

**TRAINING OF TRAINERS
ON MARINE PROTECTED AREAS
MANAGEMENT IN THE CARIBBEAN**



Manual

Training of trainers on marine protected areas management in the Caribbean



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FOREWORD OF THE FIRST EDITION

UNEP Caribbean Environment Programme (UNEP-CEP) implemented its regional training programme under the Protocol Concerning Specially Protected Areas and Wildlife (SPA) in 1998. The focus for this first step was based on the objectives of the Caribbean Environment Network Project, which was implemented under the sub-programme for Conservation and Sustainable Use of Major Ecosystems in the Wider Caribbean Region. This training course builds on the previous ones by focusing on managers and other senior personnel associated with marine protected areas (MPAs), and preparing those persons to conduct training sessions in marine ecosystem/protected areas management.

At the International Workshop on Framework for Future Training in Marine and Coastal Protected Area Management organised by the Coastal Zone Management Centre (CZMC) in 1997 and held in Manila, the need for training of trainers and development of training

modules for MPA training was strongly endorsed by the participants. Motivated by these recommendations, the CZMC supported the Regional Coordinating Unit of UNEP-CEP (UNEP-CAR/RCU) in the preparation of this manual for training of trainers in MPA management.

The CZMC is greatly encouraged by the significant effort made by the UNEP-CAR/RCU to enhance capacity for MPA management within the region and are happy to have had the opportunity to cooperate and support the activities of UNEP-CAR/RCU. Financial support for the production of this manual was provided by the Netherlands Ministry of Transport, Public Works and Water Management under the Netherlands Government Programme to support the implementation of the Action Programme of the Jakarta Mandate of the Convention on Biodiversity.

We recognise that training of trainers is the key to ensuring that a corps of skilled persons is available for the management of MPAs. These modules have been developed by specialists from the region incorporating regional experiences and are an important resource for establishing a core of trainers who can address the MPA training needs of the Caribbean region. We are proud to present this manual, and hope that it will be widely used within the region in the coming years. Capacity building requires long term commitments. It is therefore our hope that long term regional training programmes to sustain the continuous and increasing demand for trained MPA personnel will be in place in the near future.

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FOREWORD OF THE SECOND (2007) EDITION

Since its creation in 1999 until 2007, the Training the training program for MPA managers of the Caribbean” implemented 6 regional courses, namely:

- Saba, Netherland Antilles, November, 1999;
- Bayahibe, Dominican Republic (Parque Nacional del Este), May, 2000;
- Soufriere, St. Lucia (Soufriere Marine Management Area), November, 2002
- Long Key, Florida Keys, USA. (Florida Keys National Marine Sanctuary), in February 2004, and March, 2006
- Tulum, México (Sian Ka’an Biosphere Reserve and World Heritage Site) in September 2007.

Each of those courses was attended by 12 to 18 MPA managers of the wider Caribbean countries and territories, namely, U.S.A., Cuba, The Bahamas, Puerto Rico, Jamaica, Dominican Republic, Haiti, Netherland Antilles, Antigua and Barbuda, Anguilla, St. Lucia, Guadeloupe, Grenada, St. Vicente and the Grenadines, French Guyana, Barbados, Trinidad and Tobago, Belize, Guatemala, Panama, Honduras, Nicaragua, Costa Rica, Colombia, and Venezuela). Overall, ca. 600 professionals involved in MPA management and planning but also from environmental management agencies, conservation NGOs, and academia) benefitted from the classes imparted by instructors and invited lecturers. They also had the opportunity to get familiar with the biophysical and socioeconomic conditions of the marine protected area that served as the course venue and network with both their course mates and the instructors.

Based on the experiences gathered and lesson learned during the courses, and in correspondence with the recommendations made by Experts reviewers of the overall program, UNEP-CEP commissioned a revision and updating of this Manual to make it more suitable to the current conditions of MPAs in the Caribbean region.

This is the first revision of the Manual and it is at the disposition of those interested in implementing training courses, seminars, workshops or lectures for MPA managers and other stakeholders, but also to be sued as a consultation on MPA design, planning, management and research.

Hollywood, Florida, December, 2007

<p>Dr. Georgina Bustamante Manual reviewer Regional course coordinator in 2000, 2004, 2006 and 2007</p>	<p>Heidi Savelli Soderberg UNEP-CEP Programme Officer Caribbean Environment Programme (CEP) United Nations Environment Programme (UNEP), Regional Coordinating Unit (RCU)</p>
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Special thanks are extended to the persons who collaborated in the preparation of the different modules: Daniel Suman, Richard Curry, Brenda Lanzendorf, Tighe Geoghegan, Nicole Brown, Yves Renard, Lovette Byfield, Norman Hall, Tom van't Hof, Lloyd Gardner, and Dr. Georgina Bustamante.

Sincere appreciation is also extended to the persons who provided peer review to the modules: Dr. Alida Ortiz, Ms Alessandra Vanzella-Khouri, Dr. Marjo Vierros, Mr. Tom van't Hof, Dr. Floyd Homer, Mr. Randy Curtis, Ms Stephanie Rust, Mr. Malden Miller, Ms Tighe Geoghegan, Ms Dianeetha Sadacharan, and Ms Agneta Nilsson.

The preparation of this manual would not have been possible without the support provided by the Coastal Zone Management Center (CZMC) in the Netherlands. The CZMC provided financial support for the manual and the Experts Meeting in December 1998, in which the course design was finalised. Centre staff has also participated in the Experts Meeting in December, provided editorial assistance with the manual, and provided input to the introductory section of the manual and the design of the evaluation forms.

The contributions by the UN Fund for International Partnerships, the US Government, The Nature Conservancy, NOAA National Sanctuary Program, John D. and Catherine T. MacArthur Foundation, and several others that contributed with logistics resources, expertise and lecturers to enrich the 2000, 2004, 2006 and 2007 courses' experience. Hereafter a list of individuals that provided lectures and resources:

- Florida Keys National Marine Sanctuary (Billy Causey, David Score, Brian Keller, Fiona Wilmott, John Hallas)
- Environmental Mooring Bouys Inc. (Judy Hallas)
- Florida Fish and Wildlife Commission Fish and Wildlife Research Institute in Marathon (Robert Glazer, Alejandro Acosta, Gabriel Delgado, John Hunt, Major J.F. Skip Russo and enforcement officers)
- Environmental Defense (Ken Lindeman)
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- Instituto Universitario de Tulum (Joel Salazar y Telmo Ricalde)

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- Comisión de Áreas Naturales Protegidas de México, Yucatán Region (Alfredo Arellano, José Juan Domínguez)
 - Reserva de la Biosfera Sian Ka'an (Francisco Ursua, Omar Ortiz)
 - Instituto Tecnológico de Chetumal (Alejandro Medina Quej)
 - Miguel Ángel García (Oceanus A.C., México)
 - Bárbara Reveles and Arturo Romero (Energías Renovables, Chetumal, México)
 - Amigos de Sian Ka'an, México (Albert Franqueza)
 - Fundación Orígenes (Gladys Pérez)
 - Joel Salazar y Telmo Ericalde (Instituto Universitario Tulúm, México)
 - Carlos García Sáez
 - Cooperativa Pesquera y Turística Vigía Chico, Punta Allen, México

INTRODUCTION TO THE MANUAL

This manual has been prepared by UNEP-Caribbean Environment Programme, Regional Coordinating Unit (UNEP/CAR-RCU) as part of the training initiative under the UNEP-CEP's Regional Programme on Specially Protected Areas and Wildlife (SPAW Programme). The manual was designed to be used in support of the "Training of Trainers" programme, in which MPA managers are given the training skills to train others at the local level.

The manual contains eight modules, covering the range of issues most pertinent to MPA management in the Caribbean.

Module 1: Training and communication skills

Forms the core of the course, in introducing the participant to theories of adult education, training techniques, and guidelines for communicating with different groups.

Module 2: The marine environment of the Wider Caribbean

Provides an overview of the biophysical characteristics of the Caribbean Sea and the Gulf of Mexico, marine ecosystems, and the features that make the Wider Caribbean a system of ecoregions.

Module 3: Uses and threats to the marine environment

Identifies the uses and threats to marine resources, and puts these within the context of the national development planning and general environment management scenarios.

Module 4: Marine protected areas overview

Provides a historical overview of marine protected area programmes within the Caribbean, including identification of the main relevant issues.

Module 5: Participatory planning

Introduces the concept and practice of participatory planning, covering areas such as stakeholder analysis, strategies and mechanisms for stakeholder involvement, conflict management, and collaborative management.

Module 6: Marine protected area planning

Provides the rationale and guidelines for marine protected area planning, emphasising the need to place protected area planning within the context of national environmental management objectives.

Module 7: Marine protected area management

Introduces the basic principles of management, and shows how these are applied in the context of marine protected area management.

Module 8: Research and monitoring

Discusses the rationale for research and monitoring, highlighting the need for information to cover socio-economic as well as biological parameters. Specific methods are also given for monitoring of critical biological resources, such as coral reefs.

This manual is meant to be used during the courses on training of trainers, as well as by the "new" trainers in the implementation of their own local training courses. As such, the manual provides the following:

- Guidance on how to convey important concepts to selected target audiences;
- Basic instructions for the prospective tutors;
- Background notes as supporting material; and
- Bibliographical references.

The structure of the manual allows for flexibility in undertaking future training opportunities, by utilising a modular format. This flexibility therefore facilitates targeting of groups with different levels of formal education, courses with particular emphases, and varying time availability of potential participants. Although the regional courses have had a 12-day duration, the variety of the subjects covered allows for a lengthier course, 15 days or more, depending on how long time you assign to field trips and study cases analysis. The depth and academic level of the course makes it adequate to be also imparted at colleges and university graduate programs on natural resources management.

Although the Manual was structured to serve as a teaching text, the wealth of information makes it an ideal source of information for consultation by researchers, educators, planners, managers and regulators related to coastal management and protected areas.

The bibliographic lists in each Module as well as in the accompanying information package, allow instructors and trainees to get information for illustrating concepts and experiences, and elaborate "study cases". However, **the experience of the 6 regional courses suggests that the best way to illustrate and convey lessons is to use as study cases example based on the instructors experience, the course venue and the very MPAs where the trainees come from.**

BACKGROUND

It has been determined that approximately 300 marine and coastal protected areas have been established or proposed in the Wider Caribbean Region. Of these, it is estimated that approximately 70% are inadequately managed or lack management entirely, yet many of these sites have been officially declared for more than 20 years.

The Governments of the Caribbean, at several intergovernmental and ministerial consultations, have identified marine protected areas as important mechanisms to achieving marine biodiversity conservation objectives, as well as supporting the increasingly important tourism product (Cartagena Convention Contracting Parties Meetings 1994 and 1997; SIDS Programme of Action Ministers Meeting, Trinidad 1997; Meeting of Ministers of Latin America and the Caribbean, Peru 1997). Though the level of declaration indicates the interest of governments and peoples in protecting important coastal and marine resources, greater efforts must be made to ensure adequate management in order to meet the objectives for which such areas were established.

Past surveys and regional consultations have concluded that inadequate human and financial resources are the major recurring problems of protected area management. It is therefore generally agreed that adequately trained personnel, and the generation of revenue, are the two greatest needs.

Various attempts have been made, by different regional institutions, to develop training activities in support of marine protected area (MPA) management in the region. However, these efforts have been sporadic, thematic, and not implemented in a systematic manner. Training provided through these efforts has been limited to a small number of individuals, and the expected multiplier effect has not been produced.

To address this problem in a more systematic manner, UNEP-CEP therefore developed this "training of trainers" programme for marine protected area management. This programme was developed through a long process of consultation and collaboration with MPA managers, governments, regional institutions, and relevant training institutions. This programme consists of comprehensive training courses in all aspects of MPA management, including their financing and development of appropriate revenue generation mechanisms.

The focus and outline for this two-week course in Training of Trainers in Marine Protected Area Management was refined during the "Experts Consultation to Review and Finalise Materials for Marine Protected Area Training in the Wider Caribbean", Kingston, December 9-11, 1998. The first edition of the Manual was tested at all regional courses, starting from

the first one in Saba, Netherland Antilles, November, 1999, and then again in Parque Nacional de Este, Bayahibe, Dominican Republic, May, 2000, Soufriere, St. Lucia, November, 2002; Long Key, Florida Keys National Marine Sanctuary (February, 2004, and March, 2006). This second version was used during the 6th regional course held in Tulum, México, in September 2007.

LIST OF ACRONYMS

CBD	Convention on Biological Diversity
GIS	Geographic Information System
GPS	Global Positioning System
ICAM	Integrated Coastal Area Management
IUCN	The World Conservation Union
LAC	Limits of Acceptable Change
MOU	Memorandum of Understanding
MPA	Marine Protected Area
NGO	Non-governmental Organisation
SPAW	Specially Protected Areas and Wildlife
UNEP	United Nations Environment Programme
UNEP/CAR-RCU	UNEP-Caribbean Environment Programme, Regional Coordinating Unit

MODULE 1**TRAINING AND COMMUNICATION SKILLS****OBJECTIVES**

1. To expose participants to the importance of combining training methods to increase their ability to achieve learning objectives and conduct training
2. To assist participants to understand the process of communication and in order to communicate effectively.

THEMES

1. Principles of adult education
2. Needs Assessment – Institutional and Individual
3. Designing training programme for local Context
4. Planning and Preparation for Training Session
5. Evaluation and Follow-up
6. Process of communication
7. Listening skills (verbal and non-verbal, group, and Internet communication, social marketing strategies,
8. Presentation Skills

DELIVERY TIME

2.5 days (20 hrs)

MODULE 1	TRAINING AND COMMUNICATION SKILLS
THEME 1	Principles of adult education
OBJECTIVE	Trainees will be able to; explain the principles of adult education, identify the advantages and disadvantages of different training methods, and select appropriate methods relevant to the audience
MATERIALS/ EQUIPMENT	Flip chart easel, paper, markers, digital projector, Table 1 – Principles of Adult Education, Module1_1.ppt
PRESENTATION	Lecture, group discussion. role-play
TIME	1.5 h

INTRODUCTION

Adults will learn what they want to learn. They learn best by doing and by working in an environment that is non-threatening, informal, and involves their participation. For these reasons trainers should emphasize training methods, which provide variety, enhance motivation and allow active participation in activities which facilitate learning.

The Trainer, using flip chart paper, will discuss with trainees their experience with adult learning. Following the discussion, the trainer will present the principles of adult learning. Some of these are:

- ◆ **Adults must want to learn;**
- ◆ **Adults learn best when they see a need to learn, they want to learn something from each session;**
- ◆ **Adults learn best from active involvement;**
- ◆ **Adults learn by realistic problems, experience is a factor in Adult learning;**
- ◆ **Adults learn best in an informal environment;**
- ◆ **Adults respond well to a variety of teaching methods;**
- ◆ **Adults are out of the learning habit;**
- ◆ **Adults want guidance not certificates;**
- ◆ **Adults have many other pressing interests; and**
- ◆ **Teamwork in small group works best. Trainer will explain briefly each principle.**

Designing a successful training lesson involves selecting a training strategy. The strategy outlines the method or combination of methods used to facilitate the learning process. The appropriate selection of a strategy will do more to promote the effectiveness of training than any other measure.

Two factors especially relevant when selecting a training method are compatibility and variation. That is, the trainer must select the strategy, compatible to the objectives of the programme, and the trainer should have a repertoire of training methods.

Some of the more effective training methods are:

- ◆ Lesson, Lecture Presentation, Demonstration;
- ◆ Individual (Programmed) Learning, Group Discussion; and
- ◆ Brainstorming, Case Study, Exercise and Role Play

The Trainer will explain each method, and explore advantages and disadvantages through discussion with participants. (See Appendix 1.2)

The Trainer will select a teaching method.(e.g. Role Play) to demonstrate its effectiveness.

How is Role Play Done

When you role play, a situation is described for you. It could cover what has happened What is to happen in the future, and the role players are to take.

Role plays do not have scripts or detailed directions. The role players use the information they have about the situation, their own experience, and their ways of behaving when they play the role.

Role play tips for Trainers:

- a. The Trainer must be skillful to ensure that participants feel relaxed and should make sure the role play is friendly and informal. Trainer should encourage players to be creative and imaginative.
- b. When processing role play, the Trainer should process the information, the attitudes and concerns, and lessons learnt. Example, what did you learn from the role-play? What did you like about the interaction?
- c. Trainer should draw participants' attention back to the objectives or main point the role-play was designed to demonstrate.

EXERCISE

Trainees will be divided into groups and assigned situations to role play. At least two groups of volunteers will be asked to present their role play to the large group.

The trainer should lead a discussion on the strength and weaknesses of the role play as presented by the group.

MODULE 1	TRAINING AND COMMUNICATION SKILLS
THEME 2	Needs Assessment – Institutional and Individual
OBJECTIVE	<ul style="list-style-type: none"> ◆ Trainees will be able to define the concept of Needs Assessment ◆ Trainees will be able to identify the methods of Needs Assessment
MATERIALS/ EQUIPMENT	Flip chart easel, paper, markers, digital projector, Appendices 1.3, 1.4 “Techniques of Assessing Training Needs”
PRESENTATION	Lecture, group work
TIME	1.5 h

INTRODUCTION

The Trainer will introduce the concept of needs assessment. Some needs are obvious. Existence of certain training needs can be accepted on the basis of common sense and reason without extensive surveys or analysis. However, some kinds of needs assessment is a practical necessity when planning a training programme. A needs assessment therefore is an exercise which is undertaken to determine the needs (skills, knowledge, attitude, and behaviour) of an organization, community, or individual.

Careful assessment of a problem in the beginning can reduce the need for costly mid-course corrections.

In order to develop a training programme it is critical that an analysis of prevailing situation be undertaken. One should not rely on mere instinct or casual investigation. The person developing the training programme will need to ask some critical questions; such as:

1. What is the problem to be addressed?
2. Who is affected by it and how?
3. What activities have been used in addressing the problem?
4. Are other agencies or organization doing other things to help?
5. What can we say or do to eliminate the problem?
6. What do we want to accomplish?

Tools of Needs Assessment

The Trainer will then ask participants to state ways in which they have conducted needs assessment. These will be listed on the flip chart. Trainer will then explain the fundamentals of how to conduct needs assessment, including:

- ◆ Interview the persons involved;
- ◆ Study the reports, survey, statistics; and
- ◆ Observe the procedures and work situations

The Trainer will briefly present and discuss a list of needs assessment techniques (see Appendix 1.3), including:

- ◆ Interviewing;
- ◆ Questionnaires;
- ◆ Test for entry;
- ◆ Records and reports; and

- ◆ Group problem analysis.

EXERCISE

The Trainer will use matrix on transparency or flip chart paper to discuss with participants the advantages and limitations of each method. A completed matrix will be circulated to participants. (See Appendix 1.4)

MODULE 1	TRAINING AND COMMUNICATION SKILLS
THEME 3	Designing training programme for the local context
OBJECTIVE	Trainees will be able to identify critical factors in developing training programmes appropriate to the local context
MATERIALS/ EQUIPMENT	Flip chart easel, paper, markers, digital projector, Appendix 1.5
PRESENTATION	Lecture, group discussion, role-play
TIME	45 min

INTRODUCTION

The Trainer will remind participants that the training objective(s) forms the base of effective programme design. The trainer will present a guide to programme design on a transparency, participants will be asked to study and discuss. The guide will show some of the main considerations for programme design, including:

- ◆ The training objective;
- ◆ The audience that needs training;
- ◆ The content of the training;
- ◆ The learning materials to be developed;
- ◆ The appropriate training method to be used;
- ◆ The learning process to be used (i.e. visual, auditory, physical, emotional, conceptual, individual and group); and
- ◆ The evaluation criteria.

Trainees will be asked to identify a local situation for which they need to design a training programme. They will be asked to identify what specific factors should be considered when designing a training programme in this local context. The Trainer will explain that close attention should be given to the following specific factors for the local context:

1. Audience

- ◆ Literacy level;
- ◆ Age;
- ◆ Gender;
- ◆ Occupation;
- ◆ Income;
- ◆ Educational attainment;
- ◆ Family situation;
- ◆ Places of residence and work;
- ◆ Cultural characteristics;
- ◆ Attitudes;
- ◆ Opinions;
- ◆ Beliefs;
- ◆ Values; and
- ◆ Self appraisal and their personality traits.

2. Message – the sensitivity of the message the appropriateness of style, and the language.

3. Cultural peculiarities, the existing myths and practices

4. Channels to be used to reach the audience e.g. mass media, community folk medium

5. The existing structures and organizations within the particular local setting

6. The geographic location of the group, community, or organization.

<p>MODULE 1</p>	<p>TRAINING AND COMMUNICATION SKILLS</p>
<p>THEME 4</p>	<p>Planning and preparation for the training session</p>
<p>OBJECTIVE</p>	<p>Trainees will be able to develop procedures for the selection of participants, venue, and materials for training sessions.</p>
<p>MATERIALS/ EQUIPMENT</p>	<p>Flip chart paper Graphic Illustrations</p>
<p>PRESENTATION</p>	<p>Lecture, group discussion, demonstration</p>
<p>TIME</p>	<p>1.5 h</p>

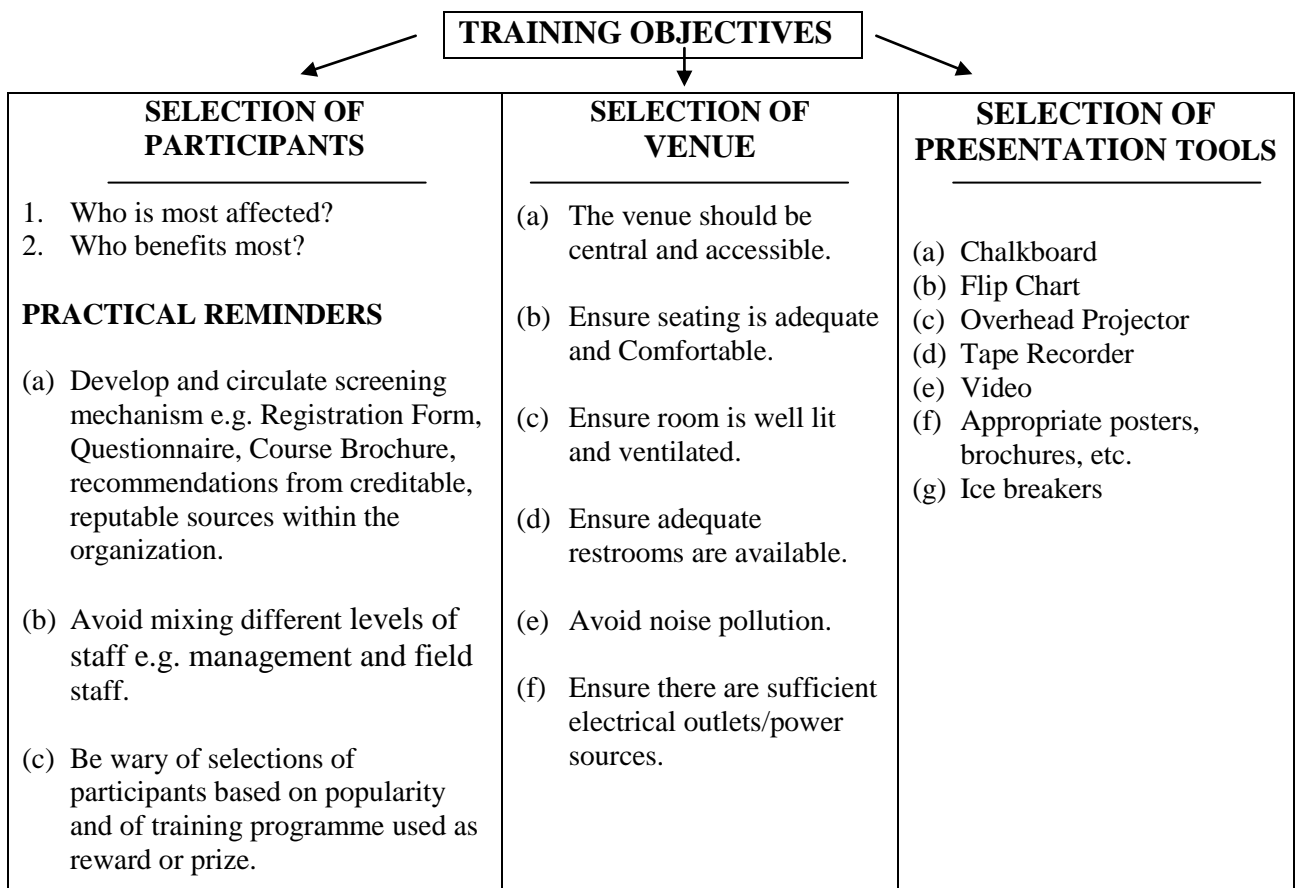
INTRODUCTION

Trainer will inform participants that in planning and preparing for a training session, the trainer needs to consider the training objectives; that is, what do I want to achieve? This is the guide used to determine the following:

- ◆ The selection of participants;
- ◆ The selection of venue; and
- ◆ The preparation of presentation tools.

These three components are inter-connected, and a skillful trainer must constantly work to maintain the right combination to achieve meaningful results.

The Trainer will present a graphic illustration to show the importance of each component and how they help to determine the achievement of the training objectives



It is important to remember that where these conditions do not exist, the skilful and versatile trainer should explore other creative solutions. See Handout # 4.

EXERCISE

The Trainer will ask for volunteer to demonstrate the use of a presentation tool, e.g. overhead projector.

Some Tips for Using the Projector

- ◆ Where are the electrical outlets?
- ◆ Is an extension cord needed?
- ◆ Do you know how to operate the digital projector?
- ◆ Has the projector been pre-focused and centered on the screen?
- ◆ Do you know how to operate the Powerpoint program?
- ◆ Is there a supply of blank transparencies available?
- ◆ Are felt tip pens available?

Do

- ◆ Leave some room lights on;
- ◆ Maintain good eye contact by facing the group while discussing transparencies;
- ◆ Use techniques such as sliding mask to control rate of presentation; and
- ◆ Touch your pointing device on the transparency.

Icebreakers

“Ice breakers’ and ‘energizers’ are games and exercises that can be used for developing trust and group interaction. The more trust there is between participants, and the more they know about each other, the more they will explore and learn.

MODULE 1	TRAINING AND COMMUNICATION SKILLS
THEME 5	Evaluation and follow up
OBJECTIVE	<ul style="list-style-type: none">◆ Trainees will be able to explain the principles of evaluation.◆ Trainees will be able to select and design an appropriate evaluation tool.
MATERIALS/ EQUIPMENT	Flip chart paper; digital projector, Appendix 1.5
PRESENTATION	Large group discussion, lecture/discussion, individual Assignment
TIME	2.5 h

INTRODUCTION

The Trainer will ask participants to identify a training course/programme/activity in which they have participated and to individually record the different ways in which it was beneficial to them. The participants will share their experiences with the group, these will be recorded on the flip chart. The trainer will lead a discussion of these comments in the large group.

Evaluation is not just a single act or event, but an entire process. It is an intrinsic part of the interrelated activities of determining needs, establishing objectives, conducting the programme, and measuring the results.

The evaluation process may begin with the initial phase of programme planning - that of studying past experiences. If the programme planner has conducted similar activities in the past, or if he can draw upon persons who have done so, a review of this past experience should serve as a guide for current efforts.

The Trainer will present the types of evaluation with the overhead transparency.

Process Evaluation

Process evaluation examines the procedures and task involved in implementing a programme or intervention.

Impact Evaluation

Impact evaluation is more comprehensive and focuses on long range results of the programme, or changes, or improvements in the status of the activity.

Outcome Evaluation

Outcome evaluation is used to obtain descriptive data in a project or programme and to document short-term results.

In conducting any of these evaluations, the following principles should be observed.

- (1) Evaluation should be an integral part of the planning phase of programme design;
- (2) Evaluation should contain an element of measurement that is inextricably linked to the learning objectives.
- (3) Evaluation should follow a systematic design and should include;
 - a. Who is to be evaluated;
 - b. How often the evaluation should be conducted, and what is to be evaluated;
 - c. What is the level or depth of the evaluation; and
 - d. What evaluation methods are most appropriate.

The Trainer will then ask participants to share evaluation methods they know. These will be listed on the flip chart.

The Trainer will provide additional methods that can be used to conduct evaluations and give the following guidelines for developing the questionnaire. The following points should be considered;

- a Determine what is to be found out - What important question are to be asked by participants;
- b Develop a form to include these questions;
- c Arrange the form for easy tabulation e.g. by using scales rating or checklist;
- d Provide a space for free comment; and
- e Decide to what extent participants will be asked to provide information about themselves. Generally it is better for responses to be anonymous.

Trainees should be asked to develop a questionnaire. See Appendix 1.6.

EXERCISE

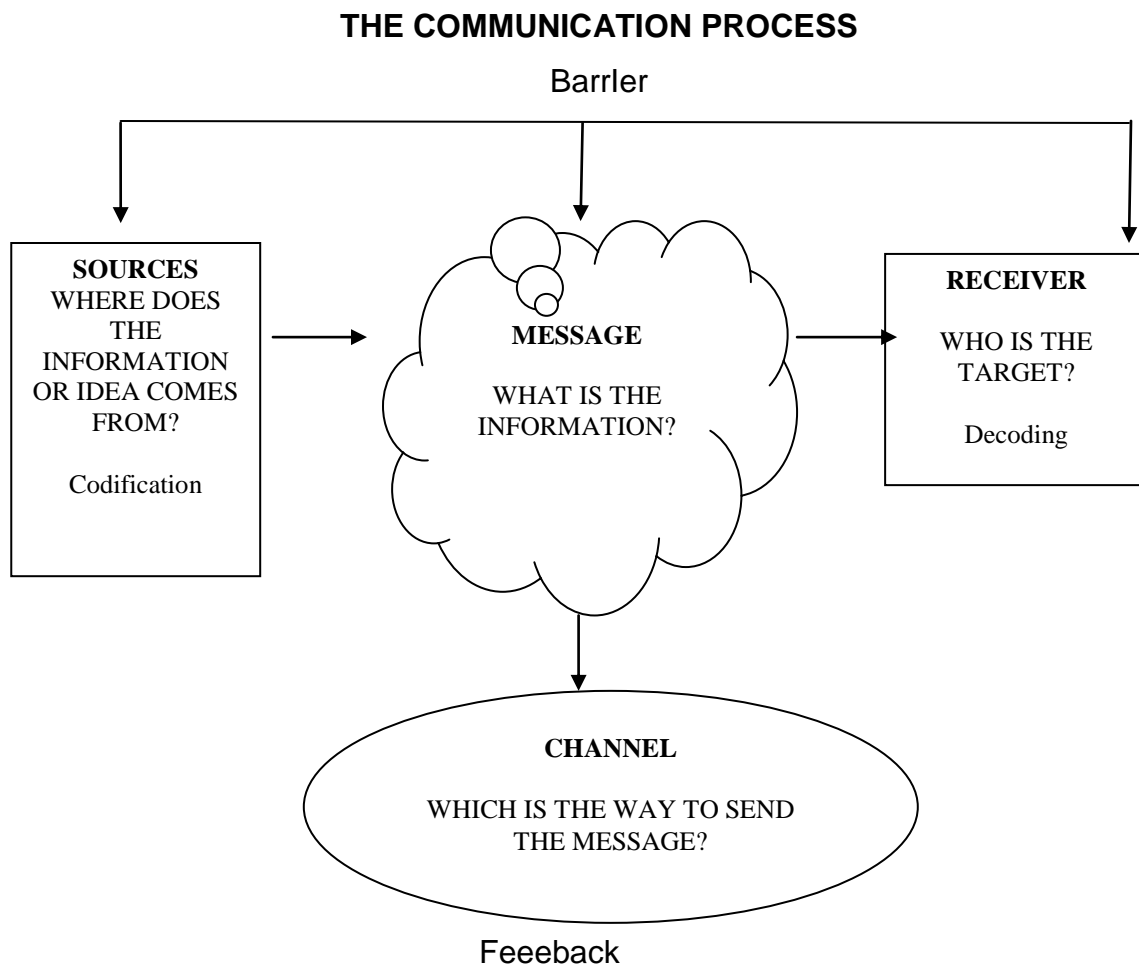
Trainees will be asked to develop a complete training programme using the concepts, principles, and techniques from this training module.

MODULE 1	TRAINING AND COMMUNICATION SKILLS
THEME 6	Process of communication
OBJECTIVE	<ul style="list-style-type: none">◆ Trainees will be able to explain the process of communication.◆ Trainees will be able to summarize the main barriers to communication.
MATERIALS/ EQUIPMENT	Overhead projector; digital projector; flip chart; Appendix 1.7, 1.8
PRESENTATION	Group discussion; lecture discussion; game
TIME	2.5 h

INTRODUCTION

Trainer will use the word of ‘mouth game’ to explain the process of communication. Trainees are asked to sit in a circle. The Trainer will whisper a message to one persons who will be asked to pass on the message exactly as he/she heard it to the person next to her/him. The person giving the message should say it only once.

The message is passed from person to person until it reaches the last person in the group. The Trainer will ask the last person to reveal to the group the message they received. The Trainer then asks the first person to reveal the message that he had sent. The Trainer will explain that the person sending the message is the source, the person who gets the message is the receiver. The Trainer will then use the simple graphic below on transparency to explain the elements of the communication process.



The Trainer will explain that the most common way to systematically look at the communication process is to resort to the well known paradigm by Harold Lasswell, “who says what, in which channel, to whom, with what effect”. **In every communication situation there is a Source, generating a message, which is transmitted through a channel to an audience receiver.** If the receiver responds overtly to the message, his response will be the first step to another communication process. He now becomes the source and this introduces the element of feedback. In small group, face to face communication where immediate feedback is possible, the communicator can see immediately (simultaneously) with his message how he is doing, how he is being understood, and if need be, can revamp his message or can repeat all or portions of it until misunderstandings have been eliminated. **Immediate feedback basically answers this question for the communicator: “How am I doing?” Delayed feedback answers the question: “How have I done?”**

The Trainer again refers to the “word of mouth” game and ask participants to give reasons for the changes in the messages, that is, why the source and the receiver did not have the same message. These will be listed on flip chart.

The Trainer will highlight some of the reasons why the communication was not effective, including; the clarity of the message, anxiety in sending or receiving the message, existence of any distractions (e.g. laughter, other noise), and the appropriateness of the language. The Trainer will point out that there are many barriers which can disrupt or frustrate the communication process. The two most important are referred to as “Noises”. Mechanical noise includes static in radio, snow on a screen, hums in a public address system, poor printing, coughing, or laughing by a audience.

Semantic noise is brought on when there is a breakdown in meaning or discordance in the message.

EXERCISE

The Trainer will provide a list of communication barriers and ask participants to add other barriers they have experienced. (Handout # 7)

MODULE 1	TRAINING AND COMMUNICATION SKILLS
THEME 7	Listening skills
OBJECTIVE	Trainees will be able to explain the role listening plays in effective communication
THEME 7.1	Verbal and non-verbal communication
OBJECTIVE	Trainees will be able to identify and demonstrate verbal and non-verbal means of communication
THEME 7.2	Group communication
OBJECTIVES	Trainees will be able to identify the principles of effective communication and demonstrate, through role play, ways of conducting group communication.
THEME 7.3	Communication via Internet social networks.
OBJECTIVE	To recognize the advantages and disadvantages of communication networks such as facebook, twitter, blogs and webinars to convene communities.
THEME 7.4	Social marketing strategies
OBJECTIVE	To learn about the social marketing strategies to promote and apply them to support its AMP
MATERIALS/ EQUIPMENT	Flip chart; role play scenarios; just-for-fun game; digital projector; Appendices 1.8, 1.9, 1.10
PRESENTATION	Brainstorming; large group discussion; role-play; demonstration; games
TIME	3 .5 h

INTRODUCTION

Listening Skills

The Trainer will conduct a game "Just for fun" to demonstrate the importance of listening in the communication process. The Trainer will read a statement and ask participants to listen carefully and identify what is wrong with the statement. Example, "An invisible car came out of nowhere, struck my vehicle, and vanished".

The Trainer will read four different statements. Trainees will be asked after each statement what they heard and what was understood. The Trainer will commend the participants who were able to identify the errors in the statements. The Trainer will point to the importance of developing sustained listening skills, through the practice of concentration and discipline. Some of the reasons we should listen are:

- ◆ Listening can solve problems;
- ◆ Listening can lead to better working relationships; and
- ◆ Listening helps you make better decisions.

EXERCISE

The Trainer will divide participants into pairs. In each pair, one person will be asked to play the role of the speaker the other the listener. The speaker will be asked to describe a real or fictional problem to the listener for 5 minutes. The listener may not speak at all, but must show good listening through non-verbal response i.e., eye contact, sympathetic facial expression, body language, towards the speaker. After 5 minutes let the pairs exchange roles. After the activity, the Trainer will lead a group discussion on the difficulties of playing the role of the listener.

The participants will be given some guidelines on good listening and ask to rate themselves. See Appendix 1.9.

7.1 Verbal and non-verbal communication

The Trainer will explain that people communicate not only with spoken and written languages but also with nods, handshakes, embraces, blows and hugs. Actions do indeed speak louder than, or as loud as, words in interpersonal communication. Trainees will be asked to identify and interpret some of the nonverbal signals they have noted among themselves; that is, the group members since the start of the session. These will be listed.

The group will be asked to comment on the interpretations of the non-verbal signals that were noted.

EXERCISE

The Trainer will write the statement on the flip chart. “I did not say you were a thief”, and ask for three (3) volunteers to interpret the phrase reflecting different emotions e.g., anger, boredom, and humor. The other trainees will be asked to identify which mood was being conveyed and what were the verbal and nonverbal signals they used to aid their interpretation.

The Trainer will remind the participants that verbal communication essentially relates to the:

1. Use of appropriate language; that is, language in which there is a shared meaning; and
2. A sensitivity or empathy between the sender and the receiver; that is, the awareness of talking “with” and not “at”, “down”, or “to” the receiver.

Trainees should be referred to Appendix 1.10.

EXERCISE

The participants will be divided into two groups and assigned two separate situations to role play, one using only nonverbal signs, and the other both verbal and nonverbal communication.

The Two Situations

- i. Conduct a meeting with a group of disgruntled fishermen who have been given new zoning areas for fishing and they are dissatisfied.
- ii. Conduct a meeting with a group of stakeholders regarding the establishment of a new marine park area.

7.2 Group communication

People spend a sizable fraction of their lives in small groups. Communication in these groups are no different than the practice in one to one, face to face communication. The group setting becomes more complex, because there are more people with their individual biases, prejudices, behaviours, and listening practices coming together and contributing to the dynamics of group communication.

Trainees will be asked to give their experience of group communication. These will be listed on flip chart paper. The Trainer will present some characteristics of group communication to which the participants should pay close attention. These include:

1. Persons who dominate the sessions, demonstrated by frequent question sand explanations and generally given to attention seeking;
2. Persons who are submissive. These persons try to hide in the large group, never ask questions, and never volunteer for any task.; and
3. Persons who make many jokes and see their role as providing comic relief. They tend to believe that this role absolves them from making any serious contribution to the group.

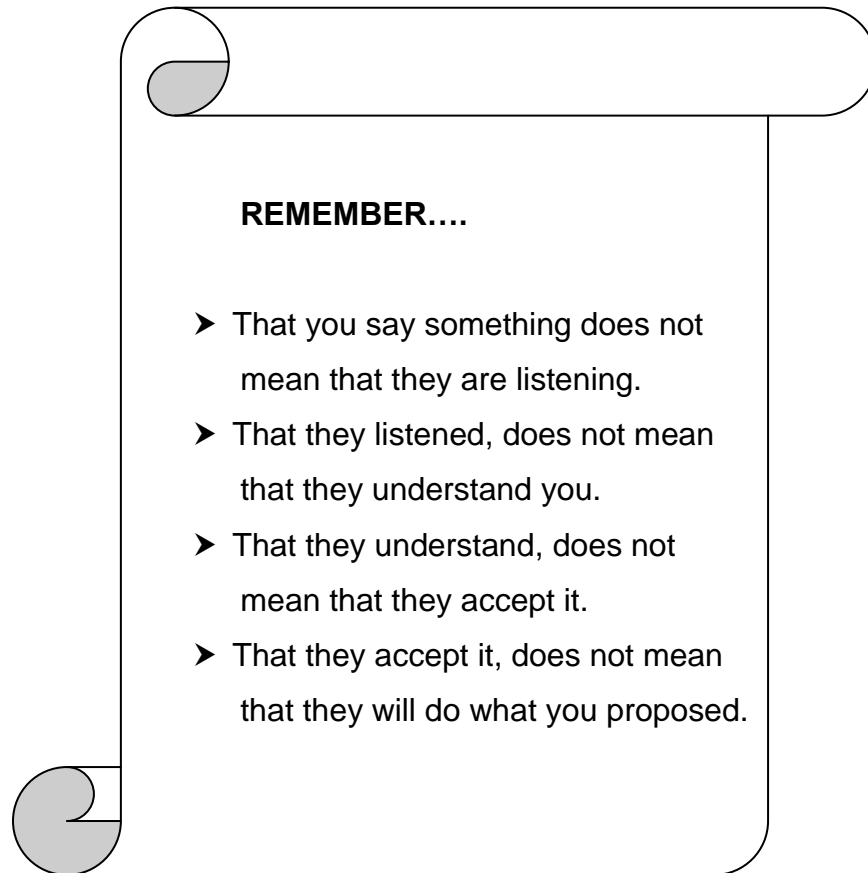
The Trainer will ask participants for suggestion to deal with these types in group communication.

Following this discussion, the Trainer will provide a list of suggestions to help address these types in group communication. Handout # 10.

EXERCISE

The Trainer will divide participants in small groups of 5 or 6 persons. The groups will be assigned topics. The group will be requested to prepare a role play, reflecting the examples and types of characters discussed in the session.

The Trainer will observe the presentation and look for the solutions used in the group communication.



7.3 Communication via Internet social networks

The use of the Internet and social networking formats that have emerged in recent years makes more flexible and immediate the contact with the community as we seek support for particular educational campaigns. In the field of social sciences, a social network is a social structure: a group of people linked together. They promote participation and collaboration among people; in other words, allow users to participate in a project online from anywhere in the world. A weblog or blog, is a web site that is regularly updated where comments, articles or items of one or more authors are collected chronologically, the most recent appearing first, where the author always retains the freedom to publish what he or she considers relevant.

For example, communicators and educators of the marine protected areas can establish a network to keep the community informed about the activities held and the natural events that occur at the site. Users may also use this channel of communication to inform the MPA staff on the changes and events observed during site visits. In this way, the scope of information may be significantly enhanced.

Other benefits of social networks are:

- It is possible to create a personal and/or virtual identity, as they allow users to share information with the rest of the social network.
- Facilitates relationships between people, avoiding all sorts of cultural and physical barriers.
- Facilitates the gathering of information at any time due to constant update.
- Facilitates comprehensive learning outside teaching environments, and allow the implementation of the concepts learned.

Some examples of social networks with greater potential for communication with MPA communities are the following:

- **Facebook:** It began as a college social network, but their marketing strategies have turned it into the most generalist social network in the world. It allows groups and pages, and tries to bring together people with common interests. In groups you can add photos, videos, messages, etc. The pages are created for specific purposes and unlike the groups do not contain discussion forums because they are directed towards specific brands or characters and not to any type of call.
- **Flickr:** The largest social networking and photo sharing amateur photography .
- **Skype:** Not just a social network, but a telephone service. It is very useful to hold conference call and meetings.
- **Twitter:** Social network for exchange of interests, specially, professional and literary through very short messages. The most common uses are for: monitoring of live events, webcasting of talks and presentations to which few people have access, exchange of views during an event in which people attend and public comments or discussions on movies or broadcast on television.

Because of the immediacy of communication offered by the Internet it becomes more essential to follow proper protocols and behaviors so that messages are effective and permanent.

CaMPAM Network & Forum (<http://campam.gcfi.org/campam.php>) is the communication portal of marine protected scientists and practitioners in the Wider Caribbean. It is hosted by

GCFI (www.gcfi.org) and supported by UNEP-CEP and partners. It allows the whole community to become familiar with the research, management and education initiatives of each country and internationally.

The website www.map.gov provides information on marine protected areas in the United States and allows a certain degree of communication among people interested in the subject.

Basic rules of etiquette for the use of Internet social networks in communication with the community, namely:

- As with the traditional effective communication strategies, the message that is intended to reach the community must be in clear and easily comprehensible language. Not all people are familiar with the cryptic and coded vocabulary that is developed by the social networks.
- Messages should be restricted to matters relating to the issue of conservation. Do not use the social network for personal matters between members.
- The sender of the message must be aware that others, outside their communication group, can read the information posted on the social networking site.

7.4 Social marketing strategies to promote support for the AMP

The field of social marketing offers some strategies that have been successfully applied in the areas of public health, energy conservation and recycling of solid waste, among others. Social marketing is the use of commercial marketing techniques to promote the adoption of a behavior to improve health or welfare of the public in question or the society as a whole. It requires a focus on customer satisfaction, market research and a systematic process to develop a marketing program. The adaptation of the content and strategies of social marketing for communication programs for the conservation and protection of natural resources in an AMP can be a great help. Social marketing strategies will strengthen the message targeted to behavior change and community support of the communication and education efforts resulting in a successful campaign.

Marketing or social marketing has five key components (5 Ps):

- **Product:** The desired behavior change
- **Price:** "costs" of adopting a new behavior
- **Place:** distribution channels to target groups
- **Promotion:** media mix used to reach target group
- **Participation:** the factor should be added for development purposes

Social marketing strategies may be used to:

- Develop awareness campaigns and public education.
- Create educational and promotional materials.
- Improve agency or organization services.
- Create new programs.

The social marketing process consists of five general phases or stages:

- *Planning*: This is the basis for the entire process. To ensure the effectiveness of the program it is necessary to understand the problem, the audiences targeted on the campaign and the environment in which the program operates. Controlled and meticulous research is essential in this phase.
- *Message development and relevant materials*: Use the information obtained from research in the design of the materials.
- *Validation or pre test*: Important to determine what strategies or methods can be successful and what not. There is a constant connection between the development phase and the pre test.
- *Implementation*: Introduction of the selected program to the public. It is important to monitor constant and consistently the public reaction to the message.
- *Evaluation and feedback*: The assessment of program impact taking into consideration public feedback. Evaluation is an ongoing process at all stages and not only at the end of the campaign. The following elements of the program need to be evaluated:
 - *Processes*: discusses the procedures and tasks involved in the execution of a program or procedure.
 - *Impacts*: focuses on the results on a larger scale of the program, or changes, or improvements in the state of the activity. It is more comprehensive.
 - *Results*: used to obtain descriptive data on a project or program and to document the short-term results.

The phase of evaluation and feedback is vital to the success of campaigns. It is at this stage where community reaction is continuously collected, especially, empathy and solidarity with the message and their willingness to compromise to achieve the objectives of conservation and natural resource protection.

MODULE 1	TRAINING AND COMMUNICATION SKILLS
THEME 8	Presentation skills
OBJECTIVE	Trainees will be able to list the main points of an effective presentation.
MATERIALS/ EQUIPMENT	Flip chart paper; marker; list of speaking topics; posters, slides, VCR/TV/Camcorder Appendix 1.11 – How to make visual aids
PRESENTATION	Discussion; demonstrations
TIME	2 h

INTRODUCTION

Trainees will be asked to describe presentation styles they have used. These will be discussed among the group.

The Trainer will explain that the style of presentation; that is, how the presenter acts, or presents oneself is almost as important as the content. The presenter needs to be aware of getting the audience to “sit up and take note” of what he says. Eye contact, posture, and hand gestures all contribute to your ability to impact the audience. Other important considerations of style are the creative pause; that is, stopping to take full breaths to regain your thoughts, posture, and stance are a sign of confidence and power. The use of your hands are important in helping to paint a visual picture. Your voice is your strongest asset for getting and holding the audience’s attention. Therefore it is important to be aware of the sounds coming out of your mouth.

Visual aids will also enhance your presentations.

EXERCISE 1.11

Trainees will be given topics to prepare and randomly selected to do a five minutes presentation to a large group. Trainees should use Handout # 11 to assist in their preparation. This presentation will be video taped.

This will be later played back for group analysis of content, style, and impact.

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APPENDIX 1.1: PRINCIPLES OF ADULT EDUCATION

1. Adults must want to learn. Parents may be able to influence children to learn by telling them they should, but adults must have a desire – a felt need to acquire knowledge – and usually for a specific goal.
2. Adults learn best when they see a need to learn. They tend to be practical in their approach to learning. They need to know how training will help them now.
3. They want to learn something from each session. They may become quickly impatient with too much theory, but like to think through and test. Allowing time for this process is well worthwhile.
4. Adults learn best from active involvement. They learn from the discussion of problems, finding solutions, and practicing a skill. They have extensive experience, and are often critical of new ideas.
5. Adults learn through realistic problems. Practical every-day issues that they meet in their work are the ones that will attract their best learning attention.
6. Experience is a factor in adult learning. Adults relate their learning to what they already know, and they expect that new knowledge should fit in with previous experience. Adults build their new learning on what is known.
7. Adults learn best in an informal environment. Most adults dislike class-room situations. Arrangement of room seating in discussion formats; choice of chairs and tables and generally a more relaxed environment usually bring good results.
8. Adults respond well to a variety of teaching methods, or presentations, particularly where these use various combinations of the senses for learning .
9. Honest dialogue among participants must take place
In adult learning, the facilitator learns from the participants when there is open dialogue in which honest sharing is taking place. The open dialogue, where the facilitator is learning and the participants are opening up, becomes the training content.
10. Teamwork in small groups works best
Adult training provides participants with opportunities to practice communication and team-building skills in small groups.

11. Sound Relationships and Clear Roles need to be Established

Adults learn best in a climate of mutual respect and trust. Everyone needs to know what is expected of trainers, participants, and the training. Each participant needs to know what he or she is expected to contribute and to gain from the training.

APPENDIX 1.2: DESCRIPTION OF TRAINING METHODS

Lectures

Usually, a lecture uses a fairly detailed set of notes. As such, lectures almost always involve a great deal of detailed preparation and planning beforehand. Most lectures are illustrated in one way or another. Audiovisual aids, such as slide projectors, overhead transparencies, flip charts, and videotapes, can add both clarity and interest to a presentation. Skillful lecturers also adjust their material and vocabulary to fit the needs and level of comprehension of a specific group. All successful lectures are well organized, to the point, relevant, and use enough examples, illustrations and humour to keep the audience interested.

Lectures and short presentations can be an effective training method when the objective is to convey information. Thus, when introducing a new subject, a short presentation can arouse the interest of trainees and explain what they will be expected to learn. In many cases, it is important to provide trainees with some basic facts and concepts as background for later activities. Trainers often make short presentations to provide an overview of a topic, and to review, clarify, emphasize or summarize a lesson. A lecture is also effective when there is not much time and when there is need to show the application of rules or concepts. When time is limited or a group is large, lectures are sometimes the only manageable alternative.

Demonstrations

The demonstration method has certain similarities with the lecture method. In both cases, telling plays a large part. In the case of the demonstration method, however, a considerable amount of time is also spent in showing trainees how to do something. It is highly visual as well as verbal.

In this method, the trainer has to impart not only knowledge, but also skill. Understanding is also important. Normally, some sort of procedure or task is involved. This might include demonstrating the steps involved in replacing a wheel on a car, showing how to balance a financial ledger, or demonstrating interviewing techniques for hiring new employees.

The underlying principle of a demonstration is that skill comes from seeing how something is done, then having the opportunity to practice and get feedback from trainers. Generally speaking, the demonstration begins with an explanation of what trainees should look for during the demonstration. As each step of the procedure is shown, it is important to stress its place in the sequence. This way, the skill will be seen as integrated activity, and not just a set of separate operations. Trainees then get the chance to practice for themselves. Feedback

from the trainer is important so that correct behaviours can be reinforced and errors can be corrected.

The demonstration method arouses trainee interest. As well, the pace is flexible and can easily be changed to the needs of the group. On the other hand, considerable time, effort, and expense may be required to set up an effective demonstration.

Group Discussions

The discussion method is trainee-oriented. Group discussions are generally informal, with a great deal of involvement, interaction, and sharing of experience. Trainees remember more because of their involvement. For this reason, the method is a very popular one with trainers and trainees alike.

Discussions are especially useful for solving problems, for exploring issues, for sharing experiences, and for making decisions. This process is one of the best ways to bring about a change in attitude on the part of trainees.

Discussions form part of many training lessons and virtually all participative instructional methods involve interaction with the group. It is therefore important for trainers to develop their skills in leading group discussions so that they can use this technique to explore differing opinions with trainees, to provide opportunities to share and develop ideas on the training material, and to discuss reactions to experiences and problems. However, discussion is time consuming and can be difficult to manage, especially in larger groups. Often, many viewpoints are presented and it can be difficult to keep a discussion on track. The trainer's ability to ask appropriate questions, to encourage participation, to summarize key points, and to limit unnecessary or lengthy dialogues are the keys to effective discussions.

Brainstorming

In this method, trainees produce as many ideas as they can in a short period of time. Quantity is what is desired. They should say anything that occurs to them, however silly it might sound. One person in the group writes down every idea, including the funny ones (these can often be quite revealing or good for climate building after the exercise). The one important rule is that trainees do not discuss or criticize any of the ideas brought forward. Since most of us have a tendency to judge what others say and to express our criticism, it is important for the trainer to carefully monitor each group and interrupt every time someone breaks this rule.

The principle of brainstorming is that ideas stimulate the development of other ideas. It is a creative process. Criticism stops this flow of ideas, whereas encouragement and time pressure increase the activity level. As such, brainstorming is a useful group discussion method for encouraging involvement, for developing ideas, and for finding out in a short space of time what a group knows or is thinking.

Case Studies

The case study method involves in-depth group discussion of real-life situations. It requires reading, study, analysis, discussion, and free exchange of ideas. As well, trainees make decisions and practice selling decisions to others.

The case study portrays a factual and accurate picture, based on firsthand observations, of a situation that portrays people acting, interacting and reacting. Trainees review the case study and discuss it in depth. They try to diagnose the problem(s) and develop solutions.

There are five important uses for the case method:

1. To promote discussion of the significant factors in a situation;
2. To develop judgement, critical thinking, and problem solving ability;
3. To learn important principles of management and leadership;
4. To build human relations skills; and
5. To learn to identify the meaningful events in a situation.

The process of developing and presenting one's own ideas is more interesting than listening to the ideas of a trainer. The results of the case discussion are generally more relevant to the experience of trainees because they reflect their own perceptions, attitudes, and feelings about the case. Ideas, concepts, and principles developed through case discussion are more likely to be retained by trainees. They become more aware of individual differences and gain new insight in their own ways of thinking, talking, listening, and making decisions.

However, a considerable amount of time is required for trainees to read, digest, and discuss all the material in case studies. The trainees' level of concentration must be consistently high if good results are to be achieved. In addition, a case situation can never fully reflect the changing quality of the real situation. It only presents a situation from one observer's point of view at a fixed point of time. Nonetheless, the case study method is one of the most popular classroom activities in business training.

Thus, case studies and examples provided by the trainees based on the own experience are recommended. This will help to capture trainees' attention and foster a richer discussion on the topics examined and a better learning.

Role playing

Role-playing can be described as real behaviour in an imaginary situation. Role-playing isn't acting a part or trying to behave as you think someone else would; it involves people being themselves in different situations. It is a good way to bridge the gap between the study of principles and techniques and the use of the same principles and techniques.

How is Role Play Done?

When you role-play a situation is described for you. It could cover what has just happened, or what is to happen in the immediate future, and the role the players are to take.

Because you don't have to act in any prescribed way, role-plays don't have scripts or detailed directions. The role players use the information they have about the situation, their own experience, and their ways of behaving when they play the role.

APPENDIX 1.3: TECHNIQUES OF ASSESSING TRAINING NEEDS

Some needs are obvious. Existence of certain training needs can be accepted on the basis of common sense and reason, without extensive survey or analysis. Training of some kind is a practical necessity for the growth and development of an individual or organization.

The trainer officer may make use of each, or all, of these methods in his inquiries:

INTERVIEW	Senior officer, supervisors, and field staff; use of questionnaires, tests and group discussion.
STUDY	Reports, surveys, statistics, and other management data.
OBSERVE	Procedure and work situations.

1. Interviewing

Interviewing is one of the most useful methods of obtaining information. More than any other method, interviews help the training officer to assess how interviewees feel about their work, and why. This information is crucial to the success of the training effort.

Interviewing is time-consuming and requires planning.

Naturally, the more skilled the interviewer, both in asking and interpreting responses, the more valuable are the facts he gathers. Try out the questions in advance, and revise them as necessary to ensure that they are correctly understood. Give interviewees time to talk, concentrate on listening to their replies and avoid pre-judging their opinions. Do not use these fact-finding interviews to interpret or sell you own ideas or educate interviewees on training matter.

Here are some questions you may want to ask.

- ◆ What is the specific purpose of the training?
- ◆ What staff groups are concerned?
- ◆ What are the principal subjects?
- ◆ Who can provide the knowledge and experience to give the training?
- ◆ What direct benefits should follow?

2. Use of questionnaires

In support of an interviewing plan, questionnaires can be used to obtain a wider sample of opinion on training needs.

These question sheets may have reference to a specific need, or to wider problems. They can be used to reach a large number of persons in a short time, and the method gives each recipient an opportunity to think about his problems and give considered replies. If the questions are carefully prepared, the information can be quickly processed and used for its training purpose.

Preparing a questionnaire can be a difficult task, and requires skill in the framing of the questions. A brief preliminary survey will help in defining the sort of questions that will give the information required, and a critical examination of the answers will give guidance in improving the form and the content of the questionnaire. The way in which supervisors and staff are informed about the purpose of the questionnaire is also important.

Once you have commenced interviewing staff, or requested help through questionnaire, interviewees will expect advice of findings and the training action to follow. In the initial stages of your survey, explain what you are attempting, and how their co-operation will assist them. Explain how the results of the survey will help to:

- ◆ Determine the training needs for the organization, or for the individual;
- ◆ Outline a training programme for urgent requirements; and
- ◆ Decide the extent of training resources needed to meet these needs.

3. Tests for entry to training

Tests of various kinds are sometimes useful in assessing training needs. Testing devices can be used to determine whether the cause of a recognised problem is due to a deficiency in knowledge, skill or attitude, and what sort of training should therefore be provided.

4. Workshops of supervisors

The use of workshops, in which selected groups of supervisors or executives analyse the problems of their organisations, is an excellent method of determining training needs and gaining cooperation.

This process, not only identifies training (among other) needs, but can be used to build a solid foundation of support for training, because the officers themselves reach agreement on the need for action and help to decide the training required.

Further, the process itself is sound training in analytical method and group discussion of mutual problems. The training officer gains maximum benefit from such workshops, if he facilitates the arrangement of meeting, helps in the clarification of objectives, and advises on the nature and extent of possible training benefits. He should avoid making value judgements or directing the workshop toward his own conclusions.

APPENDIX 1.4: TECHNIQUES OF ASSESSING TRAINING NEEDS

SUMMARY OF SOME METHODS USED IN DETERMINING TRAINING NEEDS

METHOD	ADVANTAGES	LIMITATIONS
Interviewing	Reveals feelings, causes and possible solutions of problems as well as facts. Affords maximum opportunity for free expression of opinion, giving of suggestions.	Is time-consuming, so can reach few people. Results may be difficult to quantify. Can make subject feel he is “on the spot.”
Questionnaire	Can reach many people in short time (e.g., via Internet) . Is relatively inexpensive Gives opportunity of expression without fear or embarrassment. Yields data easily summarized and reported.	Little provision for free expression of unanticipated responses May be difficult to construct Has limited effectiveness in getting at causes of problems and possible solutions
Test of entry	Are useful as diagnostic tools to identify specific areas of deficiencies. Helpful in selecting from among potential trainees those who can most profitably be trained. Results are easy to compare and report	Test validated for many specific situations often not available. Test validated elsewhere may prove invalid in new situations. Results give clues, are not conclusive. Tests are second-best evidence in relation to job performance.
Group problem analysis	Same as for interview plus: Permits synthesis of different viewpoints. Promotes general understanding and agreement. Builds support for needed training. Is in itself good training	Is time-consuming and initially expensive. Supervisors and executives may feel too busy to participate, want work done for them. Results may be difficult to quantify.
Job analysis and performance appraisal	Produces specific and precise information about jobs, performance. Is directly tied to actual jobs and to on-job performance. Breaks job into segments manageable both for training and for appraisal purposes.	Time-consuming. Difficult for people not specifically trained in job analysis techniques. Supervisors often dislike reviewing employees’ inadequacies with them personally. Reveals training needs of individuals but not those based on needs of organization.
Records and reports study	Provide excellent clues to trouble spots. Provide best objective evidence of results of problems Are usually of concern to and easily understood by operating officials.	Do not show causes of problems, or possible solutions. May not provide, enough cases (e.g. grievances) to be meaningful May not reflect current situation, recent changes.

APPENDIX 1.5: HOW TO DESIGN YOUR TRAINING PROGRAMME FOR THE LOCAL CONTEXT

Primary target audiences are those you want to affect in some way. Secondary target audiences are those with influence on the primary audience.

1. Determine the content of the training
2. Determine what audience needs what training
3. Why is the audience not performing the desired behaviour now?
 - ◆ If they cannot do it, train them to understand and perform it;
 - ◆ If they will not do it, provide motivation for them to change their attitude.
4. Determine the benefits of and barriers to adopting the new behaviour
5. Decide what behaviour is feasible
6. Determine what would reinforce the behaviour when adopted
7. Establish measurable training objectives
8. Define very clearly the content to be learned
9. Organize content for logical learning
10. Determine and develop learning materials
11. Develop materials presentations
12. Develop and organize administrative procedures
13. Analyze tasks and define the kinds of skills to be acquired or practices: reaction skills, perception skills, conceptual skills, application skills
14. Determine the learning process to be used: visual, auditory, physical, emotional, conceptual, practical, individual or group
15. Determine how participants will process and use new learning

16. Determine the most appropriate training media
17. Design evaluation criteria and instruments for the training
18. What resources are available? Include:
 - ◆ Staff and other ‘people’ resources committee members, associates from other programmes and volunteers;
 - ◆ Budget-funds and in kind resources such as computer time, mailing cost, printing;
 - ◆ Services available from another source; educational materials free or at cost;
 - ◆ Information – about the issue, the target audience, the community and media structure and available educational materials; AND
 - ◆ Time- the number of weeks, months or years available to complete the programme
19. What community activities, organizations, and or other contributing factors exists?
20. What barriers (such as approval obstacles, absence of funding, hard-to-reach target)
21. Which activities would best suit the resources you have identified and best fit within the identified constraints?

APPENDIX 1.6: EVALUATION

Evaluation is not just a single act or event, but an entire process. It is an intrinsic part of the interrelated activities of determine needs, establish objectives, conducting the programme and measure the results. The evaluation process may begin with the initial phase of programme planning - that of studying past experiences. If the programme planner has conducted similar activities in the past or if he can draw upon persons who have done so, a review of this past experience should serve as a guide for current efforts.

Such a review will indicate that certain material, methods, schedules, participants and so forth are more likely to produce effective results than others.

Evaluation also influences the selection of programme objectives. Choosing certain objectives as being more important or more feasible than others is an evaluation in itself. Whether or not the achievement of an objective can be evaluated should be kept in mind. However it is more important to consider, whether an objective is appropriate than whether it is easily measurable.

The Principles of Evaluation can serve as guidelines and can help the programme planner avoid some of the pitfalls encountered in evaluation.

- (1) Decisions about evaluation should be an integral part of the planning phase of programme design. To evaluate a training programme is to assess its value. Evaluation cannot be accomplished effectively unless the connection between the objectives of the programme and the evaluation procedures to be used are established in the planning stage.
- (2) Evaluation should contain an element of measurement. This is intricately linked to the learning objectives. This the learning objective will tell the programme manager what he is able to see or what he can expect participants to be doing when the objects have been reached.
- (3) Evaluation should follow systematic design should include the following:
 - (a) Who is to be evaluated? in most cases trainees or programme participants will be evaluated
 - (b) How often should evaluation be conducted? Evaluation should be conducted more than once. It is recommended that participant be evaluated before the programme begins, and again after it has been completed.
 - (c) What is to be evaluated? the basic choice is whether to evaluate the programme or the participants behaviour or performance

- (d) What is the level or depth of evaluation. Ideally evaluation should be carried out at more than one level and in more than one way i.e. reaction of participants should be learned as well as those of meeting leaders, coordinators, and the persons who are able to observe participants back on their jobs.
- (e) What evaluation methods are appropriate. Checklists and questionnaires to be filled out by programme participants are among the most frequently used methods of evaluation. However other methods may replace or supplement them.

Determining which method is appropriate depends largely on the type of learning outcome produced by the meeting or programme

APENDIX 1.7: THE PROCESS OF COMMUNICATION

The term “communication” comes from the Latin *communis* (common) or *communicare* (to establish a community or a commonness, or to share). At least it is clear that the term implies a sharing, a meeting of minds, a bringing about of a common set of symbols in the minds of the participants—in short, an understanding. Communication, then, as a process, is a two-way street; messages flow both ways, resulting in a participatory procedure, and shared responses. It should be reiterated here that we are considering communication as a process, not as a synonym for “message.” One may speak of a communication in the way he speaks of a message. In that sense there may be a communication without there being a receiver of the message. But when we speak of communication (a process), there must be both sender (communicator) and receiver (communicatee).

It is probably safe to say that the communication always requires four factors:

- I. Source
- II. Message
- III. Channel
- IV. Destination

When the source (communicator) has translated his mental message into symbolic stimuli (message), he channels it to the destination (communicatee) in some manner (medium or channel). If these stimuli (message) “get through” and are understood by the destination (communicatee is able to decode it), then the communication process is concluded. Most likely, if the communicatee does respond to the message overtly, his response will actually be the first step in another communicative process, he becoming now the communicator and his “response” being the new “stimulus” or message directed toward somebody else.

APPENDIX 1.8: BARRIERS TO COMMUNICATION

Effective communication implies communication where an understanding is established, where the message elicits in the receiver the response desired by the sender. In effective communication the message “gets through” to the communicatee and his meaning is very similar to that of the communicator. It is extremely difficult to achieve effective communication; in fact, many students of communication say it is really impossible. Many barriers exist to disrupt or frustrate communication. Probably the two most important are often referred to as “noises.” They are:

- ◆ Mechanical noise; and
- ◆ Semantic noise.

And they are at work in every type of communication situation.

Mechanical noise

This is often referred to as physical or channel noise. It is in most respects what laymen think of as “noise,” at least when related to the electronic media of mass communication or to oral interpersonal communication. For example, mechanical noise that would disrupt communication would be static on radio, “snow” or other screen distortion on television, hums in public-address systems, coughing or laughing by members of an audience. In the print media, examples of mechanical noise would be poor printing that results in illegibility, lines of type missing or upside down, torn pages, missing paragraphs or story continuations to the pages, or muddy or wet pages.

Semantic noise

This is, in a sense, not really noise at all. It is an interference with the message brought on by “meaning” discordance or breakdown. Semantic noise filters into a message through the language used. The more confusion there is among the participants in the communication situation over the “meaning” of terms and concepts, the more semantic noise there is in the message. Semantic noise results in misunderstanding. The participants, in effect, interpret the language of the message in different ways; therefore, they have differing meaning in their minds. They may have received the message very clearly, mechanically or phonetically-physically it got through loud and clear-but due to meaning difficulties (semantic noise) their communication has broken down.

Other barriers that tend to hinder or disrupt effective communication include:

- ◆ Wrong timing
- ◆ Divergent backgrounds of the participants
- ◆ Differences in education, formal and informal
- ◆ Differences in interest in the message
- ◆ Differences in IQ
- ◆ Differences in language levels and usage
- ◆ Lack of mutual respect among participants
- ◆ Difference in such factors as age, sex, race, class and culture
- ◆ Mental and/or physical stress at time of communication
- ◆ Environmental conditions at time of communication
- ◆ Little or no chance for “feedback” or interaction
- ◆ Little or no “experiential overlap” –few, if any, common experiences
- ◆ Lack of skill on part of communicator (poor writer or speaker)
- ◆ Lack of skill on part of communicatee (poor reader or listener)
- ◆ Lack of information in message (“empty” message)
- ◆ Lack of commitment in message or in policy behind it
- ◆ Inadequate preparation or insufficient knowledge of the subject
- ◆ Group political differences (protocol, etc.)
- ◆ Overpowering attitude of communicator
- ◆ Differences in language levels between source and audience

- ◆ Physical disabilities (speech, hearing, etc.)
- ◆ Inappropriate use of channel.

APPENDIX 1.9: GUIDELINES FOR LISTENING

1. You should prepare yourself physically by standing or facing the speaker. Making sure you can hear physically is essential for good listening. You thereby tell the sender that you are ready to listen and are able to hear the verbal messages and also see the nonverbal messages the speaker is sending. This face-to-face attention also shows that you are interested in what is being said..
2. You should learn to watch for the speaker's nonverbal as well as verbal messages. Everyone sends two messages. One message is sent verbally and the other is sent non-verbally through inflection in the voice or thorough facial expression, bodily action, or gestures.
3. You should not decide from the speaker's appearance or delivery that what he or she has to say is worthwhile.
4. You should listen for ideas and underlying feelings. Again, the purpose of good communication is to be able to reflect upon and exchange ideas.
5. You should try to determine your own biases, if any, and allow for them. Communication gets blamed for many things.
6. You should attempt to keep your mind on what the speaker is saying. Don't allow yourself to become distracted.
7. You should not interrupt immediately if you hear a statement that you feel is wrong. Indeed, if you listen closely, you may be persuaded that the statement is right.
8. You should try to see the situation from the other person's point of view. This doesn't mean that you always have to agree. However, there is no way that you can change other people's perceptions until you can see how they have formulated those perceptions.
9. You should not try to have the last word. Listen to what is being said and then think about it. This reflection may take some time, but you need time to think before you communicate.
10. You should make a conscientious effort to evaluate the logic and credibility of what you hear. Our mind functions at some 500 words a minute, but we normally speak at 125 words a minute. In other words, we can think four times faster than we speak.

There must be consistency between the verbal and non-verbal communication so that the receiver faithfully interprets the message.

The explicit	The implicit	Congruence	Inconsistency
Verbal: What I say Explicitly	The nonverbal - Tone, Voice - Facial Expression - Gestures "Body language"	The verbal matches with the non-verbal The four sides of the message point in the same direction.	The verbal does not match the non-verbal The four sides point in different directions

APPENDIX 1.10: VERBAL AND NON VERBAL COMMUNICATION

People communicate in many different ways. One of the most important ways of course, is through language.

Like all animals, people communicate by their actions as well as by the noises they make. It is perhaps true to say that our vocal noises have so far outgrown in importance and frequency, all our methods of signaling to one another.

For instance, children learn many things about their culture by aping or imitating their elders, long before their linguistic skills are far enough developed to understand verbal descriptions.

The use of clothing is avenue of obvious communication. Eye contact, the distance we observe in face to face communication, our smiles, handshakes, hugs and walk are all eloquent examples of non-verbal communication.

Then there is the other side of communication that is vocal, but nor really verbal. Examples of these are the spontaneous gasps of surprise or cries of pain. It is generally agreed that the way you say something is as important as what you say, and often more important for telling your listener about your real intentions.

Rapid and highly inflected speech usually communicates excitement, extremely distinct speech usually communicates anger, very loud speech usually communicates pomposity, and a slow monotone usually communicates boredom.

Verbal communication uses only one of the many kinds of signals that people use to exchange ideas, feelings, and information. Non-verbal behaviour can greatly reinforce or contradict the intended exchange. Understanding the communication process means we must try to understand what a person says, how he says it,, and why he says it.

Within this broad frame of reference we must recognize that both the verbal and non-verbal modes have their natural and complimentary roles to play in communication.

APPENDIX 1.11: EFFECTIVE GROUP COMMUNICATION

You will come across all types of audiences. Here are a few tips on how to deal with some of the people you will encounter in groups.

If you are challenged or for some reason greeted with a hostile question or remark, you may want to deflect the negativity by asking other groups members what their opinions are or what they think about it. Not only does it promote good ideas and lively discussion, it also diffuses latent hostility in the advocate very quickly.

If a person begins to tell a long, drawn-out story before getting to the actual question or point, politely interrupt and tactfully ask the person if he has a specific question.

Similarly, if a person begins “story-telling” during a question-and answer session or is obviously off-track, or if the audience is getting bored and inattentive, you might ask “Is there a question in that?” or “How does that apply to our topic?”

Be sensitive to how the other audience members respond to your questioning when you use this technique. You, the presenter, are responsible for monitoring the dynamics of the situation.

Another suggestion is to use “ownership language.” For example, say “Whenever I get before an audience I get nervous,” rather than “Whenever You get before an audience, well, you know, you always get nervous.” This refers to people in general rather than speaking from personal experience.

Controlling Your Audience

Remember to:

- Speak with authority; assure your audience that you are informed – an expert on the subject
- Make sure your comments are focused and Logical.
- Use as many specific examples, anecdotes and facts as possible and appropriate.
- Be early

- Be warm; “relate” to the audience
- Show enthusiasm— if you’re glad to be there, chances are your audience will be too!
- Be entertaining—but don’t go overboard. Don’t use the occasion to try out all your latest jokes.
- Show that you are comfortable, which will put your audience at ease as well.

DON’T

- Show up at the presentation obviously unprepared and disorganized
- Jump from topic to topic. Focus your comments on a few key ideas, making sure to incorporate your key message points at every appropriate opportunity.
- Generalize. Use specific examples, anecdotes and facts pertinent to the points you are making.
- Be late
- Don’t be cold or aloof.
- Don’t be dull or boring.
- Don’t alienate your audience by being unresponsive to their questions and comments.

APPENDIX 1.12 HOW TO MAKE VISUAL PRESENTATIONS

Defining your objective

First and foremost, you must organize your thoughts and plan your time wisely.

Starting from the presentation date and working back to the present time, try to anticipate every consideration that will help make your presentation a success. Pay close attention to everything, even the smallest of details, since they too can make the difference in the success or failure of your presentation.

Be sure to consider each of these factors:

Know your audience (Research their needs and tailor your presentation accordingly.)

Make advance arrangements (Provide for space, equipment, and props.)

Select proper media (Fit audience size; small, medium or large)

Select the right equipment (Match equipment to media)

Research your Presentation (Get information from all available sources)

Make an outline (State problem or need and give method or solution)

Write your script (Use sequences method; write to be seen as well as heard)

Design your visuals (Give support, substance and credibility to your presentation)

Knowing your audience should be your first concern. Are they engineers, secretaries, or civic club members, and in what way are they interested in your subject? Designing a presentation for engineers and then giving it to a civic club may cause you to lose your audience before you ever get started. Conversely, designing a presentation for a civic club that you will be giving to engineers could be just as tragic. But when you do know your audience, you can create effective, custom-made presentation. It is more effective to use case studies and examples that are close to the audience or from their own experience, rather than sites that have little relationship with them.

Making advance arrangements cannot be over-stressed. Having a presentation for thirty-five people in a meeting room that only holds twenty can also prove to be embarrassing. Don't let such minor physical details ruin your presentation.

Select the Proper Media only after you have determined audience size and facilities available.

Select the right equipment to support your choice of media. It may be necessary to take extra equipment such as bulbs, cords, screen and even an extra projector. The widespread use of computer and portable digital projectors has revolutionized the world on graphic communication. One image is better than 100 words and the presentation programs such as Powerpoint offer enormous advantages namely: slides can be modified in the last minute, including during the course of the workshop or conference, as new relevant information show up. The use of such equipments also allow for writing documents or assemble presentations in just few minutes. However, you must be prepared for using less technologically advanced media that don't need electric power if such conditions arrive.

Research your presentation; you need details, facts, figures, case histories. Leave no stone unturned. Use any and all available sources but if you have Internet access, you will find in the Web a lot of useful information. Nowadays, most publications are publicly accessible on the Internet, and you can even find powerpoint presentations, photos, and graphs that can be used, providing you credit the authors appropriately. Digging and sifting this information will take time, but without it you won't have much to say that is relevant. And, after all, you can effectively present information that you don't have!

Make an outline emphasizing selected parts that you want your message to convey. State problem or need and give method with advantages or comparisons. Follow with action or solution recommended. And always keep in mind how you could visually illustrate the most important points to your audience.

APPENDIX 1.12: ICEBREAKERS

The aim of the following set of games is to encourage participants to get to know each other and talk openly.

a. Let's talk

- ◆ Walk freely about the room avoiding physical contact.
- ◆ At a sign from the facilitator (e.g. hand-clap) find a partner.
- ◆ Find out two or three facts about your partner (e.g. birthday, likes and dislikes, hobbies). Listen carefully to each other.
- ◆ Answer the questions from your partner with full sentences. Avoid yes' and 'no answers.
- ◆ Bring all partners together in a large circle and ask each person to introduce his/her partner using a few of the facts learned.

b. Person to person: let's get physical

- ◆ Walk freely about the room.
- ◆ When the facilitator says, 'Person-to-person', find a partner.
- ◆ The facilitator calls out body parts and participants connect together with these parts of their bodies, e.g. 'head-to-head'; 'toe-to-toe', 'nose-to-nose', 'finger-to-finger'; 'pelvis-to-pelvis'.
- ◆ Change partners when the facilitator repeats the instruction, person-to-person.
- ◆ Repeat the exercise two to four times.

c. The atom game

This exercise can also be used to break the large group into small groups of any size required.

- ◆ Walk freely around the room changing directions and speeding up the pace.
- ◆ Follow the facilitator's instructions:
 - 'Freeze and hug yourself. Walk again'.
 - 'Find a partner and hug each other. Walk again'.
 - 'Hug in fours. Walk again'
 - 'Hug in 13. Walk again.'

‘Hug in six.’

APPENDIX 1.13: COMMUNICATION GAME

Listening and Speaking Effectively

JUST FOR FUN

OBJECTIVE : To inject humor in discussing problems of communication

PROCEDURE: Identify that while communication is serious business, we often find humor in strange places. For example, these statements were actually sent to insurance companies:

- ◆ “An invisible car came out of nowhere, struck my vehicle, and vanished”
- ◆ “I was on the way to the doctor with rear-end trouble when my universal joint gave way, causing me to have an accident”.
- ◆ “The pedestrian had no idea with direction to go, so I ran over him”.
- ◆ “I collided with a stationary (sic) truck coming the other way.”
- ◆ “I pulled away from the side of the road, glanced at my mother-in-law, and headed over the embankment”.
- ◆ “I had been shopping for plants and was on my way home. As I reached an intersection, a hedge sprang up, obscuring my vision”.
- ◆ “I had been driving my car 40 years when I fell asleep at the wheel and had an accident.”
- ◆ “The other car collided with mine without giving warning of its intentions”.
- ◆ “I thought my window was down, but I found out it was up when I put my hand through it”.

“My car was legally parked as it backed into the other vehicle.”

MODULE 2**THE MARINE ENVIRONMENT OF THE WIDER CARIBBEAN****OBJECTIVE**

1. To know the general characteristics of the marine environment and the coastal ecosystems in the wider Caribbean
2. To understand the physical and ecological features that make the Caribbean Sea a system of ecoregions.

THEMES

1. The physical characteristics of the Caribbean Sea and the Gulf of Mexico
2. The most common coastal ecosystems in the Caribbean
3. The Tropical Northwestern Atlantic Coastal Biogeographic Province and its marine ecoregions

DELIVERY TIME

4 h

MODULE 2

THEME 1

OBJECTIVE

THE MARINE ENVIRONMENT OF THE WIDER CARIBBEAN

The physical characteristics of the Caribbean Sea and the Gulf of Mexico

SIGNIFICANCE

To know the main physical and chemical factors influencing the environmental and habitat conditions of the Caribbean.

This knowledge is essential for developing effective conservation strategies

PRESENTATION

Lecture

EQUIPMENT / MATERIALS

Projector

EXERCISE

Visit to marine habitat (mangrove, coastal lagoon) for observing the environmental conditions^a

1.5 h

^a This visit can be combined with the field trip of Modules 3 and 8, for a better time use.

GENERAL RECOMMENDATIONS TO THE INSTRUCTOR

- Read in advance the module content to determine if you would like to request trainees any material useful for the class. In any case, request of information from trainees' own MPAs is suggested. The course coordinator can include it as a pre-course activity..
- Review the powerpoint presentation provided with the Manual and check the publication list. You might be able to enrich it with additional information. Again, information on the course venue is recommended for using in the field trip preparation. Teaching this module requires a lot of illustrations (graphs, maps, habitats and species photos, etc.).
- Bring your own relevant publications, or cover pages to post in the class bulleting board so trainees can search them by themselves.
- Instructor must be informed on the training background of trainees to shape the class according to their oceanography and ecology knowledge.

LESSONS TO LEARN

- Physical and chemical attributes of seawater determine habitat conditions
- Ocean currents circulation pattern in the Caribbean is complex and not yet clear, but data suggest that it influence the dispersal of eggs, larvae, sediments, contaminants, and migratory species across the region.
- Terrestrial drainage influence environmental conditions of the coastal area and its habitats (coastal lagoons, mangroves, coral reefs, etc.)

2.1 Physical and chemical characteristics of the sea water

Although seawater covers approximately 71% of the earth's surface (Tait, 1981), the marine environment is not a homogenous body of water, encompassing as it does many different sub-environments. These range from the cold, dark ocean depths to the well-lit surfaces that are well mixed through wave action, and from the open ocean to the highly variable transition zone between land and sea. The sea has sustained life from its origin and an enormous variety and abundance of organisms, from the tiny form of phytoplankton, to the gigantic whales. The sea provides numerous living resources and services that are played a significant role in the civilization support and development. The variables that determine biotic composition and ecological characteristics of the different zones are:

- ◆ Light and depth
- ◆ temperature
- ◆ pressure;
- ◆ wave action;
- ◆ currents;
- ◆ tides;
- ◆ chemical composition (salinity, dissolved gasses, nutrients);
- ◆ bottom type (substrate)
- ◆ propagules dispersion and migration;
- ◆ food availability;

- ◆ trophic relations (predation and concurrence);
- ◆ proximity to land mass.

Light and depth

Light is the most important physical factor for the marine biota as it controls directly (through photosynthesis, heat and vision) or indirectly the distribution of most marine organisms. Light changes in intensity and wavelength as it passes downward through the sea. Assuming consistency of incident illumination, the amount of light that penetrates the surface depends on:

- ◆ Surface conditions (a turbulent surface reflects more light than a calm surface);
- ◆ Absorption and refraction by the water column; and
- ◆ Turbidity of the water.

The more turbid the water, the less light that penetrates, and even in clear ocean waters, approximately 80% of the light is absorbed within the top 10m. Given that trenches on the ocean floor reach as deep as 11km, the light (and associated heat) is confined to a very thin surface layer of the ocean.

A second issue of relevance is that water refracts (breaks up) light, and the different wavelengths are absorbed at different rates. Infrared and ultra-violet wavelengths are usually absorbed first, with the blue-green part of the spectrum having the greatest penetration in clear water. Other factors, such as turbidity and the concentration of plankton, also affect the rate of absorption and the differing rates of attenuation of the different wavelengths.

The important issue is that due to the limited penetration of light, primary production in the marine environment takes place primarily in the upper layers, where there is sufficient light to support photosynthesis. Though different organisms congregate at different levels in the water column, marine fauna is most abundant in the surface layers (less than 50m, extending as deep as 100m under clear conditions, close to the equator in summer) (Tait, 1981).

Temperature

Temperature is one of the most important oceanographic variables and influences the ecological processes in the ocean in two main ways:

- ◆ By affecting photosynthesis; and
- ◆ By affecting the mixing of the water column.

The photosynthetic rate increases as temperature increases, up to a particular maximum. Temperature increases past this maximum result in a rapid reduction in photosynthetic rate. It has been suggested that the efficiency of photosynthetic activity is probably equivalent in both temperate and tropical climates, due to the adaptive features of the associated phytoplankton (Tait, 1981).

The mixing of the water column caused by temperature-generated density gradients facilitates the movement of nutrients into the deeper levels of the ocean (cooler water is denser, and therefore sinks). See also the information on the effect of temperature on density gradients under the sub-section on currents (see 2.5).

One of the main contributing factors to temperature gradients in the sea is latitude. In low latitudes, such as in the Caribbean, heat is absorbed at the surface of the sea, producing a thin warm layer with temperatures between 26-30°C. This thin warm layer is separated from the deeper, colder water by a discontinuity layer or thermocline, which typically is to be found between 100-500m. The permanence of this thermocline (in contrast to temperate waters) is the main reason that tropical seas (including the Caribbean) are considered the best option for the utilisation of ocean thermal energy conversion (OTEC) technology.

Temperature gradients generate strong vertical and horizontal movements of water masses. Colder water sinks along with its nutrients. The temperature gradient between superficial and deep waters (thermocline) generates strong stability of the water mass impeding the ascending and recycling of nutrients to the upper photosynthetic layers (oligotrophics). This pattern controls the distribution of organisms (high tropical diversity) and affects size, metabolism, growth, reproduction and survival of marine life.

Water temperature exerts a powerful control over the distribution and behavior of marine organisms. Coupled with the concentration of productivity in the uppermost layers of the tropical seas, the Caribbean fisheries resources can be expected to be fairly much concentrated in a thin upper layer of the Caribbean sea. In fact, much of Caribbean finfish production takes place on shallow ocean banks and coral reefs.

Currents

“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” (Tait, 1981). A major factor affecting wind action and the currents themselves is the rotation of the planet. The density differences are due to differences of temperature and salinity, the former resulting from the cooling (and sinking) of water masses at the northern and southern poles.

The sinking of water masses at the two poles produce outflows that are manifested as “deep” currents, which act to take nutrients and oxygen to the deeper layers of the oceans. The higher-density water that sinks at the poles is continuously replaced by warmer surface water from the equatorial region, resulting in the “surface” currents.

The existence of curving currents (gyres or loops) of finer scale or meso-scale may contribute to species endemism and influence the patterns of organisms dispersal, particularly of the earlier stages (egg and larvae), and subsequently the recruitment of larvae and juveniles in shallow water areas.

Due to its importance to regional scale organisms (in both larval or adult stages) dispersal, as well as the spreading out of terrestrial freshwater, sediments and pollutants drainage, we describe hereafter the characteristics of the marine currents in the wider Caribbean. This information was taken from J. A. Gyory, J. A. J. Mariano and E. H. Ryan, from University of Miami (<http://oceancurrents.rsmas.miami.edu/caribbean/caribbean.html>).

The Caribbean Currents

The Caribbean Sea is a semi-enclosed sea located next to the landmasses of South and Central America. Antilles Islands Arc separate the Caribbean from the Atlantic Ocean and act as a sieve for the inflow of Atlantic water (Murphy et al. 1999; Andrade and Barton 2000). The Caribbean Sea is highly stratified in the upper 1200 m of the water column; weakly stratified between 1200 and 2000 m; and nearly homogeneous below 2000 m. This water structure is directly related to the sill depths of the Antilles Islands arc, for they impede the flow of deep water into the Caribbean (Gordon 1967).

Deep-water inflow to the Caribbean is fairly small, and takes place primarily as part of the Upper Atlantic Deep Water, entering through the Virgin Islands Basin (Watlington and Donoso, 1996).

The surface layer penetrates the Caribbean through a series of passages among islands, and their flows derive directly from the Northern Equatorial Current and the Guiana Current. The Guiana Current enters the Caribbean along the northern coast of South America. The current is significantly influenced by freshwater discharges from the Amazon and Orinoco Rivers. The Amazon River is the largest point source of fresh water entering the ocean an enormous surface plume that extends hundreds of kilometers to the northwest. This influence is significant and it is known to affect ocean circulation and quality in the Caribbean. In support of this view, most of the drifters that Limeburner et al. (1995) deployed near the river mouth throughout the year eventually moved toward the Caribbean within 1-6 months.

These currents flow through the Caribbean and Gulf of Mexico, before exiting into the North Atlantic as the Gulf Stream. This is just an overall pattern, since recent studies (using satellite trackers, simulation models, etc.) show that the particles trajectories are more complicated, with temporal and spatial variation which complicate ocean circulation patterns.

The historical hydrographic surveys of Wust (1964) and Gordon (1967), along with the observations and numerical models of Johns et al. (2002), indicate that water flows into the Caribbean Sea mostly through the Grenada, St. Vincent, and St. Lucia Passages in the southeast. The water then continues westward as the Caribbean Current, the main surface circulation in the Caribbean Sea. The strongest flow in the Caribbean is found across the southern third of the sea and belongs to the Caribbean Current (Gordon 1967; Kinder 1983). In this area, the highest surface velocities can reach 70 cm s^{-1} along the coasts of Venezuela and the Netherland Antilles (Fratantoni 2001). There are also strong (60 cm s^{-1}) currents along the Panamanian and Colombian coasts, but there is little flow over the Central American Rise, since most of the northwestward flow gets channeled through a trough southwest of Jamaica. The flow turns sharply westward as it crosses the Cayman Basin, and it enters the Gulf of Mexico as a narrow boundary current that hugs the Yucatan Peninsula (Fratantoni 2001). This Yucatan Current flows

into the Gulf of Mexico through the Yucatan Channel. It eventually separates from the Campeche Bank and becomes the Loop Current. The Loop Current then becomes the Florida Current as it exits the Gulf of Mexico through the Straits of Florida (Molinari and Morrison 1998). The overall speed of the water as it travels from Aves Ridge to the Florida Straits was estimated by Morrison and Smith (1990). They detected a transport maximum in the Florida Straits approximately 90-100 days after detecting a transport maximum in the eastern Caribbean. Thus, the calculated propagation speed is about 30-40 cm s⁻¹, depending upon the path and mean current speed between Aves Ridge (65°W) and the Florida Straits.

Hernandez-Guerra and Joyce (2000) found different water masses in two sections: from Venezuela to about 13°N, and from 14°N to Puerto Rico. The latter seems to originate in the tropics and South Atlantic, and there is a westward jet of 130 cm/s in midbasin, while underneath, of flows eastward flow. From 14°N to Puerto Rico, the water mass is a mixture of North Atlantic surface waters, Amazon River water, and local freshwater runoff from South America.

But the Caribbean circulation experiences much variation in both space and time, in the form of *mesoscale eddies and meanders*. Researchers found that several *physical processes in the depend on bottom topography, wind forcing, current width and shear, and the collision of North Brazil Current rings with the Antilles*. Most eddies or large meanders that appeared in their drifter tracks (Molinari et al., 1981) occurred near large underwater topographic features such as the Aves Ridge (64°W), the Beata Ridge (72°W), or the Central American Rise (82°W). Although these authors affirm that these features caused perturbations in the current flow over them, like the New England Seamounts impact on the Gulf Stream (Fratantoni 2001 others authors disagree).

More recently, based on data of sea level anomalies, Andrade and Barton (2000) described for the first time the dynamics and lifespan of eddies propagation throughout the Caribbean Sea. Cyclonic and anticyclonic gyres move north of 15° N with several eddies passing through the Antillean Arc (via Anegada and St Lucia Passages, and north of Trinidad) in different seasons, all traveling northward along the Central Caribbean. There is evidence that a large part of these eddies originate in the equatorial region at the retroflexion of the North Brazil Current, make there way northwestward and, some of them, manage to pass through the gaps between the Lesser Antilles into the Caribbean. Once inside the Caribbean they reformed and continue their way northwestward. Another eddie passes through the Windward Passage and travels along the Cayman Sea exiting via the Yucatan Strait six month later. However, almost all eddies dissipate at the Nicaragua Rise as they collide against the shoals and banks. They also found that eddies from the SW Caribbean are the only ones not advected from the E Caribbean or directly related to the Caribbean Current and suggests that they are formed by the salinity gradient and direct wind action. The authors conclude that the Panama-Colombia gyre is a broad circulation that remains in the area so limiting the connection between the Colombia Basin and the Cayman Sea. These research results indicate that some kind of a barrier for larval dispersal exists between the southern Caribbean and its central and NW part.

In the other hand, altimeter data and numerical models (Murphy et al. 1999; Ezer and Mellor 2000; Oey et al. 2003) show that the cyclonic eddies in the Gulf of Honduras originated near the Nicaraguan Rise propagate westward along the coast of Honduras. These eddies may play an important role in the connectivity processes and associated biological transports along the Caribbean coasts. On average, an eddy takes approximately 10 months to transit from the Lesser Antilles to the Yucatan Channel is 10 months, with values as short as 7 months and as long as 17 months.

In the eastern Caribbean, eddies and meanders were about 100 km wide; in the northwest Caribbean, between Jamaica and Cuba, were 100-200 km wide; and in the western Caribbean 200-500 km wide, possible determined by width of the current of origin. In the southeastern Caribbean, the narrow passages of the Lesser Antilles constrain the current width and so the eddies are smallest. In the northwestern Caribbean, the wider Winward Passage and the channel between Jamaica and Cuba do not limit the current as much, and the eddies are larger. Finally, in the southwestern Caribbean, there are no geographical limitations to the Caribbean Current, so it is wide and eddies are largest.

The most recent explanation for the mesoscale variation involves North Brazil Current rings. As then collide with the Lesser Antilles Passages ring fragments drift westward into the Caribbean, resulting in mesoscale eddies and meanders with diameters of 100-500 km that travel along the Caribbean Current axis (Fu and Holt 1983; Andrade and Barton 2000; Fratantoni 2001). Most of the Caribbean eddies are anticyclonic and travel westward through a narrow corridor with an average speed of 15 cm/s, so a 10-moth journey from the Lesser Antilles to the Yucatan Channel is typical for most eddies (Murphy et al. 1999).

In the area off Panama known as the Gulf of Mosquitos (82°W), Molinari et al. (1981) found a clockwise circulation that contrasted with Wust's (1964) description of a counterclockwise flow, but drifting buoys showed a counterclockwise circulation in this area that suggested that although eddies often appear in the Gulf of Mosquitos, a shallow, permanent gyre does not exist. However, large, semi-permanent circulation features do exist in other parts of the Caribbean.

Tatai et al. (2005) showed that circulation pattern in the W Caribbean (from the Mesoamerican Reef Region to W Cuba) has a SE-NW flow with at least, 5 anticyclonic eddies along the coast of Honduras in the Gulf de Honduras, 50-150 km wide each, and the propagation of one 300 km wide anticyclonic one SE of the Yucatan Channel. Data suggest that a typical meso-scale eddy travels ca. 220 km in 30 days. This means that it takes it 10-12 months to move across the western occidental from SE to NW. The number and frequency of anticyclonic eddies in the Gulf of Honduras and the N Coats of Honduras are associated with the frequency, , strength, and nature (cyclonic or anticyclonic) of the meso-scale eddies, and despite there can be fund up to 5 cyclonical at once, some times there are only 3.

As deep water inflow into the Caribbean basin is relatively weak, the replenishment of the deeper layers takes place slowly, throughout long time periods.

This circulation pattern affects not only the flow of pollutants and pathogens, but also larval dispersal and thus biological connectivity (see further). For more detail information on the Caribbean ocean circulation, check Gyory et al.

(<http://oceancurrents.rsmas.miami.edu/caribbean/caribbean.html>) from the University of Miami

The Yucatan Current

the Yucatan Channel or the Straits of Yucatan is the passage connecting the Caribbean Sea and the Gulf of Mexico (Ochoa et al. 2001). In the late 1900s, Pillsbury (1890) made direct measurements of the Yucatan Current and reported strong currents (170 cm s^{-1} at 6.3 m depth) flowing on the western side of the channel and southerly flows on the eastern side of the channel and a northward flow on the western side now known as the Yucatan Current (that provide most of the water of the Gulf of Mexico), and the southward flow on the eastern side was named the Cuban Countercurrent (Ochoa et al. 2001). Underneath the Yucatan Current there is a southward Yucatan Undercurrent that is an important part of the upwelling mechanism at the Campeche Bank (Merino 1997; Ochoa et al. 2001). U.S researchers (Cochrane 1966, 1968, 1969; Ruiz 1979) and Cuban-Soviet expeditions (Belousov et al. 1966; Bogodanov et al. 1968; Bessonov et al. 1971; Bulanienkov y García 1973) reported an upwelling along the eastern side of the Yucatan Bank (Merino, 1997). However, the results are little known as they were published in Russian.

Because the current is on a western boundary and for other reasons, scientists thought that wind-driven divergence might not be an important mechanism for upwelling in the Yucatan region (Merino 1997). Cochrane (1968, 1969) suggested that bottom friction of the strong Yucatan Current against the slope on the eastern edge of the Yucatan Shelf caused the upwelling instead. Another possible mechanism was proposed by Garcia (1990), who speculated that the upwelling is a result of interactions between the Yucatan Current and the countercurrent that Bulanienkov and Garcia (1973) found (Merino 1997).

Merino (1997) concluded that subsurface Caribbean water from depths of 220-250 m (and with $16-20^{\circ}\text{C}$ temperature, and 36.1-36.5‰ salinity) upwelled at about 10^{-2} cm/s along the eastern slope of the Yucatan Shelf into the euphotic zone, but it rarely broke the sea surface.

The upwelling appeared to have a seasonal cycle, and during spring and summer, the upwelled water created a two-layered column over the Yucatan Shelf. Because there was strong stratification between the Caribbean Surface Water and the upwelled water, the two layers did not mix easily until the winter northern winds come.

Ochoa et al. (2001) reported for the first time a mean southerly flow on the eastern side of the Yucatan Channel between 500 and 1500 m depth and speculated that it is a recirculation of waters of the same depth that enter the Gulf of Mexico as the Loop Current. The water that cannot flow out of the gulf through the Florida Straits apparently returns to the Caribbean Sea in this fashion.

The Loop Current

The information provided hereafter was taken from Gyory, et al (<http://oceancurrents.rsmas.miami.edu/caribbean/loop-current.html>)

The penetration of the Loop Current into the Gulf of Mexico has been linked to different characteristics of the Yucatan Current (Molinari 1988). Reid (1972), in an empirical model, found that the speed and angle of the Yucatan Current as it separates from the Campeche Bank affects the northward penetration of the Loop. When the Yucatan Current separates from the eastern Campeche Bank, the Loop intrusion is shallow. On the other hand, when the separation occurs farther west, the Loop Current penetrates deeper into the gulf (Molinari 1988).

The Loop Current is variable in position. At one extreme, it has an almost direct path to the Florida Current, causing the shear in the flow to set up a quasi-permanent clockwise recirculation known as the Cuban Vortex. This feature may help initiate Loop Current expansion. (Coats, 1992; Nowlin and McLellan, 1967; Cochrane, 1972; Hoffmann and Worley, 1986). At the other extreme, the Loop Current intrudes into the Gulf of Mexico, forming an intense clockwise flow as far north as 29.1N. Occasionally this loop will reach as high as the Mississippi river delta or the Florida continental shelf (Wiseman and Dinnel, 1988; Molinari and Mayer, 1982; Huh et al., 1981; Vukovich et al., 1979). It was this large loop phase of the current from which Nowlin and McClellan (1967) derived the name Loop Current. The Loop Current returns to its direct configuration by slowly pinching off its extension to form a large, warm-core ring that then propagates westward at speeds of 2-5 km/day (Coats, 1992; Elliott, 1982; Shay et al., 1998).

Early accounts attempted to identify a spring seasonal signal in the Loop current intrusion (Leipper, 1970; Behringer et al, 1977; Nowlin and Hubertz, 1972; Maul, 1977). However, although the intrusion may tend to form more frequently in the spring, it can occur in any season and has periods varying from 6-17 months (Molinari, 1980). Changes in the Yucatan current position have been correlated with Loop Current position, allowing it to serve as index to the extent of the intrusion (Molinari and Cochrane, 1972). However, the manner in which the two currents affect each other with regards to position is as yet unclear. The Loop Current draws its waters from the Yucatan Current, which is ultimately fed by the Caribbean Current, Guiana Current and North Equatorial Current. This provides a vital link between North Atlantic and South Atlantic waters. However, analysis of 12 years of data indicated no significant correlation between monthly Loop Current position and Florida Current transport (Maul and Vukovich, 1993). Although the frequencies of ring separation vary, Sturges (1992) also was unable to correlate ring separation and changes in transport of the Florida Current. The annual fluctuations in Loop Current flow are apparently due to wind forcing (Sturges and Evans, 1983).

Seawater chemical composition

Seawater is a complex mixture of dissolved inorganic material and dissolved gases (ignoring the many inorganic and organic materials and organisms that are merely in suspension). The amount of dissolved inorganic materials is what gives seawater its salinity. Because this amount is typically 35g/kg, the salinity of seawater is typically 35‰. However, factors such as low or high

rainfall regimes, high or low evaporation, melting of glaciers, high surface drainage from landmasses, etc., influence salinity levels in localized situations.

Table 2.1 shows the major inorganic constituents of seawater.

Table 2.1: Major constituents of ocean water (S = 35.00‰)	
Constituent	g/kg
Sodium (Na)	10.770
Magnesium (Mg)	1.300
Calcium (Ca)	0.412
Potassium (K)	0.399
Strontium (Sr)	0.008
Chloride (Cl ⁻)	19.340
Sulphate (as SO ₄)	2.710
Bromide (Br)	0.067
Carbon (C, present as bicarbonate (COH ⁻), carbonate (CO ₃ ⁻²), and molecular carbon dioxide (CO ₂))	from 0.023 at pH 8.4 to 0.027 at pH 7.8
Source: Tait, 1981	

Dissolved gases

All the atmospheric gases are present in solution in seawater. Oxygen typically varies between 0-8.5 ml/l, with the higher values close to the surface, where some equilibrium with atmospheric oxygen is achieved. Carbon dioxide is present primarily as bicarbonate ions, and is the major factor controlling the pH of seawater (normally within the range 7.5-8.4).

Nutrients

A number of minor constituents of seawater can be considered as essential nutrients for plant growth. These nutrients include nitrogen (as nitrate), phosphorus (as phosphate), silicon (as silicate), iron, and manganese. Of these, nitrate and phosphate are considered the controlling nutrients, with the nitrate:phosphate ratio remaining fairly constant at 7:1 by weight and 15:1 by ions (Tait, 1981). Due to the fact that these minor elements are essential for plant growth, they are considered to be Limiting Nutrients, and the plants selectively absorb these limiting nutrients. As such, inputs of nutrients to the marine environment stimulate rapid growth of plant species, especially algae.

Nitrogen is present in seawater in several forms, nitrate (1-600µg/l), nitrite (0-15µg/l), ammonium ions (0.4-50µg/l), and traces of nitrogen-containing organic compounds (30-

200µg/l). Concentration is usually lowest at the surface (1-120 µg/l NO₃-N), because of uptake by plants.

Phosphorus is present mainly as orthophosphate ions (<1-100µg/l), with traces of organic phosphorus (<1-30 µg/l). Like nitrogen, phosphorus concentrations are low and variable at the surface (0-20 µg/l phosphate-P), increasing with depth, with maximum concentrations occurring between 500-1,500m.

2.2 Influence of physical and chemical conditions of the water on the marine benthic communities

Factors affecting the distribution of marine organisms, and therefore the types and distribution of benthic communities, include the following:

- ◆ temperature;
- ◆ water composition;
- ◆ current speed;
- ◆ depth/pressure;
- ◆ illumination;
- ◆ salinity;
- ◆ turbidity;
- ◆ substrate material;
- ◆ availability of food; and
- ◆ biological competition.

As expected, some factors (such as current speed) have a dominant influence over others (such as oxygen concentration), and several inter-related factors therefore operate to determine the structure and functioning of benthic communities. Marine benthic communities are classified based on substrate, depth, temperature, and salinity (Tait, 1981). These include:

1. **Shallow water and brackish communities**

Typically have upper limits of distribution extending to the shore or even inland where freshwater drainage meets the seawater. Temperature range based on latitude, but normally eurythermal within wide limits. Salinity varies widely (7-34‰), and communities are normally euryhaline. Examples of these communities are mangrove, estuaries, coastal lagoons, marshes, creeks, drainage channels, where freshwater influx can generate daily and seasonal variations.

2. **Neritic offshore communities**

Typically having upper limits of distribution below extreme low-water spring tidal level. Normally eurythermal and euryhaline (high temperature and salinity tolerance, respectively), but within narrower limits than the shallow water communities (salinity 23-35.5‰). Examples in the Caribbean: soft or rocky bottoms (with or without vegetation; with or

without coral reefs) such as seagrass beds, algal meadows, sandy areas, muddy bottoms, and rocky bottoms with or without coral reefs.

3. Deep communities

Typically having upper limits of distribution not above 70m in depth. Normally stenothermal and stenohaline, with salinity ranges of 34-35.5‰. Examples in the Caribbean: bathyal, abyssal and hadal bottoms.

COASTAL INFLUENCES

That area of the land-sea interface commonly referred to as the coastal zone encompasses three divisions; land, the littoral or inter-tidal zone (that is periodically inundated), and the sub-littoral zone (extending from the inter-tidal zone to the edge of the submarine shelf).

The quality of the water, distribution and types of periodically submerged lands, types and distribution of benthic communities, availability and status of fish and other marine resources vary greatly. Not only is there variation in space, but even at one location, the conditions may change significantly over different time intervals. This great variability is influenced by the following factors:

- ◆ absence or presence of a coastal shelf, and the bathymetric variability leading to the shoreline;
- ◆ season (winter vs. summer);
- ◆ drainage (dry vs. rainy);
- ◆ topography (absence or presence of wide plains);
- ◆ type of shoreline (rocky, beach, etc.);
- ◆ configuration and complexity of the coastline (open, bay, etc.);
- ◆ variation in the tidal changes; and
- ◆ rainfall pattern.

These factors determine the physical conditions of a locale, and therefore the suitability of an area for colonisation by particular assemblages of plants and animals. Physical and chemical parameters that would change based on the mix of the above “forcing functions” include:

- ◆ periodicity of exposure of inter-tidal areas;
- ◆ temperature;
- ◆ current speed;
- ◆ wave action;
- ◆ concentrations of oxygen, organic materials, nutrients, inorganic materials, and food;
- ◆ salinity; and
- ◆ freshwater inputs, turbidity, and illumination.

The variation of these conditions along the coastal areas generates different types of mosaics or combination of habitats in the Caribbean denominated that defined section of the coast denominated “coastal systems” by Sullivan Sealey y Bustamante (1999) (for lack of a better term

to define a classification hierarchy higher than the habitat but lower than the ecoregion). These *coastal systems* should be considered the minimum space size for the ecological and physical processes that are essential to maintaining coastal biological diversity (see further for more detail).

Superimposed on this natural variation are the inputs to the nearshore environment resulting from human activities. Human activities not only exacerbate the effects of a number of the forcing functions, they add new factors, such as chemical and solid waste pollutants and sewage and agricultural nutrients. In addition to changing the variability of the nearshore environment, human activities also directly affect the natural functions of these coastal ecosystems (Module 3).

MODULE 2**THEME 2****OBJECTIVE****SIGNIFICANCE****PRESENTATION****EQUIPMENT /
MATERIALS****EXERCISE****TIME****THE MARINE ENVIRONMENT OF THE WIDER
CARIBBEAN**

Coastal ecosystems of the wider Caribbean

To demonstrate that coastal ecosystems are linked so the protection of the linkages is essential for conservation and the quality of the goods and services that they provide

The linkages between coastal ecosystems are not always recognised or appreciated. As such, in making decisions on zoning of economic activities, critical ecosystem processes are often disrupted. The maintenance of ecosystem integrity therefore requires an understanding of the ecosystems and their linkages.

Lecture,

Projector

Field observation of different ecosystems

0.5 hour

LESSONS TO LEARN

- Biodiversity is more than species richness, as it comprises the variety of habitats and population genetic diversity
- Learn to recognize the most common coastal ecosystems of the Caribbean and the benefits and “environmental services” they provide in order to document and demonstrate to protect them
- People can take and obtain useful products from the marine environment, unless they are overexploited.

2.2.1 Biodiversity and ecosystems

Biodiversity is the sum of coastal and marine plant and animal species, their genetic variety, the habitats and ecosystems they form part of, and the ecological processes that support them all. Some ecosystems have a low number of species, due to extreme physical conditions (like deserts), or because the physical conditions vary greatly (estuaries). That does not mean that they have a lower “biodiversity (or conservation) value”, because some of them can be very productive and generate high biomass. However, it is true that the higher the number of species in a habitat submitted to human use (after within its natural range), the healthier and more sustainable it is. This is due to the following:

- they provide more resources (fish, mangrove wood, etc.) for the users (as food and shelter). Each species has a specialist way of using different resources and adapting to changes (e.g. in water salinity or temperature). Thus, by having more species the productivity of the habitats and ecosystem is maximized;
- through having more species, they are also more stable, i.e., they elevate their resilience against drastic environmental changes (e.g. sea level rise, flooding, hurricane and cyclone damage);
- they allow the development of life history stages (e.g. larval, juveniles, spawners) in the area. Keeping only one habitat may not be sufficient to retain all species, but keeping all habitats in a healthy condition again maximizes productivity;
- the quality of life for coastal people and the appreciation of visitors relies on the marine biodiversity for aesthetic reasons.

Ecosystems. Ecosystems are characteristic groupings of species assemblages and can be defined simply as a biological community of interacting organisms and their physical environment.

The coastal environment of the Wider Caribbean region is characterized by diverse and productive ecosystems. These natural ecosystems are very important to the integrity and productivity of the coastal and marine environment. They contribute to the biodiversity of the region and all are vital for the continued human existence in the coastal zone, namely.

- ◆ coastal forests;
- ◆ coastal shrub communities;
- ◆ beaches;
- ◆ wetlands (freshwater, saltwater and estuarine);
- ◆ rocky shorelines;
- ◆ seagrass beds;
- ◆ coral reefs; and
- ◆ the open ocean.

These ecosystems are all 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 (Table 2.2); including:

- ◆ wetlands and seagrass beds providing a nursery function for species of marine fauna and trap sediments that can affect coral reefs;
- ◆ coastal wetlands trapping sediments and reducing concentrations of nutrients and pollutants before these reach the marine environment;
- ◆ export of organic materials from wetland communities and seagrass beds to nearby coral reefs;
- ◆ protection of some nearshore communities by coral reef systems; and
- ◆ recruitment of certain marine fauna (corals, fish, etc.) from upstream areas (some occurring hundreds of miles away).

Table 2.2: Natural and economic functions of main marine ecosystems in the Caribbean

Ecosystem	Ecological and economic benefits
Forests	<ul style="list-style-type: none"> ● Flood protection ● Provides resins, oils, medicines ● Ensures water availability ● Provides food and drink ● Erosion prevention ● Provides fuelwood and charcoal ● Provides lumber/timber ● Habitats for wildlife species ● Supports tourism

<p>Wetlands (with mangroves)</p> <p>Biomass production up to 30 ton/ha; coastal mangroves (the most developed), leaves fall constitute 20-40% of gross production (10g/m²-día). Part of this production is exported to adjacent ecosystems. Almost 10% is seafood (finfish, shrimp, etc.)</p>	<ul style="list-style-type: none"> • Flood control • Fish, shrimp, and lobster nursery • Sediment trap (improved runoff to the sea) • Land building (sediment trap) • Protects the shorelines from wave energy and storms • Acts as habitat for birds, crocodiles, and other species of wildlife • Provides a source of food material for nearby coral reefs • Provides materials for construction, fishing, and craft • Tourism and other forms of recreation
<p>Coral reefs</p> <p>Distribution restricted to the Tropics (> 20⁰C), in clear waters, high salinity, low sedimentation, high illumination, hard substrate, and moderate wave energy and currents.</p> <p>High productivity and biomass in oligotrophic waters: 5-20 g/m²-day (versus 0.05-0.3 g/m²-day in adjacent oceanic waters). Can produce up to 400-2000 metric tons Ca/year.</p> <p>High biodiversity, comparable with tropical forests. Marked zonation (see figure below).</p>	<ul style="list-style-type: none"> • Provide habitat and food for fish and other marine organisms • Protect coastline from wave action • Provide material for sandy beaches • Provide highly valuable fishery products • Contribute to expansion of mangrove and seagrass bed habitats • Generate calcareous rock, including entire island systems • Living laboratory for research and education • Tourism and other forms of recreation
<p>Seagrass beds</p> <p>Only found below 40 m depth and its distribution and biomass are controlled by light (turbidity and depth), wave energy and grazing (from sea urchin and fish). Very high biomass and productivity (leaf grow rate up to 5-10 mm/day)</p>	<ul style="list-style-type: none"> • Function as nurseries for juvenile fish and shellfish • Prevent shoreline erosion by reducing wave energy, and binding the sand together. This also results in improving water clarity • Functions as feeding grounds for turtles, manatees, and some fish species and urchins • Export food materials to nearby coral reefs

MODULE 2	THE MARINE ENVIRONMENT OF THE WIDER CARIBBEAN
THEME 3	The Tropical NW Atlantic Coastal Biogeographic Province and its marine ecoregions
OBJECTIVE	To demonstrate that the Caribbean Sea is Biogeographic Province that has ecoregional divisions based on the biological connectivity of its marine populations.
SIGNIFICANCE	The patterns of ocean circulation and adult migration and larval dispersal suggest that marine populations and ecosystems of the Wider Caribbean are interconnected in different degrees so failures and success in resource management in one area can affect the resources in others.
PRESENTATION	Lecture
EQUIPMENT / MATERIALS	Projector
EXERCISE	None
TIME	0.5 hours

LESSONS TO LEARN

- The Wider Caribbean is a Biogeographic Province (Tropical NW Atlantic)
- Larval dispersal in the ocean is limited, with retention (eddies) and long-distance dispersal zones.
- There are various units of biological connectivity or ecoregions in the Wider Caribbean
- Information on ocean scale biological connectivity of marine populations is critical for marine resources conservation and management within and beyond each country boundaries.
- Patterns of larval dispersal and recruitment suggest that in some countries, nation-wide management measures might be enough, while in others, an ecoregional cooperation is needed for management to be effective.
- Sources of fish larvae of each country or marine protected area.

INTRODUCTION

With the deterioration of the marine environment and fisheries resources due to overuse, marine conservation science increasingly dedicated efforts on trying to understand the connection between marine ecosystems and populations on a scale beyond each country. In the 60's and 70's, the knowledge of marine current circulation patterns in the Wider Caribbean suggested that ocean larvae were transported by currents passively in a quasi linear direction that made them recruit in shallow-water areas hundreds of kilometers away from its origin. This meant that fish born in breeding sites in the southeastern Caribbean islands could be part of populations as far as Cuba or South Florida. If so, the entire Caribbean would be “biologically connected” and biological resources and biodiversity conservation could only be effective if it planned regionally.

With the advance of oceanographic and ecological investigations in the 80's, research data suggested that this connection is not that extended, and there were smaller biogeographic units. Thus, in the 90's, and due to the lack of better information on adult migration and larval dispersal, scientists and international conservation dedicated resources in the delineation of biogeographic units or ecoregions. Such ecoregional scenario would serve better to identify priority conservation areas for large scale biodiversity conservation planning.

In 1996, Miller (1996) defined the bioregion as “... a geographic space that contains a series or several nested ecosystems”. This means that bioregions can be of different scales, depending on the criteria that are chosen to define them, which include not only biophysical features, but also the practical use of such geographic unit.

In order to optimize resource investment in biodiversity conservation. The Biodiversity Support Program, a consortium formed by The Nature Conservancy, World Wildlife Fund, and the World Resources Institute, funded by the USAID) commissioned a series of projects for the selection of priority conservation areas (terrestrial, mangrove, marine). In 1996-1997, The Nature Conservancy conducted the first hemisphere-wide propriety-setting exercise in Latin America and the Caribbean to identify priority marine conservation areas (Sullivan Sealey and Bustamante, 1999). Led by these authors, more than thirty regional experts proposed a system of classification for biogeographic regions of different spatial resolution for the Latin America and Caribbean Region that served as the basis for the selection of propriety conservation areas. Using the existing data on temperature regime, general ocean circulation, 9 “Coastal Biogeographic Provinces” were delineated, including the Tropical NW Atlantic. This “province” comprises the marine waters of the Wider Caribbean (S Florida, The Bahamas, most of the Gulf de Mexico, Greater and Lesser Antilles, Central America, Venezuela, and Colombia), as well as French Guyana, Guiana and Surinam. In addition, features such as coastal geomorphology, and the distribution of key taxonomical groups and ecosystems served as criteria for dividing this province into 6 ecoregiones, namely: S Florida, Gulf of Mexico, Bahamian Archipelago, Central Caribbean, Lesser Antilles and Guianan.

Taking in account that the ecoregion is a too big conservation planning unit, the authors, along with a group of experts that participated in the exercise, subdivided the coastal zone of the Central Caribbean Marine Ecoregion into sections of the shelf area that were named “coastal systems”. The coastal system is just a section of the littoral area and the adjacent shelf with certain biophysical characteristics shaped by coastal geomorphology, terrestrial drainage, and the existence of a distinguished mosaic of marine habitats. Its size (dozen of square kilometers) is more appropriate for conservation planning and the application of coastal management measures. These coastal systems were classified according to the dominant habitat (mangrove, type of coral reef, seagrass beds, sandy beaches, rocky shore, etc.) and a simple methodology was used for assessing and selecting priority ones for conservation (see Sullivan-Sealey and Bustamante, 1999¹).

However, the generation of maps of species and habitat distribution for some subregiones and countries, the advance of the scientific information on ocean circulation, larval dispersal, adult migration and distribution range across the Caribbean have allowed to further refine the ecoregional subdivision. In addition, conservation gap analysis have also contributed to better understand the ecoregional scenario of the Tropical NW Atlantic Biogeographic Province and its use un resources management. Hereafter, we provide a list of some of these research works as a source of information for conservation scientists and practitioners focused locally or regionally.

¹ http://conserveonline.org/workspaces/MarCons_LAC

Table 2.3.1 Ecoregion classification and coastal conservation priority exercises in the wider Caribbean

Study area	Reference
Latinoamérica and the Caribbean	Sullivan Sealey and Bustamante (1999)
Mesoamerican Reef (from México to Honduras)	Kramer and Kramer (2002); Arrivillaga et al. (2006)
Central America	Calderón (2004)
Wider Caribbean	Chatwin et al., (2004).
Cuba	Areces et al. (2004)
Colombia, Caribbean continental coast	Alonso et al. (2007)
Florida	Geselbracht et al. (2005).
Venezuela	Miloslavich et al (2003); and INTECMAR et al. (2006) http://www.intecmar.usb.ve/PDVSACaribe/
The world	Spalding et al. (2007)

However, recent research results on oceanography and larval dispersal suggest the existence of a series of **geographic units of biological connectivity** that replace the ecoregions delineated by scientists years ago (Table 2.3.1) when data on ocean circulation and larval dispersal was insufficient.

However, over the past years there has been an increase in the research efforts of habitats and species distribution maps for some subregions and countries, as well as their use in ecoregional classification, gap analysis and conservation priority exercises. Some of these research works are listed hereafter so they can serve as a more specific source of information for those involved in marine conservation and coastal management at local or national level.

Table 2.3.1 Recent research works on ecoregional classification and selection of priority conservation areas in the wider Caribbean

Study area	Information used	Reference	Remarks
Mesoamerican Reef		Kramer P. and P. Kramer. 2002.	
Central America		Calderon, R. 199	
Wider Caribbean	Not mentioned	Burke, L. and J. Maidens. 2004.	
Cuba		Areces, A. et al.	
Caribbean continental Colombia		INVEMAR	
Florida		Geselbracht et al., 2005.	
Puerto Rico			

Research results ocean currents, as well as larval behavior and longevity suggest the existence of a number of geographic **units of biological de connectivity across** the wider Caribbean that might constitute the real ecoregions instead of those delineated previously when this type of data was not available..

Much research effort on ocean circulation and larval dispersal for the Wider Caribbean (Cowen *et al.* 2000, 2003, 2006; Andrade and Barton, 2000; Paris *et al.*, 2002, 2004, 2005, 2007; Thattai *et al.*, 2005, 2007; Ezer *et al.*, 2005; Sale *et al.*, 2005; Colin, 2004; Baums *et al.*, 2006; Cherubin *et al.*, 2007) have provided important insights on how biological and oceanographic barriers and linkages operate in the wider Caribbean (Appendix I). Despite differences in methodology and approaches, the full spectrum of spatial and temporal variability of the oceanographic conditions and larval behavior has not been fully captured. Robust estimation

of spatial probabilities of larval dispersal for multiple species and from a variety of spawning sites still requires higher resolutions, coupled with biophysical models (Werner et al., 2007). Yet, findings from these studies suggest a new ecoregional scenario of 15 units of biological connectivity of the Tropical Western Atlantic Coastal Biogeographic Province (or Wider Caribbean), a significant departure from the 9 ecoregions proposed by Spalding et al. (2007) for this Province. Major distinctions of the new scenario are that the MBRs region is divided near the Mexico-Belize border; larval exchange is limited between Honduras and Nicaragua, Costa Rica and Panama, Panama and Colombia, and Colombia and Venezuela; the San Andres and Providencia archipelago may play the role of a corridor for the replenishment of Jamaican reef related populations; the Lesser Antilles islands are weakly connected to one another and form a large, fragmented unit of biological connection from Trinidad and Tobago to Puerto Rico; the Mona Passage represents a seasonal barrier to dispersal between Puerto Rico and Hispaniola. This new scenario based on oceanography and larval exchange suggests that the ecoregional picture of the Caribbean may be more complex than previously thought (Bustamante and Paris, in press).

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Appendix I: Major biological and physical interactions in the Caribbean

Atlantic water entering the Caribbean basin:

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| <ul style="list-style-type: none"> • Cyclonic and anticyclonic gyres move north of 15° N passing through the Antillean Arc (via Anegada and St Lucia Passages, and north of Trinidad) in different seasons, all traveling northward along the Central Caribbean. • There is evidence that a large part of these eddies originate in the equatorial region at the retroflexion of the North Brazil Current, and make their way northwestward and, some of them, manage to pass through the gaps between the Lesser Antilles into the Caribbean. Once inside the Caribbean, they reformed and continue their way northwestward • On average, an eddy takes approximately 10 months to transit from the Lesser Antilles to the Yucatan Channel, with values as short as 7 months and as long as 17 months. However, almost all eddies dissipate at the Nicaragua Rise as they collide against the shoals and banks | <p>Goni and Johns (2001), Paris et al. (2002), Cowen et al. (2003b), Fratantoni and Richardson (2006)</p> |
|--|---|

Circulation within the Caribbean Basin:

- | | |
|--|---|
| <ul style="list-style-type: none"> • Cyclonic eddies in the Gulf of Honduras originating near the Nicaraguan Rise propagate westward along the coast of Honduras. These eddies play an important role in the connectivity processes and associated biological transports. • Eddies passing through the Windward Passage travel along the Cayman Sea exiting via the Yucatan Strait six months later. • In the W Caribbean Sea (from the Mesoamerican Barrier Reef System [MBRS] to W Cuba) the mean flow is characterized by a southeast-northwest flow accompanied by as many as five cyclonic gyres along the Honduran coast in the Gulf of Honduras each with diameter 50-150 km, and by the propagation of an anticyclonic eddy with a 300 km diameter southeast of the Yucatan Channel. A typical mesoscale eddy travels approximately 220 km in 30 days, which means that it could take up to 10-12 months to cross the entire area W Caribbean Sea from SE | <p>Richardson (2005), Thattai et al. (2005), Cherubin and Richardson (2008), Cherubin et al. (2008)</p> |
|--|---|
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to NW

Marine larval dispersal

- Although larvae have the potential for long-distance dispersal, evidence is mounting that transport during the pelagic phase is limited. The ecologically significant dispersal distance is in the scale of 50 to 100 km for most species with a relatively high level of local retention Cowen et al. (2000), Paris and Cowen (2004), Cowen et al. (2003a)
- The Panama-Colombia gyre is a broad circulation that limits the connection between the Colombia Basin and the Cayman Sea
- Larval retention is favored in the Caribbean, thus for some downstream location to sustain heavy fishing pressure (e.g., 40% of the population is being removed each year), recruitment to the local population must be subsidized from upstream sources to the same amount (pre-fishery recruitment rates). Paris and Cowen (2004), Cowen et al. (2003)
- There are considerable levels of self-recruitment in Cuban snapper populations, in particular, those from the southern and north central regions. For NC Cuban snapper populations, larvae end up mostly in the southern Bahamas (specifically Cay Sal Bank). However, a small lag in peak spawning times among species produces high recruitment variability among species. Paris et al., (2005)
- Using data on the presence of more than 25 reef fish species (*Elacatinus*, a small reef dweller goby fish, blue angelfish, yellow stingray, hamlets), as well as data on drifter tracks throughout the Caribbean Sea, the Central Bahamas shows a discontinuity between Little Bahama and Central Bahama Banks, and the SE Bahamas islands and Turk and Caicos; another break is detected off the Guajira peninsula (Colombia) as well as a separation between Colombia and Panama; a divergence point close to the Mexico-Belize border and a strong local circulation pattern within both the Gulf of Honduras and the southern Cuba-Cayman area are also identified; finally, the mechanism of a “filter” to gene flow for the *Acropora palmata*, a reef building coral, is described at the Mona Passage between the Dominican Republic and Puerto Rico; Colin (2004), Baums et al. (2006)

-
- Based on biophysical modeling of larval dispersal, marine populations in the region seems to be highly structured:
 - The W and E Caribbean are moderately isolated from each other along a meridian break centered around 67° - 70°W, from W Puerto Rico south to Aruba off the coast of Venezuela, which may constitute an ecological barrier from the Colombian gyre area to the western Caribbean;
 - the NE Caribbean (Puerto Rico and Leeward Is.) is relatively isolated from the reminder of the E Caribbean;
 - the Leeward Is. are highly self-recruited and constitute a sink for north-south larval exchange of the Windward Islands;
 - there is westerly exchange along the southern Windward Islands and those along the coast of South America, forming the Venezuelan corridor;
 - the Bahamas and the Turks and Caicos Islands form an enclave of high connectivity largely isolated from the rest of the Caribbean region except for minor exchanges with NC Cuba and Haiti;
 - the Belize and Honduras coasts are weakly isolated from the northern part of the MBRS, but strongly isolated from the islands along the E coast of Nicaragua , which also form a strong enclave (highly interconnected and isolated);
 - the Hispaniola and Jamaica is a mixing zone among several of the regions;
 - two ecoregions, the Windward Islands and the Mexican Caribbean and Campeche Bank seem to be more recruitment-limited (below the necessary for replenishing populations) compared to other areas;
 - Caribbean-wide self recruitment varies from 9% (off Mexico) to almost 57% (off Colombia in proximity to a semi-permanent Panama-Colombia gyre);
 - the N Yucatan conch populations are segregated from the Mexican Caribbean and contribution to South Florida larval recruitment (both fish and conch) from Mexico is relatively low

Cowen *et al.*
(2006), Paris et
al. (this issue)

MODULE 3

USES AND THREATS TO THE MARINE ENVIRONMENT

OBJECTIVE

1. To identify the potential benefits provided by the coastal and marine environment, as well as the threats that pose overuse.
2. To identify some of the basic reasons why the threats to the coastal and marine resources are difficult to control.

THEMES

1. Environmental services
2. Natural and anthropogenic impacts

TIME

3hr and several hours of field trip, in conjunction with Modules 2, 8

MODULE 3	USES AND THREATS TO THE MARINE ENVIRONMENT
THEME 1	Environmental services and products
OBJECTIVE	Know the several services that the marine environment provides and the impact of misuse
SIGNIFICANCE	In order to reduce the threats to the marine environment, it is first necessary to develop an appreciation of the actual and potential contribution of marine resources to human well being.
PRESENTATION	Lecture, Participant discussion
EQUIPMENT / MATERIALS	Overhead projector
EXERCISE	List all the uses that are made of coastal/marine resources, then rank the associated resources and/or ecosystems based on the perceived importance of the benefits provided.
TIME	1 hour

RECOMMENDATIONS TO THE INSTRUCTOR

- Review in advance the module content to ask trainees to bring information materials on real of potential treats to their MPA or the course venue and contact course coordinator to include it as a pre-course activity.
- Check our Powerpoint presentations provided in this package and bibliography list in case you can use them for enriching your class with case studies and examples. The course venue MPA or any of the trainees' is suggested as such.
- Enrich the Powerpoint presentation with slides on your own experience.
- Bring publications relevant to the subject to show trainees (or if too voluminous, bring cover page print outs to post them in the classroom bulletin board).

LESSONS TO LEARN

- Get familiar with the services and products provided by the marine environment in your area, country or region.

INTRODUCTION

The human species utilize the goods and services provided by the natural environment at the levels of single resources and ecosystem functions. These goods and services can be grouped into three main categories:

Provision of goods for direct consumption and for use as raw materials

- **Primary consumption** - air, water, foods, drinks, etc.;
- **Raw materials** - jewelry, timber, ores, construction materials, fuel, medicine, etc.

Provision of services

Transportation, recreation, education, waste treatment and disposal.

Maintenance of life-support systems

Pest control, disaster reduction, production of oxygen, maintenance of atmospheric balance, etc.

As oceans, coastal waters, and estuaries cover 71% of Planet Earth, it can easily be understood why the marine environment provides a great abundance of and diversity of foods, raw materials, and services.

FOOD FROM MARINE SOURCES

Of the 99.5 metric tons of finfish and shellfish caught in 1989, 86% (85.8 metric tons) came from the marine environment, with the remainder from inland waters (FAO, 1991). However, this figure has changed in the last years, not only because of the decline in catches in the main international fisheries grounds, but also due to the increase in aquaculture production in China.

Data compiled by the United Nations Food and Agriculture Organization (FAO) shows that in the Western Central Atlantic (Caribbean and Central American region) increased from 0.7 million MT during the period 1950-1959 to over 2 million MT in 1994 (Table 3.1). The status of the fisheries in the Western Central Atlantic region till 1994 is given as Appendix 3.1. More updated information can be found in McManus and Lacamabra (unknown date) and Parsons (2007), which provide detailed information on Caribbean fisheries, fisheries regulations, and fisheries subsidies. These publications as well as the powerpoint slide shows of Module give information on the Caribbean and world-wide fisheries and its issues.

The above publications show that excessive fishing (due to lack regulations of weak enforcement of those existing) has caused a substantial reductions of demersal and oceanic pelagic fisheries stocks in both continental and insular shelves throughout the Caribbean.

To compensate the effect of fisheries decline in their livelihoods, fishers have adapted themselves in different ways, namely:

- operating in farther and deeper areas in order to keep the catch levels;
- fishing species of less economic value;
- requesting subsidies (tax write-offs to imported fishing gears, etc.)
- switching to less fishing-dependant livelihoods.

The latter seems to have been the most widespread and convenient one, and has been stimulated and facilitated by the expansion of the tourism industry across the Caribbean. In some countries (Mexico, Belize, Dominican Republic, etc.) many fishermen have replaced their income with jobs related to coastal tourism. However, fishing still is the economic basis of many coastal communities in the Caribbean, not only because of the high demand of seafood for local tourists or export (mainly to the U.S.), but also because of the difficulty of the patriarch fishermen to adapt to other types of jobs and the weak enforcement of fisheries regulations.

Period	Total Aquaculture	Total Production	Total Marine Capture
1950-59	0	709	709
1960-69	0	1,181	1,181
1970-79	0	1,567	1,567
1980-89	82	2,076	1,994
1988	137	1,868	1,731
1989	136	1,799	1,664
1990	88	1,701	1,613
1991	113	1,822	1,709
1992	126	1,668	1,542
1993	110	1,908	1,797
1994	100	2,245	2,145

Source: <http://www.fao.org/fi/publ/circular/c920/tab.3asp>

MEDICINES FROM THE SEA

Though medicines from plants and animals have historically been derived primarily from land sources, the discovery of anti-viral and anti-tumor agents from marine organisms has spurred greater interest in the potential of marine organisms for medical research. The Caribbean has made its contribution in this respect, as in 1978 extracts from *Trididemnum* sp. (a tunicate) were found to be strongly toxic to tumor cells (Norse, 1993).

The factor that makes the sea such a rich source of materials for use in medical research is the diversity of organisms, in form, function, and biochemical makeup. Norse (1993) states that of the 33 animal phyla, 32 occur in the sea, and 15 are exclusively marine (Table 3.2).

Exclusively Marine	Marine & Non-marine	Exclusively Non-marine
Placozoa Ctenophora (Comb jellies) Mesozoa	Porifera (sponges)* Cnidaria (Coelenterates)* Platyhelminthes (Flatworms)	Onychophora

Gnathostomulida Kinorhyncha	Nemertina (Ribbon worms)* Gastrotricha	
Loricifera Phoronida Brachiopoda (Lamp shells) Priapulida Sipuncula (Peanut worms)	Rotifera (Wheel animals) Acanthocephala Entoprocta* Nematoda (Roundworms) Nematomorpha (Horsehair worms)	
Echiura Pogonophora (Beardworms) Echinodermata Chaetognatha (Arrow worms) Hemichordata (Acorn worms)	Ectoprocta (Bryozoans)* Mollusca (Mollusks) Annelida (Segmented worms) Tardigrada (Water bears) Pentastoma Arthropoda Chordata (Chordates)	
Total Phyla: 15	17	1
* = > 95 percent of species are marine Source: Norse, 1993		

RAW MATERIALS FROM THE SEA

In addition to the foods (that are directly consumed) and medicines, the marine environment provides a number of products that are used as raw materials for a variety of purposes. These include:

- ◆ Seaweed - Alginate/carrageenan/agar (for use in food and medical applications)
 - Fertilizer
 - Animal feed;
- ◆ Coralline materials - Coral skeleton (jewelry, building material)
 - Sand (beach nourishment, construction material for buildings and roads);
- ◆ Marine crustaceans - Chitin (agricultural, medical, dental, cosmetic, and wastewater applications)

SERVICES FROM THE SEA

In spite of the provision of a wide range of goods for consumption and as raw materials, the most significant contribution of the marine environment is in the form of ecosystem services. Such services include:

- ◆ Coastal protection - Mangroves, seagrass beds, coral reefs;

- ◆ Transportation - Cargo, passengers;
- ◆ Stabilisation of global climate (control of carbon dioxide concentration in the atmosphere by phytoplankton at the oceans' surface);
- ◆ Recreational/amenity value - Tourism, etc.;
- ◆ Waste treatment and disposal

The amenity value of the ocean forms the basis for the tourism industry in the Caribbean, as the product is still based on the "sand, sea, and sun" model. Although this perception of the product is slowly changing, anecdotal information from tourism actors suggests that tourists still spend 70-80% of their time on the beaches.

The value of this service to the Caribbean can be estimated from the estimates of visitors expenditure in 1994-1997 (Table 3.3), and 7 years later, in 2004 ((Table 3. 4).

In addition, the analysis conducted by Burke and Maiden (2004) and Burke et al. (2006) show coral reefs economic benefits for the Caribbean and the method to calculate them. This information is useful to demonstrate the need to protect coastal resources in areas and countries, if they are to prosper.

As land became limiting for the disposal of hazardous wastes and sewage effluent, attention turned to the ocean. Though the disposal of hazardous materials at sea is discouraged by international multilateral agreements and treaties (e.g. MARPOL 73/78), the disposal of sewage effluent has increased. More urban areas in the Caribbean are constructing central sewerage systems, more hotels are being built in previously "unspoiled" areas, and the effluent from these systems is disposed of directly or indirectly to the sea.

In this, and many other ways, the human species continues to threaten the very resource upon which its survival depends.

Destination	1994	1995	1996	1997
Commonwealth Caribbean	5,633.9	5,735.7	5,866.3	5,951.0
OECS Countries	805.1	778.5	810.7	852.5
Anguilla	51.0	48.5	48.0	57.2
Antigua and Barbuda	293.4	246.7	257.9	269.4
Dominica	31.4	34.1	36.6	39.5
Grenada	59.3	58.3	59.5	59.4
Montserrat	23.6	19.9	9.7	5.4
St. Kitts and Nevis	76.9	65.1	66.8	67.3
St. Lucia	225.5	264.8	268.5	283.7

St. Vincent & Grenadines	44.0	41.1	63.7	70.6
Other Commonwealth	4,274.0	4,444.8	4,704.1	4,879.7
Bahamas	1,332.6	1,346.2	1,450.0	1,415.9
Barbados	597.6	661.8	684.9	717.0
Belize	71.4	77.6	83.6	88.0
Bermuda	525.3	487.9	472.3	477.5
British Virgin Islands	197.7	205.4	267.6	210.2
Cayman Islands	334.1	394.0	368.0	493.0
Guyana	85.0	78.2	70.3	59.6
Jamaica	973.0	1,068.5	1,100.0	1,131.0
Trinidad and Tobago	87.3	72.6	108.1	192.6
Turks and Caicos Islands	70.0	52.6	99.3	112.9
Dutch Caribbean	1,089.4	1,082.3	1,155.5	1,289.3
Aruba	450.7	521.2	605.8	666.1
Bonaire	32.4	36.9	42.3	44.2
Curacao	186.5	175.4	185.5	200.5
St. Maarten	419.8	348.8	321.9	378.5
French West Indies	709.1	795.2	764.5	768.5
Guadeloupe	330.2	380.4	353.9	371.5
Martinique	378.9	414.8	410.6	397.0
US Territories	2,701.7	2,664.4	2,617.6	2,726.2
Puerto Rico	1,782.3	1,842.1	1,930.2	2,125.0
US Virgin Islands	919.4	822.3	687.4	601.2
Other Countries	3,487.4	4,272.4	5,227.3	6,059.4
Cancun (Mexico)	1,339.0	1,370.6	1,704.6	2,051.8
Cozumel (Mexico)	110.9	146.4	281.2	327.1
Cuba	850.0	1,100.0	1,380.0	1,500.0
Dominican Republic	1,147.5	1,568.4	1,765.5	2,079.9
Haiti	27.0	56.0	58.0	57.0
Suriname	13.0	31.0	38.0	43.6
Total	13,066.7	14,037.6	15,279.7	16,593.6
CARICOM	3,890.4	4,046.0	4,237.6	4,437.6
* A number of figures are provisional Source: Modified from CTO, 1997				

Table 3.4 Number of tourists in the Caribbean in 2004					
Destination	Period	Tourists arrivals	% Change		
			Total	No. in winter	No. in summer
Anguilla	Jan-Dec	53,987	15.1	20.6	11.6
Antigua and Barbuda*	Jan-Dec	245,797	9.7	23.6	2.2
Aruba	Jan-Dec	728,157	13.4	15.7	12.3
Bahamas	Jan-Dec	1,450,043	1.5	9.2	-3.0
Barbados	Jan-Dec	551,502	3.8	8.4	1.5
Belize	Jan-Dec	230,831	4.7	10.4	1.1
Bermuda	Jan-Dec	271,607	5.9	-8.3	10.4
Bonaire	Jan-Dec	63,156	1.6	11.5	-3.7
British Virgin Is.	Jan-Dec	304,518	-4.2	-12.4	2.4
Cancún (Mexico) **	Jan-Dec	2,331,362	12.3	13.8	11.5
Cayman Islands	Jan-Dec	259,929	-11.4	11.8	-26.5
Cozumel (Mexico) **	Jan-Dec	368,589	21.2	16.8	24.1
Cuba P	Jan-Dec	2,048,572	7.5	11.7	4.6
Curacao	Jan-Dec	223,439	0.9	8.7	-2.9
Dominican Republic. *	Jan-Dec	3,443,205	5.4	8.8	3.5
Dominica P	Jan-Dec	80,087	9.8	2.1	13.5
Grenada	Jan-Dec	133,865	-5.9	9.2	-13.8
Guyana	Jan-Dec	121,989	20.9	27.7	18.1
Haiti	Jan-Dec	96,439	-29.1	-40.5	-24.1
Jamaica	Jan-Dec	1,414,786	4.8	9.5	2.4
Martinique P	Jan-Dec	470,891	3.9	-4.5	10.0

Table 3.4 Number of tourists in the Caribbean in 2004					
Destination	Period	Tourists arrivals	% Change		
			Total	No. in winter	No. in summer
Montserrat	Jan-Dec	10,138	21.1	24.6	19.6
Puerto Rico **	Jan-Dec	1,411,910	6.8	7.1	6.6
Saba	Jan-Dec	11,012	7.3	14.9	3.4
St Lucia	Jan-Dec	298,431	7.8	4.3	9.7
St. Eustatius P	Jan-Dec	11,056	2.5	12.9	-2.3
St Maarten *	Jan-Dec	475,031	11.1	19.1	6.3
St Vincent & Grenadines	Jan-Dec	86,727	10.4	14.7	8.7
Surinam	Jan-Dec	137,808	-	-	-
Trinidad and Tobago	Jan-Dec	442,555	8.2	12.8	5.9
Turks and Caicos Is.	Jan-Dec	173,027	5.8	4.4	6.7
US Virgin Is.	Jan-Dec	658,638	6.5	7.5	5.8
<p>* Air arrivals of non-residents ** Hotel check-ins of non-residents P Preliminary figures (figures under review by countries) from Caribbean Tourism Association, June 2007 (http://www.onecaribbean.org/information/documentview.php?rowid=3462), built with data provided by state members, available in June 19, 2007</p>					

MODULE 3	USES AND THREATS TO THE MARINE ENVIRONMENT
THEME 2	Natural and anthropogenic impacts on the Caribbean marine environment
OBJECTIVE	To provide an overview of the patterns of use of marine resources, as well as the threats to the marine environment.
SIGNIFICANCE	In order to reduce the threats to the marine environment, it is necessary to know how the irresponsible use of marine resources has affected environmental quality.
PRESENTATION	Lecture, participant discussion
EQUIPMENT / MATERIALS	Projector, slide show Mod3.ppt
EXERCISE 3.2	List and rank all the threats to coastal and marine resources. Using the information from Exercise 3.1, review the ranking of threats based on the importance of the resource threatened.
TIME	1.5 h

LESSONS TO LEARN

- **What are the effects on fisheries resources of excessive fishing in your country, area and the world.**
- **How the economy of your area or country has adapted to the decline of fisheries resources**
- **What other impacts have undergone reef complexes in your area and the Caribbean overall.**
- **Which are the methods you can use to examine the threats to your protected area.**

INTRODUCTION

Human beings are responsible of the high losses of biodiversity (species and ecosystems) of the last century. The inadequate use of marine resources has led to the invasion of alien species and the displacement of natural residents; the degradation, loss and fragmentation of habitats, the overexploitation of biological resources; and the air, water and soil pollution, and their impact in global climate.

The rate of extinction has increased substantially over the last decades. Speciation takes from 100 to one million years, so *ca.* 10000 species appear each year. Due to human activity, the world is currently facing its sixth mass extinction. The current rate of species' extinction is 100-1000/year, significantly faster than in earlier periods. Hundreds of species extinct per year are expected to occur in 2100.

As in the rest of the world, in the Caribe region, biological resources are threatened by a number of factors, some naturally originated, but most man-made, that impact directly or indirectly species and habitats. The impacts caused by humans over coastal resources are the following: excessive extraction, inadequate coastal development, land-based sources of pollution; and maritime activities. These are described hereafter, and the methods to identify them at several scales (regional and site-based) are provided.

THREATS TO COASTAL RESOURCES**Overfishing**

Overfishing has severely impacted almost all fishery resources in the world. Studies conducted by FAO (2007) showed a sustainable decline of those marine fisheries stocks that are moderately or not exploited completely (from 40 to 25%).

Pauly et al. (2006) examined the trends of world catches and the likely scenarios for the next 45 years. They found that world landings increased from 1900 to the 90s, but that the current

trend is reduction.. This paper also showed the “fishing down the food web” phenomenon due to the overfishing of carnivores.

Overexploitation of marine resources is well documented, particularly for seafood fisheries. Several factors related to this resources have exacerbated this problem, namely:

- Relatively high levels of by-catch;
- Habitat destruction by fishing operation (shrimp trawling, dynamite and poison reef fish fishing, etc.);
- Single-species approach of fisheries management;
- Weak law enforcement; and
- Inadequate protection of important breeding and nursery sites.

Overexploitation has several effects among which are the alteration ecosystem balance, herbivores reduction in reefs, decline of fish average size in most commercial stocks, shifting to less economically valuable fishes, etc.

Excessive fishing (due to lack of regulation or weak enforcement) has generated a dramatic decline of coastal resources in continental and insular shelves in the Caribbean.

In the Caribbean region, snapper and grouper fishing has significantly dropped and in many islands, they are “commercially extinct” and have been replaced in the catches by species with less economic value and lower trophic level such as grunts (*Haemulidae*), parrotfishes (*Scaridae*) and other species. In some islands, such as the Lesser Antilles, with narrow shelves and centuries of intense exploitation, changes in fish fauna composition are so severe that fishermen and experts fail to recognize the existence of overfishing due to the lack of anecdotic records on past snapper and grouper abundance. This phenomenon is not exclusive of small islands, not even of islands, but rather pervasive, and exist in most areas (including S Florida). This phenomenon, known as “shifting baselines”, occurs all over the world and has led to inadequate assessment of fisheries resources.

Anecdotal information provided by patriarch fishers (who have seen their livelihood reduced over the last decades), and a wealth of research data on the Caribbean fish populations have demonstrated that overfishing is chronic in many areas.

Catch trends of several fish species in Cuba over the last 40 years (exceptional data set due to the existence of good fisheries statistics in Cuba) have showed the dramatic decline of almost all fish species catches in the late 80’s (Claro et al. 2003). The lack of similar dataset in most Caribbean countries make difficult to quantify the reduction of fisheries resources over decades. However, isolated studies in different areas have documented the dramatic reduction la fish, lobster and conch production due to overfishing.

Impact of overfishing go beyond the decline of a few economically valuable species. In order to compensate the effect on keep their catch levels and income, fishers use different strategies, namely: operating in farther and deeper areas, demanding government for more subsidies (tax reduction, etc.), as well as transiting to other economic alternatives.

Year after year, Caribbean fishermen go fish deeper, farther, and riskier. Each year “hookah” accidents take the life of several fishers. Large, adult fish, with greater reproductive power that inhabit the drop-offs are excessively harvested, affecting the population replenishment capacity.

However, the increasing research and stewardship efforts of conservation practitioners, scientists, and responsible fishermen and managers, has foster the designation of marine reserves or no-take areas in spawning aggregations sites (for groupers, snappers, jacks, etc.) in several countries. In 2002, 11 fish multispecies spawning aggregations sites were designated as marine reserves in Belize. Other countries such as The Bahamas, U.S. and Puerto Rico, have done followed suit.

Indiscriminate fishing have several effects over the marine ecosystem, namely:

- Habitat destruction (by methods such as trawling, traps, poisoning, etc.),
- Sea turtle dolphin and birds by-catch
- Fishing down the web (more and more valuable species are fished to maintain income) and
- Overall alteration of ecosystems, which prevent fast recovery after mass coral bleaching and other widespread diseases.

The use in recent years of drastic fishing management techniques (restrictions for fishing gears, seasonal or permanent closures, marine reserves, etc.) seems to have diminished exploitation rate in some areas, but recuperation is not a short term process.

The expansion of the tourism industry have allowed many fishermen to transit to other economic livelihoods less fishing-dependent. Economic activities such as construction, hotel maintenance, tour-operators, small retail business, etc.. In some countries such as Mexico, Belize, Dominican Republic, Eastern Caribbean Islands, etc., fishers have switched to such jobs to keep their income. However, fishing still is the economic basis of many coastal communities in the Caribbean due to the high demand of seafood products locally as for export in the region (mainly to the U.S.). Also, for many senior fishermen it is hard to fit into other types of jobs. Weak fishing regulations or their enforcement also play a role as they are not compel to find other livelihoods.

Environmental assessment of local areas have been conducted in the Caribbean as a result of the regional interest on determining the effect of how human activities in coastal environment. “Threat analysis” “gap analysis” are some of them. Table 3.5 provides data of a regional the threat analysis conducted by The Nature Conservancy, based on expert opinion.

The development of marine conservation science over the last years, and the needs to implement conservation measures, has led the experts to develop and apply science-based methods to assess the potential impact of human activities (also known as **threats**) to marine resources at different spatial scales (sites, country, ecoregion, biogeographic province). Among them, some are very sophisticated and are widely used by local and international organizations, such as the ecoregional assessments (see <http://www.nature.org/initiatives/marine/strategies/assessments.html>, <http://conserveonline.org/workspaces/ecoregional.shapefile>, <http://www.marineebm.org/40.htm>, and the area/site conservation planning tools. Hereafter, some of this tools and its web sites:

- Ecoregional assessment of the northern Gulf of Mexico
http://conserveonline.org/workspaces/MECA/NGoM_Final_allfigs.PDF/view
- Florida Ecoregional Assessment
<http://conserveonline.org/workspaces/MECA/FlaMarinePortfolio/view> ,
- <http://conserveonline.org/workspaces/MECA/FL%20Marine%20Site%20Prioritization%20Framework%2C%20final%20report%20Sept%202005.pdf/view>
- Puerto Rico Ecoregional Assessment
<http://conserveonline.org/docs/2005/09/PuertoRicoTerrERAMay05.pdf>
- Prioridades de PDVSA en la Conservación de la Biodiversidad en la Región Caribe de Venezuela.
http://www.intecmar.usb.ve/PDVSACaribe/documents/proyecto_PDVSA_Biodiv_ago17.ppt
- The Five-S Framework for Site Conservation. A Practitioner Handbook for Site Conservation Planning and Measuring Conservation success.
http://www.nature.org/summit/files/five_s_eng.pdf
- Site Conservation Planning Best Practices.
<http://conserveonline.org/docs/2003/04/scpbp.pdf>
- New guidelines for management planning for Ramsar sites and other wetlands.
http://www.ramsar.org/key_guide_mgt_new_e.htm
- Ecoregional Conservation Planning for the Mesoamerican Reef
<http://www.wwfca.org/php/macrf/> (2002)
- Ecoregional assessment of the Mesoamerican Reef Region
http://www.tncmar.net/english/what's_new/noticias/Memoria%20Primer_Taller_Ecoregional.pdf (2007)

- Reef at risk in the Caribbean
http://www.oceanservice.noaa.gov/programs/nccos/nos_science/ReefsRisk_Burke.pdf
(Burke and Maidens, 2004)

(the entire bibliographic references of the publications above can be found at those web sites)

Reef at Risk in the Caribbean is a region-wide analysis that uses indirect indicators of the impact of land-based pollution, overfishing, and maritime activities to assess the status of within ecoregions and marine protected areas. Despite the low spatial resolution of the analysis and the limitations of the data, this report is useful to show the general overview of the potential risks of the Wider Caribbean reefs in the short and long term.

Coastal development

Many sectors utilise coastal resources, and therein impact on coastal resource viability. In fact, many activities that take place far from coastal areas may impact on coastal and marine resources (Table 3.6, see section on land-based pollution). However, coastal development is considered to rank among the most significant human threat.

Threats from coastal development may include the following:

- Construction and operation of harbour facilities (damage or loss of habitat, suspension of sediments, loss of sessile organisms, alteration of current patterns in locale, etc.);
- Construction of shore protection structures (alteration of sand budget/movement resulting in erosion, alteration of currents in locale, etc.);
- Dredge and fill (loss of sessile organisms, destruction or loss of habitats, transportation of sediments to sensitive marine ecosystems);
- Drainage of wetlands (damage to wetland, reduced productivity, loss of important species, transportation of sediments to sensitive marine ecosystems);
- Road and infrastructure construction (disruption of ecosystem functioning, loss of habitat, transportation of sediments to sensitive marine ecosystems);
- Construction of residential, resort, commercial, and industrial developments (loss of resources and habitats, transportation of sediments to sensitive marine ecosystems).

In addition to the direct impact of these activities, studies have shown that these land-based activities can exacerbate the impacts of storms on nearshore coral reefs (Nowlis, et al, 1997).

Table 3.6: Activities utilizing or impacting coastal resources	
Activities often specifically related to the coastal zone or Ocean	Activities rarely specifically related to the coastal zone but may have direct impacts
Naval and other national defense operations (e.g. testing, coast guard, customs) Port and harbour development (including shipping channels) Shipping and navigation Recreational boating and harbours Commercial and recreational fishing Mariculture Tourism and recreation Marine and coastal research Water supply Waste disposal Industrial and commercial developments Oil and gas facilities	Agriculture; aquaculture Forestry Wildlife management Parks and recreation Education Public health (mosquito control, food) Housing Water and pollution control Water supply Transportation Flood control Oil and gas development Mining Industrial development Energy generation Waste disposal
Source: Modified from Awosika, et al. (1993)	

Land-based pollution

It is generally agreed that within the Wider Caribbean Region, the land-based sources of pollution (point and non-point sources) form the most significant threat to the marine environment. The main sources have generally been identified as the following:

- Point sources (industrial, sewage, and solid waste);
- Urban non-point runoff (stormwater runoff and combined overflow discharges);
- Non-urban non-point runoff (cropland, pastureland, and forestland runoff);

- Upstream sources (pollutants carried into the coastal zone as part of a river’s streamflow); and
- Irrigation return flows (irrigation water return to lake, stream, or canal).

Though the pollution inputs from land-based sources have not been fully quantified, the impacts on the nearshore and marine environment are well known; encompassing degradation and destruction, of the nearshore habitats, reducing bathing water quality (sometimes resulting in the temporary or permanent closure of bathing beaches), and generally creating public health hazards (UNEP, 1987).

Programmes to deal with point sources of pollution concentrate primarily on pollution reduction through the development of effluent limitations (including permit and licence systems), particularly with regard to industrial pollution.

Seemingly more problematic than the point sources of pollution are the non-point sources (Table 3.7). Mounting volumes of solid waste overwhelm the collection and disposal systems, and landfills (mostly dumps instead of properly designed landfills) produce leachate that contaminate the coastal ground water and the marine environment. Additionally, the urban inputs through the drainage system are significant, and difficult to address.

However, the activities taking place in the watersheds produce significant negative impacts on the marine environment. The watershed-generated inputs are transported to the marine environment via large river systems (Table 3.8), and may be transported “...from as far distant as the Andes and the northern Great Plains of North America...” (UNEP, 1989, P. 27).

Table 3.7: Non-point sources of pollution

Medium Impacted	Sources	Factors	Impacts
Soil	Industry Agriculture Atmospheric fallout	Toxic compounds Pesticides “Acid” rain	Decreased productivity Health problems
Water (ground/ surface/ marine)	Sewage disposal Agricultural run-off Atmospheric fallout Urban surface run-off	Sediments Sewage effluent Oils/hydrocarbons Pesticides	Health problems Contamination of water supply systems Decreased amenity

	Commercial and residential activities Shipping and other marine activities	Fertilizers Marine debris Solid waste Toxic compounds Wastewater “Acid” rain	value Ecological disruptions Decreased fisheries production
Air	Agriculture Commercial activities Residential activities Waste disposal Industry Motor vehicle exhaust Recreational activities Construction activities	Noise Particulates Gases (oxides of sulphur, carbon, nitrogen, etc.)	Property damage Health problems Crop damage
Source: Gardner, 1999			

Table 3.8 Pollutant loads discharges from some rivers in the Wider Caribbean Region

River	Country	Q (m ³ /s)	BOD ₅ (t/y)	TSS (t/y)	TN (t/y)	TP (t/y)
Rio Cobre	Jamaica	10	6.3 x 10 ³	1.3 x 10 ⁴		
Yaracuy	Venezuela	16	5.5 x 10 ³	3.5 x 10 ⁴	8.5 x 10 ²	7.8
Ozama	Dominican Republic	48	3.6 x 10 ⁴	1.3 x 10 ⁵		
Reventazon	Costa Rica	247	6.8 x 10 ⁴	1.3 x 10 ⁶	1.1 x 10 ⁴	
Coatzacoalcos	Mexico	420	6.7 x 10 ⁴	3.5 x 10 ⁷	1.7 x 10 ⁴	
Grijalva	Mexico	795	1.3 x 10 ⁵	2.2 x 10 ⁶		
Magdalena	Colombia	7,000	2.8 x 10 ⁵	6.8 x 10 ⁷	1.3 x 10 ⁵	1.4 x 10 ⁴
Mississippi	USA	17,800	4.5 x 10 ⁵	3.2 x 10 ⁸	3.4 x 10 ⁵	6.9 x 10 ⁴
Q = Discharge rate		BOD = Biological oxygen demand				
TSS = Total suspended solids		TN = Total nitrogen				
TP = Total phosphorus		t/y = Tons per year				
Source: UNEP, 1994						

Main impacts of the selected parameters

Suspended solids impact on marine ecosystems and recreational activities in the following ways:

- Smothering of benthic flora and fauna;
- Reducing productivity of benthic flora by increasing turbidity and reducing the illumination;
- Reducing the productivity of corals by smothering, reduction of illumination, and requiring the coral to waste energy in keeping itself clean;
- Reduced amenity value from reduced visibility and aesthetic appeal.

The major impact of nutrient (nitrogen and phosphorus) enrichment to the marine environment is the stimulated growth of macroalgae, which already form a significant percentage of the cover on many of the coral reefs in the Caribbean.

Biological oxygen demand levels are generally derived from primary production processes. As such, high concentrations of nutrients and organic matter usually result in elevated levels of BOD. In areas experiencing pollution, the combined effects of BOD and chemical oxygen demand can lower dissolved oxygen concentrations to the point where oxygen become limiting to other marine organisms, sometimes resulting in fish kills.

The World Resources Institute, within the ICRAN Mesoamerican Reef Program, conducted an analysis of the watersheds¹ that quantifies sediment and nutrients from 400 basins that drain to the ecoregion. This information can support coastal management plans and agriculture management, as well as conservation measures and impact abatement. This analysis uses indirect indicators and has a wide spatial scale. However, it can be very useful to bring attention from managers and policy makers on how terrestrial drainage impact the coastal zone. In order to get data with a higher spatial resolution (local) you may consult other scientific sources.

Maritime activity

Shipping and maritime activities also contribute to the degradation of the marine environment through dry-docking operations, ballasting and tank washing, harbour operations, and oil spills from exploration, production, and shipping. UNEP (1989) indicates

¹ http://www.wri.org/biodiv/pubs_description.cfm?pid=4257) y
http://www.wri.org/biodiv/pubs_images.cfm?pid=4257

that many beaches in the Caribbean have experienced tar concentrations in excess of 100 g/m of shore, making them unfit for recreational uses.

Cruise tourism, one of the beneficiaries of a pristine environment, also contribute to the problem, through the disposal of solid and sewage wastes. Though the contribution from this latter source is thought to be less than that from land-based sources, the fines levied by the United States Government on a well-known cruise line as late as 1999 indicates that the problem continues.

Some events, such as storms, also cause damage to other coastal and marine resources; including beaches, seagrass beds, and mangrove stands. Additionally, the impact of one event can increase the vulnerability of the resource to a different threat, or even act as the trigger for the other. The damage caused to corals by disease (White Band, Black Band, Yellow Band, and White Plague diseases) may increase the susceptibility of the coral reefs to hurricane damage, as well as contributing to post-hurricane mortality. Woodley (1999) suggests that coral diseases may thrive when the corals are already weakened by other stresses.

Global warming is one phenomenon that is projected to increase the frequency and intensity of some natural events, and may eventually change the weather patterns over large areas of the planet.

Caribbean countries are particularly vulnerable to sea level rise, given the concentration of infrastructure, urban areas, and commercial activities in coastal areas. Additionally, further saline intrusion into valuable coastal resources (aquifers, wetlands, agricultural lands, etc.) would have a profound impact on the development opportunities and quality of life for significant proportions of the peoples of the Caribbean.

Coral bleaching in Caribbean countries, in response to high seawater temperatures, became apparent in 1987, 1998 and 2005. Though the majority of coral colonies recover, the process can be disturbed by human impact and hurricanes (it occurred in 2004 and 2005).

The Intergovernmental Panel on Climate Change (<http://www.ipcc.ch/>) concluded that greenhouse gases have contributed to warming and other associated climate changes, in some parts of the globe. These changes seem to be impacting coral reefs by causing mass coral die-off as corals cannot recuperate from severe bleaching or diseases events.

EXERCISE

- ◆ Ask the participants to list all the threats to coastal and marine resources in their MPA, grouped according to lessons learned in Modules 2 and 3, and arranged by levels of impact over the area

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Appendix 3.1

State of the Fisheries in the Wider Caribbean Region

FAO Fisheries Circular No. 920 FIRM/C920
Rome, 1997

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REVIEW OF THE STATE OF WORLD FISHERY RESOURCES: MARINE FISHERIES

by
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WESTERN CENTRAL ATLANTIC
FAO Statistical Area 31

Introduction

The waters incorporated in Area 31, the Western Central Atlantic, centered on the Caribbean and Central American States, include a diverse array of fisheries and harvested fish species. The FAO FISHSTAT system has records of 147 species or species groups being caught in these waters between 1950 and 1994. The species groups reported include categories such as "marine molluscs: not identified" and "finfishes: not identified", so the actual number of species harvested is likely to be much higher. A total of 26 states from the area have recorded landings on the system and many of these would include fisheries ranging from artisanal to commercial operations within their national fisheries. The oceanography of the region is heavily influenced by the runoff of the major river systems of the Mississippi, Orinoco and Amazon rivers. These river systems, demonstrating mesoscale variability in runoff, contribute to inter-annual variability within the marine system which is also influenced by other climatic factors, including hurricanes.

The fisheries of the region have been characterized by generally increasing catches in recent decades as fishing pressure has risen. However, knowledge of the status of the stocks being

harvested is generally poor, and sustainable levels of fishing mortality are essentially unknown for most species. There is a common belief that many stocks are being fully or over-exploited and there is concern for the status of species such as Nassau grouper *Epinephelus striatus* and jewfish *E. itajara*, the spiny lobster in some regions, and the queen conch. The greatest need in the region is for improved knowledge of the status and potential productivity of the stocks and of the fisheries harvesting them, to enable implementing appropriate management action.

Profile of Catches

The total fish landings from the area have increased fairly steadily since 1950, reaching a peak at over 2.5 million tonnes in 1984 before falling until 1992, followed by a recovery in 1993 and 1994. In 1994 they stood at over 2.1 million tonnes, compared to an average of less than 1.5 million tonnes between 1950 and 1994.

The single major contributor to the landings at the ISSCAAP Group level is the pelagics of Group 35 (herrings, sardines and anchovies, etc.). Of these, ranking first and third respectively in terms of 1994 landings were the Gulf menhaden and the Atlantic menhaden. The landings of these two species in 1994 were 767 000 t and 37 500 t respectively, the former showing some recovery after the decline in landings in the late 1980s and early 1990s, while those of the latter remained substantially lower than the peak of the early 1980s. Combined, they represented 80% of the landings of pelagic species in ISSCAAP groups 34 and 35, and 38% of total landings from the region. There has also been a generally increasing trend in landings of small pelagics since the early 1970s. The small pelagics from Group 35 providing the largest landings, apart from those of menhaden, are largely clupeoids, particularly round sardinella and Atlantic thread herring. Within Group 34, the unidentified mullets and the Flathead gray mullet yielded the greatest landings in 1994 followed by the *Caranx* species.

In 1994 the largest landings of large pelagics in ISSCAAP Group 36 (tunas, bonitos, billfishes etc.) came from yellowfin tuna (28 000 t), Atlantic Spanish mackerel and king mackerel (19 000 t and 9 000 t respectively) and skipjack tuna (8 000 t). Landings of ISSCAAP Group 36 species have shown substantial increases over the period 1950 to 1994.

Contributing substantially less than the small pelagics in terms of landed weight, but certainly of considerable total economic value, are ISSCAAP Group 45 (shrimps, prawns etc.), Group 33 (redfishes, basses, congers etc.), and the other higher value species groups. A cause for concern is the substantial increase in ISSCAAP Group 39 (miscellaneous marine fishes). This group accounted for approximately 40% of total finfish landings in 1994, excluding menhaden. Without accurate data on the species composition of landings, and

associated information on effort, it is impossible to assess the status of the stocks, and better identification of fish landings should be given a high priority by those countries in the region which are failing in this regard.

The fisheries for crustaceans in this area are dominated by those for the Caribbean spiny lobster and penaeid shrimps, the latter particularly from the Gulf of Mexico and the Guianas-Brazil subregion. Landings of the spiny lobster have increased fairly consistently since 1950, while the total annual shrimp catch from the region has fluctuated around approximately 170 000 two decades. The production of shrimps and prawns by aquaculture has grown substantially in recent years, reaching over 11 000 t in 1994 or 7% of the total shrimp production, including aquaculture, from the region.

Several mollusc species support valuable fisheries in the area, in particular the fisheries in the USA for cupped oysters and calico scallops. In 1994, recorded landings for these species were 59,000 t and 74,000 t respectively, the latter showing recovery after the dramatic decline of the early 1990s. Production of cupped was supplemented by the culture of nearly 90 000 t of the species in Mexico and the USA in that year. Landings of queen conch have increased substantially over the last 25 years but declined somewhat after a peak at nearly 8,000 t in 1984. In 1993 landings again rose above 8,000 t, but declined to just more than 7,000 t in 1994. The status of the stock is currently causing concern.

Resource Status and Management

Despite a scarcity of hard information and few rigorous assessments, there is general concern for a number of the species and stocks in the region. One such group is that of the sharks and rays, in which landings have increased substantially in recent years, reaching a peak of nearly 34,000 t in 1994, over double that landed, on average, between 1950 and 1994. The nations taking the largest landings of these species in 1994 included Mexico, Venezuela and the USA, all of which have shown increasing landings in recent years. In addition, many species of reef fish have been reported as being fully or overexploited, including Nassau grouper and jewfish. Within ISSCAAP groups 33 (Redfishes, basses, congers etc.) and 39 (Miscellaneous marine fishes), which include most of the reef-fish species, the two highest landings categories, together accounting for nearly 70% of the total landings for the group, were unidentified marine fishes and finfishes. Clearly there is little hope for rigorous management for sustainable utilization as long as this problem remains. Of the identified landings, the greatest landings were made of unidentified groupers (*Epinephelus* spp.), unidentified snappers and jobfishes (*Lutjanidae*), unidentified weakfishes (*Cynoscion* spp.) and unidentified sea catfishes (*Ariidae*). In all of these groups landings for 1994 were above 10,000 t.

The demersal fishes of the region support important fisheries. The most important commercial fishery utilizes hook and line and occasionally traps to catch the deep reef fishes, particularly snappers and groupers, while trawl fisheries catch mainly the croaker and drum multi-species category. Considerable attention is being given to reduction of finfish bycatch in the shrimp fishery, particularly through the use of bycatch reduction devices, but finfish bycatch, including substantial proportions of juveniles, is still cause for concern.

The pelagic fisheries of the area may be divided into large offshore pelagics with oceanic distribution, large coastal pelagics with a regional distribution and small pelagics. The first group includes fish such as the billfishes, tunas and swordfish. Most of these species are assessed by the International Commission for Atlantic Tunas (ICCAT) and most are considered by the Commission to be fully or over-exploited. Any plans to expand the fisheries for these species within the region should therefore be made within the ICCAT framework, and proper representation of the smaller nations within WECAFC on this body should be seriously considered by fisheries departments in the region. This is clearly an example where regional cooperation is urgently required. In contrast to the stocks falling under ICCAT, the status of the stocks of the more common locally distributed large pelagics, such as mackerel *Scomberomorus* species, blackfin tuna and common dolphinfish is unknown. The round sardinella and Atlantic thread herring are generally caught close to the continental mainland and the larger islands such as Trinidad and Jamaica. Fisheries for small pelagics on the smaller islands making up the lesser Antilles largely make use of beach seine nets and are locally important providers of employment and food. They tend to be based on carangidae, that is the jacks and scads, such as *Selar crumenophthalmus* and *Decapturus* spp., and halfbeaks (*Hemiramphus* spp.). The flyingfish (*Hirundichthys affinis*) makes up only a low proportion of landings of small pelagics, but is important to the southeastern Caribbean states. Only two countries, Barbados and Granada, have recorded catches of this species on FAO FISHSTAT, but at least seven island states have fisheries for the species and there is considerable interest in increasing exploitation.

The main crustacean fisheries are those for spiny lobster and penaeid shrimps. Total landings of spiny lobster in 1994 amounted to nearly 30,000 t, with the fishery dominated by Cuba (9,700 t) and the Bahamas (7,800 t). The USA, Nicaragua and Honduras also recorded landings of over 1,000 t. The resource is generally considered to be over-exploited in many countries and a more holistic and effective management strategy is required for the region. Steps are being taken in this direction and, for example, both Cuba and the Bahamas have taken active steps to implement appropriate management measures. A workshop aimed at undertaking a regional assessment of these resources is scheduled for the first half of 1997.

In 1994 the total shrimp catch from the region was over 160 000 t. Of this, and including aquaculture, the USA accounted for over 100 000 t. Other major producers included Mexico (23 000 t), Venezuela (14 000 t), Colombia (9 000 t) and Guyana (7 000 t). Probably the

major concern with this fishery is the issue of bycatch, both of finfish and of turtles. Finfish species taken as bycatch include species such as croaker (*Micropogonias* spp.), snapper (*Lutjanus* spp.) and dog trout (*Macrodon ancylodon*).

Several mollusc species support valuable fisheries in the area, in particular the fisheries in the USA for cupped oysters and calico scallops. In 1994, recorded production of these species, including aquaculture, was 146 000 t and 74 000 t respectively, the latter showing some recovery after the dramatic decline of the early 1990s. The queen conch fishery is cause for some concern, and the stock is considered to be over-exploited in most countries in the area. As a result, the species has been listed on Appendix II of CITES. Mexico has the largest landings of this species. Serious attempts are being made to assess the status of the species and determine appropriate management responses. An "International Queen Conch Conference" was organized by the Caribbean Fishery Management Council in mid-1996 to consider approaches to assessment and management of the species.

Environmental degradation presents cause for concern in some areas and fisheries within the region. The coastal habitats are vulnerable to on-going coastal development and to impacts from inland developments such as pollution and damming of rivers. The Committee for the development and Management of Fisheries in the Lesser Antilles of WECAFC recently called for investigations into the impacts of environmental degradation as a priority. Loss of important coastal nursery areas such as mangrove and sea grass habitats, are specific examples of problems being experienced. Coral reefs, important habitats in the region of substantial socio-economic importance through both tourism and fisheries, are also being degraded. The Final Report of the International Coral Reef Initiative Workshop in 1995 reported on incidences of declines in reef fish populations and coral cover across the region. These changes were being brought about by factors such as terrestrial runoff of both sediments and nutrients, direct physical damage to the reefs in a number of ways, and overexploitation of fish resources. Clearly, attempts to sustainably utilize the renewable marine resources must incorporate appropriate environmental management.

Appendix 3.2 Cruise ship arrivals in the Caribbean (thousands of passengers)²

Table 47: Cruise Passenger Arrivals (<i>thousands</i>)							
Destination	2000	2001	2002	2003	2004	% ch. 2004/03	% share 2004
Bahamas ¹	2,512.6	2,551.7	2,802.1	2,970.2	3,360.0	13.1	16.9
Bermuda ²	207.9	180.0	200.1	226.1	206.1	-8.8	1.0
Antigua and Barbuda	429.4	408.8	309.7	385.7	522.8	35.5	2.6
British Virgin Islands	188.5	202.5	230.1	304.3	466.6	53.3	2.4
Dominica	239.8	207.6	136.9	177.0	383.6	116.7	1.9
Dominican Republic ³	183.2	208.2	247.0	398.3	456.3	14.6	2.3
Guadeloupe ⁴	392.3	361.7	204.8	195.1	n.a	-	-
Haiti	304.5	357.4	*354.1	n.a	n.a	-	-
Puerto Rico	1,301.9	1,350.3	1,203.9	1,235.8	1,381.4	11.8	7.0
St. Kitts and Nevis	164.6	252.2	167.2	146.3	260.2	77.8	1.3
St. Maarten	868.3	867.8	1,055.0	1,181.1	1,348.5	14.2	6.8
US Virgin Islands	1,768.4	1,891.4	1,738.7	1,773.9	1,964.7	10.8	9.9
Eastern Caribbean	5,841.0	6,108.0	5,647.4	6,179.9	7,203.0	16.6	36.3
Aruba	490.2	487.3	582.2	542.3	576.3	6.3	2.9
Barbados	533.3	527.6	523.3	559.1	721.3	29.0	3.6
Bonaire	43.5	40.5	42.2	44.6	53.3	19.6	0.3
Curacao	308.3	300.1	319.1	279.4	219.4	-21.5	1.1
Grenada	180.3	147.4	135.1	146.9	229.8	56.4	1.2
Martinique	286.2	202.4	200.8	268.5	159.4	-40.6	0.8
St. Lucia	443.6	489.9	387.2	393.2	481.3	22.4	2.4
St. Vincent and G'dines	86.2	76.5	70.3	64.6	77.6	20.1	0.4
Trinidad and Tobago	104.1	82.3	60.0	55.5	54.3	-2.3	0.3
Southern Caribbean	2,475.7	2,354.0	2,320.1	2,354.3	2,572.7	9.3	13.0
Belize	58.1	48.1	319.7	575.2	851.4	48.0	4.3
Cayman Islands	1,030.9	1,214.8	1,574.8	1,819.0	1,693.3	-6.9	8.5
Cozumel	1,504.6	1,595.4	2,227.7	2,708.9	2,862.0	5.7	14.4
Jamaica	907.6	840.3	865.4	1,132.6	1,099.8	-2.9	5.5
Western Caribbean	3,501.2	3,698.6	4,987.5	6,235.7	6,506.5	4.3	32.8
Total^m	14,538.4	14,892.2	15,957.2	17,966.1	19,848.4	10.5	100.0

¹ At first port of entry only ² Excludes sea/air arrivals ³ All sea arrivals; estimate
⁴ Port of Guadeloupe only (excludes arrivals at St.Barthelemy)

Note: Total cruise passenger arrivals as given above represent the sum of arrivals at individual destinations. However, because most cruise ships stop at more than one destination, this figure is considerably larger than the number of cruise passengers visiting the region.

Source: Section 3 of this Report and CTO estimates.

² Caribbean Tourism Association <http://www.onecaribbean.org/information/documentview.php?rowid=4681to>

Appendix 3.3 Change of number of cruise ship passengers that arrived to different Caribbean countries in 2003 and 2004 (CTO, July, 2007)

Destination	Period	2004	2003	% change
Antigua	Jan-Dec	522,753	385,686	35.5
Aruba	Jan-Dec	576,320	542,327	6.3
Bahamas	Jan-Dec	3,360,012	2,970,174	13.1
Barbados	Jan-Dec	721,270	559,119	29.0
Belize	Jan-Dec	851,436	575,196	48.0
Bermuda	Jan-Dec	206,133	226,097	-8.8
Bonaire	Jan-Dec	53,343	44,004	21.2
British Virgin Islands ^P	Jan-Dec	466,601	300,415	55.3
Cayman Islands	Jan-Dec	1,693,293	1,659,390	2.0
Cozumel (Mexico)	Jan-Dec	2,862,039	2,708,913	5.7
Curacao	Jan-Dec	219,385	279,378	-21.5
Dominica ^P	Jan-Dec	383,614	177,044	116.7
Dominican Republic	Jan-Dec	456,321	398,263	14.6
Grenada	Jan-Dec	229,800	146,925	56.4
Haiti	Jan-Dec	289,208	351,616	-17.7
Jamaica	Jan-Dec	1,099,773	1,132,596	-2.9
Martinique ^P	Jan-Dec	159,416	268,542	-40.6
Puerto Rico	Jan-Dec	1,390,343	1,234,992	12.6
St Lucia	Jan-Dec	481,279	393,240	22.4
St Maarten	Jan-Dec	1,348,450	1,171,734	15.1
St Vincent & G'dines	Jan-Dec	74,657	64,965	14.9
Trinidad and Tobago	Jan-Dec	54,254	55,532	-2.3
US Virgin Islands	Jan-Dec	1,964,689	1,773,948	10.8
				0.0

Note: Preliminary figures, under revision by state members as they appeared on June, 2007

MODULE 4	MARINE PROTECTED AREAS OVERVIEW
OBJECTIVE	To provide a historical perspective of marine protected area programmes in the Caribbean, and to identify existing issues
THEMES	<ol style="list-style-type: none">1. Definitions of protected areas (1h)2. Historical overview of marine protected area programmes in the Caribbean (1h)3. Present status of marine protected areas in the Caribbean (1h)
DELIVERY TIME	3 h

MODULE 4	MARINE PROTECTED AREAS OVERVIEW
THEME 1	Definitions of protected areas
OBJECTIVE	To provide clarification of the categories of protected areas, and their management objectives.
SIGNIFICANCE	Many of the legal and inter-institutional problems related to protected area establishment and management result from the incorrect use of terms, and ignorance of the evolving philosophies that guide the determination of the management objectives for protected areas.
PRESENTATION	Lecture, discussion
EQUIPMENT / MATERIALS	Projector, Mod4.ppt
EXERCISE	Define objectives of the MPA of each trainee
TIME	0.5 h

LESSONS TO LEARN

- What is an MPA
- Why it is important to know the objectives of the MPA where you work
- Which are the potential objectives of an MPA and which are the ones of your MPA.
- The IUCN categories and the one of your MPA

INTRODUCTION

It was established in Module 3 that the establishment of protected areas is one of the strategies used in the management of environmental resources. However, with environmental philosophy, terms, and approaches changing significantly in the past decade, the international community involved in protected areas policy, planning, and management considered it necessary to review the definition of a protected area, to ensure that the definition embraces the wide range of areas under or requiring protection.

But, what is a marine protected area (MPA)? The first definitions were derived at the 4th World Congress on National Parks and Protected Areas, held in Caracas, Venezuela, February 1992. On 1999, IUCN defined it as "any intertidal or subtidal terrain, along with the waters that covers it, and the flora and fauna and historical and cultural attributes that it contains, set aside by law or any other effective mean in order to protect part of the entire environment". More on definitions in

<http://depts.washington.edu/mpanews/MPA4.htm#Nomenclature>

Although this definition is generally accepted, some countries have had to define their own MPA categories in order to establish the legal framework for MPA designation and management. Among them, we can mention the U.S. classification system (http://mpa.gov/pdf/helpful-resources/factsheets/final_class_system_1206.pdf) which defines the different types of MPAS in the country. This allows for a common language that help to define their objectives and impact over people and ecosystems. This classification system has the following notions:

- Conservation objectives (natural heritage, cultural heritage, sustainable production)
- Level of protection (uniform multiple use, zoned multiple use, zoned without no-take areas, no-take areas, intangible areas, no access areas)
- Protection permanence (permanent, conditional, temporal)
- Protection constancy (the entire year, seasonal, rotating)
- Ecological scale of protection (ecosystem, focused on resources)

Based on its promoters, these 5 main elements answer the following questions:

- Why the site was established;
- What it aimed to protect;

- How it achieves such protection; and
- How much it impacts local ecosystems and human usages.

For more information in this classification system, go to http://mpa.gov/pdf/helpful-resources/factsheets/final_class_system_1206.pdf,

You can also consult the Belize National System of Protected area at http://www.biodiversity.bz/find/protected_area/.

The Us and Belize MPA systems, as well as other national protected area systems, are based on the basic notion that an MPA is just a “managed area” that integrates nature preservation and the use of resources for the benefit of present and future generations, both locally and nationwide.

Thus, recent research data on marine conservation show that MPAs are just another tool of the nation’s integrated coastal management system which includes other policy tools such as fisheries regulations, coastal development restrictions, waste disposal rules, and watershed best management practices. In addition, a single MPA might not be able to achieve its conservation goals if it is not part of a larger national (or ideally, ecoregional) system of protected areas that can ensure the protection of resources with spatial distribution beyond the individual MPA boundaries.

Although obvious it is important to know the main objectives of the marine protected area to develop management measures accordingly. The main purposes for establishment and management of protected areas are identified as:

- ◆ Scientific research;
- ◆ Wilderness protection;
- ◆ Preservation of species and genetic diversity;
- ◆ Maintenance of environmental services;
- ◆ Protection of specific natural and cultural features;
- ◆ Tourism and recreation;
- ◆ Education;
- ◆ Sustainable use of resources from natural ecosystems; and
- ◆ Maintenance of cultural and traditional attributes.

Many MPAs were created for one purpose but their objectives have shifted with time. That is the case of many marine parks in the Caribbean which were created as dive sites in order to restrict other uses (fishing, for example), and reduce user conflict and have become areas of

ecosystem conservation. The objectives can be expanded over time, e.g. when the park is zoned and different uses are assigned to different areas within the park. You can find more information on this subject in Module 6 (MPA planning).

Based on the possible mix of priorities that can be generated by the management objectives stated above, protected areas have been grouped into the following six (6) categories (updated from the ten categories developed by IUCN in 1978):

- ◆ Category I: Strict Nature Reserve/Wilderness Area - area managed mainly for science or wilderness protection (includes two sub-categories; Strict Nature Reserve - Ia, and Wilderness Area - Ib).
- ◆ Category II: National Park - area managed for ecosystem protection and recreation
- ◆ Category III: Natural Monument - area managed mainly for conservation of specific natural features
- ◆ Category IV: Habitat/Species Management Area - area managed mainly for conservation through management intervention
- ◆ Category V: Protected Landscape/Seascape - area managed mainly for landscape/seascape conservation and recreation
- ◆ Category VI: Managed Resource Protected Area - area managed mainly for the sustainable use of natural systems

The IUCN system category is under review (2007)¹. In addition, each country adopts its own management categories system. The analysis of management objectives and the guidelines for the selection of each category (Appendix 4.1) indicates that MPAs, can be developed according to several IUCN categories such as fisheries management areas, fish sanctuary, fisheries reserve, marine park, etc.

The current trend is " "...consists of the establishment of a large, multiple-use protected area with an integrated management system providing levels of protection varying throughout the area" (Kelleher & Kenchington, 1991. P.1). However, due to the increasing complexity and number of protected areas, as well as a growing recognition that many of the threats originate outside the protected sites, there is increasing pressure to adopt a systems approach to protected area management.

¹ <http://wcpa.almlet.net/index.php?module=pnForum&func=viewtopic&topic=44> (July 2007)

MODULE 4	MARINE PROTECTED AREAS OVERVIEW
THEME 2	Historical overview of marine protected area programmes in the Caribbean
OBJECTIVE	To provide participants with the trend of the development of MPA in the region and the main factors involved.
SIGNIFICANCE	Protected area (PA) development in the Caribbean has taken place primarily on a project by project basis. It has been argued that the project approach has led to some of the sustainability problems being experienced by PAs. The lessons learned from past activities will be useful in influencing the design of future PA projects and programmes.
PRESENTATION	Lecture, discussion
EQUIPMENT / MATERIALS	Projector, file Mod4.ppt
EXERCISE	N/A
TIME	0.5h

INTRODUCTION

The Caribbean has a long history of designating protected areas, with the first terrestrial protected area (the Main Ridge Reserve of Tobago) established in 1765, and the first marine protected area (Pedro and Morant Banks in Jamaica) established in 1907 (Putney, 1994). Most Caribbean protected areas were established in the 50's as a response to the increasing concern on watershed protection. In the 50's, a second wave of protected areas designation aimed at biodiversity protection. Due to the growing human population and limited territories of the Caribbean islands, the incorporation of nature conservation to the socioeconomic and cultural agendas of the insular Caribbean countries scenario is critical.

Since that early period, establishment of protected areas has increased significantly, with inventories in the Insular Caribbean listing 158 sites in 1988 (OAS/NPS, 1988) and 284 in 1996 (UNEP, 1996). During the same period, the number of marine protected areas in the Insular Caribbean increased from 51 to 122.

Initiatives to establish marine protected areas in the Caribbean

The initiatives to establish protected areas in the Caribbean involved the effort of individuals, national organisations (public sector and civil society), regional non-governmental organisations, regional inter-governmental institutions, international non-governmental organisations, and the international multi-lateral institutions.

Since the 70's, a number of initiatives were developed to address regional and world-wide action plans. Among them, we can mention the following:

- ◆ IUCN Marine Conservation Strategy for the Caribbean (IUCN, 1979);
- ◆ USAID Training Strategy for Natural Resource Management in Latin America and the Caribbean (WWF-US, 1980);
- ◆ Bali Action Plan (global plan for protected areas produced at the III World Parks Congress) (McNeely and Miller, 1984);
- ◆ Nahuel Huapi Action Plan (for protected areas of Latin America and the Caribbean) (IUCN, 1986);
- ◆ Survey of Conservation Priorities in the Lesser Antilles (Putney, 1982); and
- ◆ IUCN's Global Action Plan for protected areas and Earth Summits

The World Parks Congress, organized by the World Conservation Union (IUCN), is held every ten years to appraise the state of protected areas (PAs) and set an agenda for PAs for the upcoming decade. The September 2003 meeting was the fifth gathering of the World Parks Congress (initially convened as the World Conference on National Parks in 1962). The previous Congress held in Caracas, Venezuela, 1992 set the stage for this meeting by highlighting existing gaps -- the low level of community participation in decision making, the lack of attention paid to biodiversity and surrounding areas, and the inability of decision-makers to balance costs and benefits in a

sound manner -- and issuing a call for countries to identify additional areas of critical importance for sustaining biodiversity.

Two key outcomes emerged from the 1992 meeting:

- an Action Plan that set the target of extending the protected area network to encompass, at minimum, ten percent of each major biome by 2000; and,
- the Caracas Accord, which gave birth to the IUCN Category System, recognizing areas of particular importance to conservation (Bishop, 2003).

The 2003 Congress was charged with setting new commitments and generating policy recommendations for protected areas worldwide through the drafting of five key documents: The Durban Accord; The Durban Action Plan; Message to the Convention on Biological Diversity (CBD); Recommendations; and, Emerging Issues. The core issues of the Fifth World Parks Congress included: the rights of indigenous peoples in relation to protected areas; the rights and roles of industries such as mining and tourism; the transboundary nature of PAs; the under-representation of the marine environment in the PA network; and, the monetary, spiritual and other values of protected areas. The draft document distributed to Congress participants, *A Guide to: Securing Protected Areas in the Face of Global Change -- Options & Guidelines*, outlines global change factors impacting protected area viability and sets forth options and guidelines for making protected area systems more equitable (WCPA, August 2003).

The Congress generated several successful outcomes: a greater recognition of indigenous peoples' rights; an acceptance of the complexity of issues surrounding global change; and, the establishment of new protected areas and concrete targets for parks based on ecosystems and geographic regions. Some of the successes -- official and un-official -- achieved or announced at the WPC, which will impact the next decade of protected areas conservation, include:

- An increased role for indigenous peoples at the discussion table, shaping 'official' outputs;
- Balanced and open discussions with a variety of stakeholders;
- An expanded concept of protected areas to include spiritual and sacred values and to span physical boundaries;
- The recognition that compliance with IP, mobile peoples and local community rights is necessary when establishing and managing existing and future PAs;
- The adoption of targets -- development and implementation of participatory mechanisms for restitution of traditional lands; participation in the establishment and management of protected areas by indigenous and mobile peoples, local communities and other minorities; implementation of communication programmes that ensure their participation; and, establishment of mechanisms to guarantee their receipt of benefits

- establishment of mechanisms to guarantee their receipt of benefits establishment of mechanisms to guarantee their receipt of benefits -- to be achieved by 2010;
- A collection of commitments from governments and NGOs to establish new protected areas, increase pa funding, and develop strategic partnerships and incentives with a variety of stakeholders; and,
 - A vehicle to ensure continued representation of indigenous peoples at international processes through the on-going Indigenous Peoples Ad-Hoc Working Group on Protected Areas and Biodiversity Conservation.

Yet, the true significance of the Parks Congress went beyond its outputs and the issues it covered. The meeting's importance came from its design, which allowed indigenous peoples to actively join the 'official' discussion process and shape the 'official' outputs, such as the WPC Recommendations. This level of participation served to balance the influence of the corporate interests that were involved in the discussions and highlighted the emerging trend of stakeholder inclusion that places significant importance on preparatory meetings and solutions that are integrative and collaborative.

Though none of the above plans have been the basis for regional programmes, a number of regional and international organisations have implemented regional projects or programmes in support of protected areas. In addition to the financial support provided by many foundations, bilateral, and multilateral organisations, the major regional initiatives are shown below.

Caribbean Conservation Association - Marine Parks Project

The Caribbean Conservation Association (CCA), with the financial support of Canada's International Center for Ocean Development, implemented a marine parks project that focused on a wide range of actions in 10 Caribbean countries during the period 1991-96. One of the outputs of the project was the establishment of the Marine Parks and Marine Protected Areas Managers Network (MPANET).

MPANET was launched at a meeting of Pilot Project Managers in Tobago in 1995, was formed with the following objectives:

- Sharing, communication, and documentation of information and experience among marine protected area managers;
- Development and facilitation of training programmes and research methodologies and tools specific to the needs of marine protected area managers operating in small island systems; and
- Dissemination of knowledge and information to marine resource users and the general public on the need for, and benefits of, marine protected areas.
- MPANET was absorbed into CaMPAM in 1997.

For more recent information on projects and activities, go to <http://www.ccanet.net/>

Caribbean Natural Resources Institute - Parks and Protected Areas Programme

Protected areas formed one of the two initial programme areas of the Caribbean Natural Resources Institute (CANARI). The programme focused on technical cooperation, training, networking, and demonstration projects. CANARI also published the Caribbean Park and Protected Area Bulletin until 1994. the Marine Protected Areas and Coastal Communities.

The Project “Marine Protected Areas and Coastal Communities. A Resource Site for Caribbean Coastal Resource Managers” provides tools and resources to help Marine Protected Area (MPA) managers and others working on MPAs in the Caribbean better understand and respond to the needs of coastal communities. Many of the materials included here came out of a series of research projects carried out in the region through the United Kingdom Department for International Development’s Natural Resource Systems Programme. Those projects examined the linkages between coastal natural resource management, sustainable human development, and poverty reduction in the Caribbean, and a few looked specifically at MPAs and coastal communities. See <http://www.canari.org/mpa.htm> for more.

Organisation of Eastern Caribbean States - Protected Area Programme

Protected areas formed one of the areas of focus for the Natural Resources Management Unit (NRMU) of the OECS during the period 1992-96. Though no longer a programme area, the NRMU continues to support protected area activities in the OECS countries. More recently, Protected Areas and Associated Sustainable Livelihoods project (Nichols, 2004)² started thanks to GEF Block B grant that provided a regional approach to protected area establishment and management in the Eastern Caribbean. Within the St. George Declaration on Environmental Sustainability and others. This aimed at a integrated coordination multinational efforts on protected areas and with other environmental management strategies. This project aimed at fostering biodiversity conservation of participant countries, the elimination of barriers for effective management and the involvement of civil society and private sector on the areas planning, management and sustainable use.

EXISTING REGIONAL PROGRAMMES

IUCN-The World Conservation Union

The Caribbean is one of IUCN's protected areas programme regions. In addition to preparation of the marine strategy for the Caribbean, IUCN maintains an active network of protected area professionals in the region through its World Commission on Protected Areas (formerly CNPPA). The programme, which was guided by a regional steering committee

² OECS Protected Areas and Associated Livelihoods Project (OPAL)
<http://www.oecs.org/esdu/documents/Brief%20on%20OPAAL.pdf>

(1989-92), has focused on assistance to regional organizations, networking, information collection and exchange, and training. Efforts to establish a regional protected area trust fund continue.

IUCN has 5 Programmatic Commissions³, as follows:

World Commission of Protected Areas (WCPA). WCPA is the world's premier network of protected area expertise, and works by helping governments and others plan protected areas and integrate them into all sectors; by providing strategic advice to policy makers; by strengthening capacity and investment in protected areas; and by convening the diverse constituency of protected area stakeholders to address challenging issues. For more than 50 years, IUCN and WCPA have been at the forefront of global action on protected areas. This commission has a representation in the Caribbean region⁴ with the participation of 25 countries and territories, and another one for Central America⁵.

Commission on Environmental Law (CEL) is a network of environmental law and policy experts from all regions of the world who volunteer their knowledge and services to IUCN activities, especially to those of the IUCN Law Programme. CEL functions as an integral part of the IUCN Environmental Law Programme, which includes the Commission and the Environmental Law Centre. CEL not only takes the lead in projects of its own, but also provides a source of expertise for the Environmental Law Centre and other parts of IUCN. The Commission thus serves as the principal source of legal technical advice to the Union, its members and its collaborating institutions on all aspects of environmental law. It supports action by international governmental organisations, governments and non-governmental organisations to improve or develop legal and institutional infrastructure best attuned to natural resources conservation in the context of sustainable development. CEL's goal is to demonstrate the vital importance of such infrastructure within national and international strategies for environmental conservation, including the sustainable use of natural resources within and beyond national jurisdictions.

Commission on Ecosystem Management (CEM) - A network of about 400 volunteer ecosystem management experts from around the world. The Commission works closely with other IUCN Commissions, regional offices and global thematic programmes. CEM and its individual members are involved in a wide range of Ecosystem Management activities. CEM is supported by the Ecosystem Management Programme and its Secretariat both located at the IUCN Headquarters in Gland, Switzerland.

³ http://www.iucn.org/places/orma/com_wcpa_inicio.shtml

⁴ <http://www.iucn.org/themes/wcpa/region/caribbean/caribbean.html#countries>

⁵

Species Survival Commission (SSC) – A science-based network of some 7,000 volunteer experts from almost every country of the world, all working together towards achieving the vision of “A world that values and conserves present levels of biodiversity.” Members include researchers, government officials, wildlife veterinarians, zoo and botanical institute employees, marine biologists, protected area managers, and experts on plants, birds, mammals, fish, amphibians, reptiles, and invertebrates. Most members are deployed in more than 100 Specialist Groups and Task Forces. Some groups address conservation issues related to particular groups of plants or animals while others focus on topical issues such as reintroduction of species into former habitats, or wildlife health. SSC’s major role is to provide information to IUCN on biodiversity conservation, the inherent value of species, their role in ecosystem health and functioning, the provision of ecosystem services, and their support to human livelihoods. SSC members also provide scientific advice to conservation organisations, government agencies and other IUCN members, and support the implementation of multilateral environmental agreements.

Commission on Environmental, Economic and Social Policy (CEESP)- An inter-disciplinary network of professionals whose mission is to act as a source of advice on the environmental, economic, social and cultural factors that affect natural resources and biological diversity and to provide guidance and support towards effective policies and practices in environmental conservation and sustainable development.

The Nature Conservancy - Caribbean Programme

TNC is an international conservation organization that has programs and offices in different parts of the world, including the Insular Caribbean, Central America, Mexico, Venezuela and Colombia, The Mesoamerican and Caribbean Region Program⁶. TNC focus on supporting projects and partner institutions (governmental and non-governmental) in several countries such as Dominican Republic, Jamaica, US Virgin Is., St .Vincent and the Grenadines, Grenada, The Bahamas, Jamaica, Belize, Mexico, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Venezuela, Colombia. The main regional initiatives are the Parks in Peril Program⁷ (funded by the USAID), the Mesoamerican Reef Program, although there are many projects related to coastal and marine conservation (research, training, institutional capacity strengthening, participatory planning) supported by private donors (individuals, corporations, foundations, financial agencies), TNC US domestic Chapters, US federal agencies, and universities , as well as intergovernmental organizations such as UNESCO, UNEP, and UNDP.

In particular, TNC’s Mesoamerican Reef Program (that started in 2003) applies an ecoregional strategic vision to reef conservation and the abatement of threats such as

⁶ <http://www.tncmar.net/>

⁷ <http://parksinperil.org/espanol/dondetrabajamos/caribe/index.html>

overfishing, irresponsible coastal development, inadequate tourism, etc. TNC supports MPA research, monitoring, planning and management efforts in several sites of the Mexican Caribbean, Belize, Guatemala and Honduras.

United Nations Environment Programme/Caribbean Environment Programme - Specially Protected Areas and Wildlife Programme

The adoption in 1990 of the Protocol on Specially Protected Areas and Wildlife by Caribbean governments, provided the basis for what is currently the most extensive protected areas programme in the Wider Caribbean Region. The (SPAW) programme implements activities in the following areas:

- ◆ Promotion of best practices and training for sustainable coastal tourism;
- ◆ Coral reef monitoring, management, and conservation;
- ◆ Strengthening of protected areas through technical assistance and a regional training programme for trainers;
- ◆ Development of the Caribbean Marine Protected Area Management (CaMPAM) Network and Forum, a regional network of marine protected area managers;
- ◆ Development and implementation of guidelines and recovery plans for species conservation; and
- ◆ Development and implementation of guidelines for establishment and management of protected areas, and revenue generation.

UNESCO - Man and the Biosphere Programme (MAB)

UNESCO's MAB programme was initiated in 1972, as an approach to protecting entire ecosystems. The programme facilitates monitoring, research, training, implementation of demonstration projects, and site establishment for conservation of representative ecosystems and biodiversity. Some of the MAB sites are the Virgin Islands National Park, Seaflower, Sian Ka'an, and Banco Chichorro Biosphere Reserves.

UNESCO- World Heritage Center

The World Heritage Center has implemented an initiative to foster the number of marine and coastal sites all over the world⁸. As a result of this initiative, an expert consultation process conducted in 2000- 2001 that included an international workshop in Hanoi Vietnam⁹ identified several AMPs with potential value to be included in the

⁸ World Heritage Marine Program

http://portal.unesco.org/culture/en/file_download.php/dd9be20de55ad6fb25710b689fc15599Marine+programm e.pdf (Julio 2007)

⁹ Hillary, A.; M. Kokkonen and L. Max (eds.). 2003. World Heritage 4 Papers, Proceedings of the World Heritage Marine Biodiversity Workshop. Hanoi, Vietnam, February 25 – March 1, 2002, 94 pp.

http://whc.unesco.org/documents/publi_wh_papers_04_en.pdf

WH list of sites with marine natural value in the Caribbean, namely: Archipiélago Coralino del S de Cuba, Islas del Caribe Sur (Curaçao, Bonaire, Los Roques), Archipiélago de San Andrés y Providencia, Arrecifes de la Costa Maya, and other. , The initiative includes several pilot sites (serial and transboundary.) such as “Arrecifes del Sur de Cuba”, “Islas del Caribe Sur”, y “San y Providencia”, and capacity building for technical staff involved in such nominations.

Related initiatives that impact on protected areas include the following (see Module 2 for more detailed information on each initiative):

- ◆ The Caribbean Coastal Marine Productivity Programme (CARICOMP);
- ◆ Caribbean Planning for Adaptation to Global Climate Change Project (CPACC); and
- ◆ SIDS Programme of Action.

Protected Area Networks

A number of networks that are directly or indirectly related to protected area/marine resources management are operating in the Caribbean.

Wider Caribbean Marine Protected Areas Management Network (CaMPAM)

CaMPAM was formed in December 1997, during a workshop on cooperation in marine protected area management that was hosted by the Biscayne National Park and the Regional Coordinating Unit, UNEP/CEP. The Network has adopted as its mission, the "enhancement of marine and coastal area management in the Wider Caribbean Region through sharing and collaboration to strengthen the national and regional systems of existing and future marine and coastal protected areas". Participants from twenty-two (22) countries of the Wider Caribbean Region initially joined the network, and the number has since increased to 65. Since then, it has been administered by UNEP-CEP which has fostered communication among MPA managers, and sponsored and coordinated projects, training activities, and exchange programs for MPA managers, fishermen and other stakeholders of MPA planning and management process. Thanks to the Gulf and Caribbean Fisheries Institute (GCFI, <http://www.gcfi.org>), and as a result of multiple discussions sustained during several annual meetings, a few organizations and experts got together and developed a partnership in order to expand CaMPAM and make it an active Network and Forum for MPA professionals and stakeholders In March 2004, during the regional conference “White Waters to Blue Waters” (<http://www.ww2bw.org>) to foster partnerships for promoting the integrated management of marine waters and watersheds. The creation of its Steering Committee, the commitment of using the

GCFI Annual Meetings as discussion fora for CaMPAM was the first step of a plan of providing the Network with a greater dimension to make it an effective tool for communication and coordination. The fundamental partnership between the GCFI and CaMPAM made other institutions with regional scope identify CaMPAM as a good mechanism for activities coordination and training. As a result of this partnership, GCFI currently manages CaMPAM Small Grant Fund¹⁰

Caribbean Community Ocean Sciences Network (CCOSNET)

The Caribbean Community Ocean Sciences Network (CCOSNET) evolved out of the Caribbean Oceanography Resources Exploration Project, and became functional on December 12, 1990. CCOSNET is "a mechanism for marshalling the oceanographic science resources of CARICOM Member States". The Network, which is coordinated by the Institute for Marine Affairs (Trinidad), has the following responsibilities; the establishment and maintenance of a regional ocean sciences database; the establishment and maintenance of an inventory of human and physical resource needs in ocean sciences in the region in the short to medium term; facilitating the procurement of berths and coordinating the use of ships of opportunity and other data-gathering sources in systematically acquiring knowledge in the region; facilitating access to relevant marine and environmental-related data and information regionally and inter-regionally; and providing a forum to facilitate the exchange of information, experience, and expertise in areas of mutual interest.

World Commission on Protected Areas (WCPA)

The WCPA is a worldwide network of experts in protected areas, more than 50 of which are Caribbean residents. The network supports protected area activity through:

- ◆ Collection, storage, and dissemination of information;
- ◆ Provision of technical assistance on protected area policy, planning, and management;
- ◆ Networking;
- ◆ Production of relevant documentation (including guidelines and best practices);
- ◆ Information and policy support to international organisations on protected areas and related issues.

Latin American Network for Technical Cooperation in National Parks, Protected Areas, and Wildlife (LAN-NPPAW)

LAN-NPPAW is a joint FAO-UNEP programme that seeks to improve coordination in protected areas management throughout Latin America and the Caribbean. Activities include:

¹⁰ <http://www.gcfi.org/SGF/SGFEng20808Projects.php>

-
- ◆ Publication of a bulletin covering network activities;
 - ◆ Organisation of workshops and seminars on different aspects of protected areas management;
 - ◆ Publication of technical reports; and
 - ◆ Facilitation of technical assistance.

MODULE 4	MARINE PROTECTED AREAS OVERVIEW
THEME 3	Present Status of Marine Protected Area Programmes in the Caribbean
OBJECTIVE	To summarise the current state of protected area development in the Caribbean.
SIGNIFICANCE	Global conservation practices have changed somewhat to focus more on biodiversity conservation, in which PA management is seen as playing a central role. Additionally, Caribbean countries are beginning to use PAs to support their tourism strategies.
PRESENTATION	Lecture, discussion
EQUIPMENT / MATERIALS	Projector, file Mod4.ppt
EXERCISE	N/A
TIME	1h

INTRODUCTION

UNEP (1996) has identified 324 sites in the Wider Caribbean Region as containing coastal or marine components (Table 4.1, grouped by IUCN categories)

Category		Insular Caribbean		Wider Caribbean Region	
		Total	Coastal/Marine	Total	Coastal/Marine
I	Nature Reserves & Wilderness Areas	15	9	55	17
II	National Parks	49	31	239	73
III	National Monuments	7	4	28	9
IV	Wildlife Sanctuaries	104	47	335	111
V	Protected Landscapes	26	18	165	33
VI	Multiple Use Areas	66	4	471	49
	Biosphere Reserves	8	3	40	13
	World Heritage Sites	0	0	8	5
	Ramsar Sites	9	6	20	14
Totals		284	122	1,359	324

Source: Modified from UNEP, 1996

From Table 4.3.1 it can be seen that approximately 24% of the PAs contain coastal or marine habitats. This increases to approximately 43% for the Insular Caribbean. These sites were found to provide a range of benefits, including:

- ◆ Wildlife habitat (78 areas);
- ◆ Recreation (68);
- ◆ Fishing income (54);
- ◆ Research activities (53); and
- ◆ Protection of endangered species (16).

Despite the identification of the above benefits, the present level of protection was deemed to be inadequate; with only 15% considered to have complete protection, 51% having partial protection, and 32% unprotected (UNEP, 1996).

¹¹ The author of the source document indicated that there were gaps in the coverage.

After 1996, several regional analysis have been conducted of the status of MPA in the Caribbean, using different methodologies and with different geographic coverage. In 2002-2004, Burke and Maidens (2005)¹², conducted a general assessment of the Caribbean reefs using indirect indicators of human impact. This project included the analysis of management effectiveness to protect reefs in 285 MPAs of 35 states and territories, using 4 indicators such as the existence of management activity or plan, resources availability and degree of legal enforcement). They concluded that:

- Only 6% are well managed;
- Thirteen percent (13%) have partially effective management;
- Around 50% are inadequately managed and provide little protection to reefs;
- No information of 33% of the total MPAs, and
- Despite 20% of coral reefs are within MPAs, only 5 are adequately managed.

Information providers mentioned as causes of MPA management failure the “lack of financial resources and local community support due to their lack of involvement in MPA planning and having a stake of the economic benefits that the MPA brings about”. (see paper for more detail).

The Caribbean MPA Regional Database <http://cep.unep.org/caribbeanmpa> managed by the UN Caribbean Environment programme includes information of more than 360 MPAs of the Tropical NW Atlantic Coastal Biogeographic Province (Wider Caribbean). The data are updated on a regular basis by authorized experts and is shared with other databases. This information has multiple uses, namely,:

- Know the biophysical characteristics, legal status and management scheme of the MPAs in the region;
- links with individual MPAs web sites;
- graphic information (boundary and habitat maps), legal citations;
- standardized and updated information of all MPAs;
- conduct comparative analysis of the status of MPAs;
- periodic dissemination of news and notes to inform the public, bring public attention, and foster conservation awareness of the general and specialized (academia, students, regulators, planners, business sector, donor agencies) publics, and
- share right information with other databases.

The data compilation of CaribbeanMPA will provide a better overview of the status of MPAs in the Caribbean.

¹² Reef at Risk, L. Burke and J. Maidens. <http://pdf.wri.org/reefsatrisk.pdf>

MULTILATERAL ENVIRONMENTAL AGREEMENTS¹³

UNEP (1996) stated that the participation of countries of the Wider Caribbean Region in 18 international, regional, and sub-regional treaties and agreements averaged 65%. The highest levels of participation (75-100%) were in the Caribbean Environment Programme/SPAW Programme, Convention on Biological Diversity, CITES, and the World Heritage Convention. States with the highest level of participation were Panama, Guatemala, and Costa Rica.

Putney (1994) identified certain lessons from the varying programs and approaches at the national and regional levels (before 1992) as follows:

- Plenty of assessments, strategies and action plans disproportionate with the level of implementation.
- A long-term rather than short-term approach is needed.
- Despite important sites must be set aside and legally protected, the already established areas must be prioritized.
- The small scale of many islands (and the relevant institutional arrangements) create resource problems for MPA planning and management.
- Some Caribbean islands, individually, don't have the resources to establish and manage a representative system of protected areas, and so regional cooperation based in stable regional institutions is needed.
- An effective cooperation requires a better information flow in the region.
- It is necessary to expand the support basis to MPA-related activities.
- More partnerships are needed.
- MPA plans should focus in both, realistic needs definitions as well as sources of support.
- It is easier to fundraise for new work than for maintaining old ones.

More recently (2005), Vandeweerd¹⁴ examined the status of the UNEP Caribbean Environment Programme (UNEP-CEP) and the treaties it manages. She affirms that despite UNEP-CEP is an “independent, solid and dynamic entity,” that extends throughout 28 member States and territories that depend on them; it had to face difficulties of nature and socioeconomic nature. Currently, the Regional Seas Program coordinated by UNEP with the participation of representatives of the Conference of Parties and governmental organizations approved a series of strategic guidelines for 2004-2007 aiming at strengthening and further its work plans¹⁵. The Program has succeeded to attract funding form different sources, both

¹³ This issue is covered in much more detail in Module 3, so this section deals only with PAs.

¹⁴ Un Programa Bandera para los Mares. Our Planet, (edición en español), Publicación especial. http://www.unep.org/PDF/OurPlanet/Our_Planet_Cep_spanish.pdf

¹⁵ <http://www.unep.org/regionalseas/About/Strategy/>

governmental (France, U.S., Sweden, UN Foundation, etc.) and private (GEF, MacArthur Foundation, etc.). In the meeting held in Helsinki (2005) the Program presented its experiences in mobilizing national resources and the convenience of partnering with other institutions to expand the programs, particularly institutional capacity. The Program established the goals of strengthening collaboration with other regional programs, in conjunction with national and regional plans for socioeconomic development, specially their marine components; improve the control and surveillance plans, the establishment of partnerships with international y regional institutions, etc.

UNEP digital bulletin “Our Planet”¹⁶ examines the role of UNEP CEP over the last 25 years. The web page <http://www.cep.unep.org/> shows the Caribbean countries that are signatory parties of regional and international environmental treaties. We suggest reading this page to know the status of your country.

¹⁶ http://www.unep.org/PDF/OurPlanet/Our_Planet_Cep_english.pdf

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Appendix 4.1

Protected Area Categories and Management Objectives

The current IUCN WCPA categories (IUCN 1994) are as follows:

1. Strict protection
 - a. Strict Nature Reserve
 - b. Wilderness Area
11. Ecosystem conservation and recreation (National Park)
111. Conservation of natural features (Natural Monument)
- IV. Conservation through active management (Habitat/Species Management Area)
- V. Landscape/seascape conservation and recreation (Protected Landscape/ seascape)
- VI. Sustainable use of natural ecosystems (Managed Resource Protected Area)

The mix of management objectives relevant to each of the categories is summarised in the following table (IUCN 1994, p.8):

Management Objective	Ia	Ib	II	III	IV	V	VI
Scientific research	1	3	2	2	2	2	3
Wilderness protection	2	1	2	3	3	-	2
Preservation of species and genetic diversity	1	2	1	1	1	2	1
Maintenance of environmental services	2	1	1	-	1	2	1
Protection of specific natural/cultural features	-	-	2	1	3	1	3
Tourism and recreation	-	2	1	1	3	1	3
Education	-	-	2	2	2	2	3
Sustainable use of resources from natural ecosystems	-	3	3	-	2	2	1
Maintenance of cultural/traditional attributes	-	-	-	-	-	1	2

Key: I : Primary objective; 2 : Secondary objective; 3: Potentially applicable objective;
- Not applicable

The definitions, objectives and selection criteria for the categories and sub-categories are summarised as follows (IUCN 1994, part 11 and p.9):

Category I - Strict Nature Reserve/Wilderness Area: protected area managed mainly for science or wilderness protection

Category Ia - Strict Nature Reserve: protected area managed mainly for science

Definition: Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring

Objectives of management:

- ◆ To preserve habitats, ecosystems and species in as undisturbed a state as possible;
- ◆ To maintain genetic resources in a dynamic and evolutionary state;
- ◆ to maintain established ecological processes;
- ◆ To safeguard structural landscape features or rock exposures;
- ◆ To secure examples of the natural environment for scientific studies, environmental monitoring and education, including baseline areas from which all avoidable access is excluded;
- ◆ To minimise disturbance by careful planning and execution of research and other approved activities;
- ◆ To limit public access.

Guidance for selection:

- ◆ The area should be large enough to ensure the integrity of its ecosystems and to accomplish the management objectives for which it is protected.
- ◆ The area should be significantly free of direct human intervention and capable of remaining so.

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- ◆ The conservation of the area's biodiversity should be achievable through protection and not require substantial active management or habitat manipulation (c.f. Category IV).

Equivalent category, in IUCN (1978): Scientific Reserve/Strict Nature Reserve.

Category Ib - Wilderness Area: protected area managed mainly for wilderness protection

Definition: Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.

Objectives of management:

- ◆ To ensure that future generations have the opportunity to experience understanding and enjoyment of areas that have been largely undisturbed by human action over a long period of time;
- ◆ To maintain the essential natural attributes and qualities of the environment over the long term;
- ◆ To provide for public access at levels and of a type which will serve best the physical and spiritual well-being of visitors and maintain the wilderness qualities of the area for present and future generations;
- ◆ To enable indigenous human communities living at low density and in balance with the available resources to maintain their lifestyle.

Guidance for selection:

- ◆ The area should possess high natural quality, be governed primarily by the forces of nature, with human disturbance substantially absent, and be likely to continue to display those attributes if managed as proposed.
- ◆ The area should contain significant ecological, geological, physiogeographic, or other features of scientific, educational, scenic or historic value.
- ◆ The area should offer outstanding opportunities for solitude, enjoyed once the area has been reached, by simple, quiet, non-polluting and non-intrusive means of travel (i.e. non-motorised).

- ◆ The area should be of sufficient size to make practical such preservation and use.

Equivalent category in IUCN (1978): no direct equivalent.

Category 11 - National Park: protected area managed mainly for ecosystem protection and tourism

Definition: Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area, and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

Objectives of management:

- ◆ To protect natural and scenic areas of national and international significance for spiritual, scientific, educational, recreational or tourist purposes;
- ◆ To perpetuate, in as natural a state as possible, representative examples of physiographic regions, biotic communities, genetic resources, and species, to provide ecological stability and diversity;
- ◆ To manage visitor use for inspirational, educational, cultural and recreational purposes at a level which will maintain the area in a natural or near natural state;
- ◆ To eliminate and thereafter prevent exploitation or occupation inimical to the purposes of designation;
- ◆ To maintain respect for the ecological, geomorphologic, sacred or aesthetic attributes which warranted designation;
- ◆ To take into account the needs of indigenous people, including subsistence resource use, in so far as these will not adversely affect the other objectives of management.

Guidance for selection:

- ◆ The area should contain a representative sample of major natural regions, features or scenery, where plant and animal species, habitats and geomorphological sites are of special spiritual, scientific, educational, recreational and tourist significance.
- ◆ The area should be large enough to contain one or more entire ecosystems not materially altered by current human occupation or exploitation.

Equivalent category in IUCN (1978): National Park

Category III - Natural Monument: protected area managed mainly for conservation of specific natural features

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.

Objectives of management:

- ◆ To protect or preserve in perpetuity specific outstanding natural features because of their natural significance, unique or representational quality, and/or spiritual connotations;
- ◆ To an extent consistent with the foregoing objective, to provide opportunities for research, education, interpretation and public appreciation;
- ◆ To eliminate and thereafter prevent exploitation or occupation inimical to the purpose of designation;
- ◆ To deliver to any resident population such benefits as are consistent with the other objectives of management

Guidance for selection:

- ◆ The area should contain one or more features of outstanding significance (appropriate natural features include spectacular waterfalls, caves, craters, fossil beds, sand dunes and marine features, along with unique or representative fauna and flora; associated cultural features might include cave dwellings, cliff-top forts, archaeological sites, or natural sites which have heritage significance to indigenous peoples).

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- ◆ The area should be large enough to protect the integrity of the feature and its immediately related surroundings.

Equivalent category in IUCN (1978): Natural Monument Natural Landmark

Category IV - Habitat/Species Management Area: 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.

Objectives of management:

- ◆ To secure and maintain the habitat conditions necessary to protect significant species, groups of species, biotic communities or physical features of the environment where these require specific human manipulation for optimum management;
- ◆ To facilitate scientific research and environmental monitoring as primary activities associated with sustainable resource management;
- ◆ To develop limited areas for public education and appreciation of the characteristics of the habitats concerned and of the work of wildlife management;
- ◆ To eliminate and thereafter prevent exploitation or occupation inimical to the purpose of designation;
- ◆ To deliver such benefits to people living within the designated area as are consistent with the other objectives of management.

Guidance for selection:

- ◆ The area should play an important role in the protection of nature and the survival of species ('incorporating, as appropriate, breeding areas, wetlands, coral reefs, estuaries, grasslands, forests or spawning areas, including marine feeding beds).
- ◆ The area should be one where the protection of the habitat is essential to the well-being of nationally or locally-important flora, or to resident or migratory fauna.

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- ◆ Conservation of these habitats and species should depend upon active intervention by the management authority, if necessary through habitat manipulation (c.f. Category Ia).
 - ◆ The size of the area should depend on the habitat requirements of the species to be protected and may range from relatively small to very extensive.

Equivalent category in IUCN (1978): Nature Conservation Reserve/Managed Nature Reserve/Wildlife Sanctuary.

Category V - Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation

Definition: Area of land, with coast and sea as appropriate, 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. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.

Objectives of management:

- ◆ To maintain the harmonious interaction of nature and culture through the protection of landscape and/or seascape and the continuation of traditional land uses, building practices and social and cultural manifestations;
- ◆ To support lifestyles and economic activities which are in harmony with nature and the preservation of the social and cultural fabric of the communities concerned;
- ◆ To maintain the diversity of landscape and habitat, and of associated species and ecosystems;
- ◆ To eliminate where necessary, and thereafter prevent, land uses and activities which are inappropriate in scale and/or character;
- ◆ To provide opportunities for public enjoyment through recreation and tourism appropriate in type and scale to the essential qualities of the areas;

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- ◆ To encourage scientific and educational activities which will contribute to the long term well-being of resident populations and to the development of public support for the environmental protection of such areas;
 - ◆ To bring benefits to, and to contribute to the welfare of, the local community through the provision of natural products (such as forest and fisheries products) and services (such as clean water or income derived from sustainable forms of tourism).

Guidance for selection:

- ◆ The area should possess a landscape and/or coastal and island seascape of high scenic quality, with diverse associated habitats, flora and fauna along with manifestations of unique or traditional land-use patterns and social organisations as evidenced in human settlements and local customs, livelihoods, and beliefs.
- ◆ The area should provide opportunities for public enjoyment through recreation and tourism within its normal lifestyle and economic activities.

Equivalent category, in IUCN (1978): Protected Landscape.

Category VI - Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems

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.

Objectives of management:

- ◆ To protect and maintain the biological diversity and other natural values of the area in the long term;
- ◆ To promote sound management practices for sustainable production purposes;
- ◆ To protect the natural resource base from being alienated for other land use purposes that would be detrimental to the area's biological diversity;
- ◆ To contribute to regional and national development.

Guidance for selection:

- ◆ At least two-thirds of the area should be in, and is planned to remain in, a natural condition, although it may also contain limited areas of modified ecosystems; large commercial plantations are not to be included.
- ◆ The area should be large enough to absorb sustainable resource uses without detriment to its overall long-term natural values.
- ◆ A management authority must be in place.

Equivalent category, in IUCN (1978): no direct equivalent.

Appendix 4.2

Potential Benefits of Marine Reserves

Taken from Sobel (1996)

Protects Ecosystem Structure, Function, and Integrity

- Protects physical structure of habitat
- Protects ecological processes
- Restores population structure (size and age)
- Restores community composition (presence and abundance)
- Protects biodiversity at all levels
- Protects keystone species
- Protects cascading effects
- Protects vulnerable species
- Protects threshold effects
- Protects second order effects
- Protects food web and trophic structure
- Reduces incidental damage.

Improves System Resilience

- Reduces fishing gear impacts
- Maintains high quality feeding areas for fish and wildlife
- Improves non-consumptive opportunities
- Enhances and diversifies economic activities
- Enhances and diversifies social activities
- Improves peace-of-mind
- Enhances non-consumptive recreation
- Enhances aesthetic experiences
- Improves wildlife opportunities
- Spiritual connection
- Social activity
- Education
- Enhances conservation appreciation
- Increases sustainable employment opportunities
- Creates public awareness about environment

- Leaves less room for irresponsible development
- Encourages holistic approach to management
- Stabilizes economy.

Improves Fishery Yields

- Protects spawning fish stocks
- Increases spawning stock biomass
- Increases spawning density
- Improves stock fecundity
- Provides undisturbed spawning conditions, habitats, sites
- Increase egg and larval production
- Enhances recruitment
- Provides spill over of adults and juveniles
- Reduces chances of recruitment overfishing
- Reduces overfishing of vulnerable species
- Protects diversity of fishing opportunities
- Protects intra-specific genetics from fishery selection
- Enhances recovery from stock collapses and management failures
- Reduces by-catch fishing mortality
- Reduces inadvertent fishing mortality
- Simplifies enforcement and compliance
- Reduces conflicts among users
- Maintains sport trophy fisheries
- Reduces variance of yield
- Allows increased fish outside reserves
- Facilitates stakeholder involvement in management
- Provides fishery management data to improve fisheries
- Increases understanding and acceptance of fishery management
- Reduces impacts of environmental variability
- Provides some protection with limited resources and without data or information.

Increases Knowledge and Understanding of Marine Systems

- Provides long-term monitoring sites
- Provides focus for study
- Provides continuity of knowledge in undisturbed site
- Provides opportunity to restore or maintain natural behaviors
- Reduces risks to long-term experiments
- Provides experimental sites needing natural areas

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- Provides controlled natural areas for assessing anthropogenic impacts, including fishing and other impacts
 - Provides sites for enhanced primary and adult education
 - Provides sites for high-level graduate education.

MODULE 5	PARTICIPATORY PLANNING
OBJECTIVE	To understand the rationale for and benefits of stakeholder involvement in marine protected area planning and management, as well as the requirements for implementing and facilitating effective participatory processes.
THEMES	<ol style="list-style-type: none">1. Overview of participatory planning (2 hours)2. Effective communication (1 hour)3. Stakeholder analysis (2 hours)4. Strategies and mechanisms for stakeholder involvement (2 hours)5. Conflict management (2 hours)6. Collaborative management (2 hours)
EQUIPMENT/ MATERIALS	Flip chart and coloured markers Projector, Mod5.pt file Publications Copies of case study
DELIVERY TIME	1.5 day

NOTES TO THE INSTRUCTOR

Module 5 is divided into 6 themes, corresponding to one or two hour training sessions. Each theme gives the trainer background information on an issue or set of related issues, selected readings for participants, suggestions for the presentation of the material, and a list of key terms that are important for comprehension of the topic.

The Module teaching approach for this module is an interactive one, with a minimum of classroom lectures and emphasis on facilitated discussion and small group exercises that allow the trainees to extract lessons, methods, and approaches.

The case studies and exercises will allow to assess the level of understanding can illustrate topics and assist the learning process. Although Appendix 5.3 provides a brief case study of the Soufriere Marine Management Area in St. Lucia, it is strongly suggested that the instructor use his/her personal experience, the course venue or cases provided by the participants.

The exercise will assist the instructor to evaluate the level of comprehension of concepts and the ability to convey to others. Trainees will be divided into two or more groups, and each to select a case study (mostly the own trainees MPAs) to develop the following:

- ◆ Identify the stakeholders in their MPA;
- ◆ Examine how stakeholder are involved;
- ◆ Identify the political, social, and cultural factors for designing an equitable participatory planning process; and
- ◆ Suggest the specific actions (e.g., research, information sharing, awareness building, mobilization) required to prepare stakeholders to participate in a planning process.

Trainees should present their results to the group.

Trainees should design a two-hour panel discussion on issues addressed in this module, including defining the objective of the discussion and the issues to be addressed, and identifying and preparing terms of reference for four or five panelists who would have a range of perspectives on the subject.

Although, the own experience of trainees is best for this, the following is a sample of a role playing exercise:

A problem related to the management of an MPA (either real or hypothetical) is presented to the group for solving using a participatory process. Several members of the group are assigned to the facilitating team, while others are asked to represent the

interests of various stakeholders. The facilitating team is then asked to design and conduct a meeting of stakeholders to address the problem. The exercise ends with the stakeholders critiquing the process based on the roles they are playing.

We recommend the consultation of the following materials, namely:

- TNC Conservation Planning Tool <http://conserveonline.org/workspaces/tnc.cpt>
- Katrina Brown, W. Neil Adgerb, Emma Tompkinsa, Peter Baconc, David Shimd and Kathy Young. 2001. Trade-off analysis for marine protected area management. *Ecological Economics*, Volume 37, Issue 3, June 2001, Pages 417-434
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VDY-433NRMK-7&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=57b23a11fe00c1a0e513f47b96984753
- Renard, Y. 2004. Guidelines for Stakeholder Identification and Analysis: A Manual for Caribbean Natural Resource Managers and Planners. *CANARI Guidelines Series 5*, 36pp.
<http://www.canari.org/Guidelines5.pdf>
- Rodney V. Salm, John R. Clark, Erkki Siirila. 2000. Marine and Coastal Protected Areas: A Guide for Planners and Managers. 387 pages,
<http://books.google.com/books?id=11R4wO0BtLYC&printsec=frontcover&sig=JFU6Amuuu3pFKRbIajZV1SBJ-yw>
- Alan T. White, Ana Rosales, Anna Meneses. INCENTIVES FOR MARINE PROTECTED AREA MANAGEMENT IN THE PHILIPPINES: RATING, INFORMATION AND USER FEES.
http://www.oneocean.org/download/db_files/incentives_for_mpa_management_in_the_philippines.pdf
- The Nature Conservancy's Conservation Action Planning Developing Strategies, Taking Action, and Measuring Success at Any Scale Overview of Basic Practices. Version: 17 June 2005, 20pp.
<http://conserveonline.org/docs/2005/08/TNC%20CAP%20Basic%20Practices%20v%2017%20Jun%202005.pdf>
- New Guidelines for management planning for Ramsar sites and other wetlands.
http://www.ramsar.org/key_guide_mgt_new_e.htm
- Ecoregional Conservation Planning for the Mesoamerican Reef
<http://www.wwfca.org/php/macrf/> (2002)

MODULE 5

THEME 1

OBJECTIVE

SIGNIFICANCE

PRESENTATION

TIME

PARTICIPATORY PLANNING

Overview of participatory planning

To understand the benefits and constraints of participatory planning and the steps involved in the process.

Participatory planning processes can result in more effective management than traditional planning methods, but they also present a number of obstacles and challenges.

Introduction and discussion: What is participation?

Case study presentation

Group analysis: steps in the participatory planning process

2h

NOTE TO THE INSTRUCTOR

The instructor should begin this session with a brief introduction to the concept of participation and the rationale for participation in planning the use of natural resources. The instructor can then present the typology (Pretty 1995, Appendix 5.1), and the plenary or small groups will examine it, during which participants identify and analyse examples of each of the types from their own experience. Thus, the case studies can be used throughout the class and relates the material being presented with the participants' own experiences.

Once the various forms of participation are understood, the instructor will select, with the help of the trainees, two or three case studies (or AMPs) that will be used for the participatory planning exercise, in order to illustrate steps and potential mistakes. The brief case study of the Soufriere Marine Management Area (SMMA) included in this module, can be used, although another case familiar to the instructor or the trainees can be substituted.

OVERVIEW OF BASIC CONCEPTS

The instructor will briefly describe these concepts to assist the trainees in presenting their cases.

While it is generally acknowledged that stakeholder **PARTICIPATION** is an essential component of effective management of natural resources, the notion of what participation entails varies widely. In the context of MPA planning and management, **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. Participation is relevant to all aspects of development and environmental management. The challenge for policy-makers, planners and managers is to define the form of participation which is the most appropriate to a given situation.

Benefits of participation

The arguments in favour of **participation** in planning and managing MPAs include the following:

- ◆ **It contributes to improved management by incorporating popular knowledge and practices;**
- ◆ **It increases the likelihood of stakeholder compliance and support** through participation in decision-making;

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- ◆ It **incorporates a wide range of perspectives and ideas**, resulting in improved management decisions and actions;
 - ◆ It **provides a forum for identifying conflicts between users and negotiating solutions** to them;
 - ◆ It **can contribute to community empowerment and local institutional development**, especially when the sharing of management responsibility is involved.
 - ◆ It can be a basic right established in national legislative frameworks and in international standards.

Forms of participation

There are several typologies to describe the most common forms of participation. A widely used typology (Pretty 1995) is reproduced in Appendix 5.1.

Steps in the participatory planning process

The participatory planning process is, in many respects, very similar to the more conventional approach to *PLANNING*, which typically includes the following elements:

- ◆ **Identification and determination of priorities;**
- ◆ **Definition of goals and objectives;**
- ◆ **Determination of the approach and assessment of feasibility;**
- ◆ **Formulation of management instruments**, including:
 - management plans or schemes,
 - zoning,
 - operational plans,
 - regulations,
 - monitoring programmes,
 - user fees and revenue generation strategies;
- ◆ **Definition of monitoring and evaluation mechanisms.**

Planning processes can be described as participatory when they also include:

- ◆ The **identification and involvement of all stakeholders**, early in the process;
- ◆ The **incorporation of the diverse views and opinions** of the individuals within these groups;
- ◆ The **sensitization of stakeholders** to the issues being addressed;
- ◆ **Provision of information needed to shape opinions and make decisions**, in forms that are accessible to all participants;

-
- ◆ The **recognition of and accommodation for the inequities** among stakeholder groups and among individuals, in order to assure that those that are more powerful do not dominate or manipulate processes;
 - ◆ **Respect for the process and the decisions that are reached:** participatory planning cannot manipulate participation to arrive at a predetermined conclusion or even to start from a predetermined point.

Ideally, participation in the context of MPAs will start at the earliest planning stages for the protected area. However, any stakeholder (management agency, non-governmental organization, community, researcher, external agency) can take the initiative for a participatory planning exercise, any time a conflict or crisis occurs due to resource utilization (e.g. tourism development, nearby construction, overfishing, etc), a natural disaster such as a hurricane; or the integration of a new conservation partner (e.g. an NGO or business).

Key questions in a participatory planning process include: Who should participate?; How they should participate?; What is the most appropriate form of participation?; and Who decides who should participate and how? To begin to address these questions, the **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.** 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, but it generally happens after 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;
- ◆ **The identification of options.** This is a critical step, where all participants use the results of the analyses to define priorities and the various options available to them, with an appreciation of the costs and benefits associated with each.

One of the added benefits of these **participatory appraisals and assessments** is that they **build the confidence and ability of all participants, notably the powerless**, to become involved in decision-making and management. On the basis of information gathered, partners in the planning process must be in a position to define objectives, formulate action and management plans, design monitoring and evaluation procedures, and begin implementation.

Because **the purpose of a participatory planning process is change** (in perceptions, relations, practices and outcomes), it is not linear, but creates change at every step along the way. Inherent in the concept of participatory planning, therefore, is the idea that change is constant and that action can take place at any stage in the process. Participatory planning processes do not require the completion of a plan to witness changes on the ground. Their purpose is to change conditions, and thus to provoke action. In the participatory approach to planning, implementation does not follow planning. It is a part of the planning process.

Constraints and obstacles

A major constraint to participatory planning processes is **the general lack of enabling policies and the prevalence of centralized systems of management**. While there are a few countries in the region where participatory planning is encouraged through policy, legislation, or institutional cultures (e.g. Mexico, Jamaica and St. Lucia, among others), this is far from the norm.

Participatory approaches require radical changes within the culture of organizations, notably those of the state. From a culture of enforcement and control, they need to move to the new attitudes that are required of facilitators and supporters.

These stakeholders may feel they have little to gain from their involvement in a participatory planning process and may seek to coopt or circumvent it. The issue is further complicated by **the inherently political nature of participatory processes** and the high likelihood of political interference.

Involving all the agencies that have jurisdiction or responsibility over the area and its surroundings can be extremely difficult, but if any are not included, it may impair impossible the implementation of decisions taken.

Effective participation requires that participants all have a good grounding in the issues being addressed. **The process of awareness-building** that is required to assure this **can be time-consuming and expensive**.

Facilitation is key to effective participation, and facilitators must be skilled and appear to be impartial, while assuring that stakeholder participation is fair and equitable. **Many participatory planning processes are spoiled by poor or biased facilitation.**

Finally, **participatory planning requires high investments of time as well as human and financial resources.** There are no cheap and easy shortcuts.

MODULE 5	PARTICIPATORY PLANNING
THEME 2	Effective communication
OBJECTIVE	To understand the role of communication in participatory planning processes.
SIGNIFICANCE	Participatory planning processes are premised on the transfer and sharing of knowledge and information between and among stakeholders and management partners. Communication is the mechanism for this transfer, and effective facilitation of participatory processes requires a range of communication skills and techniques.
PRESENTATION	Facilitated discussion with lead-in exercise
TIME	1 hour

NOTE TO THE INSTRUCTOR

The instructor can begin the session with an exercise to demonstrate the importance of shared meaning. The instructor can ask participants to write down a word or phrase that they associate with each of three or four pre-selected words. Each participant should share her/his list with the group. The instructor should show the group the potential pitfalls of the absence of shared meaning, and lead into a discussion on the importance of and requirements for effective communication. The discussion should also focus on techniques and mechanisms for building effective communication into projects and the identification of the media available for use during the participatory planning process. Trainees can use lessons learned in Module 1 (Communication and teaching skills)

OVERVIEW OF BASIC CONCEPTS

Effective *COMMUNICATION* underpins the participatory planning process. **Participatory planning processes are premised on the transfer and sharing of knowledge and information between and among stakeholders and management partners.** Each party brings a different knowledge base (scientific, popular/traditional) to the intervention and each requires specific information to effectively fulfill its role. The planning phase of project development serves several purposes, these include identifying and negotiating project objectives and anticipated outcomes, building consensus and support for the intervention, and gathering data about the resource and its uses and users. At the centre of all of these activities is an exchange of knowledge and information. It is the role of the facilitator to assure the effectiveness of this exchange.

Rationale for Effective Communication

Communication is the sending and receiving of information or messages between individuals or groups, to transfer meaning. Within the context of participatory approaches to MPA management, **effective communication can:**

- ◆ **Encourage participation**, by demonstrating the value of playing a part in the planning and management process, and illustrating the benefits that can be gained. This is particularly critical because the Caribbean does not have strong traditions of participation, and because communities are often pessimistic, if not cynical, about the outcomes of consultative and participatory processes, especially those initiated by government agencies. Communication thus contributes to effective mobilization.

- ◆ **Provide a mechanism for** the various stakeholders to express concerns. It also enhances the empowerment by building on information available within the community. The articulation of concerns highlight gaps in existing knowledge.
- ◆ **Help integrate communities into management** by presenting and gathering information relating to the effective and sustainable use of the natural resource and on specific techniques for natural resource management, and existing local and traditional knowledge.
- ◆ **Play a critical role in identifying issues** that need to be addressed and ensure that management decisions respond to changing needs and contexts, as well as offer approaches to problem solving and conflict management.
- ◆ **Establish credibility and build widespread support for specific initiatives** by providing a base of information that increases local understanding among general populations, not just among principal stakeholder groups.
- ◆ **Focus attention on a participatory process**, and thus create a greater demand for its outcome.
- ◆ **Make data and information accessible** in an equitable manner.

Requirements of Effective Communication

Communication occurs at several different levels and can employ a range of media. **Effective communication requires ensuring that all voices can be heard and are valued, and all messages understood.** From the perspective of a facilitator of a participatory planning process, communication should:

- ◆ Be targeted at specific audiences;
- ◆ Use language and symbols that are commonly understood and accepted;
- ◆ Use media appropriate according to education background of target audience;
- ◆ Use media appropriate to different messages. Different media rely on different senses. For example, a visually strong message presented using aural communication will not be as effective as one presented using a visual medium;

- ◆ Be inclusive, rather than exclusive. This can refer, for example, to something as basic as convening meetings in settings where none of the actors feel intimidated and conducting them a style and idiom that foster a dialogue among all participants;
- ◆ Be sensitive to gender. Language and images, for example, should reflect the needs, concerns, and even presence of female and male actors and stakeholders;
- ◆ Facilitate an exchange of information between sender and receiver and provide space for the expression of different points of view;
- ◆ Be intentional, in other words, it should be planned and built into processes rather than tacked on as an afterthought or conceived of in narrow terms as public relations or community mobilization.

MODULE 5
THEME 3
OBJECTIVE
SIGNIFICANCE
PRESENTATION
TIME

PARTICIPATORY PLANNING

Stakeholder analysis

To understand the importance of identifying all stakeholders and assessing their interests at the start of the intervention.

Identifying and analysing, at the start of the planning process and as conditions change, the interests of all groups affected by the management intervention can help determine who should participate in management and how, and can help identify and manage actual or potential conflicts.

Facilitated discussion and case study analysis

2 hour

NOTE TO THE INSTRUCTOR

To present the concepts the instructor can engage participants in a discussion to develop a definition of the term stakeholder and provide a rationale for using stakeholder approaches in planning and management. Participants can use an actual case (participants' MPAs) to identify the stakeholders and their interests, establish criteria for ranking these interests and should describe methods that can be used for gathering data and information (e.g., sampling, interviewing and dialogue, visualization and diagramming, group and team dynamics). Using a local MPA near the workshop site to conduct exercises that include interviews with key stakeholders to provide participants with an example of how a stakeholder analysis can be conducted in a real situation.

OVERVIEW OF BASIC CONCEPTS

The success of any participatory process depends, in part, on an adequate identification of all the potential participants in the process. To determine who should participate in management and how, distinctions must be made among the broad collection of individuals, groups and institutions, i.e., stakeholders, who interact with the natural resource and who will affect or be affected by the management **intervention. The interests or stakes of the various actors or stakeholders differ because of such things as tenure, ownership, history of use, and pattern or type of use.**

Stakeholder identification

Assist resource managers to:

- ◆ understand the levels at which people interact with the resource;
- ◆ identify populations that may be particularly vulnerable with regard to the implementation of specific management approaches and policies.
- ◆ identify critical parties to get involved for a successful project implementation; and
- ◆ identify current and potential areas of conflict and concern (Krishnarayan 1998).

If the participatory process fails to identify and involve some of the stakeholders is likely to encounter difficulties, as those excluded could oppose its outcome, and the process will suffer from the loss of the ideas, resources and support.

The more rigorous the stakeholder identification and analysis, the more complete it will be and integrated into management as appropriate. The **failure to integrate all stakeholders can**

ultimately weaken the management arrangement. A number of important principles must be taken into consideration:

- ◆ **Differences exist among stakeholder groups.** Even when all stakeholders share a common goal, such as the long-term sustainability of a natural resource, objectives, needs and priorities may differ. It is essential to identify, with precision, the often competing interests among stakeholders and ascertain who holds these interests.
- ◆ **Stakeholder groups are not homogenous.** Within a single group, sub-groups with varying perspectives and interests may exist. Similarly, the leadership of the group may not adequately represent the interests of all members.
- ◆ **All stakeholders are not necessarily organized in formal groups.** Stakeholders could, for example, include disparate individuals or households who use the resource for a similar recreational purpose or income generating activity.
- ◆ **Even when stakeholders are organized in a group, they may not have the capacity to effectively articulate and represent their interests.**

The process of determining who should participate in management and how would be incomplete if it were limited to the mere identification of the interested parties. This process also requires an *ANALYSIS* of the stakes they hold, **defined as the sum of the interests, rights and responsibilities which can be attributed to each in relation to the resources in the MPA, in order to determine the most desirable form and extent of their participation in the management process.**

MPA managers and facilitators of participatory processes must examine the methods for the identification and analysis of stakeholders. In practice, **it is difficult that all stakeholders are properly identified, because some individuals and groups may not be obvious.** One limitation is that they involve the stakeholders who are geographically and physically close to the resource or the issue, but fail to involve those who are less visible. For example, many of the most important stakeholders of a MPA (e.g. key decision makers regarding activities within the MPA) may be physically located far away from the area. To avoid this problem is good to begin the identification exercise with a list of all the current and potential functions of the resources and the sectors which are the object of management, and then to identify, for each of these, the individuals, groups and organizations that are now involved in, or may be affected by, a change in the regime governing the use of the resource or the management of the sector. This exercise can be conducted by a facilitator or a single resource management agency; in practice, it is impossible for the exercise of stakeholder identification to be fully participatory, because its purpose is precisely to identify all potential participants.

Criteria for stakeholder analysis

For the process of stakeholder analysis, a range of criteria should be used. These include the following:

- ◆ Degree of effort and interest;
- ◆ Degree of social and economic reliance;
- ◆ Traditional resource use patterns and importance for local cultural identity
- ◆ Differing attitudes, perceptions and beliefs regarding resource use and conservation;
- ◆ Present or potential impact on the resource base;
- ◆ Equity in access to and distribution of benefits;
- ◆ Compatibility with national conservation and development policies; and
- ◆ Current and potential capacity for management.

It is at this analysis stage that the participation of all stakeholders is highly desirable. In practice, effective participatory planning processes depend, to a large extent, on the ability of all partners to appreciate and understand the various stakes involved. Such **processes should therefore aim at creating the conditions for the various participants to express their interests, needs and aspirations, and to confront them with those of others**. It is in this sense that a participatory planning process is largely a conflict resolution and management process, when it allows the various parties to define a collective understanding and evaluation of the stakes of all parties.

Depending on the issues identified and on the methods used for the process of stakeholder analysis, specific information will be needed and research activities will therefore be required. Areas to be covered include an assessment of the economic, social and environmental impacts of various activities and options, as well as an analysis of the current and potential conflicts among users and uses. Stakeholder analysis generally emphasizes the use of qualitative research methods and data. Qualitative research methods used in stakeholder analysis can include, for example:

- Personal experience
- Field visits and participatory observation
- Literature reviews
- Key informant interviews
- Participation in workshops and panels
- Focus groups
- Workshops with stakeholders using collaborative analysis methods (e.g. completing matrices and diagrams)

However, depending on time, available expertise and resources, the stakeholder analysis process can also be significantly strengthened through the use of quantitative research methods. Quantitative data gathered through specific surveys and the use of existing data sources such as censuses and national surveys can be used to complement qualitative data by more precisely identifying important stakeholder features. These include, for example, population numbers and demographic patterns of local communities, levels of resource use and dependency, economic characteristics of stakeholders and levels of human and social capital present in stakeholder groups.

MODULE 5	PARTICIPATORY PLANNING
THEME4	Strategies and mechanisms for stakeholder involvement
OBJECTIVE	To develop skills for applying strategies and methods to assure effective involvement of all relevant stakeholders in participatory planning processes
SIGNIFICANCE	Effective participatory processes require the skilled application of appropriate methods and a long-term commitment to sensitization and preparation of stakeholders
PRESENTATION	Facilitated discussion; group exercises; role playing
TIME	3-4h

NOTE TO THE INSTRUCTOR

The concepts presented in this theme are among the most difficult for participants to grasp, and the use of a case study or other examples is generally quite helpful. Participants may also come with a wide variety of cultural and professional background (E.g. NGOs, state managers, military and police) with very different opinions and preconceptions regarding the role and need for participation in comparison to enforcement in their contexts. The instructor can organize the session around the topics noted above, using examples used earlier (MPAs) to illustrate each issue and then inviting participants to comment their own experience. This session lends itself well to small group exercises in which participants identify, analyse, and critique the steps required to secure the equitable participation of stakeholders in a range of real or hypothetical situations, emphasizing in concrete ways the benefits of equitable participatory processes for MPA management and conservation. The discussion of securing participation should also include an introduction to the topic of incentives. Concrete case studies and examples can be provided by the instructor or shared by participants of the ways that aligning MPA conservation with tangible socio-cultural and economic benefits for stakeholders can enhance local stewardship of MPAs.

OVERVIEW OF BASIC CONCEPTS**The role of the facilitator**

Participatory planning processes are unlikely to occur without leadership and guidance. **Because of the diverse and sometime conflicting stakes involved, unbiased *FACILITATION* is generally required.** One of the institutions involved in the planning process can play the role of facilitator, or an external party or institution can be invited to serve this role. What is most critical is that the facilitator be accepted by all parties involved. The facilitator must be sensitive to the differences among stakeholders and skilled in the use of a range of tools for communication and consensus-building.

Leveling the playing field

In any given situation, not all relevant actors will have the same opportunity and ability to participate. **Social factors such as class, language, gender, race, and education can influence the level and quality of participation.** *EMPOWERMENT* can be defined as the process by which people, particularly the poor and the disadvantaged, gain and retain control over their lives and destinies through information, skills, resources, authority, cooperation and self-esteem. For

participation to lead to empowerment, the process has to be one that not only brings affected groups to the table, but also has mechanisms in place that will allow all stakeholders to be equal in the process.

Provision of information

Stakeholders can only participate effectively in planning processes when they have the information needed to develop proposals and make decisions. Information can come in many forms, and these forms are not equally accessible to all stakeholders. It is the job of the facilitator to assure that all stakeholders have the information they need to fully participate, in forms that they can use.

The major sources of information required for management are research and monitoring (scientific knowledge) and *POPULAR KNOWLEDGE*, (sometimes referred to as traditional or local knowledge), that derives from the observations and assessments of local persons over time. Popular knowledge and scientific knowledge are two different knowledge systems, which are both significant, even if the data they generate are different.

Information directly related to MPA management issues is naturally required. In many cases, a broader and longer-term process of awareness-building is also needed in order to sensitize stakeholders to the underlying context of conservation and sustainable development in which management occurs.

Addressing Social and Cultural issues

An individual's participation in planning processes is affected by a number of personal and cultural factors that have little to do with the actual issues being addressed. These factors include the following:

- ◆ **Gender:** in many Caribbean societies, women's issues and concerns are paid less attention than men's and representatives of stakeholder groups are more likely to be males. In a participatory forum, the balance between men and women and the roles of each one can affect the way in which they participate, both positively and negatively. Women use to be less forthcoming in fora that are dominated by men.

- ◆ **Race and ethnicity** are factors that can exacerbate conflicts in the Caribbean region and that can be used to manipulate popular processes. Those of the same race or ethnicity of the persons leading a participatory process may be perceived as having greater power in the process than others. Factors of race and ethnicity are often reinforced by economic factors, with some groups tending to have greater economic power than others.
- ◆ **Language:** many Caribbean societies are bi- or multi-lingual, and the language used in participatory processes gives power to those most fluent in it. The tendency is for the language of the political and economic elite to be used, further weakening the position of those who speak a local language or dialect.
- ◆ **Political or religious affiliation:** In some countries of the region, communities or entire societies tend to be organized based on political or religious affiliation, and animosities between groups can often be strong. It is likely in such situations that, if the political or religious affiliation of the initiators or facilitators is known, their motives and objectives will be questioned by those who are of a different political party or faith.

A range of factors including education, social class, and upbringing, define the manner in which people are most comfortable participating in planning processes. While meetings among stakeholders tend to be the most common format for participatory planning processes, some stakeholders can be reached and contribute more effectively through other means, such as one-on-one or informal small group discussions or written submissions. When larger meetings are employed, there are a number of issues to consider. For example, while one group may be quite happy to meet in an air conditioned conference room, others may find this environment intimidating to a degree that affects their willingness to participate. The times of meetings, their level of formality, the number of people involved, the way in which the room is arranged, even the food that is served, are all factors that will affect, positively or negatively, the level and quality of participation of different groups.

Community mobilization

COMMUNITY MOBILIZATION refers to the activities carried out in order to stimulate a group of people living or working together to address a specific problem or achieve a specific objective. In order to effectively mobilize community involvement, it is first necessary to understand the existing social dynamics of the community: who are the acknowledged leaders, what is the level of credibility of the local organizations and other institutions functioning in the community, what has been the community experience with mobilization and joint action in the past, what activities are occurring now, etc. It is also important to take into account that communities are not homogeneous but constituted by a wide variety of groups with diverse and

in some cases conflicting interests. Furthermore, in many communities in the region, there may be an inherent distrust of government and of outsiders, and **initiatives that present an image of imposing from outside are likely to have difficulty mobilizing interest and involvement.** Working through respected local organizations, which know the dynamics of the community and have their own methods for mobilization in place, is often very effective. It is important to beware, however, that initial perceptions regarding the status of individuals and organizations within the community may on closer inspection be skewed towards those that hold economic or political power.

Effective consultative Processes

Effective consultative processes are characterized by the active, informed, and equitable participation of all relevant stakeholders. There is no single model: the number and range of stakeholders, the time frame, the complexity and controversiality of the issues being addressed, the size of the area being considered, and other factors all need to be considered in designing the process.

The most effective processes start from the earliest stages of planning, and involve stakeholders in the identification of problems, the definition of a vision, and the setting of objectives. Where stakeholders are brought in after these steps have been taken, it is difficult to secure or maintain their participation, as the objectives of the process may be ones that are of little interest or even damaging to them.

Sustaining participation

Given the constant change of the Caribbean marine and coastal zone, planning cannot end with the implementation of decisions, but must be an ongoing process. Responding to these changes requires flexible structures that involve all actors in management and decision-making. Institutional arrangements that assure stakeholder involvement are therefore needed to sustain participation. **It is also necessary that stakeholders are compensated for their time and effort** in appropriate and equitable ways. Leaders of participatory processes should be careful to avoid creating false expectations and be consistent in following up on commitments.

Social and economic incentives

To sustain participation, MPA managers may also seek opportunities to create positive social and economic incentives to further harmonize MPA management objectives with stakeholder

interests. MPA formation and management actions often require new forms of control over resources that can have a direct impact on the economic livelihoods and well being of stakeholders. A positive incentive in the context of an MPA provides stakeholders with a motive to behave in ways that support the conservation of the area. Negative incentives may also exist that provoke resistance to conservation actions.

International organizations and academics are increasingly emphasizing the inter-relationship between ecological and social systems and the need to link the community well-being with biodiversity conservation in tangible ways (IUCN 2008). Recent studies show that community impact is often not taken into account in the formation and management of protected areas in Latin America and the Caribbean and other areas of the world, and this frequently results in the lack of collaboration and even resistance by stakeholders such as fishing communities to conservation actions (CANARI 2005). On the other hand, there is empirical evidence that MPAs can provide positive social and economic benefits for communities through contributing to poverty reduction, empowering local communities and providing a foundation for protecting and reinforcing local cultural values and identity (Leisher et al., n.d.). Furthermore, evidence suggests that stakeholders that perceive tangible socio-cultural and economic benefits from the presence of an MPA are more likely to value and protect the area (e.g. Solares-Leal and Gil 2003, McPherson 2008).

Depending on the context of the MPA, a wide variety of strategies can be employed to integrate community well-being and MPA conservation to create incentives for stakeholder stewardship of MPAs. MPA managers should seek to identify and avoid negative incentives and identify opportunities to support positive incentives that encourage stakeholder and community support. Examples of tangible benefits that local communities can perceive from MPAs with support from MPA managers include:

- Opportunities for participation in new MPA-related economic activities such tourism;
- Increased opportunities for national and international financing of projects that promote local development to enhance conservation;
- Financial and technical support for community-based organizations;
- Increased opportunities for training to provide economic alternatives;
- Credit for fishing gear to support more sustainable fishing practices and other economic alternatives.
- MPA-related job opportunities as park guards, research assistants and others.
- Support to improve marketing of local products.
- Privileged access to fishing areas and increases in fishing productivity through increased fish stocks and control of illegal fishing.
- Empowerment through participation in MPA-related governance processes and opportunities to participate in local and international networks.

- Reinforcement and support of traditional cultural activities and practices.
- Protection of valuable local resources such as beaches from encroachment by outsiders.
- Reaffirmation and preservation of local history and cultural values through contact with researchers.
- Protection of areas and resources of great importance for local cultural identity due to symbolic or ritualistic significance.

MODULE 5	PARTICIPATORY PLANNING
THEME 5	Conflict management
OBJECTIVE	To understand how the proper management of conflicts can contribute positively to a participatory process.
SIGNIFICANCE	Conflict is an inevitable by-product of participatory processes. If properly managed, however, conflicts can help to advance the participatory planning process and contribute to the effectiveness of management.
PRESENTATION	Facilitated discussion; case study analysis
TIME	2h

NOTE TO THE INSTRUCTOR

To present the concepts described in this theme, the instructor can use the Soufriere Marine Management Area, or a case with which all the participants are reasonably familiar, to examine and analyse the causes of conflicts and discuss the methods that were used to address them.

OVERVIEW OF BASIC CONCEPTS

Participatory processes aim at achieving consensus about needs and aims (Mayoux 1995:241). Arriving at this consensus can be difficult due to different and conflicting interests and objectives. In many respects, participatory processes are processes of negotiation, which aim at resolving and managing existing and potential conflicts (between and among resource users, between resource uses, or between resource management objectives and strategies).

CONFLICT occurs when competing or opposing interests fail to find common ground. In the context of natural resources in the Caribbean, conflict is very often caused by a change in management regimes. **When a management intervention alters the implicit or explicit rules governing natural resource access or use, relations between those with an interest in the resource can also change.** Where this change results in the actual or perceived net loss of benefits, conflict occurs. The establishment of a MPA, for example, can lead to conflict between the management agency and traditional users of the area, such as fishers, if they feel they have lost access to fishing grounds and gained little or nothing in return, or if the tourism interest have prevailed over the remainder. In many instances, the reduction of fisheries resources abundance change priorities of those affected who switch to other type of jobs and economic alternatives.

Although we have been socialized to think of conflict as a negative condition, it can have a positive and constructive function in society. When dealt with in an appropriate manner, **conflicts present opportunities for assessment and evaluation and can catalyze change.** The conflict can help address issues that could stymie management at a later stage in the process. If not managed properly, however, conflict can be counterproductive and undermine the resource management arrangement.

It is useful to talk about dealing with conflict in terms of management rather than resolution because **the conditions under which the management of a MPA occurs are constantly changing and variables that can give rise to differences are continuously being introduced.** The **MANAGEMENT OF CONFLICT** implies putting mechanisms in place to deal with present and possible future disputes or differences. Such an approach to addressing conflict inherently acknowledges that conflicts exist and will exist, and plans for it in general terms. The

stakeholder identification process is an important element of conflict management because it can help identify where current and potential problem areas exist. **CONFLICT RESOLUTION** is an appropriate construct for dealing with individual disputes as they arise.

Conflict management is a responsibility of MPA managers, who must play different roles in this process, ranging from facilitator to negotiator to decision maker. If the management agency is one of the parties in conflict, MPA managers have to identify a method for conflict resolution that will be appropriate and acceptable to all involved. **Effective communication is an essential tool for conflict management.**

Characteristics of protected area conflicts

Lewis (1997) has identified four characteristics of conservation area conflicts, which also apply to conflicts in MPAs. While all of these characteristics may not be relevant to each conflict that a MPA manager might face, they are useful contextual guides.

They involve several stakeholders.	Conflicts often revolve around the loss of benefits of access or use. A stakeholder group is usually perceived as gaining at the expense of other groups.
They are often influenced by factors and conditions external to the management area.	Managers should look beyond the physical boundaries of the protected area to fully understand the roots of conflicts and address them effectively. These external factors can be: political, such as a change in government; legislative, such as the introduction of new laws and regulations that affect practices inside or outside of the management area; economic, such as a local recession; or environmental, resulting from the degradation of resources in areas connected to the ecosystem.
They involve scientific and socio-cultural phenomena.	Scientific data are not always available to support management decisions, particularly at the start of interventions; there may also be clashes between scientific knowledge and local knowledge, particularly when those who possess the former ignore or undervalue the latter.
Identifying solutions to conflicts is often	The universe of solutions available is sometimes

constrained by a lack of financial resources.	limited by financial resources to obtain goods and services that might aid in the resolution process.
Adapted from Lewis, 1997.	

Guidelines for conflict management

1. **Understand the nature of the conflict and its underlying causes.** It is important to understand the various manifestations of the conflict (symptoms) and why the problem occurs (causes). This may require research and external contributions and services. A conflict in a MPA may manifest itself in the non-compliance of a user group with area regulations, for example. In such an instance, it would be important to understand such things and who are the group members that are non-compliant, if the non-compliant members are part of the original consultation and negotiation process, if social and economic conditions have changed and affected behaviour and decision-making among group members, etc.
2. **Analyse issues (including power dynamics among stakeholders) at the start of the process and clearly define interests.**
3. **Make sure the process for reaching a solution is legitimate and acceptable to all.** Ensure, for example, that all relevant stakeholders are a part of the process and that all positions and stakes are represented by the designated spokespersons. The process used should be culturally, socially, and politically appropriate.
4. **Ensure that the process is transparent**, i.e., all relevant parties are aware of all steps in the process and involved in decision-making as appropriate.
5. **Arrive at consensus on the method of addressing the conflict and define objectives for each stage of negotiation.**
6. **Design negotiation processes in stages** and reach results for each step before advancing the process to the next phase.

7. **Begin with the resolution of simple issues before attempting to resolve more complex issues.** This makes it possible for the negotiating parties to focus on the issues easier resolved and that it is possible to reach agreements.
8. **Conclude with the formulation of a formal agreement** that clearly stipulates conditions and responsibilities for implementation

Approaches for addressing conflict

There are different methods for bringing diverse interests together to reach an agreement. The following four methods can be used in resolving disputes related to the use of marine resources:

SELF-NEGOTIATION: This may be formal or informal. 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. The arbitrator seeks the views of all parties, tests solutions and options, and formulates a solution that is as acceptable as possible to all.

MODULE 5	PARTICIPATORY PLANNING
THEME 6	Collaborative management
OBJECTIVE	To understand how collaborative management (co-management) differs from other forms of management and the conditions under which it is most appropriate and effective.
SIGNIFICANCE	Stakeholder involvement in the management of MPAs can improve resource base and enhance benefits, locally and nationally, but the development of effective co-management arrangements is complex and requires skills and experience.
PRESENTATION	Presentation of main concepts
TIME	2h

NOTE TO THE INSTRUCTOR

In order to avoid misunderstandings regarding co-management, the instructor can divide participants into small groups to develop definitions of co-management. These can be presented to the group, followed by a brief presentation by the instructor on the subject of management regimes. The complexity of some management situations can be illustrated through a group exercise in which the case study (an AMP familiar to trainees and/or the instructor) is analysed to determine ownership rights, tenure and usage rights, management authority, and management responsibility. The concept of co-management can then be introduced by the instructor, and the initial definitions developed by the participants revisited and critiqued. The use of one or more real co-management agreements can be useful in presenting the material on preparing co-management agreements. The cases of participatory MPA management presented by this theme can be reviewed by the group to determine whether they represent actual co-management and why. In the brief time available, only this basic overview of co-management is possible. For more information, you can consult the publications online listed at the beginning of this Module) and the following:

- **People-centred approaches to coral reef management: Lessons learned at CERMES, UWI Cave Hill Campus. October, 2006. Slide show by Maria Pena and Patrick McConney, http://www.coralreef.gov/taskforce/pdf/barbados_update_usvi.pdf**
- **McConney, P; R. Pomeroy and R. Mahon. Coastal resources co-management in the Caribbean. http://dlc.dlib.indiana.edu/archive/00001439/00/McConney_Coastal_040512_Paper389.pdf**
- **NEGOTIATING INFLUENCE: THE EXPERIENCE OF THREE LOCAL NGOS IN MARINE RESERVE CO-MANAGEMENT IN SOUTHERN BELIZE. Jocelyn Rae Finch, Master in Science Thesis, May, 2006. <http://www.forestry.umt.edu/students/services/peacecorps/pdf/jocelyn%20finchprofessionalpaper.pdf>**
- **Peter Espeut, Caribbean Coastal Area Management Foundation . MPA PERSPECTIVE: CHALLENGES IN PLANNING PROTECTED AREAS IN JAMAICA, AND THE CO-MANAGEMENT ROLE OF NGOs . MPA NEWS Vol. 4, No. 4 October 2002. <http://depts.washington.edu/mpanews/MPA35.htm#Espeut>**

OVERVIEW OF BASIC CONCEPTS**Management regimes and options**

In the context of MPA management, an ***INSTITUTIONAL ARRANGEMENT*** can be defined as the manner in which rights and responsibilities over the use and management of the resource are distributed, regulated and applied. These rights and responsibilities are many, but they can be grouped according to the following broad categories:

- ◆ The right to sell the resource (conventional ownership right);
- ◆ The right to use the resource and consume or sell the products derived from that use;
- ◆ The right and responsibility to exclude other users;
- ◆ The right and responsibility to define and modify the conditions under which use can take place.

These rights and responsibilities can be placed under four possible *MANAGEMENT REGIMES*:

- ◆ **Private:** one or several of the rights and responsibilities described above are held by a private individual or company;
- ◆ **Communal:** they are held by a group of individuals;
- ◆ **State:** they are held by a state agency or by the government on behalf of the public;
- ◆ The rights and responsibilities are not assigned.

It is commonly assumed that the various rights and responsibilities are normally all held by the same entity, and that the most common situations are those where the same management regime applies to all types of rights. The reality is however far more complex, with most situations reflecting a combination of rights among various parties. For example, even in the case of private property, the state retains several rights and responsibilities, through its policies and programmes. Similarly, it is not rare to find public properties where use rights are traditionally held by private individuals or communities.

The goal of participatory natural resource management is to establish institutional arrangements where rights are distributed in the most effective and equitable manner. **Collaborative**

management, or *CO-MANAGEMENT*, refers to those arrangements in which management rights and responsibilities are formally shared or divided among two or more partners.

Co-management cannot be defined as a distinct management regime. Instead, **co-management is the instrument, the agreement that gives legitimacy and formality to the participatory nature of the management regime.** This implies that co-management arrangements are specific for each situation, and although most management authorities remains in the hands of the state, it is always necessary to formalize the sharing of a small portion of responsibility with civil society actors.

Conditions favouring co-management

Co-management is based on the premise that resources are sometimes best managed by an alliance of stakeholders. Co-management is an appropriate option for MPAs when it can enhance the protection of the resource base and achievement of MPA objectives than other options. With the growing popularity of the co-management concept, it is important to remember that **there are situations in which co-management may not be the most appropriate option.**

Co-management is however appropriate when the significant and structured participation of two or more stakeholders or management agencies is required to achieve management objectives. Identifying the parties in a potential co-management arrangement requires analysing the tasks that must be carried out to meet management objectives, the institutions that have the responsibility for carrying out these tasks, as well as those that are best placed to do so through their rights to, knowledge of, or propinquity to the resource.

Preparing Co-management agreements

Collaborative management presupposes the existence of formal and binding agreement between the parties involved. The major purpose of this agreement is to clearly define the responsibilities and rights of each party in managing the resource or area in question. Co-management agreements are needed because:

- ◆ In the absence of formal agreements, management regimes almost inevitably evolve towards a situation where authority is returned to the most powerful partners;
- ◆ Formal agreements provide a guarantee of transparency and fairness in the distribution and assumption of authority;

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- ◆ Formal agreements help partners move from a claim of rights to an assumption of responsibility;
 - ◆ Agreements help to manage change, as they stipulate the mechanisms that will be employed in order to adapt and respond to change.

In addition to spelling out the responsibilities and rights of each party, **co-management agreements should include the following:**

- ◆ **Rationale:** this is the justification for management, and the statement of the reason why an agreement was considered necessary in the first place.
- ◆ **Identification of partners:** this names the formal partners in the agreement, those who are formally committing themselves to its terms.
- ◆ **Vision:** this expresses the direction in which the agreement is taking its partners, the ultimate goal that it wants to realize.
- ◆ **Objectives:** this defines the specific changes and realizations that are expected to come as a result of the agreement.
- ◆ **Programmes and conditions of resource use:** this defines all the activities (conservation, sustainable resource use, research and monitoring, public awareness and education, etc.) which will be implemented in order to achieve the objectives.
- ◆ **Zoning:** this defines the geographic distribution of resource uses, and the special conditions which may apply to specific areas.
- ◆ **Roles of the partners:** this defines the functions and responsibilities of each partner.
- ◆ **Institutional arrangements:** this stipulates how these functions and responsibilities will be organized and shared, and what linkages will exist among the various partners.
- ◆ **Legal instruments:** this notes the legislation which supports the agreement, and identifies the special instruments which may be needed to establish and implement the agreement.
- ◆ **Financial instruments:** this describes how resources are generated, managed and allocated.
- ◆ **Monitoring and reporting:** this identifies the objectives of monitoring, the indicators to be used, and the channels for reporting and accountability.

- ◆ **Duration and procedures for modification:** this defines the length of the agreement, and the procedure that has to be followed to change some or all of its terms.
- ◆ Signatures

Implementing Co-management Agreements

The success of collaborative management arrangements depends, to a large extent, on four factors:

- ◆ The quality of the process that has led to the design and establishment of the arrangement;
- ◆ The clarity and specificity of the terms of the management agreement;
- ◆ The effective monitoring and control of implementation and effectiveness of management;
- ◆ The capacity of participating individuals, groups and organizations to perform their roles effectively.

CAPACITY-BUILDING must therefore be an essential component of the process of strengthening participatory and collaborative natural resources management, and it involves:

- ◆ Changes in the structures and cultures of participating organizations to facilitate collaboration, power-sharing and devolution of authority;
- ◆ Procurement of skills needed to perform the functions assigned in the management agreements (monitoring, sustainable use, communication, enforcement, etc);
- ◆ Strengthening of organizations, particularly at the community level;
- ◆ Establishment of financing mechanisms for all parties involved.

Effective Shared Management

- ◆ Formal and accepted agreement;

- ◆ Good leadership;
- ◆ Channels for 2-way continuous communication;
- ◆ Local presence of management partners;
- ◆ Formal/accepted involvement of all management partners; and
- ◆ No duplication of effort.

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Appendix 5.1: Typology of Participation

How People Participate in Development Programmes and Projects

Type	Characteristics
1. Manipulative Participation	Participation is simply a pretense, with peoples' representatives on official boards but who are unelected and have no power
2. Passive Participation	People participate by being told what has been decided or has already happened. It involves unilateral announcements by an administration or project management without any listening to people's responses. The information being shared belongs only to external professionals.
3. Participation by Consultation	People participate by being consulted or by answering questions. External agents define problems and information gathering processes, and so control analysis. Such a consultative process does not concede any share in decision-making, and professionals are under no obligation to take on board people's views.
4. Participation for Material Incentives	People participate by contributing resources, for example labour, in return for food, cash, or other material incentives. [People] are involved in neither experimentation nor the process of learning. It is very common to see this called participation, yet people have no stake in prolonging technologies or practices when the incentives end.
5. Functional Participation	Participation is seen by external agencies as a means to achieve project goals, especially reduced costs. People may participate by forming groups to meet predetermined objectives related to the project. Such involvement may be interactive and involve shared decision-making, but tends to arise only after major decisions have already been made by external agents. At worst, local people may still only be co-opted to serve external goals.
6. Interactive Participation	People participate in joint analysis, development of action plans and formation or strengthening of local institutions. Participation is seen as a right, not just the means to achieve project goals. The process involves interdisciplinary methodologies that seek multiple perspectives and make use of systemic and structured learning processes. As groups take control over local decisions and determine how available resources are used, so they have a stake in maintaining structures and practices.
7. Self-mobilization	People participate by taking initiatives independently of external institutions to change systems. They develop contacts with external institutions for resources and technical advice they need, but retain control over how resources are used. Self-mobilization can spread if governments and NGOs provide an enabling framework of support. Such self-initiated mobilization may or may not challenge existing distributions of wealth and power.

Source: Pretty 1995, in Bass et al. 1995

Appendix 5.2: Glossary of Terms

Arbitration	The hearing and determination of a case by a person chosen by the parties in conflict or appointed under statutory authority.
Capacity-building	The process of improving the ability of groups and institutions to define and achieve their goals and objectives.
Co-management	A formal agreement on the sharing or dividing of management rights and responsibilities among two or more partners.
Communication	The sending and receiving of information or messages between individuals or groups, to transfer meaning.
Community mobilization	Activities carried out in order to organize a group of people living or working together to address a specific problem or achieve a specific objective.
Conflict	The failure of competing interests to find common ground.
Empowerment	The process by which people, particularly the poor and the disadvantaged, gain and retain control over their lives and destinies through information, skills, resources, authority, cooperation, and self-esteem.
Equity	The fair or just allocation of rights and distribution of benefits.
Facilitation	The process of assisting interested parties to reach consensus on a course of action or to resolve a conflict.
Institutional arrangement	The manner in which rights and responsibilities over the use and management of a resource are distributed, regulated and applied.
Management regime	The conditions and set of rules applied to manage the manner and rate in which a resource is allowed to deplete or regenerates.
Mediation	Negotiated resolution to conflict by a neutral party who serves as the intermediary between the disputing parties.
Participation	Shared involvement of interested parties in decisions and actions related to the management of an area or resource.

Planning	A systematic process of identifying and selecting the most appropriate alternative to achieve a defined objective.
Popular knowledge	Information, skills, and methods related to the status, use, and management of a resource acquired through empirical means by persons or communities with a longstanding interest in the resource. Also called local or traditional knowledge.
Self-negotiation	The voluntary settlement of a conflict by the disputing parties without the assistance of a facilitator.
Stakeholder	An individual, group, or organization that is involved in, or may be affected by, a change in the conditions governing the management and use of a resource, area, or sector.
Stakeholder analysis	The analysis of the interests, rights, and responsibilities which can be attributed to each stakeholder, in order to determine the form and extent of their participation in the management process.
Stakeholder identification	Inventory of the groups, individuals, institutions, and initiatives with an interest in, rights to, or responsibility for the resources to be managed.
Sustainable development	A development process that improves the quality of life at all levels with minimal external support, while preserving or enhancing the resource base.
Traditional uses	Extractive or non-extractive exploitation of a resource that has been carried out for long periods of time, generally by local people for subsistence purposes.

Appendix 5.3: Participatory Planning for the Soufriere Marine Management Area

Background

Soufriere is located on the southwest coast of St. Lucia. This area is unique and remarkable in many respects, because of the richness and diversity of its natural and cultural resources. Due to its isolation and a rugged topography, the local economy has been depressed for several decades, and tourism is now seen as an opportunity to bring new benefits to the community and to create productive linkages with other sectors, notably agriculture and fishing.

Over the past few decades, there has been a concentration of human activities on the coast, in a small and fragile area. The main sectors involved are fishing (with approximately 100 full-time and 50 part-time fishers), tourism (with two large resorts, and several smaller hotels, guest houses, and restaurants), communication and transport (with the Soufriere harbour and with a large number of yachts visiting the area), recreation (with only two beaches in the immediate vicinity of residential areas), and urban development (with the town of Soufriere and its 4,000 inhabitants).

Net fishing, with gillnets and beach seines, is an important activity, and some fishermen specialize in that type of fishing. Other full-time fishermen are involved in trolling for pelagic species during the December to July period, while they use pots and bottom lines during the rest of the year. Most of the part-time fishermen specialize in pot fishing. There is one fishing cooperative in Soufriere.

The growth of the tourism sector in the past twenty years, coupled with the development of the town and the increase in the various environmental impacts of human settlements, created new pressures on the coastal resources, provoked severe conflicts between the various resource user groups, and had major impacts on fishermen and their activities. The most acute of these conflicts were between divers and fishermen (over reef areas), and between seine fishermen and yachts anchoring in fishing zones. In all instances, fishermen felt that they were being displaced and deprived of their traditional fishing zones.

The initial response of government agencies and other actors involved proved largely inadequate, and served to exacerbate many of the conflicts, much to the detriment of fishermen. For example, Marine Reserves and Fishing Priority Areas were legally established, but without boundaries, leaving much to the interpretation of the various users. In the zones which, in the understanding of fishermen, had been established as Fishing Priority Areas, many other activities were taking place, which restricted traditional uses. New hotel and infrastructural developments also resulted in limited access to some of the beaches which had been important for recreation and seining. Typically, the community of Soufriere, including its fishermen, had little opportunity to participate in the decisions affecting these resources and their uses.

In these conditions, fishermen of Soufriere felt that their interests were not properly represented, and that their rights of access to the resource were being undermined. This situation worsened, in the late 1980s, when a jetty was constructed in an area which fishermen considered important, and which had been established as a Fishing Priority Area by the Ministry of Agriculture and Fisheries.

The Negotiation Process

It is against this background that a participatory planning process was initiated, in July 1992, to attempt to address the many issues affecting users of marine and coastal resources in Soufriere. Placed under the auspices of a local non-governmental organization, the Soufriere Regional Development Foundation, the negotiation process was facilitated jointly by the Caribbean Natural Resources Institute (CANARI) and the Department of Fisheries of the Ministry of Agriculture. It was implemented over a period of eighteen months, with the following activities:

- ◆ The identification of all stakeholders, and the application of criteria to evaluate their respective rights and responsibilities;
- ◆ The sensitization and mobilization of fishermen, before the commencement of the formal negotiation, to ensure their full participation in the process;
- ◆ Conduct of a first one-day meeting, with approximately 60 participants representing all groups and sectors concerned with coastal and marine resources and activities in the Soufriere region, to identify the issues and establish the basis for the negotiation process. During this meeting, participants negotiated a map of resources, problems and issues, on the basis of a field visit on boats;
- ◆ Conduct of a second one-day meeting, with the same group of participants, to confirm the information contained on the map, to identify the causes of the various problems, and to formulate recommendations on the issues on which agreement could be reached easily;
- ◆ Specific negotiations, conducted individually or within small groups, to formulate draft recommendations concerning the areas of more severe conflicts;

- ◆ Conduct of a third one-day meeting, to confirm all decisions already made, and to begin discussions regarding management structures and implementation mechanisms;
- ◆ Distribution to all participants of a draft agreement summarizing all conclusions and recommendations;
- ◆ Conduct of a fourth one-day meeting, with a smaller group, to refine the recommendations concerning institutional and legal instruments;
- ◆ Preparation of a final document, entitled *Agreement on the use and management of marine and coastal resources in Soufriere, St. Lucia*, and submission of this document, for endorsement, to the Cabinet of Ministers;
- ◆ Public presentation of the Agreement, in the presence of representatives of the Government and all concerned institutions at the national and local levels.

Throughout this process, the public was kept informed of activities and progress, through the media.

The Agreement provides for the establishment of a Soufriere Marine Management Area (SMMA), which was officially launched on 1 July 1995. It creates five different management zones and establishes a number of measures which should ensure the rational use of resources through the involvement and collaboration of all relevant stakeholders.

The Participation of the Fishing Community in Making Decisions

The Soufriere process provides a good illustration of the place of information in a process of planning, and one of the methods used is particularly important to note. It is the preparation of a map of marine resources, issues, and conflicts, that was drawn up by the participants, while traveling by boat throughout the area under consideration. This activity proved extremely useful, because it generated valuable information, and because it used and demonstrated the value of the knowledge of the users of the resource (namely the fishermen and the divers). In this way, it created an affinity among those who "knew" (the fishermen, the divers, and one local scientist); it also established their credentials in front of the representatives of government authority.

Another feature of the Soufriere experience is that the facilitators paid attention, at the beginning of the process, to the need to mobilize the fishermen and to ensure that they would participate. This required a series of meetings, facilitated by a resource person from the community, without the involvement of government agencies, to present to the fishermen the opportunities offered by the decision to conduct a negotiation, and to assist them in organizing their representation. This resulted in the fishermen selecting eight delegates among themselves, to represent the various types of fishing, and preparing joint positions before and during meetings. As a result, the

fishermen, who are too often powerless in negotiations with government agencies and more prominent sectors of society, were able to participate fully.

A third lesson from this experience is that there must be incentives for the various stakeholders to participate. Otherwise, parties in a negotiation process can easily drop out if they get a chance. It is indeed important to remember that participants in a process of negotiation always retain the choice between the negotiation and unilateral action. It is critical for facilitators of and participants in the process to be aware of this reality, and to know that those with substantial power will always be tempted to use unilateral action to resolve the dispute and to gain greater benefits from the result. In the case of Soufriere, this happened on at least three occasions, with three prominent interests, over the period of eighteen months.

On the other hand, fishermen remained loyal and committed to the process throughout its duration, and this can be attributed, at least partially, to their social and political status. In effect, they had no other option but to participate; from their perspective, even a small opportunity to influence a decision would be better than no opportunity at all. In the eyes of persons and institutions involved in facilitating participatory planning processes, this can be positive, but there is a danger. Without vigilance, the participation of a powerless group can be taken for granted.

Adapted from Renard, Y. and S. Koester. 1995. Resolving conflicts for integrated coastal zone management: the case of Soufriere, St. Lucia. Caribbean Park and Protected Area Bulletin 5(2): 5-7.

MODULE 6	MARINE PROTECTED AREA PLANNING
OBJECTIVE	To understand the planning process and requirements for the establishment of marine protected areas.
THEMES	<ol style="list-style-type: none">1. Basis for Establishment of Marine Protected Areas2. principles for the location and design of MPAs; resource assessment, data collection, and mapping (3h)3. Zoning (43h)
DELIVERY TIME	2 days

MODULE 6
THEME 1
OBJECTIVE
SIGNIFICANCE
PRESENTATION
EQUIPMENT / MATERIALS
EXERCISE
TIME

MARINE PROTECTED AREA PLANNING

Basis for Establishment of Marine Protected Areas

To introduce the policy frameworks within which marine protected areas are normally established and clarify their conservation objectives.

Many of the problems related to lack of political or popular support that are experienced by protected areas result from not having management objectives that are linked to national policy frameworks and/or conservation objectives.

Lecture, discussion

Projector, Mod6.ppt

Group discussions

2h

NOTES FOR THE INSTRUCTOR

This Module contains information on international treaties related to biodiversity conservation (Appendices 6.1-6.6). Instructors should examine the Module before printing all appendices as some of them can be downloaded from the Internet.

POLICY FRAMEWORK

At the **international level**, the policy framework is determined to a large extent by policy statements of IUCN (the World Conservation Union) (Kelleher & Kenchington, 1991) and the Convention on Biological Diversity, in particular its Jakarta Mandate (Anon., 1995). See Appendices 6.1-6.5.

According to IUCN policy, the primary goal of marine conservation and management is: *“To provide for the protection, restoration, wise use, understanding and enjoyment of the marine heritage of the world in perpetuity through the creation of a global, representative system of marine protected areas and through the management in accordance with the principles of the World Conservation Strategy of human activities that use or affect the marine environment”*.

The main elements of the IUCN policy statements are:

- a. Implementing integrated management strategies to achieve the objectives of the World Conservation Strategy;
- b. Involving all stakeholders in the development of these strategies; and
- c. Cooperative action to develop national systems of marine protected areas.

The CBD/Jakarta Mandate focuses on five thematic issues:

- a. Integrated Marine and Coastal Area Management;
- b. Sustainable use of marine and coastal living resources;
- c. Marine and coastal protected areas;
- d. Mariculture; and
- e. Alien species.

The CBD/Jakarta Mandate includes a Ministerial Statement which recognizes the critical need to address the conservation and sustainable use of marine and coastal biological diversity and a multi-year program of work on marine and coastal biological diversity. Other policy elements can be found in the World Heritage Convention and the Ramsar Convention.

EXERCISE 6.1

Ask participants to identify the main differences between the above-listed policies.

At the **regional level**, policy is determined primarily by the Cartagena Convention and its SPAW Protocol (Anon., 1990). See Appendix 6.6. Article 4 of the Protocol describes the policy for the establishment of protected areas as follows (text shortened by author): *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.*

Such areas shall be established in order to conserve, maintain and restore, in particular:

- a. Representative types of coastal and marine ecosystems of adequate size to ensure their long-term viability and to maintain biological and genetic diversity;
- b. Habitats and their associated ecosystems critical to the survival and recovery of endangered, threatened or endemic species of flora and fauna;
- c. The productivity of ecosystems and natural resources that provide economic or social benefits and upon which the welfare of local inhabitants is dependent; and
- d. Areas of special biological, ecological, educational, scientific, historic, cultural, recreational, archaeological, aesthetic, or economic value, including in particular, areas whose ecological and biological processes are essential to the functioning of the Wider Caribbean ecosystems.

At the **national level**, policies with respect to MPAs are likely to be part of broader protected area policies, of national environmental strategies, or of a protected area system plan. National protected area system plans are called for under article 8 of the Convention on Biological Diversity. System planning aims at:

1. Defining the priority of protected areas as a worthwhile national concern; defining the relationships between (a) different units and categories of protected areas; and (b) protected areas and other relevant categories of land.
2. Taking a more strategic view of protected areas.
3. Defining roles of key players in relation to protected areas and the relationships between these players; this may include building support and a constituency for protected areas (i.e. as a means to that end, not as an end in itself).

4. Identifying gaps in protected area coverage (including opportunities and needs for connectivity) and deficiencies in management.
5. Identifying current and potential impacts - both those affecting protected areas from surrounding lands and those emanating from the protected areas which affect surrounding lands. (Davey, 1998).

EXERCISE 6.2

Participants will briefly review national policies for their respective countries.

OBJECTIVES

Objectives for MPAs have been defined by the 4th World Parks Congress (1992, Working Group III.2). See Appendix 6.7. These objectives appear to be closely related to the policy outlined in the SPAW Protocol. IUCN also gives conservation objectives for protected areas in general (McNeely *et al.*, 1994). See Appendix 6.8. Objectives for MPAs may vary depending on the overall goal of the area. Defining clear objectives at the outset of the planning process is essential to give direction to the design, management, legal, and institutional requirements of the MPA.

EXERCISE 6.3

Participants will list the objectives of the MPA with which they are most familiar.

CRITERIA FOR SELECTION OF MPAS

Salm and Clark (1984) provide a detailed list of criteria, with the following major headings: social criteria, economic criteria, ecological criteria, regional criteria, and pragmatic criteria. See Appendix 6.9.

Kelleher and Kenchington (1992) also provide a listing of criteria, while a similar version can be found in Kelleher *et al.* (1995). See Appendices 6.10 and 6.11. Kenchington and Hudson (1988) provide a listing of questions and considerations that need to be addressed in order to determine realistic options for management of coral reef areas.

EXERCISE 6.4

Participants will identify selection criteria that have been or are being applied in their respective countries.

LEGAL ISSUES

The legal authority to establish MPAs must be anchored in legislation and is usually vested in a particular Minister or in Cabinet. However, the authority, as well as the legal procedures that lead up to the designation of MPAs, vary widely, depending on the status of the country (independent nation, semi-independent, Crown Colony, Overseas Department). In the independent English-speaking Caribbean nations, such authority is usually vested in Cabinet or in a particular Minister. The French Overseas Departments (DOM) and the Netherlands Antilles represent two extremes in terms of authority. In the French departments, the final designation of an MPA must be approved by the Minister of the Environment in Paris, whereas in the Netherlands Antilles that authority has been delegated entirely to the respective Island Governments.

Generally speaking, coastal and marine waters come under the public domain and can be considered as commons. However, in planning MPAs, possible traditional ownership or use rights must be carefully considered. In most countries the public domain includes a portion of the land adjacent to the waters. The extent of this public land varies among the different countries. Considering the importance for MPAs of being able to control land-based activities that may impact on the MPA, it is extremely relevant to research the legal status of the land immediately adjacent to the planned MPA.

In most countries, the enabling legislation for protected areas is a framework that authorizes the establishment of such areas. Such legislation may be separate conservation legislation, or it may be a part of fisheries or forestry legislation. The actual designation of protected areas and the establishment of rules and regulations are usually done at a lower level. This approach allows a measure of flexibility and facilitates amendments of regulations or zoning as may be required to respond to changing circumstances or uses.

EXERCISE 6.5

Participants will give a brief overview of national legislation and the processes that lead to the designation of a MPA.

MODULE 6	MARINE PROTECTED AREA PLANNING
THEME 2	Institutional Arrangements for Marine Protected Area Management
OBJECTIVE	To reinforce the concept that cooperation between several institutions is usually required for MPA management.
SIGNIFICANCE	Factors impacting on MPA management usually fall within the preview of several government agencies. Additionally, the activities of a number of NGOs may also impact on the MPA. Successful management is therefore dependent on the cooperation between these institutions.
PRESENTATION	Lecture, Discussion
EQUIPMENT / MATERIALS	Overhead projector
EXERCISE	Group discussions
TIME	2 Hours

ARRANGEMENTS FOR MARINE PROTECTED AREA MANAGEMENT

Few countries in the Wider Caribbean can afford to have completely separate agencies for the management of protected areas. In many instances that responsibility has been delegated to an existing agency such as a Forestry or Fisheries Division. In the case of Puerto Rico and the US Virgin Islands, protected areas are managed by an agency of the metropolitan government. In some countries, so-called statutory bodies (also known as para-statal) have been created to undertake responsibility for management. In a number of countries protected areas are managed by NGOs or jointly by Government agencies and NGOs. An overview of institutional arrangements for protected area management in the Caribbean can be found in Putney (1994). See also Appendix 6.12. It is interesting to note that none of the areas rated as “fully managed”, were administered by local government agencies (Putney, 1994).

Irrespective of the type of institutional arrangement for management, there is always a need for cooperation in planning, establishing and managing a MPA. The need for cooperation arises from the following considerations:

1. Government, the private sector, and user groups or individual users each has a stake in the resources that will be protected and managed through the MPA. The greater the involvement of all stakeholders in the planning process and the management, the better chances will be of broad support for the MPA, and consequently, of achieving the objectives for which the MPA was created.
2. There is often overlapping jurisdiction between government agencies, and cooperation will help to avoid conflict.
3. Resources for the planning, establishment and management of MPAs are limited, and pooling of resources alleviates the burden on a single agency.

A number of instruments for cooperation in MPA planning and management are available, and include:

- a. Legislation that prescribes the roles and responsibilities of the respective partners;
- b. Formal or informal memorandum of understanding (MOU); and
- c. Formal and binding collaborative management agreements between two or more partners (this is treated in the module on participatory planning).

Establishing collaborative agreements on paper is one thing; making them work in practice is the challenge. Guidelines for making them work include:

1. Establish mechanisms of effective communication among partners (this is a section of the module on participatory planning);
2. Establish a mechanism for conflict management;
3. Ensure involvement of all partners in decision making; and
4. Ensure credit sharing among all partners.

EXERCISE 6.6

Participants will review existing institutional arrangements for MPA planning and management and evaluate these as to their advantages and disadvantages.

MODULE 6	MARINE PROTECTED AREA PLANNING
THEME 3	Resource Assessments, Data Collection, and Mapping
OBJECTIVE	To emphasize the importance of resource information in the planning process.
SIGNIFICANCE	Successful MPA management is dependent to a large extent on the degree of coverage of important resources, which itself is determined by the resource information used in the planning and design of the site.
PRESENTATION	Lecture, Discussion, Group exercise
EQUIPMENT / MATERIALS	Overhead projector
EXERCISE	Group discussions
TIME	3 Hours

RESOURCE ASSESSMENTS, DATA COLLECTION, AND MAPPING

EXERCISE 6.7

Assume a hypothetical situation where there is a need to design a system of MPA's in an island archipelago, but where no information is available on the marine environment and its resources. How would you approach this?

The hypothetical situation as described above is probably non-existent, since most of the time there will be some idea of the areas that should be protected. However, the boundaries may need to be defined, and the kind of activities that can be permitted in all or parts of the area may need to be determined. In other words, the following main questions need to be answered:

1. What is the extent and distribution of the different ecosystems and habitats in the area?
2. What is the condition of these systems and habitats?
3. What are the most important functions of these systems and habitats?
4. How are they being used and by whom and when?

Even in well-studied areas, the available information and data is usually incomplete. There is a need to identify the gaps and determine which information is absolutely essential in order to design the MPA or system of MPAs. Most likely there will be a compromise between what ideally should be known and what time and resources permits. **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.**

The process of information gathering can be summarized as follows:

1. Determine the information needs;
2. Compile available information from published literature and unpublished reports;
3. Identify information gaps;
4. Determine the most suitable data collection methods;
5. Collect data; and
6. Analyze and map data.

The information needs will vary considerably between areas and are obviously dependent on the complexity of an area, the uses and threats, and how well the area has been studied. Three types of information can be identified: resource information (data on the occurrence, distribution and condition of biological resources), physical information (water quality, oceanographic data) and social and economic information (uses, threats, conflicts).

The resource information needs may include:

1. Occurrence and characteristics of coral reefs and coral communities (location, extent, number of hard coral species, percent live coral cover).
2. Occurrence and characteristics of seagrass beds (location, extent, number of species, percent cover).
3. Occurrence and characteristics of mangrove forests (location, extent, number of species, tree height and diameter).
4. Characteristics of reef fish populations (census of commercially important species, presence of indicator species, calculation of biomass).
5. Occurrence of endangered species (what species, location).
6. Occurrence of migratory species (what species, location, period).
7. Occurrence of habitats critical to the survival of species (breeding, feeding, nesting, roosting, nursery).
8. Occurrence of archaeological and historical resources (shipwrecks, artifacts, etc.).

When collecting field data, the use of a global positioning system (GPS) is highly recommended.

Physical information is usually not critical to the planning and design of MPAs, although it is often useful to have information on:

- a. Water quality (especially when water quality is suspected to be affected by sewage or industrial pollution); and
- b. Current regimes (may determine distribution of species, dispersal of larvae and recruitment of certain species).

Social and economic information needs may include:

- ◆ Fishing (methods, location, number of fishers, number of boats, species targeted).
- ◆ Recreation and tourism (type of activity, numbers, location).
- ◆ Traffic (ships' movements, both commercial and recreational).
- ◆ Waste disposal (solid and liquid, location, type).
- ◆ Sand mining (location, extent).
- ◆ Industrial activities (type, location).
- ◆ Traditional use rights (type, location).
- ◆ Identification of stakeholders.

The next step includes the mapping and analysis of the information. First of all, a good base map needs to be prepared. The use of GIS is highly recommended, but if this is not available, manual mapping techniques will also be quite acceptable. One map will be prepared for each parameter (e.g. a map for the distribution of coral reefs, a map for trap fishing, a map for dive sites, etc.). In GIS, each parameter will be one layer that can be superimposed on other layers.

The maps will show how the resources are distributed, how they are being used, and where endangered species and critical habitats are situated. The resource information maps will provide the basis for determining the size and boundaries of the MPA. The overlay mapping will show us where impacts or potential impacts on the resources occur and where conflicts between different user groups occur.

MODULE 6	MARINE PROTECTED AREA PLANNING
THEME 4	Developing Zoning Plans
OBJECTIVE	To introduce the concept of allocation of resource and resource use on a spatial basis.
SIGNIFICANCE	Successful MPA management often involves the allocation of resource use or activities to well-defined areas.
PRESENTATION	Lecture, Group exercise
EQUIPMENT / MATERIALS	Overhead projector, maps of an MPA
EXERCISE	Preparation of a zoning plan
TIME	4.5 Hours

DEVELOPING ZONING PLANS

The establishment of MPAs should not be a goal in itself. The ultimate goal is the management and wise use of marine and coastal resources. MPAs can serve as useful tools in the accomplishment of that goal, while trying to establish integrated coastal area management (ICAM) programmes. The development of ICAM programs is a slow process because there are so many conflicting interests in the coastal zone. Following this line of thought, the next best approach to ICAM is to try and establish MPAs as large as possible, and zone them to allow for a range of activities and uses.

Zoning in the context of protected areas can best be defined as ‘spatial or temporal allocation of specific uses and activities to well-defined areas within a protected area.’ Zoning can fulfill a number of different functions, including:

- ◆ Protect the ecosystem, of species, or of the habitat critical to the survival of species;
- ◆ Provide a buffer between managed and unmanaged areas;
- ◆ Manage resource uses;
- ◆ Reduce or eliminate conflict between resource users; and
- ◆ Reserve areas for specific purposes such as research and education.

The maps that have been produced as part of the resource assessment and data collection process are going to be the base of the zoning plan. Overlaying these maps in various combinations will show us where threats, impacts, and conflicts are occurring. In fact a zoning plan almost dictates itself, once the required information is there and the overlay mapping process is carried out.

There are no rules or restrictions as to the kinds and numbers of zones one may apply. Examples of zoning are available, of course, but MPA planners have complete freedom as to designing a zoning system that suits their area best. **However, stakeholder involvement and public consultation, with a view to consensus building, should take place from the very beginning of the planning process.**

EXERCISE 6.8

Participants will receive a series of resource maps and use maps for a proposed MPA, which they will use to develop a draft zoning plan. The draft zoning plan will be presented at a stakeholder meeting in a role playing exercise.

MODULE 6
THEME 5
OBJECTIVE
SIGNIFICANCE
PRESENTATION
EQUIPMENT / MATERIALS
EXERCISE
TIME

MARINE PROTECTED AREA PLANNING

Management Plans

To introduce the steps in management planning, using different management plans as case references.

Management planning is required to ensure successful MPA management.

Lecture, Discussion, Group exercise

Overhead projector, Copies of management plans

Group discussion

3 Hours

MANAGEMENT PLANS

Management includes a series of decisions, actions and activities that will result in achieving the objectives of the MPA. In order to manage effectively and efficiently, planning is required. What are the tasks that need to be carried out as part of the management process, what resources need to be allocated to carrying out these tasks, by whom will they be carried out, how and when? All of these questions will be addressed in the management plan.

Although the concept of management planning is widely accepted, there is a high incidence of management plans that bear little resemblance to what is actually happening in the area to which they refer. Kenchington and Ch'ng (1994) mention the following reasons for this:

1. MPA staff has not been involved in preparing the plan and therefore has no feeling of "ownership";
2. The users have had no input or opportunity to comment on the provisions of the plan;
3. The plan has no legal status and can therefore be over-ridden or ignored at a variety of decision-making levels in the organization;
4. The plan has been written to satisfy a legal requirement and not a management need; and
5. The plan has no built-in procedures for review and evaluation.

These factors must be taken into account at the outset of the management planning process to ensure that the plan becomes a useful document.

There is no single "ideal" model for a management plan. It is therefore best to analyze several existing management plans, to identify the elements of these plans that are applicable to a particular situation, and then develop a revised model. Kelleher and Kenchington (1991) provide a comprehensive model for a management plan that will be useful to most MPA planners and managers (see Appendix 6.13). The simpler model of Salm and Clark (1984) is attached as Appendix 6.14. Appendices 6.15-6.20 give examples of the analysis of several existing management plans, and Appendix 6.21 is the model that was developed on the basis of this analysis and the model by Kelleher and Kenchington (1991) for the marine parks in Kenya.

The legitimacy and authority for developing management plans will generally be based on legislation. The requirements of the planning process will therefore be determined by the

authorizing legislation. Kenchington (1990) distinguishes five phases in the planning process:

1. Initial or pre-management information gathering and preparation;
2. Public participation or consultation prior to the preparation of a plan;
3. Preparation of draft plan;
4. Public participation or consultation to review the draft plan; and
5. Plan finalization (this should include the approval and adoption of the plan by the authority as specified in the legislation).

EXERCISE 6.9

Participants will review several management plan models, and develop a model that is most applicable to a MPA with which they are familiar. They will identify the goals and objectives for management, the major management issues and actions to address these, and recommend procedures for review and evaluation.

A less well-known management planning process is the Limits of Acceptable Change (LAC) process, originally developed for North American terrestrial wilderness settings. The process has been modified somewhat to suit the context of MPAs (Stankey & McCool, 1996) Appendix 6.22), and has been applied for the first time to a marine park (Schultz *et al.*, 1999). The LAC process consists of 10 steps, which include determining the essential values or attributes of the area, the goals and objectives of the MPA, determining the “desired” conditions for the attributes, identify indicators for the desired conditions, determine standards against which change can be measured, develop a monitoring program to detect change, and determine management interventions if limits of acceptable change are exceeded. The key factor in the LAC planning process is the stakeholder involvement and consensus building about all steps, including the management interventions.

MODULE 6	MARINE PROTECTED AREA PLANNING
THEME 6	Operational Plans
OBJECTIVE	To reinforce the concept that management plans have to be translated into operational plans, which are then used for the day-to-day management of the MPA.
SIGNIFICANCE	The achievement of management objectives is dependent on the practical guides developed to implement management plans.
PRESENTATION	Lecture, Group discussion
EQUIPMENT / MATERIALS	Overhead projector
EXERCISE	N/A
TIME	1 Hour

OPERATIONAL PLANS

The purpose of operational plans is to provide practical guidance for the implementation of management plans. Operational plans may have the form of annual or biannual work plans. There is no prescribed format for operational plans, but they need to make clear to all MPA staff who is supposed to do what, where, when and with what resources or means. Since many operational tasks are routine, some MPAs have developed “Management Manuals”, which describe all tasks and functions in detail. Such manuals should include two sets of tables: one which lists all tasks with frequency and responsible staff persons, and another which is a calendar of daily, weekly, monthly, etc. tasks. Such manuals are particularly useful in MPAs where frequent staff changes take place. They can provide guidance to all staff.

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APPENDIX 6.1: Jakarta Mandate, Background

In December 1994, at its first meeting held at the Bahamas, the Conference of the Parties (COP) to the Convention requested its Subsidiary Body on Scientific Technical and Technological Advice (SBSTTA) to advise on scientific, technical and technological aspects of the conservation and sustainable use of marine and coastal biological diversity.

SBSTTA considered this item at its first meeting (SBSTTA-I), held in Paris in September 1995, and produced recommendations I/8 on scientific, technical and technological aspects of the conservation and sustainable use of marine and coastal biological diversity.

At its second meeting held in Jakarta in November 1995, COP adopted decision II'10 on the conservation and sustainable use of marine and coastal biological diversity, supporting selected recommendations among the ones produced by SBSTTA-I, and subject to additional conclusions by COP, which are reported in Annex I to decision IWO). At the same occasion, the Ministerial Statement on the implementation of the Convention on Biological Diversity referred to a new global consensus on the importance of marine and coastal biological diversity as the "Jakarta Mandate on Marine and Coastal Biological Diversity."

Furthermore, through decision II/10, the Conference of the Parties requested the Executive Secretary of the Convention to provide, in accordance with Annex II to the decision, SBSTTA with advice and options for recommendations to COP in further elaborating the recommendations of SBSTTA-1. This annex also referred to annual reports to SBSTTA to be produced by the Executive Secretary to the Convention, as part of further work of the Secretariat on marine and coastal biological diversity. The first report will include a three-year work plan.

In accordance with decision II/IO, the Executive Secretary established a Roster of Experts on Marine and Coastal Biological Diversity, on the basis of country input; and convened, drawing from the Roster, the First Meeting of the Group of Experts on Marine and Coastal Biological Diversity (Jakarta, March 1997).

The outcome of this meeting provided the basis for the elaboration by the Executive Secretary of a three-year programme of work on marine and coastal biological diversity. This programme of work was considered and amended by SBSTTA at its third meeting, held in Montreal in September 1997. The meeting produced a recommendation including consideration of a draft three-year work plan on marine and coastal biological diversity.

Based on the recommendations of SBSTTA, the Conference of the Parties adopted at its fourth meeting (Bratislava, May 1998) decision IV/S on the conservation and sustainable use

of marine and coastal biological diversity, including a multi-year programme of work arising from decision II/10. (The decision also contains two sections specifically addressing the issue of coral reefs and the special needs and considerations of Small Island Developing States in the implementation of the programme of work.)

APPENDIX 6.2: Jakarta Mandate, Thematic Issues

Within the Jakarta Mandate, five thematic issues have been identified:

- ◆ Integrated Marine and Coastal Area Management;
- ◆ Sustainable Use of Marine and Coastal Living Resources;
- ◆ Marine and Coastal Protected Areas;
- ◆ Mariculture; and
- ◆ Alien Species.

APPENDIX 6.3: Jakarta Mandate, Ministerial Statement

THE JAKARTA MINISTERIAL STATEMENT ON THE IMPLEMENTATION OF THE CONVENTION ON BIOLOGICAL DIVERSITY

WE, THE MINISTERS PARTICIPATING IN THE MINISTERIAL SEGMENT OF THE SECOND MEETING OF THE CONFERENCE OF THE PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY, HELD IN JAKARTA, INDONESIA, ON 14 AND 15 NOVEMBER 1995;

1. REALIZE that biological diversity that comprises variability of genes, species and ecosystems is the world's most valuable resource for the sustainability and welfare of all humankind;
2. NOTE that this second meeting of the Conference of the Parties coincides with the commemoration of the fiftieth anniversary of the Republic of Indonesia's independence and of the creation of the United Nations Organization, and RECOGNIZE that such a historic moment offers an unequalled opportunity to further strengthen multilateral cooperation for promoting the objectives of the Convention on Biological Diversity for the benefit of present and future generations,
3. REAFFIRM the Convention as the legal instrument to advance the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the use of genetic resources;
4. REGARD the Convention as a treaty with a global vision based on common concern and mutual assistance, recognition and articulation of national sovereignty over their own biological resources, particularly genetic resources, and recognition of national responsibility for conservation of biological diversity and for using biological resources sustainably and for creating conditions to facilitate access to genetic resources;
5. FURTHER RECOGNIZE that the Convention is based on mutual reliance and fair and equitable sharing of benefits for the prosperity of humankind;
6. REAFFIRM that, by becoming Parties to the Convention, our Governments have committed themselves to the Convention's objectives and its provisions;

7. REAFFIRM the Convention as a global partnership, based on mutual assistance and international cooperation to achieve the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, for the benefit of present and future generations;

8. REAFFIRM ALSO that the second meeting of the Conference of the Parties to the Convention on Biological Diversity provides the momentum for global agreement relating to the implementation of Article 19, paragraph 3, of the Convention on the consideration of the need for and modalities of a protocol on the safe transfer, handling and use of any living modified organism resulting from biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity;

9. RECOGNIZE the urgency of the task we face, and the individual and collective responsibilities of Parties to the Convention for the implementation of biological diversity conservation, sustainable use and sharing of benefits for the equitable welfare of all people;

10. AWARE of the need for more information and knowledge regarding biological diversity at all levels, and the need to implant the value of biological diversity in the minds and hearts of all people, STRESS the importance of promoting education on biological diversity at all levels of formal and non-formal education systems;

11. FURTHER REAFFIRM the importance of the clearing-house mechanism for technical and scientific cooperation in support of the implementation of the Convention at national level and emphasize the need for its accessibility to all countries;

12. ENCOURAGE the Convention, through its relevant organs, to strengthen relationships with other relevant conventions and processes, including the Commission on Sustainable Development and its Intergovernmental Panel on Forests;

13. WELCOME the establishment of a position within the Secretariat of the Convention on Biological Diversity on all issues pertaining to the implementation of Article 80) of the Convention related to indigenous and local communities;

14. REAFFIRM that there is a critical need for the Conference of the Parties to address the conservation and sustainable use of marine and coastal biological diversity, and urge Parties to initiate immediate action to implement the decisions adopted on this issue. In this context, WELCOME the commitment of the Government of the Republic of Indonesia to play a major role in facilitating such implementation at the global and regional level and the declaration by the Conference of the Parties of the new global consensus on the importance of marine and coastal biological diversity as the "Jakarta Mandate on Marine and Coastal Biological Diversity";

15. FURTHER ENCOURAGE the Conference of the Parties, through its relevant organs, to actively assist Parties to fulfill their obligations, especially through cooperation, collaboration and partnership;

16. URGE the international community to continue to take action and make every effort to assist developing countries to build their own institutional capacity, including human resource development, to conserve and use sustainable biological diversity including through in-situ and ex-situ conservation and to facilitate the transfer of technology in accordance with the provisions of the Convention;

17. URGE States involved in nuclear testing to take note of the views put forward by a significant number of Parties expressing their strong concern over the impacts of nuclear testing on biodiversity, in particular to the coastal and marine ecosystems.

APPENDIX 6.4: Jakarta Mandate, Multi-Year Programme of Work

Multi-Year Programme of Work on Marine and Coastal Biological Diversity

The fourth meeting of the Conference of the Parties to the Convention on biological Diversity (Bratislava, Slovakia, 4 - 15 May 1998) adopted decision IV/5 on conservation and sustainable use of marine and coastal biological diversity, including a programme of work.

The decision mainly consists of three parts, namely (i) programme of work arising from decision 11/10 - the Jakarta Mandate on Marine and Coastal Biological Diversity; (ii) issues related to coral reefs; and (iii) small island developing States (SIDS). A multi-year programme of work appears in the annex to the decision.

The programme of work aims to assist the implementation of the Jakarta Mandate at the national, regional and global level. It identifies key operational objectives and priority activities within the five key programme elements, namely: implementation of integrated marine and coastal area management, marine and coastal living resources, marine and coastal protected areas, mariculture and alien species and genotypes. It also provides a general element to encompass the coordination role of the Secretariat, the collaborative linkages required and the effective use of experts.

The ecosystem approach, precautionary principle, the importance of science, making full use of the roster of experts, the involvement of local and indigenous communities and three levels of programme implementation (national, regional and global) were identified by the Parties as the six basic principles for the implementation of the programme of work.

The primary basis for this programme of work is action at national and local levels. The Parties should, in accordance with Article 6 of the Convention, develop national strategies, plans and programmes in order to promote the conservation and sustainable use of marine and coastal biological diversity.

At the regional level, organizations, arrangements and bodies should be invited to coordinate activities relevant to the programme of work.

At the global level, the United Nations Environment Programme (UNEP) (including the Global International Water Assessment), the Food and Agriculture Organization of the United Nations (FAO), the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization IOC/UNESCO), the International Maritime Organization (IMO), the United Nations and other relevant bodies should be

encouraged to implement the programme of work. These organizations should be invited to inform the CBD on their efforts to implement the Convention.

The programme of work is the programme of work of the Parties and of the Secretariat. The main function of the Secretariat is to promote the implementation of specific activities and to perform an overall coordination role.

Activities associated with the programme of work should be cost-effective and efficient. Duplication of efforts will be avoided, and harmonization of respective programmes of work will be pursued through strong coordination between the Convention and other relevant bodies, with a particular view to the list of partner organizations mentioned in decision 11/10, paragraph 13, and the Convention on Wetlands of International Importance, especially as Waterfowl Habitat.

The detailed programme of work is contained in decision IV/5.

Secretariat of the
Convention on Biological Diversity

World Trade Centre,
393 St Jacques Street, Office 300,
Montreal, Quebec, Canada R2Y 1N9

APPENDIX 6.5: Jakarta Mandate, Decision II/10

Decision 11/10: CONSERVATION AND SUSTAINABLE USE OF MARINE AND COASTAL BIOLOGICAL DIVERSITY

The Conference of the Parties,

Recalling that the Conference of the Parties decided to address, at its second meeting, advice from the Subsidiary Body on Scientific, Technical and Technological Advice on the scientific, technical and technological aspects of -the conservation and sustainable use of marine and coastal biological diversity,

Being deeply concerned at the serious threats to marine and coastal biological diversity caused by factors including physical alteration, destruction and degradation of habitats, pollution, invasion of alien species, and over-exploitation of living marine and coastal resources,

1. *Takes note* of recommendation 1/8 on scientific, technical and technological aspects of the conservation and sustainable use of marine and coastal biological diversity, adopted by the first meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, held in Paris at the headquarters of the United Nations Educational, Scientific and Cultural Organization, from 4 to 8 September 1995, and;

(a) *Affirms* that it represents a solid basis for future elaboration of the issues presented;

(b) *Supports* the recommendations in paragraphs 10- 19 of recommendation 1/8, subject to Annex I of the present decision and its further elaboration by the Subsidiary Body on Scientific, Technical and Technological Advice and the Conference of the Parties;

(c) *Reaffirms* the importance of future work by the Subsidiary Body on Scientific, Technical and Technological Advice to provide a balanced perspective on the remaining issues presented by the recommendations in 1/8 and Annex I of the present decision relevant to the conservation and sustainable use of marine and coastal biodiversity;

2. *Encourages the use of* integrated marine and coastal area management as the most suitable framework for addressing human impacts on marine and coastal biological diversity and for promoting conservation and sustainable use of this biodiversity;

3. *Encourages* Parties to establish and/or strengthen, where appropriate, institutional, administrative, and legislative arrangements for the development of integrated management

of marine and coastal ecosystems, plans and strategies for marine and coastal areas, and their integration within national development plans;

4. *Takes note* of the recently finalized Food and Agriculture Organization of the United Nations Code of Conduct for Responsible Fisheries, the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and the Washington Declaration *and Global Programme of Action for the Protection of the Marine Environment from Land-based Activities*, and supports their implementation, including that by Parties, in ways that are consistent with, and conform to, the objectives of the Convention on Biological Diversity;

5. *Welcomes the* International Coral Reef Initiative as a means to address threats to coral reefs and *related ecosystems* and encourages participation in International Coral Reef Initiative activities to implement its Framework for Action;

6. *Reaffirms* that under Article 25 the Subsidiary Body on Scientific, Technical and Technological Advice is the only scientific, technical and technological authority under the Convention to provide advice to the Conference of the Parties;

7. *Instructs* the Executive Secretary to provide, in accordance with Annex H, the Subsidiary Body on Scientific, Technical and Technological Advice with scientific, technical, and technological advice and options for recommendations to the Conference of the Parties in further elaborating the recommendations contained in recommendation 1/8, with the exception of paragraphs 3 and 4;

8. *Offers* the Executive Secretary the following guidance for conducting the work described in paragraph 6:

(a) Solicit input from all Parties and, as appropriate, from other countries and relevant bodies;

(b) Establish, on the basis of country input, a roster of experts with specialization appropriate to the work described in paragraph 6;

(c) The roster will draw upon expertise from scientific, technical, technological, social, management, economic, policy, legal, and indigenous and traditional knowledge;

(d) Convene, as appropriate, meetings of experts, drawn from the roster to support the Secretariat in advancing the work described in paragraph 6. Each meeting shall be for a duration of no longer than five days, and shall be comprised of no more than 15 experts with

due regard to geographical representation and to the special conditions of least-developed countries and small island developing States;

9. *Welcomes* the offer from Indonesia to be host country for the first such meeting of Experts on Marine and Coastal Biological Diversity;

10. *Decides* to forward this decision and its annexes to the next session of the Commission on Sustainable Development for its information when considering its review of Agenda 21, chapter 17, on oceans;

11. *Decides* to forward this decision and annexes to the Global Environment Facility, other funding agencies and other relevant international bodies, to be taken into account in considering activities related to the conservation and sustainable use of marine and coastal biological diversity;

12. *Requests* the Executive Secretary, in consultation with the United Nations Office for Ocean Affairs and the Law of the Sea, to undertake a study of the relationship between the Convention on Biological Diversity and the United Nations Convention on the Law of the Sea with regard to the conservation and sustainable use of genetic resources on the deep seabed, with a view to enabling the Subsidiary Body on Scientific, Technical and Technological Advice to address at future meetings, as appropriate, the scientific, technical, and technological issues relating to bio-prospecting of genetic resources on the deep seabed;

13. *Invites* international and regional bodies responsible for legal instruments, agreements and programmes which address activities relevant to the conservation and sustainable use of marine and coastal biodiversity, including the United Nations General Assembly, the Food and Agriculture Organization of the United Nations, the United Nations Environment Programme, the International Maritime Organization, the United Nations Office for Ocean Affairs and the Law of the Sea, the United Nations Educational, Scientific and Cultural Organization including its Intergovernmental Oceanographic Commission, the World Conservation Union (IUCN), the Commission on Sustainable Development, the International Coral Reef Initiative, regional fisheries bodies, migratory species agreements, secretariats of regional agreements for the conservation of the marine environment and other relevant international and regional organizations and institutions, to review their programmes with a view to improving existing measures and developing new actions which promote conservation and sustainable use of marine biological diversity, taking into account the recommendations for action by the Parties to the Convention on Biological Diversity adopted by the Conference of the Parties at its second meeting, and provide information on their actions on a regular basis to the Conference of the Parties and, in a first instance, as soon as possible through the Executive Secretary. Furthermore, these various institutions are invited to cooperate with the Conference of the Parties through the Subsidiary Body on Scientific,

Technical and Technological Advice in planning and implementation of programmes affecting marine and coastal biological diversity, so as to reduce any unnecessary duplication or gaps in coverage;

14. *Decides* to request the Subsidiary Body on Scientific, Technical and Technological Advice to carry out a summary review at its next meeting of the first report from the Executive Secretary and to submit in its report to the Conference of the Parties its recommendation on the work of the Executive Secretary.

APPENDIX 6.6: SPAW Protocol of the Cartagena Convention

Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region

Adopted at Kingston on 18 January 1990

The Final Act of the Conference of Plenipotentiaries Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region

The Contracting Parties to this Protocol,

Being Parties to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, done at Cartagena de Indias on 24 March 1983,

Taking into account Article 10 of the Convention which requires the establishment of specially protected areas,

Having regard to the special hydrographic, biotic and ecological characteristics of the Wider Caribbean Region,

Conscious of the grave threat posed by ill-conceived development options to the integrity of the marine and coastal environment of the Wider Caribbean Region,

Recognizing that protection and maintenance of the environment of the Wider Caribbean Region are essential to sustainable development within the region,

Conscious of the overwhelming ecological, economic, aesthetic, scientific, cultural, nutritional and recreational value of rare or fragile ecosystems and native flora and fauna to the Wider Caribbean Region,

Recognizing that the Wider Caribbean Region constitutes an interconnected group of ecosystems in which an environmental threat in one part represents a potential threat in other parts,

Stressing the importance of establishing regional co-operation to protect and, as appropriate, to restore and improve the state of ecosystems, as well as threatened and endangered species and their habitats in the Wider Caribbean Region by, among other means, the establishment of protected areas in the marine areas and their associated ecosystems,

Recognizing that the establishment and management of such protected areas, and the protection of threatened and endangered species will enhance the cultural heritage and values of the countries and territories in the Wider Caribbean Region and bring increased economic and ecological benefits to them,

Have agreed as follows:

Article 1 DEFINITIONS

For the purposes of this Protocol:

- a. "Convention" means the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena, March 1983);
- b. "Action Plan" means the Action Plan for the Caribbean Environment Programme (Montego Bay, April 1981);
- c. "Wider Caribbean Region" has the meaning given to the term "the Convention area" in Article 2(1) of the Convention, and in addition, includes for the purposes of this Protocol:
 - i. waters on the landward side of the baseline from which the breadth of the territorial sea is measured and extending, in the case of water courses, up to the fresh water limit; and
 - ii. such related terrestrial areas (including watersheds) as may be designated by the Party having sovereignty and jurisdiction over such Areas;
- d. "Organization" means the body referred to in Article 2(2) of the Convention;
- e. "Protected area" means the areas accorded protection pursuant to article 4 of this Protocol;
- f. "Endangered species" are species or sub-species of fauna and flora, or their populations, that are in danger of extinction throughout all or part of their range and whose survival is unlikely if the factors jeopardizing them continue to co-operate;
- g. "Threatened species" are species or sub-species of fauna and flora , or their populations:
 - i. that are likely to become endangered within the foreseeable future throughout all or part of their range if the factors causing numerical decline or habitat degradation continue to operate; or
 - ii. that are rare because they are usually localized within restricted geographical areas or habitats or are thinly scattered over a more extensive range and which are potentially or actually subject to decline and possible endangerment or extinction.
- h. "Protected species" are species or sub-species of fauna and flora, or their populations, accorded protection pursuant to Article 10 of this Protocol;
- i. "Endemic species" are species or sub-species of fauna and flora, or their populations, whose distribution is restricted to a limited geographical area;
- j. "Annex I" means the annex to the Protocol containing the agreed list of species of marine and coastal flora that fall within the categories defined in Article 1 and that require the protection measures indicated in Article 11(1)(A). The annex may include terrestrial species as provided for in Article 1(c)(ii);
- k. "Annex II" means the annex to the Protocol containing the agreed list of species of marine and coastal fauna that fall within the category defined in Article 1 and that

- require the protection measures indicated in Article 11(1)(b). The annex may include terrestrial species as provided for in Article 1(c)(ii); and
1. "Annex III" means the annex to the Protocol containing the agreed list of species of marine and coastal flora and fauna that may be utilized on a rational and sustainable basis and that require the protection measures indicated in Article 11(1)(c). The Annex may include terrestrial species as provided for in Article 1(c)(ii).

Article 2 GENERAL PROVISIONS

1. This Protocol shall apply to the Wider Caribbean Region as defined in Article 1(c).
2. The provisions of the Convention relating to its Protocols shall apply to this Protocol, including in particular, paragraphs 2 and 3 of Article 3 of the Convention.
3. The present Protocol shall not apply to warships or other ships owned or operated by a State while engaged in government non-commercial service. Nevertheless, each Party shall ensure through the adoption of appropriate measures that do not hinder the operation or operational capacities of vessels they own or operate, that they adhere to the terms of the present Protocol in so far as is reasonable and feasible.

Article 3 GENERAL OBLIGATIONS

1. Each Party to this Protocol shall, in accordance with its laws and regulations and the terms of the Protocol, take the necessary measures to protect, preserve and manage in a sustainable way, within areas of the Wider Caribbean Region in which it exercises sovereignty, or sovereign rights or jurisdiction:
 - a. areas that require protection to safeguard their special value; and
 - b. threatened or endangered species of flora and fauna.
2. Each Party shall regulate and, where necessary, prohibit activities having adverse effects on these areas and species. Each Party shall endeavour to co-operate in the enforcement of these measures, without prejudice to the sovereignty, or sovereign rights or jurisdiction of other Parties. Any measures taken by such Party to enforce or to attempt to enforce the measures agreed pursuant to this Protocol shall be limited to those within the competence of such Party and shall be in accordance with international law.
3. Each Party, to the extent possible, consistent with each Party's legal system, shall manage species of fauna and flora with the objective of preventing species from becoming endangered or threatened.

Article 4 ESTABLISHMENT OF PROTECTED AREAS

1. Each Party shall, when necessary, establish protected areas in areas over which it exercises sovereignty, or sovereign rights or jurisdiction, with a view to sustaining the natural resources of the Wider Caribbean Region, and encouraging ecologically sound and appropriate use, understanding and enjoyment of these areas, in accordance with the objectives and characteristics of each of them.
2. Such areas shall be established in order to conserve, maintain and restore, in particular:
 - a Representative types of coastal and marine ecosystems of adequate size to ensure their long-term viability and to maintain biological and genetic diversity;
 - b Habitats and their associated ecosystems critical to the survival and recovery of endangered, threatened or endemic species of flora or fauna;
 - c The productivity of ecosystems and natural resources that provide economic or social benefits and upon which the welfare of local inhabitants is dependent: and
 - d Areas of special biological, ecological, educational, scientific, historic, cultural, recreational, archaeological, aesthetic, or economic value, including in particular, areas whose ecological and biological processes are essential to the functioning of the Wider Caribbean ecosystems.

Article 5 PROTECTION MEASURES

1. Each Party taking into account the characteristics of each protected area over which it exercises sovereignty, or sovereign rights or jurisdiction, shall, in conformity with its national laws and regulations and with international law, progressively take such measures as are necessary and practicable to achieve the objectives for which the protected area was established.
2. Such measures should include, as appropriate:
 - a the regulation or prohibition of the dumping or discharge of wastes and other substances that may endanger protected areas;
 - b the regulation or prohibition of coastal disposal or discharges causing pollution, emanating from coastal establishments and developments, outfall structures or any other sources within their territories;
 - c the regulation of the passage of ships, of any stopping or anchoring, and of other ship activities, that would have significant adverse environmental effects on the protected area, without prejudice to the rights of innocent passage, transit passage, archipelagic sea lanes passage and freedom of navigation, in accordance with international law;

- d the regulation or prohibition of fishing, hunting, taking or harvesting of endangered or threatened species of fauna and flora and their parts or products;
- e the prohibition of activities that result in the destruction of endangered or threatened species of fauna or flora and their parts and products, and the regulation of any other activity likely to harm or disturb such species, their habitats or associated ecosystems;
- f the regulation or prohibition of the introduction of non- indigenous species;
- g the regulation or prohibition of any activity involving the exploration or exploitation of the sea-bed or its subsoil or a modification of the sea-bed profile:
- h the regulation or prohibition of any activity involving modification of the profile of the soil that could affect watersheds, denudation and other forms of degradation of watersheds, or the exploration or exploitation of the subsoil of the land part of a marine protected area:
- i the regulation of any archaeological activity and of the removal or damage of any object which may be considered as an archaeological object:
- j the regulation or prohibition of trade in, and import and export of threatened or endangered species of fauna or their parts, products, or eggs, and of threatened or endangered species of flora or their parts or products, and archaeological objects that originate in protected areas;
- k the regulation or prohibition of industrial activities and of other activities which are not compatible with the uses that have been envisaged for the area by national measures and/or environmental impact assessments pursuant to Article I-J:
- l the regulation of tourist and recreational activities that might endanger the ecosystems of protected areas or the survival of threatened or endangered species of flora and fauna: and
- m any other measure aimed at conserving, protecting or restoring natural processes, ecosystems or populations for which the protected areas were established.

Article 6 PLANNING AND MANAGEMENT REGIME FOR PROTECTED AREAS

1. In order to maximize the benefits from protected areas and to ensure the effective implementation of the measures set out in Article 5, each Party shall adopt and implement planning, management and enforcement measures for protected areas over which it exercises sovereignty, or sovereign rights or jurisdiction. In this regard, each Party shall take into account the guidelines and criteria formulated by the Scientific

- and Technical Advisory Committee as provided for in Article 21 and which have been adopted by meetings of the Parties.
2. Such measures should include:
 - a. the formulation and adoption of appropriate management guidelines for protected areas;
 - b. the development and adoption of a management plan that specifies the legal and institutional framework and the management and protection measures applicable to an area or areas;
 - c. the conduct of scientific research on, and monitoring of, user impacts, ecological processes, habitats, species and populations; and the undertaking of activities aimed at improved management;
 - d. the development of public awareness and education programmes for users, decision-makers and the public to enhance their appreciation and understanding of protected areas and the objectives for which they were established;
 - e. the active involvement of local communities, as appropriate, in the planning and management of protected areas, including assistance to, and training of local inhabitants who may be affected by the establishment of protected areas;
 - f. the adoption of mechanisms for financing the development and effective management of protected areas and facilitating programmes of mutual assistance;
 - g. contingency plans for responding to incidents that could cause or threaten to cause damage to protected areas including their resources;
 - h. procedures to permit, regulate or otherwise authorize activities compatible with the objectives for which the protected areas were established: and
 - i. the development of qualified managers, and technical personnel, as well as appropriate infrastructure.

Article 7 CO-OPERATION PROGRAMME FOR, AND LISTING OF, PROTECTED AREAS

1. The Parties shall establish co-operation programmes within the framework of the Convention and the Action Plan and in accordance with their sovereignty, or sovereign rights or jurisdiction to further the objectives of the Protocol.
2. A co-operation programme will be established to support the listing of protected areas. It will assist with the selection, establishment, planning, management and conservation of protected areas, and shall create a network of protected areas. To this end, the Parties shall establish a list of protected areas. The Parties shall:
 - a. recognize the particular importance of listed areas to the Wider Caribbean Region:

-
- b. accord priority to listed areas for scientific and technical research pursuant to Article 17:
 - c. accord priority to listed areas for mutual assistance pursuant to Article 18: and
 - d. not authorize or undertake activities that would undermine the purposes for which a listed area was created.
 3. The procedures for the establishment of the list of protected areas are as follows:
 - a. The Party that exercises sovereignty, or sovereign rights or jurisdiction over a protected area shall nominate it to be included in the list of protected areas. Such nominations will be made in accordance with the guideline and criteria concerning the identification, selection, establishment, management, protection and any other matter adopted by the Parties pursuant to Article 21. Each Party nomination shall provide the Scientific and Technical Advisory Committee through the Organization with the necessary supporting documentation, including in particular, the information noted in Article 19(2): and
 - b. After the Scientific and Technical Advisory Committee evaluates the nomination and supporting documentation, it will advise the Organization as to whether the nomination fulfills the common guidelines and criteria established pursuant to Article 21. If these guidelines and criteria have been met, the Organization will advise the Meeting of Contracting Parties who will include the nomination in the List of Protected Areas.

Article 8 ESTABLISHMENT OF BUFFER ZONES

Each Party to this Protocol may, as necessary, strengthen the protection of a protected area by establishing, within areas in which it exercises sovereignty, or sovereign rights or jurisdiction, one or more buffer zones in which activities are less restricted than in the protected area while remaining compatible with achieving the purposes of the protected area.

Article 9 PROTECTED AREAS AND BUFFER ZONES CONTIGUOUS TO INTERNATIONAL BOUNDARIES

1. If a Party intends to establish a protected area or a buffer zone contiguous to the frontier or to the limits of the zone of national jurisdiction of another Party, the two Parties shall consult each other with a view to reaching agreement on the measures to be taken and shall, inter alia, examine the possibility of the establishment by the other Party of a corresponding contiguous protected area or buffer zone or the adoption by

- it of any other appropriate measures including co-operative management programmes.
2. If a Party intends to establish a protected area or a buffer zone contiguous to the frontier or to the limits of the zone of national jurisdiction of a State that is not a Party to this Protocol, the Party shall endeavour to work together with the competent authorities of that State with a view to holding the consultations referred to in paragraph 1.
 3. Whenever it becomes known to a Party that a non-Party intends to establish a protected area or a buffer zone contiguous to the frontier or to the limits of the zone of national jurisdiction of a Party to this Protocol the latter shall endeavour to work together with that State with a view to holding the consultations referred to in paragraph 1.
 4. If contiguous protected areas and/or buffer zones are established by one Party and by a State that is not a Party to this Protocol, the former should attempt, where possible, to achieve conformity with the provisions of the Convention and its Protocols.

Article 10 NATIONAL MEASURES FOR THE PROTECTION OF WILD FLORA AND FAUNA

1. Each Party shall identify endangered or threatened species of flora and fauna within areas over which it exercises sovereignty, or sovereign rights or jurisdiction, and accord protected status to such species. Each Party shall regulate and prohibit according to its laws and regulations, where appropriate, activities having adverse effects on such species or their habitats and ecosystems, and carry out species recovery, management, planning and other measures to effect the survival of such species. Each Party, in keeping with its legal system, shall also take appropriate actions to prevent species from becoming endangered or threatened.
2. With respect to protected species of flora and their parts and products, each Party, in conformity with its laws and regulations, shall regulate, and where appropriate, prohibit all forms of destruction and disturbance, including the picking, collecting, cutting, uprooting or possession of, or commercial trade in, such species.
3. With respect to protected species of fauna, each Party, in conformity with its laws and regulations, shall regulate, and where appropriate, prohibit:
 - a. the taking, possession or killing (including, to the extent possible, the incidental taking, possession or killing or commercial trade in such species or their parts or products; and
 - b. to the extent possible, the disturbance of wild fauna, particularly during the period of breeding, incubation, estivation or migration, as well as other periods of biological stress.

4. Each Party shall formulate and adopt policies and plans for the management of captive breeding of protected fauna and propagation of protected flora.
5. The Parties shall, in addition to the measures specified in paragraph co-ordinate their efforts, through bilateral or multilateral actions, including if necessary, any treaties for the protection and recovery of migratory species whose range extends into areas under their sovereignty, or sovereign rights or jurisdiction.
6. The Parties shall endeavour to consult with range States that are not Parties to this Protocol, with a view to co-ordinating their efforts to manage and Protect endangered or threatened migratory species.
7. The Parties shall make provisions, where possible, for the repatriation of protected species exported illegally. Efforts should be made by Parties to reintroduce such species to the wild, or if unsuccessful, make provision for their use in scientific studies or for public education purposes.
8. The measures which Parties take under this Article are subject to their obligations under Article 11 and shall in no way derogate from such obligations.

Article 11 CO-OPERATIVE MEASURES FOR THE PROTECTION OF WILD
FLORA AND FAUNA

1. The Parties shall adopt co-operative measures to ensure the protection and recovery of endangered and threatened species of flora and fauna listed in Annexes I, II and III of the present Protocol.
 - a. The Parties shall adopt all appropriate measures to ensure the protection and recovery of species of flora listed in Annex I. For this purpose, each Party shall prohibit all forms of destruction or disturbance, including the picking, collecting, cutting, uprooting or possession of, or commercial trade in such species, their seeds, parts or products. They shall regulate activities, to the extent possible, that could have harmful effects on the habitats of the species.
 - b. Each Party shall ensure total protection and recovery to the species of fauna listed in Annex II by prohibiting:
 - i. the taking, possession or killing (including, to the extent possible, the incidental taking, possession or killing) or commercial trade in such species, their eggs, parts or products;
 - ii. to the extent possible, the disturbance of such species, particularly during periods of breeding, incubation or migration, as well as other periods of biological stress.
 - c. Each Party shall adopt appropriate measures to ensure the protection and recovery of the species of flora and fauna listed in Annex III and may regulate the use of such species in order to ensure and maintain their populations at the highest possible levels. With regard to the species listed in Annex III, each

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- Party shall, in co-operation with other Parties, formulate, adopt and implement plans for the management and use of such species, including:
- i. for species of fauna:
 - a. the prohibition of all non-selective means of capture, killing, hunting and fishing and of all actions likely to cause local disappearance of a species or serious disturbance of its tranquility;
 - b. the institution of closed hunting and fishing seasons and of other measures for maintaining their population;
 - c. the regulation of the taking, possession, transport or sale of living or dead species, their eggs, parts or products;
 - ii. For species of flora, including their parts or products, the regulation of their collection, harvest and commercial trade.
2. Each Party may adopt exemptions to the prohibitions prescribed for the protection and recovery of the species listed in Annexes I and II for scientific or management purposes necessary to ensure the survival of the species or to prevent significant damage to forests or crops. Such exemptions shall not jeopardize the species and shall be reported to the Organization in order for the Scientific and Technical Advisory Committee to assess the pertinence of the exemptions granted.
 3. The Parties also shall:
 - a. accord priority to species contained in the annexes for scientific and technical research pursuant to Article 17;
 - b. accord priority to species contained in the annexes for mutual assistance pursuant to Article 18.
 4. The procedures to amend the annexes shall be as follows:
 - a. any Party may nominate an endangered or threatened species of flora or fauna for inclusion in or deletion from these annexes, and shall submit to the Scientific and Technical Advisory Committee, through the Organization, supporting documentation, including, in particular, the information noted in Article 19. Such nomination will be made in accordance with the guidelines and criteria adopted by the Parties pursuant to Article 21;
 - b. the Scientific and Technical Advisory Committee shall review and evaluate the nominations and supporting documentation and shall report its views to the meetings of Parties held pursuant to Article 23;
 - c. the Parties shall review the nominations, supporting documentation and the reports of the Scientific and Technical Advisory Committee. A species shall be listed in the annexes by consensus, if possible, and if not, by a three-quarters majority vote of the Parties present and voting, taking fully into account the advice of the Scientific and Technical Advisory Committee that the nomination and supporting documentation meet the common guidelines and criteria established pursuant to Article 21;
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- d. a Party may, in the exercise of its sovereignty or sovereign rights, enter a reservation to the listing of a particular species in an annex by notifying the Depositary in writing within 90 days of the vote of the Parties. The Depositary shall, without delay, notify all Parties of reservations received pursuant to this paragraph;
 - e. a listing in the corresponding annex shall become effective 90 days after the vote for all Parties, except those which made a reservation in accordance with paragraph (d) of this Article; and
 - f. a Party may at any time substitute an acceptance for a previous reservation to a listing by notifying the Depositary, in writing. The acceptance shall thereupon enter into force for that Party.
5. The Parties shall establish co-operation programmes within the framework of the Convention and the Action Plan to assist with the management and conservation of protected species, and shall develop and implement regional recovery programmes for protected species in the Wider Caribbean Region, taking fully into account other existing regional conservation measures relevant to the management of those species. The Organization shall assist in the establishment and implementation of these regional recovery programmes.

Article 12 INTRODUCTION OF NON-INDIGENOUS OR GENETICALLY ALTERED SPECIES

Each Party shall take all appropriate measures to regulate or prohibit intentional or accidental introduction of non-indigenous or genetically altered species to the wild that may cause harmful impacts to the natural flora, fauna or other features of the Wider Caribbean Region.

Article 13 ENVIRONMENTAL IMPACT ASSESSMENT

1. In the planning process leading to decisions about industrial and other projects and activities that would have a negative environmental impact and significantly affect areas or species that have been afforded special protection under this Protocol, each Party shall evaluate and take into consideration the possible direct and indirect impacts, including cumulative impacts, of the projects and activities being contemplated.
2. The Organization and the Scientific and Technical Advisory Committee shall, to the extent possible, provide guidance and assistance, upon request, to the Party making these assessments.

Article 14 EXEMPTIONS FOR TRADITIONAL ACTIVITIES

1. Each Party shall, in formulating management and protective measures, take into account and provide exemptions, as necessary, to meet traditional subsistence and cultural needs of its local population. To the fullest extent possible, no exemption which is allowed for this reason shall:
 - a. endanger the maintenance or areas protected under the terms of this Protocol, including the ecological processes contributing to the maintenance of those protected areas; or
 - b. cause either the extinction of, or a substantial risk to, or substantial reduction in the number of, individuals making up the populations of species of fauna and flora within the protected areas, or any ecologically inter-connected species or population, particularly migratory species and threatened, endangered or endemic species.
2. Parties which allow exemptions with regard to protective measures shall inform the Organization accordingly.

Article 15 CHANGES IN THE STATUS OF PROTECTED AREAS OR PROTECTED SPECIES

1. Changes in the delimitation or legal status of an area, or part thereof, or of a protected species, may only take place for significant reasons, bearing in mind the need to safeguard the environment and in accordance with the provisions of this Protocol and after notification to the Organization.
2. The status of areas and species should be periodically reviewed and evaluated by the Scientific and Technical Advisory Committee on the basis of information provided by Parties through the Organization. Areas and species may be removed from the area listing or Protocol annexes by the same procedure by which they were incorporated.

Article 16 PUBLICITY, INFORMATION, PUBLIC AWARENESS AND EDUCATION

1. Each Party shall give appropriate publicity to the establishment of protected areas, in particular to their boundaries, buffer zones, and applicable regulations, and to the designation of protected species, in particular to their critical habitats and applicable regulations.
2. In order to raise public awareness, each Party shall endeavour to inform the public as widely as possible, of the significance and value of the protected areas and species and of the scientific knowledge and other benefits which may be gained from them or

any changes therein. Such information should have an appropriate place in education programmes concerning the environment and history. Each Party should also endeavour to promote the participation of its public and its conservation organizations in measures that are necessary for the protection of the areas and species concerned.

Article 17 SCIENTIFIC, TECHNICAL AND MANAGEMENT RESEARCH

1. Each Party shall encourage and develop scientific, technical and management-oriented research on protected areas, including, in particular, their ecological processes and archaeological, historical and cultural heritage, as well as on threatened or endangered species of fauna and flora and their habitats.
2. Each Party may consult with other Parties and with relevant regional and international organizations with a view to identifying, planning and undertaking scientific and technical research and monitoring programmes necessary to characterize and monitor protected areas and species and to assess the effectiveness of measures taken to implement management and recovery plans.
3. The Parties shall exchange, directly or through the Organization, scientific and technical information concerning current and planned research and monitoring programmes and the results thereof. They shall, to the fullest extent possible, coordinate their research and monitoring programmes, and endeavour to standardize procedures for collecting, reporting, archiving and analyzing relevant scientific and technical information.
4. The Parties shall, pursuant to the provisions of paragraph 1 above, compile comprehensive inventories of:
 - a. areas over which they exercise sovereignty, or sovereign rights or jurisdiction that contain rare or fragile ecosystems; that are reservoirs of biological or genetic diversity; that are of ecological value in maintaining economically important resources; that are important for threatened, endangered or migratory species; that are of value for aesthetic, recreational, tourist or archaeological reasons; and
 - b. species of fauna or flora that may qualify for listing as threatened or endangered according to the criteria established under this Protocol.

Article 18 MUTUAL ASSISTANCE

1. The Parties shall co-operate, directly or with the assistance of the Organization or other relevant international organizations, in formulating, drafting, financing and implementing programmes of assistance to those Parties that express a need for it in the selection, establishment and management of protected areas and species.

2. These programmes should include public environmental education, the training of scientific, technical and management personnel, scientific research, and the acquisition, utilization, design and development of appropriate equipment on advantageous terms to be agreed among the Parties concerned.

Article 19 NOTIFICATIONS AND REPORTS TO THE ORGANIZATION

1. Each Party shall report periodically to the Organization on:
 - a. the status of existing and newly established protected areas, buffer zones and protected species in areas over which they exercise sovereignty or sovereign rights or jurisdiction; and
 - b. any changes in the delimitation or legal status of protected areas, buffer zones and protected species in areas over which they exercise sovereignty, or sovereign rights or jurisdiction.
2. The reports relevant to the protected areas and buffer zones should include information on:
 - a. name of the areas of zone;
 - b. biography of the area or zone (boundaries, physical features, climate, flora and fauna);
 - c. legal status with reference to relevant national legislation or regulation;
 - d. date and history of establishment;
 - e. protected areas management plans;
 - f. relevance to cultural heritage;
 - g. facilities for research and visitors; and
 - h. threats to the area or zone, especially threats which originate outside the jurisdiction of the Party.
3. The reports relevant to the protected species should include, to the extent possible, information on:
 - a. scientific and common names of the species;
 - b. estimated populations of species and their geographic ranges;
 - c. status of legal protection, with reference to relevant national legislation or regulation;
 - d. ecological interactions with other species and specific habitat requirements;
 - e. management and recovery plans for endangered and threatened species;
 - f. research programmes and available scientific and technical publications relevant to the species; and
 - g. threats to the protected species, their habitats and their associated ecosystems, especially threats which originate outside the jurisdiction of the Party.
4. The reports provided to the Organization by the Parties will be used for the purposes outlined in Articles 20 and 22.

Article 20 SCIENTIFIC AND TECHNICAL ADVISORY COMMITTEE

1. A Scientific and Technical Advisory Committee is hereby established.
2. Each Party shall appoint a scientific expert appropriately qualified in the field covered by the Protocol as its representative on the Committee, who may be accompanied by other experts and advisors appointed by that Party. The Committee may also seek information from scientifically and technically qualified experts and organizations.
3. The Committee shall be responsible for providing advice to the Parties through the Organization on the following scientific and technical matters relating to the Protocol:
 - a. the listing of protected areas in the manner provided for in Article 7;
 - b. the listing of protected species in the manner provided for in Article 11;
 - c. reports on the management and protection of protected areas and species and their habitats;
 - d. proposals for technical assistance for training, research, education and management (including species recovery plans);
 - e. environmental impact assessment pursuant to Article 13;
 - f. the formulation of common guidelines and criteria pursuant to Article 21; and
 - g. any other matters relating to the implementation of the Protocol, including those matters referred to it by the meetings of the Parties.
4. The Committee shall adopt its own Rules of Procedures.

Article 21 ESTABLISHMENT OF COMMON GUIDELINES AND CRITERIA

1. The Parties shall at their first meeting, or as soon as possible thereafter, evaluate and adopt common guidelines and criteria formulated by the Scientific and Technical Advisory Committee dealing in particular with:
 - a. the identification and selection of protected areas and protected species;
 - b. the establishment of protected areas;
 - c. the management of protected areas and protected species including migratory species; and
 - d. the provision of information on protected areas and protected species, including migratory species.
2. In implementing this Protocol, the Parties shall take into account these common guidelines and criteria, without prejudicing the right of a Party to adopt more stringent guidelines and criteria.

Article 22 INSTITUTIONAL ARRANGEMENTS

1. Each Party shall designate a Focal Point to serve as liaison with the Organization on the technical aspects of the implementation of this Protocol.
2. The Parties designate the Organization to carry out the following Secretariat functions:
 - a. convening and servicing the meetings of the Parties;
 - b. assisting in raising funds as provided for in Article 24;
 - c. assisting the Parties and the Scientific and Technical Advisory Committee, in co-operation with the competent international, intergovernmental and non-governmental organizations:
 - ◆ facilitating programmes of technical and scientific research as provided for in Article 17;
 - ◆ facilitating the exchange of scientific and technical information among the Parties as provided for in Article 16;
 - ◆ the formulation of recommendations containing common guidelines and criteria pursuant to Article 21;
 - ◆ the preparation, when so requested, of management plans for protected areas and protected species pursuant to Article 6 and 10 respectively;
 - ◆ the development of co-operative programmes pursuant to Articles 7 and 11;
 - ◆ the preparation of educational materials designed for various groups identified by the Parties;
 - ◆ the repatriation of illegally exported wild flora and fauna and their parts or products;
 - d. preparing common formats to be used by the Parties as the basis for notifications and reports to the Organization, as provided in Article 19;
 - e. maintaining and updating databases of protected areas and protected species containing information pursuant to Articles 7 and 11, as well as issuing periodically updated directories of protected areas and protected species;
 - f. preparing directories, reports and technical studies which may be required for the implementation of this Protocol;
 - g. co-operating and co-ordinating with regional and international organizations concerned with the protection of areas and species; and
 - h. carrying out any other function assigned by the Parties to the Organization.

Article 23 MEETINGS OF THE PARTIES

1. The ordinary meetings of the Parties shall be held in conjunction with the ordinary meetings of the Parties to the Convention held pursuant to Article 16 of the Convention. The Parties may also hold extraordinary meetings in conformity with

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- Article 16 of the Convention. The meetings will be governed by the Rules of Procedure adopted pursuant to Article 20 of the Convention.
2. It shall be the function of the meetings of the Parties to this Protocol:
- a. to keep under review and direct the implementation of this Protocol;
 - b. to approve the expenditure of funds referred to in Article 24;
 - c. to oversee and provide policy guidance to the Organization;
 - d. to consider the efficacy of the measures adopted for the management and protection of areas and species, and to examine the need for other measures, in particular in the form of annexes, as well as amendments to this Protocol or to its annexes;
 - e. to monitor and promote the establishment and development of the network of protected areas and recovery plans for protected species provided for in Articles 7 and 11;
 - f. to adopt and revise, as needed, the guidelines and criteria provided for in Article 21;
 - g. to analyze the advice and recommendations of the Scientific and Technical Advisory Committee pursuant to Article 20;
 - h. to analyze reports transmitted by the Parties to the Organization under Article 22 of the Convention and Article 19 of this Protocol, as well as any other information which the Parties may transmit to the Organization or to the meeting of the Parties; and
 - i. to conduct such other business as appropriate.

Article 24 FUNDING

In addition to the funds provided by the Parties in accordance with paragraph 2, Article 20 of the Convention, the Parties may direct the Organization, to seek additional funds. These may include voluntary contributions for purposes connected with the Protocol from Parties, other governments, government agencies, non-governmental, international, regional and private sector organizations and individuals.

Article 25 RELATIONSHIP TO OTHER CONVENTIONS DEALING WITH THE SPECIAL PROTECTION OF WILDLIFE

Nothing in this Protocol shall be interpreted in a way that may affect the rights and obligations of Parties under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

Article 26 TRANSITIONAL CLAUSE

1. The initial version of the annexes, which constitutes an integral part of the Protocol, shall be adopted by consensus at a Conference of Plenipotentiaries of the Contracting Parties to the Convention.

Article 27 ENTRY INTO FORCE

1. The Protocol and its annexes, once adopted by the Contracting Parties to the Convention, will enter into force in conformity with the procedure established in paragraph 2 of Article 28 of the Convention.
2. The Protocol shall not enter into force until the initial annexes have been adopted in accordance with Article 26.

Article 28 SIGNATURE

This Protocol shall be open for signature at Kingston, from 18 January 1990 to 31 January 1990 and at Bogotá from 1 February 1990 to 17 January 1991 by any party to the Convention.

IN WITNESS WHEREOF the undersigned, being duly authorized by their respective governments, have signed this Protocol.

Done at Kingston, on this eighteenth day of January one thousand nine hundred and ninety in a single copy in the English, French and Spanish languages, the three texts being equally authentic.

APPENDIX 6.7: MPA OBJECTIVES

- ◆ To protect and manage substantial examples of marine and estuarine systems to ensure their long-term viability and to maintain genetic diversity.
- ◆ To protect depleted, threatened, rare or endangered species and populations and, in particular to preserve habitats considered critical to the survival of such species.
- ◆ To protect and manage areas of significance to the life cycles of economically important species.
- ◆ To prevent outside activities from detrimentally affecting the marine protected area.
- ◆ To provide for the continued welfare of people affected by the creation of marine protected areas.
- ◆ To preserve, protect and manage historical and cultural sites and natural aesthetic values of marine and estuarine areas, for the present and future generations.
- ◆ To facilitate the interpretation of marine and estuarine systems for the purpose of conservation, education and tourism.
- ◆ To accommodate within appropriate management regimes a broad spectrum of human activities compatible with the primary goal in marine and estuarine settings.
- ◆ To provide for research and training, and for monitoring the environmental effects of human activities, including the direct and indirect effects of development and adjacent land-use practices.

Source: IV World Congress on National Parks and Protected Areas. Workshop III.2.

APPENDIX 6.8: CONSERVATION OBJECTIVES FOR PROTECTED AREAS

Sample ecosystems. To maintain large areas as representative samples of each major biological region of the nation in its natural unaltered state for ensuring the continuity of evolutionary and ecological processes, including animal migration and gene flow.

Ecological diversity. To maintain examples of the different characteristics of each type of natural community, landscape and land form for protecting the representative as well unique diversity of the nation, particularly for ensuring the role of natural diversity in the regulation of the environment.

Genetic resources. To maintain all genetic materials as elements of natural communities, and avoid the loss of plant and animal species.

Education and research. To provide facilities and opportunities in natural areas for purposes of formal and informal education and research, and the study and monitoring of the environment.

Water and soil conservation. To maintain and manage watersheds to ensure an adequate quality and flow of fresh water, and to control and avoid erosion and sedimentation, especially where these processes are directly related to downstream investments which depend on water for transport, irrigation, agriculture, fisheries, and recreation, and for the protection of natural areas.

Wildlife management. To maintain and manage fishery and wildlife resources for their vital role in environmental regulation, for the production of protein, and as the base for industrial, sport, and recreational resources.

Recreation and tourism. To provide opportunities for healthy and constructive outdoor recreation for local residents and foreign visitors, and to serve as poles for tourism development based on the outstanding natural and cultural characteristics of the nation.

Timber. To manage and improve timber resources for their role in environmental regulation and to provide a sustainable production of wood products for the construction of housing and other uses of high national priority.

Cultural heritage. To protect and make available all cultural, historic and archaeological objects, structures and sites for public visitation and research purposes as elements of the cultural heritage of the nation.

Scenic beauty. To protect and manage scenic resources which ensure the quality of the environment near towns and cities, highways and rivers, and surrounding recreation and tourism areas.

Options for the future. To maintain and manage large areas of land under flexible land-use methods which conserve natural processes and ensure open options for future changes in land use, incorporate new technologies, meet new human requirements, and initiate new conservation practices as research makes them available.

Integrated development. To focus and organize conservation activities to support the integrated development of rural lands, giving particular attention to the conservation and utilization of “marginal areas” and to the provision of stable rural employment opportunities.

(after Miller, 1980)

Source: McNeely et al., 1994

APPENDIX 6.9: Selection Criteria cf. Salm and Clark

An Example List of Criteria

The following examples of criteria for protected areas in general have been compiled from IUCN (1981) and Salm (1982); the major headings represent programme goals; the numbered headings are the criteria.'

Social Criteria. Social benefits are measured in the following terms:

1. *Social acceptance*, the degree to which the support of local people is ensured. When an area is already protected by local tradition or practice, it should be encouraged, and the area should receive a higher rating. An "official" protected area designation may not be necessary if local support is high.
2. *Public health*, the degree to which the creation of a protected area may serve to diminish pollution or other disease agents that contribute to public health problems. Granting protected status to contaminated areas, such as shellfish beds or bathing beaches, may result in reduced pollution as the polluting source is recognised and controlled.
3. *Recreation*, the degree to which the area is, or could be, used for recreation by country residents. Areas that provide the local community opportunity to use, enjoy, and learn about their local natural environment should receive a high rating for this criterion.
4. *Culture*, the religious, historic, artistic, or other cultural value of the site. Natural areas that also contain important cultural features should be given high ratings as their protection may help to maintain the integrity of the adjacent ecosystems.
5. *Aesthetics*, a seascape, landscape, or other area of exceptional scenic beauty. Natural areas that also contain features of natural beauty should be given higher ratings since such features depend on maintaining the integrity of the adjacent coastal and marine systems. However, when species diversity and the biological conservation value are low, and the site is picturesque, it retains a high value for recreation.
6. *Conflicts of interest*, the degree to which area protection would affect the activities of local residents. If the area is to be used for recreational purposes, for example, the site should not be a major fishing area and should have few dependent fishermen. In some instances, careful zoning can minimise such conflicts.

7. *Safety*, the degree of danger to people from strong currents, surf, submerged obstacles, waves, etc. The principal users will often be swimmers, snorkelers, divers, and boaters. It is important that they are able to pursue their activities safely.
8. *Accessibility*, the ease of access across both land and sea. Areas to be used by visitors, students, researchers, and fishermen must be accessible to them. The more accessible, the greater the value, but the greater the likelihood of conflicting interests (such as between coral mining and fisheries or fisheries and diving) and the greater the impact of users. Accessibility weighs high for goal one (social), fairly high for goal two (economic), and low for goal three (ecological).
9. *Benchmark*, the degree to which the area may serve as a “control group” in the scientific sense, an un-manipulated area used to measure changes elsewhere. Benchmark areas are essential to an ecological monitoring programme and should receive a higher rating.
10. *Education*, the degree to which the area represents various ecological characteristics and can serve for research and demonstration of scientific methods. Areas that clearly demonstrate different habitat types and ecological relationships and are sufficiently large both to serve conservation and to accommodate teaching (i.e., field trips or on-site learning centres) should receive a higher rating.

Economic Criteria. Economic benefits are measured in the following terms:

1. *Importance to species*, the degree to which certain commercially important species depend on the area. Reefs or wetlands, for example, may be critical habitats for certain species that breed, rest, shelter, or feed there and that form the basis of local fisheries in adjacent areas. Such habitats need management to support these stocks.
2. *Importance to fisheries*, the number of dependent fishermen and the size of the fishery yield. The greater the dependence of fishermen on an area, and the greater its yield of fishes, the more important it becomes to manage the area correctly and to ensure sustainable harvest.
3. *Nature of threats*, the extent to which changes in use patterns threaten the overall value to people. Habitats may be threatened directly by destructive practices, such as fishing with explosives and certain bottom trawls, or by overexploitation of resources. Areas traditionally harvested by local fishermen become important to manage. The numbers of fishermen on these grounds may increase, bringing extra pressure to bear on stocks and habitats. Even if the numbers do not change, the traditional capture

methods may be re-placed by others that yield more per unit effort (an extreme example is the use of explosives). The stocks of some species may not be capable of withstanding such in-creased drains on their breeding populations. In this way whole species have disappeared from fishing grounds or have become exceedingly rare.

4. *Economic benefits*, the degree to which protection will affect the local economy in the long term. Initially, some protected areas may have a short-lived, disruptive economic effect. Those that have obvious positive effects should have higher ratings (for example, for protecting feeding areas of commercial fishes or areas of recreational value).
5. *Tourism*, the existing or potential value of the area to tourism development. Areas that lend themselves to forms of tourism compatible with the aims of conservation should receive a higher rating.

Ecological Criteria. The values of ecosystems and their species are measured in the following terms:

1. *Diversity*, the variety or richness of ecosystems, habitats, communities, and species. Areas having the greatest variety should receive higher ratings. However, this criterion may not apply to simplified ecosystems, such as some pioneer or climax communities, or areas subject to disruptive forces, such as shores exposed to high energy wave action.
2. *Naturalness*, the lack of disturbance or degradation. Degraded systems will have little value to fisheries or tourism, and make little biological contribution. A high degree of naturalness scores highly. If restoring de-graded habitats is a priority, a high degree of degradation may score highly.
3. *Dependency*, the degree to which a species depends on an area, or the degree to which an ecosystem depends on ecological processes occurring in the area. If an area is critical to more than one species or process, or to a valuable species or ecosystem, it should have a higher rating.
4. *Representativeness*, the degree to which an area represents a habitat type, ecological process, biological community, physiographic feature or other natural characteristic. If a habitat of a particular type has not been protected, it should have a high rating. (A classification scheme for coastal and marine areas is desirable in applying this criterion).

5. *Uniqueness*, whether an area is “one of a kind”. Habitats of endangered species occurring only in one area are an example. The interest in uniqueness may extend beyond country borders, assuming regional or international significance. To keep visitor impact low, tourism may be prohibited but limited research and education permitted. Unique sites should always have a high rating.
6. *Integrity*, the degree to which the area is a functional unit—an effective, self-sustaining ecological entity. The more ecologically self-contained the area is, the more likely its values can be effectively protected, and so a higher rating should be given to such areas.
7. *Productivity*, the degree to which productive processes within the area contribute benefits to species or to humans. Productive areas that contribute most to ecosystem sustainment should receive a high rating. Exceptions are eutrophic areas where high productivity may have a deleterious effect.
8. *Vulnerability*, the area’s susceptibility to degradation by natural events or the activities of people. Biotic communities associated with coastal habitats may have a low tolerance to changes in environmental conditions, or they may exist close to the limits of their tolerance (defined by water temperature, salinity, turbidity, or depth). They may suffer such natural stresses as storms or prolonged immersion that determine the extent of their development. Additional stress (such as domestic or industrial pollution, excessive reductions in salinity, and increases in turbidity from watershed mismanagement) may determine whether there is total, partial, or no recovery from natural stress, or the area is totally destroyed.

Regional Criteria. The contribution of an area to a regional network of protected areas can be assessed in the following terms:

1. *Regional significance*, the degree to which the area represents a characteristic of the region, whether a natural feature, an ecological process, or a cultural site. The role the area plays in contributing nutrients, materials, or support for species (especially migratory ones) to the region as a whole should be evaluated. Both ecological processes and natural resources are often shared among nations, so areas contributing to the maintenance of species or ecosystems beyond national boundaries should have higher ratings.
2. *Subregional significance*, the degree to which an area fills a gap in the network of protected areas from the sub-regional perspective. This contribution may be assessed

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- by comparing the distribution of protected areas with sub-regional characteristics. If a type of area is preserved in one sub-region, that type should also be protected in another sub-region.
3. *Awareness*, the degree to which monitoring, research, education, or training within the area can contribute knowledge and appreciation of regional values. Areas that can combine such activities as pollution monitoring and education should receive a higher rating.
 4. *Conflict and compatibility*, the degree to which the area may help to resolve conflicts between natural resource values and human activities, or the degree to which compatibilities between them may be enhanced. If an area can be used to exemplify the resolution of conflicts in the region, it should receive a higher rating. Protected areas that demonstrate the benefits, values, or methods of protection or restoration should also have higher ratings.

Pragmatic criteria. The feasibility and appropriate timing of protection can be measured in terms of the following:

1. *Urgency*, the degree to which immediate action must be taken, lest values within the area be transformed or lost. Lack of urgency should not necessarily be given a lower rating since it is often best, and least costly, to protect well in advance of the threat.
2. *Size*, which and how much of various habitats need to be included in the protected area. Size is an important factor in designing protected areas. It has often been overlooked in the design process, resulting in severe degradation, even total destruction, of protected areas. The protected area must be large enough to function as an ecological unit to receive a high rating.
3. *Degree of threat*, present and potential threats from direct exploitation and development projects. The farther the protected area is from potential sources of accidental poisoning (such as large ports, petroleum deposits, or river mouths) the better are the survival prospects of species and communities. However, if an important habitat is severely threatened, it may be important to implement a management plan to reduce the threats to tolerable levels.
4. *Effectiveness*, the feasibility of implementing a management programme. A site that satisfies many criteria, but cannot be adequately managed (i.e., monitored, patrolled, and defended) is not of much use. Higher ratings should go to sites that are manageable.

5. *Opportunism*, the degree to which existing conditions or actions already under way may justify further action. An extension of an established protected area should have a higher rating.
6. *Availability*, the degree to which the area is available for acquisition or can be managed satisfactorily by agreement with the owners. The problem of tenure rarely applies to the sea. Beaches also often belong to the central or provincial government. Thus, acquisition of aquatic areas, wetlands, and seashores may not be necessary. However, adjacent lands and islands may be privately owned or leased. Generally, to secure long-term control over these areas, the title or lease will need to be bought from current owners. Higher ratings should go to areas owned by state or national governments.
7. *Restorability*, the degree to which the area may be returned to its former natural state. Areas that can increase in productivity or value to important species and processes should receive higher ratings.

APPENDIX 6.10: Selection Criteria cf. Kelleher and Kenchington, 1992

The following list identifies factors or criteria that can be used in deciding whether an area should be included in an MPA or in determining boundaries for an MPA.

Naturalness - the extent to which the area has been protected from, or has not been subject to human-induced change.

Biogeographic importance - either contains rare biogeographic qualities or is representative of a biogeographic “type” or types.
- contains unique or unusual geological features.

Ecological importance - contributes to maintenance of essential ecological processes or life-support systems .e.g. source for larvae for downstream areas
- integrity.
- the degree to which the area either by itself or in association with other protected areas, encompasses a complete ecosystem.
- contains a variety of habitats.
- contains habitat for rare or endangered species
- contains nursery or juvenile areas.
- contains feeding, breeding or rest areas.
- contains rare or unique habitat for any species.
- preserves genetic diversity i.e. is diverse or abundant in species terms.

Economic importance - existing or potential contribution to economic value by virtue of its protection e.g. protection of an area 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.

Social importance - existing or potential value to the local, national or international communities because of its heritage, historical, cultural, traditional aesthetic, educational or recreational qualities

Scientific importance - value for research and monitoring

-
- International or National significance - is or has the potential to be listed on the World or a national Heritage List or declared as a Biosphere Re-serve or included on a list of areas of international or national importance or is the subject of an international or national conservation agreement.
- Practicality/feasibility - Degree of insulation from external destructive influences.
- social and political acceptability, degree of community support.
 - accessibility for education, tourism, recreation.
 - compatibility with existing uses, particularly by locals.
 - ease of management, compatibility with existing management regimes.

Appendix 6.11: Selection Criteria cf. Kelleher et al, 1995

Criteria for Selection of Priority Areas

Biogeographic criteria

- ◆ Presence of rare biogeographic qualities or representative of a biogeographic “type” or types; and
- ◆ Unique or unusual geological features.

Ecological criteria

- ◆ An essential part of ecological processes or life-support systems (for example, is a source for larvae for downstream areas);
- ◆ Area’s integrity, or the degree to which the area either by itself or in association with other protected areas, encompasses a complete ecosystem;
- ◆ The variety of habitats;
- ◆ Presence of habitat for rare or endangered species;
- ◆ Nursery or juvenile areas;
- ◆ Feeding, breeding or rest areas;
- ◆ Rare or unique habitat for any species; and
- ◆ Genetic diversity (is diverse or abundant in species terms).

Naturalness

- ◆ Extent to which the area has been protected from, or has not been subject to, human-induced change.

Economic importance

- ◆ Existing or potential contribution to economic value by virtue of its protection (for example, protection of an area for recreation, subsistence, use by traditional inhabitants, appreciation by tourists and others or as a refuge nursery area or source of economically important species).

Social importance

- ◆ Existing or potential value to the local, national or international communities because of its heritage, historical, cultural, traditional aesthetic, educational or recreational qualities.

Scientific importance

- ◆ Value for research and monitoring.

International or national significance

Potential to be listed on the World (or national) Heritage List, declared a Bio-sphere 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

- ◆ Degree of insulation from external destructive influences;
- ◆ Social and political acceptability, degree of community support;
- ◆ Accessibility for education, tourism, recreation;
- ◆ Compatibility with existing uses, particularly by locals; and
- ◆ Ease of management or compatibility with existing management regimes.

APPENDIX 6.12: Institutional Arrangements for Management

Institutions Taking Part in the Management of Protected Areas								
Country	MG	GA	QC	NG	LC	PE	BA	MA
Anguilla			X	X				
Antigua and Barbuda			X			X	X	
Aruba			X					
Bahamas			X					
Barbados		X						
Bermuda		X	X	X				
British Virgin Islands			X		X	X		
Cayman Islands		X						
Cuba		X						
Dominica		X						
Dominican Republic		X		X			X	
Grenada		X						X
Guadeloupe			X		X			
Haiti		X					X	X
Jamaica		X		X	X			
Martinique			X		X			
Montserrat			X					
Netherlands Antilles				X	X	X		
Puerto Rico	X	X		X				
St Kitts-Nevis				X				
St Lucia		X	X	X	X			
St Vincent and the Grenadines			X					
Trinidad and Tobago		X	X	X	X			
Turks and Caicos		X	X					
U.S. Virgin Islands	X							
Totals	2	13	13	9	7	3	3	2
<p>Key: MG: national government agencies of metropolitan countries; GA: Government agencies; QC: Independent statutory, or quasi-governmental, bodies; NG: Non-governmental organisations; LC: Local communities or resource user groups; PE: Private entities; BA: Bilateral aid organisations; MA: Multilateral aid organisations.</p>								
Source: WCMA, 1991								

APPENDIX 6.13: Model of Management Plan cf. Kelleher and Kenchington

DETAIL OF CONTENT OF AN MPA MANAGEMENT PLAN

This example of the content of an MPA Management Plan is provided to assist those involved in the preparation of plans and submissions in government agencies and non-government organisations. It should be viewed as an ideal since it implies a planning situation where there is a high level of description and understanding of the area under investigation. The precise format adopted will depend upon the provisions of the legislation establishing the MPA and the government 'processes required for putting a management plan into effect.

The relationship between a management plan and a zoning plan is optional. In large, multiple use MPAs, the zoning plan may be the primary document that defines the strategic framework for management. In such cases it will be supplemented by various subordinate tactical documents such as guidelines and day-to-day management plans.

The example that follows refers to the case where the management plan is the primary policy - setting document and the zoning plan is subordinate to it. In many cases the items 1- 4.1 may form a preliminary document which establishes the initial case for protection of the area in question.

All the information listed in the following example should be provided in one document or another.

TITLE PAGE

This includes:

- ◆ The name of the area subject to the plan and its status;
- ◆ The words - MANAGEMENT PLAN;
- ◆ The name of the agency/agencies responsible for implementing the plan; and
- ◆ The date when the plan was prepared and the expected date for review.

EXECUTIVE SUMMARY PAGE

- ◆ On this page are summarised:
- ◆ The reason why the plan was prepared;

- ◆ The period of time for which it applies;
- ◆ Any special conditions which controlled its preparation including the legislative basis and authority for plan development;
- ◆ The principal provisions of the plan;
- ◆ The estimated budget; and
- ◆ Acknowledgements.

CONTENTS PAGE

The headings of the body of the plan are listed here against the appropriate page numbers. It may be preferable to list only the main headings, but sub-headings are usually included.

BODY OF THE PLAN

1. Objectives for Management

The goal and objectives for management are stated in this section. They will reflect the purpose(s) for which the area is protected and the use(s) that will be permitted.

2. Resource Description

This section provides information on the following categories for the areas to be protected. Maps will be an important feature of this section.

2.1 Name of Area and Location

To include the geographic location (State district, etc.); latitudes and longitudes (preferably on a map); surface area (square kilometres, hectares or other units of area).

2.2 Geographic and Habitat Classification

The area should be categorised according to a habitat classification scheme to identify its geographic zone, substrate type(s) and major biological feature(s).

2.3 Conservation Status

This should indicate the area's degree of naturalness, aesthetic values, degree and nature of threats (if any), jurisdiction(s) and present ownership. The degree of habitat representativeness should also be indicated.

2.4 Access and Regional Context

The regional land and sea surroundings and access routes to the area are described, in addition to the character and use of contiguous areas, emphasising their effectiveness as buffer zones.

2.5 History and Development

This section contains a summary account of direct and peripheral human involvement in the area. This section may be divided into several sub-sections e.g.:

2.5.1 Archaeology

A summary description of the people who used the area before historical times, including any known areas of religious significance, species taken and if closed seasons or closed areas were ever used as management techniques. Archaeological information could also provide clues to species that were found in the area.

2.5.2 Historical relics

This sub-section should identify submerged wrecks and any submerged structures.

2.5.3 Written and oral history

2.5.4 Recent developments

Give a brief history of fishing and other human use of the area and developments on the land that may have had a major influence on the area.

2.5.5 Current human use and development

In this section the current use of the area by subsistence, artisanal, commercial and recreational fishermen, tourists and others is discussed. It is most important to establish who the users are, where they conduct their activities, at what times of the year, and for how long, and the social and economic importance of their use. A user survey may be helpful. This information is just as important as biophysical data.

2.6 Physical features

In this section the non-living features of the area are described. Maps in addition to descriptions should be included.

2.6.1 Coastal landforms

Nearby landforms should be described together with islands and underwater formations.

2.6.2 Bathymetry

A map showing isobaths is needed. The depth of water can provide an important insight into the dynamics of the system. Major trenches, canyons and shallows should be described in as much detail as is available.

2.6.3 Tides

A description of the tidal regime and resultant currents and water movements associated with phases of the tidal cycle.

2.6.4 Salinity and turbidity

Measurements of salinity and turbidity in all seasons are desirable.

2.6.5 Geology

A description in geological terms about how the area was formed and how that process is continuing with the deposition of present day substrates and by erosion processes observable in the area.

2.6.6 Dominant currents

A description of physical oceanographic features of the area, wind-driven, tidal and residual currents, on a seasonal basis.

2.6.7 Freshwater inputs

Major river and estuarine areas should be noted.

2.7 Climate

2.7.1 Precipitation

Annual precipitation figures and a chart to indicate average precipitation on a monthly basis should be included.

2.7.2 Temperature

Monthly charts for both air and average sea temperatures (surface and at given depth). If possible include a monthly chart of solar radiation received.

2.7.3 Winds

Monthly charts of rose diagrams plus a description of any unusual feature of the local winds.

2.8 Plant life

This section should contain at least a description of dominant marine plant life, and wherever possible a comprehensive summary of the plant community and related environmental factors such as the depth of occurrence, together with any botanical features that may have special scientific, recreational or other interest. Phytoplankton could be included if information is available. Plant species identified in the area should be listed in an appendix.

2.9 Marine fauna

As a minimum, a description of the dominant marine or estuarine fauna is required, with an account of their ecological relationships if known. Include sections on Mammals, Reptiles, Amphibians, Fish, Birds, Invertebrates and Zooplankton as appropriate. A separate appendix should list the species.

Note: Sections 2.8 and 2.9 could be amalgamated to one section entitled "Marine Wildlife". Wildlife would be defined as animals and plants that are indigenous to the nation, to its coastal sea, to its continental shelf or its overlying waters; migratory animals that periodically or occasionally visit its territory; and such other animals and plants, not being domesticated animals or cultivated plants, as are prescribed by legislation.

2.10 Miscellaneous

This can be a varied section that includes those matters which do not fit under any of the other descriptions of the plan. Each plan will be site specific and could therefore have features or problems which are not encountered in other plans.

3. Description of Management Issues

A summary of past, present and possible future threats and management conflicts should follow.

-
- 3.1 **Historic and current conflicts**
A brief statement of any historic or current conflicts between uses or user groups.
 - 3.2 **Pollution**
Include point and non-point sources of external pollution within the area and in nearby areas, especially those up-current, e.g. runoff, sewage inputs, fish processing, industrial pollution and pollution from tourism and shipping.
 - 3.3 **Future demand**
Estimate future demand for recreational and other uses, and if applicable, future pollution loading and proposed developments.
 - 3.4 **Potential conflicts**
Potential conflicts specific to the area within and close to the boundary of the MPA should be described. Any potential conflicts due to more distant regional influences should also be identified. This should include review of sectoral development plans and propose projects for, or likely to influence, the area in question.
4. **Management policies**

In this section the management plan comes to grips with the threats and conflicts and prescribes solutions.

- 4.1 **Objectives**
The goal of protecting the area is briefly reiterated. The objectives of management are stated clearly. If the area is to be subdivided, sub-objectives should be stated for each zone or subdivision of the managed area.
- 4.2 **Resource units**
It could be useful to divide the area into resource units.
 - 4.2.1 **Natural**
Each MPA will have unique characteristics and the resource units will be site specific. An area could be divided into resource units such as beaches, islands, deep-water trenches, turtle or seal rookeries etc.

4.2.2 Development areas

Another category could be areas that are either developed or proposed to be developed.

4.2.3 Areas of impact

Areas showing marked impact from human activity could be identified.

4.3 Zoning

The resource units defined above may provide a basis for zoning, which should be kept as simple as practicable, consistent with avoiding unnecessary restriction on human activities. Zoning must be easy to understand both from the point of view of the manager and the managed. This section should explain why a particular area has been given a zone classification and what activities are permitted and prohibited within each zone.

Special habitats or wildlife areas such as a seagrass bed or a turtle rookery, may require additional management provisions such as seasonal closures or permanent restrictions to human access. Unusual prescriptions may be needed in the short term and these should be described in this section.

4.4 Management policies for resource units

In the draft management plan a list of management options can be presented in this section and a choice made between them in the final version of the plan.

5. Surveillance

This section should describe any programmes proposed to assess movement of people, vessels and aircraft within and through the area and the use made of the area.

6. Monitoring

This section should describe any biological, environmental and usage-monitoring programmes proposed for the area, when these programmes will be completed and how they are to be used in reviewing the management plan. It may also identify other monitoring programmes to be initiated during the first stage of the plan and who could carry them out. Some of the results from monitoring may eventually be included in the appendices.

7. Education and Interpretation

This section should describe programmes and co-operative arrangements with educational institutions, public associations and community groups to promote protection, wise use, public understanding and enjoyment of the MPA.

8. Enforcement

This section should outline the arrangements which will need to be made to detect apparent offences and to apprehend and prosecute offenders in order to achieve an acceptable level of adherence to MPA regulations. No nation could afford to manage primarily on the basis of enforcement in the face of general public hostility or to apprehend every breach of regulation. Education is therefore the primary management tool.

9. Maintenance/ and Administration

A section will be required to address the subjects of budget, staffing, etc.

9.1 Budget

Anticipated costs should be identified so that adequate funding may be arranged.

9.2 Staffing

The management plan should indicate staffing needs and identify major functions. Volunteers, consultants and head office staff involved in the planning process should also be identified, as this will provide a more accurate indication of staffing levels. Staffing deficiencies can be predicted and recommendations suggested. Section 9 should be updated and released as part of an annual report.

10. Information Sources

Information regarding the area will come from sources outside the manager's regular information base. These should be identified and listed wherever possible, and include those other government agencies, non-government organisations, individuals, consultants, overseas sources etc that were consulted. A bibliography should be appended.

11. Appendices

Appendix 1: Boundary and Area Description

This should provide the legal description of the area including any outstanding legal tenure or matters of existing interest which might have become clear during the development of the management plan. In most federal systems of government, there are complex and sometimes unresolved questions of jurisdiction between levels of government especially in the intertidal environment. These problems should be highlighted and, if appropriate, solutions suggested. One solution is to have complementary legislative, planning and management provisions on each side of that jurisdictional boundary. Examples of this include adjacent Federal and State Marine Protected Areas at Florida Keys and the Californian Channel Islands in the United States of America and the Great Barrier Reef Marine Park and adjacent Queensland Marine Parks in Australia.

Appendix 2: Legislation

All legislation and regulations relating to the area and their interactions, should be noted and explained. Where feasible, the legislation that prevails in the event of conflict between the provisions of different enactments should be identified. Implications for the protective status of the area should be identified.

Appendix 3: Plant Species

A comprehensive list of plant species should be attempted for the first management plan. As the process continues over the years, it is very likely that new plant species will be discovered in the area. Plant names should be listed in broad taxonomic groups, with botanical and common names where possible.

Appendix 4: Animal Species

Animal species should be listed in broad taxonomic groups: e.g. Mammals, Reptiles, Amphibians, Fish, Birds and Invertebrates and common names provided where possible.

Appendix 5: Special Features

This section could describe unusual or outstanding features of the area and could range from whale strandings, waterspouts, oil slicks to spiritual revelations and cultural beliefs.

Appendix 6: Past, Present and Proposed use

This section should attempt to provide ‘more detail on uses, identify key user groups and assess the social and economic significance of areas.

Maps

The following are suggested as a minimum number of maps required.

- Map 1 - Location
- Map 2 - Land/water tenure and jurisdiction
- Map 3 - Land topography and seabed bathymetry
- Map 4 - Geology
- Map 5/6 - Dominant plant and animal communities
- Map 7/8 - Major uses
- Map 9 - Major use conflicts and threatened resources
- Map 10 - Zoning

Where practicable the use of overlay presentation is recommended in order to illustrate the associations between such factors as topography, biological communities and uses.

APPENDIX 6.14: Model of Management Plan cf. Salm and Clark

Model Outline for Protected Area Management Plan

I. Executive Summary

II. Introduction

- A. Purpose and scope of plan
- B. Legislative authority for the action

III. Management Content

- A. Regional setting: location and access
- B. Resources (only facts pertinent to management, with other data in an appendix or separate document)
 - 1. Physical
 - 2. Biological
 - 3. Cultural
- C. Existing uses (economics, description, facilities, etc.)
 - 1. Recreational
 - 2. Commercial
 - 3. Research and education
 - 4. Traditional
- D. Existing legal and management framework
- E. Existing and potential threats and implications for management (i.e., analysis of compatible or incompatible uses, solutions)
- F. The plan
 - 1. Goals and objectives
 - 2. Management tactics
 - a. Advisory committees
 - b. interagency agreements (or agreements with private organizations, institutions or individuals)
 - c. Boundary and zoning
 - d. New regulations
 - e. Resource studies plan
 - f. Resource management plan
 - g. Interpretive plan
 - 3. Administration (phased over 3- to 5-year plan)
 - a. Staffing
 - b. Training
 - c. Facilities and equipment

- d. Budget
 - 4. Surveillance and enforcement
 - 5. Evaluation of plan effectiveness (monitoring uses, impacts, etc.) and revision
- G. References
- H. Appendices

APPENDIX 6.15: Jamaican Model

(Montego Bay Marine Park, Draft Management Plan 1192)

The MBMP was enacted in 1974 and was essentially a paper park” for 15 years. Actual development and management of the park did not start until 1989 as part of the GOJ/USAID funded Protected Areas Resource Conservation Project. Implementation of management was hampered to some extent by a complex institutional structure and dependence (both in decision making and financial) of local authorities on bureaucratic Government agencies in the capital.

Organization of the management plan:

INTRODUCTION AND OVERVIEW

- ◆ Institutional context
- ◆ History of MBMP
- ◆ Goals of MBMP
- ◆ Goals and definition of the management plan

RESOURCES AND ISSUES

- ◆ Natural resources of Montego Bay
- ◆ Human resources
- ◆ Threats and issues

DEVELOPMENT AND MANAGEMENT

- ◆ Organization and institutional structure
- ◆ Zoning as a management tool
- ◆ Science and environmental monitoring
- ◆ Public education and outreach
- ◆ Enforcement

FINANCIAL MANAGEMENT

- ◆ Financial policy and goals
- ◆ Capital and recurrent costs
- ◆ Revenues and estimated income

Comments: The (1992) draft plan was poorly organized. Goals and objectives are not used consistently in various sections of the plan. Headings are sometimes misleading (e.g. section on “Human Resources” deals with impact from large urban population). Visitor facilities, infrastructure and equipment are insufficiently covered. These shortcomings stem from various individuals contributing to the writing without proper coordination.

APPENDIX 6.16: Indonesia Model (Bali Barat National Park)

This is a rather old management plan (1980) prepared under the WWF Indonesia Programme and the UNDP/FAO National Parks Development Project. Follow-up and implementation of the plan is unknown. The original park did not have a marine component and the management plan was prepared in response to the Government's decision to extend the park with 6,220 ha of marine area in the early eighties.

Organization of the plan:

INTRODUCTION

- ◆ The status of planning
- ◆ Management objectives
- ◆ Marine tourism potential in Bali Barat

MARINE RESOURCES AND PROBLEMS

- ◆ Marine resources
- ◆ Human impacts on the marine habitats
- ◆ Conclusions

MANAGEMENT AND DEVELOPMENT PROPOSALS

- ◆ Conservation values and options
- ◆ Regulations, boundaries and zoning (also including permits and enforcement)
- ◆ Staffing, administration, resource management and guarding.
- ◆ Visitor use and facilities
- ◆ Summary of facilities, equipment, costs and scheduling

APPENDIX

Description of the major marine ecosystems of proposed marine extension.

Comments: This is a fairly traditional model of a management plan. The management and development section is quite detailed, although the management plan would gain in clarity by a more elaborate division into sections and subsections of the different chapters.

APPENDIX 6.17: Netherlands Antilles Model (Curacao Underwater Park)

This plan is called a management guide, perhaps to reflect its primary purpose to serve as a guide for management of an already established park. The park was *de facto* established in 1983, but was never formally enacted by government. This has hampered the implementation of management, which has been solely based on an existing but inadequate reef management ordinance. For these reasons the plan has had little, if any, effect on actual management practice.

Organization of the plan:

PART I: DESCRIPTION

GENERAL INFORMATION

Includes location, tenure and map coverage

SITE INFORMATION

- ◆ Physical
- ◆ Biological
- ◆ Cultural
- ◆ Ecological relationships

PART II: PRESENT SITUATION

REASONS FOR ESTABLISHMENT

EVALUATION OF FEATURES AND SITE POTENTIAL

OBJECTIVES

RESOURCE USERS AND AVAILABLE FACILITIES

IMPACT OF RESOURCE USERS

PAST MANAGEMENT

PART III: MANAGEMENT ISSUES/MANAGEMENT ACTIONS

LEGAL AND MANAGERIAL CONSTRAINTS

FINANCIAL REQUIREMENTS

ADMINISTRATIVE ARRANGEMENTS

MAN INDUCED TRENDS

Includes impacts of uses, artificial beaches and mariculture

NATURAL TRENDS

Includes impact of coral diseases, bleaching, sea urchin die off, and storms

IMPACT ASSESSMENT

MANAGEMENT ACTIONS

Includes both on-site and off-site management programs

PART IV: BIBLIOGRAPHY AND RESEARCH REGISTER

Comments: The plan is well organized and very detailed, but is heavy on the descriptive/background information and light on management actions. As such it will not constitute a good model for a management planning exercise. The management plan has since been replaced by a management plan for the entire nearshore marine environment.

APPENDIX 6.18: Parks Canada Model (Sageney-St. Lawrence Marine Park)

The management plan reflects the decision of the Federal and Provincial Governments to jointly establish a marine park, the first in Quebec. The two governments signed an agreement to enact legislation and regulations for the park, in keeping with their respective jurisdictions. Establishment of the park and development of the management plan is the result of extensive public consultation.

Organization of the plan:

MARINE PARK MANAGEMENT FRAMEWORK

Includes description of the boundaries and the institutional framework for management (coordination zone, coordinating committee, partnerships with bordering municipalities and communities).

NATURAL AND CULTURAL FEATURES

Summary of the main physical, biological and cultural features.

OBJECTIVES

- ◆ Conservation
- ◆ Education and interpretation
- ◆ Research
- ◆ Land use
- ◆ Integration into the regional community

MANAGEMENT ISSUES

Mostly a description of current uses/activities and their impacts. Also addresses public safety.

ZONING

Criteria, management framework and compatible activities for 4 types of zones.

DEVELOPMENT CONCEPT

This section is comparable to an implementation plan. The development concept is based on the idea that the park, and exploration activities therein, are organized around themes illustrating the major park features.

Comments: The organization of the plan is simple and transparent. The user of the plan is not burdened with excessive or redundant information. As a model, it will be particularly applicable to the MPAs where the management planning process was an integral part of the overall planning and consultation process for the establishment of the park.

APPENDIX 6.19: Turks and Caicos Marine Parks Model

The management plan relates to two almost adjacent MPAs, which will be managed from a single operational base. The parks have been in existence for quite some time, but were not under active management. The management plan intends to change this. The management activities for both areas are very similar in nature.

Organization of the plan:

SECTION I: BACKGROUND

- ◆ Introduction
- ◆ Objectives of the plan
- ◆ Review of existing legislation
- ◆ Resource description
- ◆ Uses and impacts

SECTION II: MANAGEMENT

- ◆ Objectives for management
- ◆ Legal framework for management
- ◆ Zoning
- ◆ Institutional framework for management
- ◆ Park equipment, infrastructure and facilities
- ◆ Public outreach, education and interpretation
- ◆ Research and monitoring
- ◆ Carrying capacity and visitor management
- ◆ Licensing procedures
- ◆ Enforcement
- ◆ Staffing and training
- ◆ Revenue generation and budget
- ◆ Timetable for implementation

SECTION III: ANNEXES

- I. Information sources/bibliography
- II. Legal texts
- III. Job descriptions park staff
- IV Visitor survey

APPENDIX 6.20:

Conclusions of Evaluation of Existing Management Plans

- ◆ Management plans are being prepared by scientists, managers, consultants, or teams of experts from several agencies.
- ◆ Each author or team appears to have its own preferred model for a management plan
- ◆ All management plans follow a general pattern, including a descriptive part and a management issues/activities part.
- ◆ some management plans follow a strict pattern of policy, goals and objectives, strategy and actions
- ◆ Management plans which have been prepared on the basis of extensive public consultation and review seem to be the most valuable and may have the best chances of implementation.
- ◆ Some management plans were prepared prior to implementation of management, others after IUCN has prepared a generic management plan outline¹ which constitutes a useful basis for any organization involved in management planning²
- ◆ There is no single model that MPAs can adopt for its management planning without modifications.
- ◆ MPAs should develop its own model, based on the comprehensive outline proposed by IUCN, and using formulas and approaches of existing management plans as appropriate

¹ See Kelleher G. & Kenchington, R 1992. *Guidelines for Establishing Marine Protected Areas*. A Marine Conservation and Development Report. IUCN, Gland, Switzerland.

² The authors remark that ...”It should be viewed as an ideal since it involves a planning situation where there is a high level of description and understanding of the area under investigation. The precise format adopted will depend upon the provisions of the legislation establishing the MPA and the government processes required for putting a management plan into effect”.

APPENDIX 6.21: Annotated Management Plan Outline

PART I: DESCRIPTION AND BACKGROUND OF THE MPA

1. Summary

This section summarizes the reasons why the plan was prepared, the period for which it applies, the conditions which controlled its preparation including the legislative basis and authority for plan development (where applicable).

2. Acknowledgment

This section will acknowledge all persons who have contributed to the development of the plan, as well as the organization(s), which provided financial support to the plan development.

3. Introduction

This section will briefly introduce the purpose and subject matter of Part I. It may furthermore address the mission statement of the management agency and a brief history of the agency.

4. History of the protected area, gazettement and boundaries

Includes the criteria on which selection of area was based, date of designation, boundaries, reference to gazette notices, and boundary plans.

5. Physical characteristics

5.1 Climate

5.2 Oceanography

5.3 Geology

This will include information available from published literature and unpublished reports. It is not the intention that new data be collected. Geological information will only be included insofar it is relevant to the marine protected areas. Most emphasis will be on temperature, precipitation, sea surface temperature, salinity, and currents. Water quality may be addressed under oceanography or as part of a separate heading.

6. Coastal ecosystems

- 6.1 Coral reef communities
- 6.2 Mangroves
- 6.3 Seagrass beds
- 6.4 Fish stocks
- 6.5 Inter-tidal mud/sand flats; beaches
- 6.6 Endangered species and critical habitats
- 6.7 Islands/offshore cays

This section will be a compilation of information available and unpublished reports. It is not the intention that new data should give a clear picture of the biodiversity of the area.

7. Cultural characteristics

This section will describe any cultural features of the area.

8. Resources uses

- 8.1 Artisanal fishermen
- 8.2 Sport fishing, deep-sea fishing
- 8.3 Trawling
- 8.4 Mangrove cutting
- 8.5 Scuba diving and snorkeling
- 8.6 Other water sport activities
- 8.7 Beach recreation

9. Bibliography

10. Appendix: Gazette notices and boundary plans of protected areas

PART II: MANAGEMENT ISSUES AND ACTIONS

1. Summary

2. Mission statement and goals for marine protected areas

A mission statement will be given for each park and reserve. A possible mission statement for a marine park could be: “The mission of the marine park is to strictly conserve all biodiversity in the park, while providing for enjoyment of this biodiversity in ways compatible with the primary conservation objective”.

Goals will further elaborate on this mission. For example, goals can include “To enhance fish stocks in the park”; “To allow natural regeneration of damaged ecosystems”; “To promote sustainable tourism”; “To provide opportunities for public education and conservation awareness”; etc. The group will have to determine the appropriate mission and goals for each MPA.

3 Objectives for management

The emphasis here is on *management*. Examples of objectives for management include: “To facilitate access for visitors”; “To ensure safety of visitors”; “To increase public conservation awareness through printed material, graphic material, visitor information centers, lectures and workshops”; “To enforce regulations”; “To carry out research and monitoring in support of management”; etc.

4. Review of current management framework

This section intends to establish a baseline of the current arrangements for management in terms of the legal framework, institutional arrangements, infrastructure, equipment and human resources available for management. Paragraph 4.4 gives an evaluation of the current framework and identifies its constraints. The section gives an answer to the question: “What framework is in place today, and how effective is it?” This forms the basis for Section 5, which identifies management issues. 1

- 4.1 Current legal framework for management
- 4.2 Current institutional arrangements for management
- 4.3 Infrastructure, equipment and human resources available for management (including organogram)
- 4.4 Summary of constraints for management

5. Management issues: tenure, resource uses, impacts, and user conflicts

This section addresses the various management *issues* in the park and reserve. What are the activities (legal or illegal) that take place in the area, what are their impacts, what are the conflicts between user groups, and what management problems are associated with these activities?

- 5.1 Tenure
- 5.2 Fishing
- 5.3 SCUBA diving and snorkeling

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- 5.4 Glass bottom boating
 - 5.5 Other water sport activities
 - 5.6 Sport fishing/deep sea fishing
 - 5.7 Beach recreation
 - 5.8 Security
 - 5.9 Land-based activities with impact on the marine environment
 - 5.10 Existing and potential conflicts between resource users

6 Management actions

This step will translate the management issues and problems as identified under 5 into management action. What management actions do we need to implement to adequately address these issues and problems?

- 6.1 Additional legislation required for management
- 6.2 New/additional institutional arrangements required for management
- 6.3 Land tenure
- 6.4 Zoning plans and regulations
- 6.5 Control of land-based activities
- 6.6 Licensing procedures
- 6.7 Liaison with other agencies and organizations
- 6.8 Infrastructure and equipment needs
- 6.9 Human resources and training needs
- 6.10 Community relations
- 6.11 Public awareness, education and interpretation
- 6.12 Research and monitoring
- 6.13 Surveillance and enforcement

7 Time schedule for actions (based on priority ranking)

It is proposed to conduct a priority ranking exercise for the actions under 6, and prepare an implementation schedule for the j-year life of the plan.

8 Budget, revenue generation and “creative financing”

The budget should be divided in capital and recurrent costs. Protected area managers should seriously look into creative financing mechanisms to increase direct revenue. Such mechanisms include, but are not limited to, the establishment of supporting NGOs and Friends groups that can raise funds for the park locally or apply to donor agencies for special projects.

9 Evaluation and review

A management plan needs to be dynamic in order to respond to changing circumstances. This section will describe the procedures for evaluation and review of the management plan. It is proposed that the lifetime of the plan will be five years and that a complete review takes place at the end of the S-year period. However, depending on unforeseen developments and circumstances, interim reviews may be proposed.

PART III: DAY-TO-DAY MANAGEMENT HANDBOOK

The management handbook will be a practical guide to all day-to-day management activities that can be consulted by all park and reserve staff. It will also be extremely useful to new staff transferred from other areas and reduce the time needed for familiarization.

Following is a very rough listing of the most obvious elements that should be addressed in the management handbook. It needs to be revised and completed by the managers on the ground. Once completed and in use, the handbook should be updated periodically to incorporate new procedures or other changes.

We propose a two-part structure, whereby part one describes the day-to-day management procedures, and part two gives a schedule by day, week, month, quarter, etc. of all the management activities. The schedule can best be presented as a series of tables.

Part I. Procedures.

1. Administrative procedures (work plans, reporting, meetings)
2. Financial procedures (revenue collection, bank deposits, budgeting, reporting)
3. Personnel management
4. Patrolling
5. Law enforcement
6. Research and monitoring
7. Community outreach, education and information
8. Maintenance

Part II. Schedule.

APPENDIX 22: Limits of Acceptable Change

Managing Recreation Use of Marine Resources Through the Limits of Acceptable Change Planning System

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Introduction

Clearly, the world has undergone significant social change in the last few years: the iron curtain has disappeared, terrorism has declined, an outbreak of peace is appearing, and the number of freely elected democracies has increased dramatically. Such momentous global changes in basic social and institutional structures are important factors influencing how nations will deal with pressing population, quality of life and environmental issues. At the same time that these fundamental changes have occurred, tourism has come to be the most significant industry, worldwide, measured in employment. D'Amore, for example, reports that 400 million international tourist arrivals in 1988 resulted in about 25% of the international trade in services, and 1042% of the world's gross product. Industry expectations are that the industry will continue to grow as long as political stability occurs on a global level.

Yet, as these important and fundamental changes have occurred, the world's population, particularly in third world countries, has raised its expectations in sharing in the economic well-being held by western Europe, North America and the Pacific Rim. The debate over whether the "South" can attain the same standard of living as the "North" has developed into a fundamental split in how economic growth is defined and who will pay the costs of conservation actions. Never-the-less, rising expectations suggest that third world nations will turn to the economic development tools that will gain them faster access to the material goods and services demanded by their citizens.

The global community is also keenly aware of the crucial need to maintain biological diversity and protect the integrity of ecosystems, particularly highly productive tropical forests and marine communities. One of the fundamental principles of "Caring for the Earth:

A Strategy for Sustainable Living” (IUCN 1991) is to Conserve the Earth’s Vitality and Diversity, through establishing protected areas and strategies that combine economic use and conservation over broad areas.

These major global trends are also coupled with a greater desire for local participation in natural resource decision-making processes. Old, top-down, centralized planning paradigms frequently ignored the wishes of local communities. Many projects didn’t adequately account for the costs of development and conservation that frequently benefited the international community but had few local payoffs. Development and conservation projects with little local public involvement and participation do not result in much “ownership” in the project, and thus may fail to be adequately implemented or create antagonism.

The result of these trends is that governments are expected, as they never have been before, to develop trackable and defensible decisions about ecological protection, where the judgments and social values used are explicit and subject to scrutiny as well as debate. This is particularly true when the enormous pressures for short run (and non-sustainable) development leads to significant economic benefits, but at the expense of irreversible impacts to natural environments. The zero-sum nature of many development projects points to increased polarization over the effects, costs and benefits of development: often environmental protection and economic development are described in “win-lose” terminology. While the choices are difficult, projects can frequently be modified to incorporate both concerns.

In summary, people want to know how decisions are made, who will benefit (and why) and who will pay the variety of economic and social costs that will eventually accrue from the project. In the politicized environments that often surround proposed conservation and development projects, planners have found that current paradigms of planning--where technicians plan for people--frequently result in plan failure, frustration by both planners and their clients, and increased polarization of the contending groups affected by the proposals.

These conclusions apply to tourism development as well as other tools of economic movement. The global growth in tourism, the increased interest in using natural environments for special type of tourist activity (termed eco-tourism), and the principle of local involvement have all combined to develop a greater need for planning systems that competently address environmental protection, local participation, and development in a way that makes the social judgments involved explicit and subject to review.

The need to respond to increased interest in eco-tourism through development of more and different opportunities combined with greater recognition of the importance of protecting biological diversity has forced planners and managers to turn to the carrying capacity paradigm as a method of addressing these needs. The carrying capacity paradigm would

seem to be particularly appropriate within the context of small islands, where resources are obviously limited. Unfortunately, as we have noted before (McCool and Stankey 1992) the rise in interest in applying carrying capacity in tropical regions comes just at the time when research and management experience in temperate zones has demonstrated its severe structural weaknesses.

Some Principles to Guide' Planning Processes

With this context in mind, we suggest that planning for tourism development be guided by the following principles.

1. "Good plans", ones that identify specific management actions or policies frequently create more disagreement about proposed courses of action than agreement. This is because such plans will negatively impact certain values that have been expressed socially and which are held by groups with the political power to veto proposed actions. Therefore, the traditional rational-comprehensive paradigm of planning (containing superficial 'public participation) is no longer adequate to deal with issues of tourism development and environmental protection (Friedmann 1973).
2. Because good plans create disagreement about the future among the affected groups, planning must encompass processes beyond the traditional technocratic methodology typically used. Planners must attempt to gain consensus from the affected groups as an essential and integral component of all phases of planning. Therefore, the public participation process must proceed with integrity and with objectives of creating dialogue, mutual learning, and societal guidance. The end result is consensus about a proposed future and agreement about how to get there.
3. The traditional rational-comprehensive planning offers the strength of a systematic process that explicitly considers alternatives. In order to be effective, consensus building processes must be coupled with technical planning methods.
4. Research clearly demonstrates several major problems with the carrying capacity paradigm. These problems illuminate the intrinsic complexity and difficulty involved in establishing numerical limits to human recreational use of natural environments. Plans dealing with tourism development and recreation use should focus on desired resource and social conditions and the level of change in the social and natural environment deemed acceptable.

Limits of Acceptable Change

Carrying capacity is often defined as the amount of use that can be accommodated in an area without significantly affecting the long-term ability of an area to maintain the biological and sociological attributes that gave rise to its recreational value. Within the context of small islands, we might tentatively define carrying capacity as the number of people that can be accommodated at one time within existing resource capabilities. However, research and *management experience in North America and elsewhere has frequently failed to establish the numerical capacities implied in this definition.*

A number of authors have pointed to the complex relationships between impact and use, the effects of bio-physical variables in mitigating these relationships, the influence of individual human behavior on this relationship, and the confusion of prescriptive judgments with descriptive information in establishing capacity (Graefe and others 1984; Stankey and McCoot 1984; McCool and Stankey 1990). McCool and Stankey (1992) most recently identified nine conditions required before a numerical capacity could be established. They concluded that few places would be able to satisfy all nine conditions.

Our suspicions are that marine environments, including small islands, cayes, atolls, beaches, and reefs are no different. While these places and their biota are very sensitive to development and human activity, small in physical size with some resources such as freshwater extremely scarce, identifying a single numerical capacity still involves assumptions about values, experiences, availability and cost of technology and appropriate recreation activities. Our tentative definition of carrying capacity included a reference to “existing resource capabilities”. Nearly any development of small islands for tourism will require external inputs in terms of construction materials, labor, energy, sewage treatment and water supply. Thus, limiting carrying capacity to existing resource capabilities is not only unrealistic and impractical, but it does not help resolve more fundamental issues of scale and appropriateness of development that are often the center of debate. Reduction of complex issues of development, quality of life, environmental impact, and economic well-being to a numerical capacity over simplifies the frequently intricate and multi-faceted question of tourism development.

Recreational carrying capacity originally was, we feel, developed as a way of conceptualizing or framing real-world problems. However, the continual drive to use it in the sense of a “magical number” has made the concept one that is all but worthless in terms of utility to planning and management.

Wagar (1964), one of the original researchers testing the concept of recreational carrying capacity, felt that it was a method of looking at desired conditions. Indeed, most definitions of the term relate capacity to the objectives established for an area (see for example Lime and

Stankey 1971). We feel we should return to this idea and focus our efforts on identifying the social and resource conditions for small island tourism development, and then determine how restore or enhance them. This is the central definition of the Limits of Acceptable planning system.

As originally conceived, LAC had both the intrinsic strengths and weaknesses of typical rational-comprehensive planning processes. LAC is a rational, systematic process that attempts to fit means to desired ends. Combining it with transactive planning concepts (dialogue, mutual learning and societal guidance) leads to a process that includes the power of intimate and authentic public participation in the planning process (Friedmann 1973).

The LAC process is built upon three major premises. First, any human-use of a natural environment results in some change to that environment. Therefore, the focus of planning and management is on identifying how much human-induced change is acceptable for a given setting. Second, diversity in resource and social conditions is both inevitable and desirable. Third, management actions should focus on attaining certain outputs of the process (resource and social conditions) through appropriate management actions.

The IAC process consists of nine steps that are briefly described below. The nine steps can be modified to fit the local planning environment.

1. *Identify area special values, issues and concerns.* Citizens and managers meet to identify what special features or qualities within the area require attention, what management problems or concerns have to be dealt with, what issues the public considers important in the area's management, and what role the area plays in both a regional and national context. This step encourages a better understanding of the natural resource base, such as the sensitivity of marine environments to recreation use and tourism development, a general concept of how the resource could be managed and a focus on principal management issues. LAC is very much an issue driven process; issues identified here will be addressed later.
2. *Identify and describe recreation opportunity classes or zones.* Most marine settings of sufficient size contain a diversity of bio-physical features, such as reefs, underwater cliffs, corals, and evidence of human occupation and use. Likewise, social conditions, such as level and type of use, amount, density and type of development, and types of recreation experiences vary from place to place. The type of management needed may vary throughout the area. Opportunity classes describe subdivisions or zones of the natural resource where different social, resource or managerial conditions will be maintained. For example, deeper reef settings will require SCUBA gear while in shallower areas snorkels may be adequate. The shallower areas may also show more impact from human use, such as effects on coral, than deeper areas. The classes that

-
- are developed represent a way of defining a range of diverse conditions within the marine setting. And, while diversity is the objective here, it is important to point out that the conditions found in all cases must be consistent with the objectives laid out in the area's organic legislation or decree. In this step, the number of classes are also defined as well as their general resource, social and managerial conditions.
3. *Select indicators of resource and social conditions.* Indicators are specific elements of the resource or social setting selected to represent (or be “indicative of”) the conditions deemed appropriate and acceptable in each opportunity class. Because it is impossible to measure the condition of and change in every resource or social feature within a protected marine setting, a few indicators are selected as measures of overall health, just as we relatively frequently monitor our blood pressure rather than more complete tests of blood chemistry. Indicators should be easy to measure quantitatively and relate to the conditions specified by the opportunity classes and reflect changes in recreational use. Indicators are an essential part of the LAC framework because their condition reflects the overall condition found throughout an ‘opportunity class. It is important to understand that an individual indicator not adequately depict the condition of a particular area. It is the bundle of indicators that is used to monitor conditions.
 4. *Inventory existing resource and social conditions.* Inventories can be time consuming and expensive component of planning, indeed they usually are. In the LAC process, the inventory is guided by the indicators selected in step 3. For example, level and type of development, use density, and human-induced impacts on coral might be measured. Other variables, such as location of different corals, shipwrecks, docks and mooring spots, can also be inventoried to develop a better understanding of area constraints and opportunities. And, inventory information will be helpful later when evaluating the consequences of alternatives. Inventory data are mapped so both the condition and location of the indicators are known. The inventory also helps managers establish realistic and attainable standards. By placing the inventory as step 4, planners avoid unnecessary data collection.
 5. *Specify standards for resource and social conditions in each opportunity class.* In this step, we identify the range of conditions for each indicator considered appropriate and acceptable for each opportunity class. By defining those conditions in measurable terms, we provide the basis for establishing a distinctive and diverse range of marine settings. Standards serve to define the “limits of acceptable change”. They are the maximum permissible conditions that will be allowed in a specific opportunity class. They are not necessarily objectives to be attained. The inventory data collected in step 4 play an important role in setting standards. We want the standards defining the

- range of acceptable conditions in each opportunity class to be realistic and attainable; we also want them to do more than mimic existing (unacceptable) conditions.
6. *Identify alternative opportunity class allocations.* Most attractive marine settings could be managed in several different ways. Indeed, here in Belize Ambergris Caye, Caye Caulker and Caye Chapel differ significantly in the amount of development, human density (both residents and visitors) and recreational opportunities available. In this step, we begin to identify some different types of alternatives. Using information from step 1 (area issues and concerns) and step 4 (inventory of existing conditions), managers and citizens can begin to jointly explore how well different opportunity class allocations meet the various contending interests, concerns and values. For example, one alternative scenario for Caye Caulker might allocate the north side of the “cut” to an undeveloped class where human impact is least desirable or acceptable. On the other hand, this area could be viewed as an ideal location for expansion of the high end tourism industry and classed accordingly.
 7. *Identify management actions for each alternative.* The alternative allocations proposed in step 6 are only the first step in the process of developing a preferred alternative. In addition to the kinds of conditions that would be achieved, both managers and citizens need to know what management actions will be needed to achieve the desired conditions. For example, if the north end of Caye Caulker is to be kept pristine, a large acquisition by the Belize Department of Conservation may be needed. Conversely, if an upscale tourism experience is desired, land use zoning would be used to prescribe minimum lot sizes, etc. In a sense, step 7 requires an analysis of the costs, broadly defined, that will be imposed by each alternative. For example, many people may find attractive the alternative to protect the north end from any development, and restore to pristine condition any impacts that might exist. However, this alternative might require such a huge commitment of funds for acquisition and enforcement that the alternative might not seem as attractive.
 8. *Evaluation and selection of a preferred alternative.* With the various costs and benefits of the various alternatives before them, managers and citizens can proceed to evaluate them, and the managing authority, based on guidance from the public, can select a preferred alternative. Evaluation must take into consideration many factors, but examples would include the responsiveness of each alternative to the issues identified in step 1, management requirements from step 7, and public preferences. It is important that the factors figuring into the evaluation process and their relative weight be made explicit and available for public review.
 9. *Implement actions and monitor conditions.* With an alternative finally selected, and articulated as policy by decision-makers, the necessary management actions (if any)

are put into effect and a monitoring program instituted. Plans with significant ownership by those affected have the greatest chances of implementation; therefore, public participation throughout the LAC process is imperative.

Often, an implementation plan, detailing actions, costs, timetable, and responsibilities will be needed to ensure timely implementation. The monitoring program focuses on the indicators selected in step 3, and compares their condition with those identified in the standards. This information can be used to evaluate the success of actions. If conditions are not improving, the intensity of the management effort might need to be increased or new actions implemented.

The LAC process, in summary, provides a framework for thinking about issues of tourism development and management. It is a framework, we believe, that recognizes the intrinsic complexity of development issues, yet provides the process to competently deal with this complexity without being excessively reductionistic. By combining the technical expertise of planners and scientists with valuable personal-knowledge held by the local public, LAC can result in more defensible decisions that have greater chances of implementation.

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MODULE 7

**MARINE PROTECTED AREA
MANAGEMENT**

OBJECTIVE

To improve management success through the application of general principles of organisational theory and behaviour

THEMES

1. General principles and steps of management
2. Institutional arrangements for MPA management
3. Human resource management
4. Revenue generation
5. Work planning, reporting and evaluation
6. Surveillance
7. Permitting, licensing and enforcement
8. Interpretation, education, and outreach
9. Principles of public relations
10. Maintenance
11. Linkages, mutual assistance, cooperation and general networking.

**DELIVERY
TIME**

2 days (14 lecture hours and 4 field trip hours)

MODULE 7	MARINE PROTECTED AREA MANAGEMENT
THEME 1	General principles and steps of management
OBJECTIVE	To give the participants a general overview of the management process and how it relates to the development of a coherent management strategy for an MPA.
SIGNIFICANCE	There are many different ways to manage organizations effectively. Which is best depends on many different factors such as social conditions, ethnic traditional values, community standards, the type of resources to be managed, and many other parameters. However, even though good management styles can vary significantly from organization to organization, the basic principles of management apply to all and must be incorporated into everyone's management strategy to be effective.
PRESENTATION	Lecture
EQUIPMENT / MATERIALS	Projector, blackboard or whiteboard, PowerPoint presentation
EXERCISE	N/A
TIME	1h

NOTE TO THE INSTRUCTOR

After welcoming the participants, review what the objective is and summarize what will be presented in each of the subsequent sections. This is a fairly short section. It should aim toward an academic review of the general principles of the management process and include a brief history and summary of major management concepts. The key point to bring out in this section is the ramification and importance of the reiterative process of planning and the importance of assessment in the overall management process.

INTRODUCTION

The most commonly accepted definition of management is “working with and through other people to accomplish the objectives of both the management agency and its members.” This definition emphasizes the importance of the human resources in the management agency, focuses on results and objectives rather than activities, and acknowledges the importance of integrating the personal objectives with those of the management agency.

Obviously, no plan is ever perfect, or static, because the conditions within the human and natural environments are continually changing. Although the goals and objectives rarely change appreciably, the tools and resources needed to achieve them, such as personnel, funding and available resources (facilities), do. Changes such as these often require a reassessment of management strategies, and may, in some circumstances, require significant revision of the plan itself. Separating the assessment process from the planning process terminates the planning process prematurely, and almost certainly ensures that achievement will fall short of the desired goal.

In the natural settings of marine protected area we need to be careful of how we interpret the term “goal.” Some see goals such as the reduction of fishing pressure on natural stocks, halting the collection of “live rock,” or the installation of mooring buoys. Others, especially those in natural areas, see goals and objectives that restore and maintain an optimum condition within a resource, ecosystem or zone. For example, maintaining and increasing biodiversity, or even preserving cultural resources for scientific investigation and visitor enlightenment. In marine protected area both concepts have their place in the planning/assessment process.

With this reiterative planning/assessment process in mind, the keystone for effective management is a clear understanding of the management agency’s purpose coupled with a clear understanding of the management objectives in achieving that purpose. In other words, what are the objectives and goals of the management agency and what is the desired end product? Only after these two questions are answered clearly can a manager move on to the

next series of questions:

- ◆ *Timeline*: How much time is allowed for achieving the management agency's goals?
- ◆ *Audience*: Who or what is the audience or market of the management agency?
- ◆ *Costs*: How much is it going to cost to get there?
- ◆ *Resources*: What resources are available to accomplish the task?
- ◆ *Measures of success*: What criteria are needed to determine when and how well the goals are achieved?
- ◆ *Goals*: What is going to happen when the management agency's goals are achieved?

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.

Planning is simply 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. The planning process is rarely an individual effort. Right from the beginning, managers need to incorporate the thoughts and ideas of all interested groups and individuals. Even though each group or individual participating in the planning process will have a slightly different idea about how the ultimate goal should be defined, the enabling legislation and management agency's purpose should allow a common set of goals to be defined. Because of this, it is often very difficult to get interest groups to buy into the planning process for the accomplishment of the management agency's goals. However, achievement of a management agency's goal is very often dependent on the support and cooperation of these interest groups. Thus revising the management agency's goal to one that has greater commonality with those of the interest groups has a greater chance of success. Failure to seek and incorporate outside assistance in the planning process usually ensures the development of conflict with these groups or individuals, putting the MPA's resources in jeopardy, and usually ensures failure of management objectives. It is effective conflict resolution and consensus building in the planning process that builds support for management efforts and ensures the best possible chances for success. This subject is fully developed in Module 5 (Participatory planning).

Organization is just that: developing the necessary infrastructure and support to implement and fund a management strategy. The "organization" or in our case the management agency, could be as simple as a single individual with a clear idea of how to proceed or a complex structure employing a large number of people. Countries in the Insular Caribbean rarely have

the fiscal resources to develop a large managerial infrastructure for their MPA's and, therefore, must rely heavily on the support of contractors, partners, volunteers, and regional and international organizations. Whatever is the optimal organizational make-up for a Caribbean managerial agency, it is important to point out that one person cannot do it all. The management agency must identify or find the people that can do the best job, assign the tasks, give them authority and responsibility needed to complete the task, and evaluate their performance in terms of the outcomes on the resources.

The assessment aspect of the planning process is the process of determining how well the management agency is progressing toward achieving its goals. **The results of the assessment process feeds back into the planning process to re-evaluate and re-define desired goals and strategies.** The key issue to point out here is that the criteria needed for the assessment of the plan's success should be developed as the plan is being developed, not after the planning process is largely done. This ensures that performance criteria for the plan are consistent with the objectives and goals of the plan. Establishing evaluation criteria after the bulk of the planning process is finished increases the potential for developing evaluative criteria that do not test for success correctly.

MODULE 7**THEME 2****OBJECTIVE****SIGNIFICANCE****PRESENTATION****EQUIPMENT /
MATERIALS****EXERCISE****TIME****MARINE PROTECTED AREA MANAGEMENT****Institutional arrangements for MPA management**

To explore the importance of maintaining and building the allegiance of governmental and non-governmental agencies instrumental in establishing the MPA, and enhancing environmental management through increased outreach and cooperation with governmental and non governmental agencies not involved with the establishment of the MPA.

As part of the co-management process, every effort should be made to involve all of the players in the establishment of the MPA. While 100% involvement is rarely accomplished, it is important to identify the management agency's supporters and capitalize on what they can bring to the successful management of the area.

Lecture, presentations by participants, field trips

Projector, blackboard or whiteboard, PowerPoint presentation

Mapping of coastal zone uses

2h

NOTE TO THE INSTRUCTOR

After welcoming the participants, the instructor should explain what will be covered in this section and detail what concepts the participants will be able to take back with them. Nodule 5 and 6 address institutional arrangements from the point of view of the stakeholders participation in the planning process (Module 5) and for MPA design (Module 6), Here, it is addressed as a management activity.

INTRODUCTION

Groups and organizations involved in MPA management should not be limited to non-profit organizations or special interest groups, but should include international and other governmental organizations. These groups are important, if not critical, to its contribution to MPA funding and in-kind assistance, as well as strengthening authority, assistance in seeking project funding, and easing individual workloads. Close cooperation with local groups such as community policing often provides additional benefits such as minimization of resource sabotage by disgruntled individuals.

Interaction with these outside groups should not be an occasional action addressing the changing objectives but rather something more intimate. There actually has to be a functional cooperation between the management agency and individuals or organizations. They are, or should be, functional partners working with the MPA staff toward resolution of the objectives and goals of the MPA and its employees. Hereafter, some of these benefits:

Diverse roles: Many partner organizations may assist in acquiring funding for various projects that may range from the publication of educational materials to the restoration of damaged resources. They can also assist in the political process of strengthening, or supporting, the authority and management paradigms of the MPA. Still others, especially governmental agencies, offer assistance in enforcing management regulations, serving in some cases as the “eyes and ears” for the MPA.

Cooperative user groups and individuals can bring a lot into resolving MPA issues, but they can also create more work for the MPA staff. These groups and individuals need to be monitored and managed in much the same manner as employees. To this end, each needs a schedule of assigned tasks, complete with a clearly defined set of responsibilities, authorities and consequences to ensure that they act in a way that is within the authority and responsibilities of the MPA.

Groups and individuals participating in PA activities need to be monitored and managed, for basically the same reasons that actual employees need to be managed.

Partner management. There are many ways to manage organizations and individuals that are not legally responsible to the MPA. Some examples of potential management mechanisms are contracts, memorandums of understanding or agreement, specific legislation, and permit conditions. This is an area where the MPA manager needs to be a little creative. The key point

is to maintain control and oversight to keep the partner group on track, productive, and within the authority of the MPA. Common goals and objectives, as well as individual roles and responsibilities for both the partners and the MPA, should be mutually agreed to and explicitly stated in whatever mechanism is used to formalize the cooperation between the partners. Failure to do so could lead to conflict with other organizations or individuals or, in the extreme case, possible legal action against the MPA or members of its staff.

On the other side, the management agency needs to be very careful to be fully accountable for all of its actions. Although partners, as collaborators in the management process, are generally fairly transparent to common operations of the MPA, they can at any time ask how their donated, or contracted, monies are being spend and how staff activities have been prioritized to achieve the goals and objectives of the management agency.

EXERCISE

Participants can describe institutional arrangements, if any, for their site management.

MODULE 7

THEME 3

OBJECTIVE

SIGNIFICANCE

PRESENTATION

**EQUIPMENT /
MATERIALS**

EXERCISE

TIME

MARINE PROTECTED AREA MANAGEMENT

Human resource management

To emphasise the crucial role the management of people plays in achieving mission goals.

Staff performance and mission accomplishment must be clear. The best output can only be accomplished if the employee, volunteer, or management partners and recognize their importance and value in the process of achieving the MPA’s mission goals.

Lecture, field trip

Projector, blackboard or whiteboard, field notebooks for interviews, PowerPoint presentation

Interviewing employees in a local park

1h

NOTE TO THE INSTRUCTOR

Welcome the participants to the session and explain that during this session we will be only introducing the extremely complex topic of people management, and not presenting any in depth presentation on the subject because we just don't have the time. People management as it relates to the management of various user and partner groups, as well as the management of MPA staff itself. The focus of this session will be the management of users, partners and staff to achieve the MPA's goals and objectives and to enhance the community's involvement and support of the MPA's activities.

Throughout the presentation, discussions, and workshop the participants will be exposed to different philosophies developed to motivate support and partner groups to higher productivity. The participants will also be presented with different philosophies on how to resolve conflict within user groups, or staff, and make them an active and meaningful part of the planning, implementation, and oversight process.

The instructor will delve into some of the major reasons that generate conflicts in MPA management. The instructor will discuss what the participants should know about their MPA partners, user groups, or staff to develop a conflict avoidance strategy and to properly plan for (anticipate) the problem before it arises.

Of course conflicts between cooperators and partners are inevitable and there should be some discussion about how to resolve the problem if possible. In this discussion there should be the realization that some conflicts will not be resolvable, forcing dissolution of the partnerships and loss of the cooperative support of the partner or agency. The discussion should be about what the management agency should do when this happens.

After the session, encourage the group to start practicing there conflict resolution skills by look for potential areas of conflict in the class and develop a reasonable strategy to head off, or resolve, the problem. Use the opportunity to evaluate the local MPA user and partner groups and develop a strategy to enhance support for MPA's management paradigm.

INTRODUCTION

There are two components to the management of people, the management of MPA staff and the management of user groups, partners, and other special interest groups. Each of these areas is equally important with respect to attaining desired long and short-term goals. Each is equally difficult, having numerous pitfalls that can quickly lead to intense conflict or totally impede any progress to successful management of the MPA.

The job position. **Management of the MPA staff starts when the positions are identified, not when the position is filled.** It is called position management, and position management is critical to effective leadership and MPA management. Failure to manage MPA positions leads to ineffective management, lost time, increased costs and slower, if not disrupted, movement toward desired goals and management objectives.

When considering a new position, or filling a vacant position, the prudent manager will take the time to consider primary goal (purpose) of the position and how it fits into and supports the management strategy of the MPA. This is the time that the management agency needs to reassess its management goals and objectives and consider if the goal can be achieved without hiring more personnel, or using that position to fill a more important need in some other area. **No position is static, all positions change with time and advancing technologies.** The duties of the position need to be adjusted (tweaked) to meet changing needs and technologies. To ensure consistent progress toward management goals this should be always done before the position is filled and periodically once it is filled.

A full understanding of the goals and purpose of a position, a careful analysis of the tasks and the time that it takes to do them must be defined. Duties, common to many positions in and outside governmental agencies, need to be identified and considered when determining the specific duties and requirements of the position. Collateral duties clearly affect the employee performance, motivation, and ability to accomplish assigned tasks. Collateral duties, however important, can and often do impede progress toward reaching management and position specific goals. However, they have also been effectively used to improve motivation and job satisfaction.

Training, career ladders, and employee development must also be considered when developing the position. These need to be considered with respect to enhancing an employee's skills, but also how these three activities can enhance the MPA's progress toward reaching management goals.

Only with all of this information in hand can a position description be written. When writing the description of the position the potential employer must start to consider and write down what skills are needed for the position. This present another good point for a group discussion with regard to the challenge of reconciling MPA management needs with available human and fiscal resources

The job interview. It is a very important aspect of filling a position. It is a two-way exchange of information. The person hired could be in that position for a short time or a long time and if care is not exercised in selecting the individual it could become a long-term problem and significant barrier to accomplishing MPA goals. The interview tells the prospective employee what the job and work environment is like and what his potential coworkers will be

like. At the same time the interview tells the employer what the potential employee is like, his attitudes, his aptitude, his ability to fit into the MPA management structure, and his enthusiasm toward working within the MPA structure.

How to treat staff and partners. Care must also be exercised when working with users groups, partners and special interest groups. Unlike the employer-employee situation the MPA manager cannot choose what kind of personalities or attitudes the user groups, partners, or special interest groups might have. The management of these groups then requires the MPA manager and his staff to be effective and careful strategists, carefully coordinating user groups and partners through effective communication and active listening. The management agencies staff need to be active listeners, ombudsmen and patient negotiators. In these situations, establishing clear goals and objectives is paramount.

Working with interest groups and partners requires the staff of the management agency to be effective communicators, arbiters, and patient negotiators. In this process, it is important to have clear objectives.

Every situation will be different and will require a different strategy. Some user groups will support some MPA management decisions and oppose others. To effectively minimize vacillation between support and opposition management must bring these groups into the planning process and even into the implementation arena to achieve maximum support for a particular management goal or objective.

Performance appraisals. **They are another effective way of managing employees and cooperators.** They can be very effective in improving the performance level of poor performers and if used incorrectly can reduce the performance level of high performers. As a result the performance appraisal is a can be a very effective tool to someone who knows how to use it or it can be a very dangerous tool in the hands of someone who doesn't. The objective of the performance appraisal is to provide a mechanism for the employer to determine the efficiency of an employee, identifying weak points that can be strengthened through training or recognition. The appraisal needs to clearly identify the employee's weaknesses to show both the employee and the employer areas that can be improved, but equally important, show the employer where the employee is strong. Using this information, the employer and the employee need to work together to maximize, or maintain, the employee's performance. Unfortunately, all too often the performance appraisal is used to only identify employee weaknesses. The appraisal process quickly becomes antagonistic, adversarial, and counter-productive.

Exercise

Travel to a local park 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.

MODULE 7
THEME 4
OBJECTIVE
SIGNIFICANCE
PRESENTATION
EQUIPMENT / MATERIALS
EXERCISE
TIME

MARINE PROTECTED AREA MANAGEMENT

Sustainable revenue generation

To learn about different methods that have been used to generate sustainable revenue streams for funding operational and project costs. The students will be introduced to different options for creating a diversified and resilient system for financial management.

Funding in all MPA's is always an important issue. Adequate funding is critical to an MPA, or any organization for that matter, achieving its management goals. In many cases, MPA managers are tasked with the responsibility of generating their own operational funds without a lot of guidance. This training session will introduce the students to sources, issues and methods for developing a sustainable revenue base so that the MPA can achieve its goals and objectives over time. Lecture

Projector, PowerPoint presentation

Presentations by participants on how their areas are funded and how they have sought out funding in the past

3h

NOTE TO THE INSTRUCTOR

In this session the participants will be introduced to the various options to seek out additional funding to conduct specific projects or programs.

Fund raising and the implementation of a sustainable fundraising strategy is a complex and difficult topic to cover. Many books have been written on the subject and weeks can be spent studying various aspects of the process. This section is merely an introduction to the subject.

Participants that have fund raising responsibilities should be encouraged to seek more extensive training programs on the subject, as well as updated information in the Internet.

The students will be expected to make a brief presentation of how funds are generated by their MPA. In the work session the participants will outline a tentative fund raising campaign generating a focused fact sheet that is intended to generate non-project specific funding for a marine protected area.

INTRODUCTION

Protected areas in developing countries only receive an average of 30% of the funding necessary for basic conservation management needs (James et al. 1999). Furthermore, MPA revenues streams may be highly erratic as a result of excessive dependence on a single donor or project, undermining the management consistency required to achieve long term objectives.

The objective of developing a sustainable revenue base is to be able to satisfy in a recurrent fashion the investment costs required to achieve conservation objectives and generate tangible long lasting benefits for local communities and the State. To ensure sustainability, a successful MPA financing scheme should be resilient and avoid too much dependence on any single source or mechanism to cover management costs over time.

To ensure resilience in a funding strategy, one should take into account the following:

- Over-dependence on only one or two sources is dangerous.
- Over time, one should focus on building a diversified income portfolio including sources such as government funds, donations, entry fees, access permits, fines, private investment and others.
- Take into account mobilization of in-kind contributions and partnerships to share management costs and responsibilities. These include co-management agreements, alliances with the private sector (eg. Concessions); partnerships with NGOs for

financial resources and technical assistance, and volunteer programs, among others.

Fundraising Requirements

The generation of operational and project specific funds is more of an art than a science. Some groups are very good at it while others seem to fall flat on their faces. Fund raising is not a simple or easy task. “The key to success is having a clearly defined goal, along with a specific action plan that sets realistic objectives, outlines strategies to achieve them and identifies the right people who can contact prospective donors.”(Smith *et al.*, 1994).

The fundraiser. **Having the right person, more often than not, is more important to successful fund raising than having a person with the right academic credentials.** That “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. The “right person” needs to be someone that can seek information, recognize opportunities and respond to them quickly, while maintaining a focus on the objectives of the fund raising strategy.

This is half the equation to success; the other half is very hard work. Before even attempting to contact potential donors the MPA needs to clearly define its Fund-raising needs and ensure that its objectives are in line with its mission goals. A specific monetary goal should be established. This is what it would cost to achieve the desired end product keeping in mind that the cost to raise the funds should not exceed a reasonable percentage, normally 10-15 % of the total cost.

Know your donor community. **The funding strategy has to keep in mind any restrictions that may be in place through the MPA’s enabling legislation, governmental regulations, or fiscal oversight.** The important aspect here is to know the target audience. Do the research on what programs or topics your target audience funds, what information do they need, and who are the principle personalities involved in the funding process. It is important to be updated by subscribing to the main list servers since many donor agencies disseminate their grant opportunities through them. Some of the most notable ones for your region are the following:

- Gulf and Caribbean Fisheries Institute (GCFI) and Caribbean Marine Protected Area Management Network and Forum (CaMPAM). <http://campam.gcfi.org/campam.php>
- NOAA Coral Reef Conservation Grant. <http://www.coralreef.noaa.gov/funding/welcome.html>
- National fish and Wildlife Foundation. <http://www.nfwf.org/AM/Template.cfm?Section=Grants>

There are many other international foundations in Europe, the United States, and Canada as

well as government grant programs in many countries that should be consulted in a regular fashion to take advantage of their funding opportunities. Internet lists such as Coral List (<http://coral.aoml.noaa.gov/mailman/listinfo/coral-list>), and CaMPAM Forum (<http://campam.gcfi.org/campam.php>) are a good source of information of funding opportunities for marine conservation , resource management and research.

Good record keeping is important, as it demonstrates sound fiscal responsibility. This is very important when dealing with potential donors.

Financial transparency. Another important, if not critical, aspect of the fund raising process is good record keeping. Know where your money is being spent, where you plan on spending it. Be prepared to tell potential donors exactly how you intend to spend their money and what the final product will be. When possible it is very important to present potential donors with financial records demonstrating sound fiscal responsibility and management.

Fundraising checklist. A good checklist for the beginner seeking donor funds is:

- Clearly identify your project or need;
- Prepare a professional written summary of your ideas;
- Seek for information in the Internet on potential donors searching or consulting colleagues via list servers.
- Develop a list of prospective donors;
- Carefully review potential funding sources;
- Prepare contact lists for personal visits or telephone calls;
- Identify an enthusiastic team to work on follow-up;
- Send personal letters of thanks immediately after your visit;
- When the donation arrives send a thank you promptly;
- Be prepared; and

If you do not believe in the project, do not try to raise funds for it.**FUNDING SOURCES AND PLANNING**

There is a wide diversity of potential revenue sources that MPA managers should consider in developing a sustainable financing strategy for their MPAs. The table below lists the most common sources of income for MPA management, including potential strengths and weaknesses of each source.

FUNDING	ACTORS	POSSIBLE	POSSIBLE DISADVANTAGES
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SOURCE		ADVANTAGES	
Government	Government agencies and budgets	Long-term sustainable source of financing	<ul style="list-style-type: none"> • Normally inadequate for activities required for conservation. • Vulnerable to political changes in priorities and cuts during times of crisis. • Political objectives can take precedence over technical requirements for conservation.
Donations and project financing	<ul style="list-style-type: none"> • International and multilateral agencies (E.g. World Bank, UNDP, UNEP, GEF) • Bilateral agencies (E.g. USAID, GTZ, DGIS, EU, DFID-UK, CIDA, JICA, AECID, Italian Cooperation Agency; US NOAA) • NGOs • Foundations • Individuals • Corporations 	Wide range of potential funding opportunities	<ul style="list-style-type: none"> • Unstable short term financing. • Requires experience, dedication of time, effort and personnel to satisfy diverse reporting and administrative requirements of donors and funders.
Conservation trust funds	<ul style="list-style-type: none"> • Endowment funds: E.g. Mexican Conservation Fund • Revolving Funds: E.g. PACT Belize 	<ul style="list-style-type: none"> • Potential source of long-term sustainable financing. • Extend conservation benefits of seed grant or large donation over long 	<ul style="list-style-type: none"> • Requires endowment or stable flow of new revenues. • Can be affected by unstable or unpredictable returns on investment. • High administrative costs. • Requires high transparency to avoid funds misused

		period.	
Entrance fees	Tourists	<ul style="list-style-type: none"> • Can provide significant source of revenues. • Fees can be used as management tool to control visitation levels. 	<ul style="list-style-type: none"> • Most relevant for protected areas with charismatic or internationally known attractions. • Tourism can represent pressure on resource conservation. • Governments capture revenues for other purposes. • Revenues can drop rapidly with tourism fluctuations.
Special permits for recreation and extraction	<ul style="list-style-type: none"> • Tourists • Tour operators • Researchers • Fishers • Hunters • Other 	<ul style="list-style-type: none"> • Can be a source of revenue that complements entrance fees. • Special attractions and activities can attract high fees. 	<ul style="list-style-type: none"> • Requires area have special offerings to which permits can be applied. • Application of permits can generate conflict with stakeholders.
Conservation taxes and fees	<ul style="list-style-type: none"> • Airports • Cruise ships/docks • Hotels • Tourists • Users of ecological services. 	Significant and sustainable source of revenue earmarked for conservation.	<ul style="list-style-type: none"> • Funds not earmarked for specific protected area. • Requires political will to implement and apply special taxes and fees. • Possible conflicts with stakeholders in development of fees.
Commercial activities	<ul style="list-style-type: none"> • Protected area administrators • Concessioners. 	Can generate revenues for local communities and concessioners.	<ul style="list-style-type: none"> • Administrators do not have experience to manage operations with a entrepreneurial focus. • Subject to political influence in businesses that affect profitability. • Generates relatively small amount of revenues.

Source: Spergel, Barry. Raising Revenues for Protected Areas: A Menu of Options. World Wildlife Fund: Washington, D.C. http://www.conservation.org/sites/gcf/Documents/raising_revenues_pa.pdf

The MPA manager may also wish to consider developing a business plan for their MPA (CPM, n.d.). Similar to a plan developed for a for-profit business, the development of an MPA business plan can provide significant benefits for managers, such as:

- Illustrating the financial and operational status of the MPA, and describing specific needs, opportunities and challenges.
- Helping area administrators identify new strategies to generate revenues and reduce costs, increasing the cost effectiveness of conservation investments.
- Providing potential “investors” (eg. donors, partners) with estimates of their return on investment in terms of conservation value.
- Reorienting administrators to think more strategically about their operations and financing of their areas.

A Business Plan for an MPA can also be very useful to maximize the efficiency of investments and attract potential investors. For example, it can help to:

- Identify new fundraising and cost reduction strategies.
- Manage expenditures and showcase the desired results from future investments and the required funds.
- Communicate to stakeholders and potential investors future plans – what the strategies are, what funds are needed, how the funds will be spent, and what the priorities are, among others.

Exercise

The class should discuss other potential sources of revenues, such as access or user fees, concession charges, bonds, endowments, fundraisers, and tax rebates.

MODULE 7	MARINE PROTECTED AREA MANAGEMENT
THEME 5	Work planning, reporting, and evaluation
OBJECTIVE	To learn how to extract annual goals out of the mission goals and the MPA's long-term goals, and use these in the development of protocols and evaluation criteria to be used to quantify the success of the work plan.
SIGNIFICANCE	Work Plans are often developed on a daily basis, addressing what ever appears to be important at that point in time. This type of reactive management rarely moves efficiently toward completing established goals. More productive progress toward annual and long-term goals, with greater employee support, can be achieved through reasonable planning, proper work schedules, and appropriate feedback mechanisms.
PRESENTATION	Lecture
EQUIPMENT / MATERIALS	Mission statement, Mission Goals, Long-term goals, Brief history and a description of the park for which these plans were developed
EXERCISE	Use of case study to review of mission statement
TIME	0.5h

NOTE TO THE INSTRUCTOR

Explain to the participants that this is the work side of the management process. It is taking the General Management plan, Strategic Plan and other similar documents and translating them into actual work tasks. It is also a very complex issue and takes careful planning to properly account for project objectives, employee abilities, aptitudes, enthusiasm, and individual objectives and goals.

INTRODUCTION

Like many other aspects of the planning process the conversion of desired goals and objectives into a sequential list of work elements is fairly difficult and takes just as much thought and planning as it takes to develop the objectives and goals out of the MPA's purpose and mission objective. Considering the needs, abilities and individual objectives of the employees in addition to the time allowed for completing specific tasks and the funding availability further complicates the process.

Individual objectives as used here are defined as the goals and objectives that the employees establish when they are assigned a task. Everyone has different ways of accomplishing the same task. They establish their own milestones and goals to accomplish the assigned task. Occasionally, there will be minor modifications to the objective of the task, tolerable and as long as it is still in keeping with the overall objective of the mission.

Clearly, the manager together with the employee needs to develop specific work tasks with the goals and objectives of the management agency in mind. However some latitude must be given in defining the goals and objectives to account for the skills, abilities and individual objectives. Accounting for the employee's abilities, skills and interests employee morale and camaraderie within the management agency.

Along with developing work elements managers also need to define how the work will be evaluated and be able to communicate that to the employee at the time that the task is assigned. This lets the employee know exactly what is expected. The keeping of logs and journals of work activities in all divisions is an excellent way for a management agency to evaluate both an employee's and a division's performance toward accomplishing assigned goals. Since the work logs and journals are maintained by the employees, reviewing them to determine performance becomes a joint decision making process. The process, reviewing and discussing work journals and logs, becomes non adversarial and provides subtle feedback needed to enhance his own evaluation of his performance and efficiency. Dated journals and logs are beneficial in documenting program efficiency and critical when the management agency is being evaluated or reviewed by potential donors and other support agencies.

Program evaluations should be fairly frequent, assessing progress and early determination where potential blocks to progress are occurring. The process should be non-adversarial and matter of fact, optimizing cooperation and employee effectiveness.

Periodic reports on the activities within the management agency is a useful mechanism for documenting the performance and efficiency of the management agency.

Periodic reports on the activities within the management agency are a useful mechanism for documenting the performance and efficiency of the management agency. They document progress toward mission goals and objectives and allow various user groups, individuals and special interest groups to reevaluate the management agency and their future level of support. Reports are generally required to support funding requests for many types of projects. Managers should work to enhance employee's report writing skills.

There are several methodologies for evaluating the management effectiveness of marine protected areas. These methodologies are different but have common elements; some are more sophisticated than others, and the indicators for assessing the MPAS vary. Overall, indicators are grouped in three general categories: **biophysical, socioeconomic and governance. Each manager should select the one that better fits his/her conditions,** particularly, the amount of the information available to assess those indicators, but also other elements such as the costs and the available capacity to measure those indicators. For that reason, some MPA managers have chosen certain methods for measuring and evaluating management effectiveness because those are the one used and promote by the organizations that fund staff training and monitoring. The site manager should make the decision according to multiple factors and measure the extent of the efforts required to achieve reliable information when the resources that were available at the beginning of the project are not there anymore... Among the most recognized methods are those published by Cifuentes (2000), MBRS (2004)¹, Pomeroy *et al.* (2006). These papers are included in the list of publications that accompanies this Manual.

¹ <http://www.mbrs.org.bz/dbdocs/tech/Effective.pdf> - Manual for the Rapid Evaluation of Management Effectiveness in Marine Protected Areas of Mesoamerica. December 2004 56p. -

Exercise

Review the mission statement, mission goals and long term goals and develop annual goals including report protocols and progress evaluation criteria. Identify potential

MODULE 7	MARINE PROTECTED AREA MANAGEMENT
THEME 6	Surveillance
OBJECTIVE	To learn how to develop surveillance protocols, clearly tying them to established MPA goals and accepted human resource management philosophies as appropriate.
SIGNIFICANCE	Surveillance can be viewed from several different perspectives. However, from a law enforcement perspective it is observing visitor and other user activities for potential resource, civil, or criminal violations.
PRESENTATION	Lecture
EQUIPMENT / MATERIALS	Staff from MPA
EXERCISE	Development of surveillance protocol
TIME	2h

NOTE TO THE INSTRUCTOR

The tutor should point out in the lesson the importance of surveillance and the attendant record keeping and data analysis and how the results of this type of activity can determine the status and subtle trends in the health and use of the resources in the area.

INTRODUCTION

To exercise effective stewardship and management of the various resources that an MPA is charged to protect it is imperative that the area managers routinely monitor the activities and uses of the area's resources.

Monitoring is frequently used by law enforcement to detect and eliminate illegal activities. However, the benefits of surveillance go way beyond the needs of law enforcement. It is the tool to evaluate progress, determine successes and identify failures. Appropriately used the surveillance process is the only way to quantify the long-term health and status of the areas natural and cultural resources as well as to detect subtle changes in recreational and commercial use of the area.

Surveillance can also be an effective public awareness tool for the manager in his interactions with various user and special interest groups. Surveillance is a very powerful way to bring the community and special interest groups into the management process. For example, a well-designed program to monitor commercial fishing activities could be implemented by the fishermen themselves and analyzed by an organization mutually agreeable to both groups. The results can then be used by everyone to develop a joint management paradigm to implement a sustainable use protocol for the fishery. This type of process minimizes the adversarial aspects by including the users group into the management process. Not only that, but the user group has a greater buy in since they are the ones that collected the data and by collecting the data they have a better chance at understanding management's need to develop regulations to control or regulate the activity. More often than not the adversarial group may argue against a management paradigm on the grounds that the data or analysis was biased, or even altered by the management agency

Even if an interest group is not involved in the actual monitoring process, the sharing of information derived from monitoring can do much to keep interest groups and individuals interested in the management process. The sharing of information garners credibility management agency and the respect of the partner or special interest group that received the information.

The key to responsible resource stewardship is to knowing your resource, whether it is natural

or cultural. The only way to know your resource is to watch it through time (monitoring), learning what it responds to, what its needs and threats are, and how and by whom is it being used.

Exercise

With the staff of the local MPA acting as knowledgeable about local user and special interest groups and individuals, the class will develop a surveillance programme for the local MPA.

MODULE 7	MARINE PROTECTED AREA MANAGEMENT
THEME 7	Permitting, licensing, and enforcement
OBJECTIVE	To learn how to achieve management long and short-term goals through prudent use of mandated enforcement authorities and through partnering with those governmental agencies that have the necessary authorities. The student will also learn how to use the permitting process to gather statistically valid resource data and baseline information without the need for additional staff.
SIGNIFICANCE	This topic is critical to the implementation and effective completion of a MPAs management paradigms and goals. However, in the Wider Caribbean, this topic is very wide-ranging and somewhat specific to land ownership issues. The legal authorities of MPA staffs range widely from a broad and far-reaching scope of authorities to the other end of the spectrum, no law enforcement authority.
PRESENTATION	Lecture
EQUIPMENT / MATERIALS	Projector, PowerPoint presentation
EXERCISE	Discussion on permitting systems
TIME	0.5h

NOTE TO THE INSTRUCTOR

The point of this session is to explore the range of experiences of permitting and licensing have in the Wider Caribbean and determine how the permitting and licensing processes are used to achieve management goals.

INTRODUCTION

Permitting, licensing, and enforcement tools that managers can use to regulate the level And location of resource use. However in the Wider Caribbean the extent of authorities for issuing permits and licenses varies widely. Many areas have no authority to either issue or enforce permit and licenses while other areas have full authority for both.

Permitting and licensing activities are regulatory and require specific authorities to implement. These authorities are generally issued by government agencies. 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. In some of these cases there is even less communication between management and the issuing agency of the enforcement group.

Ideally, the MPA manager should have the authority to both issue and enforce permits and licenses. This level of authority allows the manager to both monitor regulated activities and control where those activities are occurring within the MPA. Participants that do not have this level of authority should be encouraged to get it.

This would be a good time to discuss what authorities are really needed and what are the impediments to securing that authority. Then allowing for some brainstorming on how these impediments might be over come.

Not having full authority within the permitting and licensing areas presents a number of other opportunities to build partnerships between regulatory bodies. Inter agency cooperation can be formalized through cooperative agreements, memorandums of understanding (MOU's), or contracts. It is important to have the cooperation formalized to ensure that legal actions that might arise do not fall through because of jurisdictional conflicts.

MPA managers, or their staff, need to be a prominent part of the permit or licensing process to ensure that the permitted activities are in accord with the management objectives and activities. For example, issuing permits to harvest live rock from a protected area would not optimize the re-establishment of a stable, mature, benthic community.

The key to effective permitting is to ensure that the MPA is closely involved with the evaluation and development of permit conditions to ensure protection of the resources by preventing conflicts with different management prescriptions.

Exercise

Open a discussion on the concept of permits, their use, and benefits as a users control tool, and as a mechanism for gathering data. Many areas in the Caribbean do not have any sort of permit system in place so it would be beneficial to include a discussion on how a permit program could be implemented.

<p>MODULE 7</p> <p>THEME 8</p> <p>OBJECTIVE</p> <p>SIGNIFICANCE</p> <p>PRESENTATION</p> <p>EQUIPMENT / MATERIALS</p> <p>EXERCISE</p> <p>TIME</p>	<p>MARINE PROTECTED AREA MANAGEMENT</p> <p>Interpretation, education, and outreach</p> <p>To learn about the various options for developing, or coordinating the development of, interpretive programs and projects. The student will learn how other areas are accomplishing this activity and what other outside agencies and organizations they can call upon to assist them in developing and implementing interpretive programs</p> <p>Interpretation and outreach are two of the most important activities within an MPA. While some MPAs have a strong legislative mandate to preserve and protect natural and cultural resources in an unimpaired state, others have mandates to just protect things the way they are. In either case, all MPA's have a mandate to educate visitors and other MPA users about the MPA's resources through public education and community outreach.</p> <p>Lecture, participants' presentations</p> <p>Projector, PowerPoint presentation</p> <p>Development of a community outreach programme</p> <p>2h</p>
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INTRODUCTION

Although there is no fully acceptable definition for interpretation the U.S. National Park Service commonly uses one put forward by Freeman Tilden in 1957, “An educational activity which aims to reveal meaning and relationships through the use of original objects, by first hand experience, and by illustrative media, rather than simply to communicate factual information.” (Tilden, 1957)

The interpreter is a revealer of facts, a storyteller synthesizing seemingly unrelated facts to reveal a clear picture of times past, and a soothsayer of future times. The interpreter is the teacher of future generations.

Interpretation is the education of people about the activities and conditions with in the management agency as well as the resources it is charged to preserve.

It is the interpreter’s responsibility to learn as much about the management agency as possible and then to transfer that information to various types of users. Interpretive activities have to cover a very wide spectrum of community interests to educate the community about the purpose of the management agency, the accomplishments of the management agency and how the activities of the management agency will benefit them. The goal is to provide a connection between the individual and the resource of the protected area.

The interpreter has to use a wide spectrum of tools and teaching aids to tailor outreach programs to the needs of targeted audiences. **To accomplish this, the interpreter needs to learn and understand the community, social and ethnic values of the target group to maximize his efforts.** Although the objective of outreach and educational programs are generally to teach groups and individuals about the activities, accomplishments and benefits of the management agency toward resource preservation and protection it is important that the presentation is correlated with the needs of the environment and the community.

Interpretative activities also involve the development of educational material that can be sold to or given to the visitors and interest groups alike. This educational material needs to have a high focus and purpose and contain enough information to understand the purpose but not to the point of boring the audience.

A well-developed interpretative program needs to know what, and how many, target audiences there are, how to reach each of them and what their primary focus is. With this information the interpreter can locate the material and media that are most appropriate to reach these target groups.

Building collaborative arrangements is an effective way of meeting the demands for the range of interpretive skills and materials necessary for MPA management.

Unfortunately, the number of target audiences, the differences between target audiences and the complexities within target audiences is beyond the reach of even the most affluent interpretive program. **To meet the needs of the local community and area visitors, interpreters have to develop and maintain partnerships with a wide spectrum of agencies, user, and special interest groups to attempt to fill this information gap.**

Exercise

Students will, using the resource of the local MPA, develop a strategy, and implementation outline for a community outreach program.

<p>MODULE 7</p> <p>THEME 9</p> <p>OBJECTIVE</p> <p>SIGNIFICANCE</p> <p>PRESENTATION</p> <p>EQUIPMENT / MATERIALS</p> <p>EXERCISE</p> <p>TIME</p>	<p>MARINE PROTECTED AREA MANAGEMENT</p>
	<p>Principles of public and media relations</p> <p>To learn the importance of effective and prudent use of public and media relations, as well as how public relations differs from public education and outreach.</p> <p>Developing and maintaining the image of responsible resource management is crucial to developing strong public support and funding for an MPA. A weak or negative public image significantly lessens chances for achieving the goals of the MPA, whether funded through legislative actions, philanthropic donations, or grants. An MPA’s public image and credibility are developed through successful management actions and the modest public marketing of those accomplishments and information sharing.</p> <p>Lecture, Discussion</p> <p>Projector, PowerPoint presentation</p> <p>Open discussion about how to market the accomplishments of the MPA, what media to use, how to develop it and how to time the action for maximum impact</p> <p>0.5h</p>

NOTE TO THE INSTRUCTOR

The participants should be informed that the objective of this session is only to examine the benefits and problems of public, media and interpersonal relations and relationships. It is not intended to teach them the skills needed to effectively interact with public and media to accomplish management and interpretive objectives. That level of knowledge needs to come from a more extensive public relations class like those offered through local universities or colleges.

INTRODUCTION

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. Effective public relations head off many of the problems that are often encountered in fund raising, community awareness, users and special interest support for management concepts, and crisis management.

What are public relations? The activity is nothing more than image building. Successful image building results in improved stature and prestige in the community. It begins by listening to the constituency that the management agency wants to get something from, then responding appropriately to those concerns, thoughts, or wishes

The effective communicator is a listener, a talker and a mediator. Whether the communicator is dealing with subordinates, superiors, the general public, or individuals they need to hear and understand what is being said. Only then can an answer or appropriate response be formulated. More often than not, the average person starts to formulate a response as soon as the person they are listening to starts talking, and we know how we are going to respond before they are finished. The good manager listens very carefully to everything that is said, and understands it, before formulating a response. There is nothing wrong with asking questions when a statement is not very clear.

Managers need to develop presentations that are clear, concise and focused on the issue, or topic, at hand. They need to make use of audiovisual aids to maximize the impact of the presentation and most importantly they need to develop their skills in managing the audience. This is especially true in media relations where reporters tend to redirect the focus of press conferences to issues that might have greater public interest.

Another important skill within the media and public relations arena is knowing how much and what to say. How many times can you think of when a public meeting was going very well until either too much information was provided, or the wrong thing was said? What happens when this occurs? The focus of the meeting, or presentation, is diverted to a smaller

issue within the context of the presentation or to a totally irrelevant issue.

Before making any presentation, it is a good idea to know something about you audience. Get an idea about the audience's perception of you, your management agency, and the topic being presented. Be prepared for derailing questions, or questions that could change the focus of the presentation. Again it is important that the manager is able to manage the audience rather than the audience leading the manager.

MODULE 7	MARINE PROTECTED AREA MANAGEMENT
THEME 10	Maintenance
OBJECTIVE	To learn that “maintenance” does not only mean keeping equipment and buildings operational, but includes also the “maintenance” of natural and cultural resources, information, databases and even human resources.
SIGNIFICANCE	Both resource use and natural forces act to produce stresses on MPAs. The integrity of natural areas, facilities, supporting systems, and partnerships has to be actively maintained. As such, in addition to the development of maintenance plans for facilities and equipment, maintenance components should be built into each of the sub-programmes of the MPA management plan.
PRESENTATION	Lecture
EQUIPMENT / MATERIALS	Projector, PowerPoint presentation
EXERCISE	N/A
TIME	0.5h

NOTE TO THE INSTRUCTOR

Let the participants know that this session will not delve into the nuances of building or equipment maintenance, save to say that record keeping and documentation (INVENTORY) are important. What the session will cover is how to maintain resources, harmony within the staff, and reinforcing the relationships between various partners.

INTRODUCTION

With respect to the natural and cultural resources, maintenance has two meanings. There is the obvious understanding, the maintenance of trails, campsites, deteriorating buildings, and crumbling walls, and even the removal of nuisance species. The other meaning is the restoration of resource damage, restoring the resource to a condition required for the ecosystem to function adequately, as described in the management and strategic plans. In some cases this is comparatively easy; the restoration of costal habitats via restrictions of some uses, in other cases is very difficult, if not impossible, such as the restoration of a coral reef damaged by a ship grounding or chronic overfishing if the ecosystem has been altered severely. Yet this all falls within the boundaries of maintenance, "...the work of keeping something in suitable condition."

Maintaining proper staff relationships is as difficult as maintaining a damaged or degraded resource, if not more. It requires an extensive, and sometimes innate, ability to manage people. Management decisions affecting an individual or a small group will ultimately affect the entire staff. How large, or far-reaching, that effect will be depends on the situation. The point to understand here is that before a manager makes a decision, some thought should be taken about how it will be reflected, if at all, through the rest of the staff. For example, giving a monetary award to one staff member and only a recognition award to another, both for work well done could potentially raise a great deal of conflict.

Maintenance of partnerships, be they individuals, groups, or corporations are very important, if not critical to the continued success of the management agency. If a manager expects to have the continued help of volunteer workers and organizations then he needs to maintain a healthy level of communication between that group and the staff. They need to understand their benefit to the management agency, the value of their efforts and the importance of their continued efforts. Even if it is a one time assistance, the manager and the staff, should still try to maintain a good relationship with the partner because there may come a time in the future when their help and support will be needed again. Uncomfortable, or poor, interactions with individuals, groups or partners just indicate poor people management and public relation skills. They can be improved, even if it means having someone else interface with the partner.

The maintenance of natural resources (species and ecosystems), as well as the historical and

cultural values of the site requires the achievement of the main management objectives which include protection, prevention and restoration. Each management activity as they are described in this Manual, are designed to achieve these objectives.

Traditionally, the management of biological resources has targeted species or their predators or food. Little effort has been dedicated to address genetic diversity (crossovers, endogamies, genetic drift, etc.) of species populations or the ecosystem as a whole, considering their biological connectivity along the coastal area and the open ocean.

MODULE 7	MARINE PROTECTED AREA MANAGEMENT
THEME 11	Linkages, mutual assistance, cooperation and general networking
OBJECTIVE	To improve cooperation with outside agencies, groups, and individuals.
SIGNIFICANCE	For most MPAs in the Wider Caribbean, this topic 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.
PRESENTATION	Lecture
EQUIPMENT / MATERIALS	N/A
EXERCISE	N/A
TIME	1h

NOTE TO THE INSTRUCTOR

The importance of this section cannot be emphasized enough; rarely can a manager do the job by himself or with just his staff. This is especially true with respect to the management of protected areas where designated areas have little conformity to ecological and biogeographic boundaries and the distribution of species go beyond the MPA and even the country. To maximize the potential for resource preservation and protection in the site, managers will find themselves working harder on issues that are outside the managed area than inside. Environmental management actions are always reflected through the entire ecosystem and ecoregion, never just a portion.

Participants will discuss various options of working with other environmental groups, governmental agencies, industry and local communities. They will discuss how deeply a manager needs to get involved and what the potential pitfalls could be from getting involved.

INTRODUCTION

Managing a portion of an ecosystem or part of it is one of the most difficult things anyone to do. Ecosystems respond as a whole and marine populations are connected throughout great extensions of the coastal areas of continents and island groups, as well as the ocean. This is addressed in Module 2. Occasionally something like a disease will pass through the system or biogeographic region as a wave, or it may stop before getting all of the way through the system, but the whole ecosystem will eventually feel the impact in one way or another.

Managing a marine system is one area that mandates that the manager work with other managers to develop the best management paradigms. In the Wider Caribbean the interconnectivity of the marine resources is so high that managers actually need to cooperate at the international or regional level. Most MPA managers recognize this but either do not want to, or more likely, feel overwhelmed by their own site responsibilities, and have little or no time to develop external relationships. Funding is also another important issue. To get involved in the international scene means going to meetings outside their own country and promote transboundary environmental policy which may be out of their site-based responsibilities. Rarely are there enough funds for this kind of travel, and if there are they are generally earmarked for a different purpose. So, how does a manager work with other managers at an international level with the time and means at his disposal?

There are a number of excellent starts to resolving this dilemma, involving the use of networks such the Caribbean Marine Protected Area Managers (CaMPAM), and the Internet. This is an important vehicle for establishing those relationships, but it is not the only one.

Searching for opportunities for collaboration and coordinating activities with neighboring sites or those that area biologically connected must be a permanent task for managers as it is a fundamental part of their professional job. The use of Internet as a tool for communication is critical in the modern World. Module 4 provides a list of programs and networks useful for MPA professionals. There are also a number of non-governmental organizations that are available to provide managers with advice and assistance on a number of issues. Some of these NGO groups (local and international) have enough expertise on their staff to offer management and resource management training courses and will work with MPA managers to find creative funding options to make it happen. This course is a proof of this statement.

Ultimately, though, managers need to work and talk (personal or electronically) with other managers about management issues. This exchange is very useful, as has been demonstrated by the Training the trainers program. Meeting with other MPA professionals in regional and national workshops and courses has generated numerous national and regional initiatives. Managers need to start using the experiences of others. Module 2 shows that marine currents and organisms' dispersal (during the larval stage or as adults) along the coastal area or throughout the open ocean determine the spatial distribution or biological connection of a species populations (or resource) in the wider Caribbean. Managers get to understand how decisions that they make in their own areas affect the resource of the ecoregion. For example, the uncontrolled harvest of reef fish spawners in San Andres and Providencia Islands (Columbia) could affect the level of recruitment in Jamaica. For a population whose larvae disperse long distances (like lobsters) or for highly migratory fish species (sharks, whale sharks, pelagics) the answer for fisheries sustainability may vary. Based on the same notion, one MPA is not enough for conserving the environment and biological resources of an area if it is not accompanied by other management tools and the creation of a national MPA system that can covers such connectivity at least within the country. It is critical for MPA manager to communicate among them (nation and internationally) to improve their work.

Several programs, people networks and regional and international agencies are focused on fostering communication among experts (domestically, ecoregionally, subregionally or regionally) to promote research projects and conservation measures that can provide strategies to address conservation and sustainable management of highly threatened coastal by human activity and global climate change.

Communication and feedback between scientists and resource managers have improved in the last years. Several institutions (networks, programs, organizations) have contributed to foster such communication. Managers must tell scientists which are their research needs and researchers must conducting research projects that can help to find solutions. MPA managers must be more proactive in establishing relationships with researchers so they can identify what are their needs, while scientists must focus more in applied research.

This is the basis of the association between CaMPAM and the Gulf and Caribbean fisheries Institute (GCFI). The latter serves as a forum where each year MPA managers and marine conservation scientists meet and discuss emergent issues. As a consequence of such association, GCFI manages UNEP Small Grant Fund <http://www.gcfi.org/SGF/SGFEng.php>) for improving MPA Management, and fostering fisheries sustainability and alternative livelihoods for fishers affected by resource decline.

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APPENDIX 7.1: DEFINITIONS OF MANAGEMENT

Definition:

- **To have charge of/direct/conduct/administer an organization (with its people and activities).**

MPA MANAGEMENT IS IMPLEMENTING THE ACTIONS AND STRATEGIES DEFINED IN THE MANAGEMENT PLAN;

IT IS AIMED AT ACHIEVING THE GOALS AND OBJECTIVES OF THE MPA

**APPENDIX 7.2:
ELEMENTS OF DAY-TO-DAY MPA MANAGEMENT**

- ◆ "Paper Work": report writing, record keeping, filing, correspondence.
- ◆ Work planning and supervision.
- ◆ Personnel management: supervision, evaluation, conflict management; recruitment, interviewing, job descriptions, training, use of volunteers.
- ◆ Financial management: budgeting, payments/disbursements accounting, reporting, purchasing, sales, inventory.
- ◆ Revenue generation/fund raising and proposal writing.
- ◆ Surveillance patrolling, enforcement, prosecuting.
- ◆ Interpretation, education and outreach.
- ◆ Research and monitoring.
- ◆ Maintenance.
- ◆ Advisory function (feedback to decision makers based on R&M)
- ◆ Licensing, permitting, concessions.
- ◆ Crisis management.
- ◆ Emergency response, disaster management.
- ◆ Collaboration, meetings and networking.
- ◆ Infrastructure.

APPENDIX 7.3: POSSIBLE EXERCISEES

1. Personnel recruitment exercise

Candidate 1

- High school graduate
- 4 years experience as a sergeant in the Marine Police
- Knowledge of environmental laws
- Has powers of arrest
- Experience in boat handling and navigation
- SCUBA (advanced)
- Search and rescue
- Driver's license

Motivation for applying: wants a change; job with the Marine Police is too monotonous; learning about MPAs is a challenge.

Candidate 2

- High school graduate
- Bask marine biology
- 5 years experience as technician at the Discovery Bay Marine Lab
- Familiar with coral reef monitoring and reef fish census techniques
- Experience with data analysis
- Experience in small boat handling and navigation
- SCUBA (rescue)
 - Driver's license

Motivation for applying: has great interest in marine conservation and MPAs and wants to apply knowledge and expertise to that field; willing to be trained in law enforcement techniques.

2. Interpretation/Education/Outreach Exercises

1. Address the problem of local and visiting boaters continuing to anchor on coral and to use moorings inappropriately.
2. Address the problem of snorkelers (taken out by local tour boat operators) trampling the reefs.
3. Address the problem of CITES-listed items being offered for sale by local vendors and foreign visitors buying them.
4. Persuade politicians and decision makers of the need to extend the system of MPAs.

APPENDICE 7.4: ASSESSMENT OF MANAGEMENT EFFECTIVENESS

Table 1. Basic indicators for assessing effectiveness of protected area management

<i>TYPE</i>	<i>VARIABLE</i>	<i>SUBVARIABLE</i>
ADMINISTRATIVE	Staff	<ul style="list-style-type: none"> • Manager • Technical staff • Administrative staff • Operations staff • Additional contracting capacity
	Financing	<ul style="list-style-type: none"> • Operative budget • Budget delivery deadline • Extra or special funding • Management capacity of own resources • Accounting system
	Organization	<ul style="list-style-type: none"> • Filing • Chart • Internal communication • Activity mainstreaming
	Infrastructure	<ul style="list-style-type: none"> • Tools and equipment • Basic facilities • Specific facilities • Facility sanitation • Facility safety • Boundary demarcation • Accessories
POLICY	Community involvement and support	<ul style="list-style-type: none"> • Main agency • PA system management
	Intra-institutional	

	<p>support</p> <p>Institutional support</p> <p>External support</p>	
LEGAL	<p>Land tenure</p> <p>General laws and rules</p> <p>Act for PA designation</p>	<ul style="list-style-type: none"> • Ownership • Conflicts • Clarity • Enforcement
PLANNING	<p>PA Management plan</p> <p>Compatibility of management plan with other plans</p> <p>Annual operative plan</p> <p>Level of planning</p> <p>Zoning</p> <p>Boundaries</p>	<ul style="list-style-type: none"> • Plan existence and updating status • Characteristics of the planning team • Level of implementation • Existence and updating status • Level of implementation of the plan
KNOWLEDGE	<p>Socioeconomic Information</p> <p>Biophysical information</p> <p>Cartographic information</p> <p>Legal information</p> <p>Research, monitoring and feedback</p>	<p>Subvariables to be defined for each variable, depending of the level of available and known information. (See example in Table 3)</p>

	Traditional knowledge	
MANAGEMENT TOOLS	Research Environmental education Environmental interpretation Protection Maintenance Community outreach	Each program is assessed through the following variables: <ul style="list-style-type: none"> - Design - Implementation - Coordination - Monitoring and assessment
ILEGAL USES	Wood harvesting Extraction of - renewable natural resources Extraction of wildlife (flora and fauna) Cultural resources predation Encroaching Hunting Agriculture and animal husbandry Fishing Tourism and recreation Construction of infrastructure	
LEGAL USES	Wood extraction Stone extraction Wildlife extraction Hunting and animal husbandry Fishing Tourism and recreation Education Infrastructure construction	

BIOGEOGRAPHIC FEATURES	Shape Size Isolation Vulnerability	
THREATS	Visitation impact Pollution Contamination Fires Encroaching Migration Introduced species Natural disasters Development infrastructure Subversive movements or belic conflicts Drug trafficking and associated activities	Water: marine and/or coastal systems Land Air

APPENDIX 7.5: PUBLIC USE²

¿What is public use? This concept **includes all educational and recreational activities that involve the public, such as education and environmental interpretation, recreation and research**. Some authors do not consider scientists and other users within this category, as they are seen more as collaborators or partners.

In a protected area, the activities that the public look for are much related to the specific values of the site, its perspective's, management category, visitors interests, etc... Overall, the public wants to have a learning experience different from a classroom, enjoy, exercise, and even work. There are three main categories of public use activities, namely:

- Information, education and environmental interpretation;
- Recreation and tourism, and
- Scientific research

These three types of activities are determined by a number of factors, namely:

- Management category
- Management scheme
- Zoning
- Carrying capacity
- Management capacity
- Infrastructure
- Target audience

² Provided by Cristina Juarrero de Varona (Centro Nacional de Áreas Protegidas, Cuba) in 2000

Carrying capacity. This concept originated with prairie animal husbandry and referred to the maximum number of animals per unit area that the land could carry without comprising its resource basis. When applied to recreation, it was considered that the higher the number of visitors, the greater the impact and so the needs to control visitation.

Tourism carrying capacity has been defined as the number of visitors that an area can sustain without degrading its resources and social environment, and without harming the visitors' experience.

The concept has evolved but still does not cover different regions and sites. In the 70's, the carrying capacity concept entailed mainly the range of use intensity. It has evolved as different methodologies have showed up that emphasizes primarily the targeted conditions (limits of acceptable change). Another method is the "visitors' impact management" or VIM, that aims at managing the impact within the limits of acceptable changes. Other methods focus on a combination of opportunities, activities, services and facilities for better managing the protected area.

Almost all these methods use numerical calculation, they require a certain agreement on what is the "desired" or "targeted" biophysical and social conditions, as well as the opportunities to be offered to the visitors, the estimate level of acceptable impact, and focus more on the level of usage rather than the peoples' behavior, although the relationship between the number of visitors and the biophysical impact is not linear.

Despite the importance to calculate the carrying capacity if a visited site, data show that none of the methods has an absolute accuracy since all depend on the conditions of the area, the information available, the management capacity and the availability of technical and material resources.

Experiences that visitors look for in protected areas

- Test their skills
- Get a sense of self-confidence as travelers to remote areas
- Share their experience with others during the visit
- Take own decisions
- Experience freedom and space
- Increase knowledge on the site, phenomenon and specific resource.

-
- Take risks
 - Talk with local people
 - Share with friends and relatives
 - Know local nature
 - Sporting
 - Exercise
 - Rest and relax physically
 - Contemplate scenic beauty
 - Be close to animals
 - Experience peace and quiet
 - Experience solitude
 - Escape from family

Work and research activities

- Basic research
- Studies related to resource management
- Research activities in MPAs must be regulated according to management objectives, and never allowed those that may cause damage to the site ecological conditions.

Policy must be developed to address the following:

- Species collection
- reporting
- permitting

Environmental education and interpretation

These are those with environmental content that require some communication techniques to be implemented, which are somewhat different from the ones used in a classroom: the audience is not obligated to pay attention and, in most cases people visit the area for the enjoyment and resting, rather than learning on the natural resources.

Trails, visitor centers, guided tours, lectures, live interpretation, hiking, outdoor exhibitions, audiovisuals, etc.

Recreational and tourism attractions

Resource: river. Bathing, paddling, boating, and sport fishing.

Resource: sea. Bathing, sailing, nautical sports, sport fishing, diving, submarine photography and shore cruise ship.

Resource: land. Trailing, hiking, mountain climbing, horse riding, field trips and picnic areas, bike tourism, mountain bicycle, speleologists, natural caves exploration, alpinism, visitor centers, architectonic, historic-cultural values, photographic routes, educational activities, organized camping, bird sighting.

Factors to be taking in account to implement public services in a protected area:

- **Management objectives**
- **Distance to populated areas**
- **Characteristics of visitors**
- **Optimization of facilities to prevent environmental damage and reduce maintenance costs**
- **Services to support and promote environmental education and interpretation programs**
- Most common services:
 - **Accommodation, stores, cafeterias or restaurants, equipment rental, camping, guide and backpacking services, emergency services, phone service**

Visitor's management:

In case of problems with number of visitors or their site use, regulations should be applied to prevent environmental damage.

Reduce public use

It includes the reduction of the number of visitors allowed (via permitting control, training, limiting number of visitors, etc.), diminish the duration of visitation in some areas or the entire MPA, make more difficult the access to some sites or improve it in others, eliminate infrastructure (parking lots, bridges, services, signs) in problematic areas, demand that visitors be briefed upon arrival, regulate type of equipment or skills required, control certain types of transportation (motor, animal traction, walking) and prohibit access to some areas, etc.

Modify location

Move trails and infrastructure out of susceptible areas to more resilient ones, design areas for camping and other uses, separate the time and location of the certain conflictive uses.

Modify time of use

Prohibit or prevent visitation or certain uses during periods with higher potential impact to wildlife, soils, vegetation; promote visitation out of the season of maximum impact

Modify activities

Limit the size of the groups, demand skills, teach environmental ethics, demand certain qualifications in guides, improve surveillance, contact with visitors and regulation enforcement.

Modify visitors' expectations

Visitors should be informed on the existing conditions (susceptible resources, etc.), the protected area goals, and management objectives and involve them in planning process.

Environmental interpretation: a tool for public use

Sharpe (1988) stated that environmental interpretation is a service for parks, forests, wildlife refuges, recreational areas. Although visitors desire to rest, they also want to learn on the natural and cultural resources of the area. These resources comprise geological processes, plants and animals, ecosystems, and historic and pre-historic values. The environmental interpretation is a combination of techniques to reach out to the public in a way they can understand the natural and cultural values of the site, without losing meaning and accuracy of the message.

Interpretative planning

It must be integrated with all the activities of the management plan, according to zoning scheme. Activities must be well designed as well as a budget for their implementation.

Planning scheme (Morales, 1992)

¿why we want to interpret the environment?

¿which are the objectives and the area limitations?

¿which messages we will use?

¿Who is the target audience? A profile of the audience is needed.

¿How, when and where **will be implemented the interpretative elements**? ¿Which media

and techniques will be used?

Interpretative tools

There are different tools for interpretation, depending on the type of audience, the resources, managers' interests, conservation objectives, material resources availability, and other administrative details. They can be individually tailored or not, and guided or self-guided.

Not individually tailored or self-guided.

Outdoor displays: Very common for showing isolated features, basically along roads or trails, Can be visual (an old tree) and can include photos, drawing sketches, texts, tridimensional objects. Their location in obligated stops or sites with significant values is very effective.

Publications: overall they should be distributed upon arrival and accompany the visitor, or be a supporting element for expanding the interpretative experience. The language is very important.

Visitor centers: These are centers for the reception and welcoming of visitors, and its location should be carefully selected. These centers provide initial information which serves as starting point to the visit. They usually include a reception area, an exhibition room, a lecture and projection room, and an administrative area.

Interpretative trails: Although the term “self-guided trail” is used when sightseeing occurs along a trail, self-guided tours can also be offered in many other areas. As in guided tours, they usually take people through a sequence of planned thematic stops. Self-guided tours are commonly used to show aspects that cannot be seen otherwise, or that a non-trained eye would not notice. They are conducted in a track whose signalization (signs, posters) allow for the visitor to walk alone. It is important to emphasize that people are autonomous in trails, so they move freely and their own pace.

Individually tailored or guided

Dramatizations: It is a staged scene that recalls facts and customs, so the public can have a “live” experience.

Lectures: They must be entertaining and different techniques can be used. They have to be well organized around a central subject. The best way is to know if the lecture is amusing and interesting is to look to the audience reaction.

Guided tours and walks. There are different ways to design such activities. In any case, the interpreter or guide leads the group through a series of pre-fixed stops or sites where a value must be highlighted. The role of the interpreter or guide is to “discover” what is difficult to see. Tours are good in places where there are important things to see.

INTERPRETATION/EDUCATION/OUTREACH

- ◆ What is the message you want to convey?
- ◆ Which audience(s) you want to reach?
- ◆ What is the social and cultural background of these audiences, their knowledge of the subject, and what methods and media are suitable for each?
- What resources are available?

MODULE 8	RESEARCH AND MONITORING
OBJECTIVE	<ol style="list-style-type: none">1. To convey the message that research and monitoring is essential for good management and stewardship.2. To improve management success through the design and application of standard monitoring methods.
THEMES	<ol style="list-style-type: none">1. Introduction to research and monitoring (0.5h)2. Use of remote sensing and geographic information systems in research plans (2h)3. Ecological, physical, and cultural resources monitoring (2h)4. Basic economic and social science research (1h)5. Monitoring visitor and user data (1h)6. Monitoring of effectiveness of restrictions and zoning (2h)
DELIVERY TIME	1.5 days (9 classroom hours and a 6-hour field trip)

MODULE 8
THEME 1
OBJECTIVE
SIGNIFICANCE
PRESENTATION
EQUIPMENT / MATERIALS
EXERCISE
TIME

RESEARCH AND MONITORING

Overview and Introduction to Research and Monitoring

Re-affirmation of the importance of research and monitoring plans.

Research and monitoring within marine protected areas is essential for good management and stewardship.

Lecture

Projector, PowerPoint presentation

Discuss with participants which MPA as a research and monitoring program

1h

TUTOR'S NOTES

- Some of the research described in this chapter may be beyond the financial or scientific capabilities of some marine protected areas in the Wider Caribbean Region. However, the increased academic interest on marine conservation is an excellent opportunity for managers to attract research resources (logistic support, human and financial resources).
- Due to the wide coverage of this module and the continuing production of research information, it does not include all the existing methodologies for conducting research and monitoring in MPAs.
- Participants should be advised that managers should be realists and understand what types of research and monitoring are feasible given the site-specific conditions.
- Many of the sites that are mentioned in the text are included in the accompanying PowerPoint presentations; however, instructors may need to reach out to colleagues in the region through CaMPAM list server and UNEP-CEP to look for additional information assistance from experts.
- The accompanying publication list (elibrary) should be consulted.
- The Module was designed for MPA managers can determine their biophysical and socioeconomic research and monitoring needs in order to improve management. Active search of updated information is encouraged.

INTRODUCTION

Research within a marine protected area (MPA) is essential for good management and stewardship. At the initial stages of MPA designation and the development of the management plan, research can provide environmental managers with a rationale for setting standards and giving quantitative predictive models for the selection of management strategies. After implementation of the management plan, research will assist administrators by monitoring the health of the marine resources, the extent of human uses of the area, and the impacts produced by humans on the resources. This information is essential for regulating and perhaps limiting use. Research programmes may perform some of the following functions:

- ◆ Inventory the marine resources that exist in the MPA;
- ◆ Observe and evaluate impacts (anthropogenic and natural);
- ◆ Determine uses and threats to MPA resources;
- ◆ Obtain fundamental scientific knowledge;
- ◆ Determine changes in the health of the resources, as well as changing uses;
- ◆ Evaluate compliance with regulations;
- ◆ Offer early warning signals of problems;

- ◆ Provide a link to broader research efforts outside the MPA; and
- ◆ Offer solutions to issues and problems in the management of the MPA.

The objectives of the research programme will depend on the management objective of the marine protected area.

The objectives of the research programme will depend on the management objective of the MPA, as follows:

- Wildlife reserve- Population data in space and time and reproductive success.
- Fisheries reserve (or no-take area) would emphasize fish population data, recruitment, age structures, and migration patterns.
- Marine national park- Would closely track the impacts of human uses in the area on the quality of the marine resources and ensure that the recreational uses of the area do not impact negatively on the preservation of the marine resources.
- A marine multiple-use area- Would require research that examines the impacts of various human activities on each other and on the marine resources, in an effort to minimize user impacts and conflicts while allowing activities that are consistent with long-term resource conservation objectives.

Research and monitoring activities in an MPA must be sensitive to the existing funding, although creative MPA managers might be able to extend capabilities through partnerships.

IDENTIFICATION OF RESEARCH AND MONITORING NEEDS IN SUPPORT OF MANAGEMENT

Research in MPAs includes ecological, physical, and social inventories and baseline research (preliminary diagnosis or referenced ecological and socioeconomic characteristics), long-term monitoring, and studies of impacts on the marine resources (anthropogenic and natural). Each type of research is important and plays a distinct role in the management of MPAs.

Research should be of the applied type, and designed to address management-driven questions.

Research activities also cover basic scientific research that may appear to have no immediate

link to management questions. Rather, they address “pure” research questions and advance the frontier of knowledge. This type of research should not be a priority for the MPA managers, although managers may recognize the long-term advantages and contributions of this activity, as well as the occasional findings that have immediate applicability. If “pure” scientific research does not conflict with management goals and is cost-effective, it serves as an added justification for the establishment and existence of the MPA (Harmon, 1994) and can even contribute for the MPA to be recognized (marketed) internationally with its consequent benefits.

Types of research

1. Resource inventories and baseline research

Baseline inventories are essential for the development of the MPA management plan and establishment of regulations for use of the MPA resources. **Without knowledge of the existing resources and current human use of them, imposing regulations becomes impossible.**

Ideally, baseline information should be obtained prior to establishment of the MPA, and at the beginning of implementation of management strategies, in order to determine initial conditions. Subsequent changes in physical parameters, ecological data, or human uses can then be compared to the baseline data. Baseline research should also quantify human activities outside the MPA which could have an impact on MPA resources (water pollution, habitat destruction, coastal development, forestry, hunting and fishing), as well as activities inside the MPA (boating and maritime transportation, fishing, diving). This preliminary diagnosis should also measure the health, abundance, and distribution of living marine resources, as well as sediment and water parameters.

Among the most common investigations are the studies of the biological cycle organisms, characterization of habitat or certain taxonomical groups (fish, corals, sponges, algae, birds).

2. Biological characteristics of organisms

The knowledge of the biological characteristics of key plant and animal species (due to their abundance, role in the ecosystem or commercial value) that inhabit the MPA and its surroundings is critical for developing management strategies. Among the most important biological processes are the following:

1. Size and age population structure (animals and plants);
2. Abundance or density of certain species or groups;
3. Size of the spawning populations and their reproductive potential;

4. Environmental and physiological factors that determine certain key mechanisms such as juveniles' recruitment to nursery areas, and reproduction
5. Identification of spawning aggregation sites for fish, invertebrates, mammals, birds, reptiles) and the process dynamics;
6. Breeding season of key invertebrates (stony corals, lobsters, shrimps, etc.);
7. Growth rate and feeding habits of species of ecological and economic interest;
8. Migratory routes (e.g. reef and oceanic-pelagic fishes, manatees, birds, etc.)

These investigations allow adjusting management measures such as zoning to identify no-take or no-touch areas, public use zones, and areas for fishing and tourism use, as well as specific regulations for resource extraction, visitation, boating, anchoring, waste treatment, within the MPA and in the buffer zone and the surrounding area.

Among the most known research projects are those for locating, validating and characterizing reef fish spawning aggregations, manatees' routes, bird and turtle nesting sites, population abundance of commercial fishes, etc.

Composition, structure and functioning of ecosystems

This is the most common type of investigation among marine conservation scientists. They are less expensive than those that require the collection of specimens. The use of new technologies such as geomatics has allows not only to process the information faster and more accurately, but also to produce visual products that show the spatial information more effectively for non experts. Among this type, we can mention the following:

1. Distribution of coastal habitats
2. Composition and structure of coastal fish communities (of the reef-mangrove-seagrass complex)
3. Reef coral and algal cover (to evaluate reef health)
4. Mangrove fauna

Physical and chemicals characteristics of the marine environment

Oceanographic investigations in protected areas are less common due to the spatial scale that the need. However, the interest of knowing the dispersal patterns of propagules (larvae), contaminants and sediments and the mechanisms that influence fish reproductive aggregations at the shelf edge require to invest in studying marine current direction and speed, or the morphology of submarine relief within the protected areas and its surrounding areas.

Monitoring

Continual, long-term, statistically valid monitoring in the MPA should measure the health,

abundance, and distribution of marine resources over time (Agardy, 1997). Trends in these parameters may suggest new management strategies. MPA administrators should consider innovative approaches that involve continuous monitoring and gathering of data by volunteers or students. This continuous monitoring permits analysis of changes caused by natural environmental variability and/or user impacts.

Additionally, monitoring should include studies on-site and off-site of human activities and uses of the marine resources, as well as effectiveness of adopted management strategies. Researchers and MPA managers will correlate the resource variability with the changes in human uses. Conclusions regarding the human impacts on the MPA resources are key tools for managers. This information should be linked to management strategies through feedback links that consider revision of the management strategies in light of the new information.

The design of a monitoring program should include the following factors:

- Get input from resource users, members of local communities, MPA personnel, personnel from related government agencies, and social and natural scientists.
- Identify and prioritize research needs that clearly respond to the needs of management and the relevant management philosophy.
- Examine costs and personnel use.
- Select methodologies and tools used within the country, the region or internationally for attracting external resources and being able to make comparisons

Resources for research

MPA managers should promote the use of their site for research activities that will provide information that they have determined is useful and essential for management of the area. An initial step involves the development of a research plan that is realistic considering the budgetary constraints (financial resources) and available research personnel (human personnel). The priority research must be closely linked to the management of the MPA and assist in the formulation and implementation of the management plan. MPA managers and scientific staff should attempt to include research activities within the budget of the MPA. Alternative sources of research funds might include user and admissions fees, rent paid by MPA concessionaires and monetary recovery from natural resource damage assessments. In addition, managers should develop proposals for funding of research activities from other government agencies, foundations, universities, and non-governmental organizations (NGOs).

Protected area authorities should attempt to develop cooperative linkages and partnerships via Memoranda of Understanding (MOU) with national or international universities, national or international NGOs, or local communities (fishers, mangrove users, tourists) for financing research programme and providing effort. The link with national universities should be

actively explored because this institution's mission is most likely focused on national issues and protection and management of the nation's natural resources. These researchers should also be the most sensitive to the cultural and political nuances of the country's MPAs. Moreover, this link will promote the development of a cadre of national social and natural scientists. In some situations, the private business sector may be willing to support specific projects. Even if the MPA lacks the essential research infrastructure (monitoring and laboratory equipment), creative arrangements and agreements with other entities may overcome this deficiency.

Management of research

The MPA must establish guidelines for the management of research activities within its area of jurisdiction for both local and external researchers.

All research conducted in MPAs should make a positive contribution to the management needs of the MPA.

MPA research managers should require that all research within the MPA be approved to ensure that it is compatible with the management objectives of the area and that it makes a positive contribution to MPA management needs. The staff must evaluate the research objectives, methodologies, and the qualifications of the researchers. An initial question concerns who will establish the research objectives. MPA scientists may establish objectives in close communication with managers. MPA managers should seek advice from marine scientists and social scientists. Research plans should be open to scientific peer review. In situations where the MPA lacks staff scientists, the research initiatives may originate from the scientific community whose primary interest may not be MPA management. In this case, MPA managers must determine the information that they wish to obtain and negotiate its delivery with extra-MPA researchers.

The MPA officials should monitor research activities and require that researchers deliver copies of research results, as well as specimens, to the MPA research coordinator. The sampling strategies should cause minimal disruption as possible of the marine resources, human use of the resources, and surrounding human communities. The protected area office should maintain a comprehensive record of all research activity that has been conducted in the area, along with research results and relevant publications. This information could be of high importance to present and future MPA managers, as well as to future researchers. When possible, research and monitoring should conform to the regional standards to allow for comparisons among the MPAs in the Wider Caribbean Region.

Funding availability

MPA management is subject to funding availability, both in terms of baseline research and long-term monitoring. For example, if remote sensing techniques are too expensive to be used by the MPA, local managers should use local knowledge and existing charts and maps, or attract the regions academic capacity.

Projects must be funded for their entire duration, or they must at least include contingency plans; otherwise, there is a potential for incomplete research. Therefore, officials need to understand the limitations of funding on the long-term for their MPAs and proactively decide on the extent and efficiency of their activities at various funding levels. Finally, projects must remain considerably flexible (i.e., incorporate volunteers, utilize inexpensive equipment, etc.) to remain effective even with unexpected funding setbacks.

Designing a monitoring programme

In designing a monitoring programme, the following questions should be addressed:

- ◆ What are the objectives?
- ◆ What is going to be monitored?
- ◆ How often should data be collected?
- ◆ How long data collection should be continued?
- ◆ What methods will provide the best data?
- ◆ Who will conduct the monitoring?
- ◆ What methods are realistic, considering the available time, money, equipment, people, and skills?
- ◆ What experimental design is necessary to capture the spatial and time variability of the selected indicators?
- ◆ What kind of quality assurance will be used to ensure data of the highest quality?
- ◆ How will the data be subsequently analysed?
- ◆ How will the data be stored and retrieved?

MODULE 8	RESEARCH AND MONITORING
THEME 2	Use of remote sensing and geographical information systems (GIS) in research plans
OBJECTIVE	To introduce course participants to the advantages and limitations of remote sensing and GIS applications.
SIGNIFICANCE	Geomatics is increasingly being used in MPA management for rapidly gathering data over large areas and generating visual products. Thus, GIS applications are in increased demand due to the need for improved data management in terms of relational databases.
PRESENTATION	Lecture, demonstration
EQUIPMENT / MATERIALS	Computer, maps
EXERCISE	Demonstration of data access from a machine-readable storage format
TIME	2h

TUTOR'S NOTES

Here we provide a general description of the geomatics science and techniques, and its application to the design and Management of marine protected areas. This field is constantly developing and its application to environmental conservation is expanding. For updating information, we recommend you to consult primary sources, as well as NOAA's <http://www.csc.noaa.gov/crs/>, USGS <http://coralreefs.wr.usgs.gov/mapping.html> and the University of South Florida Millennium Mapping project <http://www.imars.usf.edu/MC/index.html>

It is important for you to understand that a map is as good as the data that were used to generate it. If the data are not correct, the image (map) can mislead users, particularly those less knowledgeable. Thus, the MPA manager has to be aware that this is a very effective visual tool and be extremely responsible with the way it is produced and used.

INTRODUCTION

Geomatics is the discipline of gathering, storing, processing, and delivering of geographic information, or spatially referenced information. The term has been proposed by B. Dubuisson in 1969 and includes remote sensing tools and techniques, field surveys, geographic information systems (GIS), global positioning systems (GPS) and other mapping tools. In some countries the term “geospatial technology” is also used.

Its use in marine protected area design and management has increased in the last years. It can be utilized to cover large expanses and broadly assess an area's multiple resources. More advanced technology can assist in the identification and mapping of smaller features. **However, remote sensing techniques, aerial photography, aerial surveys, and satellite imagery, are generally coupled with ground-truthing surveys.** Therefore, remote sensing represents a two-tiered approach to assess a marine protected area's resources. It is an expensive technique, requiring specialized equipment and expertise; however the access to such technology is becoming easier and less expensive. Equally important is the fact that remote sensing should not substitute for more detailed surveys. While it can provide broad-scale and, in some instances even medium-scale data, it cannot duplicate other, more detailed monitoring efforts.

1. Aerial photography and surveys

Aerial photography and surveys refer to data collected from an altitude at a specific scale. The scales can range from 1 to a few hundred through 1 to a many thousand, depending on altitude. Surveys generally differ from photography, as the former implies actual data collection. Aerial surveys may focus on boat counts and patterns, marine mammal data collection, and other parameters. Aerial photographs may be taken using many different types of film, including color, black and white, infrared, ultraviolet, and combinations, and others. The scale, film, and equipment used generally depend on the resource being studied, as well as the financial capability of the researchers.

2. Satellite imagery

Satellite imagery has developed as a remote sensing option for smaller marine protected areas over the past two decades, especially with the introduction of the Coastal Zone Scanner in the late 1970's. Since then, satellites have been developed to detect sea surface temperatures, infrared radiation, chlorophyll, sea height, and other biological and physical factors. Representing the high end of technology, satellite imagery requires extensive funding and expertise.

3. General Methodology for Remote Sensing in Research and Monitoring

If remote sensing is a financially viable option that can be utilized for the creation of base maps and monitoring efforts, it should be utilized to characterize a marine protected area and its resources. Data should be received in the form of maps that show considerable detail, such as reef structures, seagrass communities, mangrove forests, beaches, etc. Features should be readily distinguishable.

4. Remote sensing imagery

A scale that shows the detail required should first be chosen, and images should be photographed or scanned at that scale. The appropriate film or imagery should be chosen for the site (i.e. infrared, black and white, etc.). If the site is sufficiently large, a composite of images should be captured such that they match each other at approximate boundaries.

5. Feature codes and mapping

The resulting image can only prove useful if the individual regions are sufficiently coded and mapped within the image. Named reefs, forest, and communities should be coded and traced over the image, and all other large features should be identified within their community types.

Information from remotely obtained images should go through a system of ground-truthing. This can assist in not only determining the accuracy of the information provided by remote sensing, but it can develop so-called "community signatures" or gross morphology of individual community types (Sullivan and Chiappone, 1994).

If financially feasible, the image should be digitized into a computer map. Using GIS, researchers can now link the computer maps with databases with attribute information so that the maps provide both geographical and environmental data. Like remote sensing, GIS is expensive and requires extensive training, as well as sufficient computer hardware. However, it can also manipulate and display spatial information generated from research and monitoring on base maps that change to reflect changes in the resource base.

6. Geographical information systems (GIS)

GIS is a computer technology that stores, analyzes, and displays spatially referenced data. A GIS plots attributes (data) on base maps, i.e. bathymetry, habitat, fishing zones, maritime transportation routes, habitats of endangered species, sewer outfalls, etc. The GIS technology is powerful because it allows changes in legends and scales. It also facilitates creation of overlays of selected attributes, thus producing new maps that may be specifically tailored to a management issue. It is also possible to spatially track the condition of a marine resource over time. This provides insight about potential threats to the resources and user conflicts. The GIS technology creates a significant saving of time and effort.

Limitations to the use of GIS include the absence of original attribute data. Even when they do exist, data may be deficient or difficult to obtain, especially for the marine environment. For example, existing data may be spatially insufficient or may also be housed in different sources and expressed in forms that are often incompatible. Costs of obtaining the data may be prohibitive.

MODULE 8	RESEARCH AND MONITORING
THEME 3	Ecological, physical, and cultural resources monitoring
OBJECTIVE	To impress on MPA managers the need to include all of the various resources and impacts in the monitoring programme.
SIGNIFICANCE	There is growing awareness that research and monitoring programmes that focus only on flora and fauna do not 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.
PRESENTATION	Lecture, field exercises
EQUIPMENT / MATERIALS	Projector, PowerPoint presentation
EXERCISE	Field demonstration
TIME	2h

TUTORS' NOTES

In the last years, several MPAs have been evaluated for their effectiveness using biophysical, socioeconomic and governance indicators developed by different organizations. The tutor should encourage participants to consult these primary sources if they need detailed information about this important issue. This course is accompanied by a PowerPoint presentation that presents the results of one of those assessment projects, and bibliographic references of several relevant publications can be found in the general bibliographic list.

INTRODUCTION

MPA managers must ask what type of resource information they most need to effectively manage the area under their responsibility. The most basic information focuses on the existing flora and fauna and involves resource inventories to determine what species are present and how their distributions vary in space and time. Researchers should focus on the ecologically dominant species, as well as species that are endangered, threatened, or of key ecological interest. They must also assess the ecological relationships between species, populations, and communities. Research should also address the essential physical requirements of the important ecosystems of the MPA (water quality, habitat requirements, food and nutrients). Given the fluid nature of the marine environment, water quality and other oceanographic parameters should be key components of an environmental monitoring programme.

An additional area of ecological research focuses on monitoring the dynamics of change. Key questions that research activities could address include the changes in species distribution with time, the invasion of exotic species, the recovery and recolonization of areas that were degraded by natural or anthropogenic processes, and the impact of pollution and other human activities on the ecological resources of the MPA. This will involve performing periodical sampling of indicator and key species and recording the trends in population size, reproductive success, and species and habitat health as a function of time.

Physical parameters of the MPA are another key focus for research activities, both at the initial stages of MPA establishment, as well as during its implementation and operation. MPA managers should ensure the collection of essential data regarding water quality (parameters such as temperature, salinity, turbidity, dissolved oxygen, nutrients, and various pollutants) and water circulation. Initial research efforts should also evaluate the sources of pollutants to the MPA, whether they occur inside or outside the boundaries of the protected area.

There are widely recognized programs that are extensively used by the MPA and marine conservation community all over the world. We provide hereafter a list of some of the most used. If you visit these Websites you will find a wealth of information on the methods, the results of their application, namely:

Reefcheck

http://www.reefcheck.org/about_RC_Reef/Publications.php.

http://www.reefcheck.org/reef_management/long_term_monitoring.php. Among the objectives of this program are the following:

- Educate the public and governments on the crisis of coral reefs
- Create an international network of volunteers trained by scientists that monitor reefs and report periodically the results, using standard methods.
- Facilitate collaboration and information sharing among governments, academics, business sector and the public.
- Seek solutions
- Foster local actions

Manual of methods for the Mesoamerican Barrier Reef System synoptic monitoring program. Selected methods for monitoring physical and biological parameters

For use in the Mesoamerican Region. P.C. Almada-Villela, P.F. Sale, G. Gold-Bouchot and B. Kjerfve. April, 2003. <http://www.mbrs.org.bz/dbdocs/tech/SMPMan03.pdf>

Fish Spawning Aggregation Sites in the MBRS Region: Recommendations for monitoring and management. <http://www.mbrs.org.bz/dbdocs/tech/Protocol16.pdf>

As the other monitoring protocols, it includes criteria for using, indicators, equipment, and methods for data collection, processing and analysis, etc.

Monitoreo voluntario de alerta temprana de arrecifes coralinos. http://www.ecosis.cu/chm/noticias/manual_monitoreo_alerta_temprana_arrecifes_coralinos.pdf

Alcolado, P. 2004.

How you MPA is doing . R.S. Pomeroy, J. Parks y L.M.Watson.

<http://effectivempa.noaa.gov/guidebook/guidebook.html>

Guidelines for establishing research priorities and planning activities are given in Appendix 8.1.

Manual for the Rapid Evaluation of Management Effectiveness in Marine Protected Areas of Mesoamerica. 2004. <http://www.mbrs.org.bz/dbdocs/tech/Effective.pdf>

MODULE 8

THEME 4

OBJECTIVE

SIGNIFICANCE

PRESENTATION

**EQUIPMENT /
MATERIALS**

EXERCISE

TIME

RESEARCH AND MONITORING

Basic economic and social science research

To introduce the social and economic perspectives into the MPA decision-making process.

Patterns of exploitation of natural resources are rooted in the attitudes and social norms of the exploiting peoples, as well as the prevailing economic conditions.

Lecture

Case study

1h

INTRODUCTION

Most of the problems the MPA managers face are social and political. These concern the relationship of people and the marine and coastal resources of the protected area. The central nature of these questions suggests that MPA managers and research coordinators should give priority attention to social and economic research programmes. These research questions will, at a minimum, include monitoring of human uses of the MPA, as well as economic and social impacts of the MPA. An ideal social research programme, however, would embrace a much larger set of social science issues that span the entire range of social sciences from economics, sociology, anthropology, psychology, political science, and law. These research questions relate directly to the establishment and effective management of the MPA. The Socioeconomic Manual for Coral Reef Management (or SocMon, by L. Bunce, P. Towsley, R. Pomeroy and R. Pollac. GCRMN, 2000)

http://www.reefbase.org/socmon/pdf/GCRMN_Manual.pdf

And the **Socioeconomic Monitoring Guidelines for Coastal Managers** (SocMon Caribbean)

(http://www.reefbase.org/socmon/pdf/SocMon_Caribbean.pdf) published by L. Bunce and R. Pomeroy, 2003 describe the methods and their use in environmental management

Many of the problems associated with MPA management are influenced by social and political conditions, and the research and monitoring programme must therefore cover the full range of issues.

1. Economic research

Economic research initially should focus on the effects of establishment of the MPA. It is important to determine the social and economic groups that gain and lose as a result of the creation and operation of the MPA. For example, researchers might determine the jobs and income opportunities which are created or lost in local communities because of the MPA. The MPA might also impact the economies of local communities through business development, changes in the tax base, and increased or decreased economic stability. These parameters should be examined and quantified. In short, research questions analyze the economic impact (costs and benefits) of the MPA establishment and operation. The MPA administrators might elect to compensate the “losers” in some manner.

Environmental management strategies have moved away from “command-and-control” to “market-based” techniques. Economic research might provide realistic information that would permit managers to establish economic incentives to encourage compliance with MPA regulations.

The economic valuation of the contributions of MPAs to society can be important

when decision-makers determine whether to establish an MPA, justify its existence, or grant sufficient funding for implementation of effective management strategies (Dixon and Sherman, 1990). **Clearly, administrators must be cognizant of the role of the MPA in regional economic development.** They must be able to document the contribution of the MPA to the real markets of local economies. At the same time, MPA administrators must survey local user groups and the public to monitor values of the MPA that cannot be registered by local markets.

MPAs provide water, fishery resources, recreational opportunities, control of microclimates, shoreline protection, and spiritual well being. Methodologies for quantifying the values of these goods and services are still rudimentary. Seldom have the economic benefits of MPAs been documented. However, initial calculations for the values of the benefits resulting from MPAs and discussions of uncertainties are better than a total absence of information (IUCN, 1998).

MPAs offer values that may be divided into Direct Use Values and Indirect Use Values. Direct Use Values represent those goods and services that enter directly into the human economy and refer to present and future benefits. Consumptive Use Values are the result of an individual's consumption of the resource during a given period of time, compared to Non-Consumptive Use Values that may produce enjoyment for various persons at the same time. Indirect Use Values include values of ecological services, as well as values of potential future use (Uncertain Use Values).

Consumptive Uses include fishing, extraction of algae and shellfish, and harvesting of mangrove wood products. These products may be extremely important for local communities within or surrounding an MPA. Values for these products may be estimated using the direct market values and revenue and expense analyses. Non-consumptive Uses of MPAs, such as tourism and recreation, aquatic transportation, scientific research, environmental education, aesthetic values, are more difficult to estimate than Use Values. Their values have to be estimated using methods that attempt to capture the resources that people spend in carrying out these activities. Such methods involve Travel Costs, Hedonistic Valuation, or Replacement Costs.

Indirect Use Values are much more difficult to estimate than Direct Use Values. Coastal and marine ecosystems provide a number of ecological services. Mangroves and other coastal wetlands protect coastlines against erosion and storm events. Seagrass beds help maintain coastal water quality, while coral reefs are important sites for genetic and biological diversity. People may value these resources for their intrinsic values or because they hope to use them one day. However, although we recognize the importance of these functions, determination of values is controversial

and uncertain, although important. Methodologies that are in various stages of evolution include estimation of the costs to perform a similar function by an alternative method, Replacement Valuation, and Contingent Valuation. Contingent Valuation Methodologies survey the population to determine its Willingness-To-Pay or Willingness-To-Accept for an ecological/environmental product or service (Barzetti, 1993).

Economic research might also address the issue of concessions within the MPA. Financial analyses could address the question of establishment of fees that the concessionaire would pay to the MPA administration and whether these fees provide maximum benefits to the MPA, as well as to the concessionaire.

2. Sociological research

Sociological research may examine the perceptions of resource users, residents of local communities, the general public, and national agencies regarding the purpose and goals of the MPA. This type of research will indicate to managers how gender, economic and social class, and user interest relate to the concerns, views, and expectations about the MPA. Other studies might assess the user (tourist/diver) satisfaction with the MPA experience. A trend analysis of satisfaction might assist managers in developing new regulations that would enhance the public's enjoyment of the marine resources.

Studies of public participation mechanisms may elucidate the strategies for public outreach that are most effective in conveying information about the MPA and developing active dialogue with members of the community and user groups. This information may enhance the MPA manager's ability to communicate with the public.

Additional studies may analyze the conflicts and cohesion between user groups, as well as between users and the MPA management. Information about the source and development of conflicts will greatly assist eventual conflict resolution.

Sociological research might also examine enforcement of MPA regulations. Observations regarding public perceptions regarding compliance with the law, trends in non-compliance, and spatial and temporal distribution of non-compliance all could assist the development of an improved and more effective enforcement strategy.

3. Anthropological/cultural research

Cultural research elucidates the organizational structure of communities and cultures (traditional and non-traditional) that are adjacent to or within the boundaries of the MPA. Through ethnographic surveys, interviews, and other observational methods, researchers characterize the value systems of communities and the role marine resources play in this value system. Themes that will be of direct use to MPA managers include: marine property rights systems of the local community, the importance of the marine resources for community well-being and stability, and the traditional and non-traditional techniques developed by local users to conserve and exploit marine resources. Because all communities must face cultural, technological, social, political and environmental change, research should explore the ability of the traditional value systems to adapt when confronted by change. The establishment of a marine reserve/MPA may cause change in the community and its ability to exploit marine resources, and the MPA manager should be aware of the impacts for which he/she and the MPA policies are responsible. Surveys and interviews of community leaders and residents can elucidate the perceptions of the community to the MPA and its objectives and to the conservation ethic (Gubbay, 1995).

One consideration of anthropological research is who is best suited to collect information about the community. It might be the outside anthropologist herself or in cooperation with existing local access channels to the community.

4. Political science research

Research in the Political Sciences can be important both during the establishment of the MPA, as well as during the operational phase. Institutional analyses can assess the division of governmental functions inside and outside the MPA among different agencies at different levels of government. This will indicate where possible conflict among agencies may occur and where competence is shared or repeated among various agencies. Analyses of the power and decision-making centers in the local community and at the national level can suggest the individuals or institutions that MPA administrators must approach to obtain enhanced support for MPA plans, funding, and operations. An understanding of local pressure groups and interests is essential for resolving the conflicts that inevitably arise among different user groups or between different user groups and agencies.

5. Legal research

Legal analyses at both the national and international levels will elucidate the statutory or regulatory bases for MPA management strategies, as well as possible overlaps in competence of various institutions. The growing body of international and regional environmental conventions and protocols may present the MPA manager with additional responsibilities, as well as opportunities for action and international cooperation that support research and management. Legal analyses can also evaluate the effectiveness of the legal basis for the MPA in question and suggest revisions that may facilitate effective management strategies.

MODULE 8
THEME 5
OBJECTIVE
SIGNIFICANCE
PRESENTATION
EQUIPMENT / MATERIALS
EXERCISE
TIME

RESEARCH AND MONITORING

Monitoring visitation and other uses

To reinforce the importance of recording visitor/user levels and patterns.

Patterns and levels of use of the MPA resources must be monitored in order to determine the impact on the resources, use and user conflicts, and ultimately the linkage to the management objectives of the MPA.

Lecture, case study review

Case study

Case study review

2h

INTRODUCTION

The research and monitoring plan must include the types and levels of human interventions in the MPA. This is important in order to subsequently assess the impacts that they cause on the marine resources, the conflicts that may arise between uses, and the levels of visitor and user satisfaction with the management strategies and quality of the resource base.

The user data measured will depend on the importance of the human activity in the MPA. Possible parameters measuring the uses of the MPA and the nature of the activities might include the following:

- a. Research Scientists
 - ◆ Number;
 - ◆ Institutional affiliation;
 - ◆ Activity;
 - ◆ Locations of their research sites;
 - ◆ Equipment used;
 - ◆ Material extracted; and
 - ◆ Publications and research products.

- b. Tourists/Divers
 - ◆ Number per year;
 - ◆ Origin;
 - ◆ Frequency by month or season;
 - ◆ Specific dive sites;
 - ◆ Secondary activities (spearfishing, photography, collection);
 - ◆ Types of vessels used to transport divers;
 - ◆ Types of commercial operations involved;
 - ◆ Amount of money spent on the activity; and
 - ◆ Levels of satisfaction with the activity.

- c. Fishers
 - ◆ Number of fishers per year, month, season, week;
 - ◆ Catch (species, size, methods of catch, weight of catch);
 - ◆ Multi-species nature of fishers' efforts;
 - ◆ Fishing effort (catch per unit effort);
 - ◆ Types of fishing arts;
 - ◆ By-catch data; and
 - ◆ Site-specific information on fishing activities.

- d. Mangrove Users
 - ◆ Number of persons involved;
 - ◆ Harvest products;
 - ◆ Species harvested;
 - ◆ Commercialization;
 - ◆ Site of extraction;
 - ◆ Frequency of harvest; and
 - ◆ Harvest techniques.

- e. Boating
 - ◆ Number and types of vessels;
 - ◆ Home port;
 - ◆ Frequency of activity (number of trips per week, month);
 - ◆ Routes;
 - ◆ Pollution incidents;
 - ◆ Groundings; and
 - ◆ Speed zones and violations.

CARRYING CAPACITY

Concept of carrying capacity

The determination of carrying capacity is a complex process involving an understanding of effects that users have on the environment, and a calculation of the total number of users that can use the environment without significant degradation. Carrying capacity needs to consider the ecological impacts on the environment, as well as the socio-economic impacts on the surrounding areas. According to Dixon *et al.* (1993);

“there is a maximum level of use that is sustainable . . . [which] may be lower than what is desired by local government or business interested, but must be respected if the investment in marine natural capital is to be economically profitable and if marine parks are going to meet both ecological and economic goals.”

Definition of carrying capacity

A 1991 seminar on coastal and marine parks and protected areas (Clark, 1991) determined carrying capacity is a twofold management objective defined as:

- a. A particular threshold level of tourist activity beyond which there will be physical deterioration of the resource, or damage to natural habitats; and
- b. The maximum visitor loading acceptable to both the visitors and the people living in the surroundings of the protected area.

There are three major impacts in MPAs that are exacerbated by increased density; they include tourism industry impacts, development activities and related impacts, and pollution impacts (Clark, 1991). Tourism industry impacts include: boating damage via anchoring, groundings, and chemical pollution; diving and snorkeling damage caused by inexperienced users breaking or smothering sensitive habitats, or extensive use (Davis and Tisdell, 1995); scenery appreciation and wildlife viewing, which can negatively impact the environment and cause increased traffic that can affect the users and visitors. Development activities and related impacts include: dredging, filling and mining activities that can negatively impact the marine environment (increased turbidity, sedimentation); and coastal development that affects terrestrial-marine interface zones and impact natural systems such as runoff and erosion. Pollution impacts include: domestic sewage that may result in eutrophication and public health threats; agricultural and industrial wastes and oil spills from land or marine sources which could degrade or devastate habitats in an MPA. The impacts that concern most MPAs are those that are caused by the tourist industry. However, development and pollution impacts are often functionally related to the tourist industry, and the impacts from each source tend to rise simultaneously.

Implementation of the carrying capacity concept

In order to control these impacts and sustain an MPA for present and future uses, carrying capacity objectives must be considered. The surrounding region needs to be considered as well, in terms of pollution and developmental impacts that may affect the MPA. Clark (1991) discusses the role of research, the control of visitor damage in MPAs, and mitigation and rehabilitation as measures to determine and implement carrying capacity in protected areas. Because carrying capacity differs by location, it is best implemented as a site-specific activity and left to the discretion of the management authority.

EXAMPLE 8.1: Social impact assessment and carrying capacity in the Great Barrier Reef Marine Park (Broome and Valentine, 1995)

This report, which discusses methodologies by which to conduct social impact assessments in marine parks, also provides two well-known frameworks on social carrying capacity. They include Limits of Acceptable Change (LAC) and Visitor Impact Management (VIM).

The LAC process specifies management of use within standards rather than at use levels. It calls for the identification of issues, the definition of opportunities, selection of resource and social conditions, an inventory of those conditions, specification of indicators for each opportunity, identification of alternate opportunity allocations, identification of management options for each alternative, and the evaluation and selection of preferred alternatives.

The VIM process accepts the tenuous link between use levels and social and environmental impacts, and it attempts to address area management through three issues: identification of problem conditions, determination of potential causal factors, and selection of potential management strategies.

Another strategy suggested is to take crowding perceptions from visitors and apply those in a percentage-based matrix that suggests ameliorative action.

EXAMPLE 8.2: Diver carrying capacity study in Bonaire National Park (Dixon *et al.*, 1993)

The study determined the maximum loading of divers on the coral reef sites in Bonaire National Park, providing carrying capacity totals based on ecological and economic factors. The researchers developed a carrying capacity curve per site, suggesting that loading should be maximized at 5,000 dives per year per site. The researchers also considered means by which to limit access, including a discussion on permits and user fees, to maximize profits while minimizing ecological impacts.

MODULE 8
THEME 6
OBJECTIVE
SIGNIFICANCE
PRESENTATION
EQUIPMENT / MATERIALS
EXERCISE
TIME

RESEARCH AND MONITORING

Monitoring of Effectiveness of Restrictions and Zoning

To increase management success through improved design of use areas and measurement of the impacts of user regulatory guidelines and measures.

Different ecosystems/resources within the MPA have different sensitivities and vulnerabilities, and provide different ecological functions. As such, all resources cannot support the same types and levels of use. Monitoring the effectiveness of use guidelines facilitates better management of the impacted resources.

Lecture, case study review

Case study

Case study review

2h

INTRODUCTION

This research overlaps into basic research that is beyond recording and quantifying the impacts of activities on MPA resources. The question addressed is whether zoning in the MPA effectively limits the negative impacts of multiple uses. Experiments might be designed to compare two MPA zones: a zone with restrictions and another without restrictions. Restrictions may include no fishing, no spearfishing, no anchoring, no wake speed limits, no dredging. Alternatively, an ecosystem in the MPA could be zoned into a “use zone” and a “no use zone”. Differences in the ecosystem and physical resources over time might be due to the impacts of user activities. Limitations include slow/imperceptible changes, absence of control over human uses in the “no use zone”, or unrelated variations in environmental conditions. An example of this approach is being adopted by researchers in the Sambos Ecological Reserve of the Florida Keys National Marine Sanctuary. The regulations for the reserve, established in 1997, prohibit fishing and removal of marine resources. Monitoring efforts will compare ecological changes inside and outside the reserve.

Initial Time (t = 0)

Newly Created MPA

No Restrictions on Use

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.

Subsequent Time (t = n)

Existing MPA

No Restriction on Use

Restriction on Use

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.

INTERPRETATION AND MANAGEMENT OF DATA AND INFORMATION (Adaptive Management)

The natural, social, and managerial research described above should be based on careful experimental design, accepted and reproducible methodologies, and meaningful statistical analyses. Research results should be evaluated through peer review. Good decision-making in MPAs is based on good science. Therefore, the better the quality of the scientific data, the better the informational tools available for MPA managers.

Research results should be packaged in several different forms that target different audiences. Scientific peers will demand detailed descriptions of methodologies, results, and conclusions. MPA managers need an executive summary that will highlight results that are directly applicable to management. An additional version of research results should also target the general public.

Provisions should exist for evaluation of management strategies and restrictions after a given period (perhaps 3, 5, or 10 years) based on research results concerning the effectiveness of management strategies and restrictions on user impacts. Taking management-based research results into account, managers should redefine the problem and revise management strategies, where necessary. Management should be flexible and adaptive. Ideally, the investments in research resources, personnel, and time will promote a more effective management of the MPA. Even though they may possess limited funds and resources, MPA managers should promote some well-targeted and focused research that will allow wiser management decisions.

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Appendix 8.1

Guidelines for Research Priorities and Activities

This guide is not meant to be an exhaustive handbook for MPA research activities. It describes potential research questions and activities that could center around three important ecosystems in the tropical coastal and marine environments of the Wider Caribbean Region: coral reefs, mangroves, and seagrass beds.

CORAL REEFS

Coral reefs are often considered the marine equivalents of tropical rain forests because of the marine biodiversity they harbor (Birkeland, 1997). They serve as reservoirs for a variety of marine species which are important for many economic purposes, including genetic research, commercial fisheries, recreational fisheries, and marine tourism. Coral reefs are subject to various natural and human stressors, including increased temperatures (global warming, El Niño events), species shifts (sea urchin mortalities, crown-of-thorn starfish epidemics), diseases, pollution, and harvesting (direct coral harvests, associated faunal harvests). Because of these and other impacts that coral reefs can suffer, it is imperative that a designated MPA identify all potential sources and minimize their deleterious effects.

Coral reef ecological characterization

The most important aspect of the ecological characterization is to determine the type(s), extent, and condition of coral reef resources present in the MPA. Monitoring of the resources can only take place **after** the characterization is complete.

In order to effectively characterize the coral reefs and their associated benthic and pelagic communities in the MPA, it is important to follow a set of guidelines that require detailed descriptions and accuracy. This ensures that the baseline information can be compared with subsequent monitoring results (Kenchington and Hudson, 1988).

EXAMPLE 8.3: Assessment and monitoring of US coral reefs in Hawaii and the Central Pacific (P. L. Jokiel and E. F. Cox)

The article discusses a case study on the Hawaiian Island, that of Kahoolawe Island where volunteer and agency support led to fish/coral/sediment surveys costing approximately \$3,000 per transect. The authors believe that permanent transects would cost \$5,000 per station, followed by \$3,000 costs per station for subsequent surveys.

The authors argue that monitoring studies must be designed to answer a specific question. An extensive literature base on reef research methods exists which can be used for future assessments. Finally, sufficient funding is necessary for quality research, without which programmes are often prematurely discontinued.

Remote sensing

Remote sensing refers to the preliminary characterization of coral reef communities using tools such as aerial photography, aerial surveys, or satellite imagery. In cases where such activities cannot be undertaken, reasonable proxies such as pre-existing maps, nautical charts, and local knowledge may be used.

a. Aerial Photography

Aerial photographs can show locations of different ecosystems within the MPA and even reveal smaller features, depending on the quality of the equipment utilized. Photographs should be taken on calm days, when water clarity is best.

b. Aerial Surveys

Aerial surveys can be utilized to identify smaller features, which are first revealed in aerial photographs. Aerial surveys, more so than aerial photography, require considerable effort and may thus prove financially impractical.

c. Other Information

Existing information, such as pre-existing maps from other agencies and conservation groups, can be used where aerial methods are unavailable. Users, such as local fishermen, divers, and others can also provide a wealth of information that managers would otherwise not obtain with or without aerial methods. This local user information can assist in various management aspects, including the location of geographical features, the identification of fishery-based aggregations, and knowledge

of threatened and endangered species' habitats. However, it is imperative that coordinates be obtained for all information gathered from users, as these features should be incorporated into base maps.

Base maps

Base maps can be created by tracing all information obtained from remote sensing onto basic maps or charts. Maps developed from aerial photographs have the added advantage that they are scaled and can thus be digitized or entered directly into computers. Using Geographical Information Systems (GIS), computer maps of an MPA can be transformed into multi-layered spatial maps that may be linked to a variety of databases. Changes in the databases can show changes over the spatial map. However, GIS may not be financially practical in some areas, as it does require considerable training, as well as computer hardware and software.

EXAMPLE 8.4: Benthic habitats of the Florida Keys (FMRI, 1998)

The Florida Marine Research Institute (FMRI), with the assistance from the National Oceanic and Atmospheric Administration (NOAA), developed a GIS-based atlas and CD-ROM of the benthic habitats in the Florida Keys National Marine Sanctuary. The process commenced with aerial photography in 1991-92, when pilots took a total of 450 photos along the study area at a 1:48,000 scale.

The photos were interpreted by ecologists who developed a 24-class benthic community structure under 4 major habitats: coral reefs; seagrasses; hardbottom; and bare substrate. Ground-truthing was performed to verify the habitats described from the photographs. Data was then digitized on the photographs, and in some cases, additional detail was added. The data, now in digital format, was combined to form regional mosaics. The mosaics were then joined together to create a Florida Keys-wide, benthic habitat, data set.

Ground-truthing and preliminary surveys

After the base maps are complete, it is important to determine whether the information obtained from remote-sensing and/or from local users is reasonably accurate. Smaller regions, representing the various coral reef community types, should be identified from the base maps. These smaller regions should then be surveyed using the Manta Tow Survey technique (see English *et al.*, 1997). All boundary coordinates of the survey areas

should be recorded, as well as preliminary observations.

Selection of sample site

Sample sites, representative of the coral reef types and zones in the MPA, should be selected and surveyed in detail (see Rogers *et al.*, 1994; Dahl, 1978) The information provided by the preliminary surveys shall assist in the determination of the overall complexity in the MPA. In cases where certain sites are affected by suspected anthropogenic activities, it may prove useful to set up control and sample sites.

Site characterization surveys

Because a wide variety of methods to survey the physical and ecological characteristics of coral reef sites exist, this section shall focus mainly on the factors that need to be surveyed (see Coyer and Witman, 1990).

a. Physical parameters

The physical parameters of the water and sediments at a coral reef site can provide valuable information on the health of the site. Factors such as increased temperature and fluctuating salinity cause bleaching events in corals, and lowered dissolved oxygen and lower pH can point to changes caused by pollution. The following factors should be measured as part of a characterization study, as well as part of a monitoring program:

- ◆ Temperature;
- ◆ Salinity;
- ◆ Dissolved oxygen;
- ◆ pH;
- ◆ Light transmission/Turbidity;
- ◆ Detritus;
- ◆ Sedimentation;
- ◆ Nutrient concentrations;
- ◆ Chlorophyll concentrations; and
- ◆ Pollutant concentrations.

EXAMPLE 8.5: Study of land-based pollutants on coral reefs in the Bahamas (Chiappone *et al.*, 1998)

This study assessed water quality in patch reef near areas of development and offshore areas to determine the effects of land-based pollution on coral reefs. The objectives of the assessment were to:

- determine differences in temperature, salinity, and dissolved oxygen according to proximity from variability, area, and coastal development
- determine differences in turbidity, sedimentation, nutrients, and chlorophyll concentrations according to area, coastal development, and tidal patterns
- determine differences in sediment nutrient concentration according to area and proximity to coastal development

The researchers took sub-surface water samples using Niskin bottles, and measurements of temperature, salinity, and dissolved oxygen were taken during dusk and dawn hours using a combination temperature/salinity/oxygen meter. The study also deployed four temperature meters that provided continuous readings. Most other measurements, conducted in the laboratory, were measured during ebb and flow tides to quantify effects of land-based pollutants.

b. Benthic Habitat Surveys

Benthic habitat surveys should sample the epifaunal, sessile, and relatively sedentary life forms in the sample sites. Percent coral cover (living and dead coral), damselfish totals, and sea urchin, gorgonian, and mollusk densities should be recorded. Other important indices are percent cover of algae, sponges, and octocorals. Coring, if performed, can provide information on prior reef growth rates, past climatic conditions, and previous reef associations. Because of the seasonal variability in many regions, benthic habitat surveys should be conducted at least during the summer and winter or dry and rainy seasons, as part of the characterization study.

A variety of survey techniques are available to study benthic habitats, including line intercept transects; chain transects; quadrats; and photo-quadrats. Each of the techniques has its advantages and disadvantages, and the appropriate technique should be selected according to the complexity of the reef system.

c. Fish Surveys

These surveys should determine the density, structure, and biodiversity of fish species present in the reef site (Sluka *et al.*, 1996). In all surveys, the number and types of species should be recorded. Surveys should be conducted at different times during the day to account for diurnal and nocturnal species, and they should also be conducted during the summer and winter seasons.

Fish survey techniques include a stationary fish census, belt transect census, and random swim technique (or the modified Roving Diver Method). Other advanced techniques include fixed video recordings, ROV video recordings, hydroacoustic techniques, and modified fish traps and catch methods. The latter three techniques are generally utilized for deeper regions where divers cannot safely conduct fish surveys.

EXAMPLE 8.6: Reef Environmental Education Foundation's (REEF) Fish Survey Project (www.reef.org)

REEF, a non-profit organization, conducts the REEF Fish Survey Project, which enables the collection of fish distribution and relative abundance data using a standardized visual survey method. The objectives of the project are: to provide training and educational opportunities for SCUBA divers and snorkelers; provide information to the scientific, management, and conservation communities; include the diving community as a partner in underwater research; and to encourage support and implementation of management strategies.

d. Coral Diseases and Bleaching

As part of the benthic surveys, corals with diseases or those exhibiting bleaching should be recorded. Coral colonies with black band or white band disease should be marked on survey sheets and recorded on databases and base maps. It is important to estimate the percentage cover of dead and diseased corals. Bleached corals, which are most common in the summer months, should also be recorded.

e. Biodiversity

As part of the site characterization study, scientists might determine indices of biodiversity, such as inventories of species of particular taxonomic groups or communities and analyses of community structure. Biodiversity might be measured at the community, species, or genetic level (Ricklefs, 1979).

EXAMPLE 8.7: Montego Bay Marine Park, Jamaica (Sullivan and Chiappone, 1994)

The Nature Conservancy, with its Jamaican partners, conducted a rapid ecological assessment of the Montego Bay Marine Park in 1992. The assessment had two objectives: to prepare an ecological community base map of the park, and to study patterns of benthic and inshore communities in the park. As part of the assessment, the group used three different methods to characterize the benthic community of corals, sponges, and algae. These methods were substrata and lifeform characterization, species inventories, and belt quadrants. Based on aerial photographs, the team set up a total of 32 benthic communities that they surveyed during a 4-day period.

Transects of 20-35 m, marked in 1 meter increments, were placed along communities in the park and oriented from inshore to offshore locations, parallel to shoreline. Coral cover, community type, and substrate type were recorded along square meter quadrants, and lifeforms and substrates were recorded separately. Species presence and absence inventories were performed using checklists for previously described species along the north coast of Jamaica. The group performed several post-collection analyses to determine species diversity and hierarchy indices. Belt quadrants, similar to the line transect procedure, measured the spatial density of species, including coverage of benthic algae and density and size-distribution of corals, sponges, and octocorals.

This effort included several months of preparation, training workshops, and aerial surveys. In effect, rapid ecological assessments represent an expensive form of site characterization (Sullivan, personal communication).

Coral reef socioeconomic characterization

The socioeconomic characterization of coral reefs and the use of coral reef resources is of paramount importance if the MPA is to be protected. Humans are a part of the coral reef ecosystem and, in many cases, the most prolific predators on the reefs. Therefore, the population, users, and uses need to be identified, and generalized patterns of future uses need to be determined. Depending on the type of access allowed in and the overall health of the MPA, it can be expected that exploitation levels shall generally remain at their current levels and most likely increase in the future.

a. Characterization of the coastal population

The human population in and near the coastline that relies on the coral reefs and their resources should be characterized (see Pollnac, 1998). The criteria should include political, economic, social, and cultural factors at the national, regional, and local levels which, if changed, may accelerate or retard reef exploitation or management.

EXAMPLE 8.8: Rapid Assessment of Management Parameters (Pollnac, 1998)

The author provides a set of indicators of reef-related human behaviors which can be used to assess, predict, and potentially manage these behaviors. He discusses the importance of understanding the economy and policy at the national, regional, and local levels in order to predict how changes in these parameters may accelerate or retard reef management. Factors such as GDP (gross domestic product) and unemployment at the national level, population levels and types of employment opportunities at the regional level, and social structure and political organization at the local level are just a few of the factors that he suggests that managers must incorporate to predict reef use changes.

As part of the management characterization, Pollnac also suggests identifying all reef uses. These include local reef nomenclature, a detailed description of the ten most important fisheries in the region, and the types of reef tourism and recreational activities. Reef governance must also be understood, which include indicators such as local knowledge concerning coral reefs, use rights, management efforts, as well as local and national governance settings.

An important inclusion by Pollnac is that of cognitive mapping, or mapping the region in concern with local names. This provides a common map from which decisionmakers and users can discuss management aspects. Related to that is the standardization of names for species, or as Pollnac refers to it, "folk taxonomy". Both features, and the overall research approach, can provide invaluable information for a baseline study prior to monitoring.

b. Determination of Uses

All uses of the reef, both extractive and non-extractive, should be determined. The uses should then be separated into their artisanal, commercial, and recreational segments, and they should be considered separately.

1. Boating

Boating can refer to commercial glass-bottom or pleasure cruises, or it may refer to recreational vessels. The total number of boaters and their frequency of visits should be determined as part of the baseline characterization.

Aerial surveys can be used to determine the use patterns and densities of boats in sites which have many access points. In smaller, less accessible areas, the total number of vessels in the region generally equates to the total number using the MPA. Boating frequencies can also be determined by mail or intercept surveys.

EXAMPLE 8.9: Aerial surveys of boats in the Florida Keys (McClellan, 1996)

The study, conducted by NMFS researchers, consisted of aerial surveys taken over South Florida to assess boating usage (as well as marine mammal counts). The overflights occurred from 1992-1996, on calm Fridays. The information collected on boats included the size of the vessel, the type of vessel, and the activity in which the vessel was involved.

All the information collected from the aerial surveys was compiled, and percentages on the types of boats by specific areas were determined. This type of analysis showed the most dived, fished, and visited regions in the Florida Keys.

2. Diving and snorkeling

Among the most popular activities in coral reefs, diving and snorkeling are conducted by both commercial operators and recreational users. Although patterns of diving and snorkeling activities can be determined through aerial surveys, intercept surveys with recreational users and interviews with commercial operators may provide more detailed information, such as areas of use and use frequency.

3. Fishing

Fishing includes a variety of different activities on coral reefs. Fishing may occur at artisanal, recreational, and commercial levels, and it may consist of various gear types (including traps, hooks, nets, spears, and even illegal explosives and poisons in some areas). Moreover, most coral reef fisheries are based on multiple species.

To characterize fishing use, it is important to target each fishery group separately.

Information necessary from all groups, however, are the total amounts of each species harvested, the amount of effort exerted, and the specific areas utilized in the coral reefs (Ault *et al.*, 1997). The most effective means of obtaining information from the artisanal fishing sector is through personal interviews. Commercial and recreational fishing data may be available through governmental agencies. However, both groups are best characterized by intercept or mail surveys.

EXAMPLE 8.10: Characterization of the commercial fishing industry in the Florida Keys (Milon *et al.*, 1997)

This study surveyed 15 percent of the 2,400 commercial fishermen in the Florida Keys on socioeconomic issues concerning the implementation of the Florida Keys National Marine Sanctuary. The study, which was conducted in person, consisted of an 8-page survey that solicited responses on: demographic information; economic information; catch and effort information; perceptions; and enforcement.

Fishermen were contacted through a variety of purposes. The research team collaborated with commercial fishing organizations and fish houses, and also used the fishing license list. Surveys were prepared in English and in Spanish, and they were conducted at the fishermen's places of residence, docks, and fish houses.

c. Socioeconomic base maps

Base maps showing areas of socioeconomic use- boating, snorkeling and diving, and fishing- should be developed from the data provided by users. The maps should depict the densities, totals, and spatial segregation of use by each group. This information can be best displayed by GIS. Where GIS is unavailable, uses can be traced on pre-existing maps or nautical charts to delineate categorical areas of use, i.e. low, medium, and high use.

EXAMPLE 8.11: Diving and snorkeling patterns in the Florida Keys National Marine Sanctuary (Shivlani and Suman, in press)

This study, conducted with commercial dive operators through personal surveys, determined the total level of trips and divers and snorkelers taken by Keys operators in 1995. Operators also reported on the percentage of trips and users they took to designated “no-take” zones in the Sanctuary, and the study determined the overall importance of these zones on dive operator trips.

Linking the trip and diver totals database with GIS, the study created commercial operator use base maps. These maps demonstrated the overall importance of “no-take” zones to operators, as well as the selective use of zones in certain Keys regions over others.

d. Future Use Predictions

Based on the population characteristics and the extent and types of resource uses, it may be feasible to create a risk factor matrix. This matrix can then be used to determine which combination of uses would adversely impact the coral reefs of the MPA in the future and to use that information as a tool in adaptive management.

Coral reef ecological monitoring

Ecological monitoring is an essential component that must be planned and implemented carefully. A monitoring plan should generally determine the parameters to be measured. However, any such plan must remain sufficiently flexible to allow for future threats that are not evident at the time of implementation. Therefore, general parameters such as physical and ecological measurements should be monitored periodically. Further activities that research can develop include mitigation and restoration. Finally, monitoring programmes should be developed with the knowledge of the financial capability of the management agency; otherwise, such programs too often become part of the “paper park” syndrome which, while functional in design, remain idle due to lack of funding.

For a detailed description of coral reef ecological monitoring, go to the websites cited in page 23.

EXAMPLE 8.12: Monitoring difficulties in St. Lucia (A. H. Smith, 1994)

The author demises over the paper parks in the Caribbean, arguing that only 16% of those outside of US jurisdiction enjoy meaningful protection. He describes the case of St. Lucia, part of the Windward Islands. In 1986, most of the coral reefs in St. Lucia were declared MPAs, but the boundaries were not defined, making enforcement almost impossible. In 1987, the government requested assistance from the Organization of American States in the preparation of a proposal to create a terrestrial-marine park in the Soufriere area. Monitoring began in 1988 with the following objectives: to test reef monitoring techniques with relevance to the needs of local management and development planning; use local expertise in monitoring, especially dive operators; facilitate their contribution to and responsibility toward the coral reef resource; and to design programs that were both appropriate and cost-effective.

The author summarizes that the dearth of active reef monitoring programmes in the Caribbean is due to: research being conducted by regional or external scientific organizations, whose methods are too expensive for smaller islands; survey methods that are designed have little regard for the different requirements of monitoring for management; most programmes do not include monitoring of potential impacts, such as levels of use and environmental variables; monitoring programmes are too often started through external funding which, when stopped, terminates all or most monitoring efforts and outside expertise.

a. Site monitoring

A number of sites, according to the levels of complexity of the protected area, should be set aside as permanent monitoring sites. Alternatively, monitoring can occur as general surveys (as described in the ecological characterization section) at least once a year.

1. Permanent monitoring sites

Permanent sites can be set up using the research methods described in the ecological characterization section. Whatever technique is utilized, it is important to assure that the same area that was first characterized is the one that is then monitored. The use of coordinates, permanent quadrats, marked bottom, and other techniques can ensure that the same regions are re-sampled over time. Sites may be temporary or permanent. Although randomly selected sites may be considered less biased than permanent sites, random sites may not be sensitive to change because of reef patchiness. Rogers *et al.* (1994) recommend permanent sites for long-term monitoring of reefs because of consistency and reliability.

2. Physical parameters

Physical parameters, such as temperature, salinity, light penetration, and others, should be measured during each monitoring session. For sites that have suspected anthropogenic inputs, nutrient levels and dissolved oxygen are important physical parameters to consider for potential eutrophication.

3. Coral/benthic habitats

The benthic habitats should be remapped periodically, to determine changes in benthic composition and coral cover. Using the techniques of the initial characterization survey, monitoring can determine whether there are losses or gains to the region. Also, monitoring can determine gross changes such as bleaching, diseases, and physical impacts to the resources.

EXAMPLE 8.13: Long-term monitoring in the Flower Garden Banks National Marine Sanctuary (Continental Shelf Associates, Inc., 1997)

The Flower Garden Banks were designated as a National Marine Sanctuary in 1992 to protect the northernmost tropical coral reef community on the North American continental shelf. Environmental threats to the banks include development of hydrocarbon resources and associated activities in the proximity of the Sanctuary.

To protect the region from such activities, the Sanctuary has determined the following objectives for its long-term monitoring study: to provide timely information to agencies that develop oil and gas exploration policies and decisions; to document long-term changes in the ecological communities in the Sanctuary that may be related to human activities, and to differentiate that from natural variations.

Field data for the monitoring study were collected using random transects, which were photographed and analyzed for population levels of corals, associated biota, and other organisms. Coral growth rates were determined by measuring metal spikes implanted within live coral. Additional data collection included video transects, quadrant sampling, and visual growth measurements, as well as ancillary measurements (temperature, oxygen, light, salinity).

4. Fish

Fish surveys over time, using the same techniques described above, can determine changes in the density, structure, and diversity of the fish populations on coral reefs. These surveys should also be conducted periodically. However, the monitoring efforts do not necessarily need to be coupled with the benthic surveys.

Depending on the type of activities allowed in the protected area, fish surveys can determine whether the objectives of the plan are being met.

EXAMPLE 8.14: Zone performance in the Florida Keys National Marine Sanctuary no-take zones (NOAA, 1998)

As part of the Sanctuary’s monitoring effort, NOAA and a group of independent researchers have been studying the changes in fish and invertebrate populations in the no-take zones implemented in 1997. Allowing no fishing in a majority of the zones, the researchers have determined whether the reduction of effort has led to larger individuals and bigger populations of species targeted by the fishing sector.

EXAMPLE 8.15: The use of indicator species to detect changes on coral reefs: the example of butterflyfish (Family Chaetodontidae) in Indo-Pacific coral reefs (E. S. Reese, 1996; Crosby and Reese, 1996)

Results from this study suggest that traditional environmental monitoring, while measuring change in a system, is expensive, intensive, requires technical expertise, and is often inaccurate and intrusive. Reef-feeding fish can be used as an indicator of the health of the entire coral reef community. Butterflyfishes leave the reef prior to complete collapse and, thus, represent an “early warning system” that can serve as an inexpensive proxy for monitoring agencies.

5. Pollution

Protected areas that have suspected or known human inputs of pollutants, such as nutrient or thermal pollution, require monitoring of impacts. Benthic surveys of permanent sites chosen near areas of human input can be compared with control sites chosen in areas away from human inputs. Such studies should incorporate measurements of physical parameters (nutrients, turbidity, chlorophyll, dissolved oxygen) with those of ecological observations (extent of bleaching, algal overgrowth of coral colonies, frequency of coral diseases) to determine whether human inputs have significant effects on the resources of the protected area.

b. Restoration activities

Coral and benthic habitat restoration activities may require significant funding. Less expensive restorative activities may include removal of sediments and uprighting coral heads following a storm or vessel grounding, scouring of macroalgal mats, and others. More expensive restoration would include transplantation of corals from laboratories or from other sites to affected areas. If restoration or rehabilitation of the coral reef ecosystem is undertaken, the success of these efforts must be closely monitored.

Coral reef socioeconomic monitoring

Socioeconomic monitoring is as important as ecological monitoring, as it determines the changes in the types and extent of human activities on coral reefs. Depending on the uses permitted on the reefs, users can greatly change the patterns and efforts of their use of the natural resources in and around the protected area.

a. Changes in uses

In areas that are closed to all uses, changes generally occur adjacent to the protected boundaries. Conversely, in areas that allow certain uses, use patterns may change greatly inside the protected boundaries. Although there is a gradation of effects that uses cause in protected areas, it is important nevertheless to monitor all uses inside the boundaries. This greatly facilitates the understanding of connections between the ecological health of a protected area and the intensity of uses, thereby improving management.

1. Use types

Use types, in and around the protected area, can be best monitored by surveillance. Surveillance data can be compared on a monthly or yearly period to determine what types of activities are occurring.

2. Use intensities

Use intensities can also be monitored by surveillance data, but the intensities can be best measured through aerial techniques and user surveys. Data provided directly by users can determine the levels of effort they place on and around the protected area.

3. Users' perceptions

User satisfaction may greatly facilitate cooperation in monitoring, as well as enforcement and other activities. Therefore, monitoring efforts should attempt to gauge user perceptions on resource health, protected area performance, and support for the protected area. These perceptions, obtained through surveys, provide information to managers on how best to reach users and even solicit their assistance in monitoring efforts.

b. Impacts of uses

Impacts of uses can also be determined over time using simple monitoring techniques. Impact quantification can provide means by which to devise management strategies that mitigate unacceptable activities or otherwise minimize impacts while accommodating users.

1. Immediate impacts

The monitoring of immediate impacts can be conducted through surveillance, aerial surveys, user reports, benthic surveys, and other techniques. Incorporating a “whistle-blowing” system may assist in reporting infractions. However, it is best to integrate or “buy-in” users into research and enforcement activities, such that management efforts are seen as complementary to users' activities.

2. Cumulative impacts

Cumulative impacts are best determined by correlating the ecological monitoring results with user intensities. Impacts such as coral degradation and fish abundance may be related to levels of user activities. Therefore, user surveys can be used to determine types and levels of activities in the affected area. However, it is important for comparative studies to unequivocally demonstrate the effects of human activities on the ecological health and to prove cumulative impacts; otherwise, the protected area may lose valuable user support.

MANGROVES

Mangroves are salt-tolerant (halophytic) floral species present in the tropics and sub-tropics. Belonging to various families, mangroves are distinguished mostly by their growth in the coastal zone, rather than by phylogentic similarities. Forests are described by the major species and mangrove associates they contain. Mangroves are highly productive ecosystems, providing detrital and leaf litter biomass to adjacent communities. Many unique species of flora and fauna rely on mangrove communities, as well as several juvenile marine species that spend much of their younger life stages within the ecosystem. Mangroves protect coastlines by providing a buffer zone against hurricane storm activity and associated storm surge effects. Humans across the world also utilize mangroves for other purposes, including shelter, wood, and charcoal production. However, mangroves, like other coastal ecosystems, are under threat of coastal development and agricultural conversions. Because of their links to the other major ecosystems (sea grasses and coral reefs), mangrove conversions would have negative effects on adjacent ecosystems. Therefore, mangrove ecosystems need to be protected as strongly as the other, more apparent ecosystems in an MPA.

Ecological characterization of mangroves

To effectively characterize mangrove forests in an MPA, it is important to assess the location and types of mangrove communities present, the species diversity in the communities, and the level of naturalness, representativeness, and degree of critical habitat provided for key wildlife species (Hamilton and Snedaker, 1984; FAO, 1994). Although it is generally accepted that mangroves display a level of succession along their distribution, species are more commonly distributed along a vertical gradient perpendicular to the coastline or channel which is dependent also on nutrient availability and other abiotic factors (zonation). Local residents could play an important role in data collection in mangrove forests.

a. Delineation of mangrove forest boundaries

Mangrove forest boundaries and forest types can be delineated and classified by the use of remote sensing and/or ground-truthing. Remote sensing methods, such as aerial photographs, can provide the total area occupied by a mangrove forest, and ground-truthing surveys can verify those boundaries (FAO, 1994). All boundary gathering data must be documented by GPS (Global Positioning Systems) or other coordinates to ensure that the mangrove forests are correctly delineated. The boundaries at the seaward side should extend to the high-water mark of spring tides, and the landward boundary must include all mangrove associates, especially where there is visible zonation.

b. Mangrove forest structure and productivity

Using existing floral and faunal species lists and any other existing data, researchers should survey the mangrove forests to document all species present (Chapman, 1984). Species that are not readily identified, including associated lichens, fungi, and algae, should be collected and examined in the laboratory. Mud samples, taken at different depths and at different elevations, should also be collected and analyzed where possible. These samples can provide basic data on the macrofauna and flora and the meiofauna and flora present in the community.

To determine the density and dominance of species present, researchers should employ a set of available methods. Density refers to the number of plants of a single species per unit area and the total number of plants per unit area (Chapman, 1984). Because mangrove forests are generally vertically zoned, density studies should focus on the canopy layer; the sub-canopy layer, consisting of shrubs and ferns; and the herb layer. Random quadrant sampling, can be used for these surveys. Dominant species in each layer should also be recorded. Additionally, belt transects can be performed in areas that have a homogeneous habitat, and line transects, across environmental gradients. Chapman (1984) concludes that a combination of quadrants, transects, and aerial photographs can "provide the best overall picture" (p. 79) (see also FAO, 1994). There are many other studies (productivity, community structure, and species richness, among others) that researchers can perform to more completely characterize the mangrove community (Snedaker and Snedaker, 1984; English *et al.*, 1994).

Depending on the goals of the MPA, it might be appropriate to perform mangrove forestry inventories that would measure the available wood resources. Volume of wood may be estimated through remote sensing imagery or limited field sampling of tree diameter and height in a few representative forest plots (FAO, 1994)

EXAMPLE 8.16: Rapid Ecological Assessment of Parque Nacional del Este, Dominican Republic (Vega *et al.*, 1997)

As part of a rapid ecological assessment (REA), the group determined the terrestrial and marine resources available in the Parque Nacional del Este in the Dominican Republic. The park, designated in 1975, is located southeastern coast of the Dominican Republic and encompasses almost 42,000 hectares. Among its various habitats, the park contains extensive mangrove forests. The REA, among its objectives, assessed the mangrove communities of the park. First, researchers utilized relief maps and aerial photography, as well as satellite imagery, to create a coastal community map. To better identify community types, the group also recorded in situ observations which included: 15 sample sites with 10 x 10 meter

quadrats which were chosen during overflights and ground reconnaissance; the physical conditions and general community types at each quadrat; global positioning system (GPS) ground-truthing of each sample site; soil sample studies; and forest cover. The results of the characterization determined the floral and faunal diversity present in the mangrove communities, including canopy cover types, soil composition, and crustacean and mollusk fauna associated with the mangroves.

EXAMPLE 8.17: Evaluación Preliminar de la Producción Primaria de Hojarasca en las Areas de Chame, Azuero y Chiriquí (INRENARE), Inventario Forestal de los Manglares de Chiriquí, Azuero y Chame (INRENARE, 1996)

Panama's Mangrove Management Project selected three mangrove areas on the Pacific coast and conducted socioeconomic and ecological baseline evaluations. The goal was to develop management plans based on principles of conservation and sustainable development. Staff of Panama's Natural Resources Institute (INRENARE) measured the following parameters:

- floral composition and spatial distribution
- average diameter, volume, and number of mangrove trees
- primary production measured by leaf litter
- identification of potential areas of forestry production and protection for purposes of research, ecotourism, and environmental education

c. Mangrove fauna

Series of stations along a transect that bisects the mangrove forest from the low to high shore should be created to determine the faunal types in the different forest zones (Sasekumar, 1978). Soil samples should be taken to collect all infauna. Macrofauna and meiofauna can both be studied from soil samples. Such samples should be collected during different tidal regimes to accurately account for a majority of the species that inhabit the ecosystem.

Tree samples of epiphytic fauna, such as snails, should also be taken. Marine species, such as fish and invertebrates, can be collected during high and low tides. Other mobile species, such as birds and small mammals, may be observed during different hours and seasons and can be documented via observational sheets, photographs, and other non-invasive methods. These observations can provide basic species total and frequency data.

All species collected should be cataloged into their major phyla, and they can be described in terms of species' totals as well as biomass and productivity.

d. Mangrove soils

Mangrove soils should be sampled to determine their characteristics because they represent the most important factors affecting mangrove productivity and structure. The chemical and physical properties of the soil, including pH, eH, salinity and particle size, can all be determined using simple field techniques (English *et al.*, 1994).

Socioeconomic characterization of users of mangrove ecosystems

All human uses in the mangrove forests should be determined, categorized, and quantified. Uses such as inhabitation, subsistence use, commercial use, and recreational activities should be considered. In cases where there is a human population or local community living in and using the resource, it may prove useful to characterize that population through interviews and surveys. Such baseline information can reveal potential threats to the mangrove ecosystems in the MPA over the long-term, and it can also provide solutions on how best to monitor and even mitigate those impacts. Baseline characterization can also determine the social and economic values that the users place on the mangrove resources.

EXAMPLE 8.18: Diagnóstico Socio-Económico de los Beneficiarios del Manglar del Area de Chame (INRENARE, 1994)

Panama's Natural Resource Institute (INRENARE) conducted a socio-economic characterization of users of three mangrove areas as part of its Mangrove Management Project. In one of the three areas, Chame, the research focused on the 400 persons who depended on the mangroves for their livelihood. INRENARE determined these individuals' educational levels, housing, and health; the mangrove productive systems present in the community, social organization, and artisanal production techniques.

a. Inhabitation

Simply put, the number of dwellings and residents in and adjacent to the mangrove

forests should be determined. This can be performed by a visual survey and census in many locations. In other more densely populated areas, demographic data available from the government may be used. The inhabitants should then be surveyed to gather the following data: demographic information, economic information, uses of mangrove areas, and acceptance of the MPA.

Also, the overall socioeconomic factors involved in the mangrove forests should be determined and quantified, as Pollnac (1998) recommends for coral reef management. Therefore, local economic indices, as well as social and cultural structures, should be studied.

b. Subsistence use

All types and levels of subsistence use should be determined and quantified. Note that subsistence use implies use for personal or community purposes and is different from recreational and commercial uses. There are several subsistence uses of mangroves, including the actual harvest of trees for firewood and charcoal, timber, crafts, medicines, dyes, paper, and others (see Hamilton and Snedaker, 1984; Suman, 1994). Species associated with mangroves are also affected by subsistence use, including fish and marine invertebrates, bees (for honey), and birds. The best means by which to determine subsistence use may be to conduct personal surveys with the users, as well as utilize available government data on the types and amounts of subsistence products.

c. Commercial use

Commercial use of mangrove communities may include several of the subsistence use products, except that they would be sold at commercial levels. Of particular importance are activities such as timber cutting and commercial fishing. Mangrove forest conversion for agricultural and development purposes is also important. These activities should be itemized and quantified, with the use of government information and personal surveys.

EXAMPLE 8.19: Mangrove Restoration at John U. Lloyd State Recreation Area (Florida, USA) (Fisk, 1995)

John U. Lloyd State Recreation Area (JULSRA) in Florida, USA, is the site of a mangrove restoration project performed by the Port Everglades Authority. As mitigation for conversion of 18 acres of mangrove forest at the port, the port authorities financed a 23 acre mangrove restoration project at the adjacent state protected area in 1989. Exotic species of Australian pine were removed, nursery-grown propagules were planted on scraped land at 1 foot intervals. The port was responsible for assuring 80 percent survivorship for a 10 years period.

d. Recreational Activities

Mangrove forests offer a myriad of recreational activities, including boating, fishing, hunting, hiking, swimming, and nature-based activities (Hamilton and Snedaker, 1984; Suman, 1994). To determine the types and frequencies of such activities, baseline research may consist of aerial surveys and visitor surveys. Visitor intercept surveys, if sufficiently detailed and well-designed, can assist in the quantification of the value of the mangrove forests to recreational users.

Ecological monitoring of mangroves

Ecological monitoring should include periodic surveys of the factors considered in the baseline characterization. Permanent survey plots can be utilized to determine changes in forest and soil composition, and other surveys can be conducted to determine faunal changes.

Aerial photography can determine gross changes to the forests. If mangrove restoration projects occur, their evolution must be monitored.

EXAMPLE 8.20: Restauración de Manglares en Colombia: Estudio de Caso del Parque Naturales Corales del Rosario (C. Bohorquez, 1997)

Mangroves have been successfully restored and transplanted in the Corales de Rosario National Park near Cartagena, Colombia, where local residents have degraded the mangrove ecosystem by extraction of wood products. Researchers employed two techniques: 1) transplant of small trees between 1 – 1.5 m height and 2) direct planting of propagules.

EXAMPLE 8.21: Rehabilitation of the Ciénaga Grande de Santa Marta, a Mangrove-Estuarine System in the Caribbean Coast of Colombia (Botero and Salzwedel, 1999)

The Ciénaga Grande de Santa Marta (CGSM) estuarine lagoon system is part of the exterior delta of the Magdalena River, the largest river in Colombia. The CGSM is the largest such system in the Caribbean Sea, and it has historically contained significant mangrove resources. However, due to human activities such as highway construction and water diversions, the mangrove communities have suffered extensively from hypersalinity and sedimentation, resulting in almost 70 percent mortality. In 1988, the Colombian government started a project to restore and manage the coastal resources of the CGSM via an environmental management plan and major programs. Related to the restoration of mangrove forests, one such program called on the improvement of institutional capacity and users resulting in improvement of mangrove soil conditions, regeneration of mangrove communities, and the development of a joint restoration plan between the government agencies and users.

Mangrove restoration has clearly occurred in areas adjacent to newly dredged canals and culverts, and other restoration projects have been designed for future implementation depending on the improvement of soil conditions. Monitoring studies have demonstrated that soil conditions and propagule availability are the two most important factors in regeneration. However, the authors warn that the results can only be sustained if there is continued local participation and if the upstream sediment loads are reduced. Otherwise, mangrove restoration may not only fail, but it may also lead to further degradation.

EXAMPLE 8.22: Long-term Assessment of the Oil Spill at Bahía Las Minas, Panama (Duke and Pinzón, 1991; Duke, 1997)

As a result of the 1986 oil spill in Panama which resulted from a ruptured oil storage tank in a coastal refinery, the region's mangroves were heavily impacted. There were two major impacts to the mangrove community: deforestation and sublethal effects, including altered patterns of growth and development. In order to understand how mangroves react to such catastrophic events, this study looked at the recovery of mangroves following the oil spill. Specifically, the study used three monitoring approaches to determine spill impacts and recovery rates. The researchers mapped the vegetation boundaries to determine the extent of the impact on the forest. The maps displayed the effects of currents and winds on the forests, as well as the areas planted as restorative activities by the refinery. Second, the researchers examined surviving trees and associated biota, including primary producers and consumers. Third, the study examined the recovering biota in forests where trees were killed, including studies on recruitment, growth, and census of primary consumers.

Socioeconomic monitoring of mangroves

Socioeconomic monitoring should consist of periodic surveys within the different user groups

to determine changes in the types and levels of activities. Monitoring efforts should be developed depending on the activities allowed within the protected area. In areas that do not permit any uses, monitoring should focus on uses around the forests and enforcement effectiveness. In forests where uses are allowed or zoned, monitoring should determine changes in use types and intensity. As described in the characterization section, a variety of information sources and survey techniques can be utilized for monitoring purposes. Another important aspect of socioeconomic monitoring should focus on the social changes resulting from management measures, as well as the economic welfare of the groups affected. Government data on quantities of mangrove products, visitor surveys, and user interviews can be used, depending on the type of monitoring data required.

EXAMPLE 8.23: Conservation and Sustainable Likelihoods: Collaborative Management of the Mankóté Mangrove, St. Lucia (Geoghegan and Smith, 1998)

St. Lucia's mangroves have been recently reduced as a result of human activities, including clear cutting, dumping, and charcoal use. Although nearly all of the country's mangrove areas were protected as marine reserves under the Fisheries Act of 1984 and subsequent legislation, none of these initiatives have led to effective mangrove conservation. Poor public support, multiple agency jurisdiction over the mangrove resources, limited surveys in the actual marine reserves, development conflicts, and mixed ownership schemes are among the reasons for the lowered effectiveness.

A group of users and a non-governmental organization have collaborated in Mankóté, the country's largest remaining mangrove area, to manage a sustainable harvest of the mangrove resources since 1983. As part of the management strategy, the following components have been installed: mitigation of harvesting impacts through improved techniques; reduction of harvesting pressure by offering other fuelwood sources and income opportunities to charcoal producers; and the replacement of the open access system to a system based on communal management.

SEAGRASSES

Seagrasses constitute an important inshore feature in many coastal communities. They are

sites of high primary productivity, provide habitat for many juvenile and adult species, are a principal contributor to the marine food web, and improve water quality by stabilizing mobile sediments (Sargent *et al.*, 1995). However, seagrasses are threatened by many human activities, including pollution, dredge and fill activities, and boat scarring. Because of their ecological and economic importance and due to their susceptibility to damage, any research and monitoring plan must characterize, monitor the seagrass community present in the designated MPA, and collect data for its protection.

Ecological characterization of seagrasses

The ecological characterization of seagrasses should be conducted to determine the amount of the resource present in the area, the species of seagrasses present, zonation, and the level of biodiversity that characterizes the communities. Once characterized, additional baseline research may measure the primary productivity and linkages to other systems, such as mangroves and coral reefs. However, the characterization research should at least determine the amounts and types of seagrasses present in the protected area.

a. Remote Sensing

Seagrass distribution must first be determined by remote sensing techniques, preferably aerial photographs and surveys. Satellite imagery, a developing field, may also be utilized if available. In cases where the above options are not available, boat surveys determining the average extent of the seagrass communities can be utilized. User data, if associated with coordinate-backed boundaries, may be useful in other instances. Finally, existing maps and charts can also be used in all remote sensing efforts.

b. Ground-truthing Surveys

Once the outline of the seagrass area has been obtained, ground-truthing may be done by using a sled or a manta tow (Kirkman, 1990). GPS or compass triangulation is necessary to fix the location. Different meadows, based on species, should be determined and cataloged during the ground-truthing session. All areas containing decaying, dead, or scarred seagrass beds should also be documented.

EXAMPLE 8.24: Florida Big Bend Seagrass Habitat Study (CSA and Martel Labs, 1985)

This study, which was funded by the Mineral Management Service, characterized the seagrass community in the Big Bend region. As part of the methodology, the researchers conducted a pre-overflight ground-truthing cruise, remote sensing overflights, and a final post-overflight ground-truthing cruise. While the level of sophistication in this study may be too expensive for other regions, the ground-truthing methodology may prove useful. The researchers had two objectives in the pre-flight cruise: to survey the deep portions of the study area using underwater video, as well as to select, mark, and sample representative control stations. They used a transect method to sample the sites. The post-flight cruise sought to determine the outer boundary of the seagrass growth with divers and video, to investigate questionable signature areas, and to resample previously sampled areas in a different season.

c. Community base maps

Based on the data obtained during the ground-truthing surveys, community base maps can be prepared for the different seagrass communities in the marine protected area. These may consist of the large meadows, and they may depict different species of seagrasses by meadows. The base maps should attempt to provide as much species-specific zonation as possible.

d. Species composition, biomass, and associated flora

Species composition can be best determined through a line transect or related survey technique, where the survey plot is placed along the seagrass community. Sample sites should be chosen to include all species of seagrasses present in the protected area, and the sites must also include the various depths at which the seagrasses are present. All species of seagrasses present in sample sites should be recorded, as well as associated flora. Samples of leaves and roots may be collected for biomass, density, and productivity estimates (Philips and McRoy, 1990). Ephemeral and benthic samples may be collected to identify encrusting and benthic algae in the laboratory (Russell, 1990).

e. Physical parameters

Physical parameters, such as temperature, salinity, dissolved oxygen, and turbidity,

should be collected at each sample site. In sites that are susceptible to pollutants, nutrient levels and sediment content should also be analyzed.

f. Associated seagrass fauna

Seagrass-associated fauna may be collected at the same sites as above. Fauna includes all mobile and sedentary species, as well as infauna and epifauna. Collection methods includes nets and cores, and sampling should take place during different tidal regimes and times of day to collect all potential inhabitants. Following collection or sighting, all seagrass-related fauna, including manatees and sea turtles, should be cataloged in a list that can be utilized for monitoring efforts

Socioeconomic characterization of human interactions with seagrass ecosystems

Socioeconomic characterization of seagrasses generally refers to the interactions of humans with the communities, e. g. transport over the seagrasses, fishing on the beds, bottom-altering activities (such as dredging and filling), and pollution. All such uses should be documented and quantified wherever possible, especially in regions where user impacts are evident or suspected.

a. Transport over seagrass beds

Seagrasses grow in a variety of depths, including in very shallow water. Because seagrasses are also prevalent along coastlines, they are generally threatened by boat propeller impacts. Therefore, baseline research should determine the extent and patterns of boating traffic over seagrass communities. Scarring impacts can be determined by aerial surveys (discussed above), but the potential for future effects can also be assessed by quantifying boat totals in the marine protected area, docks and marinas located near target seagrass communities, and by boat surveys of drafts and propeller types.

EXAMPLE 8.25: Scarring in Florida seagrasses (Sargent *et al.*, 1995)

The Florida Marine Research Institute (FMRI) determined the distribution of scarred seagrass

beds in Florida using aerial photography and aerial surveys. The group utilized color infrared (CIR) transparencies and other photography to determine the extent of seagrass scarring. FMRI also conducted aerial surveys to verify scarring and to refine delineations of scarring intensity. Based on a categorical system of scarring patterns, the researchers determined the extent of damage that boat propellers had caused in Florida's seagrass communities.

b. Fishing on Seagrass Beds

Fishing on seagrass substrate or in the water column above should be documented. Fishing can be accounted for by aerial techniques to determine the number and patterns of users, and also by surveys with fishermen. The latter method can provide more detailed information, such as harvest totals, species, and effort, as well as patterns.

c. Bottom-Altering Activities

These activities are generally related to development and channelization. All such activities, either in progress or planned, should be accounted for via surveys with agencies and development groups. Characterization of these activities shall provide valuable information on changes that occur over time in the seagrass environment. The extent of the activities, i.e. the locations being altered, the approximate boundaries of alteration, and potential mitigation, should also be determined.

d. Pollution

All potential polluting sources, such as sewage plants and coastal developments, should be identified, and the pathways and amounts of pollutants should be determined. This information can be obtained through from the actual facilities themselves or from pre-existing studies. Actual pathways can be approximated utilizing nearshore circulation models.

Ecological monitoring of seagrasses

Ecological monitoring of seagrass sites can determine whether the management of these

resources is effective, and it can also identify potentially deleterious factors that need to be remedied to protect the seagrass communities. Ecological monitoring should encompass the sampling of permanent sites, including surveys of physical parameters, community composition, density, and structure, and associated flora and fauna. In sites that are suspected or known to contain pollutants, sediment samples and additional physical analyses may be necessary. Also, such sites should be sampled concurrently with control sites that do not contain such pollutants.

a. Physical parameters

Parameters, such as temperature, salinity, and dissolved oxygen, should be monitored periodically. The interval (tidal, daily, monthly, seasonally) will depend on available funding, seasonality, and water circulation. These should be compared with earlier data to determine whether sites are being subjected to equal or more stressful conditions, as well as to understand the effects of changing parametric conditions on the resource's health.

b. Community composition, density, and structure

The community should be sampled periodically to determine whether there have been losses or gains in seagrasses, whether the species have changed over time, and if there are larger or smaller densities of seagrass. Related studies may include those to examine changes in standing biomass and productivity.

c. Associated flora and fauna

Using methodologies described in the characterization section, the monitoring efforts for associated flora and fauna should study the changes in benthic and epiphytic flora and mobile and sedentary fauna. Efforts, where applicable and available, should also focus on potential shifts in grazers and types of commercially viable species present. Additional monitoring may look at changes in species biomass and structure, as well as productivity of associated flora.

EXAMPLE 8.26: Sabana-Camagüey Archipelago Protected Area in Cuba (I. Fernandez, personal communication, 1999)

On Cuba's north coast, the Ministry of Agriculture manages the Protected Area of Managed Resources of the Sabana-Camagüey Archipelago which contains important coral reefs, seagrass beds, and fringing mangroves. Resource monitoring covers: mangrove fish communities, reef fish, fish on seagrass beds, rocky bottom fish communities, coralline communities and associated flora and fauna, sea turtles, and manatees.

d. Mitigation and restoration activities

All mitigation and restoration sites should be closely monitored to evaluate their success. Factors such as percent survival rate and productivity should be considered in any restoration study.

Socioeconomic monitoring of human uses of seagrass ecosystems

Socioeconomic monitoring objectives shall be determined by the allowable activities on seagrasses. In marine protected areas where no activities are permitted, socioeconomic monitoring shall study the effects on users displaced from the seagrasses. In other areas that allow certain uses, monitoring shall consider the changes in use levels and intensities both on and around the seagrasses. Monitoring the boating activities, fishing, development, and pollution are of high importance (Phillips and McRoy, 1990; Durako *et al.*, 1987).

a. Boating

Boating patterns and scarring can be best determined by aerial surveys, and this data can demonstrate whether users continue to impact seagrass communities or if other management plan strategies (such as enforcement and education) have resulted in lowered impacts. In other areas, surveillance data can serve as a proxy for actual aerial photography to obtain similar information.

b. Fishing

Monitoring fishing effort and catch in seagrass beds can be best performed by periodically surveying the users that fish those areas. Aerial surveys can assist in understanding general fishing patterns on seagrasses. The fishing data can then be used in combination with the ecological monitoring data to determine factors affecting changes in flora and fauna in seagrass beds.

c. Development Activities

Development activities that were planned or approved during designation of the MPA or already existed should be monitored closely to quantify changes in seagrass communities, both in terms of their size and their health. Monitoring efforts should optimally occur at sites where these activities are occurring, and the ecological monitoring parameters should be applied at these sites to compare these communities with others that experience little to no human interference. Also, all changes to these communities should be documented and mapped wherever possible.

d. Pollution

As part of the ecological monitoring program, the socioeconomic monitoring segment should periodically record levels of effluents and other anthropogenic runoff. This could also be measured in plants tissue samples. The information may be obtained through government agencies or through the actual polluting sources. Comparison of the ecological health of the seagrasses with the proximity of pollutants may assist in the determination of potential pollution causes and their long-term results.

MARINE MAMMALS/SPECIES OF SPECIAL INTEREST

In areas that have marine mammals and/or species of special interest (threatened or endangered), it is important to identify population totals, essential habitats, and/or migratory pathways within the marine protected area. Aerial surveys may be the best means of detecting and surveying larger marine mammals. Smaller boat surveys may also perform the same function, especially for resident populations. The identification and survey of smaller species, both mammals and others, may depend more on boat or in-water surveys, and these activities should be conducted according to the species concerned. When complete, all such species should be documented and recorded in a database. Important nesting, breeding, and feeding habitats should be noted on base maps. Future studies should concern periodic population surveys, habitat conditions, and conflicts with users. Officials might encourage recording of sightings of the more rare species by local community residents and tourists.

EXAMPLE 8.27: Silver Bank Sanctuary, Dominican Republic (Aquatic Adventures, 1999)

The Silver Bank Sanctuary was created in 1986 by presidential decree in the Dominican

Republic. In 1996, the sanctuary, a known Humpback whale breeding ground, was enlarged and renamed the “Sanctuary for the Marine Mammals of the Dominican Republic”. As part of its protective regulations, the sanctuary requires that all operators attend mandatory workshops to qualify for operator permits within sanctuary boundaries. Using such educational approaches, as well as working with national and international agencies, the sanctuary can provide effective protection for its marine mammal seasonal residents.

EXAMPLE 8.28: Hawaiian Islands Humpback Whale National Marine Sanctuary (Sanctuary Web Site (A. Tom, Manager, HIHWNMS, personal communication, July 29, 1999)

The Hawaiian Islands Humpback Whale National Marine Sanctuary conducted a whale census in 1998, as called for in its management plan. The procedure for whale surveys consisted of a series of overflights, or aerial surveys, along random transects. The study, conducted over a period of months, showed that the whale population in the Sanctuary is slightly higher than previously estimated, and the census provided invaluable baseline data for future research and monitoring activities.

CULTURAL RESOURCES

The research programme should include an initial inventory and mapping of submerged or coastal cultural resources, such as shipwrecks, artifacts, and historical building and ruins. Subsequent work will evaluate the state of the submerged cultural resources and how well they have been preserved. Archaeological research will focus on the origin of the artifacts and their importance and value as historical records of culture, politics, and maritime transportation. (See Maarleveld).

EXAMPLE 8.29: Monte Cristi Shipwreck Project (Hall, 1994)

The author summarizes the state of ongoing excavation and analysis of a 17th Century northern European merchant vessel located in Monte Cristi Bay, Dominican Republic.