MESOAMERICAN BARRIER REEF SYSTEMS PROJECT (MBRS)

TRAINING MANUAL ON DESIGN AND DEVELOPMENT OF MANAGEMENT PLANS FOR MARINE PROTECTED AREAS

(Revised for Web Publishing)

April 2003

Project Coordinating Unit
Coastal Resources Multi-Complex Building
Princess Margaret Drive
P.O. Box 93
Belize City Belize
Tel: (501) 223-3895; 223-4561
Fax: (501) 223-4513
Email: mbrs@btl.net
Website: http://www.mbrs.org.bz

CONSERVATION AND SUSTAINABLE USE OF THE MESOAMERICAN BARRIER REEF SYSTEMS PROJECT (MBRS)

Belize – Guatemala – Honduras - Mexico

TRAINING MANUAL ON DESIGN AND DEVELOPMENT OF MANAGEMENT PLANS FOR MARINE PROTECTED AREAS

Mesoamerican Barrier Reef Systems Project
Project Coordinating Unit
Coastal Resources Multi-complex Building
Princess Margaret Drive
Belize City, Belize
PO Box 93

April 2003

LIST OF ACRONYMS USED

BBRWHS	Belize Barrier Reef World Heritage Site
CEP	Caribbean Environment Programme
CONAP	Consejo Nacional de Areas Protegidas, Guatemala
Fundaeco	Fundación Para el Ecodesarrollo y la Conservación de los Recursos Naturales, Guatemala.
Fundary	Fundación Para la Conservación del Medio Ambiente y los Recursos Naturales Mario Dary Rivera, Guatemala.
INE	Instituto Nacional de Ecología, Mexico
MBRS	Mesoamerican Barrier Reef Systems
MPAs	Marine Protected Areas
SEDUMA	Secretaría de Desarrollo Urbano y Medio Ambiente, Mexico
UNEP	United Nations Environmental Programme.
UNESCO	United Nations Education and Science Commission.
IUCN	The World Conservation Union

Prologue

The constant degradation of marine and coastal ecosystems creates the urgent need to establish reserves and marine protected areas which allow the conservation of biodiversity as well as improve the living conditions of the human communities which depend directly on them.

In order to guarantee conservation, sustainable use of the marine and coastal natural resources and community development, in addition to establishing marine protected areas and reserves, it is essential to have the appropriate tools, trained personnel, infrastructure and basic equipment.

Management Plans are one of the fundamental tools that guide management and define the terms of the ecosystems, the human communities and the administrative components of the plan, required in accordance with the management category.

For this reason, the Mesoamerican Barrier Reef System Project organized and coordinated a regional training course on the design and development of Management Plans for Marine Protected Areas. During this training, support material was provided based on existing experiences. This material was enriched by the input from delegates of the four countries in the MBRS region, which ultimately resulted in the creation of the current document in the form of a manual.

The process involved the participation of an international expert, Alejandro Arrivillaga Cortéz, PhD, who prepared the initial training material, conducted the training, collected the input from the participants and developed the final version of this manual, incorporating the comments of the Project Coordination Unit (PCU.)

The training included case studies, formal presentations, field trips, individual country presentations, assigned reading and dynamic discussions. Likewise, the development of the manual was based on the Training for Trainers in the Management of Protected Areas Manual, developed by UNEP at its Regional Coordination Unit in Kingston, Jamaica.

Existing Management Plans for the 15 priority MPA's within the MBRS transboundary zones were reviewed and individual management experiences shared by the participants were incorporated, to create a manual with the particular characteristics of the four countries involved in the Project.

With this manual, the MBRS Project reaffirms its commitment to generate support material for the conservation and sustainable use of marine and coastal resources, with the participation of the different sectors of civil society, governmental and non-governmental organizations, promoting participatory forums for decision-making**.**

It is our intention that this tool be used in mass training courses and serve as a guide in the processes of revising, updating, re-orienting and preparing Management Plans for MPA's in the various countries of the Mesoamerican region. In so doing, it will strengthen the efforts to conserve biological diversity as well as foster community development by increasing the diversity of actors and levels of participation in the management process.

TABLE OF CONTENTS

LIST OF ACRONYMS USED i

PROLOGUE ii

UNIT 1. INTRODUCTION 1

1.1 Objectives 1
1.2 Source Materials 1
1.3 Manual Structure 2
1.4 Teaching Methods 3
1.5 Expected Results 3
1.6 Participants Introduction 3

UNIT 2. THE NATURE OF THE MARINE ENVIRONMENT 5

2.1 Marine Ecosystems 5
2.2 Coastal Ecosystems 5
2.3 Factors affecting distribution of Marine Organisms 6
2.4 Variables that determine Biotic Consumption and Ecological Characteristics of the different zones 6
1. Light and Depth 6
2. Temperature and Salinity 6
3. Currents and Hydrology 7

2.5 Factors affecting the different zones of the Marine and Coastal Environments 7
2.6 Linkage between Coastal and Marine Ecosystems 8
2.7 Natural and Economic functions of selected Coastal Ecosystems 8

UNIT 3. USES AND THREATS TO THE MARINE ENVIRONMENT AND ITS RESOURCES 9

3.1 Uses of Marine Resources 9
3.2 Marine Resources Threats 10
3.3 The Sea as Common Property Resource 12
3.4 Resource Management 12

UNIT 4. MARINE PROTECTED AREAS 14

4.1 Protected Area Categories and Management Objectives 15
4.2 Marine Protected Areas Objectives 16
4.3 Existing Regional Programs 17
4.4 Impacts to MPA in different Environments 18

UNIT 5. MARINE PROTECTED AREAS PLANNING 19

5.1 Participatory Planning 20
5.2 Stakeholder Identification and Analysis 20
5.3 Criteria for Selecting an Area as an MPA 22

5.4 MPAs Planning Approach 23
5.5 Phases in the Planning Process 24
5.6 Developing Zoning Plans 26
5.7 Generic Outline for a MPA Management Plan 30

UNIT 6. MARINE PROTECTED AREAS MANAGEMENT 33

6.1 Institutional Arrangements for MPA Management 33
6.2 Human Resource Management 33
6.3 Revenue Generation 34
6.4 Work Planning, Reporting and Evaluation 35
6.5 Surveillance 35
6.6 Permitting, Licensing and Enforcement 35
6.7 Interpretation, Evaluation and Outreach 36
6.8 Maintenance 36
6.9 Linkages, Mutual Assistance, Cooperation and General Networking 37

UNIT 7. MPAs RESEARCH AND MONITORING 38

7.1 Importance and Functions of a Research and Monitoring Program 38
7.2 Management and Design of MPAs Research and Monitoring Programs 39
7.3 Remote Sensing and Geographical Information Systems (GIS) in Research Plans 39
7.4 Resource Users Monitoring 39
7.5 Monitoring of Effectiveness of Restrictions and Zoning 41

UNIT 8. COURSE PARTICIPANTS CASE STUDY PRESENTATIONS 42

8.1 Mexico 42
8.2 Guatemala 42
8.3 Belize 43
8.4 Honduras 43
8.5 Regional 44

REFERENCES 45

APPENDICES 50

Appendix 1 MBRS Region MPAs Information and Management Plans Status 50
Appendix 2 List of Participants in the Course 57
Appendix 3 Pre-Course Evaluation 60
Appendix 4 Course Evaluation Form 61
Appendix 5 End of Course Exam 64
Appendix 6 MPAs in the MBRS Region, Management Plans Status Information Form 65
Appendix 7 MPA Visit Assignment 66

UNIT I. INTRODUCTION

The purpose of this manual is to provide guidelines, basic information, and methods which will assist those preparing management plans for Marine Protected Areas (MPAs) in the Mesoamerican Barrier Reef Systems Region –MBRS- (Figure 1). It describes the main issues in sustaining the various benefits and valuable uses of marine areas and suggests ways to organize environmental conservation activities and areas. Overall the emphasis is on building knowledge based on previous experience in the MBRS and the Caribbean.

Marine areas and their resources are extremely important to MBRS countries. Coastal resources have being used increasingly during the past centuries, however, overexploitation and habitat degradation endanger their sustainability. Fisheries statistics, on the other hand, show a steady decrease in catches throughout the world and important fisheries are either exhausted or near collapse.

Sustainable use of coastal resources requires that some coastal areas be retained in Marine Protected Areas -MPAs-. Saving important nursery habitats is vital for securing fisheries production while preserving genetic resources, protecting scenic spaces and, enjoying natural heritage call for adequate management of protected areas.

The focus of this training manual are nine MPAs that are located in the two-transboundary areas of the MBRS region: Mexico-Belize and Belize-Guatemala-Honduras, Banco Chinchorro Biosphere Reserve, Arrecifes de Xcalac Reserve, and Santuario del Manati in Mexico, Bacalar Chico Marine Reserve and National Park, Corozal Bay Wildlife Sanctuary, and Sarstoon-Temash National Park in Belize, Rio Sarstún Multiple User Reserve and Punta de Manabique Special Protection Area in Guatemala, and Turtle Harbor Wildlife Refuge and Marine Reserve in Utila, Honduras.

1.1 OBJECTIVES

The objectives of this manual are to:

Provide tools and information to improve the capacity of organizations responsible for marine protected areas management and increase the sustainability of management efforts through better management plans.

Provide an opportunity for the trainees to become acquainted with existing manuals and references, while facilitating the interaction between experienced MPA administrators and planners. And,

Present a review of the status of management plans for selected MPAs in the MBRS region

1.2 SOURCE MATERIALS

This manual was designed based on available instructive manuals for the region. The main sources were:

1. Training of Trainers in Marine Protected Area Management: Training Manual. United Nations Environmental Programme UNEP, Caribbean Environment

Programme (CEP). Important sections were extracted and adapted from this manual, including units II through VII.

2. Marine and Coastal Protected Areas: A Guide for Planners and Managers. By Rodney V. Salm and John R. Clark. Third Edition, 2000. The UICN Marine Program. Gland, Switzerland and Cambridge, UK. This guide was very useful for expanding and complementing important concepts of marine protected areas management and planning.

3. Fully-protected marine reserves: a guide. By: Callum M. Roberts and Julie P. Hawkins. 2000. WWF Endangered Seas Campaign, 1250 24th Street, NW, Washington, DC 20037, USA and Environment Department, University of York, York, YO10 5DD, UK. The slides from the marine reserves PowerPoint presentation were used as an assigned lecture for the course participants and latter discussed.

4. Training for the Sustainable Management of Marine Protected Areas: A Teaching Manual for Training Managers. Edited by Julius Francis, Ron Johnstone and Tom van´t Hof.

Also, Management Plans for several MBRS area MPAs were reviewed, including,

a. Banco Chinchorro Biosphere Reserve Management Program, Mexico (INE 2000).
b. Punta de Manabique Special Protected Area Master Plan 2002 - 2006, Guatemala (CONAP – Fundary 2001).
c. Rio Sarstún Multiple Use Reserve Management Plan, Guatemala (FUNDAECO 2002).
d. Draft Baseline Assessment of the Belize Barrier Reef World Heritage Site. Programme for Belize. MPAs in Belize, Bacalar Chico National Park and Marine Reserve, Blue Hole Natural Monument, Glover´s Reef Marine Reserve, Laughing Bird Caye National Park, Half Moon Caye Natural Monument, South Water Caye Marine Reserve, and Sapodilla Cayes Marine Reserve (Programme for Belize 2002).
e. Hol Chan Marine Reserve Management Plan (Belize Fisheries Department – UICN 2002).
f. Bahia de Chetumal Manatee Sanctuary, Zoning and Use Regulations, Mexico (SEDUMA 2002).

1.3 MANUAL STRUCTURE

The manual is structured into eight units, starting with Unit I, the introduction, which describes the objectives and contents of the manual, as well as the main sources of written material, the methods that can be used when using the manual for training purposes, the official languages and the expected results from both the course and the participants. Unit II briefly describes the different ecosystems of the marine environment and the variables that determine biotic composition and ecological characteristics of the different zones. Also the main coastal ecosystems and communities are presented and the linkages and ecological functions among the different systems are discussed. Unit III describes the goods and services provided by the marine environment, as well as the natural and anthropogenic threat factors such as natural events, over-exploitation, coastal development, and population increase. Unit IV is an introduction to MPAs, their main objectives and characteristics and a brief mention of existing regional programs and networks. Finally an overview of MPAs in different environments is discussed. Unit V is devoted to the planning of marine protected areas and the main factors that need to be considered when planning marine reserves,

including participatory planning, stakeholder analysis, conflict management, and community engagement. The basis, rationale, and guidelines for marine protected area establishment, selection, and planning and the necessary institutional arrangements area also discussed. Finally the selection criteria for MPAs and the elements of a management plan are presented. Unit VI deals with the management of marine protected areas and the factors that MPA managers needs to consider on a daily basis, including institutional and legal arrangements, human resource management, revenue generation, surveillance, permitting, licensing and enforcement, interpretation, education, and outreach. Unit VII is devoted to the needs for research and monitoring conducted in MPAs, the rationale for research and monitoring for management-driven questions and the methods for monitoring of critical biological resources. Finally, Unit VIII contains some of the course participants case study presentations.

1.4 TEACHING METHODS

Some of the techniques that can be tried when using this manual for training purposes include lectures, group discussions, assigned readings, plenary sessions, brainstorming, country case study presentations and a site visit to a nearby MPA. The official languages of this manual and course are English and Spanish.

1.5 EXPECTED RESULTS

Among the expected results from participants in the training courses are active participation in lectures and discussions, reading of the assigned materials and participation in the development of a network of MBRS region MPA managers and planners.

1.6 PARTICIPANTS INTRODUCTION

Participants should form pairs, interview each other for 5 minutes and then introduce their partner. They should include the following information: name, type of work conducted, course expectations, and personal rewarding activities (hobbies, etc.).

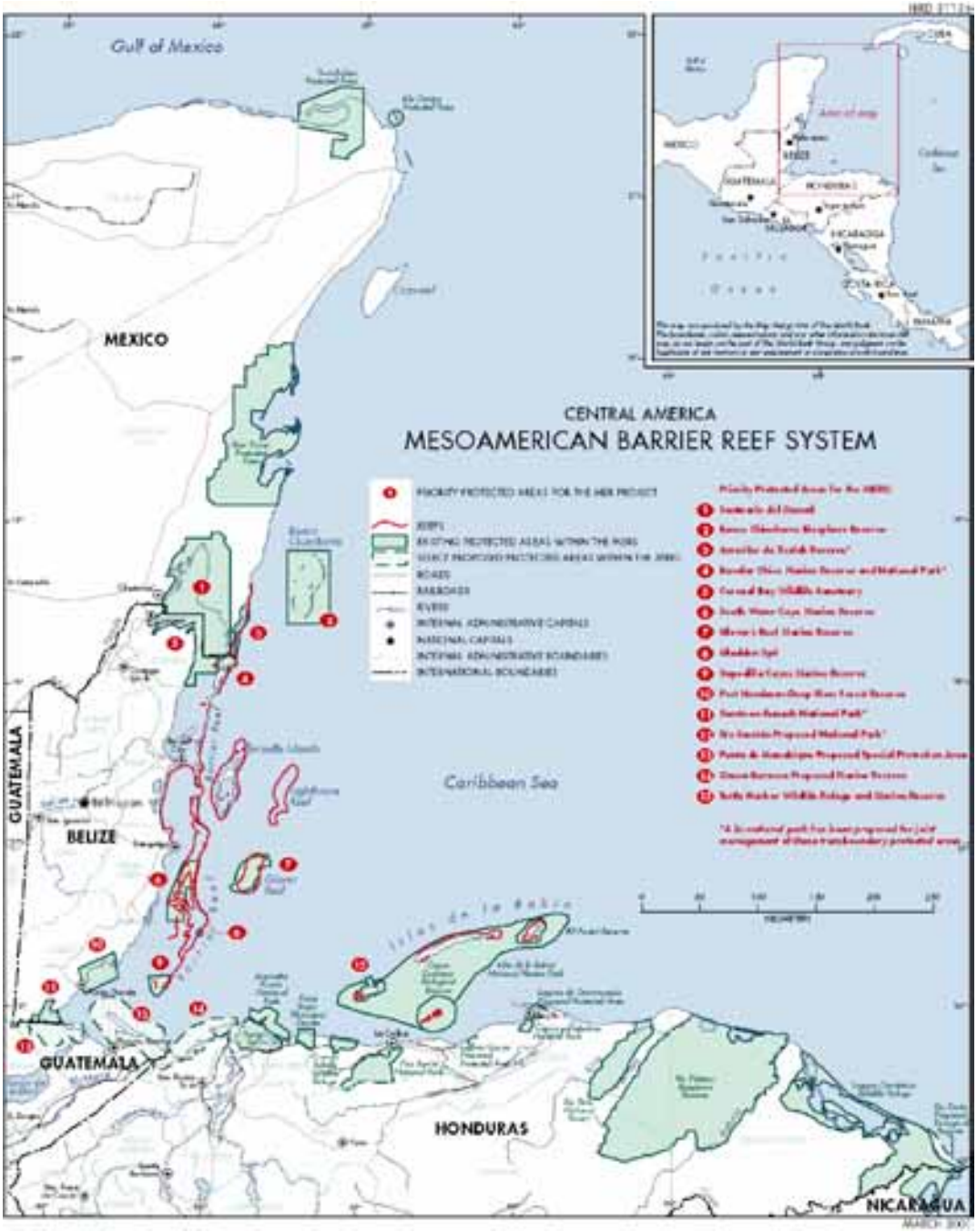


Figure 1. The MBRS area.

UNIT 2. THE NATURE OF THE MARINE ENVIRONMENT

This unit is an introduction to basic marine ecology and covers the following items:

The Marine and Coastal Ecosystems´ zones and divisions, and

The Marine and Coastal Ecosystems environmental characteristics and the different variables that determine biotic composition and ecological characteristics of the different zones, their linkages and ecological functions.

This unit is largely based on Module 2 of the manual "Training of Trainers in Marine Protected Area Management: Training Manual. United Nations Environmental Programme UNEP, Caribbean Environment Programme (CEP)". The reader is instructed to review that publication for a comprehensive description of the factors affecting the marine environment and organisms.

2.1 MARINE ECOSYSTEMS

The marine environment is composed of a series of distinct ecosystems. Biological complexity and interaction are determined by biophysical factors such as temperature and currents. Successful management of marine resources therefore requires an appreciation of the spatial differentiation of the physical factors, and its related impact on biological diversity and function

The marine environment is not homogeneous. In the horizontal plane, the Pelagic Region is divided between the Neritic province near the coast and the Oceanic Province is located beyond the continental shelf. In the vertical plane, the Pelagic Region (the environment across the water column) is divided into the Epipelagic Zone, the Mesopelagic Zone, the Bathypelagic Zone, and the Abyssopelagic Zone. The Benthic Region progresses from the coast to the ocean starting at the Littoral Zone, and then the Sublittoral Zone, the Bathybenthic Zone, and the Abyssobenthic Zone.

2.2 COASTAL ECOSYSTEMS

Coastal ecosystems provide a range of goods and services and many of those coastal ecosystems are linked. The linkages between coastal ecosystems are not always recognized or appreciated. As such, in making decisions about the spatial distribution of economic activity, critical ecosystem processes are often disrupted. The maintenance of ecosystem integrity therefore requires an understanding of the ecosystems and their linkages.

Some of the most important and commonly found coastal systems include rocky shorelines, beaches, mangrove and other coastal forests, coastal shrub communities, seagrass beds, coral reefs, coastal lagoons, river mouths, coastal marshes, and fresh and saltwater wetlands. Among those systems, coastal areas show high values of productivity, especially when compared with other terrestrial and open water systems (Figure 2).

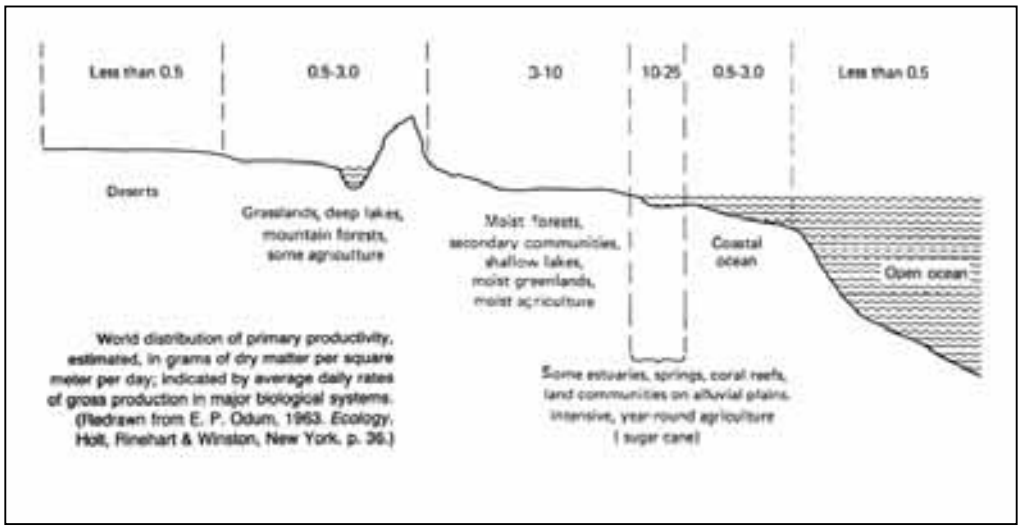


Figure 2. Primary productivity of several land and aquatic ecosystems.

2.3 FACTORS AFFECTING DISTRIBUTION OF MARINE ORGANISMS

Among the main environmental factors regulating distribution of marine organisms are temperature, water composition, current speed, depth and pressure, illumination, salinity, turbidity, substrate material, availability of food, and biological competition.

2.4 VARIABLES THAT DETERMINE BIOTIC CONSUMPTION AND ECOLOGICAL CHARACTERISTICS OF THE DIFFERENT ZONES

1. LIGHT AND DEPTH

Light changes in intensity and wavelength as it passes downward through the sea. The amount of light that penetrates the surface depends on factors such as surface conditions (a turbulent surface reflects more light than a calm surface); absorption and refraction of the light by the water column; and turbidity of the water. Photosynthetic active radiation is the minimum radiation required for photosynthetic activity while excessive radiation may cause photo inhibition.

2. TEMPERATURE AND SALINITY

Temperature affects the ecological processes in the ocean in two main ways, by affecting photosynthesis and by affecting the mixing of the water column. In the vertical plane, temperature affects ocean currents by causing cool less dense water to sink.

Salinity controls species distribution through different salinity range tolerances. Most species have a narrow salinity range, while others can shift between full strength seawater salinities and upstream freshwaters. Table 1 lists the major constituents of ocean water.

Table 1: Major Constituents of Ocean Water (S = 35.00$^0/_{00}$)	
Constituent	**g/Kg**
Sodium	10.770
Magnesium	1.300
Calcium	0.412
Potassium	0.399
Strontium	0.008
Chloride	19.340
Sulphate (as SO_4)	2.710
Bromide	0.067
Carbon (present as bicarbonate, carbonate, and molecular carbon dioxide)	0.023 at pH 8.4 to 0.027 at pH 7.8
Source: Tait, 1981	

3. CURRENTS AND HYDROLOGY

The major currents of the oceans are caused by the combined effects of wind action and barometric pressures on the surface, and density differences between different parts of the sea. Currents are responsible for egg and larval dispersal helping replenish downstream sites with products from fish and invertebrates from sometimes far away sources. The importance of marine currents knowledge for MPAs management is illustrated for Banco Chinchorro Biosphere Reserve (INE 2000). Located along the eastern shore of the Yucatan Peninsula the surface current patter in this area shows a clear northeastern flow pattern which results in a net western, onshore transport.

According to the Hol Chan Marine Reserve management plan (Belize Department of Fisheries – UICN 2002), important physical information for the protected areas management include bathymetry and turbidity, tides wind, waves, and currents, temperature, pH and salinity, hurricanes and rainfall.

At the Rio Sarstun protected area, the presence of a 55 km long river is one of the main features. With a gradient up to only 414 m altitude, this significant source of fresh water creates an important estuarine system (Fundaeco 2002).

2.5 FACTORS AFFECTING THE DIFFERENT ZONES OF THE MARINE AND COASTAL ENVIRONMENTS

Among the main factors affecting the coastal zone, the interface between land and sea, are the extension of coastal plain. The coastal plain is responsible for the upland runoff amount and composition and can be source of both nutrients and pollutants. Another factor is the size of the continental shelf and the shoreline bathymetric profile variability, which may be responsible for important coastal upwelling zones. Seasonality and rainfall pattern are also important factors. The change in daylight duration, from short days in winter to longer photoperiods in summer triggers important vegetative cycles such as flowering while the cycle of dry and rainy seasons controls the pulses of nutrient input to the coastal and oceanic regions. The topography and the type of shoreline are also important. The type of

shoreline, either rocky, sandy beach, mudflats, etc. will determine the species composition and matter cycles, while the configuration and complexity of the coastline including open shoreline, bay, inlets, etc. creates different habitats. Finally the variation in the tidal changes can result in either narrow tidal ranges of a few feet to a several meters range in some coastal areas.

2.6 LINKAGE BETWEEN COASTAL AND MARINE ECOSYSTEMS

These ecosystems are connected by the movement of water, land to sea (terrestrial influence) and open ocean to land (oceanic influence). The linkages between these ecosystems can also be determined from some of their ecological functions including, coral reefs breaking currents and creating low energy conditions needed for mangrove development. Corals, on the other hand, produce calcareous sediments which create substrate for seagrasses. Mangroves and seagrasses filter upland sediment flow to reefs while mangrove and seagrass detritus supports coral reef communities. Finally there is a faunal overlap between coral reef and adjacent seagrass beds and mangroves characterized by day migrations and ontogenetic changes of important species.

2.7 NATURAL AND ECONOMIC FUNCTIONS OF SELECTED COASTAL ECOSYSTEMS

Coastal forests provide important benefits such as flood protection and erosion prevention. Other functions of coastal forests include provision of fresh water food and drink, they also provide resins, oils, and medicines, fuel wood and charcoal, lumber and timber. Finally coastal forests create important habitats for wildlife species and supports tourism.

Wetlands and estuaries provide flood control and important fish, shrimp, and lobster nurseries while acting as habitat for species of wildlife. Wetlands also act as sediment traps helping land creation and protects the shoreline from wave energy and storms. Wetlands provide a source of food material for nearby coral reefs and are a source of fishing and craft construction materials. Finally wetlands provide areas for tourism and other forms of recreation.

Coral reefs also provide benefits such as the creation of habitat and food for fish and other marine organisms, and the protection of the coastline from wave action. Coral reefs provide material for sandy beaches and a space for tourism and other forms of recreation.

Seagrass beds on the other hand function as nurseries for juvenile fish and shellfish, and prevent shoreline erosion by reducing wave energy, and binding the sand together. This also results in improving water clarity. Seagrasses also functions as feeding grounds for turtles, manatees, and some fish species and urchins, while exporting food materials to nearby coral reefs.

In conclusion, knowledge of the main factors affecting the marine environment and marine life forms is essential for understanding the important effects of certain MPAs management planning considerations, such as the relationship between water currents and larval dispersal, are so important.

UNIT 3. USES AND THREATS TO THE MARINE ENVIRONMENT AND ITS RESOURCES

This unit covers the following items:

Goods and services provided by the marine environment: food, medicines, raw materials, transportation, recreation, and waste disposal.

Natural and anthropogenic threat factors to the marine environment: natural events, over-exploitation, and coastal development, pollution derived from land-based sources, maritime activities, and population increase, and

The sea as common property resource: The tragedy of the commons.

This unit is a summarized version of Module 3 of the manual "Training of Trainers in Marine Protected Area Management: Training Manual. United Nations Environmental Programme UNEP, Caribbean Environment Programme (CEP)". The reader is encouraged to consult that Module for a comprehensive description of the uses and threats to the marine environment and organisms.

3.1 USES OF MARINE RESOURCES

Some marine resources supply goods for direct consumption and for use as raw materials, such as, for primary consumption, air, water, foods, drinks, etc. Some of the raw materials include jewelry, timber, ores, construction materials, fuel, medicine, etc.

Marine resources also provide services such as transportation of cargo and passengers, recreation and tourism, education, waste treatment and disposal, coastal protection, and the stabilization of global climate (through the control of CO2 concentration in the atmosphere by phytoplankton at the oceans' surface).

Finally, the sea also offers maintenance of life-support systems such as pest control (acting as a dispersal barrier), disaster reduction, production of oxygen, and maintenance of atmospheric balance.

Several MBRS area MPAs support diverse economic activities. In Belize, the Hol Chan Marine Reserve's main current resource uses are tourism, scuba diving, snorkeling, sport and commercial fishing, and research and environmental monitoring (Belize Fisheries Department – UICN 2002). Bacalar Chico and Sapodilla Caye in Belize, on the other hand, shows very old signs of use by the Pre-Hispanic Maya going from B.C. 300 to A.D. 1500. Archaeological remains include heart-shaped rock-made fish pens and others from the Spanish and English settlements (Programme for Belize, 2002). Current uses of Bacalar Chico includes tourism and fishing while there are some private holdings within the reserve. At the Sapodilla Caye Marine Reserve in Belize, (Programme for Belize, 2002) shrimp trawling and tourism are the main economic activities, and these are usually conducted by nationals from Guatemala and Honduras.

In Mexico, for example, the main economic activities on the Banco Chinchorro reserve are lobster and conch fishing, followed by tourism. Activities such as mining, agriculture, manufacture, and commerce are conducted in the nearby towns (INE 2000). At the Rio Sarstun Multiple Use Area in Guatemala, the main economic activities are, in order of importance, agriculture and fishing (Fundaeco 2002).

Some of the current uses at the Punta de Manabique Special Protection Area include, according to the management plan (CONAP – Fundary 2001), maritime transportation of oil (240 million gallons of oil exported during 1997), fruits and manufacture products, artisanal and commercial fishing, agriculture of rice, corn, beans, and fruits, vegetable charcoal production, tourism, hunting, and medicinal plants harvest.

EXCERCISE

As an exercise the instructor will conduct a brainstorming session in which the participants will list the most important uses of marine resources. They will then be asked to rank the items in the list. In the case of discrepancies, the opportunity should be used to highlight how the perception of the most important benefits from the ocean change according to the participants background (fishermen, tourism operators, marine merchants, conservation agencies, etc.).

3.2 MARINE RESOURCES THREATS

Marine resources are currently under threat from different sources. Some of the most important threats are natural, including natural events such as storms, earthquakes, but most of the causes of menace are related to human activities. Over-exploitation is one of the most common causes for fisheries decline and collapse, while pollution derived from land-based sources is a common cause of habitat degradation. Some maritime activities such as oil tankers and cruise ship transit and groundings have resulted in major environmental disasters on the coast, while water ballast has been reported as a method for alien species introduction. Population increase has also resulted in increased pressure on the resources and some human coastal development projects have resulted in broken or interrupted interconnectivity.

Some examples of natural events as a source of threat are related to global climate change like high temperature which results in coral bleaching events and relative sea level rise phenomena which results in loss of coastal wetlands and forests. Flood events on the other hand can bring large volumes of fresh water and sediments from land to the coast and sometimes causes major disturbances. Storms can cause severe structural damage such as coral breakings and mangrove and seagrass sedimentation induced problems, while sea level rise can result in saline intrusion and marsh subsidence.

Over-exploitation is another important source of threat to the marine resources and environment. Some fishing practices such as trawling produce significant amounts of by-catch, which is subsequently dumped back in the ocean creating an ecological waste and affecting nearby finfish fisheries. The destruction of habitats during the harvesting process such as trawling for shrimp, dynamiting and the use of chemicals for reef fish capture, etc. produces a significant damage to marine benthos. The traditional approach to fisheries management is based on a single-species basis while many of the tropical fisheries are multi species fisheries leading sometimes to wrong conclusions regarding resource abundance. Finally, the inadequate enforcement capability of the authorities allows for violations of the law and disrespect of the rules. Only through the adequate protection of critical spawning and recruitment areas can the very source of recruits to the fisheries be guaranteed.

Non-Point Sources of Pollution			
Medium Impacted	**Sources**	**Factors**	**Impacts**
Soil	1. Industry 2. Agriculture 3. Atmospheric fallout	1. Toxic compounds 2. Pesticides 3. "Acid" rain	1. Decreased productivity 2. Health problems
Water (ground/ surface/ marine	1. Sewage disposal 2. Agricultural run-off 3. Atmospheric fallout 4. Urban surface run-off 5. Commercial and residential activities 6. Shipping and other marine activities	1. Sediments 2. Sewage effluent 3. Oils/hydrocarbons 4. Pesticides 5. Fertilizers 6. Marine debris 7. Solid waste 8. Toxic compounds 9. Wastewater 10. "Acid" rain	1. Health problems 2. Contamination of water supply systems 3. Decreased amenity value 4. Ecological disruptions 5. Decreased fisheries production
Air	1. Agriculture 2. Commercial activities 3. Residential activities 4. Waste disposal 5. Industry 6. Motor vehicle exhaust 7. Recreational activities 8. Construction activities	1. Noise 2. Particulates 3. Gases (oxides of sulphur, carbon, nitrogen, etc.)	1. Property damage 2. Health problems 3. Crop damage
Source: Gardner, 1999			

Coastal development can also be a source of threat to marine resources. Construction and operation of harbor facilities can cause damage or loss of habitat, re-suspension of sediments, loss of sessile organisms, and alteration of current patterns. Construction of shore protection structures on the other hand, can sometimes result in alteration of sand budget and movement, with consequences in erosion, and alteration of local currents. Dredge and fill operations are responsible for loss of sessile organisms and destruction of habitats, while drainage of wetlands alters transportation of sediments to sensitive marine ecosystems. Road and infrastructure construction can cause a disruption of ecosystem functioning, loss of habitat, and transportation. Finally, construction of residential, resort, commercial, and industrial developments can result in loss of resources and habitats.

Another threat to marine resources is land-based pollution, from either point or non-point sources. Point sources can be industrial, sewage, and solid waste, while non-point sources are urban runoff (storm water and overflow discharges), and non-urban runoff (crop, pasture, and forest runoff). Finally, upstream sources sometimes produce pollutants that are carried into the coastal zone as part of a river's stream flow.

Some of the pressures to MPAs identified by the Belize Barrier Reef World Heritage Site, BBRWHS, include fishing, tourism, coastal development and inland based industries. Belize has recently experienced an explosion of tourism activities represented by 11% growth in the tourism sector since 1990 (Programme for Belize 2002). The main threats to the Bacalar Chico reserve are from anthropogenic sources such as fishing and tourism and from coral bleaching, an effect linked to increase water surface temperature resulting from global warming and tropical storms (Programme for Belize 2002). Conch harvesting at Bacalar Chico is conducted even when surveys have shown that most of the conch are juveniles and unsuitable for harvest. Currently, at the Sapodilla Caye Marine Reserve in Belize, (Programme for Belize, 2002) there are three main environmental threats to both reefs and seagrass bed. First, shrimp trawling affects foraging areas of several species and produces large amounts of by-catch of many fin fish species that are discarded back to the sea. Next, large scale aquaculture and agricultural farms in locations in mainland Belize are also a menace due to nutrient enrichment and increased sediment load. The final threat factor comes from tourism, which accounts for 9,000 visitors per year. Similarly INE (2000) indicates limited knowledge on biodiversity, plant and animal inventories, tides and currents, and illegal fishing, as the main threat factors to the Banco Chinchorro Biosphere Reserve. At Punta de Manabique (CONAP - Fundary 2001), some of the main threats to sustainable resource use are overfishing, the use of seine and trawl nets which cause damage to the benthos and result in large percentage of by-catch, and large resort-type tourism developments.

EXCERCISE
As an exercise, the facilitator asks the audience to list the most important threats to marine resources. He asks then participants to rank the items on the list. This can be a source of discussion as to the most important threats for each specific site.

3.3 THE SEA AS COMMON PROPERTY RESOURCE

A Common Property Resource is defined as one that cannot be owned exclusively by one person or company. Hardin (1968) proposed in his “The Tragedy of the Commons”, that common property resources are likely to be used to exhaustion, “freedom of the commons brings ruin to all”. A way to solve this problem has been by turning them into limited entry resources, for example by limiting the number of fishing licenses.

When resources are limited and publicly owned, it is rational for each individual to overexploit them, even though this will result in tragedy for the group. To solve this situation Harding proposed either privatization or government control.

3.4 RESOURCE MANAGEMENT

Since neither private nor public ownership of renewable resources guarantees that the resources will be used in a sustainable manner, some form of state intervention is usually required.

Some of the traditional approaches to resource management includes methods such as National Physical Plans, Land Use Plans, Regional Development Plans, and Sectoral Plans. Other ways have involved the creation of sanctuaries, reserves, and parks, closed seasons, protected species listing, and the use of regulatory instruments.

More recent policy and management approaches include national conservation strategies, country environmental profiles, national environmental action plans, integrated planning and

the creation of associations of environmental management agencies. Other more comprehensive methods include both Protected Areas System Planning and Integrated Coastal Area Management. Disaster Contingency Planning and environmental reporting together with the use of regulatory standards, environmental impact assessment, and public education and environmental curriculum development have also been used successfully by some countries in the region. The restoration of degraded ecosystems, and the use of economic and financial instruments as well as the creation of partnerships with civil society, are also feasible management options.

UNIT 4. MARINE PROTECTED AREAS

This unit covers the following items:

The importance, roles, historical overview, identification of the main relevant issues of marine protected areas,

The existing regional programs and networks, and

MPAs in different environments.

This unit addresses topics included in Module 4, Marine Protected Areas Overview, of the manual “Training of Trainers in Marine Protected Area Management: Training Manual. United Nations Environmental Programme UNEP, Caribbean Environment Programme (CEP)”. The reader interested in expanding on this subject, is encouraged to consult that Module to learn on past initiatives on MPAs in the Caribbean and general issues related to MPAs.

A protected area is defined as:
"an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means" (IUCN, 1994. P.7).

Some of the main purposes for establishing marine protected areas include to promote sustainable use of marine resources and to develop scientific research. Marine reserves also help preserve species and genetic diversity while maintaining environmental services. They also help protect specific natural and cultural features and can contribute to the maintenance of cultural and traditional attributes. Finally marine reserves can be a source of income through tourism and recreation and contribute to education. Most of the protected areas serve more than one purpose and therefore are considered multipurpose areas.

According to Sobel (1996), the potential benefits of marine reserves can be grouped in four categories, protection of ecosystem structure, function and integrity; improvement of system resilience; improvement of fisheries, and increasing of knowledge and understanding of marine systems.

Marine reserves can help protect ecosystem structure, function, and integrity through the protection of the physical structure of habitat, and the protection of ecological processes. Marine reserves can also help restore population structure in size and age, and restore community composition in terms of presence and abundance. They can also protect biodiversity at all levels and keystone species. Moreover, cascading effects and vulnerable species can also be protected. Finally, reserves protects food web and trophic structure and reduce incidental damages.

System resilience can also improve through MPAs creation and management. Marine reserves can reduce fishing gear impacts and maintain high quality feeding areas for fish and wildlife. Also, reserves can improve non-consumptive opportunities such as recreation, enhancing and diversifying economic activities. Other benefits include enhancing conservation appreciation, the creation of public awareness about environment and the enhancement of aesthetic experiences

Marine reserves can also help improve fisheries yields through the protection of spawning fish stocks, the increase of spawning stock biomass, and the increase of spawning density

and egg and larval production. Reserves can also provide undisturbed spawning conditions, habitats, and sites, and enhance recruitment through spill over of adults and juveniles to nearby areas by allowing increased fish outside reserves. Reserves can also reduce overfishing of vulnerable species, and protect intra-specific genetics from fishery selection. Reduction of by-catch fishing mortality and the simplification of enforcement and compliance measurements are also benefits of marine reserves. Finally, marine reserves facilitate stakeholder involvement in management and provides fishery management data to improve fisheries, while reducing impacts of environmental variability.

Increased knowledge and understanding of marine systems is another benefit of marine reserves. Reserves provide us with long-term monitoring sites allowing for a continuity of knowledge in undisturbed sites. MPAs also provide opportunities to restore or maintain natural behaviors and reduce risks of long-term experiments. Moreover, reserves provide controlled natural areas for assessing anthropogenic impacts, including fishing and other impacts. Finally, they provide sites for enhanced primary and adult education and sites for high-level graduate education.

4.1 PROTECTED AREA CATEGORIES AND MANAGEMENT OBJECTIVES

(IUCN 1994, part 11 and p.9)

Category I Strict Nature Reserve Area:
Definition: Area possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring. A protected area managed mainly for science or wilderness protection.

Category II National Park:
Definition: Natural area designated to
(a) protect the ecological integrity of one or more ecosystems for present and future generations,
(b) exclude exploitation or occupation contrary to the purposes of designated area, and
(c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible. A protected area managed mainly for ecosystem protection and tourism.
Examples: Balcalar Chico, Laughing Bird (Belize); Rio Dulce (Guatemala), Xcalac (Mexico); Islas de la Bahia (Honduras).

Category III Natural Monument:
Definition: Area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance. A protected area managed mainly for conservation of specific natural features.
Examples: Halfmoon Caye (Belize); Cayos Cochinos (Honduras).

Category IV Habitat/Species Management Area:
A protected area managed mainly for conservation through management intervention.
Definition: Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.

Category V Protected Landscape/Seascape:
Definition: Area where the interaction of people and nature over time has produced an area of distinctive character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. A protected area managed mainly for landscape / seascape conservation and recreation.

Category VI Managed Resource Protected Area:
Definition: Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs. The area must also fit the overall definition of a protected area. A protected area managed mainly for the sustainable use of natural ecosystems.

Other marine protected area categories used in MBRS region countries include:

Category	Belize	Guatemala	Honduras	Mexico
Nature Reserves	Ship stern Swallow Cay			
Marine Reserves	Hol Chan Cay Caulker Sapodilla Cayes Turneffe.			
Ramsar Sites		Punta de Manabique		
Wildlife Refuges		Chocón Machacas	Turtle Harbor	
Biosphere Reserves				Sian Kaán Banco Chinchorro

MBRS countries have MPAs under different ownership regimes, including:

Ownership regime	Mexico	Belize	Guatemala	Honduras
Federal or national	x	x	x	x
State	x			
Municipal	x		x	
Private		x	x	x

4.2 MARINE PROTECTED AREAS OBJECTIVES

Some of the most common objectives for marine protected areas include:

The protection and management of areas of significance to the life cycles of economically important species.

The protection of depleted, threatened, rare or endangered species and populations, and the preservation of habitats considered critical to the survival of such species.

The protection and management of substantial examples of marine and estuarine systems to ensure their long-term viability and to maintain genetic diversity.

The prevention of outside activities from detrimentally affecting the marine protected area.

The provision of continued welfare for the people affected by the creation of marine protected areas.

The preservation, protection and management of historical and cultural sites and natural aesthetic values of marine areas, for present and future generations.

The facilitation of interpretation of marine and estuarine systems for the purpose of conservation, education and tourism.

The contribution to research, monitoring, and training on the environmental effects of human activities, including the direct and indirect effects of development and adjacent land-use practices on marine areas.

In many cases more than one objective (multipurpose) are listed as important for MPAs establishment. For example INE (2000) indicates the economic importance of fishing and tourism activities, the biological relevance of coral reefs, the educational value to the locals and tourists, and the scientific importance of baseline sites among the main factors for Banco Chinchorro Biosphere Reserve. Other sites, such as the Manatee reserve, and Xcalac Reefs National Parks (SEDUMA 2001) refer to conservation of commercial and sport fisheries, the support to nearby reefs, and the opportunity for recreational activities as reasons for protecting the area. Bacalar Chico in Belize is cited as having a rich diversity of marine fish and invertebrates and being documented as the spawning sites and grounds for important species.

According to the Rio Sarstun Multiple Use Reserve (Fundaeco 2002) management plan, the objectives of the protected area are to protect biodiversity of native ecosystems, promote sustainable human community development, encourage suitable natural resource management practices, and promote civil participation through local population participation on the management of the protected area. In the case of Punta de Manabique Reserve in Guatemala (CONAP – Fundary 2001), the objectives are the implementation of a integrated coastal marine ecosystem management plan, that would allow for the maintenance of the essential ecological processes and the sustainability in the production of goods and services such as forestry, fisheries, hunting, tourism, and community development.

4.3 EXISTING REGIONAL PROGRAMS

IUCN-The World Conservation Union Marine Conservation Strategy for the Caribbean (IUCN, 1979).

United States Agency for International Development –USAID- Training Strategy for Natural Resource Management in Latin America and the Caribbean (WWF-US, 1980).

Nahuel Huapi Action Plan (for protected areas of Latin America and the Caribbean) (IUCN, 1986).

The Caracas Action Plan (global plan for protected areas produced at the IV World Congress on National Parks and Protected Areas) (IUCN, 1994).

The Nature Conservancy - Caribbean Programme.

United Nations Environment Program UNEP /Caribbean Environment Program CEP.

United Nations Education and Science Commission - UNESCO - Man and the Biosphere Programme (MAB).

4.4 IMPACTS TO MPA IN DIFFERENT ENVIRONMENTS

Protected areas in coral reefs suffer impacts from commercial and recreational activities such as construction that alters water flow and shade reefs and from anchor damage. Divers can also unintentionally damage corals through breakage causing temporary closure of certain zones. Small boats can also be a source of damage as they can access shallow areas creating navigational channels in unintended areas. Reef walking and boulder moving for environmental education can be another source of damage to protected areas in coral reefs. Finally, tourism can affect protected reefs through souvenir collection and from feeding practices to attract fish.

MPA in lagoons and estuaries can suffer impacts from the construction of facilities such as channel dredging, construction of walls, levees, docks, and piers, and creation of marinas and ports. Projects that divert freshwater inputs to the coastal zone can produce significant effects through hydrological regime changes. The opening and closing of lagoon and river mouths for fishing and navigation as well as land reclamation for agriculture, urban, industrial development can also affect protected areas in lagoon and estuaries. Finally, the conversion of wetlands to mariculture and the effluents from shrimp farms can alter the nutrient content and disturb important nurseries.

On many occasions a symbol or flag species is selected to help identify the area and conservation objectives. Some of the species symbol used in MBRS countries include manatee, sea turtle, laughing bird, whale shark, Nassau grouper, snapper, lobster, jaguar, shark, ray, iguana, pink boa, and parrot.

At the Rio Sarstun protected area in Guatemala, the main threats come from the inadequately defined land ownership system, where many segments of land are not registered (Fundaeco 2003). Agricultural practices such as slash and burn agriculture, the increase of extensive cattle farming, and the time-consuming process for the official protected area status approval, are also sources of environmental stress. Factors like poverty, illiteracy, and the ineffective law enforcement and compliance system are other sources of impact to the natural systems. Some other threats listed for the Punta de Manabique Reserve (CONAP – Fundary 2001) are charcoal production, agricultural frontier advance, wetlands draining, sedimentation and pollution, commercial shrimp trawling, maritime activities, and boundary conflicts with neighboring countries.

UNIT 5. MARINE PROTECTED AREAS PLANNING

This unit covers important issues including the following:

> Participatory planning, stakeholder analysis, conflict management, community engagement, and addressing social issues,
>
> The basis, rationale, and guidelines for marine protected area establishment, selection, and planning,
>
> Protected area planning within the context of national environmental management objectives and the necessary institutional arrangements, and
>
> Resource Assessment, Data Collection, and Mapping, Development of Zoning Plans. Site planning. Strategies and tools.

This unit contains topics included in Modules 5, “Participatory Planning” and 6, “Marine Protected Areas Planning”, of the manual “Training of Trainers in Marine Protected Area Management: Training Manual”; United Nations Environmental Programme UNEP, Caribbean Environment Programme (CEP)”. The reader interested in expanding on the subject, is encouraged to refer to those Modules.

PLANNING

Planning is the process of gathering of all the available information that relates to the purpose, objectives, and goals of the management agency and using this information to develop a strategy for achieving the objectives and goals of the management agency.

MPA planning should follow a holistic “whole view” approach and consider the surrounding region that may affect the protected area and vice versa. Similarly, people should be considered as part of the natural system and not just park visitors.

Usually an interdisciplinary project team can produce more elaborate MPA management plans. The most important element is that an interdisciplinary team provides a whole perspective. Members of such a team should have a broad understanding of the total picture, through group discussions of problems, progress and activities. The number of participants should be kept to a minimum and their quality to a maximum. Participants should be selected carefully and rationally after a detailed preliminary analysis of the project, and the skills that are required, while the park manager should be a key member. The project manager acts as an integrator, coordinator, communications center, tactician and consensus-maker.

PLANNING VS MANAGEMENT

It is important to state the differences between planning and management. Planning provides the basis on how resources are to be allocated and protected through design, analysis, and selection, while management addresses the strategies and operations needed to obtain the objectives of the management plan. Moreover, planning is a process dealing with a system of problems with the purpose of determining rational solutions to those problems. Design, on the other hand is a process derived from planning in which solutions found are creatively implemented. Finally, management is a process to control and direct the devised solutions

5.1 PARTICIPATORY PLANNING

According to UNEP/CAR-RCU (2001), participation can be defined as "a process that facilitates dialogue among all actors, mobilizes and validates popular knowledge and skills, supports communities and their institutions to manage and control resources, and seeks to achieve sustainability, economic equity, and social justice while maintaining cultural integrity". Participatory planning processes can result in more effective management than traditional planning methods, but they also present a number of obstacles and challenges.

Another concept usually associated with participatory planning is that of stakeholder. Stakeholders are defined as "*the individuals, groups and organizations that are involved in, or may be affected by, a change in the conditions governing the management and use of a resource, area, or sector"*.

Participation is relevant and should be incorporated in all aspects of the development of management plans and in environmental management. First, participatory planning facilitates dialogue among all actors while mobilizes and validates popular knowledge and skills. Through participation MPA planners can obtain support from communities and their institutions to manage and control the resources. Stakeholder participation can also help in the pursue for sustainability, economic equity, and social justice while maintaining cultural integrity. Finally, participatory planning also contributes to improved management by incorporating popular knowledge and practices and increases the likelihood of stakeholder compliance and support through participation in decision-making.

Participation incorporates a wide range of perspectives and new ideas that lead to improved management decisions and actions. It also provides a forum for the early identification of conflicts between users so that managers can negotiate solutions to them. Community empowerment and local institutional development can be achieved especially when the sharing of management responsibility is involved.

5.2 STAKEHOLDERS IDENTIFICATION AND ANALYSIS

The first step in participatory planning is stakeholder identification and analysis. It is important to identify all stakeholders and assess their interests at the start of the intervention as failure to integrate all stakeholders into management can ultimately weaken the management arrangement.

According to UNEP/CAR-RCU (2001), the four next steps in a participatory planning process involve the following:

Identification of the groups, sectors, communities, and individuals who have a stake in the resource or issue which is the object of the planning initiative. This activity is generally not participatory, as its purpose is to identify those who should participate in the process;

Analysis of the expectations, rights and responsibilities of these various stakeholders. This step is ideally conducted in a participatory manner, and can be an excellent mechanism for conflict management, because it provides a forum for each party to hear and understand the perspectives of others, and to make its own perspectives heard and understood;

Analysis of needs, issues, causes and options. This is the first main step in a classical planning process. In a participatory process, these analyses follow the identification and analysis of stakeholders, and must therefore involve all these stakeholders. A wide range of tools is available and used to conduct such analyses, including those described in the literature as participatory rural appraisal and rapid rural appraisal techniques, as well as scientific methods such as biological and socio-economic surveys, impact assessment studies, and literature reviews; and

The identification of options. This is a critical step in a participatory process, as this is where all participants use the results of the various analyses to define priorities and to identify the various options available to them, with an appreciation of the costs and benefits associated with each.

It is important to realize that differences exist among stakeholder groups and that stakeholder groups are not homogenous. Moreover, all stakeholders are not necessarily organized in formal groups, and some stakeholder groups may not have the capacity to effectively articulate and represent their interests.

There are also social issues that need to be considered in the participatory planning process, including gender, race and ethnicity, language and political or religious affiliation. Some of these social issues and direct resource use and allocation aspects may be sources of conflict, which MPA planners need deal with.

According to Lewis (1997), some of the characteristics of protected area conflicts include the involvement of several stakeholders, who are often influenced by factors and conditions external to the management area, and some conflicts involve scientific and socio-cultural phenomena. This situation can be further complicated if the process of identifying solutions to conflicts is often constrained by a lack of financial resources.

At the Banco Chinchorro Biosphere Reserve (INE 2000), the fisheries management plan is developed through consultation meeting with fishermen. This allows for positive participation in the process of surveillance and monitoring, particularly that of illegal, unauthorized, and unregistered fishing activities. Similarly, at Bacalar Chico National Park and Marine Reserve, the Fisheries Department has appointed an Advisory Committee to include stakeholder participation in the management. This committee includes representatives of the Fisheries and Forest Departments, the Coastal Zone Management Authority, the town board, land owner association, tour guide association, and the fishing cooperatives (Programme for Belize 2002). Similarly at the Punta de Manabique Reserve (CONAP – Fundary 2001), a series of community consultation workshops were conducted as a step in the creation of a advisory board (grupo consultivo).

CONFLICT RESOLUTION APPROACHES

Once a conflict is identified or has surfaced in the planning process, there are some approaches a planner can follow to reach an agreement.

SELF NEGOTIATION

The parties in a conflict voluntarily and without a facilitator discuss their differences to reach a mutually acceptable agreement.

FACILITATION

Parties in conflict interact and communicate directly and seek solutions themselves, but with the help of one or more facilitator.

MEDIATION
Conflicting parties voluntarily allow a neutral party to control and direct a process of reaching agreement. There is generally no direct contact between the parties in conflict.

ARBITRATION
Stakeholders present their case to an independent party who has the authority to impose a solution.

5.3 CRITERIA FOR SELECTING AN AREA AS AN MPA

Some of the reasons for selecting a particular geographic area to become a marine protected area include factors such as areas that are the best example of an important ecosystem or habitat type, or areas that are needed for sustainable fisheries, such as nurseries, or essential fish habitats. Also areas that have high species diversity or are location of intense biological activity as spawning aggregation zones or bird rookeries are usually selected for protection. Sometimes, if an area is a natural wonder or tourist attraction, or if it has special cultural, historic or religious values it can also be a good candidate for establishment as a marine protected area. Finally, if an area provides critical habitat for particular species or group of species, protects shoreline from storms, or facilitates necessary research that delineates baseline conditions, it may be considered for inclusion in a protected area.

Salm and Clark (1984) and Kelleher and Kenchington (1992) provide detailed lists of criteria for MPA selection, including the naturalness or the extent to which the area has been protected from, or has not been subject to human-induced change. Some of the major headings on those lists include social, economic, ecological, regional, and pragmatic criteria. Following is a list of selection criteria made by combining both of those sources.

ECOLOGICAL AND SCIENTIFIC IMPORTANCE
Areas that contain rare, unique or unusual biogeographic, biodiversity, richness of ecosystems and species, habitats, communities, and geological features, or posses special value for research and monitoring are good candidates for declaration as marine protected areas. Characteristics such as species dependency to site, the contribution to the maintenance of essential ecological processes or life-support systems, for example as source of larvae for downstream areas or having exceptionally high productivity are also taken into consideration when designing MPAs. The integrity and degree to which the area either by itself or in association with other protected areas, encompasses a complete ecosystem, or areas that experience special vulnerability and susceptibility to degradation need special consideration. Finally areas that contain special habitats such as nursery, feeding, breeding or rest areas for rare or endangered species or ecosystems and habitat types not protected should have priority.

ECONOMIC IMPORTANCE
The degree to which certain commercially important species depend on the area. Also areas that have existing or potential economic value for recreation, subsistence, use by traditional inhabitants, appreciation by tourists and others or as a refuge nursery area or source of supply for economically important species. Areas of importance to fisheries or that may be used to exemplify adequate management practices. It is also important to consider the degree to which protection will affect the local economy.

SOCIAL IMPORTANCE

Areas of current or potential value to the local, national or international communities because of its heritage, historical, cultural, traditional aesthetic, educational, religious or recreational qualities. The degree of social acceptance and local support due to the degree of use by local residents. Areas with little or no conflict of interest such as no major fisheries. The accessibility of the area is also related to the social acceptance, areas close to human centers result in more visitors, which in turn will result in more pressure over the protected area.

INTERNATIONAL OR NATIONAL SIGNIFICANCE

Areas that have the potential to be listed on the World or a National Heritage List or declared as a Biosphere Reserve or included on a list of areas of international or national importance or is the subject of an international or national conservation agreement.

PRACTICALITY OR FEASIBILITY OF IMPLEMENTATION AND MANAGEMENT

The degree of insulation from external destructive influences or the social and political acceptability and the degree of community support. Areas that present special accessibility for education, tourism, recreation and compatibility with existing uses, particularly by locals.

At the Hol Chan Marine Reserve (Belize Department of Fisheries – UICN 2002) the goals of the management plan include to maintain a sample of coral reef ecosystem in its natural state, to provide education and tourism services and preserve the value of the area for fisheries, to provide an area for education and research, and to conserve genetic resources. Specific goals listed on the Punta de Manabique management plan (CONAP – Fundary 2001) include, fresh and brackish wetland conservation, assist local communities in the development of sustainable resource use practices, support scientific research, and promote education, recreation and tourism activities.

5.4 MPAs PLANNING APPROACH

THE STRATEGIC PLAN

The basic MPA planning approach consists of two phases, the Preliminary plan and the actual Management plan (Figure 3). The Preliminary plan, also known as the strategy document is a key step as it defines the policies to be implemented and states the program goals and objectives. This preliminary step also lays out the basic strategy and involves all preliminary investigation, such as data collection, issue analysis, dialog, negotiation, and draft writing. The preliminary plan may be seen as the foundation for the site Management Plan therefore it needs to be approved by policy makers, administrators, and stakeholders. This is the single most important step in the MPA planning approach.

Some of the typical objectives of MPA strategic plans involve replenishing depleted fisheries and maintain high quality coastal environments. Other aspects include the protection of species diversity and environmental sensitive areas. Restoration of damaged ecosystems and community education, together with the conservation of special habitats and critical ecological processes are also frequent objectives.

THE MPA MANAGEMENT PLAN

It is important to keep in mind that the management plan is a working document periodically updated and improved through management experience and that needs to be tailored to the

needs of the site. Generic modules can be used as guidelines but they should not be considered prescriptive. A complete management plan should include major sections on practical considerations, location of facilities, zoning, boundary demarcation, and recruitment of staff among others.

A MPA management plan is an operational guide that identifies actions to resolve management issues and is a guiding tool for managers. The goals of management plans include the optimization of economic uses, the maintenance of natural resource values, and the integration of traditional uses. The person or team in charge of designing the management plan should examine the effects a MPA establishment on local people and find ways to avoid negative effects or compensate for these, on the other hand interagency coordination and cooperation must be sought among stakeholders. Another key element of MPA management plans is a mechanism for evaluating effectiveness through monitoring and a schedule for self revision, usually within 3 to 5 years. On the more practical sense the management plan should, separate incompatible activities through zoning. More recently it has been found that entire or summarized versions of the management plan may be used for interpretation and day to day management activities.

Even though the concept of management planning is widely accepted, there is a high incidence of management plans that fail due to situations such as when the MPA staff has not been involved in preparing the plan and therefore has no feeling of “ownership”, or when users have had no input or opportunity to comment on the provisions of the plan. Other times the plan has no legal status and can therefore be ignored at a variety of decision-making levels in the organization. Finally when the plan has been written to satisfy a legal requirement and not a management need or when the plan has no built-in procedures for review and evaluation chances to fail increase.

5.5 PHASES IN THE PLANNING PROCESS

There are five major steps in the MPA planning process (Figure 3 and 4). First is the initial or pre-management information gathering and preparation through resource assessment and data collection. Next is public participation or consultation to evaluate resource information needs and Social and economic information needs. Third, the preparation of draft plans including biological, geological and physical information is conducted, followed by public participation or consultation to review the draft plan and evaluation and verification of zoning is carried out. Finally, the plan needs the approval and adoption by the authority as specified in the legislation.

Resource assessments intends to find information needs and answers to questions such as what is the extent and distribution of the different ecosystems and habitats in the area, and what is the condition of these systems and habitats? Or, what are the most important functions of these systems and habitats and how are they being used and by whom and when?

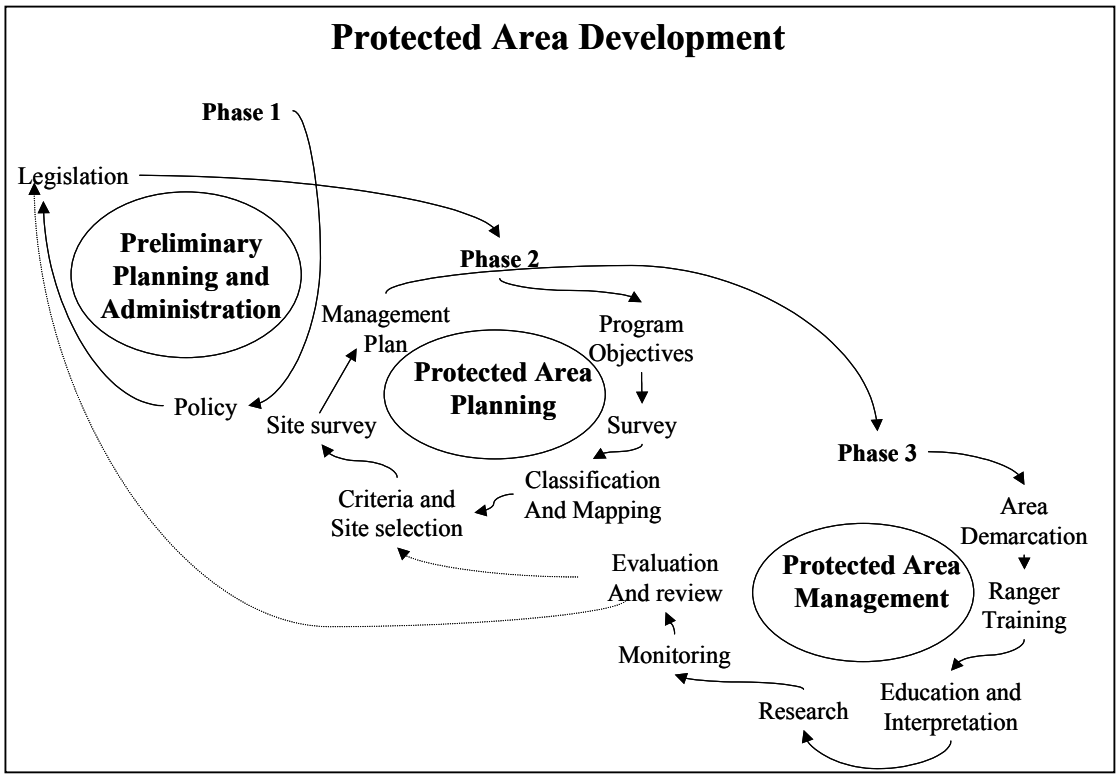


Figure 3. The MPA management plan creation process (modified from Salm, Clark, and Siirila 2002).

Data collection is a key element but even in well-studied areas, the available information and data is usually incomplete. The establishment of a MPA should not be postponed because of the impression of having insufficient data, if such postponement could lead to serious degradation of resources or endangering species, or if it could lead to the loss of an opportunity.

Among the biological resource information needs the occurrence eight major groups of organisms are necessary. First the occurrence and characteristics of coral reefs, their location and extent, the number of species and the percent of live coral cover. Next the occurrence and characteristics of seagrass beds including their location, extent, number of species, and percent cover and the occurrence and characteristics of mangrove forests (location, extent, number of species, tree height and diameter). The characteristics of reef fish populations through census of commercially important species and the calculation of biomass, and the occurrence of indicator, endangered, or migratory species come next. Finally the occurrence of habitats critical to the survival of species such as breeding, feeding, nesting, roosting, or nursery habitats and the occurrence of archaeological and historical resources such as shipwrecks or artifacts should be assessed.

Among the physical information needs water quality especially when water quality is suspected to be affected by sewage or industrial pollution is first. Information on current regimes which may determine distribution of species, dispersal of larvae and recruitment of certain species is also important.

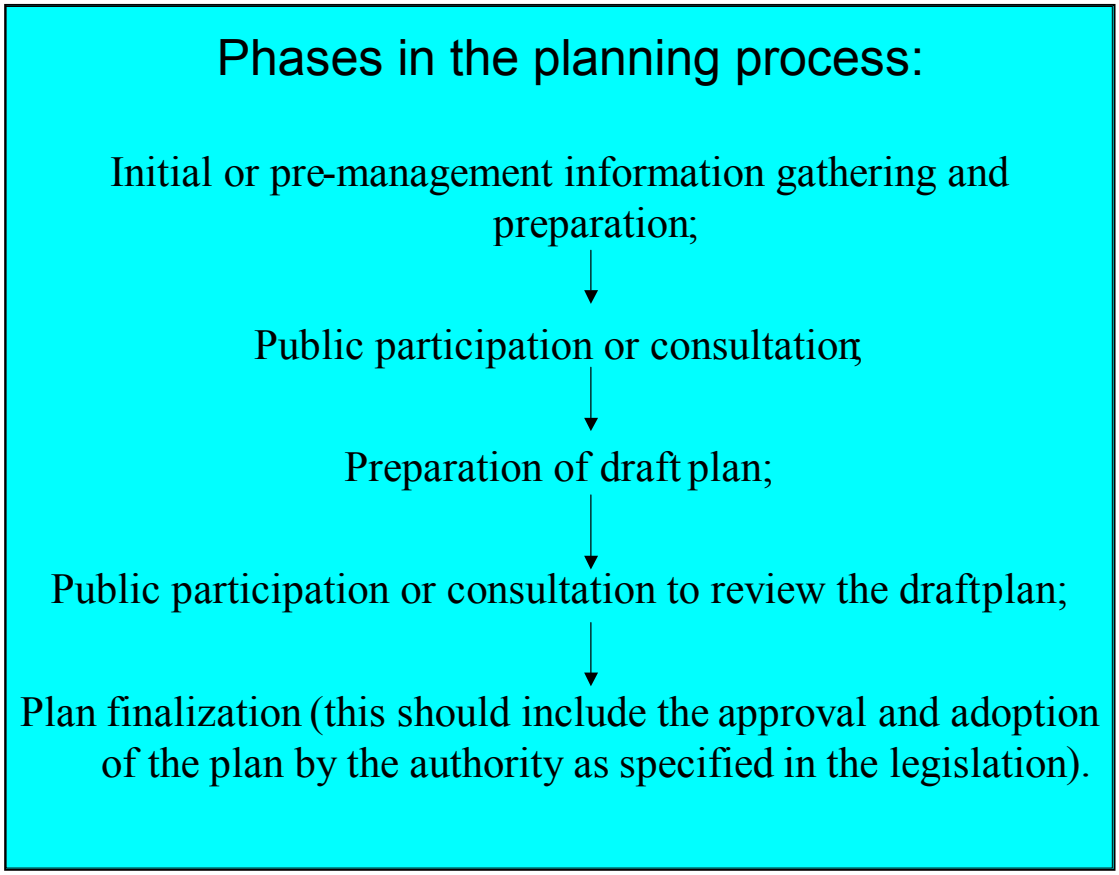


Figure 4. Phases in the MPAs planning process.

The social and economic information issues that need to be addressed include the identification of stakeholders and the reported human development indexes by UNESCO and the countries statistics including health, education, and housing. The fishing methods, location, and the number of fishers and boats and their species targeted should be integral part of the fisheries characterization and they should also include the numbers and location of recreation and tourism activities. The ships´ traffic, both commercial and recreational and the solid and liquid waste disposal process should be included. Industrial activities including sand and coral mining, traditional use rights and the land ownership system .

5.6 DEVELOPING ZONING PLANS

MPA zoning is defined as the “Spatial or temporal allocation of specific uses and activities to well-defined areas within a protected area.” Within this concept the functions of zoning include the protection of ecosystems or species, or of the habitat critical to the survival of species through the provision of a buffer between managed and unmanaged areas. Zoning also reduces or eliminates conflict between resource users and allows for the creation of reserve areas for specific purposes such as research and education.

There are four major items involved in the zoning process, defining core zones or sanctuaries, defining use zones, defining the buffer zones, and defining boundaries and size.

DEFINING CORE ZONES OR SANCTUARIES

Those areas with high conservation values, vulnerability to disturbances, or that can only tolerate minimum human use should be included in the core or sanctuary zone. The identification of such areas is usually based on the number of species per unit area, the distance to human settlements, and the levels of use and dependence by people. Other factors that should be considered include migration and feeding patterns of key species and the distance from sources of seeds and larvae.

DEFINING THE USE ZONES

Those sites with special conservation value but that can tolerate different kinds of human use would conform the different use zones. Some types of use zones include areas for water sports, and for recreational and commercial fishing. Areas dedicated to research and education could be incorporated into special protection zones

DEFINING THE BUFFER ZONES

Buffer zones will help separate incompatible use areas. Buffer zones are usually where more liberal but controlled use is permitted. Buffer zones help protect core and special use areas from nutrient, pollutant, and sediment discharges.

BOUNDARIES AND OPTIMAL SIZE

Boundaries are usually based on geological features, political districts, or costs. However, ecological boundaries are more appropriate as they will work better in protecting ecosystem functionality. Regarding the optimal size for a protected area or the different zones, there are two main philosophies disaggregating and aggregation. Those in favor of ddisaggregating claim that a number of small MPAs work better than few larger areas which is favored by those proposing aggregation. The debate is currently being conducted and the best option would have to be examined on a case by case scenario.

The management plan for the Banco Chinchorro Biosphere Reserve presents an example of zoning plans for MPAs in the MBRS region. INE (2000) zoning lists include core and buffer zones. *Core zones*, are those where scientific research, environmental education, and ecological restoration, protection, conservation and monitoring are permitted. This activities can also be conducted in the buffer zones. Buffer zones include *cooperatives fishing zones*, where boat tours, commercial video, photography, and sound recording, scientific research, environmental education and fishing by cooperative members are allowed activities; *cooperative recreational release fishing zones*, where sport release fishing is allowed; *cooperative, commercial, and recreational release fishing zones*, where commercial fishing is also allowed; *diving zone*, diurnal and nocturnal scuba and free diving, and mooring is allowed; *ship wreck zone*, a 100 m diameter zone around shipwrecks where free diving is allowed.

At the Hol Chan Marine Reserve another example of applied zoning is presented in management plan (Belize Department of Fisheries – UICN 2002). The objectives of the zoning plan at Hol Chan include the restoration of the area to previous condition, the preservation of areas of critical habitat for endangered species, and to regulate the use of the protected area for tourism and fishing to prevent overexploitation. This is achieved through the designation of four zones. One area of the reserve (Zone A) is devoted to recreational diving and observation of the reef, the preservation of coral reefs to enable recuperation from overuse, and to provide an undisturbed area which will in turn facilitate recruitment of species to adjacent areas. Fishing and specimen removal are forbidden while boat anchoring is regulated and limited to specific mooring buoys. Another area (Zone B), allows for commercial conch and lobster fishing, and for water sports such as skiing and sailing. Trawling for fish and unlicensed fishing are not permitted, while fishermen are required to report their catches. Zone C is designed to promote sport fishing and preserve

mangrove habitat, where catch and release is encouraged and reporting is mandatory. Finally Zone D also known as “Shark and Ray Alley” and the “Amigos del Mar Wreck”, is devoted to recreational diving and lobster and finfish commercial fishing. Seagrass habitat is also protected here while the use of gloves for diving as well as the feeding of fish by tourists is prohibited.

The Manatee Sanctuary in Mexico has also established a zoning policy (SEDUMA 2002). The zones are, Protection, Conservation, Restoration, Low Medium and High Use zones. The Bacalar Chico reserve has a zoning plan that includes a Preservation Zone, a Conservation Zone I, a Conservation Zone II, and a General Use Zone that applies to the marine portion of the reserve, while the terrestrial portion is strictly a no-take zone (Programme for Belize 2002).

At the Rio Sarstun protected area in Guatemala, four management zones have been defined, core (intangible) zone, multiple use zone, buffer zone, and primitive zone. The core or intangible zone is designed to protect and maintain forest biodiversity. Activities such as hunting, the introduction of exotic species, and any other resource use are forbidden, unless allowed by the park authority. The multiple use zone is located around the core (intangible) zone and its main objective is to buffer both core and primitive zones through sustainable resource use practices as defined by the management plan. Human settlements are located in the multiple use zone and their controlled forestry, agriculture and animal production activities are conducted here. Other allowed activities in the multiple use zone include tourism, research and monitoring. Buffer zones are defined as a band of land two kilometers wide around the whole Rio Sarstun Reserve. The objective of the buffer zone is the protection of the multiple use zone through the use of sustainable productive activities in order to reduce human impact or migrations to core (intangible) and primitive zones. In the buffer zone the protection and recuperation of critical natural ecosystems, reforestation, and the preservation of endangered plant and animal species are encouraged. Activities such as hunting or other plant and animal resources use are permitted under national laws. Finally, the primitive zone includes areas with little or no perturbation that requires strict protection. Objectives of primitive zone include promotion of Ecotourism, the protection of the mangrove and estuarine ecosystems, and the promotion of community participation in reserve management.

Finally, the zoning plan for Punta de Manabique reserve in Guatemala (CONAP – Fundary 2001), defines six zones. First is the Conservation Zone which is designed to preserve natural ecosystems and ensure the continuity of ecological processes such as reproduction, migration, foraging, and growth of marine and coastal species. In the conservation zone only navigation with small boats, small scale resource utilization projects, such as subsistence fishing, and scientific research are allowed. Next is the Marine Special Use Zone, which has as objectives the conservation of Gulf of Honduras processes, the development of a monitoring system for human activities, and the maintenance of migration routes for marine and terrestrial species. In the marine special use zone only subsistence and artisanal fisheries are allowed. The Terrestrial Special Use Zone, whose objectives includes the conservation of nesting and foraging areas for several bird species. The Multiple Use Zone was designed with the objective of protecting terrestrial and riparian ecosystems and their components, through the promotion of better resource use practices. This is a area that has historically supported extractive activities such as vegetable charcoal production, hunting, and construction material production. The Intensive Use Zone is were the majority of human settlements are located and where agriculture and cattle production is conducted. Also the most promising beaches for tourism development are located in the Intensive Use zone. Finally, the Recovery and Management Zone is intended for the reduction of pressure over natural resources, to retard the advance of the agriculture frontier, and for the implementation of agro-forestry practices.

POLICY FRAMEWORK

The policy framework for marine protected areas includes both international and regional level directives. At the international level the Jakarta Mandate (Convention on Biological Diversity) recognizes the critical need to address the conservation and sustainable use of marine and coastal biological diversity. At the regional level the Cartagena Convention states that "Each Party shall, when necessary, establish protected areas to sustain the natural resources of the Wider Caribbean Region and to encourage ecologically sound and appropriate use, understanding and enjoyment of these areas".

EXERCISE

As an exercise the participants in the Belize course presented a brief overview of national legislation and policy involved in the processes that leads to the designation of a MPA.

Guatemala: process begins with a request submitted to CONAP to initiate the study and analysis process. Next the technical study determines the level of importance. Then a law proposal including zoning is written and submitted to the National Congress. Parallel to this a convocation for co-management is opened. Finally, the law decree states who will be in charge of management and administration of the area. The first management actions can start before final approval.

Honduras: initiative can come from an NGO, community, municipality, ministry of environment, or even the legislators can propose and approve the initiation process. Next, a request is submitted to the Protected Areas department of CODEFOR. The necessary biological, technical, physical and social studies are then conducted. A law pre-proposal is then written and submitted to the environment ministry with management category specified. Finally, the proposal is revised by other institutions such as agriculture ministry and attorney general.

Mexico: proposal starts with a proposal with justifications submitted to the National Protected Areas Commission which forwards the document to the Ecology Institute (Instituto de Ecología). Next the protected areas advisory council revises the proposal and forwards it to the executive. Two years after the decree is approved the management plan is elaborated.

Belize: first a document stating the reasons for the establishment of a protected area is prepared and submitted by the government or NGO. Next, the necessary scientific research is conducted and a proposal is submitted to either the environment or the fisheries secretary. A process of consultation follows and a steering committee is created. Finally the house of representatives approves the proposal.

In all countries the process ends with the official publication of the decree.

5.7 GENERIC OUTLINE FOR A MPA MANAGEMENT PLAN

(cf. Kelleher and Kenchington 1991):

Title Page

This should include the name of the area and its status and include the words management plan. The name of agency responsible for implementing the plan and the date when the plan was prepared and the expected date for review should also be in the title pate.

Executive Summary

The executive summary should cover the essential issues and necessary decisions. It is necessary to include this information here as many of the final decision makers will not have the time to read all details. This section summarizes the reasons why the plan was prepared and the period of time for which it applies. The legislative basis and authority for plan development as well as the estimated budget for the MPA need to be included here as well.

Introduction

This section defines the purpose and scope of the plan and explains the legislative basis and authority for plan management. The purpose and scope of the management plan and the legislative authority for the action need to be explained here.

Management content:

A. Regional setting: this section should list both the geographic and the geopolitical location of the area and the access roads or navigation to the MPA.

B. Resources: this section describes the main resources of the proposed area, particularly those pertinent to management. Other resources should be listed in the appendix).

1. Physical: the main geological and geomorphic features of the area. Among others such features as coastal landforms, beaches, dunes, shoals, bars, reefs, etc. and the bathymetry, tides, hydrology and currents, and freshwater inputs. The main geological features and climate including temperature, precipitation, and winds will be included in this section.

2. Biological: the main ecosystems present in the protected area, including reefs, seagrasses beds, mangroves, and dunes, as well as critical habitats like nesting, feeding, spawning, and roosting habitats need to be described and listed. Important features like endangered, endemic, commercial, and symbol species and the general plant life, and marine fauna have to be described here.

3. Cultural: items included in this section are archaeological, historical, and religious sites, artifacts and documents. Recent developments like docking and transportation facilities or nearby towns should be listed.

C. Existing uses: this section includes a description of the current resource utilization activities in the area and the facilities for such use practices.

1. Recreational: any recreational activities conducted in the area and their frequency and intensity. Facilities for these activities need to be described.
2. Commercial: fishing fleet, bottom trawlers, longline fishers, scuba lobster fishing boats, commerce and industrial activities.
3. Research and education: current education facilities and the opportunities for development.

4. Description and assessment of the traditional uses, observing the inherent rights and management practices of any native populations.

D. Existing legal, policy, and management framework: a comprehensive revision and description of the legal and policy framework, preferably with help from legal counsel.

E. Existing and potential threats: these need to be assessed and a safety management plan developed.

F. The plan: six components plus appendices and maps.

1. Goals and objectives. State clearly the goals and objectives of the management plan for the proposed marine protected area.

2. Management tactics. Include:
    a. Any advisory committees formed with representatives from government, community, industry, NGO, etc.
    b. All interagency agreements established or in process, with either NGOs, government, international agencies, etc.
    c. Boundaries. The proposed boundaries for the MPA need to be clearly defined and verified.
    d. Zoning plan. Location of the different zones and the activities allowed in each one need to be stated.
    e. Regulations. All regulatory measurements in place or proposed need to be stated and their purpose explained.
    f. Resource management plan. Any resource utilization activity such as fishing, wood extraction, etc. current or proposed need to be conducted according to the resource management plan.
    g. Education and interpretative plan. This is the element that would allow the MPA management agency to reach out to community and students.

3. Administration.
    a. Staffing. Required personnel and their duties and capacities. Terms of reference for each necessary post need to be outlined.
    b. Training. All initial training necessary for the day to day management of the MPA and the ongoing training plan frequency.
    c. Facilities and equipment. All equipment and facilities existing and those that would have to be acquired according to a construction plan.
    d. Budget and business plan. All current and potential finance sources, including government, NGOs, international agencies, MPA visitors, and resource use groups.

4. Surveillance and enforcement. Facilities and equipment (boats, vehicles, radios, etc.) for regulation enforcement and surveillance have to be described. Plan of action for violator prosecution and other regulation enforcement activities.

5. Monitoring and evaluation of plan effectiveness. This component will help the MPA manager evaluate the successes and failures of the plan and take adequate corrective measures.

6. Maintenance and Administration. Among the important items to include here are budget and staffing.

G. Appendices: these can be used to expand the information included in the main body of the management plan.
- Appendix 1: Boundary and area description.
- Appendix 2: Legislation.
- Appendix 3: Plant species.
- Appendix 4: Animal species.
- Appendix 5: Special features.
- Appendix 6: past, present and proposed use.

H. References. List all references cited in the text.

I. Maps: the following list provides a guideline or suggested maps to be included in the management plan.
- Map 1: MPA location and boundaries.
- Map 2: Land and water tenure and jurisdiction.
- Map 3: Land topography and seabed bathymetry.
- Map 4: Geology.
- Map 5: Dominant plant communities.
- Map 6: Dominant animal communities.
- Map 7: Major resource uses.
- Map 8: Major use conflicts and threatened resources.
- Map 9: Zoning, core, buffer, extensive and intensive use areas.

UNIT 6. MARINE PROTECTED AREAS MANAGEMENT

This unit covers the following items:

> The general principles and steps of marine protected area management and the institutional and legal arrangements including human resource management and revenue generation.
>
> Tools such as surveillance, permitting, licensing, and enforcement, and interpretation, education and outreach, and the principles of public relations are also presented. Finally, the maintenance, linkages and mutual assistance, cooperation and general networking is discussed.

This unit contain aspects included in Modules 7, “Marine Protected Area Management” of the manual “Training of Trainers in Marine Protected Area Management: Training Manual”; United Nations Environmental Programme UNEP, Caribbean Environment Programme (CEP)”. The reader interested in expanding on the subject, is encouraged to refer to those Modules.

GENERAL PRINCIPLES AND STEPS OF MANAGEMENT

Management is defined as “working with and through other people to accomplish the objectives of the MPA management plan.” It is important to highlight that this definition emphasizes the value of the human resources in the MPA management. It also focuses on results and objectives rather than activities, and acknowledges the importance of integrating the personal objectives with those of the MPA management plan. Moreover, MPA management should be focused on providing administrative support to all of the reserve’s programs and the development of annual operative plan.

6.1 INSTITUTIONAL ARRANGEMENTS FOR MPA MANAGEMENT

Institutional arrangements are specially important for MPAs management. Groups and organizations involved in MPAs management should include, but not be limited to, NGOs or special interest groups. Other agencies involved should include international, universities, and other governmental organizations.

The importance of incorporating these groups is related to two main reasons. First, participation of other groups is important because they can bring funding and in-kind assistance. Also, these organization can provide assistance in seeking self sustaining funding, and easing individual workloads.

6.2 HUMAN RESOURCE MANAGEMENT

Human resources are key for an effective MPA management. There are two human group components involved, the management of MPA staff and the management of user groups, partners, and other special interest groups.

The management of the MPA staff starts when the positions are identified, not when the position is filled. A fundamental element to achieve effective staff management is the clear definition of terms of reference for the positions involved. Performance appraisals are another effective way of managing employees and cooperators.

6.3 REVENUE GENERATION

Revenue generation is a vital component of MPAs management since budgets are always limited. A clear plan to generate income for the protected area will help with day to day management expenses and for larger and more expensive projects. It is important that the funding strategy keeps in mind any restrictions that may be in place through the MPAs legislation, governmental regulations, or fiscal oversight.

There are basically three sources of funds for MPAs, government funds, user fees for visitors and resource users (fishermen, tourist guides, etc.), and private or corporate donations from NGOs and international agencies.

Fund raising is not an easy task. The key to success is having clearly defined goals, along with a specific action plan with realistic objectives, and a strategy that identifies the right people who can contact prospective donors. In that sense the right fund raising manager can make a big difference. The "right" person is someone that has a certain charisma, someone who quickly establishes personal relationships with perspective donors, or with people who are influential in donor organizations.

Some of the elements to take in consideration when seeking donor funds include the clear identification of your project or need and the development of a list of prospective donors. Then you must prepare a professional written summary of your ideas with a careful review of potential funding sources, and the preparation of contact lists for personal visits or telephone calls. An enthusiastic team should conduct the visit and should send personal letters of thanks immediately after the visit or meeting. When a donation arrives send a thank you promptly. Always keep in mind that, only a fundraising manager that believes in the project can make it a success.

Given the importance of a sound financial strategy for MPAs, the MBRS program implemented a training activity specifically focused on income generation for MPAs. Based on this training activity, BICA's Turtle Harbor Wildlife Refuge in Utila, Honduras (Andino 2002) identified three potential sources of funds for their protected area including, government appropriations, resource user fees and environmental tax strategies, and private donations from corporations, foundations, and local and international NGOs. Government sources are slow to process but may provide long-term funds. Visitor fees, however, with a differential for national and international visitors, with local visitors having free access, and also fees for visitor activities such as diving, kayaking, and hiking could provide much needed seed money to start small to medium projects. Finally, fees for concessions such as business, restaurants, diving centers, souvenir stores, etc., could also be sources of funds. With the money collected from dive shops and few commerce fees, Turtle Harbor Wildlife Refuge has hired park rangers, and covered fuel expenses to patrol the area. Another source has been the daily dive fee charged to sport divers, 50% of which goes to the municipality, 20% to buoy maintenance, 10% to the decompression chamber maintenance, and the remainder 20% to BICA Utila, for reef conservation and related environmental activities. Social activities and fundraising festivals are also organized and the money applied towards field equipment purchases, sea turtle projects, and pamphlets for school children.

Another example of finance strategy is presented in the Banco Chinchorro Biosphere Reserve Management Plan (INE 2000). In this case, the continuous flow of economic resources is listed as one of the priorities of the administrators and this is pursued through the diversification of financial sources, the participation of members of fishing and tourism cooperatives, and the active seeking of private donations.

At the Hol Chan Marine Reserve (Belize Fisheries Department – UICN 2002), revenues come primarily from the sale of tickets, boat registration, apartment rental and from grants and donations. Alternative sources of funds include the central government, the San Pedro Town Board, local business, local NGOs, and foreign donor agencies.

EXCERCISE

The class will discuss other potential sources of revenues, such as access or user fees, concession charges, bonds, endowments, fundraisers, and tax rebates for MPAs funding with examples from their own countries.

6.4 WORK PLANNING, REPORTING AND EVALUATION

Three components that will help the day to day management of the protected area and its personnel are work planning, progress reporting and progress evaluation. Managers and employees need to develop specific work tasks with the goals and objectives of the MPA plan in mind. This will help clarify what is expected from the employee for a specific time period. Managers also need to define how the work will be evaluated and communicate that to the employee at the time that the task is assigned. Finally, periodic reports on the activities within the management agency are useful for documenting the performance and efficiency.

According to INE (2000) the Annual Operative Plan (AOP) is the key management tool for the Banco Chinchorro Biosphere Reserve. Trough this AOP, the reserve manager designs the new projects and ongoing specific activities that would have to be conducted during a particular year. The AOP also allows for an annual monitoring of advance towards set goals. A five-year evaluation is also suggested to monitor and evaluate long term progress.

6.5 SURVEILLANCE

Surveillance is another key element in a MPA management. Through surveillance a park manager can make sure regulations including zoning and resource use are observed.

Monitoring is frequently used by law enforcement to detect and eliminate illegal activities. Fish landings and fishing gear inspections, and water quality monitoring can help to check for compliance. On the other hand, surveillance can also be an effective public awareness tool. The MPA manager, in his interactions with various user and special interest groups can help distributing pamphlets and brochures with management information for the area and explain management measures.

A program to monitor commercial fishing activities could be implemented by the fishermen themselves and analyzed by an organization mutually agreeable to both groups. Co-management practices, between government and fishermen, are viable option for enforcement and optimal fisheries yield. A more detail look at other aspects of monitoring is provided in the next unit.

6.6 PERMITTING, LICENSING AND ENFORCEMENT

In many cases permits and licenses are issued by one agency and enforced by another agency and quite often there is little communication between the two groups. Ideally, the MPA manager should have the authority to both issue and enforce permits and licenses.

The key to effective permitting is to ensure that the MPA authority is closely involved with the evaluation and development of permit conditions. This will ensure protection of the resources and prevent conflicts between authorities and resource use groups.

The types of permits issued at MPAs include small scale and recreational fishing, diving, camping, and other tourist related activities. Research and educational activities are also conducted at MPAs through a permit and licensing system.

As an example of permitting in MPAs in the MBRS region is presented by INE (2000). A list of the activities that require special permits in the Banco Chinchorro Biosphere Reserve include tourism guiding, camping, sport fishing from boats, fish and aquaculture activities, and commercial or cultural video, sound, and photography recording, scientific research including specimen collection, and permanent or temporal facilities construction. Boating activities also require special permits. There are regulations for the maximum number of fishing boats and the size of tourism boats allowed in the reserve.

6.7 INTERPRETATION, EVALUATION AND OUTREACH

Interpretation and outreach are two of the most important activities within an MPA interaction with the general public and . Park managers should educate visitors and other users about the MPA's resources through public education and community outreach through methods such as interpretation and public relations.

INTERPRETATION

Tilden (1957) defines interpretation as "an educational activity which aims to reveal meanings and relationships through the use of original objects, by first hand experience, and by illustrative media, rather than simply to communicate factual information." Interpretation is the tool of choice for MPA management outreach and communication of results.

An interpreter needs to learn and understand the community, social and ethnic values of the target group to maximize his efforts. Target groups include visitors, local population, and resource users like fishermen and mangrove timber producers.

PRINCIPLES OF PUBLIC RELATIONS

The MPA manager's ability to effectively communicate with groups and individuals will often determine how successful he/she is in reaching a desired objective. Many good ideas and plans fail to take off when they are not properly communicated. With this the support is partial and funding limited.

Public relations in the end is an activity where image is built by publishing results. Three components of an effective communicator is being a listener, a talker and a mediator.

6.8 MAINTENANCE

"Maintenance" does not only mean keeping equipment and buildings operational, but includes the "maintenance" of natural and cultural resources, information, databases and even human resources.

Maintenance of partnerships, be they individuals, groups, or corporations is very important, if not critical to the continued success of the MPA.

6.9 LINKAGES, MUTUAL ASSISTANCE, COOPERATION AND GENERAL NETWORKING

For some MPAs the topic of cooperation and networking is the most important issue in maintaining, or establishing, the image and credibility of the MPA. Participation by outside organizations, individuals and the general public is critical to generating the support and funding needed to implement many conservation, restoration and stabilization strategies.

There are networks such the Caribbean Marine Protected Area Managers (CaMPAM) and the Marine Protected Area Network (MPANET) that can assist in daily management issues and also in planning and long term management. Also, there are tools on the Internet like the MPA news organization at www.mpanews.org.

UNIT 7. MPAs RESEARCH AND MONITORING

This unit covers the following items:

> The rationale for research and monitoring of socio-economic and biological parameters, designed to addresses MPA management-driven questions. The methods for monitoring critical biological resources and the use of remote sensing and geographic information systems (GIS) in MPAs research plans.
>
> Other related topics are ecological, physical, and cultural resources monitoring, and the survey of visitor and user data. Finally the monitoring of the effectiveness of management practices including restrictions and zoning and the effectiveness of the MPA itself.

This unit contains points included in Modules 8, "Research and Monitoring" of the manual "Training of Trainers in Marine Protected Area Management: Training Manual"; United Nations Environmental Programme UNEP, Caribbean Environment Programme (CEP)". The reader interested in expanding on the subject, is encouraged to refer to those Modules.

7.1 IMPORTANCE AND FUNCTIONS OF A RESEARCH AND MONITORING PROGRAM

Research and monitoring are essential for good MPAs management and stewardship. The design and application of standard monitoring methods improves management success. The objectives of the research program will depend on the management objective of the marine protected area.

Among the many products of MPAs research and monitoring programs are, the establishment of a permanent inventory of the situation of marine resources and observation and evaluation of impacts from both human and natural sources. We can also determine uses and threats to MPA resources and obtain fundamental scientific knowledge that would help us determine changes in the health of the resources. MPA research and monitoring can also help with the evaluation of compliance with regulations and can offer early warning signals of problems. Finally, research and monitoring programs provide a link to broader research efforts outside the MPA and offer solutions to issues and problems in the MPA management.

Even though the importance of MPAs research has been made clear before, it has been noted that research conducted in MPAs not always serves a management need. Moreover, MPA personnel have noticed that some national and international researchers do not interact with local people or protected area personnel. Sometimes results from scientific research are not filed nor made available to MPA managers. The organization of research seminars and meeting presentations and the compilation of published and existing historic research are necessary to identify research gaps.

Research and monitoring can provide an important support for MPAs management. One of the most important aspects research can assist MPAs management is with resource inventories and baseline research. Baseline inventories are essential for the development of the MPA management plan and for the establishment of regulations for use of the MPA resources.

According to the Banco Chinchorro Biosphere Reserve management plan, research provides a basis in the decision taking process. Research should also identify and explain

processes affecting the reserve resource management, conductive to a better management and planning (INE 2000).

7.2 MANAGEMENT AND DESIGN OF MPAs RESEARCH AND MONITORING PROGRAMS

It is important that MPA managers develop a research and monitoring plan before any research begins. That way they can be sure that the research and monitoring conducted will serve a purpose related to the MPA management. All research conducted in MPAs should make a positive contribution to the management needs of the MPA. Moreover, when possible, research and monitoring should conform to the regional standards to allow for comparisons among the MPAs in the Wider Caribbean Region.

When designing a research and monitoring program there are several questions a MPA manager should ask including, what are the objectives of the program and what is going to be monitored? Also, how often should data be collected and how long should data collection be continued? Methodological aspects such as what methods will provide the best data, who will conduct the monitoring, and what methods are realistic, considering the available time, money, equipment, people, and skills should also be considered. Finally, the issues of quality assurance to ensure data of the highest quality, how will the data be subsequently analyzed, and how will the data be stored and retrieved need to be addressed.

Monitoring is vital in determining the degree of ecosystem degradation, whether from human or natural causes. Monitoring at the Banco Chinchorro Biosphere Reserve (INE 2000) focuses on specific indicators of resource condition including coral reefs, mangroves, seagrasses, conch, lobster, algae, fish and sponges. Weather and environmental quality are also monitored.

7.3 REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS (GIS) IN RESEARCH PLANS

Remote sensing and GIS techniques are a unique tool in MPAs management, research and monitoring. Remote sensing is a method of rapidly gathering data over large areas, while GIS applications can improve data management through the creation of relational databases and the graphic representation of important geographic information. It is important to keep in mind that remote sensing techniques, including aerial photography, aerial surveys, and satellite imagery, should be coupled with ground-truthing surveys. GIS techniques can play an important role in map creation and the visualization of zoning plans.

GIS is the tool of choice for rapid ecological evaluation process (INEP 2000). Through this technique, decision making improves, by providing reliable information in reduced time, reducing lag time for resource conservation and management. Moreover, GIS provides a quick geographically referenced system for any point in the reserve that allows for the integration of diverse and complex spatial information. Similarly, at the Hol Chan Marine Reserve in Belize, remote sensing through black and white and color aerial photographs and several satellite images are used for digital map preparation to illustrate zoning and boundaries demarcation (Belize Fisheries Department – UICN 2002).

7.4 RESOURCE USERS MONITORING

To ensure a successful MPA management, research and monitoring programs should focus not only on flora and fauna but provide all the information necessary to ensure success in

MPA management. All the resources in an area, as well as the factors that affect those resources, must be monitored. Monitoring visitor and user data includes, among others, research scientists, tourists, divers, fishermen, mangrove users, and boating.

In terms of research scientists, it is important to record number of research projects, institutional affiliation, and activities conducted. The location of the research sites, equipment used, and material extracted is also very important. Finally, a good track record of publications and research products derived from the research at the MPA is necessary to take full advantage of the information produced.

Tourists and divers constitute another group that should be monitored, including the number per year, origin, and frequency by month or season. Information on specific dive sites and any secondary activities such as spear fishing, photography, and collection also needs to be recorded. Also of importance is the types of vessels used to transport divers and the types of commercial operations involved, together with the amount of money spent and the levels of satisfaction with the activity.

Of particular importance to the MPA manager is the evaluation of the carrying capacity and acceptable loading capacity, in terms of number of divers. This will dictate the amount of tourism the area can support without a significant damage to the natural resources. On the other hand, tourist can also be of use if they are asked information like the number and listing of species and items found.

Fishermen are another group that deserves special monitoring attention. Of particular importance is the collection of data on number of fishermen per year, month, season, week and the catch they harvest in terms of species, size, methods of catch, and weight of catch. Fishing effort and catch per unit effort, for either single or multi-species fisheries and the different types of fishing arts and methods need to be described and their use monitored to evaluate impacts of the activity in the sustainability of the resources. Any by-catch data also needs to be recorded and monitored over time.

Another important resource use group in MPAs, particularly in the MBRS region, constitutes mangrove products users. Key monitoring aspects include number of persons involved and the species and products harvested. Harvest techniques, site of extraction, and frequency of harvest also needs to be documented. Finally, the commercialization of mangrove products is another aspect important to supervise (CONAP – Fundary 2002).

At the Banco Chinchorro Biosphere Reserve resource utilization focuses on fishing, the most important economic activity in the reserve, followed by tourism. Both of these uses are closely monitored particularly lobster and conch fishing through the evaluation of fishing effort, organisms distribution and abundance, size distribution, sex ratios, and economic features of the fishery (INE 2000).

Resource use monitoring and research at the Hol Chan Marine Reserve (Belize Department of Fisheries – UICN 2002) focuses on lobster, conch, fish, and coral surveys. Environmental research and monitoring at Hol Chan includes daily water quality (temperature, salinity, pH, turbidity and nutrients) monitoring. Sedimentation rates, primary productivity of mangroves, coral reefs, and seagrass, and biodiversity inventory are also monitored.

7.5 MONITORING OF EFFECTIVENESS OF RESTRICTIONS AND ZONING

Monitoring can also be a key management technique to assess the effectiveness of zoning plans. At the baseline condition, researchers would measure different environmental parameters, such as habitat quality, fish populations and species abundance, coral or sea grass cover, species diversity. Then, at a later time, researchers would measure the same environmental parameters that they measured at the initial time. Differences in the parameters between the initial and subsequent times or between the zones with and without the restriction at a given time might be explained by the restriction itself.

UNIT 8. COURSE PARTICIPANTS CASE STUDY PRESENTATIONS

The following information was extracted from presentations made by course participants throughout the course, either during individual or group presentations.

COUNTRIES INSTITUTIONAL FRAMEWORK

8.1 MEXICO

Universidad de Quintana Roo: work fields include Mayan coast management, particularly Bacalar Lagoon; outreach and consulting; integrated coastal resource management. University offers the Licenciatura (Bachelor Sciences) degree on Natural Resources Management and also on Environmental Engineering.

Comisión de Áreas Naturales Protegidas CONANP: is the government agency in charge of 154 protected areas in Mexico which occupies 8% of the national territory. Legal framework includes the General Law of Ecological Equilibrium and the Fishing Law. Current projects include a process of de-centralization by watersheds and optimization of protected areas administrative processes. CONANP administers a total of 17 protected areas in the Yucatan Peninsula.

Banco Chinchorro Biosphere Reserve: also administers Arrecifes de Xcalac National Park. The biosphere reserve was created on 1998. Current objectives include securing financial support and collaboration.

Secreataría de Desarrollo Urbano y Ecologia del Estado de Quintana Roo SEDUE: is a state agency responsible for the state Ecological Equilibrium Law. Administers six state protected areas including Xcacel, Manatee Reserve, and Chetumal Bay. Some of SEDUE´s responsibilities include resource use, and finding alternatives for stakeholders, and the creation of a trust fund.

8.2 GUATEMALA

Fundación para el Ecodesarrollo y la Conservación FUNDAECO: is an NGO created through a government decree with the goal of slowing resource destruction and promoting sustainable use. FUNDAECO administers six areas in the Atlantic coast with more than 100 communities living inside. Some of the current issues include payment for environmental services and resource use.

Centro de Estudios Conservacionistas CECON: administers the Chocon-Machacas biotope (equivalent to a wildlife refuge) on the Atlantic coast of Guatemala. It also houses the Centro de Datos para la Conservación CDC which has information on endemic and endangered species as a means of filling information gaps and increasing information exchange.

Consejo Nacional de Areas Protegidas CONAP: is the government institution responsible for protected areas administration. Since it is related directly to the presidency it is also vulnerable to political processes. CONAP administers the Guatemalan Protected Areas System SIGAP. CONAP´s northeast region co-manages three protected areas in the

Atlantic coast. It is implementing a monitoring system to evaluate management effectiveness.

8.3 BELIZE

Toledo Institute for Development and Environment TIDE: works the connectivity between marine protected areas and the upland. Is also responsible for site conservation planning for Port Honduras Protected Area and its watershed management. Some of the current issues include the balance between biodiversity protection and resource use.

Glovers Reef Marine Reserve: located 45 miles East of Dandriga is considered an atoll. It belongs to Wildlife Conservation Society and is administered by the Fisheries Department. They conduct scientific monitoring and deal conservation issues such as working with fishing cooperatives.

Sapodilla Caye Marine Reserve: is managed by the Fisheries Department. Some of the relevant conservation issues include hawksbill turtle nesting and raising environmental awareness. The site is visited by Guatemalans, Hondurans, and, in lesser scale, by Belizeans. The site management plan was revised in 1994. Visitors pay US$10 and are allowed to harvest up to 20 lbs. of seafood.

Caye Caulker Marine Reserve: covers an area 3 miles long and one mile wide with a staff of three, including a park manager and two park rangers. Some issues include community outreach and consultation with stake holders, research permits, and zoning by preservation zones. Funding comes from Coastal Zone Management Institute and the Fisheries Department.

Friends of Nature: Created in 2001 it manages two reserves, Laughing Bird National Park and Gladden Spit Marine Reserve on a community based co-management arrangement with the Forestry and Fisheries Departments. Issues include monitoring of biological systems by biologist and park rangers, reducing fishing pressure at fish spawning aggregation sites near the Placencia Peninsula. No management plan is in place yet

8.4 HONDURAS

Corporación Hondureña de Desarrollo Forestal CODEFOR: administers forests and protected areas. Honduras has a total of 107 protected areas which represent 25% of the country. Some of the challenges faced include securing financial support and some conflicts between confusing laws which they are trying to organize through a single code. It was also noted that several initiatives of CODEFOR that involved a lot of money have failed in the past.

Fundación Hondureña Para los Arrecifes Coralinos: was created on 1993 by private entrepreneurs and manages the marine protected area of Cayos Cochinos. Cayos Cochinos is privately owned and includes a scientific station, while the protected area includes the islands and 5 nautical miles around them. Among others, they conduct control and surveillance activities and develop cooperation agreements with other institutions for instrumentation. The personnel in the islands is a total of ten and they are in charge of diverse programs including sea turtle, coral, and pink boa conservation.

Bay Islands Conservation Association BICA: created with the goal of conserving the environment and the reefs on the Bay Islands of Honduras, Roatan, Utila, and Guanaja. Among other programs they conduct environmental education with elementary schools, provide ecotourism information at the visitor center, waste management, environmental impact assessment, and construction of diving buoys. They also manage Turtle Harbor Wildlife Refuge on Utila, including patrolling, control and surveillance, and research.

Secretaría de Recursos Naturales y Ambiente SERNA: is the Honduran agency in charge of biodiversity conservation, protected areas declaration, and general research on protected areas. They act as focal point for international conventions such as CITES, Ramsar, Biodiversity, MBRS, Cartagena Protocol for genetic resources. SERNA is also in charge of regulating and organizing and sometimes management of protected areas.

8.5 REGIONAL

Tri National Alliance for the Gulf of Honduras TRIGOH: an organization that coordinates environmental non governmental organizations in the three Gulf of Honduras countries, Belize, Guatemala, and Honduras. Some of the issues TRIGOH deals with include transnational protected areas in aspects such as continuity of the zoning.

REFERENCES

Agardy, T. M. 1994. Advances in marine conservation: the role of marine protected areas. Trends in Ecology and Evolution 9: 267-270.

Andino, J. 2002. Estrategia Financiera, Movilización de Fondos: Refugio de Vida Silvestre Turtle Harbor. Asociación para la Conservación Ecológica de las Islas de la Bahía BICA. Mimeo, 9 p.

Belize Fisheries Department – UICN. 2002. Hol Chan Marine Reserve Management Plan, Belize. Belize Fisheries Department and The World Conservation Union UICN. 120 p.

Bohnsack, J.A. 1993. Marine reserves: They enhance fisheries, reduce conflicts, and protected resources. Oceanus 36: 63-71.

Bohnsack, J.A. 1994. How marine fishery reserves can improve reef fisheries. Proceedings of the Gulf and Caribbean Fisheries Institute 43: 217-241.

Bohnsack, J.A. and Ault, J.S. 1996. Management strategies to conserve marine biodiversity. Oceanus 9: 73-82.

Clark, J.R. Editor. 1991. Carrying capacity: a status report on marine and coastal parks and reserves. Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Florida USA. 73 pp.

Clark, J.R. 1992. Integrated management of coastal zones. FAO Fisheries Technical Paper 327. 167 pp.

CONAP – FUNDARY. 2001. Plan Maestro 2002 - 2006 Área de Protección Especial Punta de Manabique, Izabal, Guatemala. Consejo Nacional de Áreas Protegidas, CONAP, y Fundación para la Conservación del Medio Ambiente y de los Recursos Naturales “Mario Dary Rivera” FUNDARY. Guatemala, Guatemala. 139 p.

De Fontaubert, A.C., Downesm D.R. and Agardy T.S. 1996. Biodiversity in the Seas: Implementing the Convention on Biological Diversity in Marine and Coastal Habitats. IUCN Gland and Cambridge, vii + 82 pp.

Dugan, J.E. and Davis, G.E. 1993. Applications of marine refugia to coastal fisheries management. Canadian Journal of Fisheries and Aquatic Sciences 50: 2029-2042.

English, S., Wilkinson C., and Baker V., Editors. 1994. Survey manual for tropical marine resources. Australian Institute of Marine Science. Twonsville, Australia. 368 pp.

Francis, J., Johnstone R., and van´t Hof, T. Editors . Training for the Sustainable Management of Marine Protected Areas: A Teaching Manual for Training Managers.

FUNDAECO 2003. Plan de Manejo Para la Reserva de Usos Múltiples, Río Sarstún. Fundación para el Ecodesarrollo y la Conservación, Fundaeco. Guatemala. 48 p.

Gardner, Lloyd. 1999. The Economics of Environmental Pollution. Paper presented at the 5th Annual Virgin Islands Non-Point Source Pollution Conference. St. Thomas, U.S. Virgin Islands, May 19-20, 1999.

INE. 2000. Programa de Manejo de la Reserva de la Biosfera Banco Chinchorro, México. Instituto Nacional de Ecología INE, INE / SEMARNAT, México, D.F. 189 p.

Johannes, R.E. 1981. Working with fishermen to improve coastal tropical fisheries and resource management. Bulletin of Marine Science. 31: 673-80.

Kelleher G. 1999. Guidelines for Marine Protected Areas. IUCN, Gland, Switzerland and Cambridge, UK, xxiv + 107 pp.

Kelleher, G., Bleakley, C. and Wells, S. Editors. 1995. A global representative system of marine protected areas. Vol II: Wider Caribbean, West Africa and South Atlantic. Great Barrier Reef Marine Park Authority, The World Banc, IUCN.

Kelleher, G. and Kenchington R. 1991. Guidelines for establishing marine protected areas. A Marine Conservation and Development Report. UICN. Gland, Switzerland, vii + 79 pp.

Lewis, C. 1997. 'Conflicts in conservation'. Pages 62-64 in Borrini Feyerabend, G. (ed.). Beyond 'fences: seeking social sustainability in conservation. Volume 2: a resource book. IUCN, Gland, Switzerland.

McNeill, S.E. and Fairweather, P.G. 1993. Single large or several small marine reserves? An experimental approach with seagrass fauna. Journal of Biogeography 20: 429-440.

Ogden, J.C. 1997. Marine managers look upstream for connections. Science 278: 1414-1415.

UNEP-Caribbean Environment Programme, Regional Coordinating Unit (UNEP/CAR-RCU). 2001. Training Manual: training of trainers course in marine protected area management.

Polunin, N.V.C. 1990. Marine regulated areas: an expanded approach for the tropics. Resource Management and Optimization 7: 283-299.

Polunin, N.V.C. and Roberts, C.M. 1993. Greater biomass and value of target coral-reef fishes in two small Caribbean marine reserves. Marine Ecology Progress Series 100: 167-76.

Programme for Belize. 2002. Draft baseline assessment of the Belize Barrier Reef World Heritage Site. Mimeo, 40 pp + maps.

Rakitin, A. and Kramer, D.L 1996. Effect of a marine reserve on the distribution of coral reef fishes in Barbados. Marine Ecology Progress Series 131: 97-113.

Roberts, C.M. 1994. Marine reserves: A brief guide for decision makers and users. Presented at Workshop on Coastal and Ocean Resource Management, April 25-May 6. NGO Islands Forum, UN Global Conference on the Sustainable Development of Small Island Developing States, Barbados.

Roberts, C.M. 1997. Connectivity and management of Caribbean coral reefs. Science 278: 1454-1457.

Roberts, C.M. and Polunin, NN.C. 1993. Hol Chan: demonstrating that marine reserves can be remarkably effective. Coral Reefs 13: 90.

Roberts, C.M. and Polunin, N.V.C. 1993. Marine reserves: Simple solutions to managing complex fisheries? Ambio 22: 363-368.

Rogers, C.S., Garrison, G.; Grober, R.; Hillis, Z-M. and Franke M.A.. 1994. Coral reef monitoring manual for the Caribbean and Western Atlantic. National Park Service, Virgin Islands National Park.

Russ, G.R., Alcala, A.C. and Cabanban, A.S. 1992. Marine reserves and fisheries management on coral reefs with preliminary modeling of the effects on yield per recruit. Proceedings of the 7th International Coral Reef Symposium 2: 978-985.

SEDUMA. 2001. Quintana Roo natural protected areas. Secretaria de Turismo – Secretaría de Desarrollo Urbano y Medio Ambiente SEDUMA. Gobierno del Estado de Quintana Roo. Chetumal, Quintana Roo, México. 79 pp.

SEDUMA. 2001. Bahía de Chetumal, Santuario del Manatí, Zonificación y Normas de Uso. Secretaría de Desarrollo Urbano y Medio Ambiente, Gobierno del Estado de Quintana Roo, Chetumal, Quintana Roo, México. 31 pp.

Tilden, Freeman. 1977. Interpreting Our Heritage. University of North Carolina Press.

Salm, R.V., Clark, J. and Siirila, E. 2002. Marine and coastal protected areas: a guide for planners and managers. IUCN. Washington D.C. xxi + 371 pp.

INE. 2002. Programa de manejo Reserva de la Biosfera Banco Chinchorro, México. Instituto Nacional de Ecología INE, Secretaría de Medio Ambiente, Recursos Naturales y Pesca SEMARNAP. 189 pp.

Sluka, R., Chiappone, M., Sullivan, K.M. and Wright, R. 1997. The benefits of a marine fishery reserve for Nassau grouper *Epinephelus striatus* in the central Bahamas. Proceedings of the 8th International Coral Reef Symposium 2: 1961-1964.

Sobel, J. 1996. 'Marine Reserves: Necessary Tools for Biodiversity Conservation?', in Canadian Museum of Nature. 1996, P. 8-18.

Tait, R.V. 1981. Elements of Marine Ecology: An Introductory Course. 3rd Edition. Butterworths, London.

IUCN. 1994. Guidelines for Protected Area Management Categories. IUCN - The World Conservation Union, Gland, Switzerland.

Wilcox, E.S. 1994. Lessons from the field: marine integrated conservation and development. World Wildlife Fund. Washington DC.

WEB SITES

Mesoamerican Barrier Reef Systems Program
www.mbrs.org.bz

PNUMA –Programa Ambiental del Caribe
http://www.cep.unep.org/

Caribbean Coastal Marine Productivity Programme (CARICOMP)
http://www.uwimona.edu.jm/centres/cms/caricomp

Reef Environmental Education Foundation (REEF)
http://www.reef.org

ReefBase
http://www.reefbase.org

UICN (Unión Mundial para la Naturaleza) (IUCN, The World Conservation Union)
http://www.iucn.org

Marine Conservation Biology Institute
http://www.mcbi.org

World Conservation and Monitoring Centre
http://www.wcmc.org.uk/

The Nature Conservancy
http://www.nature.org

Pronatura, Península de Yucatán, México
www.pronatura.org.mx

Center for Martine Conservation, Washington D.C., USA
www.cmc-ocean.org

Gulf and Caribbean Fisheries Institute:
GCFINET@LISTSERV.TAMU.EDU

MPA Training of Trainers Manual (English):
http://www.cep.unep.org/issues/MPA%20manual.htm

Manual de Capacitación de capacitadores en el manejo de áreas marinas protegidas (Spanish):
http://www.cep.unep.org/issues/MPA%20manual-es.htm

Fully-protected marine reserves: a guide.
http://www.panda.org/resources/publications/water/mpreserves/mar_dwnld.htm

Marine Protected Areas Corner:
http://www.cep.unep.org/pubs/cepnews/v17n1/mpa%20corner.htm#MPA%20Guide

The Project for the Conservation and Sustainable Use of the Mesoamerican Barrier Reef Systems.
http://www.mbrs.org.bz/

United Nations Environmental Program UNEP, Caribbean Regional Coordinating Unit:
http://www.cep.unep.org/

Evaluation of the Coastal and Marine Resources of the Atlantic Coast of Guatemala, CEP Technical Report No. 34 1995.
http://www.cep.unep.org/pubs/techreports/tr34en/content.html

Directrices para una planificación y un manejo integrados de las areas costeras y marinas en la región del Gran Caribe.
http://www.cep.unep.org/pubs/techreports/tr42es/contenido.htm

Common Guidelines and Criteria for Protected Areas in the Wider Caribbean Region: Identification, Selection, Establishment and Management. CEP Technical Report No. 37 1996.
http://www.cep.unep.org/pubs/techreports/tr37en/content.html

Status of Protected Area Systems in the Wider Caribbean Region, Caribbean Environment Programme, United Nations Environment Programme. CEP Technical Report No. 36 1996.
http://www.cep.unep.org/pubs/techreports/tr36en/index.html

Reserva de la Biosfera Banco Chinchorro, Quintana Roo, México
Email: chinchor@prodigy.net.mx

Parque Nacional Arrecifes de Cozumel, Cozumel, Quintana Roo, México
Email: pmnczm@cozumel.czm.com.mx

Parque Nacional Isla Contoy, Quintana Roo, México
Email: pncontoy@cxancun.rce.com.mx

Reserva de la Biosfera Sian Ka'an, Quintana Roo, México
Email: siankaan@prodigy.net.mx, o siankaan@qroo1.telmex.net.mx

Amigos de Sian Kaan, Quintana Roo, México
Email: sian@cancun.com.mx

APPENDIX 1.

MBRS Region MPAs Information and Management Plans (MP) Status :

Name and Category Designation	Location	Organization responsible for management	National or Multi National	MPA official designation date	Original MP creation date	Original MP revision date	Information available from
Honduras:							
Refugio de Vida Silvestre y Área Marina Protegida Turtle Harbor	Utila, Islas de la Bahia. Cities nearby: Eastern Harbor, Utila; Los Cayitos, Utila; La Ceiba (30 km to the South)	Asociación para la Conservación Ecológica de las Islas de la Bahía, Capítulo Utila.	National	1994		No	Proyecto para el Manejo Ambiental de las Islas de la Bahía (PMAIB), Roatan, Islas de la Bahía (www.pmaib.org); contacto: Lic. Enoc Burgos – UCP/PMAIB
Monumento Natural Marino Cayos Cochinos (proposed)	30 km northeast of Ceiba, Atlantida, Honduras	Fundación Hondureña para los Arrecifes Coralinos	National	Presidential Decree November 1993	In process	No	Adrian E. Oviedo aeoviedo@caribe.hn Adoni Cubas acubas@caribe.hn

Name and Category Designation	Location	Organization responsible for management	National or Multi National	MPA official designation date	Original MP creation date	Original MP revision date	Information available from

Guatemala:							
Biotopo Protegido Chocón Machacas	Livingston, Izabal	Co-Managed by Consejo Nacional de Áreas Protegidas CONAP, and Centro de Estudios Conservacionistas CECON – Universidad de San Carlos de Guatemala	National	February, 1989; Protected Areas Law 4-89	1981	In process	Lic. Jorge Ruíz, Director, CECON; Oscar Santos, Director Biotopo; Mercedes Barrios, Coordinadora CDC, CECON
Área de Protección Especial Río Sarstún (Multiple Use Reserve)	Livingston, Izabal	Co-Managed by Consejo Nacional de Áreas Protegidas CONAP, and Fundación para el Ecodesarrollo y la Conservación FUNDAECO	Bi-National, Guatemala - Belize	February, 1989; Protected Areas Law 4-89	June 2000	Revised by CONAP in 2001, submitted for second revision in 2002; pending CONAP´s approval	Ing. Byron Villeda, FUNDAECO fquetzal@guate.net.com; Lic. Fernando Castro, CONAP seconap@guate.net; Ing. Freddy Aguilar FUNDAECO sarstun@itelgua.com

Name and Category Designation	**Location**	**Organization responsible for management**	**National or Multi National**	**MPA official designation date**	**Original MP creation date**	**Original MP revision date**	**Information available from**
Guatemala:							
Área de Protección Especial	Izabal, Área de Conservación Sarstún -	Co-Managed by Consejo Nacional de Áreas	Bi–national Guatemala - Honduras	Protected Areas Law 4-89; pending	2002		Estuardo Herrera Director Area (502-948-4404)

Punta de Manabique	Motagua	Protegidas CONAP, and Fundación Mario Dary		legal declaration			
Parque Nacional Río Dulce	Izabal, Área de Conservación Sarstún - Motagua	Managed by Consejo Nacional de Áreas Protegidas CONAP	National	1955	Non existing		Gustavo Madrid, Director Regional CONAP conapbarrios@guate.net Fernando Castro Depto. Areas de Conservación CONAP
Área Reserva Protección de Manantiales Cerro San Gíl	Izabal, Área de Conservación Sarstún - Motagua	Fundación para el Ecodesarrollo y la Conservación FUNDAECO	National	Decree 129-96			Byron Villeda, Director Area

Name and Category Designation	**Location**	**Organization responsible for management**	**National or Multi National**	**MPA official designation date**	**Original MP creation date**	**Original MP revision date**	**Information available from**
Belize:							
Port Honduras Marine Area (Marine Protected Area)	Toledo District, near Punta Gorda Town, Punta Negra Village, and Monkey River Village	Toledo Institute for Development and Environment and the Belize Fisheries Department	National	January 25, 2000	Late 1998	Will be conducting baseline survey between October 2002 and September 2003. Will	MBRS, Belize Tourism Board, Fisheries Department

						revise MP afterwards	
Laughing Bird National Park	12 miles from Placencia in Stann Creek District	Friends of Nature, Belize Forestry Department, Coastal Zone Management	National	1996	1998	No	Friends of Nature, Placencia
Gladden Spit Marine Reserve	23 miles from Placencia, Stann Creek District	Friends of Nature, Belize Fisheries Department, Coastal Zone Management	National	April 2002	2002	Yes, now	Friends of Nature, Placencia

Name and Category Designation	**Location**	**Organization responsible for management**	**National or Multi National**	**MPA official designation date**	**Original MP creation date**	**Original MP revision date**	**Information available from**
Belize:							
Caye Caulker Forest and Marine Reserve	Belize District, 15 miles north	Belize Fisheries Department, Coastal Zone Management, Forestry Dep.	National	1998	1993	Presently being up dated	Fisheries Department
Glover´s Reef Marine Reserve	45 miles east of Dangriga Town	Belize Fisheries Department, Coastal Zone Management Authority, Wildlife Conservation Soc.	National	June 1988	1988	No	Belize Fisheries Department, James Azueta, Coordinator.
Sapodilla Cays Marine Reserve	75 km northeast of Punta Gorda	Co-managed by Belize Fisheries	Tri-national Honduras –	1996	1994	No	TASTE, Area Manager

		Department and Toledo Association for Sustainable Tourism and Empowerment TASTE	Guatemala – Belize				
Name and Category Designation	**Location**	**Organization responsible for management**	**National or Multi National**	**MPA official designation date**	**Original MP creation date**	**Original MP revision date**	**Information available from**
Mexico:							
Santuario del Manatí, Bahía de Chetumal, Área Natural Protegida Estatal, Zona Sujeta a Conservación Ecológica	Othon P. Blanco Municipality, Chetumal, State of Quintana Roo	Secretaría de Desarrollo Urbano y Medio Ambiente, del Gobierno del Estado de Quintana Roo	Bi-national Mexico – Belize	Official publication October 24, 1999	August 20, 1999	Prior to approval a consensus process was conducted	Dr. Hector Gamboa Perez, Professor Universidad de Quintana Roo; Dr. Benjamin Morales Veza, Coordinator Colegio de la Frontera Sur Unidad Chetumal.
Área de Protección de Flora y Fauna Yum Balam	Lazaro Cárdenas Municipality, Northeast of Quintana Roo State, close to Holbox Island	Comisión de Áreas Naturales Protegidas CONANP	National	June 6, 1994	In process		Isla Holbox Office, domicilio conocido (tel. 019-875-2191, and Cancun Office (tel. 019-849-4491); Francisco Remolina
Parque Nacional Isla Contoy	Isla Mujeres Municipality, close to Isla Blanca, State of	Comisión de Áreas Naturales Protegidas CONANP	National	February 2, 1998	Published 1997	No	Isla Mujeres Office, Av. Rueda Medina (tel. 019-877-0118, and Cancun Office (tel. 019-849-

	Quintana Roo						7425); Omar Ortiz

Name and Category Designation	Location	Organization responsible for management	National or Multi National	MPA official designation date	Original MP creation date	Original MP revision date	Information available from
Mexico:							
Parque Nacional Costa Occidental de Isla Mujeres, Punta Cancún y Punta Nizuc	Isla Mujeres and Benito Juarez Municipalities, northeast of Quintana Roo State, in front of Isla Mujeres and Cancún coasts.	Comisión de Áreas Naturales Protegidas CONANP	National	July 19, 1996	Published 1998	No	Isla Mujeres Office, Av. Rueda Medina (tel. 019-877-0118, and Cancun Office (tel. 019-849-7425)
Parque Nacional Arrecifes de Puerto Morelos	Benito Juarez Municipality, in front of Puerto Morelos town.	Comisión de Áreas Naturales Protegidas CONANP	National	February 2, 1998	Published 2000	No	Puerto Morelos Office Tel. 019-871-0525; Francisco Remolina
Parque Nacional Arrecifes de Cozumel	Cozumel Municipality, Cozumel Island southern coast.	Comisión de Áreas Naturales Protegidas CONANP	National	July 19, 1996	Published 1998	No	Cozumel Office (019-872-4275); Elvira Carvajal

Name and Category Designation	Location	Organization responsible for management	National or Multi National	MPA official designation date	Original MP creation date	Original MP revision date	Information available from

Mexico:

Parque Nacional Tulum	Solidaridad Municipality, 3 km north of Tulum town	Comisión de Áreas Naturales Protegidas CONANP	National	April 30, 1981		No	Cancún Office (0198-849-7554);
Reserva de la Biosfera Sian Ka´an	Felipe Carrillo Puerto and Solidaridad Municipalities	Comisión de Áreas Naturales Protegidas CONANP	National	January 20, 1986	1992	In process	Cancún Office (0198-849-7554); Felipe Carrillo Puerto Office (019-834-0265); Alfredo Arellano
Reserva de la Biosfera Banco Chinchorro	In front of X-calac and Ubero towns in Othon Pompeyo Blanco Municipality Coast, 30 km off shore	Comisión de Áreas Naturales Protegidas CONANP	National	July 19, 1996	2000	No	Cancún Office (0198-849-7523 and 0198-494-674); Tomás Camarena

APPENDIX 2.

List of participants in the "Training in the Planning and Design of Marine Protected Areas Management Plans Course", organized by the Mesoamerican Barrier Reef Systems MBRS. Belize City, Belize, September 24 to 27, 2002.

BELIZE

#	NAME / NOMBRE	POST/CARGO	INSTITUTION/ INSTITUCION	ADDRESS/DIRECCION	TELEPHONE/ TELEFONO	EMAIL /CORREO ELECTRONICO
1	Albert Munnings	Director	Glover's Reef Marine Reserve / Fisheries Department	Coastal Resources Multicomplex Building, Princess Margaret Drive, Belize City	(501) 2244552	species@btl.net
2	Francis Staine	Director	Caye Caulker Marine Reserve / Fisheries Department	Coastal Resources Multicomplex Building, Princess Margaret Drive, Belize City	(501) 2244552	species@btl.net
3	Florita Castillo	Director	Sapodilla Cayes Marine Reserve / Fisheries Department	Coastal Resources Multicomplex Building, Princess Margaret Drive, Belize City	(501) 2244552	species@btl.net
4	Annsel Dubon	Director	Port Honduras Marine Reserve / TIDE	Punta Gorda Town, Topledo District, Belize	(501) 7222431	anselbc@yahoo.com
5	Maxine Monsanto	Bióloga	Laughing Bird / Fisheries Dept. Coastal Resources	Multicomplex Building, Princess Margaret Drive, Belize City	(501) 2244552	species@btl.net

GUATEMALA

#	NAME /NOMBRE	POST/CARGO	INSTITUTION/ INSTITUCION	ADDRESS/DIRECCION	TELEPHONE/ TELEFONO	EMAIL /CORREO ELECTRONICO
6	Fredy Aguilar	Director	Area de Protección Especial, Río Sarstún / FUNDAECO	Barrio Pueblo Nuevo, Livingston Izabal, Guatemala.	(502) 947-0790	fcostas@amigo.net.gt
7	Gustavo Madrid	Director	Región Izabal / CONAP		(502) 948-0055	
8	Mercedes Barrios	Sub-Directora	CECON / USAC	Av. Reforma 0-61 zona 10, Guatemala, Guatemala	(502) 361-5450	dircecon@usac.edu.gt

HONDURAS

#	NAME /NOMBRE	POST/CARGO	INSTITUTION/ INSTITUCION	ADDRESS/DIRECCION	TELEPHONE/ TELEFONO	EMAIL /CORREO ELECTRONICO
9	Mario Suarez	Representante	AFECOHDEFOR		(504) 556-8503	
10	Jaime Andrés Rojas	Director	BICA Utila Turtle Harbor	Edif. Cooper, 2do nivel, Coxen Hole, Roatán Honduras.	(504)425-3275 ó (504)445-1424	bica@hondutel.hn
11	Carlos García	Jefe Departamento	Dirección Gral. Biodiversidad	200 mts. Sur Estadio Nacional, Tegucigalpa MdC, Secretaría de Recursos Naturales, Honduras.	(504) 235-4895	dibio@sdnhon.org.hn
12	Adrian Oviedo	Director Ejecutivo	Fundación Hondureña para los Arrecifes Coralinos (Cayos Cochinos)		(504)443-4075 (504)442-2670	

MEXICO

#	NAME /NOMBRE	POST/CARGO	INSTITUTION/ INSTITUCION	ADDRESS/DIRECCION	TELEPHONE/ TELEFONO	EMAIL /CORREO ELECTRONICO
13	Ricardo Briceño Millán	Docente / Investigador	Universidad de Quintana Roo	Blvd. Bahía s/n Esquina Ignacio Comonfort, Chetumal, Quintana Roo, México.	(52) 983-50327	rich@correo.uqroo.mx
14	Víctor Manuel Hernández	Director	Santuario de Manatí / CONANP	Blvd. Kukulcan KM 4.8 Zona Hotelera 77500 Cancun, Q. Roo Mexico	(52) 998-849-7525	santmanati@hotmail.com
15	Mercedes Sánchez Sandoval	Representante	Reserva de la Biósfera Banco Chinchorro./ CONANP	Blvd. Kukulcan KM 4.8 Zona Hotelera 77500 Cancun, Q. Roo Mexico	(52) 998-849-4852	chinchor@prodigy.net.mx
16	Maricarmen García Rivas	Coordinación Nacional Yucatán	Región XI CONANP	Blvd. Kukulcan KM 4.8 Zona Hotelera 77500 Cancun, Q. Roo Mexico	(52) 998-849-7554	xiregion@conanp.gob.mx

EQUIPO DEL PROYECTO SAM

#	NAME / NOMBRE	POST/CARGO	INSTITUTION/ INSTITUCION	ADDRESS/DIRECCION	TELEPHONE/ TELEFONO	EMAIL /CORREO ELECTRONICO
17	Oscar Lara	Especialista en el Manejo de Recursos Naturales	Sistema Arrecifal Mesoamericano	Coastal Resources Multicomplex Building, Princess Margaret Drive, P.O. Box 93, Belize City, Belize	(501) 22-33895 (501) 22-34561	oflara@mbrs.org.bz
18	Alejandro Arrivillaga	Consultor Internacional	Sistema Arrecifal Mesoamericano	Coastal Resources Multicomplex Building, Princess Margaret Drive, P.O. Box 93, Belize City, Belize	(501) 223-3895 (501) 223-4561	mbrs@btl.net ; aarrivi@lsu.edu

APPENDIX 3.

Pre course evaluation.

Name (optional): _____

1. Define MPA.

2. The two major elements in seawater.

3. What does “The Tragedy of the Commons” refers to?

4. List two reasons for establishing an MPA.

5. Difference between pelagic and benthic.

6. List two important marine resource stakeholder groups and rank them.

7. List the most important uses of marine and coastal resources and rank them.

APPENDIX 4.

Planning and Design of Management Plans for Marine Protected Areas
COURSE EVALUATION FORM

Course Content

A. The planned objectives were reached:
1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

B. The program objectives were adequate:
1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

C. I had great expectations for this course:
1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

D. I am satisfied with this course, considering my initial expectations:
1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

E. The course was well organized:
1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

Some of the following questions are classified on a scale. Please show your choice by circling the adequate number: 1=Very bad (or very little) to 5=very good (or very much)

General Overview

A. How much value did the course represent to you?
1 2 3 4 5

B. The course's format was:
1 2 3 4 5

C. The presentations were:
I 2 3 4 5

D. The interaction with the trainer was:
1 2 3 4 5

E. The interaction with other participants was:
1 2 3 4 5

F. How adequate was the course material to you?
1 2 3 4 5

G. Was the programming of activities clear?
1 2 3 4 5

Results

A. Will the material learned help in your work?

1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

B Were you able to identify solutions to existing problems?

1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

C. Contacts with new colleagues were established:

1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

D. More collaboration among colleagues will be possible in the future:

1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

E. New ways to do things were learned in the course:

1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

F. You will bring improvements upon return to your country:

1. Strongly agree 2. Agree 3. Disagree 4. Strongly disagree

Program facilities

A. Daily planning was:
1 2 3 4 5

B Lodging was:
1 2 3 4 5

C. Coffee breaks were:
1 2 3 4 5

D. Visual aids were adequate:
1 2 3 4 5

E. Course instructor quality was:
1 2 3 4 5

F. Course duration was adequate:
1 2 3 4 5

G. It was worth taking time off work to attend to the course:
1 2 3 4 5

Section 6: Observations

Please, make comments that could improve future courses.

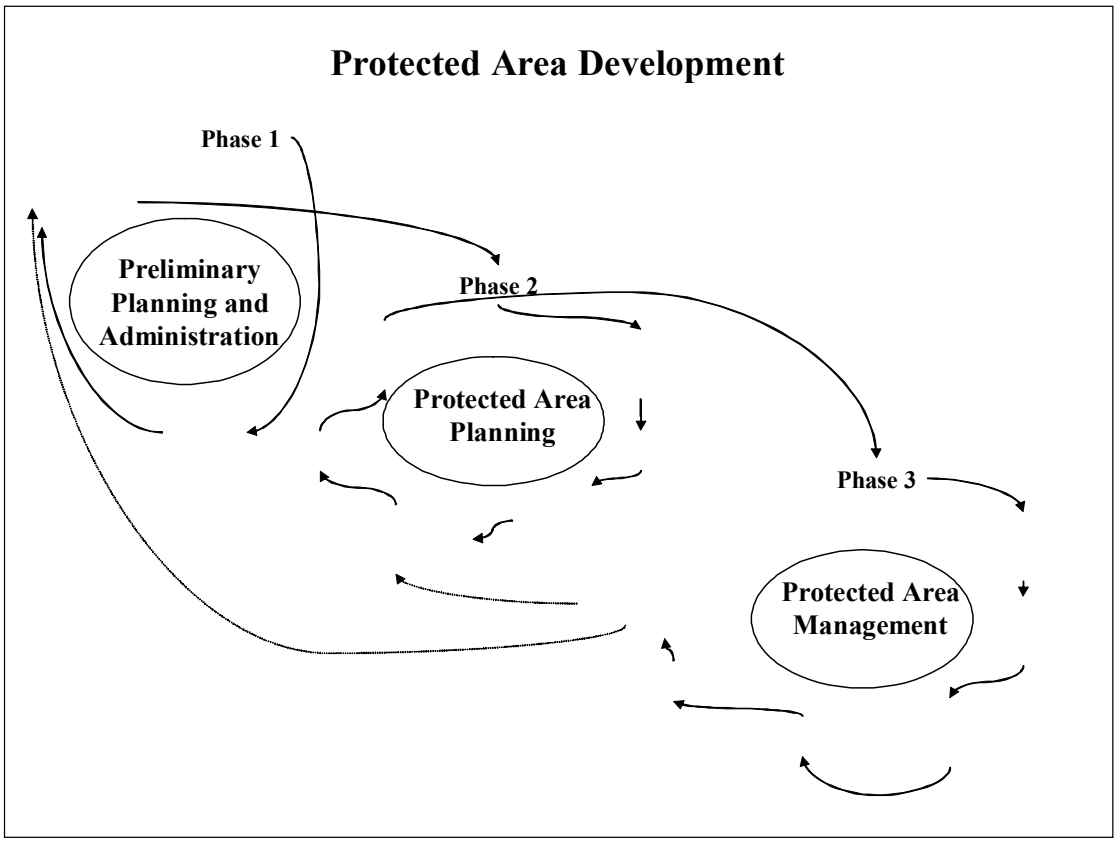
What were the course strong points?

Any course weak points and how would you change them?

4. Please add any other comment that you would like MBRS to consider:

APPENDIX 5.

End of Course exam: place the different steps involved in the development of a marine protected area in the "right" order. Explain why you think this should be the appropriate order.



5 Legislation

6 Management Plan

7 Education and Interpretation

12 Monitoring

10 Ranger Training

3 Policy

13 Criteria and Site selection

14 Site survey

8 Area Demarcation

2 Classification And Mapping

1 Program Objectives

4 Research

9 Survey

11 Review & Evaluation

APPENDIX 6.

MPAs in the MBRS Region

Management Plans Status Information Form:

1. Name of the area (and category designation):
   Nombre del area (categoría de manejo)

2. Location (state, country, nearby cities):
   Localización (departamento o estado, país, ciudades cercanas)

3. Organization (s) responsible for management:
   Organizacion (es) responsables del manejo

4. Is this a bi- or tri-national conservation area?
   ¿Area bi o tri nacional de conservación?

5. Date of official MPA designation:
   Fecha en que fue oficialmente designada

6. Date original management plan created:
   Fecha en que el plan de manejo original fue elaborado

7. Has the original management plan being revised? When?
   ¿Ha sido revisado el plan de manejo original? ¿Cuándo?

8. Who can provide area information?
   ¿Quien puede proporcionar mayor información?

APPENDIX 7.

MPA visit assignment

EXCERCISE

Travel to a local marine protected area with the assignment of interviewing employees about their understanding of, and importance to, the mission of the MPA.

WORKSHOP

Round table discussion about the results of their interviews and how they would change the management of employees to improve productivity and employee moral.