Sustainable Development and Management of Biologically Diverse Coastal Resources - Belize Project No. BZE/92/G31

BELIZE MANATEE RECOVERY PLAN

Prepared by:

Nicole Auil
December 1998

With the support of the UNDP
United Nations Environmental Programme
Belize Manatee Recovery Plan

Prepared by:
Nicole E. Auil

With the Assistance of the
National Manatee Working Group

With the Support of the
United Nations Environmental Programme

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Cover Photograph by Nicole E. Auil: Two manatees surfacing snout to snout, Belize City, Belize.

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15th January, 1999

Ms. Janet Gibson
Coastal Zone Management Project
Belize City

Dear Ms. Gibson,

RE: ENDORSEMENT FROM THE MINISTRY OF NATURAL RESOURCES AND THE ENVIRONMENT FOR THE BELIZE MANATEE RECOVERY PLAN

Belize is a developing Central American country that has a rich marine and freshwater environment. The Caribbean Sea forms the entire eastern boundary of the country, and fourteen major rivers run through the nation. Within these natural water bodies lie many types of vegetation, fish, coral, and other living organisms. One such organism that has gained much popularity is the Antillean manatee.

The Antillean manatee is an endangered species, protected through the Wildlife Protection Act, 1981 and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). These laws help to safeguard the manatee from dangers such as hunting and national and international trade. Other dangers that manatees face include those which come with development. These include pollution, increased water traffic, and clearance of various vegetation, to name a few.

The Belize Manatee Recovery Plan identifies specific problems faced by manatees in Belize, shortcomings in their protection, and provides us with recommendations to help safeguard these charismatic creatures. This Ministry fully supports the Recovery Plan's recommendations, and is dedicated to realizing them through policy amendments and creation, increased vigilance, and establishing partnerships with neighboring countries. The four-year manatee project described in the document includes many activities that will be completed with the support of the Forest Department.
We are soundly committed to doing our part to meet the goals of preventing the manatees' decline and eventual extinction, and protecting their natural habitat.

Sincerely,

R. Belisle
( RICHARD BELISLE )
CHIEF FOREST OFFICER
Listed as vulnerable in the 1982 “IUCN Mammal Red Data Book”, the West Indian or Caribbean manatee has been left at very depressed population levels throughout most of its range. Much of this has resulted from hunting pressures in this region in the 1700 and 1800s. Today, primary threats also include destruction of their natural habitat from industrial and domestic pollution and increased development; collisions with watercraft; and entanglement in nets. There are a few protected areas that were created specifically for manatee protection, and many more that, although not for the purpose of protecting manatee habitats, do provide some protection.

“Reasonable” populations still exist in Florida, Belize, Guyana, and Surinam (IUCN 1982). Manatees are migratory animals. Although they do not travel far from the coast, as do many other marine mammals, they utilize resources between various countries. Because of this, protection of the West Indian manatee should involve all countries from the US to Brazil.

The Wider Caribbean Region (WCR) with thirty-three states and territories, have unified for the common goal of protecting the marine and coastal environment by promoting economically and socially stable development of their marine and coastal resources. The Caribbean Action Plan (CAP) thus emerged in 1981 with the assistance of the United Nations Environment Programme (UNEP) and the Economic Commission from Latin America and the Caribbean (ECLAC). The Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (The Cartagena Convention) was adopted as the legal instrument for the implementation of the CAP. It gives the framework for the legal foundations of actions to be developed. One of the three Protocols of this Convention is the Specially Protected Areas and Wildlife (SPAW) Protocol. SPAW is an instrument for dealing with marine conservation, including protecting and managing sensitive areas and endangered or threatened species. The West Indian manatee falls under Appendix II of this Protocol.

To support the Convention and its Protocols, the WCR established the Caribbean Environment Programme (CEP), one of UNEP’s Regional Seas Programmes. One of the five objectives of the SPAW Programme is to develop specific regional and national management plans for endangered, threatened or vulnerable species such as sea turtles, black coral, migratory birds, and the West Indian manatee. The regionalization of global conventions and initiatives such as the Convention on Biological Diversity (CBD) and the Convention on International Trade in Endangered Species (CITES) is the responsibility of a Sub-Programme of SPAW. CEP’s facilitator the UNEP-Caribbean Regional Coordinating Unit (CAR/RCU), created in 1986, has the Memorandum of Cooperation with the CBD, as it assists CBD implementation at the regional level.

Thirty-seven CEP Technical Reports have been produced as a result of various activities performed within CEP’s framework. The “Regional Management Plan for the West Indian Manatee, *Trichechus manatus*” is one such report. The Belize National Manatee Working Group (NMWG), through an agreement with UNEP, supported the creation of this Manatee Recovery Plan for Belize, with the UNDP/GEF Coastal Zone Management Project in Belize. This Recovery Plan summarizes hazards faced by manatees in Belize, and recommends research and monitoring, habitat protection, and education guidelines to ensure their protection and security. It is anticipated that this document shall be used for sound manatee management in Belize. The Recovery Plan shall be updated to reflect changes in manatee status, development within the country and consequent hazards, and revised recommendations will be produced.
ACKNOWLEDGEMENTS

This document and the prior research could not have been completed without the cooperation and assistance of a number of individuals and organizations. Firstly, acknowledgement goes out to the Pesticides Control Board, the Belize Port Authority (Lindsay Garbutt), Geology and Petroleum (Fay Smith), the Fisheries Dept. (Jerryann Frost), the Forestry Dept. (Raphael Manzano & Hubert Arana), Dept. of the Environment (Martin Alegria), Belize Tourist Board, and the Central Statistical Office for data used in this document. Also, warm thanks to the many fishermen, tour guides and sea-goers throughout the country for patiently answering numerous questions that helped to identify major manatee issues.

Many thanks to Alfonso Avilez (Fisheries Dept.), Marlon Mar (Forestry Dept.), Dr. James “Buddy” Powell (FMRI), Benjamin Morales (ECOSUR), Alejandro Ortega (ECOSUR), Gerardo Rivas (ECOSUR), Hampton Gamboa (Fisheries), John Pinello and Ramon Vargas (Forestry) for flying long hours counting manatees in 1997. To Dr. Leopold Perriott (UCB) and Stephanie Marshallleck, thank you for assisting with the analysis of these surveys. Also, much gratitude to our main pilot Nico Varela and the crew at Maya-Island Air for the safe flights. I am very grateful to Hampton, Endir Sosa (Fisheries), Dylan Gomez, Jose 'Pepe' Garcia, Buddy, Lloyd Perriott (Fisheries), Dr. Michael DeShield and the entire CCU of Fisheries for assisting with salvaged manatees. Thanks also to the CCU who was essential during field surveys.

Special appreciation goes out to Gloria Auil, Stephanie and Dylan for providing support during the entire research, and insight into the completion of this document. Also, thanks to Jorge M. Auil and Budget Rent-a-Car for the uncharged use of needed equipment.

Thanks to the Wildlife Preservation Trust International for supporting the continuity of the manatee research and education efforts of the UNDP/GEF Coastal Zone Management Project, for the last quarter of 1998.

All of this work could not have been possible without the entire staff of the UNDP/GEF CZMP between August 1996 and December 1998, namely Melissa Bevans, David Chan, Sandra Zelaya, Georgiana Vernon, Eugene Ariola, Stewart Cruz, Ramon Pacheco, Clifford Vernon, Barry Dawson, Herbert Haylock, and especially Hugo Matus and Janet Gibson.

Last, but certainly not least, special recognition to the entire National Manatee Working Group, Janet, Buddy, Alfonso, Benjamin, Hubert, Greg Smith, Michael Somerville (BAS), Raphael, Jose Perez (Fisheries), Wil Maheia (TIDE), and Eden Garcia and Dr. Vincent Palacio (UCB/MRC) for your dedication, direction, and support.

This document is dedicated to our “manatees”, in a promise that we will help to keep them as an important part of Belize’s wildlife for many generations to come.
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<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>ALIDES</td>
<td>Alliance for Sustainable Development for Central America</td>
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<td>BAS</td>
<td>Belize Audubon Society</td>
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<td>BPA</td>
<td>Belize Port Authority</td>
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<td>CCAD</td>
<td>Central American Commission for the Environment and Development</td>
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<td>CCU</td>
<td>Conservation Compliance Unit</td>
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<td>CDB</td>
<td>Convention on Biological Diversity</td>
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<td>CEP</td>
<td>Caribbean Environment Programme</td>
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<td>CSO</td>
<td>Central Statistical Office</td>
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<td>CZMP</td>
<td>Coastal Zone Management Project</td>
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<td>CZMU</td>
<td>Coastal Zone Management Unit</td>
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<td>BCES</td>
<td>Belize Center for Environmental Studies</td>
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<td>BTB</td>
<td>Belize Tourist Board</td>
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<td>BTIA</td>
<td>Belize Tourism Industry Association</td>
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<td>CARICOMP</td>
<td>Caribbean Fisheries Resource Management Project</td>
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<td>CCC</td>
<td>Coral Cay Conservation Project</td>
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<td>CFRAMP</td>
<td>Caribbean Fisheries Resource Management</td>
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<tr>
<td>DoE</td>
<td>Department of the Environment</td>
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<tr>
<td>ECOSUR</td>
<td>El Colegio de la Frontera Sur</td>
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<td>ESTAP</td>
<td>The Environmental, Social and Technical Assistance Project</td>
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<td>FMRI</td>
<td>Florida Marine Research Institute</td>
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<td>FOCADES</td>
<td>Central American Environment Fund</td>
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<td>FR</td>
<td>Forest Reserve</td>
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<td>FUNDAECO</td>
<td>Foundation for Eco-development and Conservation</td>
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<td>GEF</td>
<td>Global Environmental Facility</td>
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<tr>
<td>GoB</td>
<td>Government of Belize</td>
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<td>GPU</td>
<td>Geology and Petroleum Unit</td>
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<td>IUCN</td>
<td>World Conservation Union</td>
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<td>LUA</td>
<td>Land Utilization Authority</td>
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<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
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<td>MR</td>
<td>Marine Reserve</td>
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<td>MRC</td>
<td>Marine Research Center</td>
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<tr>
<td>NGO</td>
<td>Non-governmental Organization</td>
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<td>NM</td>
<td>National Monument</td>
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<td>NMWG</td>
<td>National Manatee Working Group</td>
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<td>NP</td>
<td>National Park</td>
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<td>NR</td>
<td>Nature Reserve</td>
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<td>PTT</td>
<td>Platform Terminal Transmitter</td>
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<tr>
<td>PR</td>
<td>Private Reserve</td>
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<tr>
<td>PROARCA</td>
<td>Regional Environment Project for Central America</td>
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<tr>
<td>PROLANSATE</td>
<td>Foundation for the Development of Punta Sal, Lancetilla and Texiguat (Guatemala)</td>
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<tr>
<td>PS</td>
<td>Permanent Secretary</td>
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<tr>
<td>SDA</td>
<td>Special Development Area</td>
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<tr>
<td>SSC</td>
<td>Species Survival Commission</td>
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<tr>
<td>TIDE</td>
<td>Toledo Institute for Development and the Environment</td>
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<tr>
<td>TL</td>
<td>Total Length</td>
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<tr>
<td>TNC</td>
<td>The Nature Conservancy</td>
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<td>UCB</td>
<td>University College of Belize</td>
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<td>UNDP</td>
<td>United Nations Development Programme</td>
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<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<td>WCS</td>
<td>Wildlife Conservation Society</td>
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<td>WPA</td>
<td>Wildlife Protection Act</td>
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<td>WPTI</td>
<td>Wildlife Preservation Trust International</td>
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</tbody>
</table>
TABLE OF CONTENTS

Endorsement from Ministry of Natural Resources & Environment ________i
Preface __________________________________________________________________________________ ii
Acknowledgements __________________________________________________________________________iii
Abbreviations & Achronyms __________________________________________________________________iv
Table of Contents ___________________________________________________________________________ v
List of Tables and Figures _____________________________________________________________________vi
Abstract _____________________________________________________________________________________ ix
Executive Summary __________________________________________________________________________ xi

I. INRODUCTION_________________________________________________________ 1

II. DESCRIPTION OF THE SPECIES ___________________________________________ 2

III. STATUS AND DISTRIBUTION___________________________________________ 3

IV. MAJOR THREATS AND CONSERVATION PROBLEMS _________________________ 5

4.1. Entanglement in Fishing Gear / Incidental Catch Through Fishing Practices........................................................................................................6
4.2. Illegal Hunting / Poaching........................................................................ 6
4.3. Alteration and Destruction of Habitat....................................................... 7
  4.3.1. Coastal Land Reclamation / Development ....................................... 7
  4.3.2. Mangrove Destruction .................................................................. 7
  4.3.3. Sedimentation / Siltation............................................................... 9
  4.3.4. Seagrass Stress / Destruction....................................................... 9
  4.3.5. Dredging ................................................................................... 9
  4.3.6. Sewage and other Effluents .................................................. 10
  4.3.7. Contamination by Agricultural Practices................................. 10
  4.3.8. Daming of Rivers ....................................................................... 11
  4.3.9. Tourism Activities ................................................................... 12
4.4. Boat Traffic Related Fatalities ............................................................... 13
4.5. Natural and Manmade Factors .............................................................. 14

V. ACTIVITIES TO FURTHER KNOWLEDGE OR SOLVE PROBLEMS ____ 14

5.1. Assess Manatee Status and Distribution ............................................. 14
5.2. Manage, Protect and Monitor Manatee Habitat .................................... 15
  5.2.1. Identify Essential Habitat .............................................................. 15
  5.2.1.1. Survey Foraging Areas .......................................................... 16
  5.2.1.2. Survey Mating / Rearing Areas ............................................ 16
  5.2.2. Develop Area-Specific Management Plans ................................... 17
  5.2.2.1. Involve Local Coastal Zone Authorities ................................ 18
  5.2.2.2. Develop Regulatory Guidelines ........................................... 19
  5.2.2.3. Provide for Enforcement of Guidelines ................................ 19
  5.2.2.4. Monitor & Modify Law Enforcement Guidelines .................... 20
  5.2.2.5. Develop Educational Materials ............................................ 20
  5.2.3. Prevent or Minimize Degradation of Habitats ............................ 20
  5.2.4. Promote Restoration of Degraded Manatee Areas ...................... 21
  5.2.4.1. Develop Guidelines Regulating Activities ............................ 22
  5.2.5. Monitor Habitat Conditions ..................................................... 24
5.3. Manage, Protect and Monitor Status of Species ................................... 25
  5.3.1. Improve Manatee Awareness in Country ..................................... 25
  5.3.1.1. Develop and Distribute Educational Material ....................... 25
  5.3.1.2. Monitor and Modify Material Accordingly ............................. 26
  5.3.2. Create Protected Areas for Manatees/Establish Manatee Sanctuaries ........................................................................... 26
  5.3.3. Evaluate and Reduce Manatee Mortality .................................... 27
  5.3.3.1. Quantify the Impact of Accidental Catches on Species/Populations ............................................................... 28
  5.3.3.2. Review Existing Local Laws and Regulations ....................... 29
  5.3.3.3. Evaluate and Propose New Regulations Where Needed ........... 30
  5.3.4. Encourage Non-consumptive Uses of Manatees ........................... 32
  5.3.4.1. Alternative Activities for Manatee Hunters ............................ 32
  5.3.4.2. Develop Guidelines for Manatees in Captivity ....................... 32
  5.3.5. Monitor the Status of the Manatee Populations ........................... 33
5.4. Promote Co-operation and Exchange of Information on Manatee Conservation at National and Regional Levels

5.4.1. Organize National Recovery Teams

5.4.2. Co-ordinate Activities of National Recovery Team with the Regional Manatee Network and Manatee Coordinator

5.4.3. Promote Training for Local Personnel and Biologist in the Area of Coastal Area Management and Conservation

5.4.4. Support and Create Regional Treaties Promoting Manatee Conservation

VI. SUSTAINABLE FINANCING MECHANISMS

VII. OUTLINE FOR SCHEDULE OF CONSERVATION ACTIVITIES

BIBLIOGRAPHY

TABLES & FIGURES

APPENDIX 1

APPENDIX 2

APPENDIX 3

TABLES AND FIGURES

TABLE 1

Mangrove Clearance (Acres) by District for 1998 – 1996

TABLE 2

Recovery Plan Schedule of Activities

TABLE 3

Maximum Count for the West Indian Manatee in the Wider Caribbean

TABLE 4

Overall Results for Aerial Surveys Conducted in Belize

TABLE 5

Offshore Dredging for 1995 – 1997
TABLE 6
Number of Boats Registered by the BPA for 1994 – 1998

TABLE 7
Coastal and Marine Protected Areas

TABLE 8
Proposed Reserves

FIGURE 1
Acres of Mangrove by Location

FIGURE 2
Number of Boats Registered by the Fisheries Department

FIGURE 3

FIGURE 4
Regional Map with Manatee Distribution

FIGURE 5
Aerial Survey Flight Path

FIGURE 6

FIGURE 7
Manatee Sightings – Aerial Survey 1997

FIGURE 8
Manatee Calf Sightings – Aerial Survey 1997

FIGURE 9
Coastal Uses and Human Impacts

FIGURE 10
Carcass Sightings – October 1996 – August 1998

FIGURE 11
Seagrass Distribution

FIGURE 12
Belize Coastal and Marine Protected Areas

FIGURE 13
Critical Manatee Areas with 1997 Aerial Survey Statistics
ABSTRACT

Manatees were once abundant in the waters of the Wider Caribbean. Their decline was aided by the fact that they are large, relatively slow animals with a low reproductive rate and they live near communities of man. Manatees provided a tasty balance to the diets of sailors and indigenous peoples, as these people hunted this mammal frequently. By the 1930s, the manatee numbers in Belize had declined so drastically that Manatee Protection Ordinances were issued to safeguard them. Further protection was not granted until 1981 with the Wildlife Protection Act, legislated under the Ministry of Natural Resources. Although seen countrywide, the manatee population today is considered endangered in Belize, as well as other countries within the Wider Caribbean.

The primary threats faced by manatees in Belize are boats and barges, nets, careless development within the coastal zone, and hunters. The carcasses of calves are very frequently seen, as well as adults whose deaths are undetermined. A total of twenty-five carcasses were reported between September 1996 and December 1998. This Recovery Plan aims at reducing mortality by determining the causes of manatee deaths, and reducing the susceptibility of these factors. One recommendation is the improvement of the salvage and necropsy programme. Another is to develop an emergency action plan for live stranding, including rehabilitation and release of injured animals. Recommendations are made to reduce manatee collision with watercraft, one of the human related causes of identified manatee death in Belize.

The status of manatees has been reviewed in this document, with critical areas recommended for protection. Research and monitoring is emphasized, as well as revision of legislation. Essential for manatee protection is the protection of their fragile environment. Manatees utilize both fresh and marine waters - from rivers to the Turneffe Atoll. Although they favor the brackish areas of lagoons, all water bodies need to be protected from industrial and domestic pollution as well as the removal of vegetation, manatees’ food source. Regulations on manatee tours have been developed and this Plan recommends the training and licensing of these guides as soon as possible.

Manatees could easily utilize space and resources of neighboring countries. It is therefore necessary that protection reach not only a national level, but extend throughout the Wider Caribbean. A Regional Manatee Recovery Plan has been published by UNEP, and individual countries were requested by UNEP to write one specific for their nation. This is the first of such documents, produced through the Belize National Manatee Working Group with the UNDP/GEF Coastal Zone Management Project. This Recovery Plan is a national one, local in nature, following the UNEP’s outline. As Belize is known to have the greatest population of the Antillean manatee in the Wider Caribbean, it is postulated that this population may serve as a source for neighboring countries’ populations. Therefore, protection here is essential for the survival of the species within the region.

This Plan is to be used by government officials, non-governmental agencies, and individual researchers for the broad-scale conservation of manatees. A four year Manatee Conservation Programme has been outlined in this document. It is expected that this list of priority actions be completed by the end of the four years. Thereafter, reevaluation should occur and be reflected in a revised Manatee Recovery Plan for Belize.

The challenge to protect and recover the manatee population in Belize is a formidable one. It can be achieved, however, with the full cooperation of government, non-governmental organizations, and the general public. Although priorities are listed in the programme outline, all activities are important, and comprehensive conservation will not result in isolated actions. We
must today take responsibility for our past and present actions that have led to the manatee’s decline. We must bring this species back not only for the benefit of man, but for the historical, ecological and intrinsic values that these magnificent creatures possess.
EXECUTIVE SUMMARY

I. Introduction

The manatee is listed as endangered under Belize’s Wildlife Protection Act of 1981. The World Conservation Union (IUCN) lists this species as vulnerable, meaning that they will likely move to the “endangered” category in the near future if causal factors continue operating. Endangered, in turn, are “taxa in danger of extinction...if the casual factors continue operating”. As with other endangered species, action is needed to improve the manatee’s status, and eventually down-list the species from the “endangered” category. In order to accomplish this, threats to manatee survival have to be identified, and solutions sought to decrease these detrimental effects or ultimately stop them altogether. Poor environmental health and reckless human action encompass the main causes for this species’ decline. In turn, it is human action that can help to save our “mermaids”. To this end, a Manatee Recovery Plan for Belize is necessary.

II. Description of the Species

Manatees are gentle, slow-moving mammals that inhabit marine, fresh and brackish water bodies. They are classically represented as a charismatic, or flagship species because of their vulnerable status. Manatees lie in the order Sirenia, family Trichechidae, of which there are three species that exist today: the Amazonian Manatee (Trichechus inunguis), the West African Manatee (Trichechus senegalensis), and the West Indian Manatee (Trichechus manatus). The W.I. manatee has two subspecies, the Floridian subspecies (Trichechus manatus latirostris) and the Antillean subspecies (Trichechus manatus manatus). The latter is that found in Belize’s coastal areas, lagoons, rivers, cays, and atoll (Turneffe Atoll).

Manatees are grazers that incidentally ingest encrusting organisms while consuming macroalgae. They spend most of their time feeding, surface or bottom resting, and traveling. Their large gray-brown bodies are often coloured with green or red algae or barnacles. Manatees are known for their slow reproductive rate, where both female and male are not sexually mature until three to four years, a gravid female has a gestation period of 11 – 13 months, and her calf stays with her for 1 – 2 years. A sexually mature female has a calf about every 2 – 5 years.

Historically, the manatee has been hunted throughout the country. The socio-economic importance of manatees today is its role in the tourism industry.

III. Status and Distribution

In 1981, under the auspices of the Forest Department, manatees were one of the many endangered species listed under the Wildlife Protection Act (WPA) No. 4, which was drafted with the integral assistance of the Belize Audubon Society. Furthermore, as a signatory of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora, ratified in 1976) Belize has adopted to protect the West Indian manatee from over-exploitation.

The modern Sirenia are representative relics of a group formerly more widespread and diverse that date back from the Eocene (Bertram and Bertram 1973). The W.I. manatee is distributed in the North American region and the Caribbean, inhabiting their warm coasts, rivers and estuaries. The Antillean manatee is most abundant in Belize than any other country in its range. Our population may even serve as a source population for neighboring countries. In turn, declines in other countries could surely affect the manatee population in Belize. In this light, protection efforts need to encompass all of the nations within the Wider Caribbean.
VI. Major Threats and Conservation Problems

Sirenians worldwide essentially face the same hazards and conservation problems, the extents varying with location. Many risks or mortalities are natural in origin, but as human population grows, so do anthropogenic threats. Mortality reports between September 1996 and December 1998 brought to light twenty-five confirmed manatee deaths. Although the causes of many deaths are uncertain, and some are natural, the following are known treats faced by manatees.

Fishing gear pose threat to manatees as they can be accidentally ingested when the animal is feeding. Also, fishing lines can become entwined around appendages, leading to infection and possible amputation. Nets pose serious concern as manatees can become entangled and drowned in them, especially calves. Even the nets of trawlers have caused manatee deaths in Florida. Another fishing apparatus that traps manatees, as well as dolphin and turtles, is the beach trap constructed of wire and poles.

Poaching of manatees is also a major problem. This activity is a traditional one, having occurred for decades. Today, it occurs on a smaller scale, as the Wildlife Protection Act of 1981 was passed. The primary use of the slaughtered manatee is for food. Its skin was used as leather, and the bones are still used to make trinkets and for medicinal purposes.

Increasing development along the coastal zone is unavoidable with increased tourism and infrastructure. This in turn leads to the destruction of manatee habitat in numerous ways. Such includes coastal land reclamation, mangrove destruction, sedimentation or siltation, seagrass destruction, dredging, sewage and industrial effluents, agricultural contamination, damming of rivers, and even tourism activities. Certainly, the most detrimental of all the above-mentioned types of habitat destruction is that which results in seagrass, and to a lesser extent, mangrove damage. This vegetation is the manatees’ food source.

Watercrafts pose a threat for manatees by direct contact and indirectly by pollution and degradation of seagrass beds. The greatest immediate impact that watercraft have on manatees is in direct physical contact. At least four recovered carcasses have been associated with boat collisions, including calves and adults. It is certain that manatees are of greatest vulnerability near Belize City, as numerous water taxies and barges leave major ports here.

V. Activities to Further Knowledge or Solve Problems

5.1. Assess Manatee Status and Distribution

In order to accomplish the goal of creating and conducting appropriate management strategies for the threatened manatee, it is imperative to continue and enhance research techniques. Data on life history, distribution and relative abundance of the species will allow decision-makers to make informed choices. Probably the most viable method of determining distribution and manatee abundance is by aerial surveys. Although this method cannot accurately determine the manatee population of a country, with periodic seasonal surveys conducted over years, a pattern of movement and abundance can be established. Using the extended-area survey technique (Packard 1995), seven aerial surveys conducted between 1994 and 1997 have been used to assess the manatee status and distribution in Belize. Important areas for manatees have consistently been found to be the cays adjacent to Belize City and the Belize River, the Southern Lagoon, Placencia Lagoon, the Corozal Bay, and the Port Honduras area.

To assess manatee distribution, and more specifically movement, two projects have been undertaken by researchers. The first is a photo-identification project at Ambergis Cay and the cays near Belize City. The goal is to identify individual manatees to gain knowledge on short and long term movement and collect life history information on identified manatees. The other research project currently underway in Belize is a tagging and tracking project done in Southern
Lagoon. The data obtained on the animals movement and habits and the impact of ecotourism will be used to develop a management plan for the Southern Lagoon.

5.2. Manage, Protect and Monitor Manatee Habitat

In order to protect this species, it is essential to pay special attention to the changes in their use of habitat. Important manatee areas must first be identified, and detrimental activities in these areas should be analyzed and prevented. Lagoons, coastal areas, cays, and rivers are manatees’ primary distribution areas. These habitats lie within estuaries, wetlands and watersheds that provide manatees’ primary needs of water, shelter, space, and food. As their food source is marine and freshwater vegetation, this resource has to be available for their survival. Fortunately, Belize’s coastal zone is comprised of abundant seagrass, as found when classified from satellite imagery in 1997. Matting and rearing areas should also be identified. Estrus herds are usually found in shallow waters and can form all year round. Although exact locations of birthing or rearing are not known, aerial survey results in 1997 showed that calves primarily utilize the lagoon habitat.

There are six areas in Belize that are consistently used by manatees. These are, from north to south, the Corozal Bay area, the Belize City cay area including the Belize River, Southern Lagoon, Placentia Lagoon, Indian Hill Lagoon, and the Port Honduras area including Deep River and Seven Hills Lagoon. Of these areas, the Southern Lagoon and Corozal Bay are manatee Wildlife Sanctuaries. It is imperative that management plans for these two areas are made as quickly as possible. Included should be regulations on boating, pollution, development, and tourism. The other areas should have some protective status or legally standing regulations, to ensure the viability of their important transient or resident manatee communities.

Areas of high concentration of manatees, and correspondingly, rich in vegetation, should have guidelines that regulate human activity. Sanctuaries or reserves need not necessarily be implemented if the specific guidelines are passed as regulations, with fines for violations. These would include slow boating speed zones in shallow areas that are highly used by manatees. Also, they could allow for mitigation or restoration by the developer, of habitat destroyed through coastal development.

Preventing the degradation of habitat is crucial in protecting the manatee. Alterations or destruction of habitat can be minimized with the combined efforts of the law enforcement officers, NGOs, Village Councils, private organizations and individuals. Thorough EIAs should be carried out before coastal development occurs. Dredging in critical habitat should be monitored, and proper techniques should be established to prevent sedimentation and seagrass destruction. Also, protecting the soil surface and reducing soil run-off are essential in reducing the movement of biocides at agricultural farms.

Furthermore, fishing practices should be regulated. Fishing gear such as beach traps should be monitored by the fishermen who use them, thus avoid harming wildlife not intended to be caught. Shrimp trawlers cause damage to seagrass beds and coral, and can trap manatees. Reducing the number of such trawlers would reduce the damage resulting. Industries producing effluents and other pollutants should be monitored and safe standards should be established to avoid polluting of waterways. Also, as mangroves play an important role in seagrass productivity, its removal should be banned from critical manatee areas. In addition, environmental codes of conduct are essential in maintaining the tourism industry’s assets – diverse pristine habitat and wildlife. There are general boat and human behavior regulations that should be implemented to provide for enjoyable and safe tourism, for both tourists and manatees in Belize.
To provide enforcement of guidelines, institutional and government support is essential. Government funding in many cases is limited, specifically for the two departments that work with manatees, the Forest and Fisheries Departments. Therefore, assistance from other departments such as the Belize Defense Force as well as NGOs is important. A standard and efficient system of information transfer between all these government agencies is also essentially needed. This system would be used to share details on new policies or laws.

5.3. Manage, Protect and Monitor Status of Species

Firstly, environmental education is a commitment by many NGOs and government agencies in Belize. Information on protected areas, marine, terrestrial and coastal zone habitats and their wildlife are taught to schools throughout the country. Campaigns by the Belize Zoo, TIDE, and the CZMP give education programmes specifically about the manatee. The CZMP and Fisheries coordinated countrywide manatee tour guide workshops in 1995, to create proper guidelines for manatee tours. Follow-up meetings are necessary, as well as formal training and certification of guides. In addition, since much of the general public are not aware of laws that protect manatees, they are susceptible to becoming unknowing violators of the WPA. Education about these laws would decrease the taking of illegal items such as manatee bones and artifacts. Education programmes should be geared to specific target groups including, but not limited to, students, tour guides, law enforcement officers, and the general public. Seminars, brochures, booklets, workshops, competitions, training, and displays are means of disseminating an array of information to each group.

Evaluation and reduction of manatee mortality is essential for management. Of the twenty-five manatee deaths identified since the recording of manatee mortality by the CZMP in late 1996 to December 1998, 36% were human related, which could actually be higher if proper necropsies were carried out. Calves made up 44%, and perinatal mortality was the most common cause of death. To minimize injury and mortality to manatees, it is imperative that we better understand the causes of mortality, where manatees are more susceptible to specific risks, and how to minimize each hazard. A long-term salvage and necropsy programme including the following should be implemented: maintain and improve the reporting system, train local biologists in carcass assessment, and maintain international contacts with specialists working with mortality. To decrease manatee deaths, all nets but cast nets should be completely banned. Introducing a “no wake” zone in shallow manatee areas could decrease manatee mortality. Also, collaboration between Guatemala, Honduras and Belize’s governments is essential to decrease poaching in the Gulf of Honduras. Identifying hunters and vendors, providing income or food alternatives, and educating should cause changes in attitudes and consequently in actions.

The existing local law protecting manatees, the Wildlife Protection Act of 1981, states that molesting any listed wildlife (manatee) and possessing, selling or buying any part of it or attempting to do so is illegal. A first offender is liable to a fine not exceeding BZ$500.00. A second or further offence within five years is fined no more than BZ$1000.00 and/or no more than six months in prison. The current maximum fine should be substantially increased to reflect the importance of the species it protects. Comparison of fines between North America and Belize indicates the lower value placed on endangered species in Belize. Creating an Act amendment that specifically provides regulations for endangered species would also be very effective. This should include a clear definition of “molest” as well as new regulations.

A more cohesive and formal relationship between Fisheries, Forestry and the Maritime Wing should be established. This would increase vigilance efficiency substantially. In addition, the siting of marinas should be carefully considered by the Belize Port Authority, avoiding areas that are used by endangered species. Regulating marina numbers and sizes also regulates, to an extent, the number of boats, consequently the number of boat-related manatee mortalities.
Also, all boats in Belize should be registered and boaters obtain an operator’s license. Planning for sustainable and safe boat running can only occur if the quantity of boats is known, as well as their docking locations. Furthermore, obtaining an operator’s license will mean that all boaters would have to go through a proficiency programme. Finally, all manatee tour operators should be licensed as “Manatee Guides” and guidelines formed into regulations. When violated, offenders would be subject to penalties under the WPA.

Monitoring the status of manatee populations is done by applying various research methods. These include aerial surveys, telemetry and photo-identification research. Also, boat surveys, which allow for ecosystem-oriented studies and behavioral observation. Basic applied research such as determining food consumption of manatees can be done with little equipment. Mortality assessment and necropsy are also very important in detecting population status, and helps to direct ways of preventing deaths of manatees.

5.4. Promote Cooperation and Exchange of Information on Manatee Conservation at National and Regional Levels.

An effective level of management is reached when all relevant governmental and non-governmental organizations, researchers and communities are kept abreast of new information, and together make sound recommendations. At present a National Manatee Working Group exists, with multi-sectoral representation who carry out this precise role. A workshop in 1994 sponsored by the regional coordinating unit of UNEP elected Miriam Marmontel as the Manatee Coordinator. A Regional Manatee Network has not been formed, however. Such a committee should be formed as a means to begin comprehensive coordinated management of the West Indian manatee in the Wider Caribbean. This Regional Manatee Network should be a long-term goal of all countries in the region.

For manatee projects in Belize to be successful with planned continuity, local expertise should be developed. Nationals should be trained in theories and techniques relevant to manatee conservation. This should include education in ecosystems, including community dynamics. Knowledge of physical and chemical oceanographic processes is also an asset. Especially needed are trained persons in the disciplines of anatomy and physiology of marine mammals.

Belize has signed a number of regional and international treaties protecting her natural resources and wildlife. These treaties oblige us to certain responsibilities and grant us special benefits. Some of the treaties that afford protection to manatees include the Conventional on International Trade of Endangered Species of Wild Flora and Fauna 1976 (CITES), the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (The Cartagena Convention) and its Protocols, including the Protocol Concerning Specially Protected Areas and Wildlife (SPAW), the Convention on Biological Diversity 1993, the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), United Nations Law of the Seas Convention 1983 (LOSC), Convention for the Conservation of Biodiversity and Protection of Priority Wild Areas on Central America 1991, the Convention for the Prevention of Pollution from Ships 1973/78 (MARPOL), and the Convention on Wetlands of International Importance 1998 (Ramsar).

VI. Sustainable Financing Mechanisms

In order for continuity of manatee research and conservation efforts, there is the need to develop sustainable methods of acquiring consistent in-state funds. It is a recommendation of this recovery plan that the following funding mechanisms are strongly considered: boat registration fees, manatee tour license fee and site user fee or guide revenue fee, fee from wildlife offences, fees form international film documentary crews, and revenue from fueling
stations. Some of these may require amendments to legislation. The National Manatee Working Group would control funds received, and use it for manatee protection.

VII. Outline for Schedule of Conservation Activities

The Antillean manatee has declined throughout its range, primarily due to human interaction. Because of this, it is man who has to take the responsibility for helping to increase the manatee’s currently depressed population. The primary goals are to prevent manatee extinction, and the decline of their natural habitat. Research and monitoring, training and education, management and enforcement are the umbrella topics needed to accomplish the set goals. An outline for the schedule of conservation activities can be found in Section VII, and Table 2. The schedule encompasses activities that are Belize’s current primary needs. With government commitment, institutional response and public cooperation, they can be realized.
I. INTRODUCTION

Belize is bordered by Mexico in the north and by Guatemala in the west and south, while the Caribbean Sea washes her eastern coast. The country houses a total human population of 228,695 with 50.4% in urban areas and an approximate one to one gender ratio (CSO 1997).

Belize is most popularly known for its 220-250 km (132 – 150 miles [mi]) barrier reef that extends the country’s coastline, north to south. Within the reef and the reef lagoon lie over 1,060 mangrove and sand cays. Three coral atolls lie offshore, sitting between nine and 200 km (120 mi) from the barrier reef.

Geologically, Belize’s mainland can be divided into two: the northern half (north of Belize City) is a low karst platform with most of the coastline below sea level. The southern half has been uplifted to form the Maya Mountains, and is characterized by a coastal plain drained by many short streams terminating in small deltas (McField, Wells, and Gibson 1995). Of the sixteen major watersheds that cover roughly 1,765,586 ha (4,431,965 ac) of Belize land, our neighboring countries provide the source for several. The lagoons and estuaries found throughout the entire coastline of Belize provide very productive habitat for wildlife. Such wildlife includes the West Indian manatee, which is found in areas from the northernmost to the southernmost ends of Belize’s coastal zone. The Coastal Zone Management Unit (CZMU) defines the coastal zone to include “the shoreline, coastal alluvial plains, coastal watersheds, lagoons, estuaries, cays, atolls, the subtidal areas within the twelve mile territorial limit, and the 320 km (200 mi) Exclusive Economic Zone”.

The manatee is listed as endangered under Belize’s Wildlife Protection Act of 1981. The World Conservation Union (IUCN) lists this species as vulnerable, meaning that they will likely move to the “endangered” category in the near future if causal factors continue operating. Endangered, in turn, are “taxa in danger of extinction...if the casual factors continue operating”. As with other endangered species, action is needed to improve their status, and eventually down-list this species from the “endangered” category. In order to accomplish this, threats to manatee survival have to be identified, and solutions sought to decrease these detrimental effects or ultimately stop them altogether. Poor environmental health and reckless human action encompass the main causes for this species’ decline. In turn, it is human action that can help to save our “mermaids”. To this end, a Manatee Recovery Plan for Belize is necessary.

This original Belize Manatee Recovery Plan is a product of the Memorandum of Understanding concluded in 1995 between the Regional Co-ordination Unit of the Caribbean Environment Programme (CAR/RCU) and the Fisheries Department, Ministry of Agriculture and Fisheries (hereafter referred to as Fisheries Department). As the Fisheries Department has been the government entity undertaking management of manatees, it has been working with the Government of Mexico on a plan of co-operation for the conservation of the West Indian Manatee. This Recovery Plan supports the cooperative effort. Furthermore, at the first Meeting of the Parties in 1994 of the Convention on Biological Diversity (CBD - ratified December 1993), the Specially Protected Areas and Wildlife (SPAW) Protocol of the regional Cartagena Convention was implemented. The Forest Department of the Ministry of Natural Resources is one of the agencies taking the lead in developing a biodiversity action plan according to the CBD. SPAW Activity (f), “Conservation of Endangered Species Threatened with Extinction”, includes the preparation of recovery plans and management of priority species, in this case, the West Indian Manatee (Trichechus manatus manatus), as determined in the MOU.

A National Manatee Working Group (NMWG) was formed through the UNDP/GEF Coastal Zone Management Project (CZMP) to develop guidelines for a Manatee Project in Belize.
researcher was hired to carry out the research, monitoring, and educational activities as developed by the Group. This Recovery Plan is a synopsis of major findings of a year and a half of this research. It describes threats faced by manatees in Belize, and recommends various protection measures for this endangered species. The major goals of this Plan are to I) to prevent extinction or irreversible decline of the species within the foreseeable future; and II) to prevent decline in the quality of habitat used by the manatee.

II. DESCRIPTION OF THE SPECIES

Manatees are known by a number of titles in Belize, including “sea cow”, “mermaid”, and “Belizean whale”. In the Garifuna language, manatee is “manadi”, in Spanish, “manati”, and the popular creole “manantee” or “malantee”.

Manatees are gentle, slow-moving mammals that inhabit marine, fresh and brackish water bodies. They are classically represented as a charismatic, or flagship species because of their vulnerable status. Manatees lie in the order Sirenia, family Trichechidae, of which there are three species that exist today: the Amazonian Manatee (Trichechus inunguis) which live in the fresh water bodies of the Amazon River and tributaries; the West African Manatee (Trichechus senegalensis) which live by the coast and in the rivers of West Africa; and the West Indian Manatee (Trichechus manatus). The W.I. manatee has two subspecies, the Floridian subspecies (Trichechus manatus latirostris) and the Antillean subspecies (Trichechus manatus manatus). The latter is that found in Belize’s coastal areas, lagoons, rivers, cays, and atoll (Turneffe Atoll). The Steller’s Sea Cow, (Hydrodamalis gigas) was the sole Sirenia not to inhabit tropical/sub-tropical waters. They lived in the arctic waters of the Bering Strait until hunted to extinction twenty-seven years after their discovery in 1741. The Dugong (Dugong dugon) which live only in marine habitats in the Indio-Pacific region, are also in the Order Sirenia, Family Dugongidae. Sirenians have a very wide geographic range, inhabiting over ninety countries (Marsh et al. 1986).

Manatees are grazers that incidentally ingest aufwuchs [encrusting organisms such as diatoms, algae, and crustaceans] (Best 1981) while consuming submersgent, emergent, and natant macroalgae. Because of the low energy content of their food, and manatees’ low digestive efficiency (Geraci and Lounsbury 1993), they spend much time feeding. In Belize, they have been seen eating turtle grass (Thalassia testudinum), manatee grass (Syringodium filiforme), shoal grass (Halodule wrightii) - reportedly their favorite food source - and red mangrove (Rhizophora mangle) in saltwater areas. They spend most of their time feeding, surface or bottom resting, and traveling. Observations revealed that they spend an average of three minutes submerged while milling, yet can spend up to twenty-five minutes underwater while resting. As they have poor insulation and a low metabolic rate they are limited to water temperatures above 20°C (68°F) (Geraci and Lounsbury 1993). At temperatures about 16°C, they become lethargic and stop eating. Their large gray or gray-brown bodies are often coloured with green or red algae and barnacles, indications of their presence in salt water. The largest manatee measured in Belize was of a male carcass with a total length (TL) of 322.6 cm (10.8 ft). The longest female measured 312.5 cm (10.4 ft) TL.

Manatees are known for their slow reproductive rate, where both male and female reach reproductive age at 3 – 4 years, but may not breed successfully until 5 – 8 years of age (Geraci and Lounsbury 1993). A manatee’s gestation period is 11 – 13 months, and a calf remains with its mother for 1 – 2 years, after which the female again goes into oestrus. Although the length of the oestrus cycle is not exactly known, the manatee’s closest relative, the elephant, has an
oestrus cycle of at least 24 hours, and probably nearer to 48 hours (Hartman 1971). A reproductive female would have a calf every 2 – 5 years.

Although not very social animals, some manatees do exhibit a nature of curiosity. During field observations in waters adjacent to Belize City and within the Belize River, manatees have come up to the research vessel, seemingly to investigate the object. In most cases, the curious animal is a calf or juvenile.

Historically, the manatee has been hunted throughout the country. Over 2000 years ago, the Maya hunted manatee for food. The discovery of many bones on Moho Cay off the coast of Belize City shows that here was once a slaughter site. They probably used this island as a base for their hunting and fishing (Charnock-Wilson et al. 1974). Europeans in Belize also hunted manatees, and the Baymen smoked the meat to sell to passing sailors. The Miskito Indians hunted manatees, and in the 1860’s ships in the Caribbean often carried the Indians as “ strikers” to catch manatees and turtles to provide fresh meat for the sailors (Young and Smith 1996).

The socio-economic importance of manatees today is its role in the tourism industry. Throughout the country, the manatee adds a variety to the type of offshore tours available. Able to promote such a charismatic endangered species says a lot for the pride and concern Belize has towards biodiversity and natural habitat. This in turn entices naturalists and scientists to this country, thus increases foreign revenue and income for members of the general public.

III. STATUS AND DISTRIBUTION

All existing Sirenians, including the West Indian (W.I.) manatee, are classified as vulnerable in the 1994 IUCN (World Conservation Union) Red Book. The first legal manatee protection in Belize was passed in the Manatee Protection Ordinance (1933-1936), stemming from over-hunting pressures that led to a drastic decline in numbers. In 1981, under the auspices of the Forest Department, manatees were one of the many endangered species listed under the Wildlife Protection Act No. 4, which was drafted with the integral assistance of the Belize Audubon Society (BAS). This Act states that no person shall hunt, meaning “to kill, take or molest by any method and includes attempting to kill, take or molest by any method” any manatee. Furthermore, as a signatory of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora, ratified in 1976) Belize has adopted to protect the West Indian manatee from over-exploitation. By this convention, international trade of endangered species listed in Appendix I, such as the W.I. manatee, is prohibited. The Conservation Division also has management authority of this convention.

The modern Sirenia are representative relics of a group formerly more widespread and diverse that date back from the Eocene (Bertram and Bertram 1973). The W.I. manatee is distributed in the North and South American regions and the Caribbean (Fig. 4), inhabiting their warm coasts, rivers and estuaries. Florida is the northern limit for manatees’ year round range [although infrequently reported in southern Georgia’s coast] (Lefebvre et al 1989) inhabiting both the west and east coasts (Powell and Rathbun 1984; Garrott et al. 1994). They have also been seen on the coasts of Louisiana, Mississippi, and Alabama (Powell and Rathbun 1984). Florida’s minimum population count is estimated at 2,639 based on aerial surveys conducted in 1996 (FMRI). This is the largest population of the W.I. manatee in its range. In Mexico, manatees are found in greatest abundance in the Chetumal Bay, with few or rare sightings on the eastern coast of Quintana Roo (Colmenero-R and Z-rate 1990). Between 110 and 120 animals are estimated for the entire state of Q. Roo.
Manatee populations are widespread in Central America. In Honduras, manatees are found principally in the lakes and lagoons west of La Ceiba (Rathbun et al. 1983). The remainder of the Honduran coast does not provide suitable habitat as it has strong surf, steep shorelines and no broad, slow-moving rivers (Lefebvre et al. 1989). The numbers seen are low, with a maximum count of eleven in 1979 seen by Rathbun et al. (1983) during an aerial survey of the country. Guatemala's manatees live along the Caribbean coast in three low-elevation river and lake systems. In 1992, Quintana et al. (1994) identified 73 manatees, with the highest density of sightings (63%) in Lago de Izabal. Nicaragua's Caribbean coast comprises "one of the finest extensive habitat for manatees in Central America" (Lefebvre et al. 1989). However, very low counts were recorded during an aerial survey in 1979 by Rathbun et al., where only eleven manatees were seen in the entire coast (Salisbury 1992). Carr observed a total of 71 manatees in Nicaragua during surveys in 1992 (Reynolds et al. 1995). Even with excellent manatee habitat in the northeast, Costa Rica's manatee numbers have been reduced and large groups are no longer seen (Reynolds et al. 1995). They are still found in the Tortuguero area – where exists a National Park – and especially in Caño Servulo (Reynolds et al. 1985). Although Panama possesses the longest Caribbean coastline in Central America, only the region from the Costa Rican border to Punta Valiente may be a favorable habitat (Lefebvre et al. 1989) for manatees.

Of the South America countries within the manatees’ southernmost habitat range (Colombia, Venezuela, Guyana, Surinam, French Guiana, and Brazil), few manatees are seen (Lefebvre et al. 1989), but relatively abundant populations exist in Guyana and Surinam (Marsh and Lefebvre 1994). Although manatee remains are found in the Lesser Antilles, sightings have not been documented since the 18th Century, and may not occur at present (Ray 1960; Lefebvre et al. 1989). These islands may have formed the route between the Greater Antilles and South America (Lefebvre et al. 1989). Of the Greater Antilles, Puerto Rico’s manatee population is small and widely distributed (Powell et al. 1981). Jamaica’s manatees are not evenly distributed, and occur on the south coast (NFCA File 1993). Manatees are found on the southwest and entire north coasts of the Dominican Republic; on a small portion of the western coastline of Haiti (Rathbun et al. 1985); and on the north and south coasts of Cuba (Marsh and Lefebvre 1994; Lefebvre et al. 1989).

Belize’s manatee distribution has been studied since the late 1960s (Charnock-Wilson 1970), and probably earlier. Using boat surveys and anecdotal information, Charnock-Wilson, Bertram and Bertram (1974) found manatees in the quite commonly in the Deep River / Punta Ycacos area, Sittee River, the Sibun River and Southern “Manatee” Lagoon, the mouth of the Belize River, near Sarteneja village, and around the Drowned Cays.

The first countrywide aerial survey conducted by Bengston and Magor in 1977, resulted in a maximum count of 101 manatees, nine of which were calves. The more manatees (34.65%) were seen in the Southern Lagoon than any other location, followed by the Four Mile Lagoon near New River. In 1989 the second aerial survey was conducted by O’Shea and Salisbury (1991) in which only five selected areas, chosen based on the 1977 results, were flown. These were 1) the Four Mile Lagoon and lower New River, 2) lower Belize River, 3) waters and cays off Belize city, 4) Southern Lagoon, and 5) Placentia Lagoon. A total of 102 manatees were seen, 10.6% calves, and 53.92% of the total in the Southern Lagoon.

Since then, B. Morales with the Fisheries Dept. of Belize conducted two surveys in 1994, and one in 1995, and N. Auil conducted four in 1997 - all were done through the CZMP. These last seven surveys all followed very similar survey routes (Fig. 5) and protocols. The results from these surveys showed that inshore habitats are preferred to offshore ones (Gibson 1995; B. Morales unpublished manuscript; N. Auil unpublished data). These inshore areas are the rivers and lagoons, and an index of relative abundance (IRA) of number of manatees per hour was
used to make one habitat comparable to another where survey effort was not equal. These surveys are also comparable to the 1977 survey, although Bengston and Magor used a rotary-wing aircraft and the others were fixed-wing. Rathbun (1988) showed that although helicopters use slower speed and have greater maneuverability, there is no significant difference between the two types of aircraft.

The highest count of manatees recorded during an aerial survey in Belize is 318, seen in the August 1997 flight. Calf percentage between 1994 and 1997 ranged from 4.72 (August ‘97) and 10.46 (April ‘97) with an average of 7.32% for 1997 (Figures 6, 7, 8 and Table 4). As with the first aerial surveys in Belize, the calf proportion is slightly above the 7% Rathbun et al. (1990) reported for a healthy, growing population of manatees.

The 1994, 1995, and 1997 survey results show that although more manatees were seen singularly than any other group size [group size range 1 – 17], in all cases, over 50% of manatees were seen in groups of two or more (Gibson 1995; Auil 1997a,b,c & 1998). The second most frequently sighted group size was two animals.

Surveys were conducted on a seasonal basis as manatees are hypothesized to move based on the availability of freshwater and warm temperature. It is believed that in the dry season, manatees need to spend more time in inshore areas such as lagoons and rivers, as the supply of freshwater is limited at far-off cays and atolls. Furthermore, it is postulated that temperature changes also cause movement as manatees travel to warmer (southern) locations during “northerns” or cold fronts.

It should be noted that the 1994 – 1997 aerial surveys did not investigate further than 11 km up the Belize River and other rivers, nor past the Four Mile Lagoon near the New River. The New River Lagoon as well as tributaries further inland connecting to major rivers and lagoons, such as those in Southern Lagoon, were not surveyed. These areas, however, do have manatees, as reported by Bengston and Magor (1979), anecdotal accounts, and movement seen from the tagged animals (Section 5.1.) in the Southern Lagoon. Furthermore, as calves are more difficult to identify in turbid waters, it is very likely that many were missed in rivers and some lagoons. The fact that 50% of the animals tagged in November and February 1998 in the Southern Lagoon are females with calves, and only one calf was identified in the entire lagoon during the aerial survey in December 1997, indicates that we certainly miss many of them when the water is turbid.

Indeed, Belize continues to provide habitation to a vast majority of the Antillean manatee as compared with other countries within its range (Table 3). As they are thought to travel between neighboring countries, our population may serve as a source population for neighboring countries. In turn, declines in other countries will surely affect the manatee population in Belize. In this light, protection efforts need to encompass all of the above-mentioned nations within the Wider Caribbean.

IV. MAJOR THREATS AND CONSERVATION PROBLEMS

Sirenians worldwide essentially face the same hazards and conservation problems, the extents varying with location. Many risks or mortalities are natural in origin, but as human population grows, so do anthropogenic threats (Fig. 9). Mortality reports between September 1996 and December 1998 brought to light twenty-five manatee deaths (Fig 10). While not all cause of death is certain, those that are shall be mentioned where applicable below (See Section 5.3.3.1.).
4.1. Entanglement in Fishing Gear / Incidental Catch Through Fishing Practices

Fishing gear pose risks to free-swimming and grazing manatees when discarded or left unattended. Fishing lines and hooks incidentally ingested during grazing can cause a manatee’s digestive system to be affected enough to cause death (Beck 1991). Infection and possible amputation of appendages is possible when entwined in fishing lines (Van Meter 1989; Beck 1991). Net entanglement can lead to drowning especially for calves, as they are usually not strong enough to free themselves from the mesh. Even the nets from the shrimp trawlers have caused death to manatees in Florida (James Powell, pers. comm. 1998). Another fishing apparatus that can lead to damage is the beach trap. They have been caught in traps at Bacalar Chico (Dylan Gomez, pers. comm. 1997) and Consejo Village, Corozal (BAS 1998).

The Fisheries Regulations of 1977 states that “no beach seine, trap, wier or stop net” should be used in all areas outside the barrier reef, and within a radius of two miles of Belize City, Haulover Creek and Sibun River, and within “half a mile from any city, township, village or settlement”. Furthermore, no net or seine should be set within 100 yards of cays adjacent to the City. However, over-flights and boat surveys revealed seine nets at the mouth of the Deep River and near a residential area in Belize City.

Areas in which fishing gear would be most detrimental are by river and lagoon mouths that are illegally barricaded by stop nets. Also detrimental are areas where nets are laid perpendicularly to the shore or cays. In Belize, this type of activity is mostly seen in the southern region, where the settlements become small fishing villages, and the coastal waters are teeming with favorable food fish. Seventy-five percent of Gales Point residents interviewed complained of the unlawful use of fishing nets, and reportedly, a manatee was incidentally trapped in 1996. No recovered carcasses, however, have been positively identified as having died from net entanglement.

4.2. Illegal Hunting / Poaching

Poaching of manatees for food has been occurring for decades. The activity has led to the decline of manatees throughout the region. This is a cultural practice where it exists, but has decreased with the passing of laws protecting endangered species. This illegal slaughtering, however, is still a problem in parts of the Americas, including Belize. In the Port Honduras area, Toledo district, at least eleven manatee slaughtering sites were identified, having remains of thirty-five corpses (Bonde and Potter 1995). The remains of about nine manatees were found near Deep River on October 30, 1996 by the staff of BCES Toledo Branch. An investigation by CZMP confirmed that at least three manatees were butchered within the last month of discovery [evidence (bones) of the seven other bodies were no longer present at the sites during the investigation, therefore, only the confirmed three are counted in this document]. Again in the Port Honduras area in August 1998, TIDE found one calf manatee butchered at Cross Cay. Reports from Fishermen in the area were that three carcasses were seen. The Toledo district has long since been an area of special concern with regard to the hunting of manatees (McCarthy 1986). The most recent slaying was in October 1998; an adult was slaughtered in the Hopkins Village, Stann Creek District. It was reported that a local fisherman killed the manatee by striking its head with a machete. The carcass was butchered, and the meat was divided within the community.

The slaughter sites are usually very small, inconspicuous clearings of mangrove by the shore. The animals are taken with a net or trammel (a dory net), or more often, speared with a harpoon. The harpoon is tied with a buoy, allowing the hunters to follow the animal in boats to exhaust it. Once the animal no longer has energy to flee, the hunters shoot or strike it again. The dying manatee would then be brought to shore and butchered. A single adult could
produce up to 450 kg (1,000 lbs) of meat, which would be used for community subsistence or sold at other villages. The meat is highly favoured, and is said to have three distinct tastes: fish, beef, and pork, based on where the flesh is cut. The leather provided durable boot-soles, their oil was used for cooking, and the bones were made into weapons by the Maya, used for medicinal purposes, and are still crafted into sculptures and jewelry by artisans.

A primary cause for hunting today is past practice and current poverty. Although the perpetrators are not usually identified, what is known is that the manatees are being caught and butchered in Belize’s waters, and there is a market somewhere to warrant the killing of nine animals. One known market is in Livingston, Guatemala. Supported by the fact that the hunting took place close to the territorial border, the hunters, buyers, and sellers could be from Belize, Guatemala, and/or Honduras. Poaching, however, not only occurs in the south. There is strong speculation of at least one hunter in the Belize District, who reportedly hunts in the Belize River.

The Wildlife Protection Act of 1981 states that no person shall hunt, meaning “to kill, take or molest by any method and includes attempting to kill, take or molest by any method” any manatee. The possession and sale of any part of any manatee is also illegal by this Act. There is a known need for increased vigilance, but unfortunately, the Forest and Fisheries Departments alone do not have the resources to do so. As the Fisheries Dept. in Punta Gorda has encountered armed opposition while patrolling, assistance from the Police Department and/or the Maritime Wing would be valuable. Heightened education, public awareness and patrolling are imperative. If tourism is promoted in the area, including manatee tours, the waters can be “patrolled" by guides on a more regular basis. This will also build personal interest in manatees, as they will become a source of *legal* income for locals.

### 4.3. Alteration and Destruction of Habitat

#### 4.3.1. Coastal Land Reclamation / Development

Coastal zone development is unavoidable with increased tourism and infrastructure in Belize. This development without thought of mitigation measures brings with it damage to natural ecosystems. Coastal and cay development often means removal of littoral forests, seagrass destruction by dredging of canals, and mangrove destruction that leads to the need for artificial barriers such as seawalls. The cays are sought after by an array of people from local fishers to investors, resulting in approximately 67% of the cays being claimed by locals and foreigners (CZMP 1995). Development is substantial on the islands of Ambergris Cay and to a lesser extent, Cay Caulker and St. George’s Cay. Development pressures include problems from liquid and solid waste disposal, increased risk of contaminating water supplies, increased dredging, and loss of natural habitat. Coastal development of houses within the Belize district is also becoming very prominent. The area where land reclamation is most evident is on the island of Cay Chapel. Land reclamation also leads to hazards brought on by dredging (Section 4.3.5.). Generally, development also leads to increased boat traffic and docking facilities and domestic pollution (Section 4.3.6).

The Department of Land and Survey stipulates land ownership through the National Lands Act of 1992 and use through the Land Utilization Act of 1981. Town Planning Regulations fall under the Central Housing and Planning Authority.

#### 4.3.2. Mangrove Destruction

Three mangrove species are found throughout the coastal zone of Belize: red mangrove (*Rhizophora mangle*), white mangrove (*Laguncularia racemosa*), and black mangrove
(Avicennia germinans), and one main associate the buttonwood (Conocarpus erectus). Mangroves make up an estimated 3.4% of Belize’s land area, comprising approximately 296 square miles (Zisman 1992). The majority of mangrove is found in mainland areas.

Mangroves have numerous ecological significances, including their role in soil formation by stabilizing coastlines; filtering upland runoff; providing habitat for juvenile marine organisms, coastal birds and reptiles; and increasing offshore productivity by producing large amounts of detritus. They provide a shelter and residence area for many threatened and endangered species (manatees, crocodiles and species of birds). Additional benefits to man include its ability to act as a natural storm buffer, act as nurseries for commercially important fisheries, and for tourism because of their aesthetic value.

As coastal development is becoming more attractive, especially on the cays, mangrove clearance will correspondingly increase. Clearance is done for urban and rural development, infrastructure, waste disposal, tourism, and to a lesser extent, aquaculture. Mangrove distribution is limited by climate (they are not tolerant to freezing temperatures); salinity (although able to grow in freshwater, salinity decreases competition of other vascular plants); tidal fluctuation; and low wave energy, therefore, sediment accumulation.

**FIGURE 1:**

![ACRES OF MANGROVE By Location](image)

Mangrove clearance and cutting are regulated under the Forest (Protection of Mangroves) Regulations, 1989 and 1992. Furthermore, by regulation of the National Lands Act, 1992, a 20 meter (66 ft) strip of land alongside streams, rivers or open water, should be left in its natural state. Ninety mangrove clearance permits were issued between 1989 and 1996, clearing 137.19 ha (342.97 ac) of predominantly red mangrove. This figure is an underestimation as obtainable records are incomplete. Clearance in Belize City made up more than 88% of the total cleared area.

**TABLE 1: Mangrove Clearance (Acres) by District from 1989 - 1996**

<table>
<thead>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Belize City</td>
<td>26.00</td>
<td>28.95</td>
<td>10.20</td>
<td>13.96</td>
<td>146.80</td>
<td>42.00</td>
<td>31.00</td>
<td>4.38</td>
<td>303.27</td>
</tr>
<tr>
<td>Stann Creek</td>
<td>15.00</td>
<td>1.00</td>
<td>0.59</td>
<td>0.50</td>
<td>6.85</td>
<td>2.07</td>
<td>2.00</td>
<td>0.00</td>
<td>28.01</td>
</tr>
<tr>
<td>Corozal</td>
<td>0.00</td>
<td>0.00</td>
<td>2.25</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.10</td>
<td>0.00</td>
<td>2.35</td>
</tr>
<tr>
<td>Toledo</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>9.00</td>
<td>0.34</td>
<td>0.00</td>
<td>0.00</td>
<td>9.34</td>
</tr>
<tr>
<td></td>
<td>41.00</td>
<td>29.95</td>
<td>13.04</td>
<td>14.46</td>
<td>162.65</td>
<td>44.41</td>
<td>33.10</td>
<td>4.38*</td>
<td>342.97*</td>
</tr>
</tbody>
</table>

Source: Forestry Department; believed to be partial data * Incomplete data (confirmed)
Of all the permits issued, approximately one third of them were for clearance on cays. Clearance throughout Belize was requested primarily for housing, both commercial and private. Tourism and business were the second and third greatest reason for clearance, followed by the creation of marinas and for industry.

4.3.3. Sedimentation / Siltation

Marine dredging (Section 4.3.5.), oil drilling operations, and mining at inshore coastal areas result in the suspension of sediments in the water column. Land erosion resulting from vegetation clearance and dredge spills pollutes waters with their suspended sediments. Suspended sediments such as silt reduce water clarity, therefore the ability of light to reach photosynthesizing organisms. It smothers seagrass beds (Section 4.3.4) as well as coral reefs. In addition, fine sediment such as silt or clay acts as a sink for pollutants by forming colloids with them while suspended, namely in lagoons or estuaries. When settled, these pollutants are inactive, and can be very easily resuspended by further dredging or high boat traffic in shallow areas.

4.3.4. Seagrass Stress / Destruction

Some of Belize’s most substantial coastal resources are its seagrass beds that cover much of the substratum. They provide not only feeding areas, but habitat for numerous fish, lobster, conch, and of course, turtles and manatees. They also protect coral reefs from sedimentation settlement, as seagrasses trap sediments. Because of their growth limits in relation to temperature, salinity, currents, and water and sediment depths, significant changes in these parameters and other environmental impacts leave them vulnerable. Seagrass areas can, therefore, be used as an indicator of habitat health.

Seagrass is the manatee’s primary food source, and reduction of these beds directly limits manatee grazing habits and range. Threats to seagrass include dredging (Section 4.3.5.), which not only directly removes the vegetation, but can lead to substantial increases in suspended sediment that cover neighboring beds. Soil run-off from deforestation as well as oil exploration and mining also cause an increase in siltation, destroying seagrass beds and consequently decreasing coral reef viability. Agrochemical runoff, industrial effluents, and nutrient enrichment can lead to water quality changes resulting in seagrass destruction. Trawling operations can also destroy seagrass beds as the nets drag and remove benthic communities. Boat traffic in shallow areas also leads to removal of seagrass.

4.3.5. Dredging

Coastal development brings an increase in water traffic, land reclamation, and commercial building. These three activities correspondingly bring an increased need for dredging: to increase waterways, to gain material for reclamation and for construction purposes. Unfortunately, if an Environmental Impact Assessment (EIA) is not carried out prior to the operation, and monitoring does not occur throughout the dredging activity, great environmental degradation will result.

The harmful effects of dredging result from suspending material in the water column that alter suitable light and temperature levels needed by surrounding living organisms. “Dredge-and-fill” can lead to changes in water currents, circulation, mixing, flushing, and salinity; add to water turbidity, siltation, and pollution; as well as lower dissolved oxygen (Clark 1996). Also, improper or lack of assessment of the “borrow pit” (the area of seabed to be removed) can have very
detrimental effects. Its depth should not go any deeper than the compensation point of the dominant plant life, if the area is to become biologically stable (Vousden 1995).

In Belize, between 1995 and 1997, nine mining licenses and 44 quarry permits were issued (Table 5). Each year had roughly the same number of issued licenses, having increased by more than double since 1994. Fifty-nine percent of these permits were issued for dredging near cays, mainly San Pedro and Cay Caulker. Each quarry permit is only valid for the year in which it is issued, while mining licenses are issued for two to three years.

4.3.6. Sewage and other Effluents

Domestic and industrial effluents have considerable effects on the integrity of the coastal zone. Much of the discharge is organics, heavy metals and oil (McField et al. 1996). Domestic waste results in environmental health risks. These risks include eutrophication at locations of direct sewer fall-out; loss of available drinking water supplies; degradation of seagrass and coral ecosystems; loss of recreational areas; unpleasant odor and loss of aesthetic quality; increased bacteria that lead to highly contagious diseases such as cholera. As cited from McField et al. 1996, Archer (1994) identifies the following areas as primary concern in relation to inadequate sewage disposal:

- Chetumal Bay
- Belize River and Haulover Creek estuaries
- Belize City coastal waters
- North Stann Creek / Havana Creek
- Placentia
- Punta Gorda
- San Pedro
- Cay Caulker and other islands

Industrial effluent is produced primarily from the sugar and citrus industries (Newell 1993). Distilleries and other industries produce harmful effluents at much lesser extents. The sugar industry has factories in the northeast on banks of the New River. This river and the Chetumal Bay receive their effluents. One rum distillery, the breweries, the soft drink manufacturing operations, the laundry operations, and the battery factory produce waste products that greatly affect the Belize River and adjacent waters. The Stann Creek area is affected by the citrus industry as processing plants drain into canals and tributaries leading to the North Stann Creek River. Newell (1993) states that even the smallest quantities of effluent reaching the Pomona and Stann Creek Valley area will cause severe pollution, due to the oligotrophic nature and low alkalinity and hardness values of this area.

The Water and Sewage Authority is responsible for the maintenance of all sewage systems and has pollution prevention powers over all water bodies in Belize. The Department of the Environment (DoE) is also responsible for the prevention of pollution in the sea, as well as on land.

4.3.7. Contamination by Agricultural Practices

All over the world, natural ecosystems are changed as “unuseful” vegetation is cleared and replaced with vegetation preferred by man. As these newly introduced systems are not
indigenous to the area, man must compensate for pests and unsuitable soil by using biocides and fertilizers respectively. These mostly inorganic chemicals are what pose risk to the marine environment and natural waterways. Even if the farms lie far inland, they usually lie in watersheds. Bananas, one of Belize’s three major cash crops, pose a serious environmental risk due to the large amounts of pesticides and fertilizers used, and their close proximity to water sources (Usher and Pulver 1994). As bananas have a high water requirement, the twenty-one banana plantations are located within five watersheds and near rivers. Eleven farms use the Swasey River watershed, and the Bladen River watershed is used by three (Usher and Pulver 1994). These systems join to form the Monkey River - an area that is often seen inhabited by manatees. Sugar, the number one cash crop for Belize, is grown predominantly in the northernmost districts, namely Corozal and Orange Walk. Primarily grown in the Stann Creek district, citrus is also grown in the Toledo and Cayo districts.

Each chemical’s ability to reach natural water systems depends on its biological reactivity. Some bind to soil particles, rendering them unavailable for leaching, volatilization, or other movement. These can, however, move in soil sediment run-off. Others are highly soluble and therefore move via leaching. The total quantity of imported biocides in 1997 was 1,319,370 kg (2,931,934 lb), an increase of 6.8% since 1995 (Pesticide Control Board). Although not fully understood, the effects of pesticide and fertilizer run-off (in combined effect or independently) lead to a number of negative results: i) damage to seagrass and other vegetation; ii) eutrophication that can lead to fish kills in waters of poor circulation; iii) groundwater contamination; iv) possible bioavailability for marine organisms. Although not certain, it has been hypothesized that since plants can take up and hold thousands of parts per million (ppm) of copper (which is the base for a few of the chemicals used in Belize), manatees’ consumption of herbicide-treated vegetation increases the copper concentration in their livers (O’Shea 1992). Examination of manatees from the Chetumal Bay by Rojas et al. (unpublished manuscript) showed mercury values higher than that reported in the liver tissue of manatee and dugong elsewhere. Seagrass samples varied in concentrations, iron being 30 µg g⁻¹ in T. testudinum and 298 µg g⁻¹ in N. marina. Furthermore, concentrations of the heavy metals calcium, nickel, copper, manganese, cadmium, lead, and mercury were higher in manatee bones than other marine mammals.

The Pesticide Control Board controls the import, manufacture and use of pesticides and consequently prohibits the use of specific types. This Board lies within the Ministry of Agriculture and Fisheries.

**4.3.8. Damming of Rivers**

Damming is done to restrict the flow of water, to elevate water levels in certain areas facilitating abstraction, and even to restrict sediment flow to expedite dredging. The most striking case of damming of a river is at Monkey River. Agricultural and aquacultural uses of the river have resulted in decreased water discharge and sediment outflow from the river. An irrigation dam was installed at the Sorensen Banana Plantation, located on the Swasey Branch of the river. Although not still present, the dam was having an impact on the volume of sediment transported by the River (Ariola 1997). In addition, the shrimp farm Cherax Ltd., also located on the Swasey Branch of Monkey River, abstracts 22,800 liters (6,000 gallons) of water per hour for 10 hours per day (Huntington & Dixon 1997). The Swasey River feeds 47 ha (118 acres) of Cherax’s production ponds.

Decreased sediment deposition by the river has resulted in beach erosion at the Monkey River coastline. Furthermore, the decreased hydraulic capacity of the river was unable to disintegrate a sand bar that normally forms at the river’s mouth (Ariola 1997). This, in turn, has decreased
navigational ease. If this bar continually increased in size, manatees would hypothetically lose a major source of freshwater, and movement into and out of the river would be hindered. Continued beach erosion will not only lead to the removal of land where houses are situated, but also an increase in sedimentation hazards (Section 4.3.3.).

4.3.9. Tourism Activities

For over a decade, tourism has become one of Belize's most profitable and developing industries. It is a substantial income earner and employment opportunity for Belizeans, providing jobs from hotel clerks to gift shop owners to tour operators. In 1996, 1,924 nationals and 184 foreigners were employed in the hotel industry (BTB 1997). Tourism, furthermore, is reported to be the country's single largest earner of foreign exchange (McField et al. 1995). BZ$167.1 million was the total tourist expenditure for 1996, having increased by 26.45% since 1988.

The Belize Tourist Board, within the Ministry of Tourism, is responsible for hotel development under the Hotel Acts, and for tourism policy under the Belize Tourist Board Act. Furthermore, all tour guides and recreational vehicles must be licensed by the BTB as stated in their Regulations.

Undoubtedly, offshore tourist activities are more popular than mainland ones, with most tourists visiting with the intention of snorkeling or SCUBA diving. A part of some snorkeling packages, particularly those offered from Belize City, Cay Caulker, and San Pedro, is a visit to see manatees in their natural habitat. A tour averages about US$70.00 per person. In Cay Caulker, of the eleven guides interviewed, manatee tours are made everyday during the high season, but the number of visits is roughly three times per week. Six of the nine guides interviewed in San Pedro conduct manatee tours. Only two of these guides do tours approximately four times per week, the majority only conduct manatee tours on request (no more than once per month). These guides, as well as guides based in Belize City, take tourists to Swallow Cay to visit manatees.

Placentia manatee tours are not as popular as those afore-mentioned. The poor lagoon visibility results in low chances of seeing manatees here, so guides make trips approximately four times per month. In Punta Gorda, only three of the nine people interviewed were tour guides. Fishermen make up those who travel extensively by boat. Only one tour guide does manatee tours, about four times per month during the high season. His sites are Golden Stream and Deep River. Although there is great potential for successful manatee watching from Gales Point, only five of the eight people interviewed do manatee tours. Utilizing primarily Tarpon Hole, trips are made a mean of three times per month.

One of the threats faced by increased tourism is an increase in the destruction of natural mangrove and even seagrass beds as development of hotels and resorts increases. Also, with these new structures come more waste products, which in many cases, end up being pumped directly into the sea or adjacent rivers and streams. Furthermore, increased tourism includes increased boat activity - the areas of greatest impact are mentioned below. An increase in tourism can be very beneficial to manatees in areas such as Punta Gorda and in the north in the Chetumal Bay. This would result in more local “patrolling” of the area in question, by the guides themselves. Since one can bring home about BZ$100 per person per trip, the economic incentive to protect these animals should exist.

Harassment by man also stresses manatees. For example, it is usually present when tour guides carelessly allow their tourists to swim, uncontrolled, with the manatees. This harassment was so common in the Swallow Cay area in 1992, that the manatees fled this popular
As a result, the guides lost this source of their income. Since then, a “no swimming” regulation was introduced by the Forest Department, as requested by the guides. As the regulation has been abided by, the manatees have returned to the area. However, this activity by tour operators is not monitored, allowing only the guide’s discretion as a source of control. Without question, guides need to participate in a training programme on proper manatee guiding techniques, so as not to cause more damage to the manatees. Belize must take measures now to avoid a situation such as in Florida, where Shackley (1992) concludes that tourism is more detrimental than profitable to manatees.

Certainly, the most detrimental of all the above mentioned types of habitat destruction is that which results in seagrass, and to a lesser extent, mangrove damage. This would include dredging, which takes place predominantly near cays and around Belize City. Also, effluents from industry and sewage decreases water quality in the important manatee areas of the Belize River and adjacent waters, Chetumal Bay, and Placentia Lagoon. This decrease in water quality in turn makes seagrass beds more susceptible to damage. Seagrass destruction is the major form of habitat alteration that needs to be addressed.

4.4. Boat Traffic Related Fatalities

Watercrafts pose a threat for manatees by direct contact and indirectly by pollution and degradation of seagrass beds. The greatest immediate impact that watercraft have on manatees is in direct physical contact. Manatees from such accidents succumb to one of two death categories: impact injuries or propeller strikes (Wright et al. 1995). The 1979-1991 watercraft-related mortality study in Florida (Wright et al. 1995) showed that 55% were due to impact injuries. Although Belize has only a fraction of boats compared with Florida, it is quite possible that several deaths classified as “unidentified” due to lack of proper necropsy training, resulted from boat injuries.

Watercraft accidents in Belize are surely present. Four of the recovered carcasses have been associated with boat/barge collisions. It was reported that in March 1997, an 8.8 m (29 ft) water taxi with two 115 horsepower engines killed an adult male while travelling between Cay Caulker and the City. In August 1997 a female calf was found in the City with propeller scars. In March 1998, a barge in City killed an adult female near the Crystal Shipping Dock. Reports have also been made of incidences of boat collision in 1998. These were i) in Haulover Creek (the water taxi waterway in the City) in May, that led to much bleeding from the animal as reported by eyewitnesses; ii) between Coco Plum Cay and Rocks Island in June by a tour operator; and iii) in August at the Drowned Cays by a research vessel. It is uncertain if these accidents lead to manatee deaths, as the animals fled the scene in all cases and carcasses were not later found. This type of accident could leave manatees with scars or mutilations from boat propellers.

It is certain that manatees are of greatest vulnerability within a 27 km (16 mi) radius of Belize City. Approximately thirteen water taxies operate in Belize City from at least four major docks, and travel to the cays east and northeast of the City. The water taxies can transport approximately 460 tourists from the City to Cay Caulker or San Pedro each day. From 1994 to 1997, there was a 82.51% increase in the number of boats registered with the Belize Port Authority (BPA) (Table 6); from 1993 to 1997 there was a 26.53% increase in the number of boats registered by Fisheries. If this trend of significant boat increase continues, boating regulations in manatee areas will prove to be a necessity. Furthermore, with an increase in tourism there is an increase in hotels, and a resulting increase in barges transporting consumable goods to these cays. Unfortunately, without consistent reporting of accidental watercraft hits and appropriate boat speed zones, offenders of such accidents cannot be penalized or reprimanded accordingly.
4.5. Natural and Manmade Factors

Pollution in the form of domestic waste, agricultural and industrial runoff have the capacity to enter waterways used by manatees. Once in the water, suspended toxic ions and those attached to aquatic vegetation are readily consumed. This consumption may prove fatal if the heavy metals accumulate substantially in the animals’ systems over time. This, however, has not been proven for manatees. Additionally, solid waste such as plastics, string, paper, cellophane, and sponges can also be ingested, causing almost immediate fatalities (Beck 1991). As these types of waste are commonly found washed on coasts and cays, they indeed pose a risk for free-ranging manatee in our waters.

Manatee also die from diseases caused by viruses or bacterium, epidemics, biological toxins such as red tide, or a combination of factors (O’Shea et al. 1991; Buergelt et al. 1984). Temperatures below 20°C (68°F) can also lead to manatee death. This low temperature is not seen in Belize, however, as the normal temperature range is 29 – 33°C (84 – 91°F) year-round. In addition, manatees frequently die from perinatal causes. This category refers to perinatal manatees presumed to have died from natural causes for manatees 150 cm (5 ft) in total length or less, which includes neonates, stillbirths, aborted fetuses, and orphaned young (Ackerman et al. 1995).

V. ACTIVITIES TO FURTHER KNOWLEDGE OR SOLVE PROBLEMS

The following describes Belize’s achievements in acquiring data on manatees and their habitat. It also offers recommendations to reduce shortcomings and solve problems.

5.1. Assess Manatee Status and Distribution

In order to accomplish the goal of creating and conducting appropriate management strategies for the threatened manatee, it is imperative to continue and enhance research techniques. Data on life history, distribution and relative abundance of the species will allow decision-makers to
make informed choices. Probably the most viable method of determining distribution and manatee abundance is by aerial surveys. Although this method cannot accurately determine the manatee population of a country, with periodic seasonal surveys conducted over years, a pattern of movement and abundance can be established. To enhance results from this type of survey, boat transect surveys could also be carried out. This method not only allows for probability estimates of locating manatees in an area, but allows for behavioral studies as well.

Aerial surveys have been conducted in Belize since 1977. Using the extended-area survey technique (Packard 1995), seven aerial surveys conducted between 1994 and 1997 have been used to assess the manatee status and distribution in Belize (Fig. 6 & 7). These last seven surveys were conducted as an effort through the CZMP with the assistance of ECOSUR, the Fisheries and Forestry Departments. Important areas for manatee have consistently been found to be the cays adjacent to Belize City along with the Belize River, the Southern Lagoon, Placentia Lagoon, the Corozal Bay, and the Port of Honduras area (Bengston & Magor 1979; O’Shea & Salisbury 1991; Morales 1994a, 1994b & 1995; Auil 1997a, 1997b, 1997c & 1998). (See Section III & Fig. 13).

To assess manatee distribution, and more specifically movement, two projects have been undertaken by researchers. The first is a photo-identification project at Ambergris Cay and the cays near Belize City. The independent researcher Greg Smith heads this, with the assistance of the Oceanic Society. Smith’s goal is to identify individual manatees to gain knowledge on short and long term movement and collect life history information on identified manatees. Identification is made through scar patterns on the animals’ flukes. Short-term movement patterns of identified manatees at Basil Jones Cut, Ambergris Cay, have shown seasonal use of this site from March through November. However, according to Smith (1997), they are not seen in the area during the rest of the year. As Basil Jones cut is within the Bacalar Chico Marine Reserve, a newly declared World Heritage Site, any information on the manatee use of this site will be used to recommend management of tourism, commercial fishing, and boat travel.

Another manatee research project currently underway in Belize is a tagging project sponsored by the Wildlife Preservation Trust International (WPTI), Wildlife Conservation Society (WCS) and the Save the Manatee Club. It is a collaborative research project with the Belize Forest and Fisheries Departments, the Gales Point community, and the CZMP. Dr. James Powell heads the tagging project with Belizean biologist Andrea Gill, and the animals are captured from the Southern Lagoon. At this time, four adults are tagged. A female with a dependent calf and a male are tagged with VHS-satellite (PTT) transmitters; a second female with a calf and a male are tagged with VHS transmitters. Only one of the four tagged animals has left the Southern Lagoon and not returned since it was first tagged in November 1997. The others move within the lagoon, leaving to sea for short periods. The data obtained on the manatees’ movement, habits, and the impact of ecotourism will be used to develop a management plan for the Southern Lagoon.

5.2. Manage, Protect and Monitor Manatee Habitat

In order to protect this migratory species, it is essential to pay special attention to the changes in habitat used by manatees. Important manatee areas must first be identified, and detrimental activities in these areas should be analyzed and prevented.

5.2.1. Identify Essential Habitat

Lagoons, coastal areas, cays, and rivers are manatees’ primary distribution areas. In the small coastal country of Belize, these habitats make up a significant portion of the total area. They lie
within estuaries, wetlands and watersheds that provide manatees’ primary needs of water, shelter, space, and food. As their food source is marine and freshwater vegetation, this resource has to be available for their survival. Fortunately, Belize’s coast, many lagoons and adjacent cays are blanketed with seagrasses (Fig. 11). Manatees also need mangrove, as it too is a source of food, and more importantly, offer areas of protection and seclusion. The narrow mangrove channels in islands and coastal areas allow excellent refuges, especially for mothers with calves. As mentioned above, fresh to brackish inland areas are preferred by manatees, namely the lagoon and river habitats.

5.2.1.1. Survey Foraging Areas

Belize’s coastal waters and lagoons are abundant with seagrass, which also surround cays, and fill atolls. Utilizing Landstat TM imagery (using an image taken March 1996), the entire coastal zone of Belize was classified (Matus 1997). With a spatial resolution of 30 m and results of 60% overall accuracy, it was found that 4214.33 km² (1685.73 mi²) of seagrass is distributed throughout the coastal zone. “Dense seagrass” (standing crop biomass (dry weight) >80 g.m⁻²; cover 70%) comprises 13.45%; “medium density seagrass” (standing crop biomass 11-80 g.m⁻²; cover 30-70%) comprises 29.78%; and “sparse seagrass” (standing crop biomass 1-10 g.m⁻²; cover <30%) 14.52%. The seagrass density descriptions were defined by Mumby & Harborne (1996). “Seagrass with distinct coral patches” make up 0.63%, and the “turbid” areas that were found to be seagrass in all field surveys, comprises 41.61%. Seagrass makes up 71.97% of the total benthic habitat that was classified.

5.2.1.2. Survey Mating / Rearing Areas

In 1997, confirmed oestrus herds were identified in the Southern Lagoon and near Belize City. Both were seen in very shallow water (0.7 m (2.3 ft) and 0.6 m (2 ft) respectively) adjacent to the shore. The herd observed in the Southern Lagoon involved an unreceptive female fleeing from the pursuing males. In the Belize City area, the female engaged in copulation with numerous males over several hours (Auil 1997c). Oestrus cows apparently seek shoal to evade their escorts (Hartman 1971). Reproductive activity observed by Hartman (1971) also took place near the bottom of the water at 2.5 m (8.3 ft) and 5 m (16.5 ft) depth. There is no mating season for the manatee, as they can mate all year round.

From Hartman’s (1971) observations, manatees are not particularly social animals, with only unstable, small, random groups of about two to three individuals. The most cohesive group is the mother-calf bond, which can last up to two years from the calf’s birth. Mating herds only last the duration of the female’s oestrus. In addition, males engage in homosexual embraces, drawing a short-lived group of many bulls. Therefore, examining groups larger than five individuals and assuming that they could be mating herds, a total of seven were seen in two aerial surveys in 1994, two were seen in 1995, and 15 were seen in the four aerial surveys conducted in 1997. The locations of these large herds seen in 1997 are indicated in Fig. 7.

Using an Index of Relative Abundance (IRA = # calves / hr) (Gibson 1995; Morales 1994a,b; Morales 1995), there was no significant difference in calf abundance between seasonal surveys conducted in 1997 (Fig 8). There was, however, a significant difference in their habitat use between the rainy and dry seasons (Auil unpublished data). The lagoon habitat and the river habitat are preferred in the dry season. In the rainy season, no calves were seen in the rivers and the lagoon habitat was most favored, but overall sightings were not as abundant as in the dry season. Increased turbidity in the rainy season, however, may have decreased visibility of manatees, especially calves in the flooded rivers and adjacent coast. This may have caused the observed results.
5.2.2. Develop Area-Specific Management Plans

To date, Belize has about 60 protected areas, encompassing over 40% of her National territory. This includes four Nature Reserves (NR), eleven National Parks (NP), two National Monuments (NM), four Wildlife Sanctuaries (WS), nineteen Forest Reserves (FR), five Marine Reserves (MR), seven Archaeological Reserves (AR), and eight Private Reserves (PR) (Table 7). There exists several legal statutes for designating and regulating protected areas in Belize, these are listed in Appendix 1.

Currently, over 43% of protected areas are within the coastal zone. These provide protection of habitat utilized by manatees, primarily seagrass beds. However, only the Marine Reserves include significant portions of water bodies, while the others protect terrestrial resources and activities – with the exemption of the Burdon Canal NR, Shipstern NR, Deep River FR, Mango Creek FR, Golden Stream PR and Manatee FR, which do include important tributaries. It is a recommendation of this Recovery Plan that sound management plans be developed for reserves that are adjacent to manatee areas and therefore, should include the issue of manatee protection. This especially applies to the Bacalar Chico NP/MR as it lies adjacent to the Corozal Bay (Manatee) Wildlife Sanctuary, and it includes Basil Jones, a frequented area by manatees. Furthermore, other reserves within the coastal zone should produce holistic management plans with manatee protection needs incorporated.

Areas with consistently high use by manatees from north to south, include:

i) the Corozal Bay area, namely on the coast, and Rio Hondo including the Four Mile Lagoon stemming from this river;

ii) a 25 km (15 mi) radius from Belize City, which would include the coast of the city, the Belize River and Sibun River, as well as the cays (Hick’s Cays, Hen and Chicken Cays, Rider Cays, Long Cay, Montego Cay, North Drowned Cay, Swallow Cay and the Drowned Cays) adjacent to the city;

iii) the Southern Lagoon, including Quashie Trap Lagoon;

iv) the Placentia Lagoon;

v) Indian Hill Lagoon;

vi) Port Honduras, including Deep River and Seven Hills Lagoon.

These six locations possess seagrass, availability of freshwater and significant space with secluded inlets or boughes.

Of the above mentioned critical areas, the Corozal Bay has been ratified as a Wildlife (Manatee) Sanctuary as well as the Southern Lagoon as the Gales Point (West Indian Manatee) Wildlife Sanctuary. It is a recommendation of this Recovery Plan that management plans for these two reserves are immediately developed as primary objectives for both areas and corresponding guidelines need to be documented. Within the Belize City region, the Burden Canal was established as a Nature Reserve to protect mangrove species. From the 1990 Critical Habitat Survey conducted by BCES, 35 sites were identified as critical and in need of some protection of their natural and cultural elements. A rating system of ‘15’ to ‘21’, ‘21’ depicting areas of highest conservation value, was assigned to each area. The Four Mile Lagoon, which extends from the Rio Hondo, was given a Critical Value of ‘16’. The Belize River mouth to Moho Cay was assigned a value of ‘20’ and Haulover Creek and Burden Canal a value of ‘18’. The Southern Lagoon (with the Northern Lagoon) a SDA, was assigned a value of ‘19’. Placentia Lagoon falls within the Mango Creek SDA, with an objective of “protection of the natural
environment". The Placentia peninsula and the lagoon were given a Critical Habitat value of ‘15’ (the same value afforded to the Blue Hole at Lighthouse Reef Atoll, a Natural Monument).

It is a recommendation of this Recovery Plan that these priority areas have some protected status or at least legally standing regulations to ensure the viability of the important transient or resident manatee communities within. Management plans should be produced for these vicinities, especially if declared a protected area. Proposed reserves (Table 8) should incorporate protection for manatees in their management plans, where applicable. The primary regulation for these areas should be the slow speed zones in shallow areas. Development, which would include dredging, within these locations should be discouraged. If development should occur, proper EIAs should take place with the consideration of endangered species and their habitat.

5.2.2.1. Involve Local Coastal Zone Authorities

At present, the Coastal Zone Management Project works in conjunction with Heads of Departments from each of the three line Ministries directly associated with coastal zone management. These are the Ministries of Agriculture and Fisheries, Tourism, and Natural Resources and Environment. The Permanent Secretaries (PS) of all three, including the PS of the Ministry of Economic Development, are members of the CZM Steering Committee (CZMSC). This committee also includes the UNDP Programme Officer, and the National Project Advisor of the CZMP, and is the direct counterpart for advice and decision-making. The CZMSC or its Chairman (PS of the Ministry of Agriculture and Fisheries) may direct Project inquiries or concerns to any relevant GoB representative. (Project Document Amendments 1997).

In addition, a CZM Technical Committee (CZMTC) advises on technical matters, providing formal recommendations and briefing reports to the CZMSC. Its members include representatives of the Fisheries Department, CZMP, Lands and Survey Department, Geology and Petroleum Office, Forest Department, UCB/MRC, BTB, Department of the Environment, Housing and Planning, and the Public Health. Coopted members include the Ministry of Economic Development, WASA, BAS, CCC, BTIA (Cay Cauker), the Belize Institute of Environmental Law and Policy, the Meteorological Department, and the ESTAP Project. To be appointed are the Belize Chamber of Commerce and Belize Port Authority.

The CZMSC is in the process of evolving into the Coastal Zone Management Authority, with overall responsibility for coordination on coastal zone management issues. The Authority will be the body that defines coastal zone management strategies and advises Cabinet on policy issues and legislative requirements. The Coastal Zone Management Institute will be formed, and the Technical Committee will be appointed as the Advisory Council as described in the Coastal Zone Act of 1998.

A primary goal of coastal zone management is to resolve conflicts between economically important activities in the coastal zone (Clark 1996). This requires the involvement of local communities and stakeholders. Thus, closer ties shall be formed with the local level. This shall be done with the formation of Area Advisory Committees at locations partitioned into special management areas. These Committees, comprised of their local representatives, will provide relevant advice and observations to the Authority, Institute and Technical Committee. In addition, SDAs and EIAs already require meaningful input by the communities that have a vested interest in development within their municipality.
Currently, grass-root organizations exist at Gales Point (the Gales Point Progressive Cooperative), Placentia (Friends of Laughing Bird Cay NP), and Advisory Committees were established for the Hol Chan MR, Bacalar Chico NP/MR, Glover’s Reef MR.

5.2.2.2. Develop Regulatory Guidelines

It is a recommendation of this Recovery Plan that areas of high concentration of manatees, and correspondingly, rich in vegetation, have guidelines that regulate human activity. Sanctuaries or reserves need not necessarily be implemented, if the following guidelines are passed as regulations with fines for violations:

1) **Slow boating speed zones:** where manatees are in abundance, namely over shallow areas, usually covered with seagrass beds. This will not only decrease chances of injuring a manatee, but also the damaging effect that engines and boat hulls has on shallow seagrass beds. Channel exempt boat speed zones should include:
   - Between Belize City and Port-O-Stuck
   - In the Belize River
   - In the Placentia Lagoon
   - Southern Lagoon
   - Narrow mangrove channels
   - No use of boat engines in dead end creeks

2) **Tour guiding:** To avoid harassment and danger to manatees, any manatee guide should be obligated to take part in proper training, and should not practice without having a Manatee Guide certificate. Workshops should be held to train and certify guides to conduct proper and safe manatee tours.

3) **Habitat Destruction:** Allow for mitigation or restoration of habitat destroyed by coastal development. The developer should be responsible for restoration of another section of wetland or create new wetland to compensate for that which he destroyed. This would be to achieve a “no net loss” of this valuable resource. Furthermore, sound “environmentally friendly” activities such as leaving natural vegetation to prevent erosion, should be encouraged and supported by the government.

5.2.2.3. Provide for Enforcement of Guidelines

To achieve compliance of recommended regulations or policy, institutional and government support is essential. Unfortunately, in many cases the relevant government agencies are not financially able to provide sufficient equipment and manpower. In the case of manatees, patrols are essential in certain areas. One example is the Port Honduras area, which is a large expanse encompassing a multitude of cays, some of which are said to be used by manatee hunters (See Section 4.2.).

It is a recommendation of this Recovery Plan that other government agencies that frequently patrol our waters, namely the Maritime Wing of the BDF and the Police Department, be encouraged to enforce the Wildlife Protection Act on behalf of the Forest Department. This will allow more efficient safeguarding of marine wildlife by those working within the animals’ habitat range. Non-Governmental Organization (NGO) support is also essential, such as that given by TIDE in Toledo where they regularly patrol the Port Honduras area.
A communication system that all government agencies could use as a means of efficient information transfer is essentially needed. There is currently no centralized coordination of data, therefore, interested persons cannot retrieve information easily. Such a communication system would be used to input details on new policies or laws, which would thereafter be accessible to all other agencies. A cataloging system for all laws and policies pertaining to wildlife and the environment should be centralized at a library or government institution (such as the UCB library, the Attorney General’s Office or the Ministry of Natural Resources). References should also be available in digital form via the Internet, where abstracts and possibly the law itself, could be found. Having legal information readily available for government offices would be an efficient method of educating law enforcement officers.

5.2.2.4. Monitor & Modify Law Enforcement Guidelines

Law enforcement guidelines can be monitored by their results. Formal reevaluation should take place periodically, maybe every five years. Changes such as increased patrolling, education, fines, and regulations should occur where weaknesses or gaps lie. Each government department has not only the responsibility for their specific duties, but they are responsible for being aware of and addressing activities of other departments. This is because with an integrated system such as coastal zone management with a primary goal of maintaining biodiversity, many departments and agencies are involved. NGOs are also in the position to critique government departments’ actions pertaining to enforcement of their respective mandates. If departmental duties and responsibilities are not met, NGOs play an important role in their position to formally express their discontent. Furthermore, a responsibility of the NMWG (Section 5.4.) is to examine and identify areas where law enforcement agencies are not acting in the best interest of the manatee.

Development in particular should be looked at in regards to its capacity to destroy critical habitat used by endangered species, and whether this consequence is worth the development. Conducting cost/benefit analysis is necessary in development situations. It must be recognized that maintaining natural ecosystems and processes in Belize are usually more feasible than most development within the coastal zone. This is so because this small country economically relies on its natural resources in major industries such as fishing and tourism. Short term results from rapid coastal development lead to negative long term consequences.

5.2.2.5. Develop Educational Materials

Certainly, it is important that education go hand in hand with enforcement, as one is ineffective without the other. Many of the Protected Areas have educational brochures that describe not only the regulations of the zones within, but give information of the importance of each unique location. Also, there are brochures specifically describing manatees, the habitat and locations that manatee use in Belize.

Educating officers in the field is needed, as some may not be aware of all regulations within his department. More so, officers with the capacity to enforce legislation of other departments have even less knowledge of these other laws. Implementing a system where documentation of these laws are easily accessible, as mentioned above, is imperative. [See Section 5.3.1.1. for more on education.]

5.2.3. Prevent or Minimize Degradation of Habitats

Alterations and destruction of natural habitat (Section 4.3.) can be prevented or minimized with the combined efforts of the law enforcement officers, NGOs, Village Councils, private
organizations, and individuals. The following safeguard methods are made as a recommendation of this Recovery Plan:

1) **All Encompassing / General:**

- An appropriate Environmental Impact Assessment or Environmental Impact Study should be carried out before the permit is given and any development takes place in the coastal zone, as described in the Environmental Protection Act (EPA) of 1992. [Refer to EPA Section 5, EIA Regulations of 1995]
- Local residents and the general public should be consulted on any developmental changes in neighboring areas, and they should be informed of any decisions made by authorities.
- Offer incentives to developers who conduct environmentally sound practices.
- Prevent terrestrial pollution from reaching the marine environment and create policies addressing this issue.

2) **Sedimentation and Seagrass Destruction:** Dredging carried out in areas of critical habitat should be monitored, and proper techniques should be established. Dredging should take place at a location and in a manner that would allow for quick recolonization of any plant and animal life removed. It is recommended that dredging take place no deeper than 5 m if recolonization is to take place (Vousden 1995). This would further entail utilizing suitable (environmentally desirable) dredging materials, including using a silt curtain or screen to reduce suspended sediment, and having very frequent environmental and engineering assessments. The Dredging Policy has reached the level of cabinet. It is a recommendation of this Recovery Plan that it is passed by Cabinet as soon as possible.

3) **Agriculture:** Protecting the soil surface and reducing soil run-off are essential in reducing the movement of biocides. Crop covers are useful not only in preventing sediment movement, but improves water filtration into soil. Sediment ponds should be used to prevent contaminated sediments from reaching natural water sources. These ponds can then be used for irrigation in the dry season. Prevent run-off by planting or leaving sufficient fence-rows. As there is already a stipulation under the National Lands Act that a 66 ft buffer zone be left near any natural waterway, strict enforcement and compliance should be encouraged. Pesticide and fertilizer use should be applied according to soil and plant need, therefore, avoiding over-application. Encourage the use of integrated pest control management systems and its research, as well as the use of natural fertilizers.

4) **Pollution:** No dumping of solid waste should be allowed near shore, in waterways, or in the open water. The littering violation should be enforced more rigorously, and offenders charged the $500.00 littering fine. Furthermore, beach pollution should be identified and cleaned up by neighboring communities as soon as possible. To promote proper storage of litter, garbage containers should be placed at visitors’ sites.

### 5.2.4. Promote Restoration of Degraded Manatee Areas

Manatee areas that have been degraded should be restored to become as productive as possible. This will incorporate regulating human activities, as well as enforcing existing legislation and modifying outdated legislation.
5.2.4.1. Develop Guidelines Regulating Activities

1) Damaging Fishing Practices: The most predominant damaging fishing practice today is the use of shrimp trawlers. This causes considerable damage to coral communities, as well as any benthic stand, such as seagrass, in its path. Shrimp trawlers have also been associated with the death of manatees as they are caught in the large nets. The relatively new and growing aquaculture industry with eight shrimp farms had a production of approximately 1,217 Mt of shrimp in 1997 (Huntington and Dixon 1997). This productive industry allows for the reduction of ships in the trawling industry. Therefore, it is a recommendation of this Recovery Plan that joint trawling ventures with Honduras be outlawed in all waters of Belize. An assessment on the extent of damage to habitat and critical species caused by trawlers in Belize should be conducted. Thereafter, it may be found that banning all trawling in Belize may be necessary.

Beach traps are also hazardous to large marine animals such as turtles, crocodiles, dolphins and manatees that incidentally get caught within. These traps need to be constantly monitored. Fortunately, there is usually a person on site to do this. The caretakers must be educated on the importance of releasing these animals, and how to safely handle such a situation.

2) Effluents: It is a recommendation of this Recovery Plan that formal effluent treatment systems be installed at all factories. Solid organic waste products, such as those produced from fermentation in the brewing industry, should be used as fertilizers in the agriculture industry. As recommended by Newell (1993), a National Environmental Plan should be implemented as soon as possible, with a National Pollution Control Monitoring Programme. All factories should periodically produce an inventory of all effluents, and the DoE make periodic checks. If any factory does not meet proper discharge standards, a penalty should be implemented, and the offending factory should be closed if standards are not met within a specific time frame (to be determined by the National Pollution Control Monitoring Programme).

3) Discarding of Debris: Regulations pertaining to the discarding of debris within the coastal zone should be strictly enforced. The DoE with the International Development Bank has embarked on the planned programme to address the disposal of solid wastes. Additionally, an annual international beach clean up organized by the Center for Marine Conservation in Washington D.C. is carried out in Belize through the National Scouts Association with volunteers from a few schools. This programme should be expanded in scope, where at least three coastal schools from each district participate. In 1996, all countries in Central American and the West Indies, except St. Lucia, participated. Almost six million pounds of debris were collected worldwide, covering both the coast and waters encompassing 14,687 km (9,127 miles). Belize’s 463 volunteers covered 29.3 km (18.3 miles) of coast, and collected 1,632 kg (3,598 lbs) of debris.

4) Oil Exploration, Production, Refining and Transport: Of the forty-seven wells drilled since 1956, thirteen were located offshore. Two additional wells were drilled in 1997 and are still operating in Belize. Before any company begins a drilling operation, they are required to do an Environmental Impact Statement (EIS) along with an Oil Spill Contingency Plan. In most cases, companies modify their standard plan to suit different locations (Fay Smith, pers. comm. 1998). The EIS and the Oil Contingency Plan must meet international standards acceptable throughout the petroleum industry. Performance Bonds are issued so as to mitigate potential negative environmental consequences caused and accidental or intentional breach of contract conditions. Before any coastal or offshore oil exploration request is granted, the CZM Technical Committee, with members also on the NMWG,
should review the proposed locations to ensure that critical areas for endangered species are not compromised. Special areas should also be declared off-limits to oil-exploration and transport due to their ecological importance. As Belize has ratified MARPOL in 1995, “Particularly Sensitive Areas” can be designated as those particularly vulnerable to risk from vessel activity. Also, the Geology and Petroleum Unit (GPU) should monitor all oil drilling sites before commencement, periodically during operation, and at the end of each operation, in order to be able to access any stress made on natural ecosystems. If not currently a site, the CZMP’s Water Quality Monitoring Programme (Section 5.2.5) should consider including operational drilling sites where applicable.

5) **Dredging and Sedimentation**: Before all dredging activity, an EIA is required and damaged areas rehabilitated under the Mines and Minerals Act of 1988. This EIA is then to be passed to the GPU for sound revision and acceptance. Cabinet should endorse the Marine Dredging Guidelines produced by the CZM Technical Committee. This document makes recommendations for dredging equipment, methods, length of operation, environmental monitoring and compliance, and safety. These methods provide for decreased sedimentation in the marine environment.

6) **Land Reclamation / Mangrove Destruction**: The clearance of mangroves is regulated under the Forest (Protection of Mangroves) Regulations of 1982 and 1992. These regulations should be strictly adhered to, and areas that provide critical habitat for important species of birds, provide essential nursing ground for commercial fish, or are significantly important to endangered species, should be off-limits. Zisman (1992) declares eleven sites suitable for immediate designation to protect mangrove habitat, including the Burdon Canal extension, Deep River, Port Honduras, Punta Ycacos and associated cays, Northern and Southern (Manatee) Lagoons and Placentia. Belize City is the area with the highest demand for land where lack of alternative land has led to mangrove destruction. This area needs top priority to ensure that development occurs with proper mitigation measures such as buffer zone protection and drainage control (Zisman 1992).

7) **Tourism Practices**: Environmental codes of conduct for tourism are essential in maintaining the tourism industry’s assets – diverse pristine habitat and wildlife. A UNEP’s survey identified three different kinds of codes for tourists: 1) codes which serve as general behavior guidelines; 2) codes which address specialist activities such as sports and other pastimes; and 3) codes which deal with specific sites and cities (UNEP 1995). Goal number two has to be formally developed for proper manatee tours.

There are general boat and human behavior regulations that provide for enjoyable and safe tourism, for both tourists and manatees in Belize. These were decided upon at the Manatee Tour Guide Workshop held in June 1995, with input from researchers, government officials, and guides. They include the following:

- **Familiarize tourists with proper behavior for viewing manatees:**
  - No loud noise as it frightens manatees.
  - No touching or feeding manatees, as this can alter their natural behavior.
  - No approaching females with calves.

- **Boat approach:**
  - Slow to idle speed 0.8 km (½ mile) to 90 m (100 yards) from manatee site, to prevent hitting or frightening the manatees.
• Once within 22 to 30 m (75 to 100 feet) from the site, turn engine off and drift, pole, or paddle to site.
• When in position, use pole to hold boat, or tie to existing stake.

➢ **Number of boats at a site:** This will differ at each site, but guides should not use an area if many boats and tourists are already in the vicinity.
• No more than two boats at a site. Very large areas can possibly accommodate 3 – 4 boats. Boats should cooperate and share a site.

➢ **Swimming:** Currently, there is a “no swimming with manatees” regulation through the Forest Department. If changed, the recommendations made in Appendix 1 would apply.
• No swimming at the “manatee hole” at Swallow Cay and at Gales Point.

➢ **Time at a site:**
• If a boat is waiting, the boat using the site should stay only 20 minutes more, or share the site if large enough. Boaters should accommodate one another.

➢ **Departure of boats:**
• Leave site by drifting, paddling or poling away to about 22 – 30 m (75 – 100 feet) before starting engine.
• Leave boat at idle speed and do not rev the engine until in a deep channel.

### 5.2.5. Monitor Habitat Conditions

Habitat monitoring involves monitoring the effect of development, industry, and other human related activities. In order to assess whether or not changes in environmental conditions have occurred, monitoring has to begin before the natural habitats are degraded. Currently, the CZMP conducts an ongoing water quality programme, which commenced in 1992. To date, 60 (41 inshore and 19 offshore) sites located in rivers, lagoons, on the reef, and near cays are periodically examined. At each site, water temperature, depth, clarity, pH, salinity (g/l), dissolved oxygen - DO (mg/l), turbidity, phosphates (mg/l), nitrates (mg/l), chlorophyll-A (µg/l), chemical oxygen demand - COD (mg/l), and biological oxygen demand - BOD (mg/l) are measured.

A coral reef monitoring programme was initiated in 1991 by the CZMU, where a Coral Reef Monitoring Committee identified 29 sites for the programme. Unfortunately, permanent transects were placed at only eight locations, and data collected for only a year. Today, the Fisheries Department and various non-governmental organizations have resources that allow them to conduct some degree of coral reef monitoring. In 1997, the CZMP with the Fisheries Department began video-monitoring sections of the coral reef.

Representatives from Belize have attended numerous national and international coral reef monitoring workshops. Increased international support has now allowed Belize to conduct a national monitoring programme. A National Coral Reef Monitoring Working Group has hence been formed, with representatives from eleven organizations. This group shall harmonize and execute rapid reef assessment, measuring physical and biological parameters in their respective areas. An objective of the Group is also to assist in the establishment of a data management center (Dylan Gomez, pers. comm. 1998).

Belize also participates in the Caribbean Coastal Marine Productivity (CARICOMP) monitoring programme. This programme is comprised of marine laboratories throughout the Wider
Caribbean that monitor productivity change in coral reefs, seagrass beds and mangrove communities. Hol Chan, Carrie Bow Cay and the Turneffe Atoll are CARICOMP sites in Belize.

5.3. Manage, Protect and Monitor Status of Species

5.3.1. Improve Manatee Awareness in Country

A number of Non-Governmental Organizations play an important part in environmental education and awareness in Belize. A few of these agencies supplement research and government activities pertaining to the manatee. Firstly, located in Belize City, the Belize Audubon Society (BAS) takes a large role in public education, having on staff an Education Coordinator who is also a member of the National Manatee Working Group. With a complete overview of protected areas and wildlife in Belize, manatees are spoken of in education programmes for schools and the public. In addition, the previously existing Belize Center for Environmental Studies with the help of The Nature Conservancy (TNC) and the regional PROARCA programme, led manatee education and monitoring in Punta Gorda. Today, the Toledo Institute of Development and the Environment (TIDE) has taken this lead. The Belize Zoo and Tropical Education Center (TBZ&TEC) also conducted a six month manatee education programme for schools in the Toledo District and four months in the northern districts (Orange Walk, Corozal, and the northern cays) in 1997. New educators from TBZ have retailed the programme, which began in November 1997 and ran until June 1998. The Zoo's educators also developed a manatee colouring and activity book. Furthermore, in March of 1998, the CZMP with the NMWG had a programme called “Manatee Week”, which highlighted the manatee through activities, competitions and displays countrywide. It is hoped that this particular educational campaign will become an annual event.

The above-mentioned educational activities were primarily geared for students. However, in 1994, the first countrywide Manatee Tour Guide Workshops allowed for the exchange of information between tour guides and government officials. It was here that proper manatee guiding techniques (Section 5.2.4.1.) were suggested and agreed upon by those who would employ them. The Fisheries Department headed this set of workshops. Based on recommendations made here, there is a current effort by the CZMP to promote these guiding techniques by dissemination of guidelines through Tour Guide Associations or lectures.

A series of follow-up meetings are necessary to refresh old guides and acquaint new ones with proper guiding techniques. It is a recommendation of this Recovery Plan that guides conducting manatee tours receive formal training on the proper techniques that ensure safety for the animals and the onlookers. A collaborative effort with the BTB is required for this to be successful, where the training could be offered through them as a specialty course. Trained guides would allow tourists to be better informed and leave with a clearer understanding of the importance of protecting our manatees. More importantly, it would assure safety in boat travel to and from sites.

In addition, since much of the general public is not aware of laws that protect manatees, they are susceptible to becoming unknowing violators of the WPA. Education about these laws would decrease the taking of illegal items such as manatee bones and artifacts.

5.3.1.1. Develop and Distribute Educational Material

On commencement of the CZMP Manatee Project, residents of coastal communities were interviewed in order to obtain an understanding of their attitude towards manatees. General information brochures on manatees in Belize were disseminated, and uncertainties concerning
laws protecting manatees were clarified. UNEP posters and stickers were also given away for public display. Main targets were fishermen and tour-guides. All interviewees were found to be aware of manatees in their adjacent waters, and that they are protected from hunting.

It is a recommendation of this Recovery Plan that public awareness efforts include short videos for airing on local television stations so as to heighten knowledge and decrease the possibility of an offence being committed. This method should also increase the reporting of offences by the public.

Also, the production of a short information booklet, describing Belize’s manatee should be made for use in schools and institutions. The bulk of information disseminated is from research and observations made primarily in Florida, of the Floridian subspecies. With increasing information collected at home, readers would more easily relate to the situations reported. This booklet will standardize available information and will enhance the presentation of reliable information. The contents of all educational material must be local in nature, reflecting the issues relevant in Belize. Greater effectiveness would result if a chosen member of selected communities were trained to teach the material to their neighbors in conjunction with the Belize Zoo, BAS, TIDE, and other relevant NGOs.

It is a recommendation of this Recovery Plan that education programmes be geared for specific target groups including, but not limited to, students, tour guides, law enforcement officers, and the general public. Seminars, brochures, booklets, workshops, competitions, training, and displays are means of disseminating an array of information to each group.

It is a recommendation of this Recovery Plan that a centralized database to input, house, and disseminate research information should also be established. Currently, there is no such system in place, and documentation of consultancies or research projects usually sit with the government agency responsible for the research permit, and is not readily available for the public. This system would be most useful to institutions, students, and researchers. Such a system should be managed by some research organization or institution such as the Coastal Zone Management Institute, and be easily accessible by the general public. A topic search should lead to references, abstracts and even documents, pertaining to the viewer’s interest. The feasible system would be one that utilizes the Internet.

5.3.1.2. Monitor and Modify Material Accordingly

In order to assess the effectiveness of such educational activities, it is important to revisit the same target areas and interview the same target groups. Interviewees’ knowledge and attitudes should then be compared to those recorded before. Also, new findings from scientific research should be made public, specifically to the communities of influence. This approach will maintain interest by said communities. An effective start would be with identifiable manatees. The manatee tagging programme in Southern Lagoon, and the photo-identification project at Basil Jones and Spanish Cay, are perfect examples of this. Bulletins or clips in the local newspaper could be the medium for this information transfer. Considering a local “Adopt A Manatee” programme for these known animals would also heighten the public’s concern towards manatees. Furthermore, it is a recommendation of this Recovery Plan that all education material should be translated into local languages: Spanish, Mayan and Garifuna.

5.3.2. Create Protected Areas for Manatees/Establish Manatee Sanctuaries

The first manatee sanctuary, the Bi.:topo para la Conservaci.:n del ManatP, in Central America was established in 1979 at Chac.:n-Machacas, in El Golfete, Izabal, Guatemala. On October 24, 1996 Mexico established its first manatee sanctuary in the Chetumal Bay. For overall
integrity of manatees within the bay, and cooperative international ties, Belize was asked to sign an addendum declaring her territorial portion of the Bay an adjunct sanctuary. The Corozal Bay Wildlife Sanctuary (Manatee) Order was thus declared on April 28, 1998 (Fig. 12).

Although the Corozal Bay sanctuary is declared for Belize, the integrity of this and any sanctuary needs to be reviewed prior to being declared. In this instance, a large development plan that would include massive dredging has been planned for the Mexican portion. In this light, the manatee’s natural habitat and food source could be damaged enough that they flee the area to survive (See Section 4.3.5. on Dredging).

NARMAP has developed a National Protected Area Systems Plan for Belize. The fundamental objective is to produce a comprehensive network constituting key sites that help uphold our natural and cultural heritage, environmental health, the sustainable use of resources, scientific research and education, as well as tourism and recreation (Manzanero 1998). Traditionally, protected areas have been declared without having followed any specific criteria for declaration.

The Gales Point (West Indian Manatee) Wildlife Sanctuary is the second sanctuary designated for the protection of manatees in Belize. It was declared in August 1998 and includes the Southern Lagoon, Western Lagoon, Sapodilla Lagoon, Quashie Trap Lagoon, interconnecting waterways, and the adjacent (20 m / 66 ft) shoreline. It is a strong recommendation of this Recovery Plan that the management plan is created with special regulations on boating, pollution, development, and tourism for this Sanctuary and the Corozal Bay Wildlife Sanctuary.

It is further recommended that the proposed coastal/marine reserve in Port Honduras be designated, making this important manatee area a secure one. It is hoped that development here will be strictly regulated and patrols more on going, as this is a prime area that manatee hunting occurs. The Port Honduras has been a priority location in need of protection status, as recommended by BCES, TIDE, TNC and individuals.

As recommended by Manzanero (1998), common site features should consist of:

- The display of exceptional qualities that are deemed worthy of retention and should include:
  - Conservation of biodiversity and natural heritage
  - Conservation of cultural heritage
  - Maintenance of critical environmental services
  - Renewable natural resources subject to sustainable use and management
  - Outstanding assets for tourism, recreation, education and research

These recommended sites do fit the standard features worthy of granting them protection.

### 5.3.3. Evaluate and Reduce Manatee Mortality

Due to manatees’ low reproduction rate, any drastic decline in its population would make recuperation almost impossible. Determining mortality and the population dynamics of a species is necessary to ascertain a population’s ability to replace itself (Marmontel 1995). Based on observations of manatees found in Florida, a female reaches sexual maturity between three and four years of age. Examination by Marmontel (1995) of 275 female carcasses showed that the optimistic age-specific fecundity (female births / female / year) mean is 0.27. This figure could conceivable be lower for Belize’s smaller population.

It is a recommendation of this Recovery Plan that to be able to assess causes of mortality, a carcass reporting system should be implemented, where each salvage network representative
from major coastal communities ensures that these sightings are reported to the appropriate authorities. A hotline should be implemented, or use made of the Audubon's hotline to report manatee injuries or deaths.

As the illegal use of nets can readily pose disaster for calves, it is a recommendation of this Recovery Plan that all nets, with the exception of cast nets, are completely banned. If anyone is caught illegally setting a net or has illegally set a net as described in the Fisheries Regulations, not only should the net be confiscated, the offender should be fined. This type of behavior in a known area of manatee abundance could also be considered as a WPA violation, therefore penalties also made according to this Act.

The introduction of boat speed zones or no wake zones is important to reduce manatee mortality. To successfully achieve this, full cooperation is needed primarily by water taxi operators, as they will be directly affected by this change.

As poaching is another cause of manatee mortality, increased vigilance and education is a priority. First identifying the hunters and vendors, providing them with income or food alternatives, and then educating them should cause changes in attitudes and consequently in actions. This cannot work without the collaboration of Guatemala, Honduras, and Mexico.

5.3.3.1. Quantify the Impact of Accidental Catches on Species/Populations

Since the recording of manatee mortality by the CZMP in late 1996 to December 1998, twenty-five manatee deaths have been confirmed (Fig. 10). Of these, 36% were human related, which could actually be higher if proper necropsies were carried out. Calves made up 44%, of which one was an abandoned calf found alive but died within 24 hours of being identified, one was killed in a watercraft collision, and two were slaughtered. Perinatal mortality was the most common cause of death, which is similar to that found by Ackerman et al. (1995) in Florida between 1976 and 1992 [watercraft collision was also one of Florida’s two most prevalent causes of death].

Although the perinatal category refers to manatees 150 cm (5 ft) TL or less, this category also included one calf over 150 cm, as it was still within the calf size range as defined by O’Shea et al. (1985) - between 42 – 175 cm (17 – 70 in) total length. Undetermined deaths are those for which a cause could not be determined, as well as those seen and recorded, but not examined to determine cause of death.

**FIGURE 3:**

MANATEE DEATHS BY CATEGORY  
September 1996 - December 1998

![Manatee Deaths by Category Chart]

- Watercraft Collision: 32%
- Poached: 16%
- Perinatal: 20%
- Undetermined: 32%
As manatee deaths have not been logged for much more than two years, and surely not all known deaths have been reported within this time, it is difficult to determine whether human-related deaths have increased or decreased over the years. Based on the structured interviews carried out at various coastal communities (San Pedro, Cay Caulker, Gales Point, Placentia, Punta Gorda and Barranco) human related manatee casualties were not known to be very frequent. In general, manatee poaching has ceased almost entirely, but occurs infrequently in the Port Honduras area. For this reason, public education had been focused in Toledo by TIDE and the Belize Zoo. Boat collisions do not occur frequently in any location, but is probably more common in the north (Belize City area to Cay Caulker) than south (Punta Gorda and Barranco). Accidental entanglement in nets is also rare, with uncommon occurrences reported from Gales Point and Punta Gorda.

To minimize injury and mortality to manatees, it is imperative that we better understand the causes of mortality, where manatees are more susceptible to specific risks, and how to minimize each hazard. With modifications made on the recommendations from the U.S. Fish and Wildlife Service (1989) it is a recommendation of this Recovery Plan that a long-term manatee salvage and necropsy programme be implemented. This should include the following:

1) **Maintain and improve the reporting system:** Currently, reports are made to the Fisheries Department, which can only be reached from 8:00 a.m. to 5:00 p.m. from Mondays to Thursdays, and 8:00 a.m. to 4:30 p.m. on Fridays. These reports are passed to the CZMP manatee biologist who conducts a site evaluation and collects morphometric data with a representative from Fisheries. This is conducted primarily in Belize City, where the Department is located. As mentioned above, representatives from distant coastal communities such as Sarteneja, Gales Point, Placentia, and Punta Gorda should be assigned as local contacts who could carry out basic site evaluations and morphometric gathering. These persons would then report to the central office or lead biologist who would incorporate new data into the central mortality database. Said biologist and contact would then decide on the need of further assessment.

Efficient reporting systems can also be made through the existing 24-hour hotline by BAS, and reports directed to the nearest contact. The Forestry Department has also granted permission to use their radio frequency to report any casualty of any animal listed under the Wildlife Protection Act of 1981. These reporting methods should be publicized nationwide, by means of radio, television, and newspaper announcements.

2) **Train Local Biologists in Carcass Assessment:** In order that the above be successful, assistants and biologists need to be trained in necropsy evaluation. Once personnel are identified to carry out these tasks, an experienced biologist should be requested to perform a necropsy training programme appropriate for the facilities available in Belize. Government representatives from Forestry and Fisheries Departments should also take part in this training. These persons shall make up a salvage network for Belize.

3) **Maintain International Contacts with Specialists Working with Mortality Cases Abroad (Namely in Florida):** Important to initial training is follow-up. As advanced research is conducted on a large scale on manatees in Florida, it is imperative that new findings and techniques be easily available in Belize. Therefore, correspondence should continue with known researchers abroad to facilitate the exchange of important information.

### 5.3.3.2. Review Existing Local Laws and Regulations

Under the 1981 Wildlife Protection Act, molesting any manatee and possessing any part of a manatee, or attempting to do so is punishable. Furthermore, the sale of any product made from
a manatee’s parts is illegal. In addition, CITES prohibits the international movement of any part of a manatee. Therefore, manatee hunting from initial contact (molestation) to final possession and sale is specifically prohibited by the 1981 Act. What is not exactly stated is the definition of molestation. As this word is subjective, cases of “molestation” can easily be overlooked and, therefore, possible incidences continue. Such cases include molestation by boats as well as by passengers within. “Molestation” could also include the attempted molestation of laid stop nets.

Any person who commits a wildlife offence shall be liable to a fine not exceeding BZ$500.00. Where the offender has within a preceding period of five years, been convicted of a wildlife offence, there is a fine not exceeding BZ$1000.00 and/or imprisonment not exceeding six months. These fines are currently being considered for revision (increased), as they correctly should be.

5.3.3.3. Evaluate and Propose New Regulations Where Needed

1) In the WPA 1981, the maximum fine for an offence is a mere BZ$1,000.00. This fine should be substantially levied to reflect the importance of the species it protects. Canada’s Endangered Species Protection Act of 1996 includes a fine for corporations up to BZ$666,600 for each specimen of a species that is harmed. For repeat offenders (corporations), the fine is BZ$1,333,200. Individual offenders can be fined up to BZ$333,300 and/or five years imprisonment. The criminal penalty in the United States of America is a fine of BZ$100,000 or imprisonment for one year, or both, and civil penalties of up to BZ$50,000 per violation of their Endangered Species Act of 1973. This can be assessed against a person who knowingly violates the Act by importing or exporting, taking, possessing, selling, delivering, carrying, transporting, or shipping after taking of any endangered species in violation of CITES. Under the Ecological Act of 1994, Mexico has a maximum penalty of six months in prison or a BZ$74,000 fine for killing a manatee.

Comparison of fines between countries in North America and Belize indicates the lower value placed on endangered species in Belize. It is a recommendation of this Recovery Plan that the minimum penalty should be raised to at least twice that of the current maximum fine, and the maximum fine should be at least in the neighborhood of BZ$35,000 for an offence. Furthermore, creating an Act amendment that specifically provides regulations for endangered species would be very effective, where some of the following themes could be considered.

2) Codes of behavior constituted as violation are not clearly defined in the WPA for endangered species. For instance, there is no definition for the crucial word “molestation”. This needs to be defined, specifically stating possible offences. Such would include:

- Collisions with water-craft (leading to death or injury)
- Physically harassing an animal by chasing or cornering
- Speeding in slow speed zones (once implemented)
- Laying nets in known manatee areas

3) Currently, there is a combined force of forty-one patrol officers between the Fisheries and Forestry Departments, with ten boats available for patrol of the coastal zone. By combining the strength of the Maritime Wing, who already police our waters, the area covered and vigilance efficiency will increase substantially. Under their mandate, Maritime officers already have the authority to enforce all laws pertaining to Belize’s waters. They have routine patrols with specific and non-specific tasks, lasting from 24 – 72 hours per patrol. As recommended by Major Flowers (pers. comm. 1998), the Fisheries’ patrol schedule should
be shared with the Maritime Wing, so as to avoid duplication and strengthen the patrol
countrywide. Furthermore, these officers need to be kept abreast of all laws and regulations
concerning manatees, other species, and their environment. Arrests are sometimes not
made because of lack of background knowledge on these issues.

4) Under the Belize Port Authority Act, the limits for ports are controlled. As marina siting is an
important land use planning issue, they should be placed where the least possible impact to
manatees and other endangered species will occur. Regulating marina numbers and sizes
also regulates, to an extent, the number of boats, consequently the number of boat-related
manatee mortalities (Reynolds 1988).

5) All boats in Belize should be registered, and boaters obtain an operator’s license. For the
first quarter of 1998, 480 boats were registered under the BPA, and 850 under the Fisheries
Department from January to July. All commercial fishers must license their boats with the
Fisheries Dept., while only commercial passenger carrying vessels require licensing under
the BPA. Registration of those watercraft has to take place each year. If all boats including
tour guide and personal vessels are registered, it will allow for a more comprehensive look
at their impact on species and their environment. Knowing the quantity of boats in an area,
as well as their docking locations facilitates planning for sustainable and safe boat running.
In addition, obtaining an operator’s license will mean that all boaters would have to go
through a proficiency programme. This would be the perfect opportunity to train boaters,
and consequently reducing the damage to manatees and their habitat caused by watercraft
operators.

6) All manatee tour operators should be licensed as “Manatee Guides” and guidelines created
as regulations. When violated, offenders would be subject to penalties under the WPA.
Underwater observation of manatees could be added as an independent tour, making it an
addition to the tour choices available. This specialty tour will only be able to accommodate
a smaller number of tourists per trip, i.e. no more than five. Revenue should not be affected
as smaller boats should be used and higher prices could be charged. Guidelines for
“Underwater Observation” of manatees are listed in Appendix 3. The following are
recommended policy for tour guiding:

• Only guides with valid tour guide license from the BTB will be eligible for this specialty
license.

• The Conservation Division, as the regulatory agency for the Wildlife Protection Act, will
be the certification and decertification agency (directly or indirectly) of licenses, with the
collaboration of the BTB. This will also include limiting the number of people certified for
an area.

• Training will be conducted with the assistance of manatee researchers with experience
in manatee behavior. Advice from experienced guides will have bearing on swimming
techniques.

• Renewal of licenses with review sessions will take place periodically, possibly every two
to three years.

• Certain areas will be designated as suitable swimming areas, based on physical and
biological reasoning.

• At any time, tour guides will be responsible for taking out an official inspector on any of
the tours. Periodic inspections should be made in order to ensure continued sound
guiding.
• Installation of mooring buoys should be made at chosen sites for guiding. The best sites are those with clear water, however, manatees can be sighted almost anywhere in Belize. Popular manatee tour destinations such as in Southern Lagoon and around Swallow Cay and the Drowned Cays near Belize City would benefit from mooring buoys. Buoys or stakes in the water should be used for boats to tie on, as well as to demarcate areas of no entry.

5.3.4. **Encourage Non-consumptive Uses of Manatees**

The hunting of manatees is still occurring in Belize. Furthermore, gift shops in San Pedro and at the Philip Goldson International Airport were identified as possessing and selling sculptures and jewelry made from the bone of manatees. The Forest Department confiscated these items in early 1998 and the vendors warned of their violations. However, the authorities have been unable to identify the artisans and suppliers of the bones in some cases. In addition, other shops selling similar items may have also gone unidentified.

Education efforts need to be increased, stressing the ecological and personal consequences that those consumptive uses of manatees have on the society. Alternative activities must be encouraged (Section 5.3.4.1).

5.3.4.1. **Alternative Activities for Manatee Hunters**

Due to the fact that fishermen and tour-guides spend substantial time on the water, they have the capacity and opportunity to become manatee stewards. As government agencies may not have sufficient funds, manpower, or equipment, these professionals can be granted the authority to act as wardens in certain areas. Furthermore, to offer a means of work to fishermen who are no longer active, tour guiding should be encouraged. This will give them an economic incentive to try to protect that which brings them reward. It cannot be overemphasized how significantly more revenue one animal can bring per day through weekly tourism, than through a one time hunt. Prospective guides, and those who are currently manatee guides, should be trained, and only allowed to conduct manatee tours with their certificate of accomplishment. This will help to avoid the occurrence of reckless tours that lead to manatee molestation. Guidelines for manatee tours are included in Section 5.3.3.3. and Appendix 2.

5.3.4.2. **Develop Guidelines for Manatees in Captivity**

Currently, there are no facilities to house, or professional personnel to monitor a captured manatee. It is a recommendation of this Recovery Plan that manatees are not kept in captivity for the sake of tourism, genetic research, or breeding. To do this would mean expending huge sums of money on a project that would not help the manatees, and possibly lead to unfortunate deaths. The only need that Belize would have for a center to hold captive manatees would be for the rehabilitation of injured ones, at which time opportunistic research could be carried out. As the development of such a location would be very costly, and at this time impractical, an existing one needs to be identified and a protocol for such cases established. This protocol should include steps for initial care of an injured animal, for transporting the animal to its temporary rehabilitation center – including acquiring necessary permits – and reintroducing the recovered animal into Belize’s waters (Appendix 3).

Two identified locations for rehabilitation include the Veracruz Aquarium in Veracruz, Mexico and Xcaret in Quintana Roo, Mexico. As the travel costs to transport an animal to and from Veracruz are too expensive, Xcaret is the more feasible choice at this time. Both organizations have persons who are members of the Mexican-Caribbean Marine Mammal Stranding Network.
It may be more efficient for Belize to receive help from these organizations if a member of the
Network. ECOSUR, a member of the Belize NMWG, is a member of this Network. It is a
recommendation of this Recovery Plan that the Group becomes a member. It would also prove
advantageous if Belize joined the Caribbean Stranding Network. This network is comprised of
volunteer consultants from more than 40 organizations and governments of 31 Caribbean
countries. The Network has four base projects: i) the Monitoring and Mortality Project; ii) the
Rescue and Rehabilitation Project; iii) the Education Project; and iv) the Alternative Investigation
Project. The Rescue and Rehabilitation Project has a team of persons who run the Marine
Fauna Rehabilitation Center in Puerto Rico.

5.3.5. Monitor the Status of the Manatee Populations

Although there is no definitive way to determine an index of abundance for manatees, or to
to accurately determine if the population is increasing or decreasing, important information about
the population can be gathered through a number of methods.

1) Aerial Surveys: It is a recommendation of the Recovery Plan that efforts in aerial surveys
continue. Long-term monitoring is probably needed to assess changes in population and
habitat use (Ackerman 1995). If annual surveying is not possible, at least a rotary schedule
of about every 3 – 5 years is necessary to update data used for manatee protection. Aerial
surveys are used to obtain information of the distribution and relative abundance of
manatees. Irvine (1982) describes this survey technique as being more effective for
quantitative analysis than surface surveys, as a broader area can be surveyed with a
superior viewing angle. The survey technique most suitable for Belize is the extended-area
technique described by Packard (1985). This technique is suitable for surveying broad
areas with various habitat types. If conducted throughout the year for several years, it can
detect changes in seasonal and local distribution (Lefebvre et al. 1995). Seasonal habitat
preferences are identified through this technique. Unfortunately, while distribution trends
can be determined, neither abundance trends nor an estimate of total manatee abundance
can be. These are all important for management purposes. The knowledge of distribution is
important for locating critical areas and assigning guidelines for those areas. Many survey
biases (March 1995; Lefebvre et al. 1995; Packard et al. 1995) exist during aerial surveys
which do not allow for accurate or statistical measures of abundance. Undoubtedly, new
techniques and correction factors for biased counts should be developed. As a high priority
included in the Florida Manatee Recovery Plan is the establishment of population size
estimation techniques (US Fish and Wildlife Service 1989), their development should be
followed. With the help of statisticians and population biologists, Belize should also try to
develop more statistically viable methods of determining population size estimates.

2) Radio and Satellite Telemetric Research: The radio and satellite telemetric research should
continue and be expanded. This will improve information on seasonal movements and
patterns of habitat use, enabling priority areas to be further identified for management
purposes (Reynolds 1988). Life history and behavioral information can also be gathered
from this survey technique. Telemetry data can additionally be used to investigate absence
bias where manatees are present in an aerial survey. Capture and tagging should take
place at various locations in Belize. Such could include Turneffe Atoll, the Belize City cays,
the Port of Honduras area (near Seven Hills Lagoon), and Basil Jones. Furthermore, data
from tagged animals in the Chetumal Bay should be made readily available by ECOSUR for
Belize, by means of regular reports reviewed at the quarterly National Manatee Working
Group meetings (Section 5.4.).
3) *Photo-identification:* Some of the hazards that manatees encounter, such as boats and fishing lines, leave their bodies scarred and mutilated. These discernable marks have been used to study the behavior and ecology of individual manatees. This technique is another that can gather life history information, which would be very advantageous since most of this type of information is based on that of the Floridian subspecies. This data type has been collected from Basil Jones and between Blue Field Range and the Drowned Cays. An automated photo-identification catalog (Beck and Reid 1995) can be used to digitally record and easily manipulate the collected data. The manatee needs to be well photographed with its permanent, unique feature that would be archived on a videodisc, accessed through the catalog programme and displayed on a monitor. Sighting history and the animals’ features are recorded with identification given to each subject. The automated cataloging system makes sorting efficient. This system, as stated by Beck and Reid (1995), is “ideally suited for studies of manatee population biology”, such as movement, reproductive traits, and survival analysis.

4) *Basic Applied Research:* Basic research that involves low-tech equipment and little manpower are ideal for Belize. This could include such studies as determining the food consumption of manatees. Botanical composition of the diet of herbivores can be determined by direct observation (recording feeding observations); utilization studies (observations of feed areas before and after grazing); and faecal and ingesta analysis (Hurst and Beck 1988). Analysis of manatee ingesta can be carried out using techniques described by Hurst and Beck (1988), as one can conduct simple tests on the food habits of the manatee. Fragment material to be analyzed can be found in the field as faecal matter, and from salvaged carcasses as ingesta. Firstly, plant specimens believed to be used by manatees in Belize must be preserved as references for comparisons with test samples. The ingesta or faecal samples can be analyzed by manual separation with weight volume analysis; by macroscopic analysis; and with microscope point analysis (Hurst and Beck 1988). This will aid in understanding specifically what types and in what quantity manatees consume various seagrasses.

5) *Boat Surveys:* Surveying by boats allows for numerous opportunities for field research. This can include ecosystem-oriented studies and behavioral studies. Ecosystem studies could encompass investigation of seagrass beds, including composition, productivity, and biomass. Measuring environmental factors such as temperature and salinity, which affect manatee distribution, should also be emphasized. By locating any freshwater or warm-water springs and correlating these findings with distribution patterns, areas of great importance can be identified and protected. “Manatee holes” can also be more thoroughly studied. Behavioral studies of the W.I. manatee can only occur in the field at this time. In Belize, behavioral and life history information is primarily available from studies conducted on the *T. m. latirostris* in Florida.

6) *Mortality Assessment and Necropsy:* As clarified in Section 5.3.3.1., it is important to gain knowledge on manatee mortalities as a means of preventing them.

5.4. **Promote Co-operation and Exchange of Information on Manatee Conservation at National and Regional Levels**

An effective level of management is reached when all relevant governmental and non-governmental organizations, researchers, and communities are kept abreast of new information and together make sound recommendations. The afore-mentioned representatives should share the information as well as make comments on recommendations, thus allowing for broad-scope decision making. At present a National Manatee Working Group exists, with multi-
sectoral representation (see below) who carry out this precise role. Information is disseminated on a quarterly basis between all members. The original goal of the Group was to discuss the specific plan of action for the CZMP’s project, including research, monitoring and education. The group has met quarterly since the commencement of the Manatee Project. Meetings were held to review progress reports from the researcher, and provide recommendations and discuss relevant management issues.

It is a recommendation of this Recovery Plan that the NMWG not only continue to act as an advisory body for research within the CZMP, but for any manatee research in Belize. Basic and applied research that collect data needed for management should be encouraged, especially as opportunities for Belizean students working towards advanced degrees. Any manatee research proposal should be passed to the Group for review and acceptance, rejection or modification. The Group is responsible for funds within the “Manatee Fund” and should seek new ways of acquiring money for research, monitoring and education. Therefore, opportunities will be created for the above mentioned projects as well as for interested researchers.

Finally, government officials should take a more active role in carrying out recommendations made by the NMWG. These recommendations would pertain to illegal activities, such as investigating suspected hunters or vendors selling manatee artifacts.

5.4.1. Organize National Recovery Teams

In 1994, a National Manatee Working Group was formed, which operates through the Coastal Zone Management Project. This Group consists of Government representatives of Forestry and Fisheries Departments, representatives of the NGOs BAS and TIDE, MRC/UCB, and the CZMP. Also included are researchers/specialists from ECOSUR in Mexico, the Florida Marine Research Institute, and an independent local researcher working with the Oceanic Society. The Group meets on a quarterly basis to monitor the progress of the Manatee Researcher, discuss issues brought by either member, and correspondingly make informed decisions concerning manatee protection.

5.4.2. Co-ordinate Activities of National Recovery Team with the Regional Manatee Network and Manatee Coordinator

A workshop in 1994 sponsored by the regional coordinating unit of UNEP elected Miriam Marmontel as the Manatee Coordinator. A Regional Manatee Network has not been formed, however. Such a committee should be formed as a means to begin comprehensive coordinated management of the West Indian manatee in the Wider Caribbean. This Regional Manatee Network should be a long term goal of all countries in the region. The Network would be similar to that of the WIDECAST network for marine turtles. Once a Regional Manatee Network is established, communication should be facilitated with readily available contact names and addresses, and even create an online newsgroup and/or website. As manatees know no international boundaries, they move between the Mexico’s and Belize’s portions of the Chetumal Bay, and the Guatemalan, Honduran, and Belizean portions of the Gulf of Honduras. Therefore, establishing ties with these three countries is of primary importance. Through Belize’s relationship with ECOSUR in Mexico, joint activities and regular communication occurs. The ties with Guatemala are not as strong, but should grow with the NGO FUNDAECO. This tie, as with the even weaker one with PROLANSE in Honduras, was brought on by ALIDES’s (Alliance for Sustainable Development for Central America) environmental commitment through the Central American Commission for Environmental Development (CCAD). FOCADES, which is the Tri-National Alliance of NGOs, has proposed a plan for the Conservation of Manatees in
the Gulf of Honduras. FUNDAECO, PROLANSATE, and TIDE shall be the three NGOs responsible for their country’s participation, as members of FOCADES.

After the establishment of a Regional Manatee Network, the elected Coordinator shall coordinate regional activities, collect and disseminate regional updates and identify financial support for research and education projects. An international IUCN/SSC (World Conservation Union/Species Survival Commission) Sirenian Specialist Group does exist, and produces the newsletter Sirenews that includes articles from around the world. These articles provide mechanisms for information sharing on research activities and concerns pertaining to Sirenians worldwide. The Sirenian Specialist Group could provide the umbrella organization for a smaller, more focused Regional Manatee Network.

5.4.3. Promote Training for Local Personnel and Biologist in the Area of Coastal Area Management and Conservation

For manatee projects in Belize to be successful with planned continuity, local expertise should be developed. This sort of training should range from the technical field assistant to the trained graduate. The UCB is developing its Natural Resources Management Programme / Marine Research Center Unit, focusing on sustainable management of marine, terrestrial, and recreational resources. This programme offers an Associate's Degree, with future plans of developing a Bachelor's Degree.

For advanced learning, it is a recommendation of this Recovery Plan that a fund through the Regional Manatee Network be established. This fund would allow eligible applicants within the region to compete for a study grant abroad. These students will be expected to return to their country and train other interested researchers.

Nationals should be trained in theories and techniques relevant to manatee conservation. This should include education in ecosystems, including community dynamics. Knowledge of physical and chemical oceanographic processes is also an asset. Especially needed are trained persons in the disciplines of anatomy and physiology of marine mammals. This would help with the assessment of strandings, including rehabilitation of live ones.

5.4.4. Support and Create Regional Treaties Promoting Manatee Conservation

Belize has signed a number of international and regional treaties protecting such resources as the marine environment, mangroves, and wildlife. Although signed, not all treaties have been ratified. By participation in these and other regional and international treaties, Belize accepts certain responsibilities and obligations, as well as becomes a recipient of special benefits. Such benefits may include access to technical assistance and an array of information, financial facilitation, and wider enforcement of laws reflecting national interest. These treaties complement one another for the ultimate goal of a broad scale protection of natural resources and biological diversity.

1) Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES): Belize ratified this Convention August 19, 1976. It was adopted to protect certain endangered species from over-exploitation by controlling their international trade or that of their products. Listed under Appendix I, international commercial trade of the West Indian manatee is prohibited.

2) Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (The Cartagena Convention) and its Protocols: This was adopted in 1983
for the protection and management of the marine environment and coastal areas of the Wider Caribbean Region.

- **Protocol Concerning Specially Protected Areas and Wildlife (SPAW Protocol):** This Protocol under the Cartagena Convention provides a framework for the protection of marine and associated terrestrial areas and wildlife. Members must establish protected areas and implement management regimes for these areas. Also, they are to develop a strong regional capacity for coordination of information exchange, as well as training and technical assistance. Furthermore, members are to develop specific national management plans for endangered, threatened or vulnerable species. The SPAW Protocol of the Cartagena Convention has yet to enter into force as of July 1998. It awaits ratification by three more signatories, which will result in the nine signatory ratifications needed for its entry into force. It is recommended that Belize ratify this Protocol, thus harmonizing legislation to improve protection of critical species and their environment.

- **Land-Based Sources of Marine Pollution (LBSMP Protocol):** This Protocol is an instrument for dealing with land-based sources of pollution reaching the marine environment. This includes point sources and non-point sources of pollution. This Protocol has not been finalized. However, when it is finalized it is recommended that Belize signs and ratifies this protocol.

3) **Convention on Biological Diversity:** This Convention was concluded at the UN Conference on Environment and Development (UNCED), and was ratified by Belize in December 1993. It requires that conservation policies to maintain biological diversity be adopted and carried out. For the Caribbean region, it is recognized that the SPAW Protocol of the Cartagena Convention would complement the implementation of the obligations of the Convention on Biological Diversity (CBD). The CBD is implemented on a regional level through an agreement between the Caribbean Environment Programme CEP Secretariat, the UNEP-Caribbean Regional Coordinating Unit (CAR/RCU), and the CBD Secretariat.

4) **Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention):** This Convention was established to protect migratory species. This is to be done by restricting harvesting, controlling other conflicting factors, and protecting their habitat. Belize has not ratified this Convention, but doing so would strengthen the protection of migratory species such as sea turtles, birds, and manatees.

5) **United Nations Law of the Sea Convention (LOSC):** On August 13, 1983 Belize ratified this Convention. It essentially deals with establishing maritime zones and regulating activities within these areas including pollution, research, and fishing. This convention also obliges parties to preserve fragile or rare marine ecosystems as habitat of endangered species of marine life.

6) **Convention for the Conservation of Biodiversity and Protection of Priority Wild Areas in Central America:** All Central American countries signed this treaty on June of 1991, Belize ratified it in June 1992. The Central American Commission for Environmental Development is responsible for taking the lead role for the development and implementation of a Central American Environmental Policy. Two primary objects of this Convention are to create a National Biodiversity Committee and to create a National Biodiversity Action Plan. This committee has been formed and includes members of various government departments, who have created a draft National Biodiversity Strategy with consultations from stakeholders countrywide. The final draft of the Action Plan is completed and awaits approval by Cabinet.
7) *Convention for the Prevention of Pollution from Ships (MARPOL 73/78):* This Convention, ratified by Belize in 1995, is administered through the International Maritime Organization (IMO) and imposes controls over ship pollution. There are five Annexes under this Convention, all of which have been signed by Belize: Annex I – oil; Annex II – noxious liquids in bulk; Annex III – harmful substances in packaged form; Annex IV – sewage; and Annex V – garbage. The Convention allows states to enforce and prosecute vessels that violate these standards, especially if they pose a threat to the coastal environment.

8) *Convention on Wetland of International Importance (Ramsar):* This convention was signed and ratified in February 1998. It provides protection to wetlands, and shallow coastal and marine areas. At least one Ramsar site per signatory must be designated. The Crooked Tree Wildlife Sanctuary is the first and only Ramsar site for Belize, managed by BAS.

### VI. SUSTAINABLE FINANCING MECHANISMS

In order to have continuity of manatee research and conservation efforts, there is the need to develop sustainable methods of acquiring consistent in-state funds. It is a recommendation of this recovery plan that the following funding mechanisms are strongly considered:

1) **Boat registration fees:** As recommended in Section 5.3.3.3., boats should be registered with the payment of a fee. A portion of this fee should be allocated for manatee conservation efforts. The justification behind this is that since boats cause a notable portion of damage to manatees, some sort of mitigation measure is required.

2) **Manatee Tours:** As discussed in Section 5.2.4.1., all tour guides who conduct manatee tours should be certified, and given a license. Although not expected to be a large fee, no more than BZ$35.00 per training and licensing, a fraction of this fee should go towards manatee conservation and research. After all, without safeguarding this resource, the guides’ income will be affected. Furthermore, a user fee could be imposed for all popular visiting sites (such as Manatee Hole in the Southern Lagoon and the Swallow Cay area), giving tickets to keep as souvenirs. Alternatively, each tour guide could donate a standard percentage (maybe 10% per season) of the manatee tour income to the manatee research and conservation fund.

3) **From Wildlife Offences:** Currently, fines collected from Wildlife offences are put back into Government Revenue. A system should be implemented where these fines are directly put back into a fund that would immediately serve wildlife protection. These funds could either be a government fund where said revenue could not be used for anything but measures to protect wildlife. This would exemplify the government’s commitment to manatee and other wildlife protection.

4) **Fees from Film Documentation:** There was a great market for wildlife documentation in Belize. In 1997, at least six international film crews requested information about the filming of manatees in Belize. Before a crew comes to film in Belize, they require a BZ$200.00 permit from the Conservation Division. Many of these crews are well financed, often stating that our fee is very small. It is possible to increase that fee significantly, and have the additional funds be put towards the protection of manatees. A fee such as BZ$1000.00 would be more appropriate. This would also encompass the understanding that three copies of all final images be given to the permitting agency, which could be used for local educational use as the state sees fit.

5) **Revenue from Fueling Stations:** There are 64 service stations countrywide, with eleven marinas. The parent companies of these stations, primarily marinas, should be approached
to contribute towards the protection of manatees. A percentage of their gasoline and oil sales could be designated for this purpose, which would be a most favorable method of expressing their commitment to environmental protection.

6) **Sale of Memorabilia:** Manatee souvenirs such as T-shirts, wooden sculptures, manatee shaped jewelry etc. could be bought and sold at NGOs. A portion of the revenue could be contributed to manatee protection. Also, establishing an “Adopt A Manatee” programme would be an education effort and bring revenue for manatee conservation.

For the majority of the above mentioned recommendations, amendments to legislation is necessary, specifically for those that deal with government funds, that is points 1), 3), and 4). Portions of funds, such as those mentioned in points 1), 3), and 4) could be managed by government (Forestry), solely for the protection of wildlife – namely for patrol efforts. The majority of the funds should be put into the Manatee Fund controlled by the NMWG, which includes government representatives. The Group would then decide how to spend the funds, either on research, education, monitoring or enforcement. The feasibility of each mechanism should be determined, and contracts with relevant associations or companies made thereafter.

**VII. OUTLINE FOR SCHEDULE OF CONSERVATION ACTIVITIES**

Manatee numbers have declined for a number of reasons, all of which are human related. This includes destruction or alteration of their natural habitat to direct taking of the animals. We know that Belize has a minimum population of 318 manatees, and estimate that there are probably almost a thousand swimming in our waters. Two centuries ago, there were feasibly a few thousand. Although we cannot realistically expect manatee numbers to reach this high in the near future, it is imperative that we evaluate and reduce their decline today.

This Manatee Recovery Plan for Belize is only a step in achieving the goal of manatee conservation. They and their habitat must be protected by our actions. Aside from the anthropocentric rewards received by protecting manatees, their ecological and intrinsic values are far more important. Below are goals we shall strive to realize within the next four years towards the safeguarding of our “mermaids”. Table 2 outlines a time schedule for the activities. This effort will take government commitment, institutional response and public cooperation.

- **GOALS**
  1. To prevent extinction or irreversible decline of the species within the foreseeable future.
  2. To prevent decline in habitat quality.

- **OBJECTIVES**
  1. To decrease the number of manatee deaths countrywide.
  2. To monitor species population change and its causes.
  3. To develop a formal salvage group consisting of government and non-government persons.
  4. To educate officers, tour guides, students, and the general public.
5. To increase enforcement of national and international laws relating to manatees and their habitat.

➢ **ACTIVITIES**

1. Training & Education
   a) *Develop a formal salvage and necropsy programme*: This will be undertaken with the efforts of the Fisheries and Forestry Departments. It shall include a selected team of people from various municipalities to be trained to carry out investigations - a Salvage Network shall thus be formed. The selection of the necropsy team should take place within the first two months of the project, and training commence at the soonest possible time thereafter. It is anticipated that a necropsy specialist from the Sirenia Project in Florida or the FMRI will head the training. This activity will help to more accurately determine causes of manatee deaths on a long-term basis.

   b) *Implement proper manatee tour guiding system, including training and certification of guides*: This shall be a combined effort headed by the Forest Department in collaboration with the BTB. This effort will be an ongoing one, certifying and offering refresher courses to guides annually or every other year. The first programme should take place during the first year of activities.

   c) *Expand education efforts to include a variety of target groups and cater programmes for these groups*: The Belize Audubon Society shall take a primary role in this task, with consultations from researchers. The primary development of these programmes shall be completed within the first year, but implementation should be ongoing. Produce videos and information pamphlets about the laws protecting manatees within the first year. Dissemination of information should thereafter commence and be an ongoing activity.

   d) *Create a library with a centralized cataloging system of all research projects/activities relating to manatees*: This information should be readily accessible through an appropriate medium. As the national manatee research was conducted through the Coastal Zone Management Project, most of the data is at this office. A database will be worked on within the second year and a functioning system available for public use by the end of the third year. Problems in the programme should be identified and corrected by the end of the fourth year. This activity shall be done with the assistance of the data analyst at the CZMP.

2. Research & Monitoring
   a) *Continue and enhance research projects concerning manatee population biology, life history, behavior, and habitat use*: Research will be ongoing throughout the length of the project. Aerial and boat surveys will be done seasonally and on a monthly basis respectively. Other research techniques should be investigated and attempted, based on attainable equipment. These would include telemetry and enhancing the photo-identification project.

   b) *Maintain, protect and monitor water quality and seagrasses*: The CZMP’s Water Quality Programme will continue its consistent monitoring throughout the country. The researcher or the NMWG should review reports from the CARICOMP sites that monitor seagrass productivity. Also, other site monitoring should be identified and results made available. Our ability to expand this research should also be investigated.
3. Management & Regulations

a) **Formulate a plan of action to rescue and rehabilitate distressed manatees:** This will be undertaken immediately, with consultations with specialists abroad and local authorities. Six months into the project, this plan of action should be available.

b) **Formalize slow boat speed zones in high use, shallow areas:** A priority area is the high-use water adjacent to Belize City, including the Belize River. Signs should be placed at these areas, and frequent patrols made by Fisheries and Forestry. There must be an institutional framework by which offenders could be prosecuted. This regulation should come into effect within a year of this outline’s implementation. Other areas such as Southern Lagoon and Placentia should then be implemented by the following year.

c) **Produce and amend management plans for protected areas, providing protection of manatees:** Priority should be given to the development of a management plan for the Corozal Bay and Gales Point Wildlife Sanctuaries. This should be done by the government agency responsible for each reserve, and should commence in the first year of this plan’s implementation. Completion of management plans or necessary amendments for existing plans for all reserves adjacent to manatee areas should be done by the end of this four year programme.

d) **Give priority areas some protection status, creating a system of reserves protecting manatees:** These should include the Belize City cays area, Placentia Lagoon, Indian Hill Lagoon, and the Port Honduras area. Corridors between these reserves should also be monitored. This will be a long process, but should commence immediately, with a framework established by the middle of the second year. The Ministry of Natural Resources will be a key instrument for this task.

e) **Review and update National legislation pertaining to wildlife protection:** The NMWG should reevaluate the Wildlife Protection Act and take recommendations to the Ministry of Natural Resources. Serious consideration should be given to the development of an amendment of the WPA that focuses on endangered species and their habitat. Evaluation should be done within the first year of the project, and the commencement of amendments by the Ministry made by the third year.

f) **Investigate funding mechanisms:** It is essential that funding agencies be identified so that research activities could be carried out. Also necessary is identifying and coordinating methods of attaining a consistent flow of funds from various local sources. This would support daily activities of monitoring and education. This task should be done by the NMWG, and at some point, an attorney should be brought in for consultation. These sustainable funding systems should be in place by the end of the third year.

g) **Maintain the National Manatee Working Group:** Quarterly meetings shall continue with members of the NMWG. It shall supervise research activities, review legislation, investigate funding mechanisms, and coordinate activities of a national manatee researcher/biologist. The Group will ensure that the tasks listed here shall be completed. Also, maintain the position of manatee researcher, possibly at the Coastal Zone Management Institute.

h) **Produce annual work plan:** Twelve-month work plans should be produced annually by the national manatee biologist/researcher. The NMWG should review and approve this document before it is implemented.
i) **Publish annual reports:** Progress reports will be produced annually by the national manatee biologist/researcher. The NMWG would review this document before it is formally published.

j) **Update Manatee Recovery Plan every five years:** The NMWG should select a member or the researcher to compile an updated Manatee Recovery Plan, with input from all members of the Group.

4. **Enforcement**

a) **Implement a proper system to report manatee deaths and injuries:** The Forestry Department should publicly advertise the availability of radios to report any manatee found dead or injured. Also, the Belize Audubon Society shall do the same with their 24-hour hotline. This should start within the first six months of the project.

b) **Coordinate patrol activities of the Fisheries Dept., Forestry Dept., and the BDF Maritime Wing:** This activity can begin immediately, with the cooperation of each department. Information can be easily transferred digitally using Internet capacity. These officers will be reminded of the areas and reasons for slow boat speed to prevent hitting manatees.

c) **Deputizing few tour guides as Forest Officers:** This will enable greater surveillance for these mission specific officers. They could give tickets to violators of the WPS, which could then be taken up with the authorities.

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**RESULTS AND OUTPUTS**

The following important outputs are expected from the initiation of the four year national manatee conservation programme.

1. A full-time researcher hired by the National Manatee Working Group for the duration of the project.

2. Trained persons for salvage and basic necropsy techniques and the formation of a Salvage Network.

3. Work schedules and reports produced annually.

4. Boat speed zones established.

5. Training and formal licensing of tour guides commenced.

6. Educational packages produced for specific target groups (such as tour guides, students, general public) including an information booklet on Belize’s manatees, as well as videos on legislation.

7. Research continued and enhanced.

8. Protected areas with updated management plans and regulations enforced.

9. Legislation protecting manatees reviewed.

10. Recovery Plan in place.
<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>YR 1</th>
<th>YR 2</th>
<th>YR 3</th>
<th>YR 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carry Out Salvage &amp; Necropsy Programme</td>
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<tr>
<td>Implement Proper Tour Guiding System w/ Training</td>
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<tr>
<td>Conduct Education Programme</td>
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<tr>
<td>Create &amp; Upkeep Library of Manatee Research &amp; Activities</td>
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<td></td>
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<tr>
<td>Continue &amp; Enhance Research Projects</td>
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<tr>
<td>Monitor Water Quality &amp; Seagrass Beds</td>
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<td>Prepare Action Plan for Live Strandings</td>
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<tr>
<td>Formalize Slow Boat Speed Zones</td>
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<tr>
<td>Produce &amp; Amend Management Plans for Protected Areas</td>
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<tr>
<td>Give Priority Manatee Areas Protective Status or Regulations</td>
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<tr>
<td>Review &amp; Update National Legislation</td>
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<td></td>
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<tr>
<td>Formalize Funding Mechanisms</td>
<td></td>
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<tr>
<td>Maintain National Working Group</td>
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<tr>
<td>Produce Annual Work Plans</td>
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<tr>
<td>Publish Annual Reports</td>
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<tr>
<td>Implement Reporting System</td>
<td></td>
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<tr>
<td>Coordinate Patrol Activities</td>
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<td></td>
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</tbody>
</table>

YR = Year; Qtr = Yearly Quarter
BIBLIOGRAPHY


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Morales-Vela, B. 1994b. Second technical report and activities developed on the first manatee aerial survey over the Belize coasts and Chetumal Bay, Mexico. Centro de Investigaciones de Quintana Roo.

Morales-Vela, B. 1995. Third technical report and activities developed on the first manatee aerial survey over the Belize coasts and Chetumal Bay, Mexico. Centro de Investigaciones de Quintana Roo.


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**Map Coverages**

1. Land Information Center, Ministry of Natural Resources and the Environment:
   - Mainland and Cays
   - Reef Outline

2. World Conservation Union (IUCN)
   - Coastal Uses and Activities
   - Seagrass Distribution
   - Wider Caribbean Manatee Distribution (with the National Oceanic and Atmospheric Administration - NOAA)

3. Coastal Zone Management Project
   - Protected Areas
   - Coastal Uses and Activities
   - Aerial Survey Flight Path
   - Carcass Sightings
   - Critical Manatee Areas
<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>MAXIMUM COUNT</th>
<th>REMARKS</th>
<th>REFERENCE</th>
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<tbody>
<tr>
<td>Belize</td>
<td>318</td>
<td>Countrywide aerial survey in 1997</td>
<td>Auil (1997c)</td>
</tr>
<tr>
<td>Cuba</td>
<td>none available</td>
<td>No reported aerial surveys, although some areas of abundance reported in 1987 by Estrada &amp; Ferrer</td>
<td>Lefebvre et al. (1989)</td>
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<tr>
<td>Dominican Republic</td>
<td>41</td>
<td>Aerial survey of entire coast in 1977</td>
<td>Belitski and Belitski (1980)</td>
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<td>Florida</td>
<td>2639</td>
<td>Maximum count made in 1996</td>
<td>Florida Marine Research Institute</td>
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<td>Guatemala</td>
<td>30</td>
<td>Max count in 1992; five areas along the Caribbean coast and inland waters were surveyed</td>
<td>Quintana-Rizzo et al. (1994)</td>
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<td>Haiti</td>
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<td>Aerial survey of entire coast in 1982</td>
<td>Rathbun et al. (1985)</td>
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<td>Honduras</td>
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<td>Aerial survey of entire coast in 1979</td>
<td>Rathbun et al. (1983)</td>
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<td>Jamaica</td>
<td>13</td>
<td>Highest count during aerial surveys of entire coast in 1981-82</td>
<td>Fairbairn et al. (1982)</td>
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<td>Nicaragua</td>
<td>43</td>
<td>Aerial survey of 190 km of coastline within the Miskito Protected Area</td>
<td>Carr (1992)</td>
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<tr>
<td>Panama</td>
<td>24</td>
<td>River systems and in Bocas del Toro province, and Carib. coast to Ustupo surveyed in 1987</td>
<td>Mou-S. et al. (1990)</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>62</td>
<td>Aerial survey of entire coast in 1984/5</td>
<td>Rathbun et al. (1986)</td>
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<tr>
<td>Quintana Roo, Mexico</td>
<td>49</td>
<td>Highest count during surveys in the Bajia de Chetumal surveyed in 1987-88</td>
<td>Colmenero-R. et al. (1988)</td>
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<td>Q. Roo, Mexico (excluding the Chetumal Bay)</td>
<td>6</td>
<td>Highest count during 8 surveys in 1997-98</td>
<td>Colmenero-R. et al. (1988)</td>
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Source: Modified from O’Shea and Salisbury 1991 & Salisbury 1992
TABLE 4: Overall Results for Aerial Surveys Conducted in Belize

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<tbody>
<tr>
<td>Survey Area</td>
<td>country&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5 selected areas&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>country</td>
<td>country</td>
<td>country</td>
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<tr>
<td>Hrs. of Survey</td>
<td>10.40</td>
<td>5.2</td>
<td>11.23</td>
<td>10.62</td>
<td>11.94</td>
<td>9.62</td>
<td>9.09</td>
<td>10.45</td>
<td>8.66</td>
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<tr>
<td>Total Count</td>
<td>101</td>
<td>102</td>
<td>228</td>
<td>182</td>
<td>148</td>
<td>231</td>
<td>315</td>
<td>318</td>
<td>224</td>
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<tr>
<td>IRA*</td>
<td>9.71</td>
<td>18.89</td>
<td>21.82</td>
<td>17.14</td>
<td>13.49</td>
<td>24.12</td>
<td>34.65</td>
<td>30.43</td>
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<tr>
<td>Area of Highest Count</td>
<td>Southern Lagoon</td>
<td>Southern Lagoon</td>
<td>Placentia Lagoon</td>
<td>Cays near Belize City</td>
<td>Cays Near Belize City</td>
<td>Placentia Lagoon</td>
<td>Cays Near Belize City</td>
<td>Cays Near Belize City</td>
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<td>Habitat with Highest IRA</td>
<td>lagoon</td>
<td>lagoon</td>
<td>river</td>
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<td>lagoon</td>
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</tbody>
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<sup>a</sup> Excluding Turneffe Atoll
<sup>b</sup> Four Mile Lagoon & lower New River; lower Belize River; waters and cays off Belize City; Southern Lagoon; Placentia Lagoon

* Index of Relative Abundance (# manatees / hour)

TABLE 5: Offshore Dredging 1995-1997

<table>
<thead>
<tr>
<th>AREA</th>
<th>No. Permits Issued</th>
<th>Range of Volume for Permits (cu. Yd.)</th>
<th>Total Volume (cu. Yd.)</th>
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<tbody>
<tr>
<td>Belize City</td>
<td>3</td>
<td>300 - 87,000*</td>
<td>90,300*</td>
</tr>
<tr>
<td>Cays</td>
<td>31</td>
<td>100 - 40,000</td>
<td>150,092*</td>
</tr>
<tr>
<td>Placentia Lagoon</td>
<td>11</td>
<td>100 - 22,000</td>
<td>51,025</td>
</tr>
<tr>
<td>Rivers</td>
<td>3</td>
<td>Not available</td>
<td>7000*</td>
</tr>
<tr>
<td>Ladyville &amp; Bella Vista</td>
<td>3</td>
<td>2,500 – 14,000</td>
<td>20,500</td>
</tr>
<tr>
<td>Punta Gorda</td>
<td>2</td>
<td>3,000 – 5,000</td>
<td>8,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>53</td>
<td>100 – 87,000*</td>
<td>326,917*</td>
</tr>
</tbody>
</table>

*Minimum volume of dredged material (not actual total).
Source: Department of Geology & Petroleum
### TABLE 6: Number of Boats Registered by the Belize Port Authority

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<td>Belize City</td>
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<td>36</td>
<td>20</td>
<td>40</td>
<td>25</td>
<td>156</td>
</tr>
<tr>
<td>San Pedro</td>
<td>&gt;164</td>
<td>132</td>
<td>159</td>
<td>178</td>
<td>200</td>
<td>833</td>
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<tr>
<td>Cayo</td>
<td>2</td>
<td>2</td>
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<td>0</td>
<td>--</td>
<td>5</td>
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<td>Cay Caulker</td>
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<td>54</td>
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<td>Placencia</td>
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<td>2</td>
<td>--</td>
<td>3</td>
</tr>
<tr>
<td>Orange Walk</td>
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<tr>
<td>Corozal</td>
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<td>0</td>
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<td>2</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td>Sittee River &amp;</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>--</td>
<td>12</td>
</tr>
<tr>
<td>Southern Cays</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monkey River</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>20</td>
<td>20</td>
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<td>--</td>
<td>32</td>
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<td><strong>Total</strong></td>
<td>263</td>
<td>279</td>
<td>316</td>
<td>480</td>
<td>480</td>
<td>1818</td>
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</table>

*Registration figures not complete for the year.

### TABLE 7: Coastal and Marine Protected Areas

<table>
<thead>
<tr>
<th>Protected Area Status</th>
<th>Protected Area</th>
<th>Area (acres)</th>
<th>Date Established</th>
<th>Management Plan</th>
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<td></td>
<td>Burden Canal</td>
<td>5,255</td>
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<td>Bird Cays</td>
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<td></td>
<td>Paynes Creek</td>
<td>31,676</td>
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<td>in progress</td>
</tr>
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<td></td>
<td>Sarstoon / Temash</td>
<td>41,898</td>
<td>1994</td>
<td>in progress</td>
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<tr>
<td></td>
<td>Bacalar Chico</td>
<td></td>
<td>1996</td>
<td>1996</td>
</tr>
<tr>
<td>Natural Monument</td>
<td>Half Moon Cay</td>
<td>9,771</td>
<td>1982</td>
<td>1986</td>
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<tr>
<td></td>
<td>Blue Hole</td>
<td>1,023</td>
<td>1996</td>
<td>none</td>
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<tr>
<td>Wildlife Sanctories</td>
<td>Crooked Tree</td>
<td>41,297</td>
<td>1984</td>
<td>1994</td>
</tr>
<tr>
<td></td>
<td>Corozal Bay (Manatee)</td>
<td>177,762</td>
<td>1998</td>
<td>none</td>
</tr>
<tr>
<td></td>
<td>Gales Point (W. I. Manatee)</td>
<td>9095</td>
<td>1998</td>
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<td>Forest Reserves</td>
<td>Deep River</td>
<td>78,574</td>
<td>1941</td>
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<td></td>
<td>Freshwater Creek</td>
<td>60,177</td>
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<td>Manatee</td>
<td>103,878</td>
<td>1994 &amp; 1959</td>
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<tr>
<td></td>
<td>Mango Creek</td>
<td>35,549</td>
<td>1960 &amp; 1977</td>
<td>none</td>
</tr>
<tr>
<td></td>
<td>Cay Caulker</td>
<td>160</td>
<td>1998</td>
<td>1996 (draft)</td>
</tr>
<tr>
<td>Marine Reserves</td>
<td>Sapodilla Cays</td>
<td>33,401</td>
<td>1996</td>
<td>1994</td>
</tr>
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<td>Southwater Cays</td>
<td>78,374</td>
<td>1996</td>
<td>1993</td>
</tr>
<tr>
<td></td>
<td>Glover's Reef</td>
<td>81,237</td>
<td>1993</td>
<td>1988</td>
</tr>
<tr>
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<td>Hol Chan</td>
<td>2,759</td>
<td>1987</td>
<td>1986</td>
</tr>
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<td>Bacalar Chico</td>
<td>15,117</td>
<td>1996</td>
<td>1995</td>
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<td>Cay Caulker</td>
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<td>1998</td>
<td>1996 (draft)</td>
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<td>Archaeological Reserves</td>
<td>Cerro Maya</td>
<td>49</td>
<td>1976</td>
<td>pending</td>
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<tr>
<td>Private Reserves</td>
<td>Shipstern Nature Reserve</td>
<td>18,841</td>
<td>1987</td>
<td>1990</td>
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<tr>
<td></td>
<td>Golden Stream</td>
<td>27,228</td>
<td>in progress</td>
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### TABLE 8: Proposed Reserves

<table>
<thead>
<tr>
<th>Mexican Rocks</th>
<th>Siwa Ban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipstern Cay &amp; Lagoon</td>
<td>Four Mile Lagoon</td>
</tr>
<tr>
<td>Belize River Mouth</td>
<td>Northern Lagoon</td>
</tr>
<tr>
<td>Placentia Peninsula</td>
<td>Port Honduras</td>
</tr>
<tr>
<td>Mussel Creek</td>
<td>Beaver Dam</td>
</tr>
<tr>
<td>Northern River</td>
<td>New River Lagoon</td>
</tr>
<tr>
<td>Rio Hondo</td>
<td>Sennis</td>
</tr>
<tr>
<td>Aquacaliente Swamp</td>
<td>Bull Run</td>
</tr>
<tr>
<td>Whitewater</td>
<td>The Dump</td>
</tr>
<tr>
<td>Indian Creek</td>
<td>Baldy Beacon</td>
</tr>
<tr>
<td>Upper Macal River / Privassion Creek</td>
<td>Raspaculo Branch Watershed</td>
</tr>
<tr>
<td>Silk Cays</td>
<td>Toledo Ridge SDA</td>
</tr>
</tbody>
</table>

Source: Conservation Division, Forestry Department
APPENDIX 1

Legal Statutes for Designating Protected Areas

i. The National Parks Systems Act, 1981, allows the Minister to declare any specified area of crown land a national park, nature reserve, wildlife sanctuary, or natural monument. A “National Park” is an area reserved for the protection and preservation of natural and scenic values of national significance for the benefit and enjoyment of the general public. A “Nature Reserve” is an area saved as a scientific reserve for the protection of biological communities or species and natural process in an undisturbed state for scientific study, monitoring, education and the maintenance of genetic resources. A “Wildlife Sanctuary” is an area reserved as a nature conservation reserve for the protection of nationally significant species, wildlife habitats, and physical features. A “Natural Monument” is an area reserved for the protection and preservation of nationally significant natural features and unique characteristics for education, research and public appreciation.

ii. The Forest Act, 1927, provides the powers to declare and administer Forest Reserves. A “Forest Reserve” is any area reserved for the protection of forests for management of timber extraction and the conservation of soil, watersheds, and wildlife resources.

iii. The Fisheries (Amendment) Act (No. 1 of 1983) amended the Fisheries Act to permit the Minister to declare any area within the fishing limits of Belize and any adjacent land to be a marine reserve. A “Marine Reserve” is an area reserved for the protection, research, recreation, education, and controlled extraction in relation to marine and freshwater species and their habitats.

iv. The Ancient Monuments & Antiquities Act, 1972, allows the Minister of Tourism and the Environment to declare an Archaeological Reserve.

v. National Lands Act, 1992 governs the manner in which land owned by the Government can be sold or leased to the public.

National areas can also be afforded various levels of protection through other mechanisms.

i. Special Development Areas (SDAs) are intended to act as land development guidance to the Land Utilization Authority (LUA), other government departments, and the general public (McGill 1994). The LUA is the implementing body for the SDA programme.

ii. Protection of private land can be afforded through the creation of a Private Reserve, which issues rights of management within the rights of ownership.

iii. The Central Housing and Planning Authority (Ministry of Housing, Urban Development and Co-operatives) can designate statutory planning areas that may include “reserves” or “conservation areas”.

iv. “Conservation areas” may be included within Archeological Reserves and therefore have a statutory basis.

v. It is required that a 66 ft strip of land beside streams be left as a reserve under the National Lands Act.
APPENDIX 2

Manatee Tours: Underwater Manatee Observation

The issue of swimming with manatees is currently in the forefront of manatee protection. At the first national Manatee Tour Guide Workshop, held in June 1995, issues of manatee tour guiding were discussed at length between tour guides, representatives from government and environmental NGOs, and interested persons. One of these issues was swimming with manatees as a part of the manatee tour. Participants were divided on this issue, Cay Caulker and Belize City participants disagreeing with swimming, and Placencia and Gales Point participants finding it impractical in their areas due to poor water clarity. All other participants believed that swimming could be allowed at appropriate sites (based on water clarity and depth), under a controlled basis. Additionally, in the June 12, 1996 meeting of the Manatee Working Group, it was agreed upon that swimming with manatees would prove beneficial, if conducted with "...strict guidelines, in certain areas". It was also suggested that only certified and licensed "manatee guides" carry out these tours.

In May 1996, Conservation Division of the Forest Department implemented regulations prohibiting the swimming with manatees [on a commercial basis]. Yet, it is of the opinion of the Manatee Working Group that through strict criteria, swimming with manatees could be permitted. The rationale behind this decision is the magnification of public awareness and interest it will have on manatee conservation. Furthermore, as there is an obvious handicap (equipment and manpower) within the formal regulatory agencies of our wildlife, it is strongly believed that these certified guides could act as the stewards that they should be. This stewardship will be enhanced as guides economic incentive is, resulting in more recording and reporting of manatee sightings, deaths, and issues relating to manatee survival.

Two meetings have been held since concerning this issue. The July 10, 1997 Manatee Working Group meeting discussed the benefits and the possible guidelines needed to have a successful practice of swimming with the manatees. A follow-up of the issue was a meeting with Mr. Rafael Mansanero and Mr. George Hanson of the Forest Department, Greg Smith, and Nicole Auil on August 7, 1997. Here, more specific methods of controlling swimming were discussed. The Forest Department is now considering the options brought forward, and as agreed, the following is a list of points for consideration and fine-tuning for the certifying of guides.

Manatee Swimming Policy - Points For Consideration:

1. Only those who successfully complete a course in underwater manatee observation will be allowed a permit/license for this specialized tour.

2. SWIMMING GUIDELINES:

- Guides should give a mandatory orientation of guidelines to all swimmers.
- All who enter the water should be adequate swimmers, or provisions by tour establishment made (individual attention to swimmer).
- Swim only if environmental conditions permit, i.e. if the water current is weak and waves are low.
• A maximum of five swimmers, with one to two guides present. Guide will always enter the water with tourists to monitor their behavior, as well as the animals’ behavior. It is recommended that one person stay onboard the vessel to direct the group in the water.

• Only one group at a time at any given site.

• All swimmers will wear a life vest during swimming (this will be beneficial to weak swimmers, and keep control of anxious ones).

• Enter the water only if manatees seem undisturbed and stay in the area (it is pointless to chase a marine animal while swimming). No chasing animals with the boat!!

• Swimmers should enter the water quietly and as far from the animal as possible so as to approach the animal quietly and comfortably (having to adjust all equipment) in the water. This eliminates boat and possible splashing disturbances.

• Swimming only allowed in deep (10 feet and over) areas or channels. No swimming in holes surrounded by emergent vegetation or shallow areas that would not allow manatees to escape if desired.

• View the animal from a distance, floating at the water’s surface - do not dive down and no touching of an animal; contact only made if animal touches you.

• No chasing or attempting to corner or isolate a manatee. Especially do not attempt to separate a mother and calf.

• No feeding of animals.

• Minimize swimming time - no more than 15 minutes per group.

• Boat approach and departure will follow those of the guidelines made during the Manatee Workshop.

3. Schedule guide times so as to avoid user conflicts between guides.

4. Have specific days for swimming. This would make it more easily controls and increase the possibility of having a guard/warden at the site.

5. Using Florida as a model, we can establish an area of underwater observation, marked off by buoys.
APPENDIX 3

Outline For Manatee Stranding Emergency Action Plan

1. Identify a rescue team consisting of at least five local representatives whom would be responsible for assisting the lead Manatee Researcher in initial care of any stranding. This should include Fisheries and Forestry officers, as well as manatee researchers/biologists.
   - Specifically, members of the National Manatee Working Group.

2. Compile protocol for care of live standings.
   - Utilize that compiled by rehabilitation centers mentioned below.

3. Identify local professional veterinarian whom would take primary role in initial assessment of stranding.
   - Member(s) of the Humane Society.

4. Identify primary equipment needed to care for a stranding, and companies that have them.
   - Medication
   - Food
   - Equipment for transfer and holding of animal

5. Identify suitable location to temporarily house a stranding.
   - This would have to be an area easily accessible by caretakers, but out of the reach of the general public.

6. Identify an aquarium or research facility that can accommodate a live manatee stranding, including provide for its rehabilitation. It is hoped that said organization could maintain calves until they are of juvenile stage (for two – three years) and able to be released into Belizean waters. Adult strandings would need a much shortened rehabilitation period.

   ➢ The facility should be chosen on its capacity to assist:
   - Have trained personnel available to access the situation and determine if transfer for rehabilitation is necessary and possible.
   - Have facility to transport stranding to their rehabilitation center.
   - Time/distance of transfer.
   - Ease of acquiring necessary international transfer permits.
   - Duration that organization can maintain stranding.
   - Financial capacity of organization.

   ➢ Possible rehabilitation centers:
   - Xcaret - Quintana Roo, Mexico
   - Veracruz Aquarium - Veracruz, Mexico
   - The Marine Fauna Rehabilitation Center - Puerto Rico
   - Sea World - Florida
   - Miami Seaquarium - Florida

7. Identify or create rapid means of acquiring the proper CITES permits for the emigration of this endangered species during this critical time.

8. Once a manatee has been rehabilitated, it is anticipated that it be returned to Belizean waters, equipped with a radio-satellite tag and monitored.