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Wider Caribbean Region

Caracas, Venezuela, 28 January-1 February 1980

CARIBBEAN ENVIRONMENT PROGRAMME

ACTION PLAN

FINAL REPORT

A STRATEGY FOR THE CONSERVATION OF LIVING MARINE RESOURCES AND PROCESSES IN THE CARIBBEAN REGION

A Report of the International Union for the Conservation of Nature and Natural Resources (IUCN) with financial support of the World Wildlife Fund (WWF)

prepared in collaboration with the International
Union for Conservation of Nature
and Natural Resources

UNEP/CEPAL
1979

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* References to figures are to material held in limited numbers at IUCN Headquarters.

/ACKNOWLEDGMENTS

ACKNOWLEDGMENTS

The Objectives section (pp. 5-8) presents a brief history of this project. Obviously, a great many people contributed to the work. Over 100 persons, for example, contributed to the Data Atlas. Most notably, the persons listed below, who performed the work, wish to acknowledge the support and advice of colleagues at IUCN and WWF. In particular, we thank Mats Segnestam, Marine Programme Officer at IUCN, Hartmut Jungius, who succeeded to that position, Adrian Phillips, and Robert Allen for their leadership and counsel. We also acknowledge the aid of the personnel of the UNEP Regional Seas Programme and UNEP/ECLA Caribbean Environment Project.

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/INTRODUCTION

INTRODUCTION

Towards the Management of Marine Resources

Humans are now utilizing most of the plant's terrestrial area in order to meet their basic requirements for food, water, shelter, energy, health, education and spiritual/emotional harmony. Generally, through several millenia of human cultural evolution, land use techniques have evolved from hunting and gathering to agriculture and forestry to industrialization, with ever greater manipulation of the biosphere to provide mankind with desired goods and services.

As the land has been increasingly used and resources depleted, attention has turned increasingly to using the resources found in the sea. Humans, perhaps naturally, seek to follow their terrestrial experience there, but the scale of time is greatly different. Most harvesting of marine organisms, even today, must be classified as hunting and gathering, even though industrialized methods are used. Fish, kelp, whales, lobsters, coral, sand and other resources are removed from ocean waters, the sea floor, and rich coastal estuaries, bays, and wetlands. When supplies run short, there is need to culture living resources to perpetuate yields and enhance both quality and quantity, yet mariculture is still in its infancy. Industrialization of the sea may soon be upon us as civilization seeks to satisfy a growing need for energy and food.

Though use of the sea may appear to be tracking that for the land, management of the sea and coastal zone cannot be expected to follow terrestrial paradigms with any reasonable success. The sea is much different in character than the land. While the atmosphere contains very little life, the hydrosphere contains the greatest variety of life on earth. While life on land is but a few meters thick, life in the sea occupies the entire water column. And, while the air currents transport relatively little biological material, the ocean currents carry plants, animals, and organic and inorganic substances from land and sea. Entire "clouds" of nutrients and planktonic life move by ocean currents to supply ecologic functions far removed from their source. Different stages in the life cycles of marine animals very often inhabit entirely different ecosystems.

/Other differences

Other differences are relevant to any consideration of managing the seas. The downstream effect in the ocean far exceeds that on land. The chain of events between primary productivity and secondary and tertiary productivity may be far removed in space because of ocean currents. Similarly, pollution's effects may be hundreds of kilometers removed from the source. This makes it necessary to view individual organisms and places of interest to humans in far different spatial terms than is familiar in terrestrially-oriented thinking. That is, marine ecosystems, in terms of relationships between organisms, nutrients, and perturbations, are seen in terms of whole segments of oceans.

The sea and the land are interdependent. The sea receives sand, silt, pesticides, effluent wastes, fresh water and nutrients from the land. Nearshore areas are inseparable from the sea and many organisms depend upon terrestrial contributions. The sea, in turn, modifies the climate of land, provides fog, oxygen, rain, and winds to the shore, and stores the sun's heat. The "coastal zone" where over 50% of the world's people live, is the meeting place of land and sea and is, at the same time, one of the most perturbed, yet still productive, zones of our planet. The concept of residuals illuminates these regional interdependencies. All human activities have effects called "residuals" which, in turn may affect other human activities. In the sea, such residuals as siltation may affect habitats of species which move through whole oceans.

Therefore, if ecosystem management is to be applied to the sea, it is necessary to focus upon entire oceanic regions. Appreciation of the sea's processes is like looking at weather; from a local perspective, we may see clouds, but a satellite's eye gives one the appreciation of whole meteorological systems. The ocean's processes are to be seen on a similar scale. Further, the sea and land must be considered together. Ecological processes, including nutrient flow, species movements, siltation, energy transfer and stream flow between land and sea, are key factors in determining the boundaries of regions. Management requires that such processes be integrated with social, economic and political factors to insure that

/our equation

our equation for the best sustainable use of marine resources contains the vital elements necessary for holistic treatment and solution.1/

A Regional Context for Marine Resources Management

With this perspective in mind, IUCN has placed major emphasis upon the need to plan the sustainable use of marine and coastal natural resources within a regional and ecosystem context. Specifically, IUCN's concern for maintaining the living resources of the seas is seen to form a part of regional analysis as a basis for the ecologically sound development of the human environment.

The first region to receive priority by IUCN for marine conservation is the Caribbean, defined as the coastal and marine areas of the Caribbean Sea, the Gulf of Mexico, including the Greater and Lesser Antilles, the Bahamas, Turks and Caicos Islands, the Gulf Coast of the United States and Mexico, and the Caribbean Coasts of Central America, Panama, Colombia, Venezuela, Guyana, Suriname and French Guiana.

IUCN's effort is compatible, and indeed complementary, to the United Nations Environment Programme's and the Economic Commission for Latin America's Caribbean Environment Project on "Sound Environmental Management in the Wider Caribbean".2/ Considerable emphasis is being placed on co-operative work to integrate IUCN's work with UNEP/ECLA's activities to insure that development in the region is as sustainable as possible.

The Caribbean Region is characterized by high biological productivity along the coasts where sea and land interact, but by low productivity in the deep ocean regions. The Region is large and exceedingly varied both biophysically and culturally and, as for all marine-dominated regions, many

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1/ Ray, G.C., Ecology, Law, and the "Marine Revolution." 1970. Biological Conservation 3(1):7-17; Ray, G.C., and Norris, K.S., 1972. Managing Marine Environments. Transactions of the Thirty-Seventh North American Wildlife and Natural Resources Conference, March 12-15, 1972. Washington, D.C., pp. 190-200.

2/ This Programme has offices in Trinidad and has been in development since about 1976. Various documentation is available from the UNEP Regional Seas office in Geneva and from the UNEP/ECLA office, which describes the various components of the programme.

/of its

of its resources are shared among nations, not lying discreetly within national jurisdictions. The concept of resource sharing is essential to the sustainability of the region's support system for humans.

The Region has been subdivided into "subregions" as shown in Figure 1. These subregions focus attention upon major ecological units of the larger system. The characteristics of each of the six subregions are listed in relative terms in Table 1.

It is useful to note that most of the political entities with the lowest per capita income (Haiti, Honduras, St. Vincent, Grenada, Dominica) are in the insular Caribbean, as are the countries with the greatest population densities (especially the Lesser Antilles). These form the areas with greatest pressure on their living natural resources from local people. The major fishing countries of the Region (United States, Mexico, Venezuela, Cuba) are much less dependent on fish protein than the insular countries, especially the Lesser Antilles, which have the highest rates of per capita consumption of fish products. The insular countries receive the major portions of the region's marine-oriented tourism. In contrast, the Continental portion of the Caribbean Region is not heavily populated. There are few large urban centres along the coasts of the Central American portion of the Region. Santo Domingo, Dominican Republic, is the only city of over one million inhabitants facing the Caribbean Sea. All other cities of one million or larger face the heavily developed Gulf of Mexico, including Miami, St. Petersburg, New Orleans, Houston and La Habana. Others, such as Maracaibo and Barranquilla, may affect the Caribbean indirectly by way of rivers or other downstream effects.

Environmental threats to the Region are associated with overfishing, oil and mineral exploitation, pollution, the destruction of the coastal zone, including mangroves, wetlands, estuaries and coral reefs, and with the deforestation of watersheds. There is a general lack of capacity and techniques to protect and manage these habitats which are critical for the reproduction, growth and survival of marine organisms and stocks of commercially important species. This presents a serious threat in the face of increasing development. For example, trends in the extraction,

/Table 1

Table 1

SUBREGION CHARACTERISTICS

	Gulf	Bahamian	Northwest	Antillean	Southern	Guianan
Environmental						
Shelf	Large	Large	Moderate	Small	Moderate	Large
Upwellings	Large	?	Large	Small	Large	?
Climate	Temp. Tropical	Cool Tropical	Tropical	Cool Tropical	Tropical	Tropical
Rivers	Many	None	Moderate	Few	Many	Many
Productivity	High	Moderate	Moderate	Low	High	High
Major influence	Continental	Oceanic	Continental	Oceanic	Continental	Continental
Habitat						
Wetlands	Many	Few	Many	Few	Many	Many
Bays, Estuaries and Leggons	Many	Moderate	Many	Few	Many	Moderate
Living Reefs	Few	Dominant	Many	Moderate	Few	None
Sea Grasses	Many	Dominant	Many	Moderate	Moderate	Few
Species						
Dominants	Shrimp Demersal fish Pelagic fish Wading birds Endangered species	Corals Sea grasses Conchs Lobster Demersal fish	Corals Sea grasses Conchs Lobster Demersal fish Sea birds Endangered species	Lobster Moderate fish populations Sea birds Sea turtles	Shrimp Lobster Demersal fish Pelagic fish Endangered species	Shrimp Demersal fish Endangered species
Socioeconomic						
Population	Moderate	Low	Low	High	Low	Low
Fisheries	Valuable	Valuable	Valuable	Low	High	Moderate
Ocean traffic	Heavy	Moderate	Moderate to low	Heavy	Heavy	Low
Minerals	Rich (+oil and gas)	Low	Moderate to low	Low	Rich (+oil and gas)	Unknown
Coastal development	Moderate	Hight to low	Low	High	Moderate to low	Low

Note: There are many points of differentiation between the subregions. Only some major characteristics are included here.

/processing and

processing and transportation of petroleum products raise the spectre of even more massive oil pollution than at present from spills and disasters with little means, at present, for control. Similarly, coastal development of one country may seriously affect the natural resources of another, yet there are few agreements to negotiate such potential conflicts.

World Conservation Strategy

IUCN defines conservation as:

> "the management of human use of the biosphere, and of the ecosystems and species that compose it, so that they may yield the greatest sustainable benefits to present generations while maintaining their potential to meet the needs and aspirations of future generations."3/

Traditionally, conservation has been oriented toward the protection of single species and individual areas observed to be important habitats for wildlife. It is becoming apparent that what is required is nothing less than the appropriate management of nature's, and thus humankind's life support systems. This cannot be accomplished by isolated actions; rather, it is necessary to comprehend the workings of whole ecological systems and to devise means to maintain, and often enhance, the critical ecological processes of these systems. The task is two-fold: first it is necessary to understand natural systems, and second, action must be taken to insure that these systems continue to contribute to and support human development and the environmental health of the planet.

With this purpose in mind, IUCN has developed the World Conservation Strategy (WCS), with support from UNEP and the World Wildlife Fund (WWF).4/ The WCS presents a conceptual framework for conserving the earth's living resources on a global scale. General lines of action are drawn to direct attention, expertise, and financial resources toward those issued, species, and areas which are of critical concern to the appropriate development and sustainment of the environment.

3/ World Conservation Strategy Ref. 18.4.79, IUCN, Morges, Switzerland.

4/ Reference No. 3 also includes information on the history of the WCS and its support. The dates of implementation of the WCS are available from IUCN Headquarters.

/The strategy

The strategy presented here for the Caribbean Region follows that of the WCS. In this Region, it is apparent that conservation and development depend upon one another to a degree not traditionally recognized in the past. In fact, conservation and development have often been adversaries, the former relegated to protecting scraps of land or relict or endangered species, while the latter stood as the champion of human well-being. Neither of these positions can be sustained. Clearly, conservation and development are linked in ways we are only beginning to comprehend - and that human institutions are not usually well-prepared to accept.

Strategic Planning

Strategic planning for the maintenance of living resources examines the major overall problems facing species, communities, people and life support systems. It focuses upon the requirements for ensuring the long-term maintenance of species and habitats while immediate-term benefits can continue to be derived. Strategic planning reviews major trends, analyses the relevant factors, synthesizes the relationships among key factors, and identifies priorities for action. In addition, and to keep the planning process up-to-date and on target, strategic planning periodically reviews all field activities which have been derived from the strategy in order to glean learning from experience, and to constantly revise the information upon which planning is based.

Strategic planning provides conservation with a view of the "forest obstructed by the trees" - for perceiving the bouillabaisse of water masses unobstructed by surface glitter - an objective grasp of ecosystems with relationship to the goal of maintaining the sustainability of living resources. And, the goals of conservation must be integrated with those of development. To development, strategic conservation planning provides a means to identify those areas of land or sea which merit special forms of management to sustain human development and environmental stability and to note in which way, where and when, certain development alternatives will involve negative or positive impacts for the environment.

Thus, with the WCS, IUCN has taken a decisive step towards placing conservation onto a footing which will assist development planning and the

/management of

management of the environment. Living resources can be integrated with development decisions, and in their effective management, they may yield ever greater benefits to humankind.

Objective of this document

The objective of this document is to guide IUCN, and other interested organizations, in the development of a procedure for preparing strategy plans for marine conservation in the Caribbean Region. The ultimate goals of this effort are: (1) to support the management of the living marine and coastal resources of the Caribbean and related support systems so as to yield the greatest sustainable benefits to humans while maintaining their potential to meet the needs and aspirations of future generations, and (2) to serve as a model for strategic planning in other marine and terrestrial regions or areas.

The document includes a suggested STRATEGY PLANNING PROCESS - a procedure for the preparation, implementation and up-dating of conservation plans at the strategy level. This PROCESS consists of six organizational and managerial functions which are described individually. Emphasis is given to the fact that when the six functions are interrelated and interdependent, and, when operated as one programmatic or "organic" whole, they enable IUCN to analyse and synthesize fresh information from the field, orient conservation action, and learn quickly from past experience.

IUCN/WWF Projects 1037 and 1462 modified and/or adapted tested techniques to provide IUCN with methods to implement the strategy planning process in practical terms. The RESULTS of the work are summarized herein; the details are to be found in the various reports, displays, and publications of the individual projects.

Several problems and difficulties were encountered by the Projects. In the DISCUSSION section, particular cases are mentioned where the suggested methods require special handling. There remain limits for conservation planning due to a lack of information, knowledge of ecological and socioeconomic processes, and technologies for sustainable management of marine resources which must be addressed in this evolution of strategic planning.

RECOMMENDATIONS are presented in three parts - those directed to IUCN itself for implementation of strategic planning; to IUCN and WWF concerning priorities for action in the Caribbean Region; and, for IUCN to suggest to UNEP/ECLA for work on the Caribbean Environment Programme.

/BACKGROUND

BACKGROUND

IUCN activities in the field of marine conservation began to be stressed in 1970 when in December of that year the Committee on Marine Habitats of the IUCN Commission on Ecology met for the first time. By late 1973, momentum had been gained and Project No. 1037, "Conservation of Critical Marine Habitats" (CMH) was launched under the leadership of Dr. G. Carleton Ray at The Johns Hopkins University. The early years of the project were spent in the development of concepts in providing consultative service to IUCN.5/

The first major international meeting on marine parks and reserves occurred in Teheran in March 1975, and was followed in May of 1976 by the International Conference on Marine Parks and Reserves in Tokyo. One of the recommendations of the latter meeting was the establishment of a Critical Marine Habitats Working Group at IUCN which eventually evolved into the IUCN Marine Steering Committee (MSC) which met for the first time in September 1976. The combined efforts of the CMH Project and the MSC resulted in the definition of a Global Marine Conservation Strategy that was launched as the IUCN/WWF Marine Programme at the Fourth International Congress of the World Wildlife Fund in San Francisco in November 1976.

In 1976 and 1977, the MSC identified the Caribbean as a priority region within the IUCN Marine Programme. Work had already begun in the region through several IUCN/WWF Projects on particular habitats or species. Most relevant were the activities of the CMH Project which included the development of methods and techniques for the inventory and evaluation of critical marine habitats. The project also made several field visits and instituted co-ordination with the Caribbean Conservation Association and the UNEP Regional Seas Programme, particularly. The UNEP/ECLA Caribbean

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5/ Ray, G.C., 1978. Critical Marine Habitats. A Report for November 1973 - December 1977 on IUCN/WWF Project No. 1037. Johns Hopkins University: December. 47 pp.

Environment Project is based in Trinidad. The latter had also identified the Caribbean as one of its concentration areas for its Regional Seas Programme.

In the Spring of 1977, the CMH Project began to concentrate on information-gathering for the Caribbean region. This resulted in the preparation of a "Caribbean Habitat Notebook" and a series of maps showing habitat data. This preliminary effort was expanded by the addition of James A. Dobbin of James Dobbin Associates Limited, and Dr. V. Elliott Smith of the Cranbrook Institute of Science. Dobbin had previously applied environmental planning and mapping techniques to the Persian-Arabian Gulf for the United Nations' Ocean Economics and Technology Office.6/ Systems Analytic Mapping (SAM) was the name given to this technique during the course of work on defining critical habitats of walrus for the United States Marine Mammal Commission.7/ It is based on the IMGRID computer-mapping and hand-drawn data file systems developed at Harvard University. Dobbin refined and modified those techniques to address problems of coastal and ocean resource management while there from 1974-1976.8/

Dr. V. E. Smith had previously analysed LANDSAT satellite imagery for distinguishing reef and other habitats of the Great Barrier Reef of Australia.9/ As satellites present the only truly synoptic tools for

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6/ Dobbin, J.A., 1976. Integrated Regional Planning: Illustrative Examples of Planning & Mapping Techniques. Consultation on the Development & Protection of the Marine & Coastal Areas Kuwait, 6-10 December 1976. UN/ESA Ocean Economics & Technology Office, 1976.

7/ Ray, G.C., Dobbin, J.A., and Salm, R.V., 1978. Strategies for Protecting Marine Mammal Habitats. Oceanus 21(2):55-67.

8/ Dobbin, J.A., 1976. Planning, Management & Design of Marine Parks and Reserves. Harvard University, Department of Landscape Architecture. Master's Thesis, 108 pp.: Dobbin, J.A., 1976. Ocean Planning: Systematic Planning of Ocean Resources in the Economic Zone. Harvard Graduate School of Design, Department of Landscape Architecture. MS Thesis, 65 pp.

9/ Smith, V.E., Rogers, R.H., and Reed, L.E., 1975a. Automated Mapping and Inventory of Great Barrier Reef Zonation with Landsat Data. Ocean '75 Conference and Exposition, San Diego, California September 22-24; Smith, V.E., Rogers, R.H., and Reed, L.E., 1975b. Thematic Mapping of Coral Reefs Using Landsat Data. Tenth International Symposium on Remote Sensing of Environment, Ann Arbor, Michigan, October 6-10, 10 pp.

/habitat analysis

habitat analysis on a regional level, their data supply another essential tool for purposes of critical habitat evaluation. The results of his Caribbean analysis are in preparation.10/

In February 1978, IUCN held a Caribbean Marine Programme meeting in Guadeloupe for the purpose of (1) discussing IUCN's involvement in the Caribbean region in relation to other conservation activities, (2) structuring IUCN's involvement for maximum impact, and (3) identifying sources of funds and manpower. A major conclusion of the meeting was the need for a strategic conservation planning document for the region to be completed by the end of the year. The need to integrate a project for the development of such a programme with the CMH Project was stressed, as this task was outside the scope of Project 1037.

Within the hemisphere, some strategic conservation planning experience has been gained, and indeed, strategies for the conservation of wildlands have been prepared for Chile, Ecuador, Dominica and Brazil.11/ It was expected that the methods employed for the development of these strategies would be applicable to marine resources if proper adjustments were made.

Miller and Putney, authors of two of these strategies for the conservation management of critical natural areas, and other works on conservation planning, were present at the meetings in Guadeloupe, representing the Eastern Caribbean Natural Areas Management Programme (ECNAMP), which was initiated in 1977 through the School of Natural Resources of the University of Michigan and the Caribbean Conservation Association with funding from the Rockefeller Brothers Fund and the World Wildlife Fund.

10/ Smith, V.E., and Ray, G.C., (Preliminary Draft) A Satellite-Based System for Mapping and Inventory of Marine Habitats in the Wider Caribbean Region. Partial report on IUCN/WWF 1037. 56 pp.

11/ Putney, A.D., 1976. Informe Final sobre Estrategia Preliminar para la Conservación de Areas Silvestres Sobresalientes del Ecuador. Documento de Trabajo. No. 17, UNDP/FAO/ECU/71/527. Quito, Ecuador (mimeographed); Putney, A.D., 1977. A National Park and Forest Systems Plan for Dominica. The University of Michigan/Dominica Wildlife Programme. Roseau, Dominica (mimeographed); Thelen, Kyran D., and K.R. Miller, 1976. Planificación de Sistemas de Areas Silvestres. Documento Técnico de Trabajo No. 16, Proyecto FAO-RLAT TF-199. Santiago, Chile; Wetterberg, Gary B. et. al., 1976. Technical Series No. 8, UNDP/FAO/IBDF/BRA/545 Project. Division of Nature Protection, Brasilia, Brazil.

Miller and Putney were asked to assist in the design and implementation of a project to write a strategic Caribbean Marine Conservation Programme for IUCN.

Thus, Project 1462: "A Strategy for Marine Conservation in the Wider Caribbean" was initiated in April 1978, by the ECNAMP of UM/CCA in close working collaboration with Project 1037. Through several joint working meetings and combined field work, both projects addressed their respective and common objectives and submitted draft field reports for review by IUCN.12/ Additional graphic materials, data and bibliography were submitted to IUCN/WWF by Project 1037, representing major elements of their contributions. Notably, a 9-panel display on the application of SAM to the Caribbean region was presented at the IUCN General Assembly at Ashkhabad, TSSR, September 1978. Copies of this display are with IUCN, Ray, and James Dobbin Associates Limited and are available for use.

At the first meeting of IUCN's Programme Planning Advisory Group (PPAG) at Morges in February 1979, of which Miller and Ray are members, the overall programme procedure for the IUCN was discussed at considerable length. Basic requirements and lines of approach were suggested. To place the suggestions for strategy planning prepared by Projects 1037 and 1462 for marine conservation in the Caribbean Region into the evolving planning framework of IUCN, it was decided by Miller and Ray, in concurrence with A. Phillips, IUCN Programme Director, that a unified document be prepared by both projects to transmit the essential guidelines from the work of their teams to IUCN and WWF in a manner consistent with the strategy procedures being developed. This document is the result of that joint exercise.

12/ Putney, A.D., 1979. A Strategy for Marine Conservation in the Wider Caribbean. Draft Report submitted to IUCN/WWF for Project 1462. 22 December. 184 pp.; Ray, G.C., and McCormick-Ray, M.G., 1979. Planning a Marine Conservation Strategy for the Caribbean Region. Draft Report submitted to IUCN/WWF for Project 1037. January. 27 pp.

THE STRATEGY PLANNING PROCESS

The Process

The process by which strategies for the conservation of marine, as well as terrestrial, resources can be planned consists of six interrelated and interdependent planning functions. In the planning stage, these functions may be considered as sequential steps. Later, when a strategic system has been set up, they are to be carried out together:

Function 1. Gather information relevant to the extent and status of marine resources and the problems and issues related to their protection and use. Store the information in a manner useful for, and easily retrieved by, interested users.

Function 2. Verify and gather additional and detailed information in the field. Study areas which are representative of resource types and particular problems to gain relevant field experience.

Function 3. Analyse information to determine concentrations of living resources, the nature of ecological processes important to major species and productive habitats, and locations where present or potential human activities are concentrated. Synthesize the results of analyses to show where potential conflicts and/or compatibilities lie. Present information to guide interested organizations and individuals on strategies for conservation action.

Function 4. Determine priorities for action to address the key problems and issues pertinent to support systems for humans and other species of the Region, and those related to possible conflicts between human activities and natural resources.

Function 5. Implement activities through agreements, conventions, and field projects, as appropriate, and in collaboration with other institutions and individuals, to solve problems and issues.

Function 6. Monitor agreements, field projects, and the programme as a whole to learn from real-world experience and to improve the efficiency of future project and programme operations. Monitor the status

/of the

of the marine and coastal environment in the Region on a continuous basis to provide a periodic updating of information, knowledge, problems and issues, and their analysis and synthesis.

Activities of IUCN/WWF Projects 1037 and 1462

IUCN/WWF Projects 1037 and 1462 employed their past experience and methods to adapt to the Caribbean Region for implementation of this strategic planning process. Only the first four planning functions were undertaken. Project experience is summarized according to the individual planning functions to which they relate:

Function 1. Gather, store and present information

Particular types of information, representative of species, habitats, processes, and socioeconomics are required to guide decisions at the strategic level. Table 2 lists the types of information or ELEMENTS (e.g., currents, wetlands, tuna, fisheries, tourism, reserves, etc.) gathered. This information was obtained over a period of a year and a half by Project 1037 through literature search, contact with a large number of experts on the region and/or from the region, and from personal experience. All information and unpublished references were catalogued and filed in a carefully organized manner, called the DATA BASE. Published references for the work were noted in the BIBLIOGRAPHY. Information was also presented in a cartographic format on standardized maps of the Caribbean Region to form the DATA ATLAS. The SAM method was employed in rough form by Project 1037 to show concentrations of resources, their ecological process support systems, and potential conflicts or compatibilities with socioeconomic activities.

As shown in Figure 1, the SAM method provides a graphic presentation of (a) large areas containing many different resources, (b) smaller areas containing many different resources, (c) areas where information was found to be deficient, and (d) areas of singular importance. With regard to (c) "information deficiency" may not mean that information does not exist; rather information was not available to the Projects during the brief course of work. These areas show the location of greatest resources values and/or of greatest potential risk from inappropriate activities. They also show explicitly those areas where information may be too deficient for further

/Table 2

Table 2

ELEMENTS MAPPED IN THE CARIBBEAN DATA ATLAS

Element	Mapped (confidence indicated)	Map desired but lack adequate data	Data costly and complex to map
Place names	#		
Subregions (selected areas)	#		
Environmental			
Bathymetry	#		
Physiographic province			X
Currents			
March	#		
June	#		
September	#		
December	#		
Water masses			X
Upwellings and downwellings	o		
Tides			X
Sea swell		X	
Wave energy		X	
Climate			X
Wind			X
Rainfall			X
Evapotranspiration		X	
Rivers	o		
Sea temperature			
March	#		
June	#		
Air temperature			X
Topography			X
Geology			X
Sediments	#		
Phytoplankton productivity	*		
Plankton distribution	*		
Tropical storms		X	
Earthquakes		X	
Habitats			
Wetlands	#		
Bays, estuaries and lagoons	#		
Living reefs	#		
Sea grasses	*		
Watershed vegetation			X
Species			
Coelenterata			
Black coral		X	
Plexaura		X	
Vermetid worms		X	
Mollusca			
Conchs	o		
Octopuses	o		
Squids	o		
Bivalves		X	
Insecta			
Mosquitoes	*		
Sand flies	*		
Crustacea			
Shrimps	o		
Lobster	#		
Land crabs		X	

/Table 2 (concl.)

Table 2 (concluded)

Element	Mapped (confidence indicated)	Map desired but lack adequate data	Data costly and complex to map
Species (continuation)			
Fishes			
Demersal	*		
Pelagic			
Tuna	*		
Billfishes			
Springs	*		
Summer	*		
Winter	*		
Sciaenids		X	
Groupers		X	
Jacks	*		
Reptiles			
Sea turtles	#		
Crocodilians	#		
Birds			
Wading birds	0		
Sea birds	0		
Marine mammals	0		
Socioeconomic			
Population density	0		
Transportation	0		
Fisheries			
Commercial			
Conch/Lobster	0		
Octopus/Squid	0		
Shrimps	0		
Fishes	*		
Artisanal		X	
Sport			X
Petroleum			
Favorable strata and leases	*		
Infrastructure	0		
Transportation		X	
Spill trajectories		X	
Minerals	*		
Ocean dumping			X
Pollution		X	
Watershed development			X
Coastal development			X
Tourism			X
Economics			X
Health			X
Nutrition		X	
Communicable disease		X	
Vector-borne disease		X	
Psychological		X	
Phisiological		X	
Jurisdictional			
Marine jurisdictions	#		
Reserves			
Existing	#		
Proposed	#		
Cultural/Intitutional			
Historic cultural sites	0		
Research institutions	0		
Total	50	21	15
Grand total proposed = 87			

Note: # = Data complete and reliable according to best available knowledge.
0 = Data reliable but geographically incomplete.
* = Data uncertain.
X = Not graded for confidence.

/analysis.

analysis.13/ Figure 1 is a refinement of the initial rough analysis and synthesis, but elucidates one result of the SAM method.

Function 2. Gather and verify information in the field

Study sites were selected with the aid of SAM from the zones with greatest resource value/risk based upon five criteria:

(a) geographical balance - at least one study area was to be chosen from each subregion (as delineated in Figure 1);

(b) representativeness - the study areas were to include among them examples of key habitats, species and human development activities;

(c) importance to human welfare - each area was to be related to basic human needs in relatively obvious terms;

(d) availability of data - information must be available on each area to facilitate analysis, synthesis and the determination of priorities for action; and

(e) practicability - each area was to be accessible and feature reasonable facilities for transport and field study.

Seven study areas were chosen (Figure 1). They are: the coastal lands and waters of Belize, Guatemala and Honduras in the Gulf of Honduras; the Usumacinta watershed and coastal area in Campeche, Mexico; the Magdalena river delta and eastward to include the bays of Tayrona; the Monticristi area of northwest Dominican Republic; the Bahamas (Little Bahama Bank); the Turks and Caicos; and the British Virgin Islands and Anguilla.

Each study area was visited by one or more of the members of the two Project teams. Field data were collected to supplement the information already mapped by the SAM technique at the regional scale and to check confidence in the information gathered to that time. Larger scales were utilized to map elements at a level of detail more appropriate to the local area. Human influences on the resources were studied to determine (1) the kinds and extent of present uses, (2) planned activities or developments related to marine habitats or major species, (3) the developmental potential

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13/ There is reason to assume that additional information would be available, given further opportunity to search local libraries and explore the French, Spanish and Dutch literature.

/of the

of the marine and coastal resources along ecologically sound principles (ECODEVELOPMENT), (4) traditional values, and (5) the socioeconomic characteristics of the local human population. Analysis was made of institutional and administrative aspects to determine: (1) the existence of institutions for the planning and management of marine resources, (2) existing legislative and policy frameworks relative to marine resources, (3) the kinds and locations of management units, (4) the present management infrastructure, (5) existing public information programmes, (6) research infrastructures and capabilities, (7) ongoing training programmes, and (8) participation in international programmes, organizations, and treaties. Key references, including both individuals and publications, were noted.

For almost all of the study areas, most of this information was available. It was not, however, published or gathered at one source. Rather, it was dispersed through the offices of Government or in the minds or files of interested individuals. One of the main tasks of each field team, therefore, was to ferret out this information, as time permitted, on a piecemeal basis. Rapid reconnaissance of key areas was also made by plane, boat or car, as appropriate. Fortunately, in almost every study area there was a key individual, dedicated to conservation, who steered the field team both in data acquisition and in making site visits. Without the assistance of these key individuals, the area studies would have taken much more time to piece together.

The information gathered in the field for each study area was summarized in the form of PROFILES for use in subsequent steps.

Function 3. Analyse and Synthesize Information

As stated above, preliminary analysis and synthesis was carried out during phase 1. The information from DATA BASE, DATA ATLAS and PROFILES was used to refine the initial analyses on concentrations of living resources, to locate important ecological processes for marine productivity and major productive habitats and to locate concentrations of present and proposed human activities. The information was analysed to check for inconsistencies between the information gathered initially and that obtained in the field. Referencing of all information sources was examined to ensure that each

element map could be explained and defended properly, and each element map was assigned a confidence limit as shown in Table 2.

The information was then re-synthesized to refine concepts and locations of potential conflicts and/or compatibilities. For example, there are associations among resources. In Figure 2, the associations among shrimp, crocodiles, manatees and wetland habitats are presented. While the biology and ecology of this relationship are not well understood, this synthesis can serve to guide planners to grasp that a disturbance or alteration to any of these resources may affect the others; that is, the manipulation of wetlands may be related to the production of shrimp, crocodiles, and manatees together. All of these species depend upon coastal wetlands, and their functional interdependencies may be significant. Therefore, in order to protect manatees and crocodiles, it may be a more appropriate strategy to develop a case for wetlands conservation from the standpoint of a sustained yield of an economically-important fishery. At least, the interrelationships among these species and their habitats should be investigated.

To carry this strategy further, it is necessary to evolve concepts of the vulnerability of shrimp and other resources important to various human activities, such as fishing, petroleum exploration and exploitation, urban and industrial development, and watershed deterioration. A beginning toward this end is illustrated in Figure 3. From this synthesis the planner can note relationships between resource uses and particular natural resources.

A final illustration of the synthesis of information methos is shown by Figure 4. Protected areas have been established in the Region to conserve particular natural resources. The seemingly large number of reserves could give the impression that much has been done to preserve genetic resources and key ecological sites. However, the Figure calls attention to the fact that while some reserves lie within areas of high priority for marine resource conservation, as derived from Figure 1, most are very small in size and many are located in areas with few resources. It is also apparent that such reserves cannot possibly encompass areas sufficient in size to protect migratory marine species. In any case, one is led to appreciate

/that additional

that additional reserves and management areas of different kinds than traditional parks and sanctuaries will be required to meet specific conservation objectives for marine resources.

Function 4. Determine Priorities for Action

From within the seven study areas, action priorities were identified to guide the formulation of project proposals for the conservation of marine resources in the Region. This procedure provides the project planner with a means to reduce the scope of work to specific sites, themes and resources. These suggested activities are representative of some of the kinds of work which should be carried out in support of national and regional institutions by IUCN, WWF and other interested organizations and individuals. They do not comprise a complete list, but result from the application of the strategic methods described herein within the time and funds available.

In addition to specific priorities for selected site action, a set of recommendations is presented below to guide IUCN, WWF, UNEP and other organizations in the design and implementation of a conservation and development programme in the Region.

The identification of action priorities and recommendations were a result of the analysis and synthesis of information, the application of draft decision tools for considering alternative management categories and for establishing priorities according to the objectives of management, the use of a set of preliminary guidelines derived from the ecodevelopment principles, and a consideration of the needs of the region as a whole.

RESULTS

The results of the IUCN/WWF Projects 1037 and 1462 consist fundamentally of:

- A Data Bank for the Caribbean Region, with source references
- A Bibliography to support the Data Bank
- A Data Atlas for the Caribbean Region
- Analysis and Synthesis Models
- Profiles for the Study Areas
- Representative Priorities for Action in the Study Areas

/Also, both

Also, both projects contributed additional guidelines for programme development which are concepts in need of further elaboration. These include issue-specific submodels to exemplify relationships among selected elements which support particular management decision, a preliminary set of policy and tactical guidelines to orient strategy decision, a preliminary decision tool for the selection of management alternatives according to the objectives for marine resource conservation, and guidelines for the formulation of action priorities (see Discussion).

Data Bank

The Data Bank consists of data which have been recorded on file cards and on reference maps, organized both by data element and location (for example, by nation, sea, or latitute/longitude co-ordinates). All data are cross-referenced to source. Some data are also in notebook form (e.g., in a looseleaf book, which is more easily transported than the cards). Presently, there are but one set of cards and reference maps located in the Project 1037 office at The Johns Hopkins University. To be most useful, this material could be entered into a computer programme, and reproduced for distribution.

Bibliography

The Bibliography consists of a numbered listing of printed or published information which presently totals over 660 references. All material consulted, useful or not, is included. Word-of-mouth or in litt., references are not included here, but are referenced on the Data Bank cards.

Data Atlas

The Data Atlas consists of a set of 50 data maps including the information gathered during the study period. Not all data elements listed in Table 2 are represented by a map in the final Data Atlas. Some elements had to be omitted or delayed because of unreliability or incompleteness of data or because of the complexity of the subject material and the associated high costs of mapping. Also, most elements should be mapped seasonally - ideally at 3-month (seasonal) intervals. Currents and sea surface temperatures have been partially handled in this manner already. To do so for other data would at least double the size of the Data Atlas. One complete set of the Data Atlas containing all references is kept with the Data Bank.

/Analysis and

Analysis and Synthesis Models

The SAM Analysis and Synthesis Models as prepared for the XIV IUCN General Assembly at Ashkhabad, TSSR, consists of 9 panels, four of which combine data in a variety of ways. These will be described only briefly here as a full appreciation of them requires examination of the maps themselves. Currently, three sets of these models are available (with IUCN, G.C. Ray, and J.A. Dobbin).

1. Analyses

(a) Concentration of Living Resources. Shows areas where selected commercial, non-commercial, and rare or endangered species tend to concentrate. The coastal zone, including the continental or island shelves, is the richest zone in the Caribbean Region, especially near or downstream of major rivers or wetlands or in association with reefs, sea grasses, bays, lagoons, and estuaries. These concentrations lead to a first interpretation of critical habitat, according to locations of resources.

(b) Support Systems. Shows where ecological processes important to major productive habitats are concentrated. A combination of this analysis with the above reveals some important aspects of species' dependencies on environmental factors. This yields a second interpretation of the locations of critical habitats, i.e., according to ecological vulnerability. Such critical areas are very large. Detailed examination reveals that the areas are of several types and of varying levels of importance, depending on the resources considered.

(c) Concentrations of Socioeconomic Activities. Shows where present or potential human activities are concentrated, including fisheries, oil and gas extraction, mineral extraction, transportation, etc. The maps are in some cases difficult to validate because of the unpredictability of human activities and the problem of obtaining reliable data from "classified" and/or private sources.

2. Synthesis

The three analyses have been combined to show where selected potential conflicts and/or compatibilities may lie. These areas represent a third interpretation of the locations of critical habitats, i.e., according to

/potential threat

potential threat or socioeconomic conflict. Obviously, the areas most critical in the first (or biological) and second (or ecological) interpretations are very different from the third (or potential) conflict interpretation. One may consider the first two in terms of nature's supply, and the third as mankind's demand. Thus, three types of concerns are identified, one on sources of important resources, a second on support systems for man and other species of the region, and another in terms of possible conflict. The SAM method located in space and, to some extent in time, where attention should be concentrated and how. It is a "sieve" to identify, from a vast Region, important resources areas which warrant special action. One must also note that degree of threat is only one way of determining a critical habitat or priority area. It is as important, for example, to begin management before threat is apparent as to await that eventuality.

Profiles for the Study Areas

The information gathered during the field studies of IUCN/WWF Projects 1037 and 1462 has been placed in a series of PROFILES, one per STUDY AREA. Descriptive materials are presented along with maps to show the resources of the specific areas. Each PROFILE includes a resume of the determinants for resource management and a presentation of the priorities and objectives suggested for action at the national level. Then, more specific determinants and management objectives and categories are provided for particular sites of highest importance. Finally, priorities for action on themes and resources of regional and subregional importance are suggested. And, bibliography, lists of personal contacts, and relevant institutions are noted.

The PROFILES were presented as appendices to the final report from Project 1462 to IUCN/WWF, Morges.14/ It is intended that they be maintained for references purposes as they are considered to be preliminary studies only. Their major conclusions are presented below.

14/ Putney, A.D., 1979. A Strategy for Marine Conservation in the Wider Caribbean (fn. 12, supra).

Representative Priorities for Action

The action priorities are listed in summarized form under three categories: site-specific (particular locations within study areas), theme-specific (e.g., legislation, policy, training, etc.), and resource-specific (e.g., mangroves, marine turtles, etc.). These are to be considered a representative sample of needed activities, rather than a complete list. And, as most are site-specific, the suggestion of action does not imply endorsement by local government or people. The priorities are determined together from: (1) the analyses and synthesis of the SAM method; (2) the field analysis of resource data; (3) the analysis of human influences upon the resources; (4) the analysis of alternatives for management and development; and (5) the evaluation of institutional and administrative capacities of local organizations for managing natural resources and their use by humans.

A matrix tool, Table 3, was adapted from experience of personnel of Project 1462 with wildland management to guide decisions on the selection of appropriate management categories according to primary objectives for resource conservation. It was adapted from the original work of K.R. Miller and the field activities of FAO.15/

As shown in Table 3, the primary objectives of management are listed down the vertical column on the left. Across the top of the table, the preliminary alternative management systems are suggested. In the body of the matrix, the objectives are related to management systems according to their dominance, i.e., they prevail in the management of the entire area, in only some portions of the area, in parts or all of the area in conjunction with other objectives as by-products, or may or may not have relation to other objectives depending upon particular circumstances. Thus, by reading the table in horizontal fashion, the options for the pursuit of each objective can be noted, in relation to all other objectives. By reading the table down the vertical columns, the groupings of objectives for each management category can be examined. In this manner, management categories can be chosen according to the objectives of interest.

15/ F.A.O., 1974 Manjo y Desarrollo Integral de Areas Silvestres. Documento Técnido de Trabajo, No. 4. Proyecto FAO-RLAT/TF-199. Santiago, Chile.

/Table 3

Table 3

-PRELIMINARY DRAFT-

ALTERNATIVE SYSTEMS FOR THE MANAGEMENT AND DEVELOPMENT OF MARINE RESOURCES a/

1. Objective prevails in management of whole zone.
2. Objective prevails in management of some parts of the zone.
3. Objective is accomplished in parts or all of the zone in relation to other management objectives.
4. Objective may or may not have relation to other objectives and resource characteristics of specific area under consideration.

Primary Management Objectives	Alternative Management Systems										
	National Park	Natural Monument	Biological Reserve	Wildlife Refuge	Resource Reserve	Sustained Yield Harvest Zone	Fisheries Management Zone	Water Quality Control Zone	Tourism Management Zone	Cultural Monument	Coastal Zone Management Scheme
Maintain sample ecosystems in natural state	1	1	2	1						4	4
Maintain ecological processes uninterrupted	1	1	3	1	1					3	2
Conserve genetic resources	1	1	3	1						3	2
Provide education, research and environmental monitoring	2	2	1	2				1	1	2	4
Safeguard water quality	3	3	3	3				1	4	4	2
Control shore erosion and sedimentation to prevent "downstream effects"	3	3	3	3				4		4	2
Produce fish protein or products; sport fishing						4	1	4	4		4
Provide recreation and tourism services	2	4		4					1	4	4
Sustain yield of precious corals, sand or other materials						1	4	4			4
Protect sites and objects of cultural, historical or archaeological heritage	4	4							4	1	4
Protect aesthetic qualities	1	1	3	3				4	1	4	2
Maintain open options; management flexibility; multiple use					1			2			3
Stimulate rational use of coastal resources and rural development	3	3	3	3	4	1	4	3	4	3	1

a/ Adapted from FAO, 1974.

/Following identification

Following identification of a category of resource management which focuses upon a compatible set of objectives for the given resource and socioeconomic situation of the site, it is possible to suggest priorities for action at the site level or even beyond the site to the international level (for example, if migratory species or downstream effects are involved). These priorities relate generally to such activities as: legislation, policy, infrastructure, personnel, planning, research and monitoring, protection resource utilization techniques and methods, field operations and maintenance, and the acquisition of rights or lands or other types of control.

Site-Specific Priorities for Action

1. Gulf of Honduras Study Area

(a) Belize. While leadership at the national level, especially within the Fisheries Department, is recognized in the region as being good, urgent action is required to assist Fisheries in developing the capacity to enforce existing legislation. Equipment, such as patrol boats and radios, is required as well as trained crews. Increased co-operation between the Fishermen's Co-operatives and the Fisheries Department is also required.

The coastal and marine resources are extensive and varied and critical to the development of Belize. Coastal zone management is thus of major importance, and a coastal zone policy organized at the interministerial level through Fisheries is urgent. The life support systems for the coastal zone should be considered as an integral component of the coastal zone. The purpose of such a policy would be to stimulate rational use of resources, maintain natural productivity of critical habitats and their support systems, and incorporate ecological guidelines into all coastal development projects.

Rational use of the fisheries of Belize requires more information on present and potential commercial species and their habitats and support systems. The life histories of these species must be understood so that critical components of their habitat requirements can be identified and maintained. Additionally, habitat classification is required as a tool for making decisions on management.

Once more is known about life histories, habitat requirements, and life support systems, and once actual and potential developmental conflicts

/can be

can be identified, it is urgent to integrate this information into a fisheries management plan which will include a site-specific system of protected marine and coastal areas. This, together with the overall development and enforcement of a coastal zone policy should strengthen considerably the management of coastal and marine resources.

While of lesser priority, the development of environmental education and public awareness is also important. Resource user groups, especially fishermen, should receive priority attention. It is hoped that such an educational programme would build a constituency for the maintenance of critical ecological processes and improve the potential for sustained yield management.

Training is required to support all of the above-mentioned activities. Immediate priority should be given to the training of a fisheries officer in the management of protected areas, and another fisheries officer in fisheries management.

Organic legislation for the establishment and management of national parks has been prepared and its passage is urgently needed to provide the basis for site-specific management of protected areas critical to ecodevelopment.

Initiation of a system of marine and coastal protected areas should begin with the development of a Wildlife Reserve at Half Moon Cay and a National Park at the North and South Lagoons. Some general objectives for management of these categories of protected areas are indicated in Table 3.

(b) Guatemala. The very small Caribbean coastline of Guatemala is under considerable pressure for rapid development. Although little is known of the fisheries resources of the coastal area, information indicates that these resources are important. A fisheries resource survey and assessment is required for a fisheries development and management plan. Thus, there is urgent need to develop and implement a national policy, based upon sound ecological guidelines, for all development projects, especially colonization schemes in the tropical wet forest areas, oil pipeline construction, and port development. There is also a need to develop fishermen's co-operatives, similar to those already existing in Belize which would provide the basis for ecodevelopment in the coastal area.

/The management

The management and development of the existing Río Dulce National Park is critical to the ecologically consistent development of the Guatemalan coast and neighbouring areas. The most immediate need is for implementation of a protection programme within the park. This will require the construction of physical facilities and training of protection personnel, but in addition will also require interinstitutional co-operation among the government agencies active in the development of the coastal zone.

(c) Honduras. The coastal zone and near shore waters of Honduras are rish in marine resources. Unfortunately, information and knowledge on the interrelationships of the various resources which occur in association (Figure 2) are limited. Urgent support must be afforded Honduras at the national level to (a) locate remaining populations of manatee and to locate the best site for a conservation unit to protect the species, (b) improve the fisheries statistics programme, (c) determine the role of coastal lagoons and estuaries in fisheries productivity, and (d) determine fisheries potential. These activities would benefit from collaboration with the FAO/West Central Atlantic Fisheries Commission's Central American Fisheries Project.

Protection of the fisheries resource would benefit greatly by stationing trained inspectors at the several processing plants. These officers would improve law enforcement and engage in public awareness activities.

However, in addition to on-the-ground protection activities, a comprehensive coastal zone policy, developed at the interministerial level, is required to guide the management and development of the coastal resources. Implementation of such policies will require the development of appropriate management capacity within key national institutions such as the proposed National Fishery Research Institute, Environmental Institute, and Coastal Zone Policy Commission. This will require the training of key personnel for these new bodies. Work is also required to determine the feasibility of utilizing fishery products presently being wasted. These added benefits may be directed to support local artisanal or subsistence fisheries.

Two specific areas require priority attention. One area, encompassing the Bay Islands, urgently requires a regional plan to integrate potential national parks and other protected areas with tourism, agriculture, fisheries, and mariculture development.

/The other

The other area for urgent attention is Puerto Castillo which requires a comprehensive plan focusing on the management of the coastal zone. Management capacity will need to be developed to assure the maintenance of water quality, especially in relation to the new pulp mill complex. In addition, further information is required in order to plan the maintenance of the productive processes of the bay, lagoon, and Río Bonito. Information is also required to plan the artisanal fisheries near Trujillo and to maintain the critical ecological processes of the region. Further conservation planning in this area requires access to up-to-date plans for the many development projects under consideration.

2. Campeche Study Area of Mexico

The wetland systems of the Campeche Area are both extensive and of regional importance. However, one of the major factors which has hindered the proper management of resources of the area has been the lack of inter-institutional co-ordination at all levels. It is suggested that a state level co-ordinating body is required which will have a clear and strong mandate and sufficient resources for action.

It can be noted that considerable research and information gathering has taken place in the area, but the benefits of this work are not generally available as an input into the decision-making process for management. Therefore, the inventory and evaluation of existing research is of high priority. Special emphasis should be directed toward determining the dynamics of the populations of important commercial species as well as their habitat and life support requirements, and also to the potential for sustainable agricultural practices which are compatible with maintaining the productivity of the wetlands system for other uses.

Training of personnel is also urgent so that management capacity can be made available for the development of protected areas and the utilization of commercially important species. At the same time, proper protection of the marine and coastal resources will require the revision of existing legislation which is scattered and inadequate at present. Provision should be made for ecological guidelines for development and for agreements with other countries, principally the United States, for management of the

/fisheries of

fisheries of the Campeche area. Complemented by environmental education and public awareness campaigns, as well as the development of management plans for specific fisheries, these measures will provide the basis for proper protection of the significant marine resources of this area.

Within the Campeche study area, the Usumacinta Delta, Sabancuy and the Terminos coastal areas are in urgent need of management. Creation of a Resource Reserve (Table 3) in the Usumacinta Delta Area would provide for a "holding" category of management to permit time to properly assess and plan development of the area. As a first step, a research and monitoring component should be undertaken to review previous studies to provide data on the productivity and dynamics of the area, to determine some of the more important ecological impacts of industry, agriculture, and other potential uses of the area, to develop promising new resource utilization techniques, and to develop alternative management possibilities.

The Sabancuy area urgently requires management as a Wildlife Refuge (Table 3). To do this properly, a research and monitoring project for the area is required to provide information on the ecological role of individual species, to determine the importance of specific biological elements to the entire system, and to determine the status of faunal populations which are rare or endangered, or which are critical to the maintenance of the ecological processes of the system. In addition, adequate legislation is required so that effective protection programmes can be established and implemented, and training undertaken to provide the capacity to manage the unit.

The Laguna de Terminos area should be managed under an integrated coastal zone management scheme (Table 3). Further planning urgently requires information on the dynamics of the ecosystems involved. Also urgent is the development of management plans for key fisheries, and interinstitutional co-operation in fisheries management. These elements would provide the basis for the development of resource protection programmes.

3. Magdalena Delta Study Area of Colombia

The area comprising the Magdalena River Delta, Cienaga Grande, and the Tayrona Coast is of critical importance to the maintenance of the ecological processes of the Caribbean coast of Colombia. Given the various

development pressures of the area together with the development needs of the local populations, it is urgent that a coastal zone management scheme be developed for the Cienaga Grande area. The UNEP/INDERENA Ecodevelopment Project should be supported to reinforce the research and monitoring component of the scheme to provide information on: (a) the dynamics of the wetland system, (b) recommended techniques for resource utilization on a sustained yield basis, (c) life cycles of species of major economic importance, (d) technologies for the improvement of harvests, and (e) collective marketing and processing systems appropriate to local traditions. It is also important to provide information on the reasons for the massive die-off of the mangroves of Salamanca Island. Protection is also an urgent priority and can be achieved by improved law enforcement and public education programmes.

Resource utilization techniques must be improved to benefit local inhabitants of the area. These should include improvement of fishing techniques, aquaculture experimentation and extension, and collective processing and marketing arrangements.

Planning of the integral use of the wetland system is urgently needed, together with the development of individual management plans for units of the overall coastal development scheme.

Tayrona National Park is of major importance due to the aesthetic qualities of the area and the great diversity of life it contains. The upgrading of the Park's protection programme is urgently required to (a) detain and reverse the erosion of legal authority of the Government over the Park, (b) improve enforcement of the park regulations, especially those pertaining to illegal occupation of park lands, (c) transfer illegal squatters out of the park, and (d) improve and expand the public awareness programme for the park.

The Canal del Dique Area is also of great importance as part of the Magdalena River Delta system. Most urgent attention should be directed to monitoring the information on resource management being gained in the Cienaga Grande area for potential application in the Canal area, to freezing land use in the area until research results provide guidelines for management, and to planning the integral use of the area.

4. Virgin Islands and Anguilla Study Area

In both the British Virgin Islands and Anguilla, the planning of marine resources utilization is of crucial importance since these form the main resources for these territories. A secondary requirement is the development of institutional infrastructure and capacity to manage marine resources.

5. Monticristi Study Area of the Dominican Republic

This area is apparently one of the richest on the island of Hispaniola. A determination of the fisheries potential would provide the basis for planning the ecodevelopmental possibilities of the area. Any management scheme devised for the area must be co-ordinated with the Government of Haiti since the boundary between the Dominican Republic and Haiti runs through the middle of the wetland system of the area. Another urgent priority is the protection of the manatee population through improved law enforcement and the training of protection personnel.

6. Turks and Caicos Study Area

The marine resources of the Turks and Caicos Islands dominate the economy. However, the institutional infrastructure to manage these resources on a sustained-yield basis is lacking and is the most urgent priority. Together with the development of a management infrastructure is the need for a parallel development of policy guidelines for resource utilization and development. As an initial step, this should include the diversification of resource use to relieve pressure on the already overfished conch and lobster populations. The development of fin fisheries and agriculture are the most promising alternatives. Public education and awareness programmes and the updating of fisheries legislation are also important.

7. Little Bahamas Bank Study Area

Marine resources dominate in the Little Bahamas Bank and comprehensive planning is essential for such matters as (a) wetland exploitation and perturbation, (b) protection of the fresh water aquifers on Grand Bahama Island and Abaco, (c) control of water-bourne sediment from both marine and terrestrial sources, and (d) a wildlands-and-seas survey for the entire nation. Research and monitoring are essential to complement the planning

/effort. Special

effort. Special emphasis needs to be placed on the life histories, support systems, and critical habitats of commercially important marine species so that populations of these species do not fall to the level of "economic extinction", especially lobsters, conchs, and predatory fishes valuable as food. Environmental education is of continuing importance as is the training of local wildlife biologists, park and reserve administrators, and resource planners.

Theme-Specific Priorities for Action

Six theme-specific priorities were deduced from work in the study areas. These are restricted by results of field work only. Post-project analogies lead to other action priorities (see Discussion). The following are common to two or more study sites and provide the basis for further elaboration in the Recommendations section below.

1. There is common concern for the urgent need to design and establish a contingency plan for major oil spills from tankers or other sources of petroleum pollution.

2. There is a common need to provide the means whereby potential resource management leaders can benefit from educational and training opportunities.

3. Artisanal and subsistence fisheries would benefit from a pilot project to study and demonstrate ecodevelopmental opportunities and techniques.

4. A pilot project is needed to develop tourism models which confer equitable benefits to local people and which are sustainable in the long run.

5. The management of coastal and marine resources should be integrated into the curriculum of the proposed interamerican regional wildlands training centre.16/

16/ Organization of American States. 1978 Interamerican meeting on "Education and Training of Human Resources for Administration of National Parks, Wildlife Reserves, and other Protected Areas", Mérida, Venezuela.

/6. Finally,

6. Finally, the strategic planning process for marine resources conservation must be continued in order to prepare PROFILES and action priorities for areas not examined in 1978, and to continually revise and update ongoing work in the present study sites.

Resource-Specific Priorities

The work on study sites called attention to priorities for action oriented to particular resources. These, too, will be elaborated upon in the Recommendations section below.

1. Important marine and coastal environments, including mangroves, coral reefs, and sea grass beds, require periodic assessment and evaluation through a monitoring programme utilizing remote sensing or other appropriate synoptic, region-wide means.

2. The importance of crocodilians, manatees, sea turtles, and birds, as elements of critical marine habitats, is noted from their associations with wetlands, shrimp, sea grasses, and other key resources. Specific co-ordinated strategies must be developed and implemented for the conservation of each of these groups of species.

3. The importance of invertebrates and fishes, as elements of critical marine habitats and as important economic and social importance, is noted from their habitat associations. Co-ordinated management strategies must be developed and implemented for their conservation.

4. Most fishery resources of the region are shared between nations, by virtue of their migration or life cycles. International agreements in fishing and habitat protection are urgently needed.

5. The region is increasingly being developed for mineral and oil/gas exploitation. Means should be evolved for exploration and exploitation on a level consistent with sustainability of living resources.

DISCUSSION

The IUCN/WWF Projects 1037 and 1462 have suggested a procedure for strategy planning and programming which involves six specific functions. The work of the projects concentrated upon the application and development of texted tools and methods for establishing and implementing the first

/four functions:

four functions: Information Gathering, Field Study, Analysis and Synthesis, and Selection of Action Priorities. The Project Operations function of IUCN and WWF is already being organized and developed on a joint basis in Morges. The monitoring function is discussed below.

The six functions operate individually yet are interrelated and interdependent, each supporting the others and depending upon the others. Initially, they may be considered as consecutive steps, but as the strategy is implemented, they become parts of an "organic" whole - that is, functioning parts of a true "programme". And, by working from functions 1 through 6 on a cyclical basis, improvements can be made both in the quality of managing conservation projects and in the quality of information and knowledge. Thus, each successive decision should benefit from a more knowledgeable and experienced and "wiser" base.

The Information Gathering Function requires that formalized and standardized procedures be adopted to obtain particular types of data related to conservation planning. These data must be stored in a meticulous way and referenced for rapid recall and up-dating. This information will contribute directly to the preparation of the World Conservation Strategy and other documentation on the status of resources, themes of timely importance or position papers. It should also facilitate the work of the Commissions, such as: for monitoring the world's protected areas; for review of the status of plant and animal species; for work on environmental legislation, policy and administration; and for the insertion of ecology, planning, and education at all levels. The techniques for applying Systems Analytic Mapping (SAM), reviewed herein, suggest means to gather, store, present, analyse, and synthesize information for strategic planning and programming. By applying such integrative techniques to other regions, a consistent information-handling system for conservation could be developed on a worldwide basis.

The experience of the Projects in the Caribbean Region suggests that it is quite possible to gather information and map the location of biophysical resources and some ecological processes from the wide body of existing knowledge. Emerging remote sensing techniques promise the means to update data on a periodic basis in a synoptic and regional, yet relatively inexpensive way.

/In contrast,

In contrast, gathering information and mapping of certain ecological and socioeconomic factors have demonstrated problems which do not detract from the usefulness of the method used here, but require that adjustments be made for particular cases. For example, it can be observed that the depletion of mangrove and coral resources is due to the insidious activities of firewood, charcoal and pole production, coastal land reclamation (i.e., clearing for development), pollution, and abusive fishing and boat handling techniques. These factors are in all probability orders of magnitude greater in importance to resource loss than petroleum pollution. Yet, there is no simple socioeconomic factor(s) to map and to guide the user to grasp the situation and the trends. This particular case requires that complementary observations be made and recorded.

The other difficulty of data-gathering on socioeconomic factors is found in obtaining information on industrial development, ports, and harbors and residuals of activities. Many of these types of data are held in secrecy by governments and private companies. Better relations will have to be developed to gain access to these data.

Similarly, ecological processes remain difficult to interpret and map, largely due to the state of our knowledge about our coasts and seas. Integration of ecological information into planning models requires the best ecological expertise one can muster.

A Field Work Function which includes basic research, is essential to provide a means to continuously develop techniques and methods for planning, to cross-check information, and to gather new information and knowledge of places, processes, and topics of importance. Aside from the normal action priorities and projects which are basic to IUCN and WWF, the works of Projects 1037 and 1462, among others, have demonstrated the usefulness and importance of fundamental theory-based and practical field activities on the science and technology of conservation. In addition to needing further work on planning techniques, there is desperate need to sponsor work in the study of ecological processes, the nature of ecosystems, the subtle effects of human disturbance, the minimum size required for marine reserves, the biophysical categories of coasts and seas, and the appropriate management categories for marine protected areas. Similar to Projects 1037

/and 1462,

and 1462, these suggested topics should be studied to support the development of conservation science and technology in general, as well as towards the execution of actual field activities to solve specific problems.

The Analysis and Synthesis Function must be formalized in an institutional sense. SAM offers a fundamental tool and procedure for this purpose and it provides an objective framework for orienting the selection of priorities for action. Conceptually, the use of graphic representations of resources, ecological processes, socioeconomic situations, and the threats and conflicts among resources and uses, makes the method extremely useful to examine problems and issues. However, there are situations when important threats and conflicts are not made apparent in graphic form because certain ecological and socioeconomic factors are either difficult to map or the data are difficult to acquire and/or to analyse. For the most part, this information can be shared with other organizations and individuals through interdisciplinary exchange.

Accordingly, the methods used here must be complemented with other more informal and opportunistic sources of information for understanding problems and issues and becoming aware of the conflicts between resources or ecological processes and development activities. This is due to the fact that vast sectors of the Caribbean are not covered by sufficient information to allow objective and formal treatment. For some factors it is difficult to imagine how the lack of information will be overcome at a reasonable expense. Aside from the lack of information there is a fundamental lack of knowledge on how marine ecosystems operate. While the association among resources, such as shrimps, crocodiles, manatees, and wetland habitats, is apparent and warrants great care in planning, the nature of this association is not understood. Thus, the problem is to institute objective means to analyse areas, resources, and themes for their component parts; to seek the important interrelationships and at the same time, to maintain an awareness of other types of information to complement the formal analysis and synthesis. SAM, coupled with the Information Gathering and Field Work Functions involving analysis at much smaller scales, should provide for this complementarity.

/The benefits

The benefits of such integrative methods as SAM represents have been only partially explored. Such methods could be employed to develop "submodels" to exemplify relationships of interest to management decisions. Some possible relationships which should be examined in detail include:

- relationships between existing and proposed marine parks/reserves and concentrations of living resources;
- protection of ecological processes of sustained yield zones for insuring maintenance of productivity;
- determination of industrial siting in areas of living natural resource value;
- resolution of conflicts between efforts to control vector-borne deseases and habitat alteration and pollution;
- developing strategies for insuring survival of endangered or depleted species with wide distributions by means of emphasis on sustained yields of associated commercial species;
- development of a representative regional system of reserves for ecological research and environmental monitoring;
- relationships between local and regional interests, emphasizing the interdependencies of nations in preserving their shared resources;
- the phenology (timing of events) of environmental protection, particularly emphasizing time-sequences of human activity, migratory species, productivity or seasonal changes;
- residuals of tourism as they affect environmental values and resources use;
- consequences for management of living resources of the emergent Law of the Sea;
- legal/jurisdictional problems of coastal zone managements, including watershed management, coastal development, and fisheries.

Similar to the other topics mentioned above under Field Work, these efforts require funding and implementation to provide conservation with tools, methods and knowledge for more objective and useful work.

The Selection of Priorities Function can be realized as a consequence of objective analyses and syntheses. That is, action priorities can be

/related directly

related directly to important concentrations of resources, resources of singular importance, life support systems for humans and other species, human activities for food, water and other basic needs, and to the threats or conflicts between human activity and natural resources. The priorities which have been delineated above are suggested as sample activities which are representative of the kinds of work required in the Study Areas, and no doubt elsewhere throughout the Region. These suggested priorities demonstrate the need for work in particular geographic areas, on themes of interest common to several countries around the Region, and on resources which because of their mobility or wide-ranging behaviour are of common concern or require common action.

These representative activities are not, however, to be implemented in their present form. Clearly, nations and intergovernmental organizations in the Region must be involved in their further elaboration. Also both IUCN Commissions and Secretariat need to develop such projects further, within a regional programme framework.

The use of protected areas for the conservation of marine resources, considering conservation in the broad and complete sense as per the IUCN World Conservation Strategy, can be expected to be important in the Caribbean. However, there is danger in the direct transfer of terrestrial experience to the sea. Networks of parks and reserves along coastal zones and in open waters will only provide protection and appropriate controlled use in objective and limited ways where information and knowledge are sufficient. Many marine species are highly mobile. Pollution flows through the area irrespective of reserve frontiers and national territories. Fixed boundaries in the sea are irrelevant for many situations.

The decision model on management categories shown in Table 3 warrants further development. The basic approach is parallel to the concepts and methods being employed by CNNPA for terrestrial areas, and requires additional study and testing by marine scientists, managers, and other IUCN Commissions to develop an accurate representation of marine resource management. Similar to past work on terrestrial areas, action priorities for marine conservation will also require activities on legislation, policy, infrastructure,

/training, protection,

training, protection, planning, research and monitoring, and the acquisition of rights and "lands". There will also be activities specific to sites, themes, and resources.

Another matrix is useful for the establishment of priorities among suggested activities. This is shown in Table 4. The study areas are listed along the left-hand vertical edge of the matrix. The general classes of management activities are listed across the top of the matrix in an order which reflects normal procedures from the initiation of a protected area on the left, toward more advanced stages of implementation to the right. In the body of the matrix, the letters A, B and C, identify the relative "urgency" among the various activities and sites, a letter "A" denoting extremely high urgency for a particular activity to be given support in a particular place. With unlimited budget, personnel and facilities, the letters would guide decisions to carry out all of the work in relatively short order. However, given the fact that resources of all types are limited, there is the obvious necessity to choose those activities which should receive the first support, second support and so on. In the Table, numbers are utilized to designate "priority". That is, the number "1" in the body of the matrix denotes that highest priority should be given to support a particular activity in a given place. Therefore, the letters provide an "ideal" listing derived from technical logic and based in part upon the information shown in the PROFILES, and upon the experience and intuition of the staff of the Projects and local officers. The numbers place this ideal framework into the realities of budget, manpower and facilities. As resources become available, the number designations beginning with the "1's", suggest the activities which warrant earliest attention.

Naturally, the urgencies and priorities in the Table will shift as further study is given to each project proposal during formulation, and as the interest and support available from local governments, individuals and institutions is considered in detail. Attention is also drawn to the three interpretations of critical habitat, described above. These also may form sets of priorities, based upon location of resources, ecological

/Table 4

Table 4

GUIDELINES FOR THE FORMULATION OF ACTION PRIORITIES

Letters indicate level of urgency atwhich particular management activity should ideally be supported. "A" is highest urgency, "C" is lowest.

Numbers indicate level of priority at which particular management activities can be supported in practical terms, given local management capacity and the technical ordering in which work can be actually done. "1" is highest priority, "7" is lowest.

Study Areas (Sites)	General Management Activities										
	Law	Policy	Area Acquisition	Institutional Infrastructure	Training	Planning	Public Education and Awareness	Research and Monitoring	Protection	Utilization	Field Operations and Maintenance
I. Gulf of Honduras											
A. Belize											
1. National	A/7	A/2			C/6	B/4	C/5	B/3	A/1		
2. Half Moon Cay Wildlife Reserve			A/1								
3. North and South Lagoon National Park	B/2					A/1					
B. Guatemala											
1. National		A/1						B/2		C/3	
2. Río Dulce National Park				A/2	B/3				A/1		
C. Honduras											
1. National		A/3		A/4	A/5			A/1	A/2	C/6	
2. Puerto Castillo Development Area								A/1			
3. Bay Island Coastal Zone Management Scheme						A/1					
II. Campeche											
A. National		A/3			B/4	B/6	B/5	A/1	A/2		
B. Usumacinta Resource Reserve		A/1				C/4		A/2	B/3		
C. Sabarcuy Wildlife Reserve					B/3			A/2	B/1		
D. Terminos Coastal Zone Management Scheme						B/2		A/1	B/3		
III. Magdalena-Tayrona											
A. Cienaga Grande Coastal Zone Management Scheme						A/2	C/5	A/1	B/3	B/4	
B. Tayrona National Park							B/2		A/1		
C. Canal del Dique Resorce Reserve						C/2		C/1			
IV. Dominican Republic											
A. National				C/4		C/2					
B. Montecristi								C/3	A/1		
V. Bahamas (National)					C/4	A/1	C/3	B/2	A/5		
VI. Turks and Caicos (National)	C/5	B/2		A/1			B/4		B/3		
VII. Virgin Islands and Anguilla											
A. British Virgin Islands				B/2		A/1					
B. Anguilla				B/2		A/1					

/process and

process and threat. As such, they relate to "urgency". Thus, it is necessary to treat Table 4 as a guideline method for the organizing of actions at various levels, a method which must be used with flexibility and in accordance with the nature of "critical habitat" definition.

In addition to action priorities related to areas, there are priorities which relate to subregional, regional, and international activities and organizations. These will be presented in the Recommendations section, below. These suggestions relate particularly to resources and activities which are of regional concern or require common action and which may or may not be obvious at the site level. Whereas it can be argued that the basic unit of action, after all is said and done, is the nation state, there is inherent danger in underestimating the importance of international co-operation. Emanating from the Analysis and Synthesis Function, it is feasible to delineate the resources, support systems, socioeconomic activities, threats and conflicts which may be associated with two or more states. Intercountry activities must be planned in order to address these problems and issues. National and local actions free from a regional focus run the risk of irrelevancy due to the activities of neighbouring nations "upstream". Thus, a balance must be maintained between the regional view of co-operative action for conservation among nations, on the one hand, and the specific work of individual nations on the other.

Similarly, a balance is required between the development of science and technology for conservation, including research and monitoring, on the one hand, and implementation of field activities to protect species or to protect areas. Decisions related to achieving this balance must be based ultimately upon the needs for effective conservation resource management in the field. An over-emphasis on the establishment of protection systems at the expense of the development of basic science and derived technology for conservation runs the risk, for example, of having reserves in locations with little importance for maintaining ecological processes, or protecting species in areas too small for their maintenance, or undertaking action without clearly addressing basic human needs and threats, or being unable to monitor the states of species, habitats, and ecosystems.

/The need

The need for balance can be further reinforced by noting present land-use trends and the rapid conversion of wild resources to meet human needs, particularly along the coastal zones. There is great urgency to identify those areas which, because of their biophysical properties and their role in ecological processes, warrant special treatment under one or another type of reserve area. The analyses show that greatest productivity, value and threat lie in the inshore and coastal zone areas in the Caribbean. These productive areas are extensive. Parts of them need complete protection, but most others can be utilized in various ways. An ecological system of reserves is essential to monitoring the effects of man's use.

Finally, with regard to choice of action priorities, it is reasonable to assume that the 1980s will comprise the last decase for choice. Yet, even with the rush, it is dangerous to risk hasty choices. Several months of serious field work can often minimize the uncertainties and raise the probabilities of a good selection of systems of resource protection and utilization.

The Project Operations Function is being reorganized on a joint basis by IUCN and WWF at their Headquarters. Evident from the work reported here is the importance of scheduling activities on data gathering, research and monitoring in a sequence appropriate to action for the development of any activity. In many cases, research and monitoring can be integrated into regular field projects for the establishment of protected areas. In fact, given the paucity of knowledge and information, all protected areas should include research and monitoring elements in the work programme, very much along the lines suggested for Biosphere Reserves. Such research and monitoring activities would be directed to support the management and development of reserves and the surrounding areas, would serve to "bench mark" the natural resources of the area, and would serve as a centre for developing tools, methods and knowledge of importance for conservation and development throughout the Region.

Projects must relate as carefully as possible to local field conditions and to realistic socioeconomic contexts. Local managers, agencies,

/scientists and

scientists and peoples must be involved to insure that reserves and other activities relate clearly to basic human needs and perceptions. Because of the design of Projects 1037 and 1462, and the short duration of their field work, it was impossible to link field activities with local managers, scientists and agencies, beyond co-operation in the gathering of data and the preliminary analysis of problems and issues. Further work in the Caribbean now requires the establishment of close working relations with local institutions and individuals in the Region. It also requires "link-ups" with international organizations in order to achieve local/regional and science/technology balance mentioned above.

Finally, the vital element needed to give dynamic life to the planning process is the Monitoring Function. Two types of monitoring are required for the IUCN/WWF Strategic Programme: first, field projects must be monitored systematically for their management and administration, to insure appropriate co-operation and impact upon local conservation work, and to evaluate the effects and results of project activities. From this, the efficiency of project implementation can be constantly improved and the effect of IUCN/WWF labours will be more beneficial to world conservation as a whole. Second, programmes must be monitored as a whole. Field projects and all other information sources must be systematically observed and evaluated to gather information on problems and issues facing resources, life support systems, socioeconomic needs of humans, and the threats and conflicts between humans and the environment. These flows of monitoring information enter into the Information Gathering Function to up-date the World Conservation Strategy and improve project and programme operations. Again, the monitoring work of the IUCN and its Commissions, as well as numerous member organizations of IUCN, form elements of this function and supply the other functions of the planning process with periodic information and guidelines.

One final point from the work of the Projects warrants discussion. Considerable emphasis has been given to the principles of ECODEVELOPMENT, and it has become clear that conservation would benefit from a presentation of the relationship of these principles to conservation planning and

/management. Other

management. Other concepts such as the Cocoyoc Declaration 17/ and the emerging ideas of "new economic order", the revision of terms of trade by UNCTAD and the development of ethics and standards for the conduct of international aid and of multinational companies such as timber firms, all relate to conservation. These consepts and ideas have been reviewed and analysed by N. Myers and K. Miller.18/ It is important that IUCN and WWF become more involved in the development of these and other bodies of thought in order to insure that ecology and environmental considerations are adequately incorporated into development in the most harmonious manner possible.

RECOMMENDATIONS

A. To IUCN, it is recommended that:

1. Conservation of the plant's living resources be fostered through offensive (rather than defensive) planning for conservation action around the world. This requires the closest possible collaboration with all member organizations and individuals, and with those institutions most related to economic and social planning and development. And, as shall be suggested below, this requires an active tactical-level field programme which is intimately linked to strategic planning in order to insure the appropriate management of living resources and to guarantee the rapid improvement of conservation efforts as based upon real-world experience.

2. A strategic planning procedure be implemented at IUCN, consisting of 6 interrelated and interdependent functions:

- The gathering, storage, and presentation of information.
- The gathering and verification of information in the field.
- The analysing and synthesizing of information.
- The determining of priorities for action.
- The implementing of field activities.
- The monitoring of field and programme-level activities and the state of the environment.

17/ Cocoyoc Declaration. 1974. U.N. Conference on Trade and Development (UNCTAD). Cocoyoc, Mexico.

18/ Myers, Norman. In press. The Sinking Ark. Pergamon Press, London; Miller, K., In press. Planning National Parks for Ecodevelopment. Incafo, Madrid, Spain.

/Several specific

Several specific recommendations can be suggested:

(a) The functions to gather, store, and present information consist of the continuous up-dating and presentation of the World Conservation Strategy (WCS), based upon a flow of information from members, commissions, governments and related institutions. This requires a systematic procedure for the handling and storage of information such that it can support the WCS as well as be available to members for their respective objectives. Based upon the experience gained from this regional study, IUCN may wish to consider the employment of methods used here for other regions of the world, the advantage obviously being the establishment of a common technique for conservation planning on a global scale.

(b) The function to gather and verify information in the field consists of cross-checking information and in obtaining reliable information on environmental trends, socioeconomic developments and policies, and guidelines from government organizations and the UN agencies. It requires that all headquarters staff, commission officers and members, and the membership of the Union participate, in an orderly manner, in the review of the WCS, IUCN position papers, UN declarations, and regional action programmes. It requires that the travel of IUCN officers and staff be designed to involve communication with local members and colleagues in the field. This function must be aggressive to seek and examine actual problems of importance to conservation to be sure that the strategic programme is on target and that it maintains proper pace (several steps ahead) of problems challenging living resources. This function also involves the development and field testing of methods and techniques for conservation planning.

(c) The function to analyse and synthesize information consists of a systematic means to bring together and digest information, to locate natural resources, ecological processes and socioeconomic factors in space and time, and to note where possible threats and conflicts to living resources can be expected to occur. This requires that orderly procedures be employed to present the information graphically for ease of universal understanding. In addition, more intuitive methods are generally required in cases where key variables are difficult to catalogue or map in a manner or at a scale which is meaningful or where data are difficult to obtain due to complexity or to secrecy. Further work on integrative methods is urgent to develop and test "issue-specific

/analyses and

analyses and syntheses" which will show associations among factors which are key for making management decisions.

(d) The function to determine priorities for action consists of the identification of specific geographic areas warranting particular types of conservation management; for marine conservation, the starting point should be regional in scope. It included the identification of particular problems or themes which require support at regional, subregional, national or local levels, depending upon to which level the topics are of interest. And, the function identifies those natural resources which, because of their mobility, behaviour, territories, or habitat requirements, require the common action of two or more states. Techniques should be employed which supply a basic overview of the location and extent of resources and socioeconomic activities and to guide attention to particular threats and conflicts among resources and processes and various human activities. Again, this will need to be complemented with additional information and explicit guidelines based upon field work and experience to note those factors which are not apparent at any one particular scale.

(i) It would be useful to develop further a decision tool or matrix to guide the selection of the appropriate management category based upon the objectives of conservation (ecodevelopment). This effort could analogously follow CNPPA's work on criteria, objectives and categories for terrestrial protected areas and could profit from intercommision attention.

(ii) It is vital that resources be made available to support continued integrative work on the development of the "issue-specific synthesis models".

(iii) A set of policy guidelines needs to be developed to orient the selection of priorities to channel past experience and intuitive ideas in a consistent manner.

(iv) A set of policy guidelines is required on the subject of "conservation and ecodevelopment" to insure appropriate balance to concerns for local versus national interests, national versus regional, etc. The role of area management, and the treatment of endangered species within overall ecodevelopment policy warrants exploration such that guidelines can be given to Union membership to provide stronger and more consistent ties between conservation and socioeconomic development.

/(e) The

(e) The function to implement activities such as field projects consists of the formulation, operation and administration of field projects. To a large extent this function is already in effect having been developed to cover the interests and objectives of IUCN and WWF. Of importance is to insure that this function is placed into the overall strategic procedure to avoid independent action. Namely, the projects to be implemented are to be identified as a result of the previous four functions such that each investment and commitment has relevance to overall conservation in the light of real-world demands and the limited supply of talent and financial resources for conservation work. Naturally, there are situations where fast opportunistic action is warranted. However, in all cases, the formulation and operation of projects should involve reference to overall strategy and the maximum possible participation of local and national professionals, IUCN members, government bodies, and regional and UN agencies. Finally, project operations require careful follow-up and monitoring action to insure that conservation objectives are met, that projects are run as efficiently as possible, and that all ideas and suggestions emanating from project operations in the field and at Headquarters are carefully and faithfully passed on to influence the formulation of future projects and the strategic planning process itself.

(f) The function to monitor field and programme-level activities and the state of the environment insures that the strategic planning process can learn from real-world experience. The knowledge gained from field activities often remains with the field researchers and officers. Generally, knowledge about the state of the environment is often surmised in offices, without reference to field contact. The monitoring function consists of formalizing the means to gather and formulate guidelines to improve the efficiency of project operations, to improve conservation work in general, to insure that up-to-date knowledge and techniques are available and utilized by IUCN and WWF and known to IUCN membership, and to alert IUCN officers of overall strategic needs for new and improved knowledge and techniques for strategic planning. This function requires specifically that:

(i) projects be audited periodically during their operation, and at their termination to learn lessons for improving administrative procedures;

/(ii) project

(ii) project personnel be given a "briefing" and a "debriefing" following project termination to glean information and guidelines for improving the World Conservation Strategy, and to gather evidence on newly emerging problems and issues to be considered at local to regional levels;

(iii) information in the Data Atlas, Data Bank, and Bibliography be up-dated as a result of field projects;

(iv) information and comments coming to headquarters from the general membership and the Commissions be channeled systematically into the other functions, as appropriate;

(v) information and guidelines be channelled to the Office of the Director General, to headquarters staff, Commission Chairmen and general IUCN membership through the Bulletin and other forms, as appropriate;

(vi) Commissions be informed of the problems and issues requiring their technical support, policy suggestions, and the preparation of position papers;

(vii) Commissions establish formal procedures for channelling information, guidelines, and policies to the up-dating of the WCS;

(viii) review and follow-up on the interrelations between IUCN's strategic programme and the work and activities of other organizations, particularly the members of the Ecosystems Conservation Group (ECG) involving UNESCO, UNEP and FAO;

(ix) ties be maintained with the UNEP Regional Seas Programme.

3. The Data Atlas on the Caribbean Region be published to provide a tool for strategic thinking and planning for related institutions and individuals. This should be done in collaboration with UNEP and will involve additional funding. The Data Atlas should serve as a model for work in other regions.

4. The Data Bank and Bibliography be examined for alternative management and applications. These materials are key to all of the functions of the strategic planning process, and as such, must be integrated into the day to day work at headquarters. Much of the information is related to the work of IUCN Commissions; the work of Man and the Biosphere programme of

/UNESCO; the

UNESCO; the Global Environmental Monitoring System (GEMS) and EARTHWATCH of UNEP; and the genetic conservation work of FAO. As such, it may be useful to consider a relationship with the International Referral Service (IRS) of UNEP, to make the information available to interested parties. And it may be useful to consider the computerization of the information contained in the Data Bank, perhaps in conjunction with plans to computerize information on the protected areas of the world and endangered species, and with the well advanced computerization of environmental law and policy by CEPLA.

5. The Data Atlas and this report be presented to UNEP/ECLA Caribbean Environmental Programme as a contribution to regional expert and government meetings. Particular mention should be made of the tools for strategic planning, the identification of sites, themes and resources requiring urgent action, the information bank and bibliography, and the usefulness for future collaboration on the development of "issue-specific synthesis models" objectives for ecodevelopment, and of policies for the selection of priorities for action and for the integration of conservation into ecodevelopment.

6. The strategic programme for the conservation of marine resources in the Caribbean Region be integrated towards the selection of a network of protected and managed areas and the conservation of endangered species. Critically, the work on protected areas and endangered species should relate to the strategy for the region as suggested by the synthesis given here. While many activities will require more detailed analysis and information not explicitly treated here, and whereas some activities require immediate and opportunistic action, even those lines of work should be cross-checked against the overview provided, to insure consistency and to reduce the risks associated with unrelated and disconnected expenditures of talent and funds.

7. Research be considered as an integral element of strategic planning. The most fundamental questions surrounding the conservation of marine resources and processes are not well enough supported by knowledge and experience to allow for relatively certain action. Examples of urgent needs are: biogeographical studies on which to base systems of reserves; theoretical/field studies on ecological processes; theoretical/field studies on the

/sizes and

sizes and shapes of reserves appropriate to sustainability of species and habitats; and studies on the effects of perturbation. It is critical that a balance be created between research to support strategic planning and project planning, on the one hand, and field project operations to implement action priorities on the other. Much of the research required can be accomplished in collaboration with other institutions at the national, regional, and international level. But, much of this type of research may not be given appropriate priority without active promotion by IUCN. A basic research programme should be designed as an essential part of the strategic planning process in order to incorporate this element into the overall effort.

8. The development of applied science and appropriate technology for conservation be considered as an integral element of strategic planning. In addition to the need for knowledge on the fundamentals of marine resources and processes addressed in recommendation 7, there is need to develop knowledge, methods and techniques for assessing and evaluating the technology of conservation action in relation to the sea and its support systems. Examples are: further exploration and testing of integrative mapping and planning methods; the application of strategic planning at local scales; the employment of remote sensing for assessing and acquiring information on the status and extent of environmental features; and the employment of local sources to support planning with relevant information. Similar to basic research, the development of applied science and technology for conservation is integral to stragetig planning and must be pushed forward in a balanced manner with actual field conservation activities. Much of this work can be supported by other institutions but will require active promotion by IUCN.

9. A series of management categories for the utilization and conservation of marine resources be developed and accepted as fundamental to the strategy programme. Given the characteristics of marine resources and processes, it is evident that only limited species, habitats and ecological functions can be maintained through the establishment of protected areas in the traditional sense. The vast portion of the seas, as with

/the land,

the land, must of necessity be managed for productivity of use to man. Thus, it is critical, right from the beginning, that IUCN accept the position that conservation objectives can be realized under an array of management combinations. While the array will include strict conservation areas, there will also be areas where the utilization of resources will take place at appropriate intensities under appropriate management. This attitude recognizes the relationship of conservation to development. Recommendation 3(d)(i) suggests a specific tool for guiding decisions on this point, which could also serve to guide IUCN policy on this matter.

10. Strategy planning for the conservation of marine resources be considered integral to social and economic development planning. This requires that note be taken of UN declarations, UNEP Action Programmes, strategies and priorities of regional bodies such as OAS, OAU, and the several regional development commissions, and the development of global policies, such as for the "new economic order". These and other initiatives all relate to the conservation of marine resources. Furthermore, it is important that IUCN influence these developments to provide sound technical advice on critical habitats and ecological processes upon which social and economic progress must necessarily be based. This involved an enhanced profile for IUCN in these various fora and the promotion of greater action on the part of member organizations at the local, regional and international levels.

11. IUCN should help implement and explain the above through publications of policy and guideline papers. These should cover a full range of topics from law and social policy through ecology and methods.

B. To IUCN/WWF Joint Project Operations, it is suggested that:

1. The action priorities identified by Projects 1037 and 1462 for the conservation of marine resources and processes in the Wider Caribbean Region, and presented above, be employed to guide the actual formulation of potential project proposals. The methods utilized by the Projects identified particular areas where, because of the concentration of important resources and processes or because of uniqueness, actual field study was warranted. In the selected study areas, action priorities at the strategic level were

/derived. These

derived. These provide the overview of the kinds of work required to achieve conservation management in these areas, and can be considered to provide guidance for the design of action priorities in other similar areas. Further formulation is necessary to develop these strategic lines of action into actual tactical field project proposals.

2. The strategic-level action priorities be developed together with local expertise and management institutions into actual project proposals. The Projects enjoyed excellent collaboration from local professionals and government officers involved in the management of terrestrial and marine resources and in research institutions. They also enjoyed excellent co-operation with experts on this region but not resident there. However, because of the limited objectives of the Projects, and the limited time and funds available for such a large project territory, discussions with colleagues concentrated upon strategic considerations. Therefore, it is now necessary to develop project proposals for specific lines of action. This requires the observation of normal and appropriate lines of authority, participation of local expertise and management agencies, and integration into other local and regional development plans and activities. Local colleagues and organization should benefit from a presentation of the overall regional strategy in order to capture the purpose of the exercise at the regional, subregional and local scales.

3. The individual tactical-level project proposals be placed into relative priority. Once having developed a series of project proposals each of which can be explained and defended in terms of the regional strategy (e.g., they are not a shopping list in the traditional sense), it is necessary to consider the resources available for their implementation.

Figure 4 suggests a preliminary decision tool for placing the many potential projects into a priority order. This tool suggests a method of priority establishment at several levels. IUCN should seek to develop such a scheme further for specific application to marine conservation.

/C. For

C. For IUCN to recommend to UNEP/ECLA - Caribbean Environmental Programme (CEP), it is suggested that:

1. The work of IUCN/WWF Projects 1037 and 1462 in the Wider Caribbean Region has demonstrated the usefulness and importance of collaboration between IUCN/WWF and UNEP/ECLA in practical terms. Closer working relations should be established between these institutions to insure the most efficient utilization of IUCN/WWF's resources to support the proper integration of marine and coastal resource management and conservation into the ACTION PLAN for the Wider Caribbean Region.

2. The materials prepared by the Projects, specifically the DATA ATLAS, should be published and distributed to all related parties involved in the CEP ACTION PLAN.

3. The DATA ATLAS and other materials from the IUCN/WWF Projects should be presented to the various technical and policy meetings of CEP. These materials would be useful for several reasons: they provide a tool for developing "systems thinking" and thus could serve the meetings as a mechanism for entertaining many other items on the agenda; these materials demonstrate the linkages between marine resources and processes and the management and development of land resources and terrestrial based activities; and they demonstrate a method for ordering information for any sector, to guide decisions, and to defend conclusions in a credible manner.

4. Consideration should be given to establishing a data centre to gather, store and make available, information on the Caribbean Region along the lines utilized by the Systems Analytic Mapping technique (SAM). This data centre should relate to the information being prepared by the IUCN Commissions on endangered species, protected areas, environmental law and policy; UNESCO's information on biosphere reserves and Man and Biosphere project activities; UNEP's Earthwatch and Global Environmental Monitoring System, particularly the reference and impact sites; and the UNEP Information Referral Service (IRS).;

5. UNEP/ECLA and IUCN/WWF could collaborate usefully in the practical development of ecodevelopment. In particular, there is urgent need to develop model fisheries for local areas, alternative tourism models which provide equitable benefits for local peoples, based upon sustained management of natural resources, and alternative management categories for the protection and use of critical marine resources and processes.

/6. Training

6. Training courses and workshops should be organized to focus on important topics of interest at the subregional and regional levels. These include the following: (a) methods for the selection of areas to receive special forms of management for purposes related to the maintenance of critical marine resources and processes and to ecodevelopment; (b) management techniques for alternative categories of protection and utilization areas; (c) design, management, and development of alternative categories of protection and utilization areas to cover the array of objectives, including the MAB biosphere reserves, world heritage sites, and the GEMS monitoring site programmes; (d) planning methods and techniques for management and development of protection and utilization areas of critical importance; and (e) design and organization of research and monitoring activities to address the key questions facing the protection and utilization of marine and related terrestrial resources on a sustained basis.

7. Educational opportunities should be developed for promising candidates for management, research and leadership position in the Region. This requires that scholarships be established for work in marine biology, fisheries science and management, resource planning and management, coastal zone management and planning, and related topics, enabling talented individuals from the Region to obtain university and post-graduate education at institutions within the Region and elsewhere as appropriate. Particular attention should be given to developing special arrangements with selected schools where appropriate education and field work can be arranged.

8. UNEP/ECLA and IUCN/WWF should join forces to promote and support interinstitutional co-operation in solving problems of common interest to the region and critical to appropriate and sustainable resource management. Three general areas of work are required: new knowledge (science), new methods (technology), and learning from past experience (monitoring). Some of the key questions include: How do ecological processes work? What are the nature and extent of the interrelationships and interdependencies between marine resources and processes and related land areas? How can protected areas be most appropriately located and managed in the sea and along marine shores? How can a regional network of reserves be developed

/for purposes

for purposes of protection of genetic resources, monitoring of ecological processes, and monitoring of perturbation by man? What kinds of categories for the management of marine resources can be developed in practical terms? How can remote sensing serve management of marine resources? What needs to be monitored, where, when and how? Of these sites, which need to be maintained in a natural state, perhaps in perpetuity? How can monitoring be utilized to orient and correct management and development activities? Many of these and other similar topics could be the themes of individual projects and items for workshops and seminars. All are critical and successful sustained management of marine resources.