitats (INDERENA, 1993 Caicedo l993).

Socio-economic significance of the species to local communities

People living under conditions of extreme poverty along rivers or other water bodies often organize manatee hunting parties, after which the animal is slaughtered and sold for cash income (INDERENA 1993 unpbl. report).

National legislation and conservation measures

Manatees in Colombia are protected by Resolucion no. 574 of 1969 by INDERENA (Instituto Nacional de los Recursos Naturales Renovables y del Ambiente), which urges permanently to prohibit poaching on the two manatee species in Colombia, Decreto Ley 2811 of l974, through which the national code on Natural Resources is established, Decreto Reglamentario No. 1608 of 1978 and Ley 84 of 1989 which establishes the status of protection of the species. Colombia is Party to the CITES Convention and regulates the trade of any manatee product under Appendix I of this Convention. However, enforcement of such laws is hampered by the inefficiency of the control and monitoring measures to cover the areas of distribution of the species and by the lack of education of local people. The Colombian government has set aside a number of sanctuaries and parks for the protection of its wildlife, and in a number of them the manatee is being protected. Manatees occur in Salamanca Island National Park, near Barranquilla, and in Parque Nacional Natural de los Katios (Atrato River basin) (INDERENA l993 unpub. report, Caicedo l993). Colombia signed the SPAW Protocol in l990 but it has not yet been ratified.

In 1988 INDERENA launched a protection campaign in the area of Ayapel, Cordoba district (Prieto, l988). Between 1990 and 1992 Corporacion Autonoma Regional de los Valles del Sinu y del San Jorge (CVS), with support from the Caribbean Stranding Network (Puerto Rico), conducted a rehabilitation programme, where two neonates and 4 adults were rescued. Several manatees captured by local people have been placed in artificial lakes where they are maintained in semi-captivity. Two manatees have been born under these conditions (INDERENA 1993 unpbl. report). Previous conservation plans have not had continuity and have not been evaluated. The CVS has proposals in the areas of environmental education, rehabilitation and population monitoring through radiotelemetry, in the state of Cordoba, and INDERENA (since l993 its functions assumed by the Ministry of the Environment), plans to implement several conservation projects in the lower Magdalena and the Colombian Caribbean (INDERENA 1993 unpbl. report). In the past INDERENA has produced educational pamphlets about endangered species, including one on 'manati'. The CVS also developed an educational programme with brochures and posters explaining the importance of conservation of species and inviting all local inhabitants to report the presence of manatee in the area, but discontinued it due to lack of funds and personnel. In l994, a regional plan for the conservation of the manatee was proposed based on the work undertaken in the Cienaga de Paredes, which will be implemented in the areas as resources become available. Since l992, the "Grupo de amigos del manati" has conducted educational campaigns in Magangue (Caicedo l993).

Costa Rica

Status and distribution

Costa Rica has excellent manatee habitat: quiet and shallow canals and lagoons, freshwater and abundant emergent and floating vegetation, such as the canals in the Atlantic of Costa Rica (Reynolds et al. *in ms*, Vasquez R. 1993 *in litt.*). Manatees were reported all along the Atlantic coast in the past, and entered rivers San Juan, Sarapiquí and San Carlos (Frantzius 1869). Although relatively common in Costa Rica until the 1950's manatees are considered rare nowadays (Reynolds et al. *in ms*). O'Donnell (1981) described manatee distribution in the late 70's based on interviews and aerial surveys. Tortuguero, in the northeastern coastal plain, still harbors the largest, although small, concentration of manatees in the country, especially in Caño Servulo (Reynolds et al. *in ms*). Recent sightings are scattered and include Rio Colorado (1 in 1991) and Laguna Gandoca, Refúgio de Fauna Silvestre Gandoca-Manzanillo, in southeastern Costa Rica (1 in 1982 and 3 in 1990) (Vasquez R. 1993 *in litt.*). No manatees were observed in three boat surveys conducted in Tortuguero Lagoon between 1984 and 1991, and an aerial survey in July 1991 yielded only 3 sightings: 1 manatee in Caño Servulo and 2 just north of the mouth of the Rio Sixaola on the Panama border (Reynolds et al. *in ms*).

Major threats and conservation problems

Illegal hunting for subsistence and motorboat traffic in the canals of Tortuguero claim the lives of 1 to 2 manatees a year. The meat is used by the black community in the town of Tortuguero, adjacent to the Park (Elizondo 1993 unpubl. report). Increase in vessel traffic in Río Colorado, water contamination by oil released by the motors in those areas, and habitat loss (Elizondo 1993 unpubl. report, Vásquez R. 1993 *in litt.*) further threaten manatee persistence in Costa Rica. Forests destroyed in the buffer area of Tortuguero National Park may cause siltation of the canals in the intermediate or long term (Elizondo 1993 unpubl. report). Agrochemicals are being released into canals of Tortuguero (e.g., near Boca Parismina) by local banana growers and new projects are being installed along the basin of Rio Tortuguero, which drains into the Park. Manatees may be ingesting discarded plastic banana bags (Elizondo 1993 unpubl. report, Reynolds et al. *in ms*).

Socio-economic significance and conservation measures

Manatees are hunted for their meat of alleged many flavors, and fat which yields high quality oil (Vasquez R. 1993 *in litt.*, Reynolds et al. *in ms.*). However younger people seem to have lost interest in hunting; this is justified in interviews partially by the time and patience that it requires and partially to a certain level of awareness about the endangered status of the species and its tourist appeal (Reynolds et al. *in ms.*).

National legislation and conservation measures

Costa Rica has protected its manatees since 1953. The recent law Ley de Conservación de la Vida Silvestre no. 7317 of 1992 characterizes manatees as endangered of extinction (Vásquez R. 1993 *in litt.*). Costa Rica is a Party to the CITES Convention but has not signed the SPAW Protocol.

Protection is difficult, however, due to lack of personnel both in the refuges and at national level. The best habitat protection is provided by the implementation of Parque Nacional Tortuguero and Refúgio de Fauna Silvestre Barra del Colorado, as well as Refúgio Gandoca-Manzanillo. The Dirección General de Vida Silvestre stimulates the conservation of wild flora and fauna in general and implements programmes, but no specific programmes have been developed for manatees (Vásquez R. 1993 *in litt.*).

Cuba

Status and distribution

Extensive areas of shallow, protected coastal areas and many rivers on both the northern and southern coasts of Cuba constitute favorable manatee habitat (Lefebvre *et al.* 1989). Ecological changes in Cuba's rivers (contamination, damming, and deforestation along the margins, all affecting plant production) may have caused manatees to shift from a riverine (Cuni 1918) to more coastal marine habitat, where they occur most often along protected coasts with extensive shallow areas (Estrada and Ferrer 1987).

A comprehensive national survey (excluding the area between Jaimanitas and Punta Hicacos) involving 301 fishermen produced indications of continuous manatee presence along the coast. Twelve are the areas where manatees were sighted more frequently: Ensenada de Guadiana-Puerto Esperanza, Bahía de Cárdenas, Carahatas-Caibarién, Turiguanó, Nuevitas-Puerto Padre, Gibara-Cayo Saetía (northern coast), Siguanea and Punta del Este (Isla de la Juventud), Ensenada de la Broa, Casilda-Tunas de Zaza, Golfo de Ana María, Golfo de Guacanayabo-Ensenada de Mora, Baitiquirí (southern coast) (Estrada 1993 and Ferrer 1993). Manatees were reportedly more abundant in the complex Ensenada de La Broa-Río Hatiguanico in the southern coast of Zapata Peninsula, rich in estuaries and abundant vegetation (Ferrer 1993 unpbl. report). The Zapata Peninsula is not heavily populated and has suffered small environmental impact. Manatees are also present in the southern coast of Pinar del Río (between Cortés and La Coloma), the northern coast of the Villa Clara province (north-central Cuba), north coast of the Las Tunas province (northeastern region), and southern coast of the Sancti Spiritus province (south-central Cuba) (COMARNA 1993 *unpbl. report*). Despite alarming news of decreasing populations because of illegal hunting and pollution in the late 1970's (Lefebvre *et al.* 1989) 58% of

interviewees reported seeing a manatee in the 12 months prior to survey, and the same percentage thought that manatee numbers have been increasing in the past 10 years; only 11% considered manatees "rare" in Cuba. This apparent improvement may result from fishermen's awareness about legislation and law enforcement (Ferrer 1993 *unpbl. report*).

A few aerial surveys have been conducted in Cuba (Estrada and Ferrer 1993 *unpbl. report*). Between October 1985 and January 1986, 8 flights covering the Casilda-Tunas de Zaza area (between the mouths of rivers Jatibonico del Sur and Agabama-Manati, south of Sancti Spiritus Province, approximately 93 km total) produced 44 sightings; in November 1986 and July 1987, 4 flights were conducted each time in western Zapata Peninsula and Ensenada de La Broa and Rio Hatiguanico (approximately 96 km), with counts of 21 and 39 manatees, respectively; in July 1992, 4 flights covering all coasts of Zapata Peninsula and Rio Hatiguanico basin and Laguna del Tesoro produced a count of 20 manatees.

Major threats and conservation problems

The level of threats on manatees is believed to have remained stable at least between 1959 and 1989 (Ferrer 1993 *unpbl. report*). As a result of protective measures, illegal hunting has practically been eliminated in Cuba (COMARNA 1993 *unpbl. report*.). Although mortality is said not to be high, coastal fishing activities are the main identifiable cause of manatee deaths in Cuba, due to suffocation when animals become entangled in various net types. Contamination and loss of natural condition especially in the lower reaches of 90% of the rivers have dramatically reduced manatee habitat. In 1981 approximately 8 manatees died due to exposure to residues from the sugar cane industry. The Bahía de Nipe, Cuba's largest, is said to have been abandoned in the past 20 years because of contamination which also affected the shrimp fishery. An increase in tourism, accentuated in the past 3 years and translated into maritime construction such as roads and bridges in low coastal areas, and hotels and nautical bases for yachts, may add to the dangers (Estrada and Ferrer 1993). A smaller proportion of manatee deaths is attributed to collisions with boats, harpooning, underwater explosions produced by petroleum prospection, and shark attacks (Estrada 1987, Ferrer 1993 *unpbl. report*).

National legislation and conservation measures

Manatees have been in Cuba's threatened species list since 1973 (Estrada and Ferrer 1993). They have been protected since 1936 by Decreto-Ley 707; its article 39 prohibited manatee captures and prescribed 500-pesos fines and/or imprisonment for 180 days. In 1955 Decreto 2724 ("Reglamento de la Ley General de Pesca") in its article 75 declared the manatee an animal under permanent closed season. In 1982 the

Ministry of Fisheries created Decreto 103, permanently prohibiting the capture of manatees in all national territory with fines of 100 pesos, and confiscation of the captured animals, fishing gear, and boats. There is no authorized market for commercialization of manatee meat. Cuba is a Party to the CITES Convention and has signed the SPAW Protocol.

Only in the past 30 years these laws have been enforced (Ferrer 1993 *unpbl. report*), but it is suggested that both the population and the governmental institutions possess a high level of awareness relative to manatees' situation (COMARNA 1993 *unpbl. report*). Nevertheless it is hard to evaluate the effects of these regulations due to an extensive coast with many areas of difficult access (Estrada and Ferrer 1993).

Limitations on economic development in Cuba prevent the implementation of management and protective measures. The large development in scientific investigation in the past 30 years has been directed towards production, medicine, and fishing technology. Cuba promotes the need to protect nature, with many radio and TV campaigns for the conservation of flora and fauna, although none specific for manatee. In addition economic limitations have reduced such campaigns in the past 3 years (Estrada and Ferrer 1993 *unpbl. report*).

Despite being the largest Caribbean island, Cuba has no programme directed to the study, evaluation, protection and management of its marine fauna and their habitat, and only in the last few years has a consciousness for its need begun to show. There is no national conservation programme (Estrada and Ferrer 1993). Environmental awareness programmes about wildlife protection are often produced by the T.V., radio and newspapers (Ferrer and Estrada 1993 unpubl. report). The only two limited research programmes include a) aerial surveys to estimate the size of the population occupying vicinities of Zapata Peninsula, by Institute of Forestry Research of the Ministry of Agriculture (affected by the lack of funds) ; b) a similar project for the study of coastal ecosystems of the cays of Sabana-Camagüey on the north coast of Cuba as part of a UNDP Programme (not yet started) (Estrada and Ferrer 1993).

Dominican Republic

Status and distribution

During pre-Columbian days manatees in the Dominican Republic were abundant enough to be used for food and have their bones built into icons (Belitsky and Belitsky 1980). However, numbers are now believed to be lower than in the past (Campbell and Irvine 1975 unpubl. report), which Belitsky and Belitsky attribute to hunting pressure and habitat degradation by land development.

Manatees are defined as coastal marine in the Dominican Republic, explained by the formation of sand bars at the mouths of rivers due to agricultural land preparation (Belitsky and Belitsky 1980). Individuals may occur in river mouths but stay in the proximity of fresh water (Campbell and Irvine 1975 unpubl. report) and frequent the upwellings at Tres Hermanas, La Guazuma and Saledilla Beach (Belitsky and Belitsky 1980). Manatees are sighted most often in the northern and southwestern portions of Dominican Republic. Suitable habitat in the southeastern portion of the Dominican Republic is scarce. Husar (1977), Campbell and Irvine (1975 unpubl. report), and Belitsky and Belitsky (1980) identified important manatee areas: Tres Hermanas, Las Terrenas, Monte Cristi, and Las Calderas Lagoon in the northern coast, and Bahia de Ocoa and Bahia de Neiba in the southwest coast. Also cited were the proximity of Boca de Yuma on the east coast south to Saona Island, Nizao in the south, coastal waters between Beata Island and the mainland, and Pedernales in the southwest, and rivers Masacre, Yaque del Norte, San Juan, Bajabonico Isabela and Yaque del Sur (Belitsky and Belitsky 1980). Additional areas include Playa Grande, Playa de Rincón, Bahía de Rincón, Río Caño del Água, Río Cosón, Arroyo Cañada Salada, La Poza, Bahía de Manzanillo, Los Patos, Bahía Regalada, Estero Hondo, Punta Rucia, Bahía de Yuma (Lefebvre *et al.* 1989).

Six comprehensive bimonthly aerial surveys were conducted in 1977 along the coast and over rivers, lagoons and estuaries. The maximum count was 41 manatees, with a mean number per flight of 12.3 in the north and 7.5 in the south, and an estimated 60 total population between Manzanillo and Pedernales. Primary areas of distribution were between Manzanillo and Miches (north coast) and between Ocoa Bay and Beata Island (south coast), with a single sighting northwest of Saona Island (southeast coast). Foci of manatee presence were coastal waters near Monte Cristi and bays of Samana, Ocoa and Neiba (Belitsky and Belitsky 1980).

Major threats and conservation problems

Poaching and shark predation were cited during interviews as causes of manatee mortality, although the latter may represent scavenging (Belitsky and Belitsky 1980). Although fishermen are aware of the legislation, in Azua they admitted catching manatee opportunistically and selling the meat in local markets. Given the difficulty to find and catch manatees, the number poached yearly is estimated to be small (Campbell and Irvine 1975 unpubl. report). Three episodes of net entanglement were reported near Nizao (Belitsky and Belitsky 1980). Manatees are frequently seen and occasionally accidentally caught in fishing nets in Bahia de Samaná (Lefebvre *et al.* 1989). A few instances of collisions with boats have been reported (Secretaria de Estado de Agricultura 1993 unpubl. report).

National legislation and conservation measures

Manatees in the Dominican Republic are protected by Ley de Pesca 5914 (article 45) of 1962, and the country has been a signatory of CITES since 1987 (Secretaria de Estado de Agricultura 1993 unpubl. report). However, Dominican Republic has not yet signed the SPAW Protocol. In the past year, Prospectiva Ambiental Dominicana, a non-governmental organization, has been developing a Project of Conservation of Manatees and Sea Turtles which includes field and aerial surveys, collection of sighting data and manatee carcasses, and distribution of educational posters (P. Brandy 1993 *in litt.*, Secretaria de Estado de Agricultura 1993 unpubl. report).

French Guiana

Status and distribution

The species is considered rare but no interviews or aerial surveys have been conducted in French Guiana and there is no data on the status of the population in the country (Sanite 1993 *in litt*.). Favourable habitat is scarce due to a narrow coastal plain (Bertram and Bertram 1963). Brazilian fishermen reported manatees in rivers Approuage, Mahury, Laughan and Ouanari and smaller rivers in the vicinity of Oiapoque (Best and Teixeira 1982). Officials from the Ministry of Environment have reported incidental captures in the estuaries of Cayenne and Iracoubo rivers, and Mahury river (Sanite 1993 *in litt.*).

Major threats and conservation problems

The major threat faced by manatees in French Guiana is drowning as a result of incidental catches in artisanal fishing nets (Sanite 1993 *unp. report*).

Socio-economic significance of the species to local communities

Manatees were hunted in the past by Amerindians and Creoles, but such activity has been marginalized due to the scarcity of the species.

National legislation and conservation measures

The manatee in French Guiana is totally protected by an inter-ministerial decree of 1986. France is a Party to the CITES Convention since 1978 and has signed the SPAW Protocol. A project for the identification of manatees' actual distribution in the country recently approved for funding entails interviewing local fishermen. An observer will be placed on board fishing vessels to help estimate population size, and boats from the French Navy will be requested to report manatee sightings and observations. A brochure was produced in June 1992 on the mammals of French

Guiana but French Guiana does not count with an active education programme for the preservation of the manatee in particular (Sanite 1993 *unpbl. report*).

Guatemala

Status and distribution

Manatees in Guatemala are said to have been greatly reduced in numbers between the 1500s and 1800s due to commercial hunting, and by sport and subsistence harvest by 1960. Habitat seems good for manatees in most areas of Guatemala, however recent observations indicate that the population is small, and even a few yearly deaths might hold it at a low level.

Manatees in Guatemala occur mostly in the freshwater Río Dulce ecosystem (El Golfete, Rio Chocón-Machacas, Lago de Izabal, Río Polochic and Río Oscuro). Smaller numbers occur in the short Caribbean coast (Bahia de Amatique, Bahia de la Graciosa and Punta Manabique), Río Sarstun on the Belize border, Canal de los Ingleses (Canal Chapín), and Río Motagua close to the border with Honduras (Janson 1978, Ackerman 1992, Quintana 1993). A single 6-hour flight in 1976 produced only 1 manatee sighting (Lefebvre *et al.* 1989). In 1991, 9 manatees were observed in a survey over the Caribbean coast and the river systems of Río Dulce, Sarstun and Motagua. Comprehensive aerial surveys covering the Atlantic coast and the Lago Izabal/El Golfete complex, during 4 months of 1992 (January, March, April, May) yielded a total count of 66 manatees (including 7 calves) in 40 hours of survey, resulting in an estimate of $\pm$ 44 manatees in the country (Quintana 1993). The percentage of calves is comparable to the value derived for Crystal River's growing population (Rathbun *et al.* 1983b). Manatees were most frequently observed in Lago de Izabal, particularly in the southwestern area between Punta Chapín and Cayo Padre, where vegetation, shallow canals and lagoons are abundant, and boat traffic is reduced. Calves were frequently observed in Cayo Padre ensenada and mating episodes have been reported for Punta Chapín. El Golfete may represent only a corridor between Lago de Izabal and the marine area. Presence of manatees in the latter tends to increase during the winter (May) when salinity decreases (Quintana 1993).

Major threats and conservation problems

Boat traffic, illegal hunting, illegal use of gill nets in the lakes, and contamination by pesticide residues are major threats to manatee survival in Guatemala. There are several reports of manatees hit by boats or killed in gill nets in the past few years. El Golfete is an area of intense tourist boat traffic between Río Dulce and Livingston (Quintana 1993). Gill-netting is very common in the area, affecting mainly calves.

Indians fish from dugout canoes using 100-300 m monofilament gill nets or cast nets (Ackerman 1991, 1992 unpubl. reports). Manatee meat is occasionally offered in various local markets; the fines applied to hunters are insufficient to discourage infraction, as the price commanded by the illegal sale compensates the offense. A petroleum company has been conducting seismic testing for oil deposits in the vicinity of Lago de Izabal (Ackerman 1992 unpubl. report). If prospection ensues, threats associated with oil spills and increased boat traffic may alter manatee distribution in the area.

National legislation and conservation measures

Manatees are further protected by Acuerdo Presidencial of 1959 whereby manatee hunting is illegal (Quintana 1993), however enforcement is little in the remote Indian villages (Ackerman 1991 unpubl. report). Guatemala is a Party to the CITES Convention and is signatory to the SPAW Protocol.

Guatemala created the first reserve designated for manatees in Central and South America, the Biótopo para la Conservación del Manatí Chocón-Machacas, in El Golfete, Izabal in 1979 (Lefebvre *et al.* 1989). With its numerous lagoons, vegetated shorelines, and winding rivers, the Biótopo constitutes an excellent site for manatee protection and provides considerable manatee and environmental awareness to nationals and foreign tourists. However, it may be too small to contain the full seasonal movements of manatees and few are the sightings of manatees in the Reserve (Ackerman 1992 unpubl. report). In addition, the Rio Dulce - from Lago de Izabal to the ocean - and El Golfete receive some protection as a National Park since 1955.

Guyana

Status and distribution

There is no recent information on population status and distribution, and aerial surveys have not been attempted. Bertram and Bertram (1963) estimated Guyana's manatee population at some thousands but reduced from former levels. Manatees are more common along coastal rivers, specially in wet savannah areas (e.g. Canje, Abary and Berbice rivers), or near sluices by the outflow of drainage channels from plantations in the sugar estates of Buxton, Leonora, Uitvulgt and Airy Hall. Manatees in the ocean are more likely to be travelling between rivers (Bertram and Bertram 1963, 1964, 1973). Northwest Guyana and the border with Suriname (Courantyne River region) contain the greatest numbers (Bertram and Bertram 1963). Manatees have been reported for the Arapiako, Akawini, Wuini, Barima, Sebai and Kiatuna rivers. They are sometimes seen in the Demerara river and occasionally at the river mouth in Georgetown (Bertram and Bertram 1973).

Major threats and conservation problems

Bertram and Bertram (1963, 1964) noticed an increase in motorized dugout canoes and other powered boats and suggested this was restricting manatee distribution. There is no organized hunting of manatees in Guyana although they may be taken when opportunity presents itself (Bertram and Bertram 1963). Accidental entanglement in fishing nets is responsible for some manatee deaths (Lefebvre *et al.* 1989).

Socio-economic significance of the species to local communities

Manatees have been experimentally used as biological weed control agents (Alsopp 1960, Bertram and Bertram 1963, National Science Research Council of Guyana and National Academy of Sciences 1973), without conclusive results.

National legislation and conservation measures

The species has been totally protected since 1956 by the Fisheries Ordinance No. 30, revised in 1961 (Fisheries (Manatee Control) Regulations) (Bertram and Bertram 1963, Lefebvre *et al.* 1989). Guyana is a Party to the CITES Convention but has not yet signed the SPAW Protocol.

During a specialist Manatee Workshop in 1974, the establishment of an International Centre for Manatee research and conservation was proposed in Georgetown (National Science Research Council 1974). No information is available on current conservation programmes.

Haiti

Status and distribution

Optimal manatee habitat occurs along the coast of Haiti, however very few (8) animals were sighted during a complete aerial survey in 1982. These individuals were either at one of such areas or travelling between them, in a very restricted portion of the western coast, between Montrouis and Gonaives (Rathbun *et al.* 1985). Interviews with local residents indicated that manatee numbers in Haiti have dramatically decreased in the past 50 years to the point that sightings and intentional takes are rare. In the late 1970's the Bay of Jacmel was said to harbor a manatee population (Rathbun *et al.* 1985).

Major threats and conservation problems

Accidental entanglement in fishing nets, specifically in beach seines, represents the greatest threat to manatee survival in Haiti.

Socio-economic significance of the species to local communities

Despite the very reduced numbers manatees may represent a source of protein for the impoverished people of Haiti.

National legislation and conservation measures

In a country of extreme poverty support for manatee conservation if bound to be minimum. There is no conservation education programme in the country and the government wildlife agency is does not have the personnel or equipment to enforce any legislation. Haiti has not signed the CITES Convention nor the SPAW Protocol.

Honduras

Status and distribution

Manatee populations in Honduras were said to be plentiful in the late 19th century (Husar 1977) but have dwindled in the past few decades. They persist in the wetlands of Honduras' extensive coastal plain (Cerrato 1993 unpubl. report) where they encounter freshwater sources, shelter from open ocean, and abundant vegetation. Such areas include rivers and lagoons east and west of La Ceiba, rivers east of Trujillo, and rivers and lakes of La Mosquitia in eastern Honduras (Klein 1979, Rathbun *et al.* 1983a, Cerrato 1993 unpubl. report). The latter consists of the largest wetland in Central America and contains the Rio Plátano Biosphere Reserve; it represents the largest potential manatee habitat and is the least populated and developed area in the country. Manatees are said to occur in lagunas de Brus, Ibans, Rapa, Guarunta, Biltamaira, Tilbalaca, Siksa, Tansin and Caratasca (Klein 1979, Rathbun *et al.* 1983a, Cerrato 1993 unpubl. report). No recent records are available for manatees in the Islas de la Bahia (Klein 1979, Rathbun *et al.* 1983a, Cerrato 1993 unpubl. report). Important manatee areas east of La Ceiba are Río Aguán and adjacent lagoons El Lirio and Guaimoreto; west of La Ceiba manatees occur from El Porvenir to Zambuco-estuary of the Colorado, and from Río Lean to the estuary of the Chamelecón river (Cerrato 1993 unpubl. report). During the dry season (November through April) many rivers and lagoons may become landlocked, trapping manatees inside (Rathbun and Powell 1979 unpubl. trip report).

Rathbun *et al.* (1983) conducted aerial surveys and interviews with local residents in 1979 and 1980, determining that manatee numbers in the country were low. A 13-hour comprehensive survey of the Atlantic coast and most inland waters yielded a maximum count of 11 animals, most of them in coastal rivers and lagoons (coast near Zambuco, Laguna de Boca Cerrada, Laguna de Tansín, and the mouths of the Río Lecan, Río Cuero, and Río Salado) (Rathbun and Powell 1979 unpubl. report). The percentage of calves during the surveys was high. Cerrato (1993 unpubl. report) estimates the manatee population in Honduras between 120 and 140 individuals, based on boat and aerial surveys and interviews with fishermen and local residents.

Main populations are said to occur in a) area between Chamalecón river and Punta Sal,;b) area between Zambuco-Colorado river and El Porvenir; c) Bacalar, Ibans and Brus lagoons, and Plátano river; and d) Caratasca lagoon (Cerrato 1993 unp. report).

Major threats and conservation problems

Substantial illegal hunting continued into the 1980's (Lefebvre *et al.* 1989) but manatee harpooning has decreased in importance in the past 10 years as a result of protective measures and protected areas. The most important threats faced by manatees in Honduras today are the widespread use of fishing nets, loss of habitat, and possibly the use of agricultural and industrial contaminants. Gill nets, set perpendicular to shore, have been a major hazard to manatees since they first appeared in Honduras in the 1960's. Rathbun and Powell (1979 unp. trip report) described instances of nets closing off the mouths of many rivers and lagoons.

It is suspected that pesticides and contaminants may be detrimentally impacting manatee populations in Honduras, although no studies have been conducted. The basin of the Sula (especially at the mouth of rivers Ulúa and Chamelecón) in close proximity to Punta Sal National Park, is thought to be one of the most affected areas. The decline in manatee numbers has been attributed by villagers to an increase in dugout canoes with inboard diesel engines ("tuk-tuks") (Klein 1979).

Socio-economic significance of the species to local communities

Miskito Indians (native residents of La Mosquitia) and Garifuna (Carib negroes) have probably exerted a continuous low-intensity hunting pressure on manatees until past the middle of this century, using traditional methods (Klein 1979, Rathbun *et al.* 1983a, Cerrato 1993 unpubl. report). Pre-Columbian pottery found in the wetlands of the present-day Refúgio de Vida Silvestre suggest that the manatee was part of the daily life of early Hondurans. Manatees are said to exert some control over the growth of aquatic plants in rivers, canals and coastal lagoons (Cerrato 1993 unpubl. report).

National legislation and conservation measures

Article 49 of the Fisheries Law (Decree No. 154 of 1959) provides total protection to manatees in Honduras, prohibiting the take of manatees or trade of their products. However, enforcement is lacking due to personnel shortage and difficulty of access to remote areas. Honduras is Party to the CITES Convention but it has not signed the SPAW Protocol.

Wildlife refuge Refúgio de Vida Silvestre Cuero y Salado, protected by law and supported by Fundación Cuero y Salado (one of the strongest private conservation groups in Honduras based in La Ceiba) was created specifically with the purpose of manatee preservation. It grants 100% protection to manatees in the area, and in addition improves local awareness. Punta Sal, 40 km west of Cuero y Salado, and its coastal lagoon have recently been declared a marine national park. Some protection is also provided by the Río Plátano Biosphere Reserve, in Ibans Lagoon (Cruz 1991 *in litt.*, Cerrato 1993 unpubl. report).

There is no national environmental education programme dedicated to the conservation of manatees. Educational lectures are offered on Reserva de Vida Silvestre Cuero y Salado and Parque Nacional Punta Sal, at the local level (Cerrato 1993 unpubl. report).

Jamaica

Status and distribution

Jamaica's manatee population was judged to be declining throughout the island in the l960's and l970's (Crombie 1975 unpubl. report, Powell 1976 unpubl. report). In a 1976 aerial survey from St. Mary to St. Elizabeth (Powell (1976 unpubl. report) observed a single manatee, at Alligator Reef, off Manchester Parish. Thirteen island-wide aerial surveys were conducted monthly between May 1981 and April 1982 (Fairbairn and Haynes 1982), and again in February 1983 (Hurst 1987, Brown 1993 unpubl. ms.) by the Natural Resources Conservation Department (now NRCA), disclosing an uneven distribution. Most sightings occurred in shallow areas of the southern coast west of Kingston. The largest numbers were observed, in decreasing order, off the parishes of St. Elizabeth and Manchester, and in the Portland Bight, off the parishes of St. Catherine and Clarendon. The maximum count at any single survey was 13 (Fairbairn and Haynes 1982). Two aerial surveys have been conducted by Natural Resources Conservation Authority since then. Between March 6 and June 12, 1991 only 2 adults were sighted off the coast near Alligator Pond Bay, Clarendon; in April 10-11, 1993, 8 manatees were seen (1 at Manatee Bay, St. Catherine, 6 at Morant Bay, St. Thomas and 1 at the Salt Creek Bay, Portland). No calves were observed (Donaldson in 1993 *in litt.*). Manatees are reported more frequently for Treasure Beach (St. Elizabeth parish), Alligator Pond (Manchester parish), and Farquhar's Beach (Clarendon parish). Falmouth (Trelawny), Bloody Bay (Hanover), Morant Bay (Portland), Priory (St. Ann). Although commonly seen in the 1970's, manatees have not been reported for the Black River recently (Lefebvre *et al.* 1989).

Major threats and conservation problems

Human-related activities (poaching for food and incidental taking in fishing devices) constitute the major threats to manatees in Jamaica. An increase in the number of artisanal fishermen due to high unemployment rates, associated with destruction of coastal mangroves and seagrass beds has led to a decline in fish stocks. It is in the most economically depressed areas that local residents turn to manatee hunting (NRCA 1993 unpubl. report), using both harpoons and dynamite. Shaul and Haynes (1986) estimated that 3 manatees are killed a year usually in the most depressed areas of the south coast, such as in St. Elizabeth Parish between Parottee Point and Black

River (Hurst 1987). However, due to their relative rarity manatees are taken opportunistically rather than actively sought (Powell 1976 unpubl. report). Most manatee deaths are due to incidental or intentional entanglement in gill nets (NRCA 1993 unpubl. report). In 1976 Powell (unpubl. report) identified gill nets set perpendicular to the beach as a source of problems for manatees in Jamaica. Gill nets were seen in every area considered as suitable manatee habitat during the 1993 aerial surveys (Donaldson 1993 *in litt.*). Hurst (1987) reported on manatee deaths due to seine netting parallel to the coast in Long Bay, south coast of Jamaica. Gill and seine netting account for 23% of Jamaica's total catch (NRCA 1993 unpubl. report). Despite protection, manatees are intentionally caught in gill and seine nets and the meat sold illegally at boat sides on the beach, where it commands a higher price than fish or lobster (NRCA 1993 unpubl. report).

Habitat degradation and pollution may also be affecting manatee distribution in Jamaica. Raw sewage, industrial waste, and agricultural and urban runoff are dumped into Kingston Harbour and Cobre and Duhaney rivers; Rio Cobre also receives waste from beverage plants, and Black and Cabarrita rivers from sugar industries; and several rivers are being silted up due to deforestation of watersheds. Oil tankers wash their tanks close to Port Esquivel (adjacent to Old Harbour power station) where an oil leak in a storage pipeline destroyed 5 acres of seagrasses in 1984. In Port Kaiser seagrasses are smothered by spilled bauxite ore (Brown 1993 unpubl. ms.). Coastal seagrass beds have also been affected by thermal and industrial pollution, siltation and dredging, threatening manatees' food source (NRCA 1993 unpubl. report). In addition agricultural and waterfront development projects have claimed mangrove swamps in St. Catherine, Kingston Harbour and Montego Bay (NRCA 1993 unpubl. report). The use of explosives as a means of capturing fish has caused loss of some coastal wetlands (NRCA 1993 unpubl. report) and is a potential threat to manatees.

Socio-economic significant of the species to local communities

Manatees were used in pre-historic times (AD 900-1000) in the southern coast by Arawak Indians (Hurst 1987), and by Amerindians in the late 15th and early 16th centuries (Baughman 1946). In the past, the Alligator Hole River area had been used as a manatee butchering and cooking site (Hurst 1987).

National legislation and conservation measures

Manatees in Jamaica are considered endangered and vulnerable (Hurst 1987). They have been protected since 1971 by Jamaica's Wildlife Protection Act, which stipulates a J$10,000.00 fine or 12 months imprisonment to offenders. Although fishermen are aware of legislation, enforcement is inadequate (Donaldson 1993 *in litt.*). Jamaica signed the SPAW Protocol but is not yet Party to the CITES Convention.

An island-wide public education programme, with emphasis on the southern parishes, was conducted in 1991 as part of a United Nations Environment Programme (UNEP) and Government of Jamaica Manatee Project. The programme was geared towards elementary and high-school students, teachers, and fishermen and included the distribution of pamphlets, posters and bumper stickers (NRCA 1993 unpubl. report). Environmental non-governmental organizations often conduct talks with fishermen and other groups about manatees and environmental issues (Donaldson 1993 *in litt.*). Four female manatees (three of which were confiscated from fishermen) were placed in Alligator Hole River, Canoe Valley, Manchester Parish between 1981 and 1986, in an attempt to publicize and encourage manatee research and conservation (Operation Sea Cow) (Hurst 1987). The carrying capacity of Alligator Hole River was estimated (NRCA 1993 unpubl. report) and a programme set up in 1993 to try to increase the vegetation cover in that area, to support the captive manatees' need (Donaldson 1993 *in litt.*). A Manatee Management Plan has been produced outlining the management strategies for the West Indian manatee in Jamaica (Brown 1993 unpubl. ms.).

Mexico

Status and distribution

In a country with one of the most potential manatee habitats, and where the species used to be widely distributed, numbers have been reduced (Husar 1977, Campbell and Gicca 1978) due to the growing human population and associated activities (Colmenero 1991).

Manatees occur along the southeastern coast from Nautla, Veracruz, to southern Quintana Roo; however only in the wetland systems in the state of Tabasco and the bays and coastal springs along the eastern coast of the state of Quintana Roo they are reasonably abundant (Colmenero 1984, Colmenero 1991, Colmenero and Hoz 1986, Colmenero and Zárate 1990, Lefebvre *et al.* 1989, Morales and Olivera 1992). Manatees are present in Quintana Roo throughout the year with an increasing gradient from north to south and greatest concentration (89-93% of state population) in Bahia de Chetumal, Laguna Guerrero and Rio Hondo (Colmenero *et al.* 1988, Morales and Olivera 1992). Preliminary data on spatial movements of manatees in Bahia de Chetumal (Colmenero and Zárate 1990, Zárate 1993) and knowledge of manatee movements in Florida (Rathbun *et al.* 1983b) support the idea that the population crosses the political border to neighboring Belize. Tabasco harbors an important population, in the area of rivers Grijalva and Usumacinta and tributaries (e.g., San Pedro, San Pablo, San Antonio, Chilapa, and González rivers) plus adjacent lagoons (Colmenero and Hoz 1986, Colmenero *et al.* 1990). Contrary to Tabasco, Chiapas' population is very reduced, restricted to Laguna de Catajazá and interior lagoons close to Emiliano Zapata (Colmenero and Hoz 1986, Colmenero *et al.* 1990). In Campeche manatees occur in several freshwater systems connected to Laguna de Términos (e.g., río Palizada-laguna del Este towards Boca Chica; río del Este-lagunas de Atasta, Pom; río Chumpán-Balchacah; and río Candelaria-Panlau) but records for the coastal area are scarce (Campbell and Gicca 1978, Colmenero and Hoz 1986). There is a reduced manatee population in

the lagoons adjacent to rio de Soto (La Marina) and rio Pánuco (Tamaulipas) and Chairel lagoon (Lazcano-Barrero and Packard 1989, Colmenero *et al.* 1990, Colmenero 1991). In Veracruz the population is also sparse and occurs in lagoons interconnected with rio Nautla and tributaries of rio Papaloapan (Colmenero and Hoz 1986, Colmenero *et al.* 1990, Colmenero 1991). Manatees are scarce in northern Peninsula de Yucatan and northern Quintana Roo where animals found are mostly migrating (Gallo 1983, Colmenero and Zárate 1990, Colmenero 1991). Large bays of central Quintana Roo contain mainly isolated individuals or small groups (Colmenero *et al.* 1988).

At the national level, the sole information on population size is Heinsohn's (1976) overestimated 5,000 manatees. However, it is now believed that the total manatee population in Mexico ranges between 400 to 800 animals. The size of the manatee population in Quintana Roo is estimated at 110 individuals (Colmenero *et al.* 1988). Estimates for Bahia de Chetumal vary between a minimum of 60 (Zárate 1993) and an average of 83.3 (range of 71-95) (Morales and Olivera 1991). Bahia de Chetumal has been proposed as one of the most important mating and calving areas of western Caribbean (Morales and Olivera 1992) due to the percentage of calves varying between 5.0 and 12.4 during surveys (Morales and Olivera 1992, Zarate 1993). Arriaga and Contreras (1993, *cited in* Morales and Olivera 1993 unpubl. report) identified 9 manatee distribution areas in Tabasco, 4 of them containing more than 10 animals, according to information from local fishermen.

Major threats and conservation problems

Accelerated development along the coasts of Golfo de Mexico and freshwater systems of Campeche, Tabasco and Veracruz are cause of concern for the future of wetlands. Habitat is being lost along the coastal zone, new areas are being developed for tourism, improvement of urban zones and fishing activities (Morales 1993 *in litt.*) and both Mexico and Belize have many plans for urban development in the area of Chetumal which will undoubtedly affect the manatee population (Morales and Olivera 1992). The construction of some roads have altered the freshwater flow into Bahía de Chetumal, río Hondo and Laguna Guerrero, important areas for manatee cow-calf pairs. Another road is projected to pass over a water body that supplies freshwater to an area important to manatees in the southeast coast of the Chetumal Bay (Morales and Olivera 1993 unpubl. report). In the past 2 decades Quintana Roo has suffered fast changes in its coastal zone (Salazar-Vallejo 1992 *cited in* Morales and Olivera 1993 unpubl. report). A large portion of the area between Cancún and Chetumal is scheduled for massive tourism-oriented development causing a great deal of immediate concern about how future development will affect natural resources, particularly wetlands. Population growth is constant in key points such as rio Hondo, bahia de Chetumal and bays in Reserva de la Biosfera de Sian Ka'an (Morales, pers. com.). Important inlets for manatees in the corridor Cancún-Tulum have been altered, such as caleta de Xel-ha (Gallo 1983) and Xcaret, presently part of a tourist center (Morales and Olivera 1993 unpubl. report). Colmenero and Hoz (1986) suggested that manatees disappeared from the Papaloapan river and Alvarado lagoon (Veracruz) as a result of the construction of the Miguel Alemán dam, in the basin of the Papaloapan.

There have been several records of boat collisions, and deaths due to incidental entanglements in fishing nets. Gill nets set across the Usumacinta, Chacamax, and Palizada rivers for long periods

of time hinder manatee movements and affect their feeding and reproductive activities (Colmenero and Hoz 1986, Morales and Olivera 1993 unpubl. report). Collisions with boats may be occurring with motorized army boats travelling from the mouth of Rio Hondo to Unión; also due to competitions of fast boats from the mouth of Rio Hondo to the mouth of canal to Laguna Bacalar, areas used by manatees (Colmenero *et al.* 1988).

Extensive use of pesticides in chili pepper and sugar cane plantations close to rio Hondo and other water bodies both in Mexico and Belize are a potential threat to manatees (Morales 1993 *unpbl. report,* Morales and Olivera 1993 unpubl. report). Many petroleum industries in Tabasco may cause water pollution (Colmenero 1991). Manatees are said to have disappeared from Coatzacoalcos and Papaloapan rivers due to pollution and boat traffic (Colmenero 1991). The city of Chetumal does not have an adequate sewage system so all household waste water is discharged into the Bahia de Chetumal (Morales and Olivera 1993 unpubl. report).

Hunting has been the greatest threat to manatee survival in Mexico until recently. However, significant numbers are not killed anymore at the mouth of Rio Hondo and Bahia de Chetumal. In the last four years, six manatees have been reported killed in the Chetumal and Rio Hondo area (Morales et.al. l993, unp. report). Subsistence and some commercial hunting persists in areas of Veracruz (Nautla, Minatitlán and Cosamaloapan) and Campeche (Colmenero *et al.* 1990). In Quintana Roo and other southeastern states manatee ribs are still used in the handcraft industry. Figurines and bone jewelry sell for up to US$500.00 in places like Chetumal, Cozumel, Playa del Carmen and Mérida (Morales and Olivera 1993 unpubl. report).

Socio-economic significance of the species to local communities

Mayans used the manatee, which had great meaning in daily life of these peoples (Landa 1941, Bradley 1983, McKillop 1985). The main use given to manatee has been as a source of meat for subsistence. However the meat and bones are also said to have medicinal properties and the fat is used for cooking (Colmenero *et al.* 1988). In several localities in Mexico manatees have until recently been considered "white meat fish" of high traditional value and which should be respected outside of Easter week. Some grant them special importance for "deepening" rivers and maintaining them clear of plants that interfere with boat traffic (Colmenero and Hoz 1985).

National legislation and conservation measures

Manatees were first protected in Mexico in 1921 and 1925, when hunting became illegal under the Ley de Pesca. In October 1981 Departamento de Pesca prohibited the commercialization of any manatee product. Manatees in Mexico are classified as "subject to special protection" by Secretaría de Desarrollo Social. The new fisheries law of Secretaría de Pesca ratifies the prohibition of manatee hunting and stipulates fines between 2001 and 20,000 minimum wages for offenders and the Calendario Cinegético (hunting calendar) maintains its total protected status. Mexico has signed both the CITES Convention and the SPAW Protocol but has not ratified SPAW. (Morales 1993 *unp. report*).

A proposal is being presented to the government of Mexico to declare Bahia de Chetumal as a refuge for manatees (Morales 1993 *in litt.*). CIQRO's initiative has received support from 12

other institutions from the areas of research, law enforcement, education, communication, tourism, fisheries, and government (Morales and Olivera 1993 unpubl. report). Tabasco has an important population of manatees within the Biosphere Reserve of Pantanos de Centla; a few manatees also receive protection in Reserve Sian Ka'an.

Colmenero (1991) elaborated a recovery plan for the Antillean manatee in Mexico and identified priority actions to be taken for the management of manatees in the country. Manatee conservation is among the activities supported by the Sociedad Mexicana para el Estudio de Mamiferos Marinos (SOMEMMA, A.C.) (Morales and Olivera 1993 unpubl. report). In a workshop conducted by CIQRO in September 1992 representatives of Belize, Mexico and the United States analyzed the regional situation and made recommendations for research and conservation priorities for Quintana Roo and Belize (Morales *et al.* 1992). A joint proposal for a pilot radio-tracking programme in Belize and Mexico has been submitted to funding agencies.

To date educational programmes are only being carried out at a local level: by CIQRO in southern Quintana Roo and Universidad Veracruzana in Xalapa for the area of Coatzacoalcos and Papaloapan (Veracruz) (Colmenero 1991). During September and October 1993 CIQRO was to take to 70 elementary and high schools in the vicinities of Chetumal Bay, an environmental programme on the biology of the manatee and the importance of its preservation; the environmental message is also carried to the population via television, radio and newspapers (Morales and Olivera 1993 unpubl. report). Universidad Juaréz Autónoma de Tabasco recently completed the construction of the Centro de Investigaciones para la Conservación de Espécies Amenazadas, which will include captive studies and rehabilitation of manatees (Morales and Olivera 1993).

Nicaragua

Status and distribution

Nicaragua has one of the greatest potential manatee habitats in Central America, constituted by coastal lagoons, sluggish rivers and wetland areas, with abundant submergent and floating vegetation and offshore seagrass meadows. Two preliminary aerial surveys of all rivers and lagoons in l90 Km of Miskito coast in northeastern Nicaragua in l992 disclosed a surprisingly large number of manatees, with a total of 71 sightings constituting the highest sighting rate for the Caribbean basin (Carr l993 in ms). Over 90% of the manatees (including 2 calves) were sighted in Bismuna, and Waunta, two of the largest coastal lagoons (Carr l993 in ms). Miskito Indians and the turtle fishermen report that manatees frequent Pearl Lagoon estuary and Pearl Cays (Ryan l990 unpbl. report). Low numbers of manatees may occur at Lake Nicaragua and on the border with Costa Rica, in Rio San Juan (O'Donnell l981).

Major threats and conservation problems

Economic pressures derived from a long civil war are affecting coastal lagoon habitats. In one single coastal lagoon (Wanuta) 9 manatees were slaughtered by a small group of young fishermen in a two-week period in February l992. This incident may have been encouraged by outsiders interest in a video opportunity. The meat was distributed locally and all those who ate it reported becoming ill (Carr l993 in ms). As recent as January l993, the same group of fishermen killed 11 manatees in the same lagoon. No side effects to eating the meat were reported this time (Carr, pers. com).

Silt from inland deforestation and slash-and-burn practices may contaminate coastal areas. Proposals which are not environmentally sound, include toxic waste dumping, gravel mining along the coast, Cuban shrimping and Jamaican trap fishing (Velador spring l993). Gill nets were introduced to Pahara lagoon 10 years ago, but entanglements normally do not occur (Carr l993 in ms).

Socio-economic significance of the species to local communities

Rama Indians inhabit Rama Cay in Bluefields Lagoon, eastern Nicaragua. Manatee is important in Rama culture as a subsistence item and a symbol of social order and Rama themselves; its hunt, butchering, distribution and consumption of the meat by the community involves concepts of social co-operation and solidarity. The word "palpah" means manatee in Rama and Miskito (Loveland 1976). When a Rama boy is about to become a man he must go through the ritual of hunting, speaking to, and killing a manatee.

Interviews with local residents in two villages of Waunta and Pahara lagoons indicated that they have not hunted manatee for the past 2-3 decades, possibly due to low manatee population levels (Carr 1993, in ms). However, the two recent episodes of poaching in l992 and l993 raise the concern that revival of such activities may occur if measures to prevent them are not taken immediately.

National legislation and conservation measures

Legislative Decree 306 of 1956 protects manatees under a general hunting law Ley de Caza (Lefebvre *et al.* 1989); under that law in 1972 manatees were awarded an indefinite closed season. Protection is further provided under Decreto no. 625 of 1977 which prohibits commercial take or export of wildlife species in Nicaragua. Nicaragua is Party to the CITES Convention since 1977 but has not signed the SPAW Protocol.

The marine reserve Miskito Coast Biological Reserve (Reserva Marina y Costera Cayos Miskitos) created in 1991, in northeastern Nicaragua, and presently being implemented, includes plans for manatee conservation (C. Espinosa 1993 *in litt.*)

through a co-operative agreement between Caribbean Conservation Corporation and MARENA, the Nicaraguan Ministry of Natural Resources.

Panama

Status and distribution

Although no systematic surveys have been conducted, it is believed that manatee populations have decreased in Panama (Mou Sue *et al.* 1990). Panama has the longest Caribbean coastline in Central America but suitable habitat is limited. The total number of manatees in the country may be as low as 42 to 72 (Mou Sue *et al.* 1990). Resident manatee populations in Panama seem restricted to two main areas (Mou Sue *et al.* 1990): Bocas del Toro Province (specifically Changuinola and Chiriqui Grande areas) and in the Panama Canal system (including Gatún Lake and associated rivers). In the area of Changuinola manatees occur mainly in three sites: (a) Rio San San, especially in its lower reaches, away from human populations and boat traffic; (b) Lagunas de Changuinola, originated from the rerouting of Rio Changuinola by United Fruit Company to use lowlands for banana plantations; (c) Ensenada de Soropta (10 km northwest of the mouth of Rio Changuinola) with seagrass meadows and coral reef protection (Mou Sue *et al.* 1990). In the Chiriqui Grande area manatees have been sighted in Rio Mananti, a slow-moving river rich in *Panicum* sp. meadows which owes its name to manatees, and Rio Caña, including Lagunas Jugli and Damani (Mou Sue *et al.* 1990). Small numbers of manatees occur in the Gatún Lake area and Panama Canal (Montgomery *et al.* 1982, Mou Sue *et al.* 1990) derived at least partially to a translocation project in the early 60's (MacLaren 1967). Muizon and Domning (1985) speculate that manatees have reached the Pacific coast through the Canal. Occasional sightings occur in Veraguas and Colon (Mou Sue *et al.* 1990). Rio San San, and most specifically the La Olla lagoon, yielded the most consistent manatee observations during aerial surveys of separate river systems with emphasis in Bocas del Toro area. The high proportion of calves observed (15.7%), most of them in rio San San, indicates that reproduction is occurring in the area (Mou Sue *et al.* 1990).

Major threats and conservation problems

Although reduced in recent years, illegal hunting still highly threatens the small population of manatees in Panama, with poaching reported in Rio San San, Rio Sixaola and probably Rio Changuinola and surroundings, and occasional clandestine sale of manatee meat (Mou Sue *et al.* 1990).

Habitat degradation by economic activities may soon become the most serious pressure on manatee survival. The largest cattle-raising area in Panama is located between San San and Changuinola rivers. Extensive banana plantations in the same

area release drainage water with agrochemicals and pesticides into coastal areas and especially into the upper San San and Changuinola lagoons: The expansion of both industries may result in forest cutting and burning of the watersheds in the area of Changuinola (Mou Sue *et al.* 1990).

On a smaller scale, motorboat traffic in Rio San San (Mou Sue *et al.* 1990) represents a threat to the manatee population; to date only one boat-related manatee death was recorded in Lake Gatun (Mou Sue *et al.* 1990). Additional potential threats include (a) the exploration of the greatest peat deposit in the Caribbean region, located in Humedal de San San, close to the village of Changuinola; (b) the construction of 6 projected dams in the rivers Changuinola and Teribe, which will increase turbidity and divert water flow into Rio San San, ; and (c) alternative projects to the Panama Canal (Mou Sue *et al.* 1990).

Socio-economic significance of the species to local communities

Archaeological excavations at Cerro Brujo (Aguacate Peninsula) indicate that manatees represented an important source of protein to aborigines between 500 and 900 AD. Later on buccaneers supplied their ships with manatee meat from Bahia Almirante and Bocas del Toro (O'Donnell 1981). Manatee bone statuettes and batons were found in graves in the Central provinces and bone may have been important in Pre-Columbian trade (Lothrop 1937, Ladd 1964).

National legislation and conservation measures

The wildlife law Decreto no. 23 of 1967 extends protection and prohibits hunting of manatee, among other species; resolution no. -DIR-002-80 of 1980 of Ministerio de Desarrollo Agropecuario (Dirección Nacional de Recursos Naturales Renovables RENARE) declares the manatee as an endangered species. However this legislation is ineffective and needs revision (Mou Sue *et al.* 1990). Gill netting is forbidden in rivers (Mou Sue *et al.* 1990). Panama is Party to the Convention for the Protection of Flora, Fauna and Scenic Beauties (1972) and to the CITES Convention (1977), and signatory to the SPAW Protocol. Dirección de Áreas Protegidas y Vida Silvestre del Instituto Nacional de Recursos Naturales Renovables (INRENARE) and Asociación Conservacionista CARIBARO with support from Programas de Humedales de Panama of The World Conservation Union (IUCN), have proposed the San San area as a Ramsar site. Panama is a Party to the Ramsar Convention (Mou Sue *et al.* 1990).

Fundación de Parques Nacionales y Medio Ambiente (PA.NA.M.A) proposed the establishment of a marine reserve Parque Nacional Boca de los Toros.

During 1988, an educational programme was carried out among the population in the province of Changuinola, especially at high school level (Mou Sue *et al.* 1990).

Puerto Rico

Status and distribution

Comprehensive aerial surveys were flown in August 1976 and almost every month between June 1978 and March 1979, and between March 1984 and March 1985, in conjunction with interviews with coastal residents. Distribution of manatees in Puerto Rico is uneven, with most manatees spotted along protected areas of the southern and northeastern coasts. Roughly a third of the sightings occurred in the area of Roosevelt Roads Naval Station (RRNS) (Powell *et al.* 1981, Rathbun *et al.* 1985). Second in sighting frequencies is Jobos Bay in Guayama, and areas such as Guayanilla, Bahía Montalva, Joyuda, Cabo Rojo, Guanajibo, Toa Baja, Ocean Park, Loiza and Rio Grande are of tertiary importance. Around RRNS, half of the sightings occurred west of Isla Cabras (especially Pelican Cove and Ensenada Honda) and a quarter in northwestern Vieques Island (Rathbun *et al.* 1985). Similarities between results of the two aerial survey studies indicate that the Puerto Rico manatee population is at least not declining (Lefebvre *et al.* 1989). Highest counts were 51 in the first survey and 62 in the second; average number sighted was 22.6 and 43.6, and percentage of calves was 6.4% and 7.6% respectively (Powell *et al.* 1981, Rathbun *et al.*1985). Seventy-four (74) were sighted on the latest survey in l993 (Carr, unpbl. data).

Major threats and conservation problems

In the past 17 years, up to 8 manatee deaths have been reported each year in Puerto Rico (excluding poaching for meat). Direct takes represent the major source of mortality among the manatee population (25.3%), followed by watercraft-related fatalities, including jet skis (18%) and incidental entanglements in nets (7.4%) (Mignucci-Giannonni 1989). Some entanglement may result from nets being set intentionally to catch both manatees and sea turtles; animals are often slaughtered after becoming entangled (Powell *et al.* 1981, Rathbun *et al.* 1985).

National legislation and conservation measures

Manatees in Puerto Rico receive protection from several Commonwealth of Puerto Rico laws (Ley de Pesca del Estado Libre Asociado of 1936, Ley de Vida Silvestre of 1976, and the Commonwealth of Puerto Rico Vulnerable and Endangered Species Management Regulation of 1985), and the U. S. Marine Mammal Protection Act and the Endangered Species Act (Lefebvre *et al.* 1989, Mignucci-Giannonni 1989). Those animals using Roosevelt Roads Naval Station and Jobanes National Estuarine

Research Reserve, are partially protected by the restrictions imposed by federal agencies (Rathbun and Possardt 1986). The United States of America (which includes Puerto Rico) is Party to the CITES Convention since 1975 and has signed but not ratified the SPAW Protocol.

A recovery plan for the Puerto Rican population of manatees has been prepared (Rathbun and Possardt 1986) with the final objective of downlisting the species. The plan, which describes a series of recommendations in the areas of research, conservation and law enforcement is just beginning to be implemented. The Caribbean Stranding Network (Red Caribeña de Varamientos or RCV) co-ordinates the rescue and rehabilitation of orphaned and injured animals, and the salvage of dead manatees in Puerto Rico and the Caribbean region. RCV is also very active in environmental education and promotes lectures and ecological activities related to the conservation of turtles and marine mammals. In April 1992, the U.S. Fish and Wildlife Service initiated a feasibility study of radio-tracking manatees in Puerto Rico. To date, 6 manatees have been captured at RRNS and released with satellite-monitored radio transmitters.

Suriname

Status and distribution

In a country that used to be known by the large number of manatees, the species has decreased to the point of being considered one of Suriname's most endangered. The greatest decline occurred between 1700 and 1940 when Europeans exploited manatee meat, hides and oil (Duplaix and Reichart 1978). There is no recent information on manatee distribution but studies conducted in the late 1970's report manatees in rivers and creeks up to 60 km inland: the Corantijn and its tributary Nanni creek; Nickerie and tributaries Maratakka river and Paradise creek; Coppename and tributaries Coesewijne, Wayombo and Tibiti rivers; Commewijne River, with tributary Cassewenica creek; Cottica river with tributaries Perica river and Koopmans and Barbakoeba creeks; Wane Creek, Marowijne, Tapoeripacreek; and Saramacca and Suriname rivers (Duplaix and Reichart 1978). The greatest numbers observed in Nanni creek, Coesewijne, Tibiti and Cottica may be biased due to the small width of these water bodies (Duplaix and Reichart 1978, Husson 1978). The manatee has never been seen in open ocean (Husson 1978).

Duplaix and Reichart (1978) made an attempt at an estimation for population during aerial surveys over major river systems, but were discouraged by the turbidity of the water and vegetation cover. Best results were obtained from a questionnaire applied to 89 local residents, sightings and secondary evidence. Contradictory results were obtained from different segments of interviewees: some believed the reduction in hunting has allowed for manatee increase in numbers; Amerindians have noticed their disappearance from their usual haunts in the 30 years prior to interview.

Major threats and conservation problems

Habitat alteration is probably the major obstruction to manatee survival in Suriname. Manatees in Suriname inhabit the coastal area of the country, which is also the most populated area. Almost 95% of the human population in the country inhabit this area.

Drainage of swamps and diking of rivers for sugar, coffee and more recently rice plantations have been reclaiming land for centuries (Dekker 1967, Husson 1978). Boat collisions may become an important cause of manatee fatalities as the large number of small local boats are being fitted with motors. Traffic of cargo trips is heavy in all major rivers in Suriname (Duplaix and Reichart 1978). Poaching levels are considered light, with the last recorded episode in 1993 when a confiscated specimen, which was entangled in a fishing net and released in a canal was slaughtered for meat in the last week of December l993. Most illegal takes are practiced for the alleged medicinal powers of the earbones (Reichart 1993 in litt.).

Reports of manatees caught in fishing nets date back to the early 1970s but fishermen claim animals are immediately released (Duplaix and Reichart 1978, Husson 1978). Manatees are said to be more vulnerable during January and February (Husson 1978). Hunting pressure is very reduced nowadays, as the tradition of manatee hunts has not been passed to young people (Duplaix and Reichart 1978). Probably 8 of the original 15 manatees captive in canals are alive and well (Reichart 1993 *in litt.*). Four died by getting jammed in the canals where they were kept while clearing the canals of vegetation. Some probably escaped or were released in the wild by the holder.

Socio-economic significance of the species to local communities

Manatee meat, provided by Amerindians, represented an important source of protein to workers during the early days of Suriname plantations (Husson 1978). In Nickerie, western Suriname, 7 manatees were being used as weed control agents since 1965 (Duplaix and Reichart 1978). Only two legends about manatees were identified in Carib folklore (Duplaix and Reichart 1978). Additionally, their earbones are used for the treatment of whopping cough and epilepsy.

National legislation and conservation measures

Manatee is fully protected under the Nature Protection Act and the 1954 Suriname Game Ordinance as revised in 1970 (Duplaix and Reichart 1978, Husson 1978). However, due to the serious shortage of qualified personnel and transport means, enforcement is not as effective as it should be. Suriname became Party to the CITES Convention in l981, but has not acceded to the SPAW Protocol.

Although no reserve has been designated especially for manatees, they occur in the estuary and mangrove swamps of the 10,000 ha Coppename river Nature Reserve; and the presence of large numbers of manatees in the upper Coesewijne river has contributed to the selection of this area as a protected area. In l986, this area was declared a nature reserve. Another area, the Kaboericreek, where manatees also occur, has been proposed to be established as a nature reserve. Government approval of this reserve is expected soon.

Trinidad & Tobago

Status and distribution

In the early 1900s, manatees were considered rare in Trinidad (Groome 19..), to the point of being thought extinct by Bacon (1979). Manatees still occur in the Nariva swamp, Trinidad's largest freshwater wetland, where the annual flood of the Orinoco river may affect their distribution. J. A. Bindernagel, a consultant for FAO, conducted a series of interviews with fishermen, and boat and helicopter surveys in 1983 and concluded that the Trinidad manatee population did not exceed 100 animals (Amour 1993 unpubl. report). A 1991 aerial survey over the North Oropouche River/Nariva Swamp areas recorded evidence of 4 manatees and a follow-up boat survey found signs of manatee feeding (Seddon 1992). The Manatee Subcommittee of the Trinidad and Tobago Field Naturalist Club, initiated research on the manatee in 1993 and estimated there are approximately 25-30 manatees along the eastern coast of Trinidad. Significant groups are found in Big Pond, a large body of water with easy access, of fishermen and farmers through Manzanilla Road and no connection to the sea, in the north of the Nariva Swamp; and the Nariva River, just south of the pond, an area of difficult land access, connected to the ocean (Boyle and Khan 1993 unpubl. report). Additional areas of sightings include the North Oropouche, Charamel, and Otoire rivers (Amour 1993 unpubl. report, Boyle and Khan 1993 unpubl. report).

Major threats and conservation problems

Long term development plans and their effects on the hydrology and ecology of the area such as drainage of swamps and wetlands (especially the alteration of Nariva Swamp for rice and aquaculture), dam construction (such as the one proposed for the Biche area, west of Nariva Swamp), pesticide runoff and aquatic pollution, felling of mangrove trees, and quarrying, dredging and timber cutting in the North Oropouche threaten manatees in Trinidad (Hislop 1985, Seddon 1992, Amour 1993 unpubl. report, Boyle and Khan 1993 unpubl. report). The construction of ditches for access to the ocean might cause salinization of present freshwater areas. Sluice gate and canal construction in the river systems has resulted in the blocking of some areas to manatee local migrations, and possibly in the isolation of the two populations in the Nariva Swamp (Boyle and Khan 1993 unpubl. report). This could be very detrimental to genetic flow of an already small population.

There have been reports of accidental entanglement of manatees in the North Oropouche river (Hislop 1985) and in the L'Embranche River (North Manzanilla) in 1990 (Boyle and Khan 1993 unpubl. report). Data on poaching are contradictory (Amour 1993 unpubl. report, Boyle and Khan 1993 unpubl. report) but Seddon (1992) reports manatee meat being occasionally available in local markets, although it is unclear if the killing is intentional.

National legislation and conservation measures

The Conservation of Wildlife Act of 1980 encompasses manatees under its jurisdiction by default. The Nariva Swamp habitat is protected under the Fisheries Act of 1975 and declared the Nariva Swamp a Prohibited area under Legal Notice No. 78 of l993 of the Forest Act of l955. However, under the Fisheries Act of l990, manatees could be legally hunted unless the owner of the area objected to it, and enforcement of protective measures is not adequate, due to lack of manpower. The Nariva Swamp, and the Oropouche and Otoire river areas are being proposed to receive National Park status. The Nariva Swamp has been declared a RAMSAR site and the management plan for the area is presently being drafted (Amour 1993 unpubl. report, Boyle and Khan 1993 unpubl. report). Trinidad and Tobago became a Party to the CITES Convention in 1984 and is signatory to the SPAW Protocol.

The Manatee Subcommittee of the Trinidad and Tobago Field Naturalists' Club has been involved since 1991 in public education programme to schools and workshops. Funds are being sought to establish a Trinidad and Tobago Conservation Trust Fund for the conservation and management of natural areas and wildlife, including the manatee (Boyle and Khan 1993 unpubl. report).

In 1983, the Wildlife Section of Trinidad's Forestry Division initiated projects to evaluate the status of West Indian manatee and wildlife habitat, in 1990 the project for the development and management of wildlife sanctuaries for the protection of endangered species (including the manatee) in the island nation. The Wildlife Section is encouraging and providing training to community groups interested in ecotourism and conservation (Amour 1993 unpubl. report).

United States of America

Status and distribution

Florida manatees are found on both sides of the peninsula, which represents the northern limit of the specie's year-round range. Some individuals migrate to southern Georgia during the summer and occasionally, animals are sighted as far north as Virginia. Greatest numbers are seen in the St. Johns river, the Banana and Indian rivers to Jupiter Inlet, and Biscayne Bay on the east coast; and at the Suwannee, Crystal and Homossassa rivers, Tampa Bay, the Charlotte Harbor/Matlacha Pass/San Carlos Bay region, and in the creeks, rivers and bays of the Everglades, on the west coast (Lefebvre et al. 1989).

The latest and comprehensive aerial survey of 1992, revealed a minimum population size of 1856 manatees in Florida (Ackerman 1992) with similar proportions on both sides of the state.

Major threats and conservation problems

Human-related factors take the heaviest toll of the manatee population every year. Boat collisions represent the most important known mortality factor, but manatees are also vulnerable to drowning or infection as a result of entanglement in commercial fishing gear, entrapment

water control structures, poaching and vandalism. Among natural causes of mortality, deaths associated with unusually low winter temperature are prevalent (O'Shea et al. 1985). The number of deaths of dependent calves has been on the rise in the past years (Ackerman et al. 1992). Coastal residential and commercial development continues to threat manatee habitat (Packard and Wetterqvist 1986). Interactions of tourists with manatees also have the potential to harm manatees in various ways, and need to be closely monitored in the future.

National legislation and conservation measures

Florida manatees are considered endangered under the Endangered Species Act of 1973 and receive full protection under the U.S. Marine Mammal Protection Act of 1972. They are also protected under the Florida Endangered and Threatened species Act of 1977 and the Manatee Sanctuary Act of 1978. A recovery plan (U.S. Fish and Wildlife Service 1989) for the Florida manatee, formulated with the long-term aim of downlisting the species from endangered to threatened, is presently under implementation in Florida. The United States of America is Party to the CITES Convention since 1975 and has signed the SPAW Protocol.

Protective measures include the designation of 21 manatee sanctuaries to date, establishment and enforcement of boat speed zones throughout portions of the state in areas of manatee use, review and regulation of coastal development projects through county plans. The Save the Manatee Club has been instrumental at raising public awareness for the plight of the manatee, by means of information and education programmes.

Venezuela

Status and distribution

Aerial surveys of potential manatee habitat in conjunction with interviews with approximately 150 local inhabitants were conducted in Venezuela in 1986. In spite of extensive favourable habitat, only 8 sightings were made. This may be at least partially explained by non-ideal survey conditions, however it is generally agreed that manatee numbers have been greatly reduced in the past few decades (Mondolfi 1974, O'Shea *et al.* 1988). Manatees do not occur often along the Caribbean coast, probably due to unsuitable habitat (O'Shea*et al.* 1988). There are only 2 recent records, one for the mouth of Neveri river, state of Anzoátegui, in 1990 and one for Puerto Cabello, state of Carabobo, in 1991 (Ojeda *et al.*1993 unpubl. report). In contrast, eastern Venezuela offers favourable manatee habitat and reports are frequent along the Golfo de Paria in the states of Sucre and Monagas and in the Delta Amacuro Federal Territory. Rio Morichal Largo (Monagas) and Caño La Brea (Sucre), represent important freshwater sources. Sightings are also common throughout most of the Orinoco basin, including the delta. Manatees occur in low levels in northwestern Lake Maracaibo. They possibly also occur in swamps around the southwestern portion of the lake and portions of the 230.000 ha protected by the Reserva de Fauna Silvestre Ciénagas de Juan Manuel de Aguas Blancas y Aguas Negras (70.000 ha) and the

Cienaga de Juan Manuel National Park (160,000 ha) (Mondolfi l974, O'Shea *et al.* 1988).

Major threats and conservation problems

Manatees were hunted in the area of the Orinoco even before 1800 and the meat sold in local markets for many years (Mondolfi 1974). Warao Indians and local fishermen take manatees for their meat, fat, and other products (Ojeda *et al.* 1993 unpubl. report). Hunting tradition is slowly disappearing in Venezuela because of manatee scarcity, difficulty involved in the task, and lack of interest of younger groups; however meat is still occasionally offered at more inaccessible places (Mondolfi 1974, O'Shea *et al.* 1988). The threat of intentional killing is presently being replaced by incidental human-related deaths. Entanglement in net fisheries occurs mostly in the llanos tributaries of the Orinoco (e.g., Apure and Portuguesa rivers), and often-times is followed by the slaughter of the trapped animal. A few boat collisions have already been reported in Venezuela (O'Shea *et al.* 1988). Land reclamation and habitat alteration due to fisheries, agricultural, and industrial development, are certain to affect manatee populations in the near future (O'Shea *et al.* 1988, Ojeda *et al.* 1993 unpubl. report). Dams in Apure state, Caño Manamo and the Tucupita dike have already altered manatee routine. Oil exploration with associated barge traffic and pollution is intense at Lake Maracaibo. Mangrove logging and destruction, drainage of soils and flood control projects threaten the food base of manatees in the Monagas state and Orinoco delta (Moldolfi 1974, O'Shea *et al.* 1988). Manatees are susceptible to noises produced by motorboat traffic, illegal use of explosives, seismic prospection and oil exploitation (Ojeda*et al.* 1993 unpubl. report). The projected construction of a port for large cargo ships in Golfo de Pária will detrimentally affect one of the most pristine areas in Venezuela, which harbors important populations of manatees (e.g. caños La Brea, Deri, Guariquen, La Laguna) (Ojeda C. *et al.* 1993 unpubl. report).

Socio-economic significance of the species to local communities

Manatee has been widely used in Venezuela mainly as a source of food (said to taste like beef, pork and fish), but various products have been attributed medicinal properties. Nowadays they are actively hunted only by the Warao and some Creoles. Manatees have also played an important role in the folklore of indigenous peoples like the Warauno (who call them joninaba and aira), Piaroa, and tribes from the Amazonas Territory. On the basin of the Orinoco and Apure rivers, earbones are prized as good luck charms. Locality names such as Lago Manati, Picacho Manati and Caño Manati attest to the previous greater abundance and perhaps importance of manatees in local life (O'Shea *et al.* 1988, Ojeda *et al.*1993 unp. report).

National legislation and conservation measures

The Venezuelan Constitution and a number of laws are committed to the defense and conservation and natural resources (Ojeda *et al.* 1993 unpubl. report). Hunting is illegal and manatees are totally protected under wildlife legislation Ley de Protección a la Fauna Silvestre of 1970 (articles 11 and 17), Resolución MARNR no. 127 of 1978, and Resolución MARNR no. 95 of 1979 (O'Shea *et al.* 1988, Ojeda *et al.* 1993 unpubl. report) but, as in other Latin American countries, enforcement is lacking. Venezuela has ratified CITES since 1992 and is signatary to the SPAW Protocol. Four national parks encompassing manatee habitat have been declared:

Parque Nacional Ciénagas del Catatumbo, in the state of Zulia; Parque Nacional Mariusa in the state of Delta Amacuro; Parque Nacional Santos Luzardo, in the state of Apure; and Parque Nacional Turuepano, in the state of Sucre as well as one refuge, the Cienaga de los Olivitos and a reserve, the Cienaga de Juan Manuel de Aguas Blancas y Aguas Negras Wildlife Reserve, both of them in the state of Zulia. Caño La Brea and Morichal largo are being considered as future wildlife reserves or national protected areas (ANAPRO) (Ojeda *et al.* 1993 unpubl. report).

A number of governmental and non-governmental organizations are involved in research, conservation, and education projects, such as Fundación Vuelta Larga and Project Mermaid in the state of Sucre and Grupo Carun in Monaguas (Ojeda *et al.* 1993 unpubl. report, L. Ward 1993 *in litt.*), PROFAUNA in the state of Zulia (Ojeda *et al.* 1993 unpubl. report), and Fundación Ecológica Donã Barbara in the area of the llanos, (F. J. Estrada C. *in litt.*). Educational programmes developed in the past decade by conservation organizations have been instrumental in reducing the level of illegal hunting (O'Shea *et al.* 1988). The Caribbean Stranding Network, Save the Manatee Club (in Florida) and the U.S. Fish and Wildlife Service are supporting baseline studies of semi-captive manatees both in Venezuela and Colombia, and so far have provided for the rescue and rehabilitation of over 20 manatees (Mignucci 1992). In September 1992, la Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales (FUDECI) organized a symposium (Simposio Internacional sobre Delfines y otros Mamíferos Acuáticos de Venezuela) where research and conservation aspects of manatees were discussed. A management plan for the harvest and protection of mangroves in Monagas state has been designed by the Ministerio del Ambiente y Recursos Naturales Renovables (MARNR) (O'Shea *et al.* 1988). During the last quarter of l993, a Manatee Group was formed under the co-ordination of PROFAUNA (the Venezuelan fish and wildlife service), comprising several NGO's, one university, two zoos (with captive animals), as well as two other government agencies (INPARQUES and the Ministry of Foreign Affairs).

III. SHORT AND LONG-TERM RECOMMENDED ACTIVITIES

Achieving manatee conservation in the tropics is no easy task. The most difficult problem facing manatee conservation efforts in the Caribbean region is the need to reconcile the protection of species and the integrity of the habitat at the same time we protect the rights of the people using the same areas to survive. One aspect of this equation cannot be neglected in favor of the other; on the contrary, both must be taken into account. The Wider Caribbean is a puzzlework of developing nations, some undergoing civil wars, and populated by disadvantaged peoples at various levels of poverty and with high levels of population growth. The development of the region and its present and future generations depends on conservation, but in turn the latter will depend on how well its strategies serve the people. In an area of poor socio-economic conditions, manatee conservation is not likely to be a high priority. In addition tremendous economic and political pressure exists for the maintenance and expansion of fishing, logging, and coastal development activities, activities known to negatively impact manatees and their habitats. The great challenge is to unite socio-economic development and manatee conservation in a sustainable framework. This is likely to be a slow process, and will require a concerted effort from the various segments of the society. It will be necessary for Caribbean nations to commit to a long-term conservation goal, and start by enforcing protective measures, saving critical habitat, and educating its peoples.

The following paragraphs contain recommendations for short and long-term activities concerning the West Indian manatee in the Wider Caribbean region. Recommendations grouped in the category of "Priority Measures" for conservation, research, education, and law enforcement, should be implemented as immediately as possible. An annotated list of conservation measures to be implemented in a longer term is provided under "Conservation Measures". In the long run, these recommendations should allow the implementation and strengthening of a research, education and conservation programme designed to ensure the recovery and maintenance of manatees, and the protection of their habitats. However, they must be adopted as an integrated, multi-faceted programme, where the scientific findings and educational programmes provide support to the protective and legislative measures. General recommendations are followed by in-country specific activities being recommended for implementation in the short and long-term. These recommendations were identified in the course of reviewing the status of the manatee in the Wider Caribbean.

At the Sirenia Workshop held during the Sixth International Theriological Congress in Sydney, Australia, 7-9 July 1993, the Sirenia Specialist Group of IUCN's Species Survival Commission made some considerations about work with sirenians in areas where they have not been intensively studied. The group recommended primarily, the

use of relatively inexpensive approaches of easy access to researchers in those countries to derive basic information, in light of the fact that good quality data is required to make adequate management decisions. At a later time, and once baseline data has been gathered, more sophisticated equipment may be used and techniques attempted (Reynolds 1993 in litt). A problem common to most countries in the region is that, despite existence of protective legislation, financial and personnel limitations often prevent adequate implementation. However, in addition to conservation programmes, effective legislative measures will be necessary to ensure the survival of manatees in the Caribbean. On the other hand, protection and enforcement of laws will not be achieved unless the public understands and support those measures. Programmes of environmental education are an integral portion of a conservation programme and should be immediately implemented in areas where manatees occur. The public at all levels must understand the immediate and long-term benefits of species and habitat conservation. By stimulating appreciation and pride on the species, it may be possible to induce the development of a conservation philosophy, and achieve the goal of resource preservation. By being a high-profile species, the manatee may function as a catalyst in bringing together interested governmental and non-governmental agencies to elaborate comprehensive conservation plans. Manatees may be instrumental as well in the establishment of sanctuaries and attainment of the overall goal of preservation of coastal ecosystems with all their associated species.

A. PRIORITY MEASURES

1. Assess manatee status and distribution

A country-wide qualitative assessment of manatee status and distribution along coastal areas is necessary in every manatee-range country to include review of available information and causes of death. This has been accomplished in some countries, however, in others, there is no recent data on the situation of the manatee. The process may be initiated by conducting a literature search and reviewing all the scientific (including anthropological and archaeological) and popular literature, and local newspapers. Gathering of this information, will allow for the preparation of abackground report containing, but not limited to, sightings, mortality events, and life history observations. Interviews, carried out in several countries of the Caribbean with very positive results, provide fairly good insights on manatee distribution and trends (as well as the amount and type of mortality, including poaching) occurring each year. During this type of survey, the researcher may design questions to obtain information such as areas where manatees seem to occur more often, or for particular purposes (i.e., mating, resting) and at what times of the year. Interviews should be carefully designed to obtain the needed information without biasing the responses. Old manatee hunters, fishermen and local residents of coastal areas, are the most appropriate subjects for interview surveys. For this purpose, a standard questionnaire for

interviewing should be developed. The examination of the distribution of seagrasses and other aquatic plants, along the coastline may provide clues to the distribution of manatees in some countries. On an opportunistic basis, boats or aircraft should be used when possible to verify manatee distribution and habitat.

2. Define guidelines for data collection/censusing

Most of the techniques involved in the recommended activities (e.g., carcass salvage programmes, aerial surveys, telemetry, genetic sampling) are costly and effort-intensive. To ensure that results will be comparable among different countries, it is recommended that techniques and computerized storage formats be standardized including biological data (measurements, blood sampling and other) from captive, captured or incidentally captured and released animals. Data that is collected for each type of survey can be analyzed and displayed using computer software known as a Geographic Information System (GIS). While GIS hardware, software and personnel costs are currently higher than many research and management programmes can afford, data that must be collected for GIS analyses should include precise location in an accepted co-ordinated system like latitude/longitude, date, time and a unique identification number for each event.

3. Provide protection to manatees and manatee habitat

3a. Improve manatee awareness among the peoples of the Wider Caribbean

It is fundamental to the success of the conservation efforts to educate the public at all levels about the plight of the manatee in the Wider Caribbean in order to enlist their support to the cause. Conservation efforts should be encouraged by developing a targeted and specific educational and public awareness programme (or supporting an existing one). It must be emphasized that manatees are an integral component of the native fauna, culture, and history, and are vulnerable to the hazards associated with development and human activities such as gill netting and hunting. By clarifying the reasons for laws restricting such activities, we tend to reduce the resistance offered by affected people. Communication means such as radio, tv, magazines, and newspapers are the most effective ways to incorporate the environmental dimension into the daily life of people. Children can receive conservation education in school, and have the information reinforced at home through televised lectures or the airing of available videos on manatees (e.g., from Save the Manatee Club in Florida) on local television. A public radio service announcement may broadcast a programme for public awareness, extensive to rural areas. The awareness programme might also include a widely distributed poster, illustrated leaflets and brochures, a slide show, and signs on the waterways. In certain areas, the church infrastructure may be used as well. The "creation-centered Theology" with its emphasis on ecology and responsible

stewardship of the environment, is perfectly compatible and synergistic with efforts to protect manatees and other endangered species. Education, public awareness and community participation will all benefit from identifying progressive members of the clergy and influential laity and soliciting their help on these efforts at the local level. Special activities may be planned such as a manatee day during a local festival, or an adopt-a-manatee programme.

Despite conditions particular to each country in developing educational campaigns, a regional effort to find a common ground will be fruitful for all. Wider Caribbean countries, especially neighbours, must co-ordinate the production of educational materials (such as brochures, videos and posters) by sharing existing educational resources which will be a more cost-effective system. The Belize programme, with input from Save the Manatee Club in Florida, may be used as a model for public education programmes, in other countries of the region. Educational materials for the conservation programme need to be developed and produced in multi-lingual format: a) in English, Spanish, French and Dutch for application throughout the region, and ultimately b) in the local indian languages to allow maximum utilization in all countries. Funds spent on educational materials should be targeted on translation, adaptation, reprinting, and wider dissemination of existing materials in preference to developing wholly new materials, in the interest of minimizing duplication of efforts.

The design of the methodology and contents of the education and public awareness programmes, must be local in nature and according to the realities and needs of people to benefit from such programmes. It should also be designed to involve the local community at all levels. Environmental education programmes should focus on coastal regions inhabited by manatees where local communities interact with the animals. Materials developed should address particular audiences. A programme developed and distributed to the schools on the Caribbean coast should encourage children to learn more about manatees and observe them first hand. Adults should be encouraged to participate in selected scientific studies on manatees in their communities. It is of great importance in implementing regional programmes to prepare materials to be distributed to indigenous communities. In most places, there are usually only a small number of active manateepoachers, and environmental activities targeted at them might produce significant results; however, caution must be exercised not to stimulate interest in a potential product. In the most impoverished areas in particular, it is important to provide not only penalties for poaching but also viable economic alternatives. Specific measures to raise the standard of living should be implemented to the point where poaching is no longer necessary for survival, and enforcement efforts are accepted by the people and not seen as oppression for purposes that do not benefit the local population. Fishermen should be educated not to kill manatees and to release them alive from nets.

The potential of using manatees and their habitats as ecotourism attractions, and the benefits it might incur to the local economy and people knowledgeable on manatees may be invoked as a stimulus for hunters to side with conservation. Tourist-related jobs may also include food and lodging, transportation, guides, services, arts and crafts. The manatee-based tourist industry in Florida may serve as an example of what may occur in certain areas of the region. The programme should also apply to national and local law enforcement officers so that they understand the protection laws and the need for their enforcement. The importance of their task may be restated at law enforcement workshops and training sessions. Education programmes must also reach local authorities, managers, and policy-makers, instrumental in getting the laws approved and enforced, and providing funds necessary for investigation and regulatory activities.

Manatee life is intimately connected with the lives of coastal inhabitants. Ecological, social and economic aspects are intertwined and influence the biological work. It will be useful to develop research programmes about the relationships between traditional as well as modern communities in protected areas, and assemble information on the traditional significance of manatees in relation to the communities' needs, to obtain the complete picture of manatees' situation in the Wider Caribbean.

3b. Create protected areas and enforce relevant laws

Greater protection should be granted to manatees, both in law and in practice. The manatee must be maintained as a protected species as currently provided by laws of most Wider Caribbean countries. Countries of the Wider Caribbean need to ratify or accede the SPAW Protocol and the CITES Convention if they have not done so. In countries where legal protection is not guaranteed, efforts should be made to ensure manatee a protected status. Enforcement of existing laws is likely to be problematic, given the level of poverty of many countries of the region and understaffed law enforcement agencies. A combination of funds made available for the employment of extra personnel, and ensuring adequate transportation means, as well as for the implementation of educational programmes, should improve the success of protective measures.

In a world undergoing continuous and rapid alteration, it is fundamental to preserve manatee habitat. Manatees' basic requirements include water, food, shallow areas, and shelter, usually not encompassed in marine reserves. Known well-used sites, meeting those specifications should be designated as protected areas, refuges, or sanctuaries specifically for manatees, following the example of the Chocon-Machacas Reserve in Guatemala. Manatees are herbivores and depend on the quality and quantity of vegetation in and surrounding manatee preferred sites. Seagrass beds must be protected to ensure appropriate and uninterrupted supply. Additionally, fresh water

plant supplies, specifically aquatic true grasses, also need to be protected as a source of food for manatees. Areas known to be used for mating, calving, and resting, should be designated as critical habitat and enjoy the most stringent protection. Safe and quiet routes to and from the sea are also essential for manatee maintenance. As manatees seem to move over longer distances and time periods than previously thought (Rathbun et al. 1983b), protection must be granted to corridors connecting protected areas, thereby creating manatee reserve networks.

Wider Caribbean countries should ratify and offer support to the Ramsar Convention in the conservation of Ramsar sites, and become involved in the consolidation of biosphere reserves as conservation tools, appropriate to the environmental, cultural and socio-economic needs of the region. Probably the best way to conserve manatees is establishing large reserves/protected areaswhere any activity adverse or detrimental to the animals (hunting, net fishing, boating, human settlement) is outlawed. However, such an ideal situation may become harder and harder to achieve under the economic difficulties faced by many countries of the region. The best alternative may be a biosphere reserve approach, whereby the local populations are not removed from the area to be protected, and a zoning system is defined. Zoning includes areas to be maintained permanently untouched (such as areas identified as mating grounds, in the present case) and areas where a controllable take may be allowed for subsistence. This system will require a good amount of information on the species and the area. The selection process of zones takes into consideration the rights of the peoples affected by the designation of the protected area, and allows for local residents' opinion in the decision-making process. The involvement level derived from this strategy gives the local inhabitants a sense of responsibility which may be crucial in the attempts to save the manatee.

3c. Reduce human-related mortality

Considering that manatee populations in the Wider Caribbean are small, and the reproductive potential of the species is slow, it is necessary to keep human-induced mortality (the only one over which we may have) at a low level. Encourage, initiate and develop identification of mortality factors through a carcass salvage programme. As opportunities arise, examine dead manatees to determine their size, sex and cause of death. Records of locations where mortality occur should also be taken.

i). Maintain and increase law enforcement regulations to ban gill netting

In place of intentional hunting, manatees (especially young) in the Wider Caribbean are being killed due to accidental entanglement in nets. As the greatest immediate threat to manatees in the region, gill net fishing in rivers must remain banned, and further regulations implemented to prevent the misuse of this activity. Special

attention must be given to those nets illegally placed across or near the mouths of rivers, blocking off river mouths and the entrance to lagoons. If the trend of catching young animals continues, recruitment of manatee populations may be seriously threatened.

ii). Maintain and increase law enforcement regulations against manatee hunting

In many countries within the range of the species, manatee hunting by harpoon is on the decline, and seems to be naturally disappearing from the arsenal of native subsistence techniques. Despite this reducing trend, the take of even a few manatees every year may represent the difference between growth or decline of the very small manatee populations in the region. Hunters should be initially warned and later apprehended to set the example among violators.

4. Promote co-operation and exchange of information on manatee conservation at the national and regional levels

4a. Prepare national recovery plans and organize national recovery teams

A recovery plan consists of the compilation of guidelines for the appropriate preservation of the species and must serve the overall goal of ensuring the continued survival of manatee populations in the Wider Caribbean. A detailed recovery plan should be developed and implemented in each country of the Wider Caribbean where manatees occur, tailored to the specific needs and conditions of the country. Additionally, the plan must be formulated in such a way to attract relevant donors that will make the plan operational and financially viable. The document should be based on the best available data for each country and include an annotated list of the activities to be adopted in the fields of conservation, scientific research, law enforcement, and education. The recovery plan should include to the extent possible, contingency plan for single or catastrophic events (such as oil spills, hurricanes, epizootics), a protocol for rescue and rehabilitation of distressed or injured manatees, and guidelines on the release and re-introduction of rehabilitated animals to the wild. The Caribbean Stranding Network, in Puerto Rico, might be contacted regarding the latter points given their previous involvement with injured manatees. For example, guidelines for salvaging and necropsy will be available shortly from the Stranding Network. It is advisable to produce and distribute a list of individuals and agencies interested in helping during such events. Agencies and/or individuals should be assigned specific responsibilities and a time-table must accompany the recovery plan for implementation of each proposed activity. The plan must be revised and updated regularly, and reports being produced yearly. The elaboration of specific-area plans may be warranted for areas identified as of special interest for manatees.

Investigators, conservationists, managers, policy makers, government officials and non-government organizations, grass-roots and members of the local communities, should be involved in the elaboration of this document. This group of experts should comprise the national recovery team, in charge of co-ordinating the implementation of recovery activities, and monitoring and evaluating its progress at the national level. The establishment of national recovery teams will not attract any costs and the work of the network will be considered voluntary. Additionally, bilateral agreements with countries which have already developed their recovery plans could be undertaken to assist with the preparation of recovery plans in other countries.

4b. Establish an information and co-operation network among the Wider Caribbean countries that share manatee populations

i). Regional manatee network:

The establishment of an efficient and reliable communication system to allow exchange of experiences and information, as well as the co-ordination of efforts of common interest is of paramount importance. Individual countries must analyze the strategies utilized in the other countries of the region to conduct environmental education, as well as the technical, cultural, social, economic and political conditions that facilitate or retard their implementation. International interest and support may prove essential for successful manatee conservation in the Wider Caribbean. Manatees in Florida range over large areas and engage in long movements. Experts have suggested that Belize and Mexico share a manatee population in Chetumal Bay. Guatemala, Nicaragua and Honduras may also harbor mobile populations of manatees. In that context, manatee management will only be achieved through regional co-operation. The establishment of multilateral agreements will prove important not only for research purposes but to ensure that manatee protection extends beyond the boundaries of any given country. Data may eventually show that the Antillean subspecies may be treated as a single population, in which case an international management plan may be justified. A regional information-sharing system can only improve co-operation among the groups presently conducting research on manatees in countries of the Wider Caribbean. Sirenian researchers have the advantage of working with a small number of species distributed in a relatively restricted area, as compared to other marine mammal specialists. This unique characteristic allows professionals involved with manatee conservation in the Caribbean, to work at an almost grass roots level, with the tremendous advantage of facilitated co-ordination of activities and reduced levels of bureaucracy. The existing newsletter of the IUCN/SSC Sirenia Specialist Group, SIRENEWS, and The Pilot (the newsletter of the Marine Mammal Action Plan) should be considered as an important channel for sharing of information. Since already in existence, funding and time will not be required to develop another news-sharing mechanism.

The utilization of an electronic mail network within all institutions involved in manatee research and conservation in the region can expedite the exchange of information and is highly recommended. Use of the global Internet System should be promoted as one of the primary means of communication between institutions.

It should be noted that Brazil is the only country of the range of *Trichechus manatus* which is not included in the Wider Caribbean network. It is recommended that, for the purposes of conservation network, Brazil be considered as part of the manatee-range countries of the region.

ii).Manatee regional network co-ordinator:

A regional manatee co-ordinator should be elected to assist with the co-ordination of manatee-related activities in the region. Co-ordinator responsibilities should include collecting, centralizing and disseminating all information concerning manatees (specifically but not limited to mortality statistics and data, reproduction, movements), co-ordinating all research and manatee management activities, of the regional network and identifying relevant sources of financial support for specific projects.

B. LONG-TERM CONSERVATION MEASURES

1. Monitor the status of manatees in the region

1a. Status and distribution:

Aerial surveys have been widely used to determine manatee abundance and distribution in the Wider Caribbean (Bengtson and Magor 1979, Belitsky and Belitsky 1980, Rathbun et al. 1983, 1985, 1986, Powell et al. 1981, O'Shea et al. 1988). However, they constitute a very expensive technique which should be used only after the preliminary work of interview surveying has been completed. Interviews and the background report (see Priority Measures) should support focused aerial surveys. Surveys should cover the entire coast, including areas of past and present manatee presence and thoroughly search areas where manatee density might be anticipated, such as river mouths, or sites identified during the preliminary work. Boat searches should be dedicated only to areas of highest density. Following the more intense searching, regularly replicated aerial surveys are likely to disclose trends in manatee numbers and distribution. After basic data has been amassed and assuming funding is available, efforts could be concentrated on a few wild animals intensively followed, using radiotelemetry to obtain detailed information on movements and habitat use. Initially, only a few VHF tags should be used, and the number increased as appropriate. The use of more costly satellite tags should only be attempted after tag loss and visibility problems have been overcome, background data has accumulated,

and researchers are familiar with the techniques. Radio-tracked individuals can provide information about manatee behavior and social structure.

1b. Biological information leading to major aspects of population dynamics:

Current threats to the continued existence of manatees include hunting/poaching, incidental catch in fishing and shrimp nets, debris ingestion, monofilament lines and hooks, vandalism, contamination, and habitat loss. These factors must be quantified and monitored to obtain an understanding of their relative importance and plan regulatory measures accordingly. Potential conflicts between manatees and regional human activities, such as fishing, deforestation and construction of canals and dams should be identified and monitored. Baseline data must also be acquired on common diseases and parasites in manatees in the Wider Caribbean and their role in natural manatee mortality.

The carcass salvage/necropsy programme in effect in Florida for almost two decade has demonstrated the value of gathering long-term data. The recovery of carcasses found stranded or victims of accidental entanglement in fishing nets, can provide a wealth of information on basic life history parameters, as well as the most serious threats to manatees in the area, including realistic estimates of human-induced mortality. Florida, and more recently Puerto Rico, may serve as models for the implementation of this programme. Higher temperatures and lack of appropriate facilities will initially hamper efforts to obtain complete data, so standardized data sheets must be planned to expedite the process of data collection. A network of informants and a hotline for reporting dead manatees, followed by prompt response, may greatly improve the chances of success. If state of decomposition allows it, a complete necropsy should be performed and samples collected of all organs to help evaluate natural causes of mortality and conduct genetic studies, according to the necropsy manual developed by the U. S. Fish and Wildlife Service. In the long run, the data accumulated will permit the analysis of population biology parameters and application of population models to manatees in the Wider Caribbean.

2. Monitor habitat condition

2a. Identify habitat requirements and protect areas of special significance to manatees:

Countries in the Wider Caribbean are undergoing a series of alterations regarding coastal development and tourism activities. No species will survive if their habitat is gone. Therefore, it is fundamental to characterize and protect manatee habitat, and evaluate and monitor changes. The physico-chemical characteristics of water bodies inhabited by manatees, the distribution and abundance of feeding grounds (seagrasses and freshwater aquatic vegetation), and mating and calving areas should be

investigated and identified. The use of the Geographic Information System to display and manipulate geographically-referenced databases (e.g., manatee location, habitat data, information on development projects, and carcass salvage data) has been extremely useful in decision-making in Florida and should be implemented in the rest of the region, as soon as funding is available.

2b. Promote restoration of degraded manatee preferred areas:

In many countries, habitats previously occupied by manatees, have been altered by industrial and urban development, siltation, agricultural runoff and sewage. Areas historically used by the species must be returned to (or as possible as to) its original condition and released for manatee reoccupation.

3. Monitor and modify accordingly manatee awareness programmes and law enforcement measures

3a. Manatee awareness:

The use of a manatee conservation education programme in communities near future reserves should be regularly promoted, through the inclusion of an education component to all proposed and presently protected areas. An educational programme for park users and interpretation programmes for parks visitors, advising them of the regulations, should be initiated in protected areas that contain manatees. Small supervised tours, however, may be encouraged. Local personnel (park rangers, researchers, managers) must be trained, and tour operators running boats in and out of the area licensed, so they become familiar and understand the value of the resource, honor all regulations regarding manatees, and help educate the public. The success in the establishment of a new reserve or implementation of an existing park, will depend partially on the support received from the various segments of the society. Besides the regular public, it is important not to neglect the traditional cultures living within the boundaries of the protected area. Involving native people in the administration of the reserve will give them a sense of worth, prevent resistance to protective measures, and improve the possibility of success. Effective pathways should be identified to communicate with and inform local and national governments, and non-governmental organizations, about the reserve such as to obtain political support in the strengthening of the protected area. Efforts should be made to include manatee in management plans for national and state/district systems of protected areas. It is also important to ensure public access to the designated areas via public transportation to ensure regular visitors and consequently a significant impact on public awareness.

All education and public awareness programmes should be evaluated on a regular basis to assess their impact within the communities or the groups they are targeted for, and be modified if necessary.

3b. Assess and improve the effectiveness of existing law:

All countries should review the set of laws that makes up their protective legislation regarding manatees and their habitats. The protected status of manatees must be dealt with in an explicit manner, rather than by default in a more general fauna protection legislation. Any ambiguities that give margin to double interpretations in the law must be eliminated. If necessary, legislation should be expanded to address specific areas or conflicts.

Communication among experts on legislation of each country would allow a review of the legislation at a regional level, and might lead to the updating and standardization of laws and fines along the area of distribution of the manatee. This would guarantee the species a consistent regulatory and enforcement effort throughout its range.

4. Reduce activities that may be detrimental to manatees

Manatees are very mobile and do not remain in confined areas all the time. Consequently, manatees are subject to encounters with boats in the travelled waters. Watercraft collisions represent one of the most important causes of manatee mortality in the southeastern USA almost every year. The numbers of motorized boats in the region are rising as these have been replacing the traditional dugout canoes in Wider Caribbean countries. To prevent the development of a similar situation to the one in Florida, speeds will have to be regulated and boat areas designated in preferred manatee areas. As an added advantage, slow speed zones prevent bank erosion, water turbidity, and human fatalities.

Disturbances such as water skiing, snorkeling, SCUBA diving, jet skiing, boating, and fishing should be prohibited within the proximity of manatee areas. Tourism-associated practices must be regulated to prevent manatees from moving away from preferred or critical areas.

Coastal area development is accelerating in many areas of the Wider Caribbean. If unplanned, many of these activities may detrimentally affect manatee populations, by causing pollution, increased boat traffic and water turbidity, and mangrove destruction. It is necessary to consider these factors when drafting growth management plans for specific areas, and include sound and comprehensive policies regarding sewage treatment, agricultural runoff, contaminant input, mangrove destruction, deforestation, and erosion. Permit applications for the implementation of

large-scale development enterprises in manatee habitats, should require an environmental impact assessment, and educational and enforcement programmes.

It must be constantly kept in mind that the fundamental process bringing humans and manatees into increasing conflict is the continued explosive growth of the human population. Governments of all manatee-range countries must acknowledge -and manatee recovery plans must reflect- the fact that all efforts on behalf of manatees and other endangered species and their habitats, will ultimately be futile if human populations are not stabilized.

5. Develop guidelines for manatees and tourism

Ecotourism is a growing activity in many countries in the Wider Caribbean. Already, a number of countries offer attractions involving manatees. This trend is expected to grow as the search for pristine environments by the tourism industry increases.

Ecotourism has the potential for benefits to manatee conservation. These result primarily from a reduction in the mortality if former hunters convert to tour guides. However, the disadvantages to manatee conservation are also recognized.

The opportunities for targeting manatees in ecotourism will vary from country to country. Where such opportunities are being pursued, national policies and management strategies must ensure that disturbance to the animals is prevented.

The role of manatees in ecotourism or education should therefore be pursued only where effective management can be guaranteed, or where manatees need to be held in captive or recuperative programmes. Where ecotourism involving manatees is to be allowed, it should always be a part of a management plan for the species and strictly zoned, in order to minimize disturbance to breeding populations.

Small scale ecotourism is already taking place in countries like Belize and Trinidad. Many people are willing to travel long distances for the opportunity of observing unique wildlife in unspoiled ecosystems. Ecotourism may be beneficial to manatees if properly planned and managed and may represent an alternative source of income to hunters and fishermen, and generally improve the local economy. In Florida, the yearly income of thousands of tourists interested in seeing and swimming with manatees has rendered great public support for manatee conservation. However, there is a fine line between human-manatee contact and harassment. For the effective management of tourism in manatee protected areas, it is recommended that the scientific community, the tourist industry and the natural resources agencies jointly delineate policies, and define management strategies for visitors and granting of concessions to commercial enterprises. Such policies should be geared to prevent

harm to the animals and their habitats. Visitors must receive a short educational talk and be advised of the local rules. Only licensed guides, who must go through a training programme, may be allowed to take visitors for a closer viewing of the animals. The number of visitors must be limited, and their presence and actions regulated and restricted to certain areas and times of the day. Feeding will not be allowed and harassment should not be tolerated. In a few areas, swimming with manatees might be allowed. Only small-scale businesses, adapted to the local community, may be allowed into the area such as to improve the local economy rather than negatively affect it.

6. Develop guidelines for manatees in captivity

Programmes involving captive manatees in the Wider Caribbean should deal exclusively with the rescue and rehabilitation, with high consideration given to maximizing public education during the process. Rehabilitated manatees should be returned to the wild unless they are not re-adaptable to natural conditions. Programmes in Florida have demonstrated the feasibility of propagating manatees in aquaria. The monetary burden of maintaining manatees in captivity under adequate conditions may be excessive for many Wider Caribbean countries. Removal of manatees for captivity may also cause more harm to manatee conservation than help. The removal of only a few animals from small populations such as manatees in the Wider Caribbean, is likely to have an impact on the reproduction, gene pool and maintenance of the subspecies in the area. The concept of captivity for display may send the wrong idea that manatees are safe and efforts to preserve habitat and manatees in the wild are unnecessary.

Guidelines should be established for those cases where manatees are maintained in captivity for rehabilitation to ensure the well-being of individual manatees. All cases of captivity and semi-captivity,must be approved by the agency responsible for issuing the protective law for manatees. Captures for display and other non-rehabilitation situations must be prevented. Display of manatees (non-releasable, rehabilitated) must be coupled with public education and research programmes. For those animals that are maintained captive or semi-captive, a veterinarian must be appointed in charge of seeing to its well-being, proper and daily supply of well-balanced diet, and regular health check-ups. The long-term holding facilities must meet basic requirements regarding size of the pool/enclosure and water quality. In the eventual release of the animal back into the wild, the area for relocation must be carefully selected and the animal marked and closely monitored.

7. Provide training for local personnel and biologists in the area of coastal area management and conservation

The continuity of programmes dedicated to manatees into long-term national initiatives will require the development of local expertise and committed individuals. Local, regional and national biologists must be trained at various levels, from technician to graduate, as well as through internships and secondments. As the offer of wildlife programmes might be very limited at the local level, candidates may have to seek education abroad. Training may not have to be strictly on manatee biology, although some exposure to that field is highly recommended. Programmes should preferably focus on coastal wildlife management and conservation, which provide a broader scope of disciplines. Upon return to the native country, biologists will be expected to share their knowledge and experience with the local scientific community, and should entertain the idea of implementing a national programme. Close co-ordination would be maintained with the training component of the SPAW Regional Programme for protected areas and wildlife personnel.

C. SUGGESTED COUNTRY-SPECIFIC ACTIONS

In order to ensure that efforts to conserve manatees are regionally and nationally focussed on issues of critical importance, countries should attempt (based on existing information) to identify critical issues. In this context, the following country-specific actions are being recommended to assist with the identification of critical issues relevant to manatee conservation in each country. The underlined activities are being recommended as priority measures.

Belize:

Establish a reserve or park including Northern and Southern Lagoons, and the Manatee Bar area. Designate speed zones within Southern Lagoon to protect manatees from boat encounters. Fully protect Tarpon Hole from motorized boat activity. Exercise stronger enforcement, increase restriction, and consider banning altogether gill nets within the lagoon system. Regulate activities of nature tours programmed to interact with manatees (including feeding, snorkeling and swimming with the animals) in Southern Lagoon and the lower Belize River or off of Drowned Caye. Elaborate a comprehensive land-use plan for the Manatee Special Development Area and the Big Creek/Placencia Special Development Area and its watershed, addressing sewage practices, siltation, turbidity, increased high speed boat traffic, chemical runoff, petrochemical pollution, construction of docks and dredging around the lagoons, and mangrove destruction. Support and expand the environmental education programme conducted by the Belize Audubon Society to all coastal communities. Insert an education component to the proposed Manatee Sanctuary in Southern Lagoon. Monitor and regulate the expansion of citrus plantations around Southern Lagoon, and sugar plantations and factories along the New River. Monitor offshore shrimping and fishing practices. Continue efforts to assess population, and refine

census estimates, using radio telemetry and additional aerial surveys, focusing on Southern Lagoon. Define migration routes within Mexico and into nearby countries, preferably in co-operation with Mexico and Guatemala. Investigate the shore south of the ocean mouth of the Bar River as a possible offshore feeding or resting area. Monitor the incidence of entanglement of manatees in shrimp trawler equipment offshore Belize. Continue the monitoring programme on water quality in the lagoon system.

Colombia:

Conduct interview surveys to improve data on abundance and distribution of manatees in the country. Provide financial support to implement conservation programmes. Improve the housing and husbandry conditions of captive Zallida, in the Barranquilla Zoo as well as semi-captive manatees.

Costa Rica:

Conduct an exhaustive inventory to identify the exact locations where healthy manatee populations still exist. Enforce protective legislation especially in known high-use manatee areas such as Caño Servulo, in Tortuguero. Target conservation efforts around Tortuguero and the estuary of the Colorado river. Evaluate the socio-economic importance of this species to the black population of Tortuguero, main consumers of manatee meat, and implement an education programme. Determine manatee density in Parque Nacional Tortuguero.

Cuba:

Protect the complex Ensenada La Broa-Río Hatiguanico as manatee preferred areas. Regulate coastal fishing activities to reduce entanglement. Control tourism-oriented development in coastal areas. Support existing research proposals in the Zapata peninsula and the Sabana-Camagüey system.

Dominican Republic:

Protect freshwater sources at Tres Hermanas springs, and Las Calderas as critical manatee habitat. Protect preferred habitat at Monte Cristi, and Bahia Ocoa and Bahia Neiba. Establish legislation to regulate gill net fishing in areas used by manatees. Target environmental education programmes mainly at provinces between Manzanillo and Miches, and between Ocoa Bay and Beata Island.

French Guiana:

Conduct interview surveys and habitat checks. Establish legislation to regulate gill net fishing in areas used by manatees. Monitor the amount of organochlorides seeping into the canals from adjacent fields.

Guatemala:

Declare Lago de Izabal a manatee refuge. Maintain protection of El Golfete as a travel area. Establish legislation to regulate gill net fishing in areas used by manatees. Concentrate manatee awareness programmes in the Lago de Izabal/El Golfete/Rio Dulce area, using the Rio Chocon-Machacas Manatee Conservation Reserve as the focus of this education programme. Conduct more intensive surveys of Lago de Izabal. If funding is available, initiate a radiotelemetry study using VHF. If oil production begins, conduct surveys to monitor manatees near drilling sites. Establish a research programme on use of area and behaviour in the Cayo Padre area. Evaluate Cayo Padre as a calving/rearing area. Evaluate Punta Chapín as mating area. Conduct habitat studies to characterize habitats and food plants. Identify areas of aquatic meadows in Lago de Izabal. Initiate a network to report sightings of manatees. Continue water quality sampling where manatees occur.

Guyana:

Conduct interview surveys to update information on manatee distribution and abundance. Investigate the effects of boat traffic and gill netting on manatees.

Haiti:

Initiate an education programme aimed at fishermen. Regulate the use of beach seines to prevent manatee deaths.

Honduras:

Protect the coastal lagoons of La Mosquitia, declaring refuges for manatees at the Laguna Brus and the Caratasca system. Establish legislation to regulate gill net fishing in areas used by manatees. Further investigate the impact of gill net fishing over manatee populations. If it is certain that landlocked manatees will die, attempt to capture and release the animals. However, it is not recommended that manatees be relocated or introduced into new areas, given the potential dangers of failure. Conduct an updated survey of the Atlantic coast.

Jamaica:

Evaluate the situation of manatees in Alligator Hole River, and either supplement their food source or remove them from the river. As they are 4 females, their release would represent an important contribution to Jamaica's small manatee population. If they are not released they should be part of an intense public education programme. Conduct a survey on the location and intensity of gill-netting practices. Develop a public awareness programme for fishermen with emphasis in the southern parishes, and in areas where manatees are regularly observed including Old Harbour Bay, Farquhar's Beach, Alligator Pond, Black River, Treasure Beach, Falmouth, Port Antonio, in an attempt to reduce the number of manatees captured accidentally and on purpose.Regulate the widespread use of seine nets especially in the southern parishes. Beach seines are a threat to manatee, turtle and benthic communities. Feasibility of banning use of seine nets at least in critical manatee areas. Prevent destruction of mangrove swamps by declaration of these areas as Protected Areas under the NRCA Act. Identify critical manatee habitats (especially breeding areas) and ensure that as far as possible these areas are included in the protected area system. Implement the manatee management plan. Enforce the ban on the use of explosives as a fishing tool.

Mexico:

Declare Bahia de Chetumal (Quintana Roo) a refuge area for manatees. Preserve Laguna Guerrero and canals as an important area of reproduction and calving. Regulate use of nets in bays, lagoons and canals (especially along Chetumal Bay) to ensure liberation of manatees when accidentally entangled. Regulate traffic of motor boats in Bahia de Chetumal and Rio Hondo.Formulate a management plan for coastal resources to control development of human settlements and tourist developments in Quintana Roo. Control development activities in tourism corridor Cancún-Tulum. Develop a joint effort by Belize and Mexico in defining management strategies to protect manatees and their habitat in the Quintana Roo-Belize region. Consider rivers Grijalva and Usumacinta (Tabasco), Laguna Catajazá (Chiapas) and Laguna de Términos (Campeche) for protected area status. Expand environmental programmes in effect in Quintana Roo and Veracruz to other provinces, using the present programmes as examples. Regulate industrial development along margins of large rivers and lagoon areas of Veracruz, Tabasco and Campeche. Enhance law enforcement efforts in southern Quintana Roo and the hydrological system Rio Hondo-Bahia de Chetumal. Enforce legislation prohibiting manatee hunting, with special attention to manatee preferred areas. Establish and/or improve communication between inspectors from Belize and Mexico in charge of regulating and protecting the species to reach an agreement to safeguard manatees both in Mexican and Belizean waters. Restrict pesticide use in water bodies important for manatees. Control commercialization of ribs for handcraft. Clean up sewage released into Chetumal Bay. Control development activities in tourism corridor Cancún-Tulum. Evaluate and

properly regulate the maintenance of captive animals in Quintana Roo and in tourist center Xcaret, close to Cancún. Monitor annual changes in manatee distribution and habitat use in Quintana Roo. Initiate aerial survey/radio tracking programme in co-operation with Belize. Continue aerial surveys of selected areas to obtain a better estimate of the population. Start research projects with manatee population in Bahia de Chetumal/Rio Hondo system. Investigate mortality patterns and start a salvage programme in the southern portion of Quintana Roo. Update interview information in Campeche and Veracruz. Investigate the intercommunicable and adjacent lagoon systems in the basin of Chacamax river (Emiliano Zapata, Tabasco) as a potential habitat of special biological significance. Examine disturbances due to contamination and boat traffic in Coatzacoalcos river in Veracruz.

Nicaragua:

Continue and expand aerial censuses of major lagoons on the northeast coast of Nicaragua to better assess current status. Investigate seasonality of manatee distribution. Provide training to a local biologist on research techniques. Develop a management plan for manatees in Nicaragua's moskitia. Launch an educational campaign to improve awareness among local populations, specifically and with an emergency character at Waunta Lagoon. Produce educational materials in Miskito, English and Spanish.

Panama:

Establish protected areas along the rivers and lagoons used by manatees in Bocas del Toro province: San San, Changuinola, Mananti and Caña rivers, and Changuinola Damani and Jugli lagoons.Strictly enforce regulations against gill netting in rivers. Enforce hunting restrictions. Extend enforcement to Gatun Lake. Extend education efforts to Gatun Lake and Bocas del Toro province.

Puerto Rico:

Protect high-use areas such as Pelican Cove and Ensenada Honda from development, boat traffic, and pollution. Maintain the protected status of Roosevelt Roads Naval Station, (possibly an important area for cow-calf pairs) and Jobos Bay Estuarine Sanctuary. Protect treated sewage effluents known as important sources of freshwater. Enforce legislation relative to manatee hunting. Strengthen legislation regarding gill-netting and encourage enactment of legislation or regulation of boat speed zones in known manatee areas. Continue to conduct replicated aerial surveys to assess trends in the population. Continue and expand the radio-tracking programme initiated in 1992, the carcass salvage studies and the rescue and rehabilitation

project. Continue launching an intense education programme geared to manatee hunters, gill-net fishermen (to minimize catchers), boaters and the general public.

Suriname:

Protect areas of high manatee density such as Nanni creek, the upper Coesewijne river and the Perica river. Conduct an update interview survey to determine abundance and distribution (observation of the manatees in Suriname are virtually impossible.) Initiate an environmental education programme designed to discourage people from killing manatees for the alleged medicinal properties of the earbones. Improve enforcement of the Nature Protection Act to provide direct protection to manatees.

Trinidad and Tobago:

Update interview and aerial surveys along the country's coastal areas. Concentrate efforts initially in the Nariva area where residents have shown concern and interest in assisting with conservation efforts, and expand to adjacent areas. Review present legislation (especially the Fisheries Act of 1980) to provide better protection to manatees. Initiate the development of a draft recovery plan that aims at a sustainable and multiple use of the resources, having manatee and manatee habitat protection as a key goal.

U.S.A, Florida:

Include manatee protection plans in land-use proposals. Establish additional sanctuaries to protect critical habitat from development and watercraft activity. Enforce boat traffic regulations in the waterways.

Venezuela:

Declare extensive areas along the least populated waterways of the Delta as manatee reserves. Give a special emphasis to manatee management in the objectives for the establishment of reserves at Caño La Brea and Morichal Largo rivers. Grant manatee reserve status to Caño La Brea and Morichal Largo river. Formulate a management plan which includes manatee conservation for Cienaga de Juan Manuel (both the reserve and the national park) at the Lago de Maracaibo region, as well as for the existing or future protected areas: Turuepano, Caño La Brea and Morichal Largo. Formulate mangrove forest management plans for the Delta Amacuro State after the plans in existence for Monagas State. Educate fishermen to release manatees incidentally captured without harming them. Continue and increase enforcement of laws prohibiting manatee hunting. Enforce net fishery regulations, particularly in the

llanos tributaries of the Orinoco. Carefully evaluate effect of development projects, especially dikes and channel closures in Apure and Delta Amacuro States. Consider releasing the captive manatee presently under PROFAUNA'S responsibility, for biological and telemetry studies into a natural environment, possibly into Caño La Brea. Start working on the national recovery plan for the conservation of manatee. Improve the captive conditions, or alternatively, consider releasing the two manatees in a tank in San Fernando de Apure and one in Parque Zoológico de Barquisimeto and one at the Zoológico de Valencia.

D. FUNDRAISING

All of the above recommended activities, along with the relevant implementing institutions, will require financial and in-kind contributions. Funds will be necessary for the establishment of manatee conservation and public education programmes, and to continue research into local manatee populations and their habitats. Funding must be allocated to specific target activities and to those institutions that will implement the actual research, education and enforcement activities. Each country should identify in-country financing sources (including government agencies) and support the request for adequate funds so that the actions proposed may be implemented. Local government should contribute (in cash and in-kind) to the programmes, but alternative sources of financial support must be identified. Some costs may be defrayed by working in co-operation with neighbouring countries.

It is also recommended that through the SPAW Regional Programme of the Caribbean Environment Programme a financial contribution is allocated on a continued basis in support of manatee activities in the Wider Caribbean. This document and the future national recovery plans should assist at both the national and international levels with the fundraising required for the implementation of activities as soon as possible. A global Action Plan for Sirenia species is presently being drafted for IUCN. It is advisable to maintain communication with and join efforts with the IUCN and its Sirenian Specialist Group, as well as close co-operation with the Marine Mammal Action Plan.

IV. REFERENCES

Ackerman, B. B. 1991. Manatee aerial surveys in Guatemala. Unpublished manuscript. 6 pp.

Ackerman, B. B. 1992. 1992 Manatee aerial surveys in Guatemala. Unpublished manuscript. 8 pp.

Ackerman, B. B. 1992. Ongoing manatee aerial survey programs - a progress report. Pp. 14-15 *in* Interim report of the technical workshop on manatee population biology, T. J. O'Shea, B. B. Ackerman, and H. F. Percival (eds.). Manatee Population Research Report No. 10. Florida Cooperative Fish and Wildlife Research Unit. University of Florida, Gainesville, FL. 83 pp.

Ackerman, B. B., S. D. Wright, R. K. Bonde, D. K. Odell, and D. J. Banowetz. 1992. Trends and patterns in manatee mortality in Florida, 1974-1991. P. 22 *in* Interim report of the technical workshop on manatee population biology, T. J. O'Shea, B. B. Ackerman, and H. F. Percival (eds.). Manatee Population Research Report No. 10. Florida Cooperative Fish and Wildlife Research Unit. University of Florida, Gainesville, FL. 83 pp.

Allsopp, W. H. L. 1960. The manatee: ecology and use for weed control. Nature 188(4752): 762.

Allsopp, W. H. L. 1969. Aquatic weed control by manatees - its prospects and problems. Pp. 344-351 in L. E. Obend, eg. Man-made lakes. Ghana University Press, Accra. 398 pp.

Amour, K. 1993. Status of the West Indian manatee (*Trichechus manatus*) in Trinidad and Tobago. Unpublished report, 16 pp.

Augusta, C. 1992. Overview of Manatee Population and Preliminary Recommendations. Manatee Special Development Area. Unpaged manuscript.

Bacon, P. (ed.). 1979. Studies on the biological resources of the Nariva Swamp, Trinidad. Vols. I and II. Occasional Paper no. 4. Department of Zoology, University of the West Indies, St. Augustine, Trinidad.

Bartram, W. 1761. Travels through North and South Carolina, Georgia, east and west Florida. James and Johnson, Philadelphia.

Baughman, J. L. 1946. Some early notes on American manatees and the mode of their capture. Journal of Mammalogy 27:234-239.

Belitsky, D. W. and C. L. Belitsky. 1980. Distribution and abundance of manatees *Trichechus manatus* in the Dominican Republic. Biological Conservation 17:313-319.

Bengtson, J. L. 1981. Ecology of manatees (*Trichechus manatus*) in the St. Johns River, Florida. Unpubl. Ph.D. dissertation, University of Minnesota, Minneapolis. 126 pp.

Bengtson, J. L. and D. Magor. 1979. A survey of manatees in Belize. Journal of Mammalogy 60(1):230-232.

Bertram, G. C. L. 1974. Conservation of Sirenia - Current status and perspectives for action. Occasional paper no. 12, International Union for Conservation of Nature and Natural Resources, Morges, Switzerland. Manuscript 20 pp.

Bertram, G. C. L. and C. K. R. Bertram. 1963. The status of manatees in the Guianas. Oryx 7(2/3):127-135.

Bertram, G. C. L. and C. K. R. Bertram. 1964. Manatees in the Guianas. Zoologica (New York Zoological Society) 49:115-120.

Bertram, C. K. and G. C. L. Bertram. 1968. The Sirenia as aquatic meat-producing herbivores. Symposium of the Zoological Society of London 21:385-391.

Bertram, G. C. L. and C. K. R. Bertram. 1973. The modern Sirenia: their distribution and status. Biological Journal of the Linnean Society 5:297-338.

Best, R. C. 1981. Foods and feeding habits of wild and captive Sirenia. Mammal Review 11(1):3-29.

Best, R. C. and D. M. Teixeira. 1982. Notas sobre a distribuição e "status" aparentes dos peixes-bois (Mammalia:Sirenia) nas costas amapaenses brasileiras. 1. Boletim da Fundação Brasileira para a Conservação da Natureza 17:41-47.

Boardman, B. 1992. Manatee Special Development Area. Unpublished manuscript.

Boyle, C. and J. Khan. 1993. National report on the status of the West Indian manatee population in Trinidad and Tobago. Unpublished report, 6 pp.

Bradley, R. 1983. The pre-Columbian exploitation of the manatee in MesoAmerica. Papers in Anthropology, University of Oklahoma 24(1):1-82.

Brown, D. 1993. Management plan for the West Indian manatee in Jamaica. Unpublished document, NRCA, Government of Jamaica.

Burn, D. M. 1985. The digestive strategy and efficiency of the West Indian manatee, *Trichechus manatus*. M.Sc. Thesis, University of Miami. 57 pp.

Bradley, R. 1983. The pre-Columbian exploitation of the manatee in MesoAmerica. Papers in Anthropology, University of Oklahoma 24(1):1-82.

Caicedo, Dalila. l993. Estado actual del manati antillano, *Trichechus manatus* y del manati amazónico, *Trichechus inunguis* en Colombia. Unpbl.rep. 3 pp.

Campbell, H. W. and D. Gicca. 1978. Reseña preliminar del estado actual y distribución del manatí (*Trichechus manatus*) en México. Anales del Instituto de Biologia de la Universidad Autónoma de México, série Zoologia 49:257-265.

Campbell, H. W. and B. Irvine. 1975. Trip report: manatee survey in Dominican Republic, Feb. 14-25, 1975. Unpublished report, 9 pp.

Caribbean Conservation Corporation. Technical support for establishment of the Miskito Cays Marine and Coastal Reserve for biodiversity and cultural protection in northeastern Nicaragua - a proposal. 25 pp.

Carr, T. 1993. (in ms.). The manatees and dolphins of the Miskito Coast Protected Area, Nicaragua contract report to the us Marine Mammal commission, 33pp.

Cerrato B., C. A. 1993. Estado del manati en Honduras. Unpublished manuscript, 13 pp.

Charnock-Wilson, J. 1968. The manatee in British Honduras. Oryx 9:293-294.

Colmenero R., L. del C. 1984. Nuevos registros del manatí (*Trichechus manatus*) en el Sureste de México. Anales del Instituto de Biologia de la Universidad Autónoma de México 54(1983), série Zoologia 1:243-254.

Colmenero R., L. del C. 1991. Propuesta de un plan de recuperación para la población del manatí *Trichechus manatus* de México. Anales del Instituto de Biologia de la Universidad Autónoma de México, série Zoologia 62(2):203-218.

Colmenero R., L. del C., and B. E. Zárate. 1986. Distribution, status and conservation of the West Indian manatee in Quintana Roo, Mexico. Biological Conservation 52:27-35.

Colmenero R., L. del C., J. C. Azcarate C., E. Zarate B. 1988. Estado y distribucion del manati in Quintana Roo. Final report, Centro de Investigaciones de Quintana Roo. Cancun, Quintana Roo. 159 pp.

Colmenero R., L. del C. and E. Hoz Z. 1985. Distribucion, situacion y conservacion de los manaties en Mexico. Memoria de la X Reunion Internacional sobre Mamiferos Marinos, 24-27 Marzo: 177-196.

Colmenero R., L. del C. and E. Hoz Z. 1986. Distribucion de los manaties, situacion y su conservacion en Mexico. Annales del Instituto de la Universidad Autonoma de Mexico 56(1985), Serie Zoologia 3:955-1020.

Colmenero-R., L. C. and B. E. Zárate. 1990. Distribution, status and conservation of the West Indian manatee in Quintana Roo, Mexico. Biological Conservation 52:27-35.

Colmenero R., L. del C., B. Morales V., and I. Fuentes A. 1990. Proyecto: Investigacion y conservacion del manati *Trichechus manatus* en Mexico. Programa Nacional de Investigacion, Conservacion y Manejo de los Mamiferos Marinos, Subprograma Especies Amenazadas o en peligro de extinction y su relacion con las actividades pesqueras y el deterioro ambiental. Manuscript, 13 pp.

Craig, A. K. 1966. Geography of fishing in British Honduras and adjacent coastal waters. Coastal Study Series no. 14. Louisiana state University Press, Baton Rouge, LA. 143 pp.

Crombie, R. I. 1975. Manatee survey of the south-eastern tip of the Republica Dominicana, July 1975 - a continuation. Unpublished report. 9 pp.

Crombie, R. 1975. A report on the status and distribution of the manatee, *Trichechus manatus,* in Jamaica. Report prepared for the U.S. Fish and Wildlife Service, Gainesville. 8 pp.

Cuni, L. A. 1918. Contribución al estudio de los mamíferos acuaticos observados en las costas de Cuba. Memorias de la Sociedad Cubana de Historia Natural "Felipe Poey" 3:83-126.

Dekker, D. 1967. Zeekoeien uit Suriname II. Artis 12(6):184-191.

Domning, D.P. 1990. Distribution and status of manatees in Cuba. Sirenews 13:5-6. Department of Anatomy, Howard University, Washington, D.C.

Domning, D. P. 1992. Why save the manatee? Pp. 168-173 *in* Manatees and Dugongs, J. E. Reynolds III and D. K. Odell. Facts on File, New York. 192 pp.

Domning, D.P. and L. C. Hayek. 1986. Interspecific and intraspecific morphological variation in manatees (Sirenia: *Trichechus*). Marine Mammal Science 2:87-144.

Duplaix, N. and H. A. Reichart. 1978. History, status and protection of the Caribbean manatee *Trichechus m. manatus* in Suriname. Rare Animal Relief Effort and United States Fish and Wildlife Service, unpublished report. 23 pp + x append.

Elizondo C., L. H. 1993. El manati (*Trichechus manatus*) en Costa Rica. Pp. 94-95 *in* Base de Datos Conservación. Instituto Nacional de Biodiversidad (Convenio INBio-TNC).

Estrada, A. R. and L. T. Ferrer. 1987. Distribución del manatí antillano, *Trichechus manatus* (Mammalia: Sirenia), en Cuba. I. Región occidental. Poeyana 354:1-11.

Etheridge, K., G. B. Rathbun, J. A. Powell, and H. I. Kochman. 1985. Consumption of aquatic plants by the West Indian manatee. Journal of Aquatic Plant Management 23:21-25.

Fairbairn, P. W. and A. M. Haynes. 1982. Jamaican surveys of the West Indian manatee (*Trichechus manatus*), dolphin (*Tursiops truncatus*), sea turtles (Families Cheloniidae and Dermochelydae) and booby terns (Family Laridae). FAO Fisheries Report no. 278: 289-295.

Ferrer, L. T. and A. R. Estrada. 1993. Informe sobre el estado del manati antillano en Cuba. Unpublished report, 4 pp.

Forrester, D. J. 1992. Parasites and diseases of wild mammals in Florida. University Press of Florida, Gainesville. 459 pp.

Frantzius, A. von. 1869. Die Saugethiere Costaricas. Arch. Naturgesch (Berlin) 35:247-325.

Gallo R., J. P. 1983. Notas sobre la distribucion del manati (*Trichechus manatus*) en las costas de Quintana Roo. Annales del Instituto Biologica de la Universidad Nacional Autónoma de México 53, Série Zoologia 1:443-448.

Gibson, J. 1992. Manatees in Belize - a discussion paper, manuscript for presentation at a meeting September 1992.

Groome, J. R. 19.. A natural history of the island of Grenada, W.I. Caribbean Printers Limited, Trinidad. 115 pp.

Gumilla, J. 1745. El Orinoco ilustrado, y defendido, historia natural, civil, y geographica de este gran rio, y de sus caudalosas vertientes. Tomo primero, segunda impression: 226-228.

Hartman, D. S. 1979. Ecology and behavior of the manatee (*Trichechus manatus*) in Florida. American Society of Mammalogists, Special Publication 5:1-153.

Heinsohn, G. E. 1976. Sirenians - draft report. In Scientific Consultation on Marine Mammals, Bergen, Norway, 31 Aug.-9 Sep. 1976. Food and Agriculture Organization, U.N. (FAO), ACMRR/MM/SC/WG 4-1.

Hislop, G. 1985. Trinidad and Tobago. Sirenews 3:8. Department of Anatomy, Howard University, Washington D.C.

Hurst, L. A. 1987. The status and distribution of the West Indian manatee (*Trichechus manatus*) in Jamaica, with an evaluation of the aquatic vegetation of Alligator Hole River. M.A. thesis, University of Florida, Gainesville. 170 pp.

Husson, A. M. 1978. The mammals of Suriname. Zoölogishe Monographieën van het Rijksumuseum van Natuurlijke Historie No. 2: 334-339 (Sirenia). E. J. Brill, Leiden.

Husar, S. L. 1977. The West Indian manatee (*Trichechus manatus*). Wildlife Research Report 7, United States Department of the Interior. Washington, D.C., 22 pp.

INDERENA (Instituto Nacional de los Recursos Naturales, Renovables y del Ambiente.) Division de Fauna Terrestre l993. Informe del estado actual del manati antillano (*Trichechus manatus*) en Colombia. Unpub. report, 6pp.

Irvine, A. B. 1983. Manatee metabolism and its influence on distribution in Florida. Biological Conservation 25:315-334.

Irvine, A. B. and H. W. Campbell. 1978. Aerial census of the West Indian manatee, *Trichechus manatus*, in the Southeastern United States. Journal of Mammalogy 59:613-617.

Irvine, A. B., J. E. Caffin, and H. I. Kochman. 1982. Aerial surveys for manatees and dolphins in western peninsular Florida. Fishery Bulletin 80:621-629.

Janson, T. 1977. The ecology and conservation of the Guatemalan manatee. Progress report 13 May 1977. Unpublished manuscript, 6 pp.

Klein, E. H. 1979. Review of the status of manatee (*Trichechus manatus*) in Honduras, Central America. Ceiba 23(1):21-28.

Kochman, H. E., G. B. Rathbun, and J. A. Powell. 1985. Temporal and spatial distribution of manatees in Kings Bay, Crystal River, Florida. Journal of Wildlife Management 49(4):921-924.

Ladd, J. 1964. Archaeological investigations in the Parita and Santa María Zones of Panamá. Smithsonian Institute Bureau of American Ethnics, Bulletin 193.

Landa, D. de. 1941. Landa's relación de las cosas de Yucatán. Vol. 18. A. M. Tozzer (trans. and ed.). Papers of the Peabody Museum of American Archaelogy and Ethnology. 200 pp.

Lazcano-Barrero, M. A. and J. M. Packard. 1989. The occurrence of manatees (*Trichechus manatus*) in Tamaulipas, Mexico. Marine Mammal Science 5(2):202-205.

Lefebvre, L. W., T. J. O'Shea, G. B. Rathbun, and R. C. Best. 1989. Distribution, status, and biogeography of the West Indian manatee. Pp. 567-620 *in* The biogeography of the West Indies: past, present, and future, C. A. Woods, ed. Sandhill Crane Press, Gainesville, FL. 878 pp.

Lomolino, M. V. 1977. The ecological role of the Florida manatee (*Trichechus manatus latirostris*). M.Sc. Thesis, University of Florida, Gainesville.

Lomolino, M. V., and K. C. Ewel. 1984. Digestive efficiencies of the West Indian manatee (*Trichechus manatus*). Florida Scientist 47:176-179.

Lothrop, S. K. 1937. Coclé: an Archaeological Study of Central Panamá. Harvard University Press.

Loveland, F. O. 1976. Tapirs and manatees: cosmological categories and social process among Rama Indians of eastern Nicaragua. Pp. 67-82 *in* Frontier Adaptations in Lower Central America, M. W. Helms and F. O. Loveland (eds.). Philadelphia Institute for the Study of Human Issues. Philadelphia, PA. 178 pp.

MacLaren, J. P. 1967. Manatees as a naturalistic biological mosquito control method. Mosquito News 27(3):387-393.

Marmontel, M. 1993. Age determination and population biology of the Florida manatee, *Trichechus manatus latirostris*. Ph.D. dissertation, University of Florida, Gainesville. 410 pp.

Matola, S. 1986. Belize Zoo Outreach/Future in the Wild: developing a conservation awareness for the West Indian manatee, *Trichechus manatus*, in Belize, Central America. Manuscript, 5 unnumbered pages.

McKillop, H. I. 1985. Prehistoric exploitation of the manatee in the Maya and circum-Caribbean areas. World Archaeology 16(3):337-353.

Mignucci, A. 1992. Caribbean region - Manatee research in Colombia and Venezuela. Sirenews 18:12-13. Department of Anatomy, Howard University, Washington D.C.

Mignucci-Giannoni, A.A.,B. Pinto-Rodriguez, R.A. Montoya-Ospina, D.P.Moore, and E.H. Williams. l993. Stranding and mortality assessment of marine mammals in Puerto Rico and the Virgin Islands. presented at the Tenth Biennial Conference on the Biology of Marine Mammals, Galveston, Texas, 11-16 November.

Mignucci-Giannoni, A.A., l989. Zoogeography of marine Mammals in Puerto Rico and the Virgin Islands. Unpbl. master's thesis, The University of Rhode Island

Mondolfi, E. 1974. Taxonomy, distribution and status of the manatee in Venezuela. Memorias de la Sociedad de Ciencias Naturales La Salle 34(97):5-23.

Montenegro, P.M.I. l994). Distribución Espacial de la Vaca Marina Trichechus inungis)Mammalia:Sirenio= en el río Amazonas, Trapezio Amazónico, Trianea (Act.Cient.Tecn. INDERENA), 5:323-334

Montenegro, P.M.I. 1995). Evaluación Ambiental de la Ciénaga de Paredes, Santander, como hábitat potencial para fauna silvestre con énfasis en el manatí (*Trichechus manatus*). Informe final INDERENA 'Banco de la República, 70p.

Montgomery, G. G., N. B. Gale, and W. P. Murdoch, Jr. 1982. Have manatee entered the eastern Pacific Ocean? Mammalia 46(2):257-258.

Moore, J. C. 1951. The range of the Florida manatee. Quarterly Journal of the Florida Academy of Sciences 14:1-19.

Morales V., B. and L. D. Olivera G. 1991. Presencia y distribución de manatíes *Trichechus manatus* en la Bahía de Chetumal, Q. Roo, Mex. XVI Reunion Internacional para el estudio de los mamiferos marinos 2-5 abril. Nuevo Vallarta y la Cruz de Huanacaxtle, Bahia de Banderas, Nayarit. Manuscript, 13 pp.

Morales V., B. and L. D. Olivera G. 1992. La Bahia de Chetumal y su importancia para el manati en el Caribe mexicano. Trabajo presentado en la XVII Reunion Internacional para el Estudio de los mamiferos marinos. 21-25 abril 1992, La Paz, B.C.S., Mexico. 13 unnumbered pages.

Morales V., B. and D. Olivera G. 1993. Situacion de la poblacion de manaties (*Trichechus m. manatus*) en Mexico. Unpublished report, 16 pp.

Morales V., B., J. Gibson, L. W. Lefebvre, J. Reynolds III, G. B. Rathbun, and L. D. Olivera G. 1992. Recomendaciones para las investigaciones y manejo del manati en Quintana Roo y Belice. Conclusiones del Taller para establecer las prioridades de investigación y conservación de los manatíes en el Caribe Mexicano y Beliceño. 7-8 de septiembre de 1992. 5 pp + Directorio. Documento Interno. CIQRO, Chetumal, Q. Roo, Mexico.

Mou Sue, L. L., D. H. Chen, R. K. Bonde, and T. J. O'Shea. 1990. Distribution and status of manatees (*Trichechus manatus*) in Panama. Marine Mammal Science 6(3):234-241.

Muizon, C. D., and D. P. Domning. 1985. The first records of fossil sirenians in the southeastern Pacific Ocean? Mammalia 46:257-258.

National Science Research Council of Guyana and National Academy of Sciences, USA. 1973. Some prospects for aquatic weed management in Guyana. Workshop on aquatic weed management and utilisation. Georgetown, Guyana

National Science Research Council. 1974. An international centre for manatee research. Georgetown, Guyana. 34 pp.

Natural Resources Conservation Authority. 1993. National report on the status of the West Indian manatee (*Trichechus manatus manatus*). Unpublished report, 8 pp.

O'Donnell, D. J. 1981. Manatees and man in Central America. Unpublished Ph.D. dissertation, University of California, Los Angeles.

Ojeda C., M. M., J. Porras, H. Gonzales, and J. Ojasti. 1993. Estado actual del manati antillano *Trichechus manatus* en Venezuela. Informe nacional. Unpublished report, 14 pp.

O'Shea, T. J. 1992. Florida manatee *Trichechus manatus latirostris*. Pp. 190-200 *in* Rare and Endangered Biota of Florida. Volume I. Mammals, S. R. Humphrey, ed. University Press of Florida. 392 pp.

O'Shea, T. J. and C. A. Salisbury. 1989. Status of manatees, *Trichechus manatus* (Mammalia: Sirenia), in Belize, with results of a May 1989 aerial survey. Trip report, 30 pp, 7 figs.

O'Shea, T. J. and C. A. Salisbury. 1991. Belize - a last stronghold for manatees in the Caribbean. Oryx 25(3):156-164.

O'Shea, T. J., C. A. Beck, R. K. Bonde, H. I. Kochman, and D. K. Odell. 1985. An analysis of manatee mortality patterns in Florida, 1976-1981. Journal of Wildlife Management 49:1-11.

O'Shea, T. J., M. Correa-Viana, M. E. Ludlow, and J. G. Robinson. 1988. Distribution, status, and traditional significance of the West Indian manatee *Trichechus manatus* in Venezuela. Biological Conservation 46:281-301.

O'Shea, T. J., G. B. Rathbun, R. K. Bonde, C. D. Buergelt, and D. K. Odell. 1991. An epizootic of Florida manatees associated with a dinoflagellate bloom. Marine Mammal Science 7:118-146.

Packard, J. M. 1981. Abundance, distribution, and feeding habits of manatees (*Trichechus manatus*) wintering between St. Lucie and Palm Beach Inlets, Florida. United States Fish and Wildlife Service Contract Report No. 14-16-004-80-105. 142 pp.

Packard, J. M. 1985. Preliminary assessment of uncertainty involved in modelling manatee populations. Manatee Population Research Report No. 9, Technical Report No. 8-9. Florida Cooperative Fish and Wildlife Research Unit, University of Florida, Gainesville. 19 pp.

Packard, J. M. and O. F. Wetterqvist. 1986. Evaluation of manatee habitat systems on the northwestern Florida coast. Coastal Zone Management Journal, 14:279-310.

Powell, J. 1976. Trip report - Jamaica. Unpublished report. 6 pp.

Powell, J. 1978. Evidence of carnivory in manatees (*Trichechus manatus*). Journal of Mammalogy 59:442.

Powell, J. A. and D. F. Gicca. 1975. Trip report to Colombia, South America. Unpublished report. 6 unnumbered pages.

Powell, J. A. and G. B. Rathbun. 1984. Distribution and abundance of manatees along the northern coast of the Gulf of Mexico. Northeast Gulf Science 7:1-28.

Powell, J. A. and J. C. Waldron. 1981. The manatee population in Blue Spring, Volusia County, Florida. Pp. 41-51 *in* The West Indian manatee in Florida, R. L. Brownell and K. Ralls (eds.). Florida Department of Natural Resources, Tallahassee, unpublished report. 154 pp.

Powell, J. A., D. W. Belitsky, and G. B. Rathbun. 1981. Status of the West Indian manatee (*Trichechus manatus*) in Puerto Rico. Journal of Mammalogy 62(3):642-646.

Prieto, M. l988. Bioecología y observación del manatí (*Trichechus manatus*) en la cuenca del rio San Jorge. Resúmenes XI Congreso latinoamericano de Soología, Cartagena, Oct. l990.

Quintana Rizzo, E. 1993. Estimación de la distribución y el tamaño poblacional del manati *Trichechus manatus* (Trichechidae-Sirenia) en Guatemala. B.Sc. thesis, Universidad de San Carlos de Guatemala, 80 pp.

Rathbun, G. B. and E. Possardt. 1986. Recovery plan for the Puerto Rico population of the West Indian (Antillean) manatee (*Trichechus manatus manatus* L.). Prepared for the Southeast Region, U.S. Fish and Wildlife Service, Atlanta, Georgia. 28 pp.

Rathbun, G. B. and J. A. Powell. 1979. Trip report. Honduras Manatee Survey, 28 February-15 March 1979. 18 pp.

Rathbun, G.B., J.P. Reid, and G. Carowan. 1990. Distribution and movement patterns of manatees (*Trichechus manatus*) in northwestern peninsular Florida. Florida Marine Research Publication 48:1-33.

Rathbun, G. B., J. A. Powell, and G. Cruz. 1983a. Status of the West Indian manatee in Honduras. Biological Conservation 26:301-308.

Rathbun, G. B., J. A. Powell, and J. P. Reid. 1983b. Movements of manatees (*Trichechus manatus*) using power plant effluents in southern Florida. Final Report, P.O. No. 88798-87154, Florida Power and Light Company. 26 pp.

Rathbun, G. B., T. Carr, N. Carr, C. A. Woods. 1985. The distribution of manatees and seas turtles in Puerto Rico, with emphasis on Roosevelt Roads Naval Station. National Technical Information Service PB86-1518347AS, Springfield, VA. 83 pp.

Rathbun, G. B., C. A. Woods, and J. A. Ottenwalder. 1985. The manatee in Haiti. Oryx 19(4):234-236.

Rathbun, G. B., J. P. Reid, R. K. Bonde, and J. A. Powell. 1992. Reproduction in free-ranging West Indian manatees (*Trichechus manatus*). Pp. 12 *in* Interim report of the Technical Workshop on Manatee Population Biology (T. J. O'Shea, B. B. Ackerman, and H. F. Percival, eds.). Manatee Population Research Report No. 10. Florida Cooperative Fish and Wildlife Research Unit. University of Florida, Gainesville, FL. 83 pp.

Reynolds III, J.E. 1981. Aspects of the social behavior and herd structure of a semi-isolated colony of West Indian manatees, *Trichechus manatus*. Mammalia 45(4):431-451.

Reynolds, J. E. III, and D. K. Odell. 1992. Manatees and Dugongs. Facts on File, New York. 192 pp.

Reynolds III, J. E., W. A. Szelistowski, and M. A. León. Status and conservation of manatees (*Trichechus manatus manatus*) in Costa Rica. Submitted manuscript. 9 pp.

Secretaria de Estado de Agricultura. 1993. El estado del manati en la República Dominicana. Unpublished report, 19 unnumbered pages.

Seddon, D. 1992. Trinidad and Tobago - Manatee surveys. Sirenews 18:16-17. Department of Anatomy, Howard University, Washington D.C.

Shane, S. H. 1983. Abundance, distribution, and movements of manatees (*Trichechus manatus*) in Brevard County, Florida. Bulletin of Marine Science 33:1-9.

Shaul, W. and A. Haynes. 1986. Manatees and their struggle for survival. Jamaica Journal 19:29-36.

Thornback J. and M. Jenkins. 1982. The IUCN Mammal Red Data Book. Part I. Threatened Mammalian Taxa of the Americas and the Australasian Zoogeographic Region (Excluding Cetacea). IUCN, Gland, Switzerland.

U.S. Fish and Wildlife Service. 1989. Florida manatee (*Trichechus manatus latirostris*) recovery plan. Atlanta, Georgia. 98 pp.

Whitehead, P. J. P. 1977. The former southern distribution of New World manatees (*Trichechus* spp.). Biological Journal of the Linnean Society 9:165-189.

Zárate B., E. 1993. Distribución del manati (*Trichechus manatus*) en la porción sur de Quintana Roo, Mexico. Revista de Investigación Científica 1 (Numero Especial SOMMEMA 1), UABCS: 1-11.

APPENDIX I

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Bocas del Toro

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Belize Audubon Society

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Belize City, Belize Tel.: (501-2) 35004

The Belize Zoo & Tropical Education Center

P.O. Box 1787

Belize City, Belize

Caribbean Conservation Corporation

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San Pedro, Costa Rica

Caribbean Conservation Corporation

P.O. Box 2866 Tel.: (904) 373-6441

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01010 Guatemala, Guatemala

Centro de Investigaciones Pesqueras del Ministerio de la Industria Pesquera

Barlovento, La Habana

Cuba

Centro de Investigaciones de Quintana Roo

C. P. 7700

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Coastal Zone Management Unit

Fisheries Dept.

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Ministere de l'Environnment

Cayenne, Guyane Française

Departamentos de Vida Silvestre y Recursos Pesqueros

Secretaria de Estado de Agricultura

Santo Domingo, Republica Dominica

Direccion General de Vida Silvestre

Ministerio de Recursos Naturales, Energia y Minas

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Florida Department of Environmental Protection

Florida Marine Research Institute

Marine Mammal Research Group — Tel.: (1813) 896-8626 ext. 253

100 8th. Avenue SE — Fax.: (1-813) 823-0166

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Florida Department of Environmental Protection

Office of Protected Species Management

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Fundacion Dominicana Pro Investigacion y Conservacion de los Recursos Marinos, Inc. (MAMMA)

Santo Domingo, Republica Dominicana

Fundacion Ecologia Doña Bárbara

Apartado Postal 100

San Fernando de Apure, Venezuela

Fundación Vuelta Larga

Sucre, Venezuela

Foundation for Nature Preservation in Suriname of the Ministry of Natural Resources

Paramaribo, Suriname

Gales Point Community Manatee Reserve

Belize

Hubbs-Sea World Research Institute

P.O. Box 691602 Tel.: (407) 363-2662

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INBio - Instituto Nacional de Biodiversidad

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Costa Rica

Instituto de Investigaciones Forestales del Ministerio de Agricultura

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La Habana, Cuba 10500

The Living Seas

Walt Disney World

P.O.Box 10000

Lake Buena Vista, Fl. 32830, USA

Lowry Park Zoo

North Boulevard

Tampa, Fl., USA

Miami Seaquarium

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Miami, Fl. 33149, USA

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Save the Manatee Club

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see under U.S.

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fax: (1-809) 923-5070

Table 1 - Legal Status

Legal Status of the Manatee in the Manatee-Range Countries of the Wider Caribbean - 20 Jan 1997

Country	Ramsar Convention (1971)		CITES CONVENTION (1973)		SPAW PROTOCOL/1 (1990)		BIODIVERSITY CONVENTION (1992)		NATIONAL LEGISLATION/2
	Sign	Ratif.	Sign	Ratif.	Sign	Ratif.	Sign	Ratif.	
Belize				x				x	x
Colombia				x		x		x	x
Costa Rica		x		x				x	x
Cuba				x		x		x	x
Dominican Republic				x				x	x
French Guiana (Fr.)		x		x		x		x	x
Guatemala		x		x		x		x	x
Guyana				x				x	x
Haiti									x
Honduras				x				x	x
Jamaica			x			x		x	x

Mexico		x		x		x			
x	x								
Nicaragua				x					
x	x								
Panama		x		x			x		
x	x								
Puerto Rico (USA)		x		x		x			
x									
Suriname		x		x					
x	x								
Trinidad & Tobago		x		x					
x	x								
United States		x		x		x			x
x									
Venezuela		x		x			x		
x	x								

1/ Only the Netherlands and St. Vincent and the Grenadines have ratified the SPAW Protocol, but they are not manatee-range countries.

2/ This column indicates those countries with national legislation to protect manatees and/or their habitats.