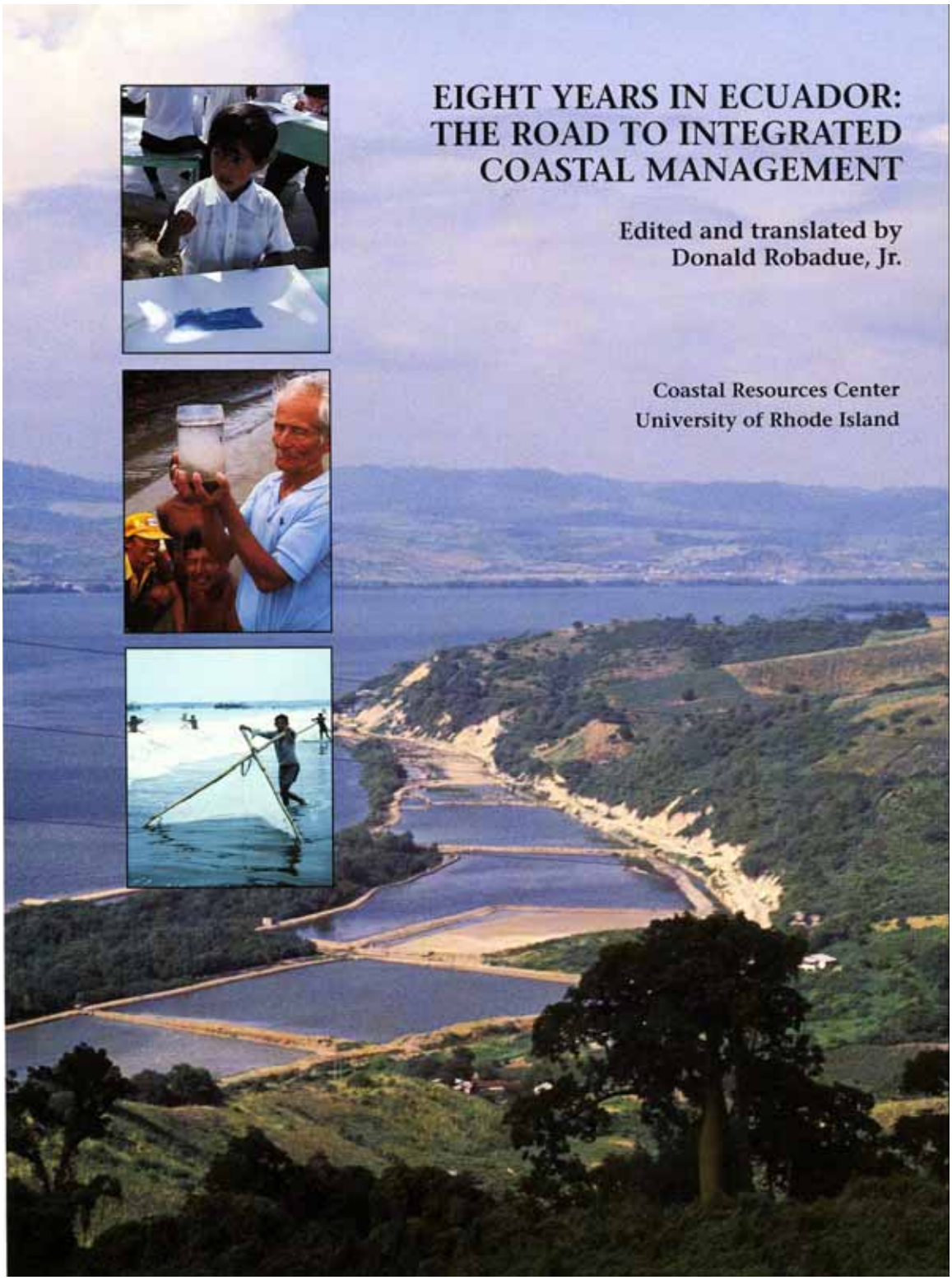

EIGHT YEARS IN ECUADOR: THE ROAD TO INTEGRATED COASTAL MANAGEMENT

Edited and translated by
Donald Robadue, Jr.

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University of Rhode Island

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September 1995

Formed in 1971, the University of Rhode Island Coastal Resources Center (CRC) is dedicated to facilitating effective coastal management worldwide.

CRC's work focuses on four main areas of activity:

Field programs, where CRC works in partnership with other governments and nongovernmental organizations to address local, national, and regional coastal management challenges;

Research and evaluation to improve understanding of specific resource management issues and to analyze efforts to address these issues;

Communications, including publications, networks, and newsletters that provide a forum for sharing experience among coastal management practitioners; and

Capacity building of individuals and institutions involved in coastal management, through education and training programs.

In both u.s. and international programs, CRC has.a commitment to meaningful partnerships, full participation of all stakeholders in the management process, and the development of indigenous capacity for sustained management of coastal resources.

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PREFACE

This document synthesizes a decade's experience in creating and integrating the management of Ecuador's coastal resources. The program that the U.S. Agency for International Development (USAID) designed in the early 1980s confronted the need to communicate environmental, political, and community perspectives on resource issues among many interested parties. The "two-track approach" that evolved worked simultaneously at the national level-to adopt a mandate for integrated approaches to coastal management, and at the community level-to illustrate the local benefits of sound resource planning. The bridges connecting these parallel approaches are the sectoral agencies and the educational institutions that collect, compare, and convey essential technical information.

The effort is succeeding through the strength of a partnership between the people of Ecuador's coastal communities, the government of Ecuador, the University of Rhode Island, USAID, and most recently, the Inter-American Development Bank. Sustainable development in all sectors of environmental management depends on our ability to collaborate in unified programs such as this.

Eight Years in Ecuador: The Road to Integrated Coastal Management documents the history of Ecuador's coastal resources management program, and shares its techniques and lessons learned with environmental planners and managers everywhere. We count on you to let us know if this information meets your needs. Please write to USAID or to the University of Rhode Island with comments on the value of this publication and our other efforts to improve the management of coastal resources around the world.

David Hales
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ACRONYMS AND TRANSLATIONS

Acronyms

ACEBAE	Association of Cultivators of Bioaquatic Species (shrimp farmers association)
CACE	Esmeraldas Agricultural Center
CEDEGE	Study Commission for the Development of the Guayas River Basin
CENAIM	National Center for Aquaculture and Marine Research
CETUR	Ecuadorian Tourism Corporation
CLIRSEN	Center for Remote Sensing of Natural Resources-Military Geographic Institute
CONADE	National Planning Council
CRC	Coastal Resources Center (University of Rhode Island)
CRM	Coastal resources management
CRMP	Coastal Resources Management Project (CRC/USAID)
DIGEIM	General Directorate of Maritime Interests (Navy)
DIGEMA	Office of the Environment, Ministry of Energy and Mines
DIGMER	General Directorate of the Merchant Marine
DINAF	National Forest Service
DITURIS	National Tourism Office
DNH	National Petroleum Directorate (Ministry of Energy and Mines)
EMAG	Guayaquil Wastewater Administration
EPOMEX	Program of Ecology, Fisheries, and Oceanography of the Gulf of Mexico
ESPOL	Coastal Polytechnical University
FEDECAM	Federation of Shrimp Exporters
FIRBA	Foundation for Bioaquatic Resources
ICLARM	International Center for Living Aquatic Resources Management
IDB	Inter-American Development Bank
IEOS	Ecuadorian Institute of Sanitary Works
IERAC	Ecuadorian Institute for Agrarian Reform and Colonization
INEC	National Statistic and Census Institute
INEFAN	National Forestry Institute
INERHI	Ecuadorian Institute of Hydraulic Resources (Water Resources Agency)
INOCAR	Oceanographic Institute of the Armada (Naval Oceanographic Institute)
INP	National Fisheries Institute
MAG-DSV	Ministry of Agriculture
MICIP	Ministry of Industry, Commerce, Integration, and Fisheries
NGO	Nongovernmental organization
PL	Shrimp postlarvae
PREDESUR	Program for the Development of the South
PRONADES	National Development Program
SMA	Subsecretary for Environment (Ministry of Energy and Mines)
SRP-DGP	Subsecretariat of Fisheries Resources-General Directorate of Fisheries
URI	University of Rhode Island
USAID	U.S. Agency for International Development
ZEM	Special area management zone

Spanish words frequently used in this book

Caipirifiero	vendor who sells drinks at small beach kiosk
Comuna	agricultural commune
Concha	cockle
Conchera	cockle harvester
Convenio	agreement
Precriadero	shrimp nursery
Larvero	larvae fisherman
Salina	salt flat
Estero	tidal inlet
Vigilante comunitaria	community enforcement monitor

Introduction

Ecuador's Coastal Resources Management Program (PMRC) was designed as a process by which a North American and Ecuadorian partnership could learn how to institutionalize progress toward more sustainable forms of development along Ecuador's coast. As the program took shape, we came to realize that our challenge was to make this progress in a context of anarchic and accelerating social and ecosystem change. How could we invent structures and procedures of governance that could begin to bring order to this process of change, and then direct the development process toward sustainable intensities and combinations of uses?

For 15 years prior to the launching of the PMRC, the University of Rhode Island's Coastal Resources Center (CRC) had worked to answer similar questions in the United States. As a result of this work, CRC had identified principles that had proven to be important to achieving better resource management:

- Use an approach to issue analysis that considers the historical roots of the present and the long-term implications of trends in social and ecosystem change.
- Formulate, with those most directly affected, area-specific "visions for the future" that identify specific priorities for both conservation and development, and attract local constituencies for their achievement.
- Select management tools and strategies that are within the capacity of implementing agencies to execute, and that strike a balance between actions likely to produce immediate and visible results and actions with only a long-term payoff.
- Commit to a 'transparent' and participatory approach to all the phases of the management process, in order to engage and empower elements of society, especially at the community level.
- Adopt a two-track approach to building institutional structure and political support for the program, producing advances simultaneously at the central government and at the community levels, and emphasizing support among those who will be most directly affected by the program's policies.

Recognizing the great differences in the social and political context in Ecuador, the PMRC made a major effort to give these principles an Ecuadorian expression. From a strategic point of view, the most important challenge before the PMRC during this 'first generation' of work has been to create constituencies that actively advocate improved resource management along the coast. Without such constituencies, any progress that might be made in the form of plans, new governmental procedures, regulations, and even public works are unlikely to have any lasting impact.

In the initial years, there was a strong sense that the project was a venture into the unknown and that we could not predict where in Ecuadorian society we would find constituencies for a resource management initiative, or what techniques of resource management might prove to be implementable and effective. As the team matured, we became more confident. Our strategies, and the values that the program promotes, became more explicit and consistent. By 1993, the PMRC had succeeded in building constituencies within several levels of Ecuadorian society. Within the special area management zones-designated areas that have served as testing grounds for a participatory management process-support for the concept of local level governance that has a responsibility for the condition of the environment, in resolving conflicts and in articulating an integrated vision for the future has been strong especially amongst the poorer segments of society. Those that have either benefited little or have even seen their quality of life erode as a result of the past development process were initially the most active supporters of the PMRC. Shrimp farmers have been skeptical that the program would be able to muster the resources and the technical capacity to address the changes in ecosystem quality that now threaten the sustainability of the mariculture industry. Only recently

have some shrimp farmers come to support the PMRC's transparent and pragmatic approach to problem solving. Constituencies that understand the goals and the approach of the PMRC now also exists within the public at large, and among members of the media that have covered the PMRC's work. Within central government, support for the program has been sustained through three presidential administrations and, through the National Commission on Coastal Resources Management, has achieved high-level support in a crosssection of ministries. The activities of the PMRC working groups in water quality, mariculture, and mangroves has created a context for policy reform at the national scale.

In 1993, the team that had worked together for nearly a decade decided that it was important to document in some detail what we had done, why we had done it, and what we had learned in the process. We agreed that following the traditions of the project we would be explicit about our failures as well as our successes, and would write papers in sufficient detail to give others a sense for the feel and values (la mistica) of the program, which all believe is one of its most important attributes. When we discuss this experience, we find ourselves repeating that the essence of our work lies in building a philosophy that can lead to striking a new balance between people-in this case Ecuador's coastal people-and the ecosystems of which they are a part.

Spanish and English versions of this book are being released simultaneously. They both are an attempt to document a voyage of discovery that, the authors believe, is making sustainable progress toward integrated coastal management.

Stephen B. Olsen
September 1995

The Nature of the Challenge

The Coastal Management Mandate

In June, 1992, more than 178 governments at the United Nations Conference on Environment and Development (known as the Earth Summit or the Rio Conference) adopted, by consensus, Agenda 21 -a program of action for sustainable development worldwide. Agenda 21 provides governments, United Nations organizations, development agencies, non-governmental organizations and independent-sector groups with guidance on the numerous aspects of human interactions with the environment. In Chapter 17, "Protection of the Oceans, All Kinds of Seas, Including Enclosed and Semi-enclosed Areas and the Protection, Rational Use and Development of their Living Resources," integrated coastal management is addressed, calling upon coastal states to

- provide for an integrated policy- and decision-making process...to promote compatible and balanced use of coastal resources;
- identify existing and projected uses of coastal areas and their interactions;
- concentrate on well-defined issues;
- apply preventive and precautionary approaches in project planning and implementation, including prior assessment and systematic observation of the impacts of major projects;
- promote the development and application of methods such as natural resource and environmental accounting that reflect changes in value resulting from uses of coastal and marine areas, including pollution, marine erosion, loss of resources and habitat destruction; and
- provide access...for concerned individuals, groups, and organizations to relevant information and opportunities for consultation and participation in planning and decision making.

The Rio conference identified a broad array of measures that should be considered for inclusion in an integrated coastal resources management program, including living resources management and water pollution control:

Marine living resources (Chapter 17.75)

(i) Develop and increase the potential of marine living resources to meet human nutritional needs, as well as social, economic, and development goals.
(ii) Take into account traditional knowledge and interests of local communities.
(iii) Maintain or restore populations of marine species at levels that can produce the maximum sustainable yield.
(iv) Promote the development and use of selective fishing gear and practices that minimize waste and post-harvest losses.
(v) Protect and restore endangered marine species.
(vi) Preserve rare or fragile ecosystems, as well as habitats and other ecologically sensitive areas.

Pollution control (Chapter 17.27-29)

(i) Locate coastal outfalls to avoid exposing shellfish beds, water intakes, and bathing areas.
(ii) Improve local and national regulatory and monitoring programs, using minimum sewage effluent guidelines and water quality criteria, and give consideration of conditions in receiving water bodies.
(iii) Develop and apply pollution control and recycling techniques.
(iv) Promote assessments of risk and environmental impact.
(v) Implement sound land use techniques and practices to reduce runoff to estuaries and coastal water bodies.
(vi) Promote the use of less harmful pesticides and fertilizers.
(vii) Promote watershed management practices to prevent or reduce degradation of the marine environment.

This paper describes how Ecuador has been working since 1985 to understand its coastal resource issues and proceed step by step toward effective integrated coastal resources management. Ecuador's program anticipated the challenges posed by the Rio Conference, and has pioneered an approach that is proving to be effective. The body of experience from this "first generation" of the program-during which issues were defined, policy developed, governance structures put in place, and solutions tested-should be useful to other nations as they initiate coastal management programs.

The Recent Transformation of Ecuador's Coast

Ecuador's coastal region, when defined to include the provinces that encompass the coastal tier of watersheds and associated estuaries, has emerged as the stronghold of progress and development for the country. In the past 35 years, activities in the coastal region have transformed Ecuador's economy and coastal ecosystems. The recent boom in shrimp mariculture has made this the largest private sector activity in the country. Producing and exporting about $500 million dollars worth of shrimp a year, the industry is second only to petroleum and bananas in the value of goods exported. Ecuador's estuaries provide critical habitat for fish and shellfish populations that support artisanal fishers that produce a critically important source of protein for the region's rapidly growing population. Industrial fisheries, which started in the 1950s, have modernized and diversified in the last 20 years.

The country's coastal ecosystems also contain the nation's best farmland and produce virtually all of the nation's agricultural exports. The coastal city of Guayaquil, the nation's largest and most rapidly growing city, is the center for banking and industry, and is a thriving seaport. Oil is transported across the Andes to the coast for refining, storage, and export. Petroleum companies are currently exploring for offshore natural gas and petroleum deposits. Coastal tourism is becoming an important industry.

Today, the very resources that have provided the foundation for this economic development in the coastal region are in jeopardy. Rapid population growth and accompanying development have put a variety of pressures on Ecuador's coastal ecosystems. Economic boom-and-bust cycles, frequent in the development of coastal Ecuador, have led to overexploitation of resources, followed by abandonment. In some instances, the resources that fueled these booms have never recuperated. Once-luxuriant coastal forests that supported a thriving shipbuilding and lumber export trade a century ago have virtually been replaced by low-yielding, frequently eroding pastures and wastelands. Agricultural activities, both along the coast and inland, are accelerating erosion and contaminating rivers and estuaries with agricultural chemicals.

The construction of shrimp ponds has brought almost complete eradication, in several estuaries, of mangroves-the very habitat that sustains the wild shrimp populations from which mariculture ponds are stocked. The construction of upstream dams threatens both

estuarine habitats and water quality by altering the volume, timing, and quality of river discharges. Declining water quality from a variety of causes threatens public health, the shrimp mariculture industry, and the ability of estuarine habitats to support fisheries. In addition to overuse and contamination of resources, conflicts among incompatible activities-such as fish processing and tourism-and poor siting of coastal structures are all too apparent along Ecuador's 1,256 kilometers (km) of open shore. Not only are such problems expensive to solve and avoidable, but they threaten to undermine tourism, which has the potential to capitalize on the sandy beaches and scenic bays of this extraordinarily diverse coastline.

Table 1. Ecuador's coastal resources

Coastline of Ecuador

Total Length	Gulf of Guayaquil
1,603 estuarine coast	1,026 km estuarine coast
1,256 km open coast	519 km open coast

Population in the coast

Province	1982	1990	Percent increase
Esmeraldas	249,008	307,200	23
Manabí	868,598	1,026,100	18
Guayas	2,038,454	2,463,400	21
El Oro	334,872	415,100	24
Los RIacuteos	455,869	530,800	16
Total	3,946,801	4,742,600	20

Source: INEC Censo de Poblacioacuten 1982, 1990.

Production of shrimp mariculture

Ponds available for production (1992): 133,000 hectares (ha).

Exports of Shrimp

Year	Metric tons	Value, US$
1984	21,700	159,840,000
1987	48,912	383,136,000
1990	70,652	340,291,000
1991	103,222	491,371,000
1992	116,315	525,759,000

Authorized shrimp larvae hatcheries = 100
Source: Shrimp Exporters Federation.

Mangrove ecosystem changes

Year	Mangrove area	Salt flats	Shrimp farms
1969	203,696	51,496	-

1984	182,106	20,008	89,078
1987	174,252	12,420	116,796
1991	161,776	6,320	145,998

Total loss of mangroves: 41,920 ha = 20 percent
Total loss of salt flats: 45,176 ha = 87.7 percent
Source: Center for Remote Sensing, 1992

Artisanal Fishing

Number of artisanal fishermen: 11-18,000
Number of artisanal vessels (motor boats, canoes): 4-9,000
Annual production (metric tons): ~20,000

Source: estimates of the National Fisheries Institute.

Compliance with Ecuador's existing environmental protection and management laws and regulations is weak along the coast. Closed seasons for fishing and shellfishing are still not widely respected. The complete ban on mangrove cutting adopted in 1985 by the Ministry of Agriculture was followed by increasing rates of cutting coastwide, and many shrimp farmers built their ponds in the beach and bay zone or upland without first obtaining all the required licenses. Effective controls do not exist for discharges of wastewater by industries, businesses, and municipalities to estuaries, rivers, and coastal waters. Coastal municipalities have the authority to zone shore and upland areas, but few have initiated any urban planning, and make decisions without technical guidelines. This broad-based absence of compliance with environmental regulations is explained in part by a low level of public awareness of government regulations, or of the reasons for restrictions on resource use. Public authorities themselves often are unfamiliar with the body of regulations and correct procedures that apply to typical cases. Furthermore, the current regulatory framework is often ambiguous.

The difficulty of achieving integrated action also extends to economic and social development programs. In the mid-1980s, the communities and resource users of estuaries, lagoons, and beach systems did not have any forum through which they could participate in resource management actions. National authorities only address their specific sectoral and regulatory mandates. Regional planning efforts focus primarily on expanding the road network, potable water, and irrigation for the expansion of agriculture. Rural development programs place emphasis on short-term economic projects rather than long-range natural resources management. Coastal communities have little access to sustained technical assistance or leadership to help them resolve resource-use conflicts, or to learn how to engage in more sustainable forms of development.

The quality of life for some sectors of the population has already been adversely affected by unsustainable resource exploitation. It is essential that the resource base that could indefinitely produce a rich bounty of agricultural products, lumber, fisheries, and cultured seafood is not further degraded, and does not lose its ability to produce the goods and benefits that are central to Ecuador's economy and political stability. Because, historically, these resources have tended to be regarded as public property and no one's responsibility, their development has generally been excessive, unplanned, and destructive. Ecuador's future economic development in large measure depends upon how its coastal ecosystems are utilized and managed.

A Brief Overview of Ecuador's Coastal Management Program

Milestones in the Program's Evolution

The importance of Ecuador's coastal region and the need for more effective management of its resources was first recognized at a workshop sponsored by the Ecuadorian Navy and the United Nations in 1981. The partnership between the Government of Ecuador and CRC gave rise to a pioneering program that is now entering an initial phase of full-scale implementation.

In March 1986, the U.S. Agency for International Development (USAID) initiated the Coastal Resources Management Project (CRMP) through a cooperative agreement with the University of Rhode Island's Coastal Resources Center (CRC). Ecuador was one of the three pilot nations to participate in the project. Over its eight-year lifespan, partnerships and collaboration were crucial to the progress of the CRMP. CRC worked closely with the government of Ecuador's Executive Director to the National Coastal Resources Management Commission and maintained technical and support staff composed entirely of Ecuadorians in both the main office in Guayaquil and five field offices. Staff from CRC also provided technical assistance and management services on a continuing basis during the project. The CRMP also relied upon the Fundaci&oacuten Pedro Vicente Maldonado, a Guayaquil-based nongovernmental organization for public education and outreach activities at the national and field office levels.

In 1988, a proposed strategy for a national CRM program was drafted by the Ecuador CRMP and circulated to all candidates for the presidency, national congress, regional and local elections during the election campaign. The proposal was accompanied by a manifesto for support from leaders in all four coastal provinces. Newly elected president Rodrigo Borja signed Executive Decree 375 in January 1989 (see annex 15.c.). This formally established the PMRC, set up the National Coastal Resource Management Commission, created a technical secretariat, set a two-year deadline for creating special area management plans for six locations, and established a Ranger Corps for law enforcement. In 1992 the framework for coastal resources management in Ecuador was completed through publication of Executive Decree 3399 (see annex 15.d.), which details the administrative procedures that govern the program (Figure 1).

In 1994, an agreement was signed by the Inter-American Development Bank (IDB) and the government of Ecuador, by which the bank is to provide a five-year loan to fund the PMRC.

Program Structure

The National Commission on Coastal Resources Management

This interministerial commission, which provides the focal point for national program activities, is charged with advising the president of the Republic of Ecuador on coastal management policy and working with its individual member ministries to oversee its implementation. These members include:

- Office of the President secretary for administration
- General secretary of planning of the National Development Commission (CONADE)
- Ministry of Agriculture, National Forestry Institute [INEFAN]
- Ministry of Industry, Commerce, Integration, and Fisheries

[MICIP]

- Ministry of Defense
- Ministry of Energy and Mines
- Corporation for Tourism [CETUR]

During the implementation of Executive Decree 375, the National Commission supervised preparation and execution of annual work plans, appointed local advisory committees, visited the special area management zones, reviewed and approved the special area plans, and promoted the development of the Ranger Corps. The National Commission became more involved in settling key coastal area controversies, guiding the preparation of the Inter-American Development Bank project on coastal resources management, and strengthening the government of Ecuador's executive directorate.

The Executive Directorate

Executive Decree 3399 strengthened the PMRC's executive directorate. The newly strengthened office in Guayaquil is administratively decentralized, and will be fully responsible for supervising the implementation of the Inter-American Development Bank project. The PMRC will gain the capacity necessary to expand its scope of operations throughout the coast and to implement many of the projects identified in the five ZEM plans, which were chosen as the main focus of the IDB project.

Special Area Management Plans and Offices

Executive Decree 375 established six special management zones, and gave the PMRC two years to prepare integrated coastal resources management plans for each site:

- Atacames-Suacutea-Muisne, in Esmeraldas Province
- Bahía de Caráquez-San Vicente-Canoa in Manabí Province
- San Pedro-Valdivia-Manglaralto, in Guayas Province
- Playas-Posorja-Puerto El Morro, in Guayas Province
- Machala-Puerto Bolívar-Isla Jambelí, in El Oro Province
- Galápagos, in an area defined by the National Commission

Locally, these areas are known as Zonas Especiales de Manejo, or ZEMs. The ZEMs were selected as microcosms of the challenges posed by the development and management of the Ecuadorian coast. They have shorelines ranging from 25 to 75 km in length. Together the ZEMs encompass only about 8 percent of the shore, but represent the full variety of problems that can be found throughout the coast. About 30 percent of all coastal construction and modifications since 1989 have occurred in these critical areas.

Advisory and executive committees were created in each ZEM in 1990. Once the management plans were completed for the ZEMs, Executive Decree 3399 was issued, fusing the two groups into a single committee. The PMRC established coordinator offices to support the planning process and carry out local projects. The coordinators worked with the PMRC's executive directorate and the Fundaci&oacuten Pedro Vicente Maldonado, which was responsible for outreach and public education, on every step of the planning process, including reviewing technical reports, building public awareness, designing policy options, and crafting the actions included in the plan. The coordination offices also organized user groups and helped implement

small "practical exercises in management" (see section 12) selected and executed by the local advisory committees.

All the ZEM plans were endorsed, first locally, and then by the National Coastal Resources Management Commission, in 1992.

The Ranger Corps

Seven coastal law enforcement coordination units, known as "Ranger Corps," were also established by Executive Decree 375, to improve the effectiveness of enforcing existing laws governing shore use, mangrove forest protection, water pollution, near-shore fisheries, and mariculture. The groups are led by the port captain of each region, and are composed of local inspectors with responsibility for detecting and prosecuting violations of shore- and water-use regulations. Members typically include the forestry agency (INEFAN,) Sub-secretary of Fisheries (SRP), and the Ecuadorian Tourism Corporation (CETUR). The port captains are under the command of the General Direction of the Merchant Marine (DIGMER) of the Ecuadorian Navy. The Ranger Corps units meet monthly and conduct joint patrols as well as follow-up on legal actions. Three of the seven port captains currently have active Ranger Corps units: Esmeraldas, Bahía de Caráquez, and Puerto Bolivar.

A PMRC enforcement manual has been prepared for the Ranger Corps that provides environmental information explaining why policies and rules have been put into place. The manual contains tables that identify which sanctions and procedures apply to specific infractions on the following topics:

- protected areas,
- water quality,
- land use, ecology and environment,
- shrimp farming and aquaculture,
- construction and siting of structures,
- mangrove ecosystem,
- navigation,
- fisheries, and
- tourism.

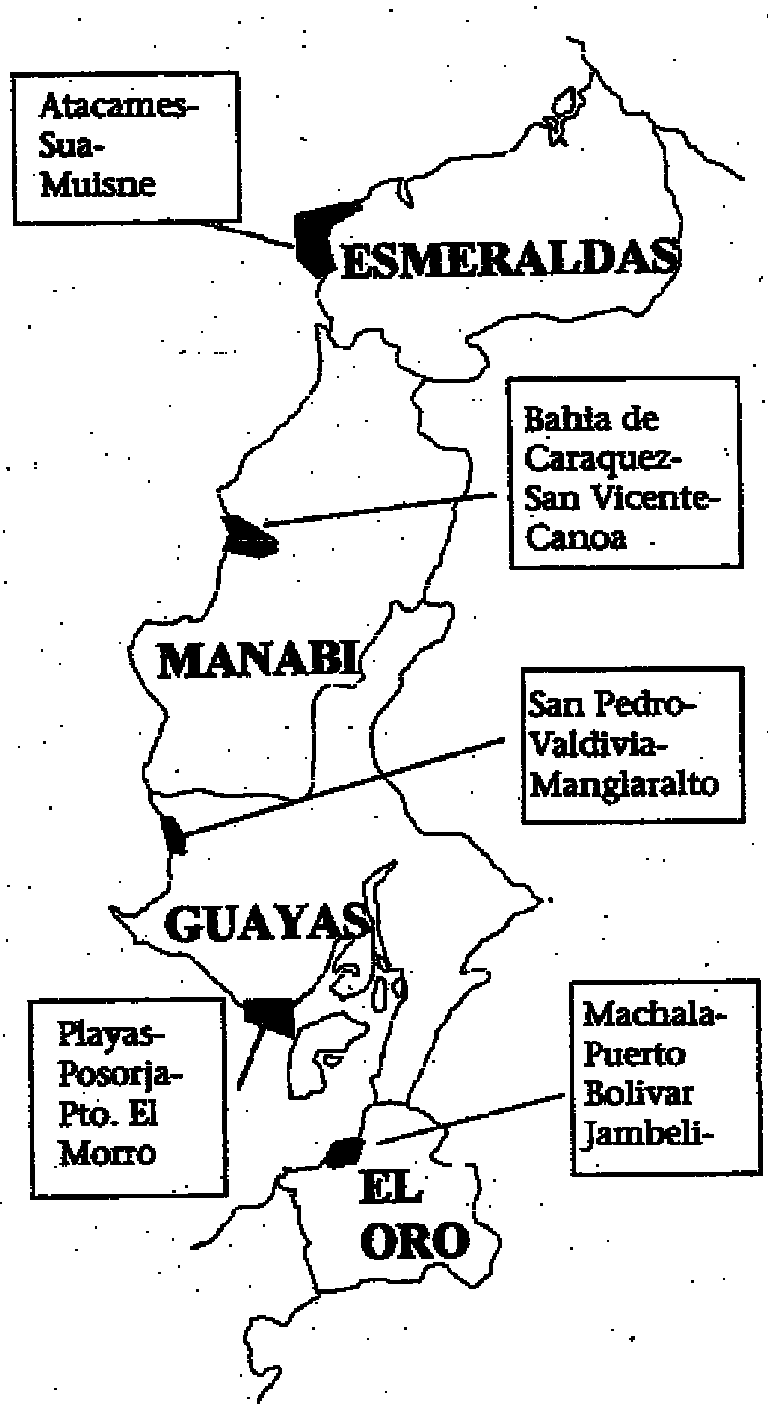

Figure 2. Location of Ecuador's special area management zones (ZEMs).

The PMRC Approach to Coastal Management

Characteristics of integrated coastal management
Balances the needs for conservation and development
Management structures are a mix of regulatory and non-regulatory tools
All stakeholders participate in the governance process
*Major focus is on the interactions and interdependencies among different sector*s

The Fundamental Objective

Human societies are sustainable when (1) they are in balance with the ecosystems of which they are but one element, and when (2) they are perceived to provide an adequate quality of life for the majority. These fundamental goals translate, for the PMRC, into the dual objectives of

- creating an equitable, transparent and dynamic governance process that engages and serves the people, and
- advancing toward a healthy and resilient life-support system.

The PMRC has been constructed on the premise that effective management to reduce, and eventually even reverse, the degradation of coastal ecosystems and the anarchic exploitation of their resources must directly address the societal values and the behavior that are the root causes of these trends. Change to societal values and behavior can occur only through a protracted and sustained process. Thus, the solutions lie primarily in inventing a dynamic and adaptive method of governance that can begin the process of discovering approaches to more sustainable forms of development. Applying technical fixes to technical problems is a secondary effort, at the heart of this endeavor lies the task of building constituencies across society that support the program's work and the values that it promotes.

How can we judge whether progress toward these objectives is being made? The PMRC believes that the indicators lie in measurable progress toward forms of development that

- do not exhaust the resources of the country,
- create many incomes and chains of enterprises,
- build local institutions that involve and empower the citizenry,
- are governed by institutions that operate with transparency and are held accountable for their actions, and
- promote the equitable allocation of resources and a flow of benefits to the majority.

A Two-Track Strategy to Building Constituencies for Improved Coastal Management

Attempts to deal with such fundamental issues as societal values and sustainable development can usually be placed in two categories. One strategy is to focus upon central government, its procedures and structures, and the need for national policy reform. This is the "top-down" approach. It assumes that a capacity for command and control resides within central government which, once properly adjusted, can produce the desired changes to how the coast is developed. More important, it assumes that a sufficient desire for change exists or can be created within central government.

An alternative strategy works to foment change at the community level, believing that the modeling of innovation at the grass roots will be transferred and will multiply across society. This is often termed the "bottom-up" approach.

The PMRC has combined the two in a two-track strategy. This calls for simultaneously and incrementally building capacity both within central government-track one-and at selected community sites (the Zonas Especiales de Manejo, or ZEMs)-track two. Both governments and communities must be involved in the analysis of development issues and in taking responsible action. The power of this approach lies in creating a dialogue that links the two tracks and promotes a sense of shared purpose at both levels. It creates mechanisms for conflict resolution and consensus building that draw together the energies of all sectors of society-ranging from a shellfisherwoman's association whose members are mostly illiterate and all very poor, to the National Commission, comprising high level representatives of five ministries. Such diverse groups, the PMRC believes, all have important roles in the process of analyzing management issues and framing a course of action.

The two-track approach creates opportunities to bring such different groups together to meet face to face and to develop respect and a measure of understanding for one another. The second track also serves as a "flywheel of continuity," since it is not subject to the continuous changes of personnel and the political agenda within central government. A strong and well-informed first track ensures that greater responsibility and initiative at the local level is not perceived as a threat to the power and prerogatives of central government.

The Operational Approach to Preparing Integrated Coastal Management Plans

The PMRC has been concerned from the very beginning that its plans and policies be implementable within the Ecuadorian context. This means assuring that an action will have the desired tangible impact on the problem. Actions must be acceptable to those who must carry them out. Actions must also be feasible in view of the available time, funds, and personnel.

Five key attributes characterize the work of the PMRC. The difficulties the program has encountered usually occurred when one or more of these factors was out of balance:

- participation,
- partnerships,
- integrated approaches and methods,
- learning and adaptation, and/or
- building indigenous capacity.

Participation

Sustainable coastal development can only be achieved when the governance process responds to, and is accountable to, the people who live with the results. International experience demonstrates time and again that programs are sustained only where there are constituencies that are active advocates for improved resource management.

The PMRC has carefully designed mechanisms to assure that participants on both the national and local tracks participate in each phase of the policy process. It has identified stakeholders for each of the issues addressed by the program and assessed their interests and needs. Thus, participants at the community level (track two) have attended public workshops and meetings at which management issues are analyzed, possible courses of action are evaluated, and priorities for action

are set. ZEM committees have become focal points for conflict resolution and implementation of "practical exercises in integrated management" that test new approaches to resource management at a pilot scale. The ZEM committees have become strong advocates for the continuance of the PMRC. Within agencies of central government (track one), key actors have been consulted to solicit their views and to build consensus on the nature of the issues and the most fruitful courses of action.

Partnerships

The complex overlays of issues and institutions along coastlines makes it impossible for a single agency to meet the challenges of management alone. Success lies in forging partnership among institutions, among user groups, and with donors. Productive and sustainable partnerships are built on trust and nourished by shared experience and shared values. Such relationships have been a central feature of the PMRC at every level. The convenio that has governed the relationship between the government of Ecuador and CRC is designed as a partnership with Ecuadorian and American codirectors with comparable responsibilities and authority. At the ministerial level, the National Commission is a partnership among the seven agencies with major roles in coastal management. The Ranger Corps (Unidades de Conservación y Vigilancia or UCVs) are partnerships that have been designed to improve the effectiveness of governmental agency actions at the local level. A partnership between the PMRC and the Fundaci&oacuten Pedro Vicente Maldonado has been crucial to the success of the program.

Integrated Approaches and Methods

The integration in coastal management is what makes the endeavor stand apart from traditional sectoral programs that address only fragments of the whole picture-such as fisheries or beach development. Coastal regions, with their burgeoning populations and competing human activities are where integrated approaches are most urgently needed.

The integration required by coastal management programs is multidimensional:

- The integration of good science with good politics

  This is expressed by the strong emphasis on a social and political process and the belief that research and technical tools (such as permits, zoning, and impact assessment) are of little value if the institutional and societal context in which they are introduced is not yet capable of making the changes in values and behavior that such tools require. The PMRC has involved internationally recognized scientists to help it understand the long-term social and ecological consequences of current trends in the condition and use of Ecuador's coast.

- The integration between bottom-up and top-down approaches to resource management and policy reform

  This is the principle underlying the two-track strategy. The National Commission holds many of its meetings along the coast in the ZEMs, where it can view problems and emerging solutions firsthand.

- Integration between large- and small-scale management, and between short- and long-term time scales

  The "visions for the future" prepared as ZEM plans balance immediate actions with long-term approaches to root problems.

- Integration among sectors and disciplines

This is an imperative in coastal planning, research, policy formulation, and implementation. This integration is expressed through the multi-agency working groups and commissions that have functioned on both tracks and the focus on geographically specific planning that forces integrated analysis of management issues. From a disciplinary perspective, the PMRC has worked to promote integration between:

- economics and ecology
- environmental management and public health, and
- environmental management and business strategy.

Learning and Adaptation

Retroalimentación, or feedback, has been central to the design and implementation of the PMRC. Techniques have been developed that encourage the open exchange of ideas and experience and foster learning through the frequent opportunities for feedback both internally, within the PMRC staff, and externally, with stakeholders on both tracks and with the public at large.

- Each year the entire PMRC staff has engaged in a self-assessment of progress and lessons learned that precedes the preparation of the next annual work plan. This approach has allowed for an incremental design of the program, and periodic reflection on which strategies are succeeding, which did not meet expectations, and what problems of both process and substance have been resolved or need attention. New issues and new demands on the PMRC are constantly developing, and such reassessments and adjustments help keep the program agile and responsive.

- The emphasis of the first-generation program upon five ZEMs provided for analysis of a diversity of issues and experimentation with different approaches to management in different settings. Thus, the PMRC design calls for five "experiments" in track two governance during the first generation of the program. This experience will be the foundation for a program of wider geographic scope during generation two.

- At a smaller scale, the PMRC has adopted a strategy of "practical exercises in management" to test management techniques during the planning phase (see Section 12). This is crucially important when the context is one of massive failures in the implementation phase of resource management.

Building Local Capacity

The first-generation program has worked to build a core group of professionals that can sustain a coherent program into the future. This requires individuals with adequate training and experience within government, and the Fundaci&oacuten Maldonado, and universities, and in the ZEMs. In the initial years of the project, "learning by doing" was the principal method for creating such local capacity on both tracks. This was bolstered by exchange visits to other countries to view those working on similar issues, along with formal training and mentoring through long-term collaborative relationships between PMRC participants and an advisor. Aware that there is great interest in the practice of coastal management throughout Latin America, the PMRC has invested in preparing a core of trainers, drawn from its own staff and its partners, that have been offering international training courses since 1993. The courses are being administered by the newly created Centro de Recursos Costeros (Coastal Resources Center) at Escuela Superior Politechnica del

Litoral, or ESPOL, the Polytechnical University of the Coast, in partnership with CRC.

The Policy Cycle as a Road Map to the Formulation of an Integrated Coastal Management Program

Although the coastal management process is dynamic and adaptive, it follows the familiar steps and phases by which all public policy progresses-from issue definition, to selection of objectives, to formalization of structure, and on to implementation and evaluation (Figure 3). It is essential, however, that the actions and priorities in any given year are appropriate to the phase and step in the policy cycle that the program has achieved. A superficial or incomplete analysis of an issue, for example, will likely lead to policies and actions that will ultimately prove unworkable and unsustainable.

Experience from both developed and developing nations suggests that eight to 12 years is the usual amount of time for completion of an initial cycle through all the phases and steps of the policy cycle. The PMRC is now poised to begin the full-scale implementation phase of its first generation. Thus, Phases One and Two required eight years. The first generation of the PMRC should be completed by the year 2000.

The evolution of a program calls for shifts in emphasis, but many activities, once initiated, must be sustained. For example, issue analysis and the implementation of strategies and planning are themselves dynamic processes requiring constant refinement as new information becomes available, experience accumulates, and the political and social context within which the program is operating changes. Public education, capacity building, new small-scale "practical exercises," and the annual cycle of self-evaluation and adjustment must be sustained through all phases of a generation.

The "PMRC process" and the manner in which the principles and methods of the program are made tangible is reflected best by considering the highlights of the PMRC's work in each phase of the policy cycle (Table 2).

Figure 3. Phases in the Policy Process

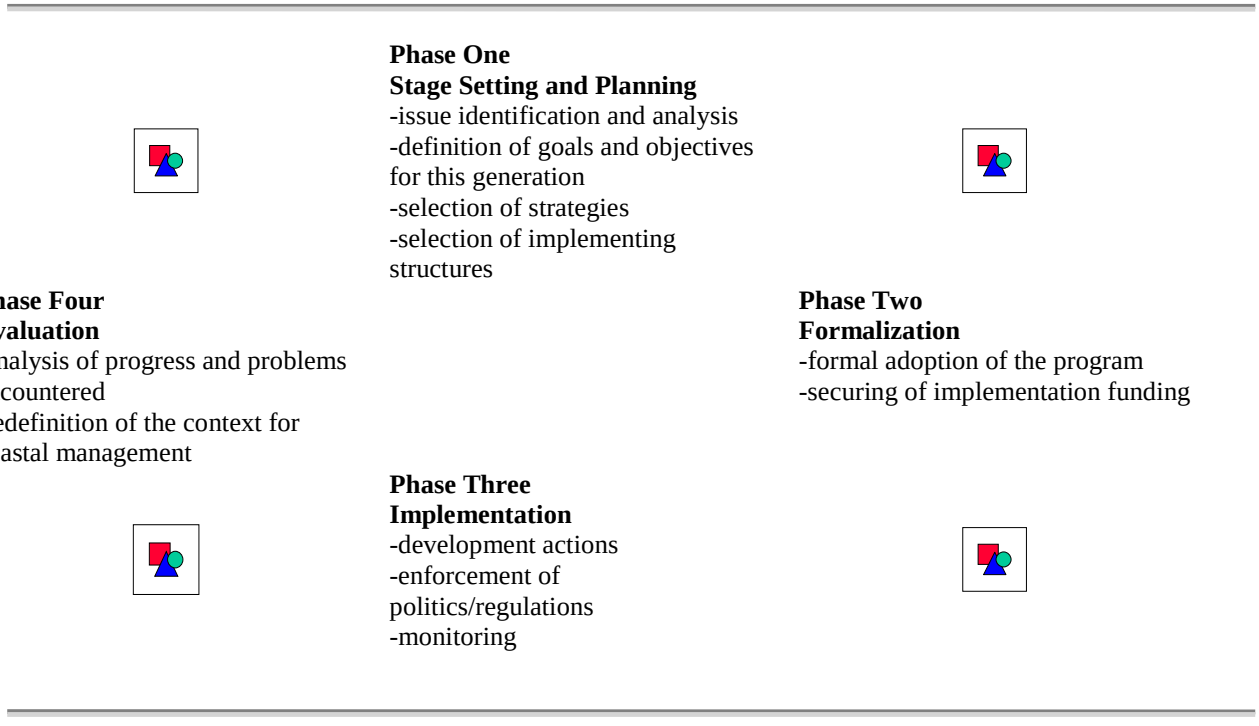

Table 2. Events and phases of the policy process in the Ecuador coastal resources management program.

Phase in policy process	Year	Key events
	1981	United Nations / Ecuadorian Navy seminar on planning and integrated development of coastal zones
Phase 1. Issue identification and initial planning	1986	USAID-GOE-URI coastal resources management project convenio Shrimp mariculture profile and national symposium
	1987	Compilation of available information on the condition and use of coastal resources: • Overview of the coastal region • Province profiles and workshops
		Public review of information, definition of objectives for a national CRM program Institutional structure and program priorities proposed
Phase 2(a). Formal adoption	1988-89	Manifesto of support signed by local leaders Executive Decree 375 formally creates the Ecuador Coastal Resources Management Program: • Technical secretariat • Special area management zone (ZEM) offices • Ranger Corps units
Phase 2(b). Detailed planning and securing adequate funding	1990-91	Preparation of ZEM plans Practical exercises in integrated management Initiation of the Ranger Corps
	1992	Approval of ZEM plans Executive Decree 3399 to restructure and decentralize the PMRC Inter-American Development Bank (IDB) loan proposal
	1993	Review and approval of the loan; documentation of PMRC experience
Phase 3. Full-scale implementation	1994-99	Implementation through the IDB loan program
Phase 4. Evaluation	1998-99	Overall program evaluation of progress in the PMRC's work, including problems and lessons learned, and definition of issues and scope for a second-generation coastal program

Phase 1: Planning and Stage Setting

When the project began in 1986, the priority was to gather and interpret the available technical information on coastal management issues. It was important to capture and reinforce traditional knowledge and to understand perspectives of knowledge people on both tracks. The major activities of this phase were:

- A multidisciplinary analysis of shrimp mariculture and formulation of the strategy for a sustainable industry.

- Cataloguing and analysis of existing laws and procedures affecting coastal management.

- Preparation of profiles of the four coastal provinces to document the history and status of the development process. This exercise followed a highly participatory process involving interviews, public meetings, and identification of different perspectives on both problems and potential solutions.

These three activities succeeded in creating widespread interest and support for a new resource management initiative within each province, and among governmental officials in several ministries. Public workshops proved to be very successful and, along with the production of draft and final versions of various reports, prompted sustained press coverage and editorial commentary. A Manifesto in Support of a Coastal Management Program, signed by leaders from across the political spectrum from government, industry, academia, and the church was the culmination of the public debate created in this phase.

Phase 2: Formalization of the PMRC

This phase had two distinct periods. The first was directed at the formal enactment of the national coastal management program. This initial goal was achieved in 1989 through Executive Decree 375.
The executive decree created the National Coastal Resources Management Commission, the Executive Directorate based in Guayaquil, the Ranger Corps and the six ZEMs. However, it provided for only modest government funds. A second phase of planning, focused on track two, within the ZEMs, began in 1990 and continued through 1993. The objectives of the second phase were to produce detailed area-specific plans, and to secure funding for their implementation. All five ZEM plans were formulated in a highly participatory manner during this period. They were approved by the advisory committees of each ZEM and by the National Commission in 1992. That same year, a detailed proposal was prepared with the Inter-American Development Bank (IDB) for a loan that would fund the PMRC during its initial implementation phase. The loan was approved in early 1994. The actions to be funded in each ZEM build upon the "practical exercises" (see section 10) undertaken during the second planning phase.

Phase 3: Implementation

The PMRC is now entering an initial phase of implementation with financing from the Inter-American Development Bank.
The bank initiated the design of a project that would:

(i) Implement a selection of the actions contained in the adopted special area (ZEM) plans
(ii) Carry out applied scientific investigations for coastal management, environmental monitoring and strengthening of the Ranger Corps
(iii) Strengthen and develop the institutional framework for integrated coastal management and provide external technical assistance.

The 1994 agreement between IDB and the government of Ecuador specifies that the five-year bank project will finance actions aimed at

- Strengthening the government of Ecuador’s coastal planning and coordination capacity,

- Building the Ranger Corps,

- Sustaining the ZEM offices,

- Projects in: mangrove management, shore use zoning, community sanitation, small-scale tourism facilities, and small projects with artisanal fishers.

In addition, the national program includes an intensive, ongoing training program, and places greater emphasis on monitoring coastal conditions and trends.

Phase 4: Evaluation

A full-scale assessment of the progress made by the first generation of the PMRC should be undertaken in 1998 and 1999. This will set the stage for a second-generation program that is expected to address a larger geographic area and fully implement the national policy reforms developed and tested in Generation 1.

Advances Made on Major Coastal Management Issues

The PMRC has carefully selected its activities to target problems and concerns of national importance while seeking to make tangible progress in specific areas. Ecuador's first generation program has been focused on four specific issues:

- mangrove destruction,
- mariculture expansion,
- disorderly shore use, and
- environmental sanitation.

Curtailing the Destruction of Mangroves and Promoting Community Participation in Management

The Accelerating Destruction of Mangroves

The oldest detailed baseline available for estimating the extent of mangroves along Ecuador's coast is a set of aerial photographs taken in 1969 and analyzed by CLIRSEN (Center for Remote Sensing of Natural Resources). At that time, there were 204,000 hectares (ha). Aerial surveys in 1984, 1987, and 1991, reveal that the rate at which these wetlands are being destroyed is accelerating, and the cumulative loss was greater than 20 percent by 1991. Losses in specific areas of the coast, however, are far greater, and frequently approach 50 to 80 percent. Furthermore, the data are only for areas covered in mangrove trees and do not estimate losses in the much more extensive mangrove ecosystem including creeks and mud banks. If mangrove ecosystems, rather than only mangrove trees, had been analyzed, the proportion of area lost would be larger.

The reductions in mangroves are attributable primarily to the construction of shrimp farms and secondarily to the growth of urban areas.

Table 3: Mangroves by sub-area, showing percent loss by date and principal causes.

Sub-area	Area (hectares)	Conversion, 1969-91 (percent)	Principal factors causing change
San Lorenzo (Santiago, Cayapas, Mataje)	22,859	3.5	agriculture, mariculture
Atacames	52	69.5	mariculture, urbanization
Muisne	1,375	59.0	mariculture
Cojim&iacutees	3,448	51.3	mariculture
Rio Chone	783	80.3	mariculture
Posorja	3,313	10.9	mariculture, urbanization
Estero Salado	40,846	12.0	mariculture, urbanization

Taura	19,583	12.0	mariculture
Churute	12,209	4.3	mariculture
Naranjal	11,833	25.1	mariculture
Jambelí	5,625	52.8	mariculture, urbanization
Hualtaco	13,630	25.5	mariculture

The Evolving Response of the Government of Ecuador For Mangrove Forest Protection

When the shrimp mariculture industry began its rapid expansion in the 1970s, Ecuador did not recognize the ecological, social, and economic importance of mangrove ecosystems.

The official response to the accelerating destruction of mangroves has been to adopt increasingly stringent regulations based on the principle that restrictions on mangrove use will result in conservation. A chronology of the enactment of these restrictions, along with punishments for unauthorized use, is presented below.

1978
The National Forestry Agency issued Decree 2939-B. These rules prohibited the use of mangrove forest areas for shrimp pond construction. The decree also established a policy of zoning all mangrove forest areas where cutting could take place, and requires careful harvesting techniques and reforestation of cut areas.

1979
A mangrove ecological reserve was established for the Churute area of the Guayas estuary, an ecosystem that was virtually untouched by shrimp farm development. [Ministerial Agreement 322, Official Register 69, November 20, 1979]

1981
Forestry Law 74 created new rules for the cutting, transportation, and exportation of mangrove wood products. The Ecuadorian Navy was given responsibility for controlling the use of mangroves, and had the authority to confiscate equipment, tools and products derived from illegal cutting.

1985
Executive Decree 824, published in Official Register 64 of June, 1985, declared that all mangrove forests were to be conserved, protected, and restored. The Fisheries Law adopted in 1985 also prohibited the destruction or alteration of mangroves for the purpose of building shrimp farms. The regulations governing the cultivation of bioaquatic species obligated shrimp farm owners to protect land covered with mangrove vegetation, as well as agricultural soils adjacent to their ponds.

Despite the emergence of a legal framework that prohibited any use of mangroves, the rate of cutting continued to increase:

Period	**ha per year lost**
1969-1984	1,439 ha per year
1984-1987	2,434 ha per year
1987-1991	3,348 ha per year

Regulations on the use of mangroves fall under the jurisdictions of three agencies in three different ministries-the Navy, Forestry Agency, and Fisheries Agency. Such a system might work if the authorities routinely consulted one other, and had procedures in place for allocating responsibilities for enforcement. This is not the case, however. Many agency staff are unsure of each others' powers. Resources for initiating patrols and inspections, or following up on legal cases are scarce.

Mangrove Management Initiatives of the PMRC

The overall goal of the PMRC is to reduce or reverse mangrove destruction through collaborative actions with government authorities and resource users.

The PMRC has used five strategies to develop a new approach to mangrove management.

Strategy 1: Increase public awareness of the benefits produced by mangrove ecosystems and the alarming trends of losses in their condition and use.

This strategy included action items to:

> Produce public information materials on the social, economic, and ecological functions of mangrove ecosystems, and promote press coverage of mangrove management issues.
>
> Work with the formal education system to include mangroves and other coastal resource themes in science education, initiate field trips and study tours to mangrove sites, and use the annual Earth Day celebration to focus on the importance of mangroves.
>
> Promote local awareness of the culture and traditions associated with mangrove areas, provide guided tours for adult community members, and commission stories and memoirs of traditional lifestyles in which mangroves were important.

Strategy 2: Develop and test mangrove management techniques that promote community-level stewardship and sustained use.

> The PMRC has drawn on worldwide experience to test a wide range of methods for promoting conservation and sustainable use of mangrove areas.
>
> Ecotourism in mangroves is a promising option for combining economic activities and promoting a conservation ethic. Practical exercises have been conducted to construct the first mangrove boardwalk and tours in Atacames, and guided tours in the Rio Chone and Estero Santa Rosa.
>
> Production of wood and charcoal are traditional uses of mangroves in Ecuador that can be sustained, according to tests carried out by the PMRC, if cutting is limited, and the harvest patterns and methods are controlled.
>
> Degraded mangrove forest areas can be restored through replanting and vigilant community monitoring of the growing trees. Two practical exercises involving replanting have been conducted.
>
> Zoning and allocation of mangrove areas for specific uses is a popular option for local communities in the special management zones. These are being implemented through written agreements among mangrove users, shrimp farmers, and local authorities. Widespread application of these methods, however, requires changes in Ecuador's mangrove management policies at the national level.

Table 4. Examples of the application of mangrove management techniques in one ZEM: Atacames-Suacutea-Muisne.

Initiative	Action item	Results
Education and awareness program 1989-1993	Expert presentations, site visits, school programs, community discussions, simple educational materials.	Increased sensitivity in communities to mangrove values, and consensus on need for conservation, awareness of management techniques.
Ranger Corps and community vigilance of mangrove areas 1991-1993	Since 1991, funding provided to an assistant to Esmeraldas Ranger Corps.	Joint patrols under leadership of Esmeraldas port captain. Organization of local residents. Participation of member agencies in ZEM planning process, initiation of parallel projects. Identification of the legal status of shrimp ponds. Participation in conflict resolution meetings.
Resolving site conflicts: Comedores "El Manglar" in Rio Atacames 1991-1992	Food vendors applied for right to fill Rio Atacames mangroves near footbridge to tourist beach. CRMP opposed project, asked municipality to modify it or seek alternatives for the food vendors. CRMP provided funds for alternate design, 1991. CRMP and the Ranger Corps opposed local decision to approve house construction in site.	Municipality and food vendors agreed to modify proposal, but requested financial assistance for project development. Their proposal was included project funding in IDB project and the CRMP developed new designs. PMRC still monitors site to prevent encroachment.
Replanting of mangroves, and forest management, Rio Muisne 1991	Planting of propagules in 10 ha of degraded forest area in several sites within Rio Muisne, using local participation. Development of monitoring techniques to evaluate results.	Part-time forester assigned to ZEM office. Excellent growth of replanted areas after initial problems with mangrove crabs eating young plants, and in finding good source of mangrove propagules. A larger (200-ha) proposal is included in IDB project.

Strategy 3: Improve awareness and enforcement of mangrove laws and regulations.

The various laws and regulations governing mangrove use have been analyzed, and procedures for their proper implementation clarified in a manual. The manual is used in training courses for environmental law enforcement officials and in public education programs.

The focus of the Ranger Corps now operating in three port captaincies is enforcement of existing laws against cutting. Enforcement is enhanced by building local interest in monitoring, and by encouraging citizens to report violations.

Strategy 4: Work with the national agencies that are responsible for mangrove management in order to prepare a proposal for a new approach that emphasizes planning and sustained use at the community level.

Although many PMRC management actions appear to be purely local in nature, they require and benefit from the collaboration with national authorities, especially the National Forestry Institute and DIGMER.

Workshops and a national symposium have been held to discuss lessons learned, and to prepare proposals for reforms in the regulatory approach taken by government agencies.

Strategy 5: Apply international experience to foster monitoring and research in support of management.

An interagency, national-level mangrove working group involves professionals and students in expanding knowledge on the ecological functioning of Ecuador's mangrove ecosystems, testing new management techniques, and fostering a continuing dialogue on issues related to national policy.

Linking applied research to tests of mangrove conservation and reforestation techniques enables community members, researchers and international experts to exchange ideas, knowledge and build in-country skills.

Advances Toward More Effective Mangrove Management

Based on the experience gained in the four special management zones that contain mangrove ecosystems, as well as in the three operating Ranger Corps units, the PMRC developed a national mangrove policy proposal, aided by the National Symposium on Mangrove Management held in July 1993, and cosponsored by DIGEIM, INEFAN, and the CRMP.

The proposal is under review before formal presentation to the National Coastal Resources Management Commission. It contains the following recommendations:

- Management plans should be implemented for Ecuador's principal estuaries or for specific sites, to take into account the ecological, social, and economic characteristics of the area.

- Community groups and local users must be incorporated into the planning and management process.

- Multiple use of mangroves is an acceptable management objective for ecosystems when the use is in a sustainable form that does not significantly alter the vegetative cover or the structure and functioning of the ecosystem.

- Management plans for specific ecosystems should address the following:
  - reduction of mangrove forest cover,
  - reforestation of degraded areas ,
  - conservation of flora and fauna that are an integral part of the ecosystem, and
  - improvement of the quality of life of local communities that depend on the goods and services that a healthy mangrove ecosystem can provide them.

- The specific rules and plans for managing a mangrove ecosystem must be developed and adopted through the consensus of the national authorities that share jurisdiction over these areas, with the awareness and approval of the National Coastal Management Commission. Public participation and open access to information and debates are essential for the success of this process.

- Enforcement of the rules and regulations of these plans and national laws is the responsibility of the Ranger Corps, which integrates all local authorities who have administrative responsibility for coastal resources. The Ranger Corps must be strengthened to cover the vast extensions of mangrove ecosystems throughout the coast.

- The administrative process for adopting regulations, issuing concessions, and sanctioning violations must be transparent and open for public involvement.

- Public education and outreach programs are vital for the success of mangrove management, because they promote appreciation of the value of the resource base, understanding of the policies and rules on mangrove use, and awareness of the

penalties for violating laws and plans.

The PMRC continues to play a catalytic and entrepreneurial role for policy change at the national and local levels. The fact that the PRMC has no regulatory powers of its own to adopt and impose management criteria and decision rules has provided it with considerable freedom to explore ideas and approaches that are new to Ecuador or that resource users themselves find more workable than those already in place. However, this freedom also requires the CRMP to devote considerable energy educating and persuading user groups and public officials to try a promising approach once it has been tested. Agencies that do accept the new ideas are still faced with persistent implementation problems, and with the low level of public- and private-sector confidence in their performance. Line agencies are still not equipped or experienced in working with local groups and resource users to gain voluntary compliance or collaboration.

Next Steps for Mangrove Management

Activities proposed for IDB financing

The Inter-American Development Bank project is primarily focusing on full-scale implementation of the pilot mangrove management activities in the Atacames-Sœa-Muisne special management zone, including ecotourism and interpretation, mangrove reforestation, and training. Similar projects have also been planned for the Rio Chone, Puerto El Morro, and Isla Jambeli. These efforts will enable the PMRC to provide protection for the several thousand hectares of mangroves remaining within ZEMs, as well as restoration of several hundred hectares in critical estuaries, such as Muisne and the Rio Chone. The IDB program will also provide some support to the mangrove working group and continue the monitoring of trends in condition and use. No initiatives outside the special management zones are contemplated.

Issues in Northern Esmeraldas

A major challenge facing Ecuador is the proposal to build a coastal road along the only remaining undeveloped section of Ecuador's coast. This is the northernmost part of Esmeraldas, a region containing the only remaining virgin stands of coastal forests, several indigenous tribes, and, as yet undisturbed estuaries. Shrimp farmers increasingly constrained by declining water quality elsewhere along the coast are eager to move into this pristine region. The PMRC must work to avoid a repetition of the over-development and siting mistakes that are currently reducing the profitability of shrimp mariculture operations elsewhere along the coast.

Need for Strengthened Public Education and Involvement in the Management Process

Community groups and organizations throughout the coast have an important role to play in the design and implementation of mangrove ecosystem plans for locations outside of the special management zones, particularly in northern Esmeraldas, Cojimies, Estero Salado, Taura, and Naranjal. The principles of building local interest, helping organize community groups, addressing local needs for sustainable use, and motivating continued vigilance can be applied to these areas using techniques already demonstrated and proven by the PMRC.

IDB's Proposal to Involve the PMRC in the Regulatory Process for Renewing Shrimp Farm Concessions

A precondition set by the bank for receipt of the loan is that the PMRC must become involved in the process of renewing concessions for shrimp ponds and the issuance of any new concessions. Consultants to IDB have proposed a number of reforms to the existing renewal procedures of DIGMER, INEFAN, and SRP, and recommend that the PMRC make written recommendations to the line agencies before concessions are renewed. There is currently no

involvement of outside groups in the process.

If approved, implementation of this recommendation will place the PMRC squarely in the midst of one of the most divisive issues that it will ever face. It will require the effective coordination of three agencies that have previously been unable to work together on this important expression of governance. It could result in making the shrimp mariculture industry a forceful opponent of the PMRC, rather than a potential collaborator.

No source of funding for this work has been identified.

Management of Mariculture

The shrimp mariculture industry in Ecuador has demonstrated that it can create employment opportunities, promote significant private sector investment, encourage technology innovation and transfer, stimulate economic growth, provide food for local consumption, and generate export earnings. Simultaneously, it has produced large-scale and usually detrimental changes in coastal ecosystems, conflicts with traditional activities and has raised concern over the socioeconomic well-being of poor coastal communities.

In an effort to define and address these issues, PMRC personnel assembled an interdisciplinary team of national and international experts in environmental, biological, economic, technical, and sociopolitical aspects of shrimp mariculture at a workshop in Guayaquil in August 1986, which identified the following issues:

Decline in coastal water quality

Urban growth, industry, mining, and hydroelectric projects, as well as mariculture itself are contributing to declining water quality in Ecuador's rivers, estuaries, and coastal areas. Hatchery operators and growers report occasional mass moralities, blooms of microscopic algae, and reduced growth rates attributed to low water quality. Such allegations have justifiably heightened public concern that humans are also experiencing health problems related to water quality.

Outbreaks of pathology in shrimp ponds have been attributed to poor water quality in the Guayas estuary. In 1993 and 1994, a serious dispute emerged between banana growers and shrimp farmers in the Guayas estuary regarding the use of fungicides such as Tilt and Calixin to combat "Sigatoka Negra," a black fungus that destroys banana crops. Many shrimp farms closed their ponds in the vicinity of the Rio Taura due to deformities, slow growth, and high mortality rates.

Habitat Degradation and the Fluctuating Supply of Postlarvae

Research conducted worldwide has shown strong correlations between the area covered by coastal wetlands and population size of the commercially harvested and cultivated penaeid shrimps. Destruction of habitat, combined with fishing pressure from postlarvae (PL) fishermen, leaves scientists pondering the status and future of this valuable stock. In addition, mortality between capture and acclimation to pond conditions is high; shrimp PL are poorly and inefficiently handled both during and after capture. Estimates vary, but between 50 and 85 percent of all PL die before reaching a harvestable size. It is obvious that better treatment will lead to a reduction in the rate of mortality. An extension program designed to improve handling techniques during capture and transport, in holding centers (centros de acopio), in nursery ponds, and during grow-out is economically justifiable. Based on 1991 data, export earnings would increase by U.S. $4.9 million for each 1 percent increase in the overall survival rate.

To date, industry performance has been strongly correlated with fluctuations in the natural abundance of shrimp postlarvae. During El Nino years, the industry flourishes, in intervening

years, the supply of PL determines the extent of areas under production.

Many shrimp unsuitable for mariculture, as well as other fish species are also being killed in the collection and handling process. A 1993 study by Gaibor reveals that only about 18 percent of the organisms captured in the fine-meshed nets used by larveros (larvae harvesters) are desired species of PL, and that the remaining 82 percent are usually killed when they are discarded on the beach. The analysis found that the unwanted bycatch contained 32 species of juvenile fish, half of which were of commercial value, and the larvae of 35 species of fish, 21 of which were of commercial importance. The remainder of the bycatch consisted of large quantities of organisms, crabs in particular, that are important in the food chain.

Increased Competition in the World Market

Nations in Southeast Asia have a tradition in mariculture and are rapidly moving to increase shrimp production. Latin American countries-such as Brazil, Panama, and Belize-have also entered the industry. Increasing supplies of shrimp, changes in technology, reputation, and the intricacies of international trade and currency exchange will determine the continued economic viability of Ecuador's shrimp mariculture industry.

Complex and Ineffective Government Regulation

The existing system for granting concessions in the government-controlled intertidal zone is complex and expensive, both in terms of time and money. The system fails to secure the real value applicants are willing to pay for concessions, provides no incentive for intensive culture, is unregulated, and fails to establish guidelines for pond construction, or to discourage environmental degradation. Laws and government policies affecting the industry are varied, often not enforced, and favor large-scale, vertically integrated companies. Incentives to promote hatchery development may be well-founded, but incentives to promote more efficient land use through intensive culture are nonexistent.

Low Public Awareness of the Environmental and Economic Issues Surrounding the Mariculture Industry

In order to gain public support for programs designed to maximize benefits derived from coastal resources, residents must be made aware of the uniqueness and value of these resources. A recurring theme at the 1986 CRM mariculture workshop, "An Integrated Strategy for Developing Shrimp Mariculture in Ecuador," held in August 1986 in Guayaquil, was the need for broad dissemination of information on the conditions and problems affecting the quality of ecosystems. The commitment to public education on environmental matters should be broadened to emphasize the diversity, uses, value, and sustainability of coastal resources.

Resources Not Assigned Appropriate Values

The shrimp mariculture industry is primarily sustained by exploiting PL, water, and intertidal areas, each of which is a common property resource. No values are assigned to the postlarvae (PL) fishery or to water, and fees charged for concessions of mangrove areas assign only minimal values to these resources. Shrimp farmers pay only about $3 per ha per year for ponds located in the beach and bay zone. History has repeatedly shown that the failure to charge a fee or assign a value to such resources results in their overexploitation. Tied to the issue of undervaluation of intertidal areas is the fact that some sites have been clear-cut and abandoned without constructing ponds. Shrimp ponds often sit idle for years, and are only put into production when economic and biological conditions-such as a year when PL are abundant and cheap-make stocking the idle ponds profitable. Rather than invest in improving the productivity of existing ponds, many shrimp growers find it more profitable to increase production by continually converting mangroves into new grow-out ponds. It is the role of government, as the manager and steward of these resources, to ensure that public resources

are used in a manner that optimizes social welfare.

Strategy 1: Prepare and promote a vision for a sustainable mariculture industry for Ecuador.

- The 1986 shrimp mariculture workshop brought together Ecuadorian and international experts on the ecological, economic, legal, and technological dimensions of the shrimp mariculture industry, and generated a strategy document for achieving a sustainable industry.

- Each of the five ZEM plans addresses how to harmonize mariculture operations with other uses of mangroves, lagoons and estuaries.

Strategy 2: Bring international experience to bear in addressing mariculture issues.

- Asian experts in mariculture conducted an extended visit to the Ecuador coast and prepared recommendations urging the diversification of cultivated species and improvements in pond design and management in order to increase the productivity of existing ponds.

- Dr. Howard Odum examined the mariculture industry from a systems ecology perspective. He recommended restoration and reforestation of critical estuaries, such as the Rio Chone, that had lost most of their mangrove cover; protection of fresh water inflow to estuaries; and improvements to water circulation, which had been greatly reduced in many areas by overcrowding of shrimp farms.

Strategy 3: Take positive actions to protect the environmental base of the mariculture industry.

- Use public education to enable coastal residents to understand and engage in discussions about changes in use of coastal resources as a result of mariculture.

- Reduce the mortality of shrimp PL by understanding the social and biological dynamics of the fishery, introducing more appropriate fishing methods, controlling the fishery, and protecting shrimp larvae habitat.

- Maintain and restore water quality in estuaries and areas occupied by shrimp farms and hatcheries.

- Gain shrimp farmer involvement in mangrove management and habitat protection.

- Promote the work of the National Fisheries Institute in obtaining information and preparing a shrimp fisheries management program.

- Simplify and improve the permit system, clarify objectives, reduce administrative procedures, and consider a "one-stop" permit. Adopt criteria to minimize impact of mariculture on habitat.

Strategy 4: Diversify the flow of benefits and species cultured.

- Work with shrimp larvae fishers, larvae collection centers, and precriaderos (nursery ponds) to improve the efficiency of larvae handling and to broaden the distribution of economic benefits of shrimp mariculture.

- Provide technical assistance and exchange of information on shrimp farm management techniques, policulture within shrimp ponds, and diversifying the types of native species cultured.

Advances toward effective mariculture management and diversification by the PMRC

The papers presented at the 1986 mariculture workshop were published and widely distributed by the PMRC. At the same time, reports containing more detailed recommendations of two groups of international experts were also published. Dr. Chua Thia-Eng and P. Kungavankij introduced lessons from the Asian experience and urged diversification of the species grown in aquaculture farms. Dr. Odum and a team of ecologists focused on the need to protect and restore ecological conditions for mariculture.

The PMRC has tried to establish cooperative working relationships with ministries and the shrimp industry to promote the strategies and recommendations made during the 1986 meeting. However, both the agencies and the industry have been reluctant to enter into discussions that might appear to delegate their sectoral responsibilities and prerogatives to a new initiative. The PMRC has been able to allocate some resources to follow through on the recommendations. This can be seen most clearly in the policies and actions in the special management zones.

Next Steps in Mariculture Management

Activities Proposed for IDB Financing

The PMRC has limited funding for shrimp mariculture related projects. Work will be funded to collect basic information on the shrimp PL fishery within the five ZEMs, and the gravid female shrimp fishery within the Atacames-S&uacutea-Muisne ZEM. IDB will also support training and technical assistance to the managers of small artisanal precriaderos in the ZEMs.

The program to create an estuary management plan for the Rio Chone estuary, part of Component II of the IDB project, provides a major opportunity for working directly with large scale shrimp farmers in order to understand the effects that industry growth has had on the estuary. The project will establish the information and tools needed to determine what environmental conditions are necessary for sustainable mariculture in this estuary.

The Future of Shrimp Mariculture in Ecuador

The PMRC has had the most success in working to build relationships, setting innovative policies, and carrying out joint actions related to mariculture in the special management zones. The participation of shrimp farmers in program activities at the local level is now increasing, after a long period of disinterest and skepticism.

The agenda set out in 1986 has accurately foreseen the actions required to promote sustainable mariculture. In 1994, environmental concerns are finally reaching the foreground for many shrimp farmers, although perhaps too late. A recent report (August, 1994) by the U.S. Environmental Protection Agency on a strategy for addressing the "Taura Syndrome" in the Guayas estuary states:

It is imperative that the GOE continue its efforts to bring together the major institutions, economic sectors in the area, and concerned citizen groups to deal with the "Taura Syndrome," and to improve and protect the overall environmental quality of the Gulf of Guayaquil. An open and collaborative effort among all interests will be necessary to insure the long-term sustainability of this valuable resource.

The experience of the PMRC offers many promising approaches for how such sustained collaborative action can be achieved.

Management of Shore Use and Tourism

Shore Use Management Issues in the Coastal Provinces

Along its 1,256 km of highly varied ocean-facing coast, Ecuador has more than 100 sandy beaches, hundreds of small fishing villages, rural towns, and vacation homes and complexes. In recent decades, the coastal population has become increasingly urbanized. There are four sprawling coastal cities with populations of over 100,000, and a total of 22 urban centers. Approximately 2.5 million people live in the 12 largest coastal urban centers. The coastal population continues to grow at a faster rate than the country as a whole. Coastal populations have quadrupled since 1950, while the national population only tripled. Access to the coast from the interior has improved markedly in recent years, and several road construction projects will open up new areas in the near future. These new roads will stimulate economic growth and population increase in the coastal zone, but will also threaten environmental quality and productivity.

Each province has a distinct character and mix of concerns over shore use, as expressed in the regional workshops held in 1987 and 1988. Examples of poor construction practices, and siting of homes and commercial buildings in hazardous and unstable shoreline systems can be found throughout the coast.

The Need for Coastal Economic Development Initiatives in Esmeraldas Province

Twenty-six of Ecuador's 107 beaches are located in the province, with nine considered sufficiently attractive for regional tourism. The low level of investment in the region in the 1980s was due to concern about poor highway access to sites of tourist interest. Problems in promoting tourism in available sites include chaotic patterns of beachfront development, lack of basic services for tourists, and limited hotel facilities.

Tourism and Port Development in Manabí Province

Manabí has extensive lengths of open, relatively undeveloped coastline, with high bluffs. The coastline includes 48 beaches considered suitable for tourism use, 16 beaches that are regional tourist attractions and two undeveloped sites, located south of Machalilla. Despite the abundance of attractive shore areas, tourism development faced major difficulties in the province during the 1980s because of a lack of protection and maintenance of beaches, poor highway connections from major demand centers to coastal destinations, and absence of a strong promotion program. Manabí also has other resources of tourist interest-such as mangrove ecosystems, folklore, cultural sites, and natural areas with flora and fauna-that are not well known or promoted.

Chaotic Growth Along the Coast of Guayas Province

Nine of the 36 beaches in the province were classified as particularly important for tourism. The growing, intensive use of beaches has led to conflicts among artisanal fishing, tourism, shrimp farms and laboratories, and industrial fish processing plants. Heavily used beaches are poorly maintained and unmanaged, while others suffer from erosion. As in other parts of the coast, tourism heavily emphasizes beach-going, with little attention given to archaeological resources in the northern part of the coast near Valdivia or the extensive mangrove ecosystems and natural areas of the Guayas estuary. Coastal cities are expanding rapidly, without urban development plans or the provision of basic municipal services such as potable water and sewage disposal.

A lack of understanding of the hazards and dynamic nature of coastal features on the open ocean coast has led to poor planning and the construction of roads and buildings in unstable bluffs and flood-prone areas. Much of the filling of the shoreline in the estuary of Guayaquil has been done with unstable materials such as dredged sediments from the continually sedimenting navigation channels.

Rapid Migration to the Puerto Bolívar-Machala Urban Area in El Oro Province

The most pressing problem in El Oro province is accelerated immigration, which has completely overburdened the urban infrastructure. The beach on Isla Jambeli is the only site recognized as regionally important for tourism, and had been the focus of local investment in a simple but

attractive plaza with restaurants. The urban waterfront is dominated by the port of Puerto Bolivar, and a waterfront walkway and dock for passengers departing to Isla Jambeli. The Estero Huayla on the southern edge of the city of Machala and Puerto Bolivar is experiencing pressure from rapid growth of the mariculture industry, expansion of urban barrios, and the relocation of fishing facilities and other commercial uses.

Poor Siting and Construction Practices

Inappropriate siting and construction practices continue to result in loss of property and infrastructure, destruction of coastal features, and even risk to life. The PMRC is concerned with the practices, as well as with the need to promote sustainable forms of tourism and to improve the ability of coastal communities to benefit economically from recreational shore use. The principal issues coastwide include

Low awareness among residents and builders of dangers present in shore areas;

Absence of regulations that address the hazards of construction along the shoreline, on unstable bluffs, and in flood-prone lowlands;

Scarcity of examples of using of existing laws to zone and control the use of shore lands;

Limited knowledge of the location and characteristics of fragile or threatened natural and scenic areas, flood hazard zones, and cultural sites; and

Decision-making procedures that do not permit citizen participation in major development decisions.

Low Capacity for Tourism

Coastal communities with good beaches and attractive shorelines face a number of obstacles to success in improving the potential for generating more income from local and regional tourism.

Tourism infrastructure is generally of poor quality. Many areas are in need of stable access roads to points of interest, hotels that meet basic standards for comfort and cleanliness, potable water and waste disposal, information centers, signs and interpretive maps, and guidebooks.

The tourist service industry in many coastal communities is poorly organized, is composed of an untrained work force, and offer slow quality service and few professional guides who can provide visitors with an interesting, safe visit.

Community members in locations with tourism expansion potential often do not support measures to maintain environmental quality or good relations with visitors.

Shore Use and Tourism Management Initiatives in the PMRC

Strategy 1: Map all coastal features, analyze problems and opportunities for use of the shore, and prepare recommendations on good development practices.

- The formation of a technical team on coastal processes and geomorphology provided the PMRC with photography and an interpretative map series that shows in detail the location of various shoreline systems, and identifies hazardous areas and poor siting and construction practices. A national workshop was held to review the information and discuss national guidelines for shorefront development.

Strategy 2: Focus efforts to prepare and implement shore-use plans and zoning in the five ZEMs.

- The coastal processes technical team examined the shore use problems in the five special management zones in great detail, and proposed that the PMRC work closely with municipalities to prepare zoning plans for specific beach and coastal areas. The team also recommended rehabilitation of sites, and introduced decision-making criteria for determining what measures should be taken in erosion-prone and storm hazard areas.

- The coastal processes group began routine monitoring of key beaches in the Atacames, Bahia de Caráquez, and Manglaralto special management zones to provide a long-term record of beach erosion and accretion, and aid in establishing setbacks.

- The PMRC worked on specific issues and shore use conflicts in the special management zones. For example, it advocated careful investigations, rather than construction of ineffective shore protection devices in the case of the sudden loss of the tourist beach in Punta Norte at Bahia de Caráquez, and worked to reduce conflicts during peak tourist weekends in Playas.

Strategy 3: Examine the economic and marketing potential of recreation and tourism development, especially in terms of its link to good environmental quality.

- The PMRC commissioned a detailed study of the characteristics and issues related to tourism development in the five special management zones. The study was used to identify the links between expanding employment in underutilized beaches and the need to maintain or improve the environmental quality of those areas. The special area plans contain a range of proposed activities to build facilities to improve visitor services in beach areas, expand the number of environmentally oriented tourist activities (mangrove tours, walkways, and interpretive materials), and to protect cultural areas and scenic spots.

- The PMRC conducted an economic analysis of tourism impacts on the Galapagos Islands. The final report recommended that Ecuador increase its fees for access to the islands in order to finance needed conservation measures. The study also showed that international tourism provided few economic benefits to island residents and local entrepreneurs, since the major tour operators purchase most goods and services off-island. The study recommended diversifying the economic base of the Galapagos.

Advances Toward Effective Shore Use Planning and Decision-making

Work in the special management zones revealed that Ecuador's municipalities have access to powerful land use laws that give them wide-ranging authority to control the siting of buildings and use of urban lands. The Navy customarily allows municipalities to take the lead in regulating coastal construction in urban shorelines. However, there is little practical experience in land use planning and zoning in coastal communities, and a scarcity of the technical capacity needed to design and implement ordinances and regulations in a way that takes environmental issues into account. The special area management plans call for the PMRC to collaborate with municipalities to prepare shore use zoning ordinances and building criteria in areas where shore development is advancing most rapidly.

Although the PMRC has no direct regulatory powers, its work in the special management zones helps to illustrate the elements that must be in place for effective shore management:

- The ZEM committees and staff, along with the Ranger Corps, are effective in identifying local projects that need permits and that may cause problems if not sited carefully.

- A capable local staff is essential for addressing shore use conflicts among several resource users in situations that the routine administrative procedures of Ecuadorian agencies do not address. Shore management decision-making is enhanced when the local management committee has already conducted a planning assessment and, therefore, is familiar with the issues. The ZEM committees have demonstrated their ability to help resolve disputes by encouraging all parties to a conflict to meet together to address the substantive concerns.

- Technical staff need to prepare objective assessments of a shore use proposal, and offer potential mitigating measures. The PMRC has been able to provide this support in many instances. However, the local capacity to make routine technical evaluations of the feasibility and potential impacts of shore construction projects must be created. Government authorities with final decision-making authority should remain present throughout the dispute resolution process.

- The PMRC has worked to promote tourism facilities and small enterprises that can resolve shore use conflicts, generate employment, and create an expanded local constituency for coastal management. However, it is important that appropriate technical assistance be provided to the organization and execution of such projects in order to supplement the PMRC's focus on the environmental impacts of shore use decisions.

Next Steps in Management of Shore Use and Tourism

Activities Proposed for IDB Financing

The PMRC has chosen a priority segment of each ZEM's shoreline as an initial focus for planning and regulation. The PMRC will collaborate with municipalities to set shore use priorities and establish zones and technical criteria for evaluating individual cases. The sites include:

- the tourist zone between Súa and Puerto Gaviota in the Atacames ZEM;
- Canoa to Punta Napo in the Bahia de Caráquez ZEM;
- the 5 km section of shore between Olon and Manglaralto in the San Pedro ZEM;
- the major tourist beach of Playas-Data de Posorja in the Playas-Posorja ZEM; and
- Isla Jambeli and the urban waterfront of Machala in the Puerto Bolivar ZEM.

In addition, support will be provided for a facility to help resolve beach use conflicts and improve services in each ZEM, and to guide visitors to facilities in the area. The work will be scheduled so that the experiences in the first ZEM project can be transferred to other sites.

The Need for Education, Awareness and Greater Participation in Agency Decisions on Shore Use

Most coastal residents and many owners of property and buildings constructed in unstable bluffs and eroding beach areas remain unaware of the risks present in these dynamic coastal features. The PMRC's beach monitoring work is a low-cost way to build up a base of local knowledge about shoreline changes. Increased awareness strengthens the credibility of arguments in favor of setbacks and minimal use of shore protection structures. Such monitoring and education should be extended to other areas where shore development is occurring at a rapid pace. Ecuador also needs to examine recent experiences with flooding and damage to residences and coastal infrastructure, and to review earlier decisions on the siting of hotels, houses, discharge pipes, and shore protection, in order to determine whether past decisions have worked out as expected. Insights from this work will set the stage for the Navy and municipalities to adopt the specific recommendations proposed in the shoreline characterization report.

The methods used by the PMRC to involve the public should be built into the procedures used by the Ministry of Public Works, CETUR, and the Navy before they make decisions about major projects such as coastal roads, infrastructure, hotels, and port facilities. This consultation mechanism should enable the government of Ecuador to understand the full range of issues at stake, and to modify projects to avoid negative impacts.

Environmental Sanitation and Water Quality Management

Initially, the PMRC approached the issue of coastal water quality without making the link to basic community services or environmental sanitation. The program initially emphasized building public awareness of the impacts of declining water quality on the mariculture industry, recreation, and estuarine

productivity. The PMRC examined the institutional problems surrounding water pollution control, and provided technical assistance to standardize analytical methods and build confidence in water quality data, and organize and train the water quality working group that was formed by technical staff from the major mariculture laboratories.

The PMRC's work in the ZEMs led it to discover the important social dimensions of water quality. This led to greater attention to community concerns over safe drinking water, sewage, and solid waste disposal, beach and neighborhood cleanliness, and public health. This integrated approach enabled the PMRC to build local constituencies for coastal resources management, by incorporating the citizens' concerns for improving their quality of life with Ecuador's definition of coastal resources management.

Environmental Sanitation and Water Quality Issues Along Ecuador's Coast

Shrimp Mariculture

- The negative effects of declining water quality on shrimp mariculture have become a real economic threat to the industry in the 1990s, and a hazard to the productivity of estuaries.

- Low oxygen levels and eutrophication are being caused by the high volume of daily water exchange between shrimp ponds and coastal waters. For example, in the Rio Chone estuary, it is estimated that shrimp farms exchange 1,000 cubic meters of estuary water per second, which is 25 times the average flow of the Rio Chone. Evidence of eutrophication has been found in Cinco Bocas, in the middle of the most heavily developed section of the estuary. In the Rio Guayas, shrimp farms pump about 1700 cubic meters per second, which is equivalent to the average flow of all rivers in the provinces of Manabí, Guayas, and El Oro.

- Extensive modifications to coastal watersheds by dams is reducing the seasonal pulses of fresh water to estuaries, degrading habitat quality for juvenile shrimp, and reducing the flushing of estuaries.

Urban and Rural Community Sanitation

- Water taken from coastal rivers for domestic use is often contaminated from pesticide use in agriculture, and from industrial and domestic sewage discharges from urban areas.

- Investments in potable water supply and liquid waste disposal have not kept up with population growth in urban centers, and water pollution control laws have not been implemented. In communities where environmental sanitation projects have been built, education and training in the use and maintenance of the systems have been overlooked, leading to poor administration and to failure to recover system costs.

- The proportion of coastal residents connected to potable water and sewage disposal systems actually dropped from 20 to 17 percent between 1982 and 1990.

- The majority of coastal cities suffer from serious deficits in basic municipal sanitation services, including solid waste disposal. The situation is most severe in communities of fewer than 5,000 people, where facilities are virtually nonexistent.

- The heavy use of certain tourist beaches during peak holiday periods (January to March and July to September), combined with poor infrastructure, results in bacteriological contamination of bathing beaches and coastal waters, risking public health and depressing the recreational potential of these areas.

Industrial Pollution

- Fish processing plant discharges in Posorja, Chanduy, Monteverde, and Manta, along with shrimp larvae hatcheries in San Pablo, San Vicente-Canoa, and Atacames, are degrading local water quality, in several cases near important recreation beaches.

- Gold mining in the upper watersheds of Guayas Province is generating concern about the discharge of toxic heavy metals into coastal water bodies.

Specific water quality problems identified by the PMRC include:

Water Body	**Type of Discharge**	**Affected Activities**
Rio Atacames estuary	residential sewage shrimp ponds	tourism shrimp pond productivity estuary ecology shellfishery
Rio Chone estuary	residential sewage shrimp ponds	productivity of shrimp ponds tourism fisheries estuary productivity
Beaches of Playas-Data de Posorja	residential and beachgoers' sewage fish cleaning and evisceration	tourism
Estero Salado (city of Guayaquil)	residential sewage industrial waste discharges urban stormwater	recreation shrimp pond productivity fisheries estuary ecology
Estero Huayla (city of Machala)	residential sewage industrial discharges agricultural runoff	potable water estuary ecology shrimp pond productivity fisheries recreation

Environmental Sanitation and Water Quality Monitoring Initiatives in the PMRC

Strategy 1: Design and implement a water quality sampling program focused on issues relating to shrimp mariculture; assess the strengths and capacity of in-country water quality laboratories; and combine the results of these efforts into the design of an integrated program to generate baseline data and conduct continuous water quality monitoring.

- The PMRC established an interinstitutional water quality working group to review the existing data on water quality, discuss perceived problems from the perspective of shrimp farmers and larvae hatcheries, and address concerns about the quality of available data. This group succeeded in standardizing laboratory methods and establishing credibility in the data generated by different agencies and laboratories.

- A sampling program targeted issues of priority concern to the shrimp mariculture industry, including direct measurements of those water quality variables that may be affecting the operations of the shrimp mariculture industry. The initial focus was on monitoring oxygen, coliform, and nutrient levels. Overall, Ecuador's water quality was found to be good, but a number of localized problems demand attention.

- The water quality working group works with local collaborators on a volunteer basis. Shrimp farmers in the Rio Chone estuary have collaborated to monitor water quality conditions in the inner estuary.

Strategy 2: Guide and promote public investments and private collaboration in pollution control in the ZEMs.

- All five ZEM plans contain policies and proposed actions to improve basic services and promote the construction and proper administration of water supply, solid waste, and sewage disposal facilities. Several detailed designs have been completed with the assistance of the Instituto Ecuatoriano de Obras Sanitarias, but have not yet been implemented.

- Coastal communities with successful sanitation improvement projects have actively participated in the planning, construction and maintenance phases.

Advances Toward Water Quality Management and Improved Community Sanitation

The water quality working group greatly improved the level of confidence in water quality data collected by different laboratories, and helped identify site-specific problems in Estero Santa Rosa, Estero Salado, Rio Chone, and Rio Esmeraldas. Collaboration with the shrimp mariculture industry to better understand the links between shrimp pond water quality and the coastal waters they utilize proved very difficult in the late 1980s, due to the low level of interest in questions associated with environmental conditions needed for a sustainable shrimp industry. The PMRC was unable to finance a major initiative in water quality monitoring and management for the coast.

Reports prepared on coastal water quality issues related to shrimp mariculture by the U.S. Environmental Protection Agency in 1994 and for urban areas by USAID's Water and Sanitation for Health project in 1993, confirm the PMRC's own conclusions regarding the need for a major initiative on coastal water quality in the Guayas estuary and for all major coastal cities. Policies and actions on water quality management are included in the five plans adopted in 1992.

The prospects for implementation of Ecuador's basic water law—which calls for setting water quality goals and management plans for all coastal and freshwater bodies—are not good at present. Even in locations where local and national officials are committed to improving water quality, the financial situation is far less favorable than the conditions present in the United States in its highly successful drive to clean up rivers, lakes and estuaries in the 1970s and 80s. Ecuadorian cities currently must repay 100 percent of loans for wastewater collection and treatment facilities, even though, at present they are capable of recovering only 25 to 40 per cent of their operating costs. Rural communities are eligible for a combination of grants and loans, but still must repay 50 percent. The U.S. federal government, by contrast, paid for planning, and up to 75 percent of construction costs for publicly owned treatment works.

The PMRC placed most of its emphasis on exploring how coastal villages within the ZEMs could improve environmental quality and health conditions through local initiatives. The results of these practical exercises showed the importance of education, involvement, and follow-through in even the smallest project, a feature that was missing from the many failed projects along Ecuador's coast.

Initiative	Actions	Results
Public education and awareness 1990–1993	Presentations on household hygiene practices, community cleanup days	Improvement in personal hygiene practices, recognition of need for local facilities to protect health and local environment
Practical exercises 1989–1990	Solid waste collection in Atacames	Greater overall involvement of communities in the PMRC's activities. Community creates a sanitation committee which is then incorporated into the municipality of Atacames
Practical exercises 1992–1993	Technical assistance in a solid waste service for Atacames; improvement of similar services for Súa, latrines for Salinas, and solid waste collection in Canoa; latrines for Data de Posorja and Data Villamil; solid waste collection on Jambell island	Awareness and education campaigns preceded the successful projects, with a high level of beneficiary involvement, and shifts in personal hygiene and local sanitary practices

Next Steps in Environmental Sanitation and Water Quality Management

Activities Proposed for IDB Financing

The Inter-American Development Bank project emphasizes assistance to basic sanitation projects in all five ZEMs. These projects for the most part seek to address indirect contamination such as solid waste collection and disposal and latrine construction. Some data collection on the existing and post-project conditions will be an important part of demonstrating the feasibility and value of continuous environmental monitoring.

In addition, a limited amount of funds has been allocated for monitoring activities. The funds may cover the costs of training and organizing local monitoring groups, preparing water quality standards in the ZEMs and other critical coastal areas, and publication of guidelines and status reports on the water quality issues in the coast.

The Need for Continued PMRC Leadership in Coastal Environmental Sanitation and Water Quality Management

The PMRC can take the following steps to break through the current barrier of inertia and discouragement that has recently characterized coastal water quality management:

- Designate priority areas for the establishment of water quality standards, and promote local agreements to guide pollution control initiatives.

- Develop monitoring and characterization protocols; provide training and technical assistance to local groups, and support the compilation and interpretation of monitoring information.

- Test and develop pollution source inventory and disclosure to the public, by working with national and municipal authorities and the Ranger Corps.

- Develop and foster local education and monitoring efforts that involve schools and community groups in pollution monitoring and control activities.

- Establish agreements with agencies authorized by the Ley de Aguas to carry out water quality planning for selected areas, and maintain public information and files on the results of these programs.

- Work with the private sector, including shrimp farmers, businesses, port facilities, and other marine user groups, to examine current waste disposal practices and establish viable control strategies, possibly including a transparently operated permit system.

- Sponsor economic and social impact analyses of the importance of improving and maintaining water quality in targeted areas. Identify future economic development options, such as shellfish culture and exports, and new tourism investments, which will depend on a credible method of monitoring and supervising water quality conditions.

- Publish annual assessments of the status of coastal water quality and pollution control activities in coastal areas.

THE NEXT PHASE OF THE PMRC, 1994–2000

THE SCOPE OF THE INTER-AMERICAN DEVELOPMENT BANK LOAN PROGRAM

The primary emphasis of the loan program, signed in April 1994, is Component I, which supports the five ZEMs, and the administrative and technical assistance network needed to successfully implement the ZEM process. The Fundación Pedro Vicente Maldonado will manage ZEM activities and provide technical support in public education and outreach to the field teams. Additional technical staff will be assigned to the field offices.

Component II will support an interdisciplinary applied research program in the Rio Chone estuary; basic monitoring of trends in coastal resource use and condition; and providing the tools needed to make the PMRC's growing knowledge of the coast more available for planning and decision-making. It will also fund the enforcement activities of the Ranger Corps, as well as a look ahead to expanding the operating scope of the program outside the five ZEMs.

In Component III, the technical and management capability of the PMRC staff will be strengthened, including the transfer of personnel previously funded through the USAID CRMP. Physical and equipment improvements will be made so the ZEM offices can support local needs, as well as those of the project teams carrying out loan-funded actions. A comprehensive training program will help all project staff, field personnel, community members, and contractors understand the PMRC philosophy and methods, as well as technical aspects of integrated coastal resources management. The PMRC will continue to receive international technical assistance through the University of Rhode Island Coastal Resources Center.

MAJOR CHALLENGES FACING THE PMRC IN THE NEXT FIVE YEARS

The Transition to the IDB Loan Program

The PMRC is about to make an important, but difficult, transition. The administration of the entire program and the control of disbursement of funds was transferred in 1994 from the cooperative agreement administered by the University of Rhode Island and USAID, to the newly expanded Executive Directorate which is charged with carrying out the IDB loan. The annual budgets will increase from USD $500,000 to 600,000 per year, to nearly $3,000,000. The flexible, experimental style of the USAID-funded program will give way to the more complex and slower procedures governing the awards of contracts, the hiring of staff, and the purchase of goods and services dictated by Ecuadorian governmental procedures. Even though Executive Decree 3399 provides the Executive Directorate with considerable autonomy, and retains the PMRC's flexibility and adaptability, the difficulties of administering a much larger program will be considerable.

The greatest challenge, however, will be in continuing to build upon and gain further acceptance for the values and unique program approach that have characterized the PMRC during its initial years, as many more staff members, consultants, local groups, community officials, and resource users come into contact with the program and attempt to carry out its agenda. It is essential that new staff be able to maintain a dedication to an adaptive and participatory approach to resource management. They must learn how to empower and build local capacity, as well as reach out to the national agencies that are responsible for guiding and controlling coastal development. The national and local constituencies for coastal resources management must be maintained and strengthened by the actions of the new agency.

A Commitment to High-Quality Technical Performance

The practical exercises and other small-scale projects undertaken during the USAID-sponsored project repeatedly reminded the PMRC that any activities aimed at helping maintain or restore the productivity of coastal ecosystems to both traditional livelihoods and economic development require sustained levels of

high-quality technical assistance. The typical projects that have been approved for the first phase of implementation through the IDB loan range in size from 10 to 100 times larger than any of the practical exercises. The logistical problems and the technical nature of many of the projects, coupled with the newness and greater public visibility of this work will demand careful attention to how tasks are carried out, and the identification and correction of difficulties as they emerge.

Helping the Government of Ecuador Improve Its Ability to Govern Coastal Ecosystems

A basic operating principle for the PMRC remains the concept of partnerships with existing ministries through the National Coastal Resources Management Commission, who retain their individual authority and responsibility for management decisions and sectoral resource management policies. Thus, since 1989, DIGMER (the National Merchant Marine and Directorate for the Coast), INEFAN (the Forestry Agency), and the Subsecretary of Fisheries, have all participated in PMRC activities, both in the ZEMs and through the Ranger Corps, but they also have maintained their own decision-making procedures. For example, two-thirds of DIGMER's over 400 beach and bay zone decisions since 1989 have taken place outside of the five ZEMs, where there has been no local planning similar to that in the special zones. These agencies have not yet adopted new regulations that will allow public involvement in resource management decisions and place stronger emphasis on environmental protection criteria nor have they developed the staff capacity to foster local stewardship.

The members of the National Coastal Resources Management Commission are depending on the implementation of the Inter-American Development Bank project to demonstrate the feasibility and acceptability of the new approaches that the CRMP is promoting. As the year 2000 approaches, the PMRC hopes to see all the ministries contributing to positive management actions in the coast, both within and outside the ZEMs, so that the level of management action increases, and the cycles of learning become more frequent.

Strategies for Managing Mangrove Ecosystems

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Mangrove wetlands are widely recognized as one of the most important and productive coastal habitats in the tropics. Mangroves played an important role in sustaining the livelihoods and cultures of many pre-Columbian coastal communities in Ecuador-such as "La Tolita" in the northwest section of the country, where development centered around a mangrove forest. After the colonial period, mangroves provided wood for shipbuilding and bark to produce tannin for curing leather. In this century, mangroves remain a source of firewood, charcoal, and lumber for construction of piers, houses, bridges, and woodworking. Mangroves have always provided the habitat for fish and shellfish that thousands of coastal residents depend upon for personal consumption and for sale.

In addition, mangrove ecosystems play an important role in maintaining water quality in estuaries, protecting shoreline from storm damage and erosion, production and export of organic matter from estuaries, and retention of sediments and heavy metals in estuarine waters.

The past three decades have brought destruction and overuse of mangrove wetlands and forest, due to population growth, urbanization, and the construction of shrimp farms. This in turn has diminished the ability of these systems to provide food, materials, and energy-benefits that are now more important than ever to coastal residents, many of whom have few practical alternatives for meeting basic needs and earning income.

Since 1979, Ecuador has been searching for a viable mangrove policy: one that would allow for the use of the ecosystem without damage to ecological processes and biodiversity, and that would provide for improvement to the quality of life of surrounding communities. Many laws, regulations, and interministerial agreements have been published to regulate and prohibit the conversion of mangroves to other uses, but the result of these measures has not been encouraging. More than 40,000 hectares (ha) of mangroves have been converted to shrimp farms, and indiscriminate cutting continues.

Since 1986, Ecuador's Coastal Resources Management Program (PMRC) has been exploring alternative approaches to management that take into account the wide variability in the physical characteristics of mangrove ecosystems, and that recognize the economic and social self-interest of coastal communities and resource users. The central role of the PMRC has been to develop a body of experience on how to govern mangrove ecosystems for sustainable use through tests of innovative policies and techniques to create capacity for local mangrove stewardship. Many of the ideas generated from this experience appear to offer Ecuador new hope in designing sound national mangrove management policies that can be put into action through local leadership and collaboration.

Mangrove Ecosystem Characteristics and Management Issues in Ecuador

Mangroves characteristics important to management

Mangrove is a broad term used to describe about 50 species of trees worldwide that are adapted to grow in salt water. As many as 15 of these are found in Latin America. There are five important species that make up Ecuador's 162,055 remaining hectares of mangrove forest:

Family or genera - Common name
Rhizophera - Red mangrove
Avicennia - Black mangrove
Laguncularia - White mangrove Conocarpus - Mangle jelí
Pelliceria - Pinuelo

Mangrove forests are found in three types of intertidal zone settings.

River mangrove forests are located along edges of coastal rivers, as far upstream as the last point of intrusion of salt water. The flow of river water provides rich nutrients that enable river mangroves to generate thick forest cover. There are about 13,000 ha of this forest type in Ecuador.

Basin mangroves are found in the interior of the coast adjacent to salt flats, and receive water intermittently from high tides, which is slowly renovated and much higher in salinity. Growth is more restricted in this zone, which includes about 40,000 ha in Ecuador, primarily Avicennia and Conocarpus.

Fringing mangroves are flooded with salt water during each high tide. Forest production is high here due to the inflow of nutrients and sediments circulating in estuaries. Rhizophera is the predominant species in this setting, which accounts for 77 percent of the mangrove ecosystem in Ecuador, or about 125,400 ha.

Mangroves provide food and habitat to a variety of trophic levels, including important estuary-dependent species of fish, mollusks and crustaceans. These include:

Scientific name - Common name
Anadara tuberculosa - conch
Anadara similis - conch
Crassostrea columbiensis - oyster
Myella guyanensis - estuary mussel
Cardisona crasum - crab
Mugil spp. lisa - (fish)
Ucides occidentalis - red mangrove crab
Penaeidae (californiensis, vannamei, stylirostris) - white shrimp

The contribution of mangroves to secondary productivity of coastal ecosystems is dependent on the fate of leaf litter, including production in the forest, transport to the estuary, and utilization by marine food webs. Variation among the mangrove systems in Ecuador is considerable, ranging from the high tidal amplitude and large river discharge in northern Esmeraldas and the Guayas River, to arid environments with minor tides and little freshwater input-such as the Rio Chone in Manab' province, and the northern Santa Elena peninsula in Guayas province.

Critical mangrove ecosystem management issues in Ecuador

- Destruction of mangrove ecosystems continues at an accelerated pace.

Since 1969, Ecuador has lost 42,000 of its estimated 204,000 ha of mangrove forest cover, primarily to the shrimp mariculture industry. (CLIRSEN, 1992) This nationwide average loss of 20 percent does not reflect the fact that most estuaries have actually received much higher rates of damage, and that the comprehensive data compiled by the Center for Remote Sensing (CLIRSEN) for 1969, 1984, 1987, and 1991 does not include associated intertidal areas that have also been filled, diked, or channelized. Destruction includes not only the permanent loss of forest cover, but also the underlying riverine, basin, and fringe mangrove environments that serve as habitat and fishing grounds.

Mangrove loss fall into two categories: the elimination of 95 percent of the basin mangroves; and site-specific losses that range from 3.5 percent to as much as 82 percent of the mangroves of individual estuaries.

The extent and impact of conversion of mangroves to other uses varies considerably among the principal estuaries. In Esmeraldas, the zone of the Santiago-Cayapas-Mataje rivers records a total loss of only 3.5 percent, but this area is currently one of the most threatened, due to recent, often illegal, construction of shrimp farms. Water quality problems and diseases afflicting shrimp farms in the south now endanger what are considered to be the oldest, largest Rhizophora mangroves on the Pacific coast,

with heights to 50 meters (m) and diameters of up to 1 m. This area was also the location of the first large-scale destruction of mangroves for coconut palm plantations in the early 1940s, as well as the site of livestock production and urban growth.

Shrimp farm construction has devastated other major estuaries in Manabí province, such as Bolívar-Chamanga-Cojimíes, which has suffered a 51 percent loss, and the Rio Chone, which has lost more than 80 percent.

The Guayas estuary has a total of 130,000 ha of mangroves, along with about 124,000 ha of shrimp farms in the surrounding provinces of Guayas and El Oro. It is the largest estuary on the Pacific coast of South America. It has an extensive river flow, a tidal range of 3 m, and heavy sedimentation. The estuary manages to support shrimp in every stage of the lifecycle, as well as the shrimp mariculture industry itself, and extensive artisanal fin, mollusk, and crustacean fisheries-all while receiving the raw wastewater discharges of more than 2 million people living in the cities of Guayaquil and Machala. In addition, it handles most waterborne commerce into the country, requiring frequent dredging and disposal of contaminated sediments. The estuary also receives the runoff of nearly half of the agricultural production of the coastal provinces. The Daule-Peripe dam, constructed in 1988, is intended to provide irrigation for up to 100,000 ha. The resulting diversion of water is reducing freshwater flow to the estuary.

According to CLIRSEN studies, Guayas and El Oro provinces have lost only 18 percent of mangrove forest cover. But this picture changes when subregions of the Guayas estuary are more carefully examined. The good news is that the 12,209-ha area near Churute has lost only about 4.3 percent, thanks to forceful implementation of the Ecological Reserve status given it in 1978. Both Taura, which has 19,583 ha, and the Estero Salado, with 40,846 ha, have lost 12 percent of forest cover to urban expansion around Guayaquil, as well as to mariculture. Throughout the Guayas estuary, shrimp farms have spilled over from their initial development in salinas (salt flats), which have virtually disappeared, into the esteros (tidal inlets), estuaries, and upland sites. The 11,833 ha of mangroves in Naranjal estuary, on the border of Guayas and El Oro provinces, has lost 25 percent of cover, while Jambelí has just 5,625 ha remaining, suffering a decline of more than 52 percent. The Hualtaco region, comprising 13,630 ha in the southernmost section of El Oro, has also lost more than 25 percent of its cover since the inception of the mariculture industry there in the late 1960s.

- Ecuador's mangrove governance policies focus on centralized enforcement of a virtual prohibition of mangrove uses.

The overall pace of destruction has actually increased since tougher mangrove policies and regulations were adopted in the mid-1980s, as documented by CLIRSEN:

Period/ Loss per year (ha)
1969-1984/1,439
1984-1987/2,434
1987-1991/3,348

Ecuador turned its attention to managing mangrove forest when the shrimp mariculture industry was just beginning its rapid expansion in the 1970s. In 1978, the National Forestry Directorate published Decree 2939 (Official Register 596 of October 23, 1978), which prohibited the use of mangrove forest for shrimp farm construction, and required zoning plans to be prepared for any site where mangrove cutting would take place. Such cutting was to be carefully planned and accompanied by reforestation. Agriculture interests promoted the requirement that shrimp farms could not be constructed in coastal land suitable for farming. The following year, the Churute Mangrove Reserve was established through a Ministerial Agreement. (Number 322, Official Register 69 of November 20, 1979). Two years later, the forestry law provided for controlling the cutting, transportation, and export of mangroves. The Navy was empowered to confiscate boats and cargo of illegally cut mangrove logs.

Publication of CLIRSEN's first comparison of mangrove forest cover between 1969 and 1984 revealed the extensive damage caused by mariculture development and urbanization on detailed maps at a scale

of 1:25,000. Some 21,587 ha of mangrove forest had been lost. The government of Ecuador responded swiftly through Executive decree 824 (Official Register 64 of June 24, 1985), which declared it was in the public interest to conserve, protect and restore all mangroves. This also made the traditional uses of mangroves practiced in coastal communities illegal. The Fisheries Law of the same year prohibited destroying or altering mangroves and forbid installation of mariculture ponds in mangroves. The accompanying regulations on cultivation of aquatic species in 1985 obligated shrimp farm owners to monitor and protect mangroves, and agricultural lands adjacent to their farms. This language is included in each published shrimp farm concession.

With the exception of the Ecological Reserve in Churute, the government of Ecuador did not add any new financial or administrative resources to put mangrove conservation laws and regulations into action. It takes seven full-time people, along with a travel budget, information centers and continuous patrols to take good care of the Churute Reserve, which represents a mere 7.5 percent of the total mangrove resource. Only 10 staff are available to work part-time on mangrove management for the entire remainder of the coast.

In the 1993 Workshop on Mangrove Management in 1993 sponsored by the Navy of Ecuador, the National Forestry Institute and the PMRC, the working group on legal aspects concluded:

> The revision of Ecuadorian law has created a legal regime in which the proliferation of often contradictory rules actually impedes law enforcement and makes the job of the agencies with jurisdiction (over mangroves) more difficult to implement.

- Latin America offers few models for creating site-by-site management solutions.

The problem with Ecuador's mangrove management policy lies deeper than confusing regulations. The premise that mangroves should not be utilized, and that a centralized government agency can tightly control harmful activities, does not have any basis in Latin American or world experience. Countries that have relied on such policies-for example, the Philippines, have seen destruction exceed 50 percent. Puerto Rico lost 75 percent of its mangroves before proposing strict construction and zoning regulations.

During the period in the late 1980s when the PMRC was beginning to explore viable options to the failed policy of prohibiting mangrove cutting, two important developments were taking place in Asian countries that had a bearing on the future of Ecuadorian policy and implementation. First, in the early 1980s, the United Nations published a number of widely read reports on the status and traditional uses of mangrove management (Saenger, et. al, 1983; Hamilton and Snedaker, 1984; Vannucci, 1988). Second, the social forestry movement, along with training workshops and studies of successful traditional mangrove management practices in Asia and the Pacific, were influencing national policy and practice in some countries. The Philippines adopted sophisticated mangrove stewardship policies and programs to replace earlier unsuccessful centralized regulation. (Kunstadter et. al, 1986; Department of Environment and Natural Resources, Philippines, 1991)

Unfortunately, Latin America has not benefited from the same level of international assistance in mangrove management. Although some regional activities took place in the late 1970s, Shaeffer-Novelli and Cintron (1990) point out that a lack of external funding has prevented regional coordination, resulting in a lack of research on Latin American mangrove forests. They go on to stress that management of mangroves for sustainable use must be determined on a site-by-site basis, accounting for the unique physical and social characteristics of each ecosystem. Ecuador, like every coastal tropical nation, must actively experiment to learn what will work.

The emergence of the PMRC approach to mangrove management

The PMRC defined its role in mangrove management through two early project efforts: the preparation of a shrimp mariculture strategy for Ecuador in 1986 (Olsen and Arriaga, 1989); and the issue profiles of the country's four coastal provinces. (Fundaci—n Pedro Vicente Maldonado, 1987). Four of the six special area management zones (ZEMs) that were included in Executive Decree 375 had substantial use conflicts over mangroves.

The mariculture strategy proposed two specific lines of work for the PMRC to follow. The first involved curtailing wetlands loss and protecting estuary water quality by focusing management on the mangrove ecosystem, not merely on forest cover. The mariculture strategy also urged the PMRC to show that better management could actually be done in Ecuador, including working with the shrimp industry to incorporate mangroves into their ponds:

An urgent planning priority is to develop demonstration plans for the management of mangroves. It is not feasible to expect that there will be no further destruction of mangroves. Realistic and implementable management strategies must be developed that can accommodate the continuing utilization of coastal resources.

Between project years 3 and 8 (1987-1993), about $108,000 of USAID funds were assigned to support a series of small demonstrations and other activities aimed at gaining knowledge and experience in managing mangroves for sustainable use.

The PMRC experiments confirmed that the largest untapped source of energy and resources for mangrove management remains the self-interest of mangrove users, and an enlightened citizenry that appreciates and acts to maintain the functioning of a critical coastal ecosystem. The initial tests of new mangrove policies by the PMRC show that it is indeed possible to tap into this source of local power with relatively inexpensive techniques and projects.

Public education in Atacames not only generated a strong demand for mangrove protection, it spawned local initiatives to include mangroves as a tourism and environmental education resource, and to clean up the Rio Atacames. It also empowered local residents to confront and resolve conflicts with shrimp farm operators. Mangrove protection has been a key focus of the three Ranger Corps, who not only carried out patrols, but helped initiate dozens of enforcement actions and the formation of local watchdog groups. The Ranger Corps also helped in the preparation of user group agreements in which individual users committed themselves to carrying out mangrove conservation actions. Four ZEM plans adopted by the national government contain detailed findings, policies and actions aimed at fostering sustainable use of mangrove ecosystems.

Since 1992, government institutions, researchers, academic institutions, nongovernmental (NGO) groups, communities, and user groups have worked together to examine the experiences of the PMRC and the results of small scale projects, and have debated the design of new policies and strategies to remove the key obstacles to the rational administration of integrated management based on local participation. The final proposal developed in a national workshop held in 1993 at the Navy's Oceanographic Institute, INOCAR, is found in Annex I, and is now in the implementation stage. During 1995, the PMRC has worked with the National Forestry Institute to develop new regulations that include many of the ideas discussed in the mangrove workshop.

Although the best solutions to the national mangrove management crisis may lie predominantly in mobilizing the efforts of communities and resource users, the path toward fulfilling this vision of coastal management will require decisive national leadership. National agencies must still apply their legal authority and expertise to any new special area plans or user group agreements. National support for a management initiative in an estuary may be an essential precondition for obtaining financial assistance.

PMRC Strategies to Develop New Approaches for Mangrove Ecosystem Management

Prior to the initiation of the Ecuador PMRC, Snedaker et. al. (1986) examined the status of the mariculture industry in Ecuador and its impact on mangrove ecosystems. They found the mangroves have a low diversity of species, low density, and reduced tree size. Heavy loss of mangroves probably led to loss of artisanal fisheries, and may have had an impact on the shrimp larvae fishery itself. The authors presented data from Asia showing the link between greater mangrove habitat and shrimp production, and recommended a study of the Rio Chone to develop local information on these links. They also noted that, until very recently, mangroves in Latin America were considered to have little value, and that there was no

experience in multiple-use management or forestry. Most timber harvesting was done on an extractive basis, and other countries were trying to follow Ecuador's example in developing a mariculture industry, rather than looking to the Asian example of sustained multiple-use management. The report also strongly urged Ecuador to move quickly to develop optimal use plans for the intertidal zone that considered all economic activities, and to carefully zone all mangrove areas to protect access for traditional uses. The authors urged the legalization of mariculture investments and concessions, which they proposed should pay for access to the resource, based on the potential productive value of coastal sites.

One of the first actions of the PMRC was the creation of a mangrove working group, an interinstitutional group dedicated to improving the knowledge base and management practices in mangrove ecosystems. It was composed of about 20 experts who worked in government, academia, and nongovernmental organizations (NGOs), and met informally to present information, debate issues, and design and carry out projects.

Mangrove management working group members:

Forest Districts of the provinces of Guayas, Esmeraldas, Manab', and El Oro
Center for Remote Sensing (CLIRSEN)
Navy Merchant Marine (DIGMER)
Subsecretary for Fisheries Resources
National Fisheries Institute (INP)
Natural Sciences Faculty of the University of Guayaquil
Technical University "Vargas Torres" in Esmeraldas
Technical University of Manabí
Technical University of Machala

Nongovernmental groups:

Fundaci&oacuten Pedro Vicente Maldonado
Fundaci&oacuten Natura-Guayaquil
FUNDECOL, Muisne
Fundaci&oacuten "Seeds of Life," Guayaquil
FUNDEPRENA, Guayaquil
CORPORENA, Guayaquil

In February 1987, Luis Arriaga and José Vásconez of the Environmental Directorate of Ecuador's Ministry of Energy and Mines presented the PMRC's first statement on the characteristics of a mangrove management strategy to Ecuador's first environmental congress. They proposed a program of work (see Annex IV for full text of this proposal) with several objectives: to evaluate mangrove ecosystems, including the nature of use conflicts and human impacts; to promote sustainable fisheries, forestry, and recreation uses; to build national capacity to manage multiple-use areas; to conduct education campaigns, training, and public outreach to build support for environmental protection; and to provide technical guidance, materials, and extension support for conservation efforts.

The following July, the PMRC's mangrove working group organized the first workshop to broaden knowledge and awareness of Ecuador's mangrove resources. The meeting, sponsored by DIGEMA, brought together national authorities, experts, and leaders of NGOs concerned about the rapid loss of mangrove resources.

The PMRC's Year 3 (1988) work plan launched work in mangrove management, which was based on five strategies:

1. Bring international scientific expertise on mangrove ecosystems to Ecuador to exchange information and ideas with the mangrove working group.
2. Build public awareness of mangrove issues, identify site-specific issues, and document mangrove ecosystem changes.
3. Develop and test mangrove governance techniques.

4. Test site-specific mangrove management methods.
5. Prepare a national mangrove policy proposal.

The following sections examine in detail each of the strategies and resulting activities, and assess the results of these initiatives in terms of how the efforts helped further the PMRC's primary objective of creating a rich experience that would help justify a basic change in the approach to mangrove ecosystem governance.

Strategy 1. Bring International Scientific Expertise to Ecuador.

Ecuador's scientists, public officials, and mangrove resource users were in the unique position of not only needing to learn more about mangrove ecology and stewardship, but being able to offer the international community a laboratory to conduct research and test ideas new to Latin America. The involvement of international researchers included training activities, visits and tours, and research projects.

Training activities

The PMRC sponsored a series of training activities through the mangrove working group, including workshops on mangroves for Guayas and El Oro provinces, and a study tour to Puerto Rico in 1989 by members of the working group. The tour involved experts based in Puerto Rico, such as Ariel Lugo and Gilberto Cintron, as well as Robert Twilley and the director of EPOMEX, Alejandro Yanez-Arencibia. The mangrove working group organized three additional training events in Ecuador, addressing mangrove ecology (led by Twilley), fisheries (led by Arencibia), and forestry (led by Francis Putz of the University of Florida).

The flow of lessons was two-way during these events. Perhaps most notable is the reaction of Yanez-Arencibia (1991) of EPOMEX to his visit to Ecuador. He concluded that the declining profitability of the shrimp mariculture industry in Ecuador was caused by a squeeze between lower world prices and higher production costs, coupled with the degradation of mangrove ecosystems due to turbidity and erosion, organic enrichment of coastal waters, alterations in drainage patterns and circulation in estuaries, and increases in agrochemical residues. In his view, Ecuador now provided Latin America with the model of how not to develop shrimp mariculture. He was especially concerned that his home country of Mexico not repeat the series of mistakes in its coastal zone, and advocated experimentation with methods for achieving a sustainable mariculture activity.

Visits by international experts

Visits by international experts generated two funded scientific investigations, and stimulated the preparation of other research proposals-which in turn involved a number of students, professionals, and Ecuadorian researchers who have continued to be involved in the PMRC. The URI-USAID coastal management project (CRMP) decided not to fund scientific investigations directly, but strongly supported the development of proposals that might be accepted by other donors.

Study of the mangrove reserve in Churute

The most important investigation related to the PMRC's efforts in mangroves was a comparative study on the importance of mangroves in sustaining fisheries and controlling water quality in coastal ecosystems. The study focused on the Churute Ecological Reserve, as well as on the Terminos Lagoon in Mexico. The project was proposed by Robert Twilley, Lucia Solorzano of Ecuador's National Fisheries Institute (INP), and Roger Zimmerman of the U.S. National Marine Fisheries Service (NMFS). The USAID Washington project officer for the PMRC, Nora Berwick, along with Stephen Olsen, director of the international Coastal Resources Management Project, worked to promote funding of the project by the USAID Office of the Science Advisor. The PMRC helped coordinate and provide logistical support to the field work.

The project focused on five aspects of the Churute ecosystem. The Office of the Science Advisory

financed work carried out by INP on the nutrient cycle, and on the utilization of leaf litter. The latter was executed by NMFS and ESPOL. USAID Quito funded the Ministry of Agriculture National Forestry Directorate (DINAF) to support work on biomass production-carried out by the University of Guayaquil-and research on the effect of seasonal changes on the ecosystem. This was carried out by a DINAF staff member, Ramon Zambrano, who also was studying at the University of Leica Rocafuerte.

The resulting report (Twilley et al., 1993) documents destruction due to urbanization, wood production, and shrimp mariculture. It also notes natural stresses, such as damage from a bag worm that defoliated 1,000 hectares (ha) in the Guayas estuary. The research also found that the production of leaf litter in the Ecological Reserve of Churute neither accumulates nor is exported, but is harvested and stored by the mangrove crab, giving the mangroves one of the highest reported litter turnover rates. Commercially valuable shrimp species Penaeus vannamei and P. stylirostris were found to be abundant in mangrove areas. Twilley cites the work of Turner in estimating that the loss of 25,000 ha of mangrove nationwide as of 1987 may have been accompanied by a drop in coastal zone shrimp production by 15,000 metric tons per year.

With greater river discharge and tidal exchange than other studied mangroves, the Churute Reserve system is a nutrient and sediment sink. Twilley notes the importance of site-specific characteristics in determining the role of a particular mangrove ecosystem, through comparisons of Churute with the highly altered Estero Salado, observing differences in salinity-a dominant characteristic that is determined by seasonal rainfall and river discharge patterns, and varies greatly along the coast of Ecuador-as well as in light, silicate concentrations, and use by estuarine fauna.

Twilley proposes that mariculture and other economic uses of the intertidal zone be integrated with the six ecological functions of mangrove systems, which fall under two broad categories: Habitat quality includes the functions of nursery, food source, and shoreline protection. Water quality includes the functions of sedimentation, nutrient sink, and pollution sink. The shrimp industry has caused many negative feedbacks to this ecosystem. Twilley prescribes using integrated pond management to take advantage of the habitat and water quality functions of mangroves-for example, by decreasing channelization of estuaries, filtering shrimp pond discharges, returning a portion of produced shrimp to the estuary to enhance wild stocks, reforesting mangrove estuaries, continuing seasonal freshwater discharges to the Rio Guayas estuary, and managing and protecting the mangrove crab fishery. He also calls for advancing work on valuation techniques for mangrove estuaries, which will in turn help focus additional mangrove research.

Guidance from other experts

In 1990, Howard Odum, along with Betty Odum, Dan Campbell, and Stephen Olsen, conducted a field visit to key mariculture-dominated estuaries in Ecuador and offered lectures on the valuation of coastal ecosystems, applying his concept of energy (solar energy value of resources). He raised a concern about the future health of mangrove ecosystems in Ecuador during periods of drought- building on Twilley's 1989 projections of the impact of changes to freshwater inputs of the Rio Guayas from the Daule-Peripe dam project. Without periodic pulses of fresh water, mangrove ecosystems will become degraded. Odum noted that the extensive mangroves of the Guayas estuary already exhibited signs of stress, and that some estuaries, such as the Rio Chone, had lost more than 90 percent of their mangrove cover, compared to a national average of about 14 percent. These site-specific impacts included displacement of people who had previously depended on mangrove fisheries and forest products, and loss of the fish habitat itself.

For the Rio Chone, Odum et al. (1991) recommended conservation of all remaining mangroves, along with a plan of reforestation along canals of shrimp ponds, and possibly on some emerging islands. Freshwater inflow to the estuary also needs to be assured, the report stressed. This is threatened by the construction of the Esperanza dam project and irrigation for the central area of Manab' province. Carefully controlled tourism in wetlands areas could be a way of conserving mangroves while obtaining local economic benefits. Public education is essential and might include a research station that can support local investigations. The Odum report contains detailed recommendations for a research agenda as well as suggested measures for improving water circulation in the Rio Chone

estuary.

Twilley and Costanza developed a proposal in 1991 to focus additional economic and ecological valuation work on the Rio Chone estuary. The proposal was not funded. Gonsalez (1992), with some assistance from the URI Coastal Resources Center, developed a mathematical model of environmental factors affecting the shrimp mariculture industry, based on the Rio Chone estuary. Campbell and AgŸero, along with Gonsalez, constructed an integrated model of the ecological and economic productivity of the Rio Chone, with some support from USAID Research and Development.

Two Asian experts in mariculture also conducted an extensive field visit to estuaries where mangroves had been replaced by shrimp ponds. Chua Thia-Eng of the International Center for Living Aquatic Resources Management (ICLARM) in the Philippines, and Pinij Kungvankij, a shrimp expert from Thailand, examined the potential for improving the efficiency and diversification of the Ecuador mariculture industry. They concluded that existing shrimp ponds could be operated much more efficiently, that the current number of ponds was adequate, and that unused ponds should be replanted with mangroves. They estimated that as much as 27,000 ha could be returned to functioning mangrove ecosystem.

None of the international experts offering guidance to Ecuador advocated pursuing the no-use policy adopted by the government of Ecuador, even though all were greatly concerned about the rapid degradation of mangrove ecosystems. They offered instead a variety of recommendations for the PMRC to test in order to achieve a realistic, effective approach to conserving the productivity of these systems. Most of these recommendations have subsequently been accepted as policies in special area management plans and tested in one of the ZEMs:

- Carry out public education programs.
- Promote ecological tourism in mangrove areas.
- Enforce existing conservation laws.
- Reforest shrimp farm intake and discharge canals.
- Actively experiment to develop sustainable mariculture in estuaries, integrating mangroves and productivity of mariculture.
- Zone mangrove areas according to appropriate uses.
- Restore mangrove area hydrology.
- Create buffer zones around shrimp ponds.
- Plant emerging islands with mangroves.
- Manage timber harvesting, and institute site-specific mangrove forest management.
- Protect freshwater inflow to mangrove estuaries.
- Prepare optimal use plans for all activities in the intertidal zone.
- Reforest abandoned shrimp farms.

Outcomes and assessment of scientific activities

The visits of scientists interested in mangrove ecosystems, and PMRC collaboration with research projects greatly stimulated learning and experimentation with mangrove ecosystem management in Ecuador. It also validated the idea that managing for sustainable use was a good path to follow in trying to keep the majority of the ecosystems productive. The PMRC directly benefited by hiring staff and consultants trained through their participation in research projects, including Alejandro Bodero, Mirella Pozo, Guillermo Garcia, Nikita Gaibor and Ramon Zambrano. Two theses were produced in Ecuador (Zambrano, Guillermo Prado), along with that of Blanchard, Riveras, and Cardenas in the United States. In addition, several articles have been published or are in press in the international literature.

Many of the international investigators will continue to be tapped during the implementation of the Inter-American Development Bank project, which will fully fund a number of the recommended management actions first suggested by scientists. This modest support for collaborative relationships between the international and local experts will continue to give good dividends, since it promotes long-term career commitments to advancing applied, as well as basic knowledge about Ecuador's mangrove systems.

The mangrove working group created a broad-based technical capacity that enables Ecuador to conduct new research and apply innovative management techniques. However, Ecuador has not generated its own mangrove ecosystem research program, nor has there emerged significant collaboration among the various universities of the coast to build capacity in mangrove forest management or ecological investigations. The PMRC focus has shifted to greater concern about specific problem areas in the ZEMs and about national policy. Over the past few years, the mangrove working group has become dispersed. Renewing its efforts must be a key priority of the PMRC under the Inter-American Development Bank project.

Strategy 2. Build public awareness of mangrove issues, identify site-specific issues, and document mangrove ecosystem changes.

Public awareness and education have unanimous support as a technique for changing attitudes and building support for mangrove management. The role of public education in mangrove ecosystem management is to promote awareness, understanding, and new attitudes among both adults and children regarding values and appropriate uses for these coastal resources. The audience for this message is diverse in its education levels and socio-economic status, as well as in the part individuals and groups play-consciously or unconsciously-in determining present and future mangrove condition and use patterns. Thus, a broad-based approach to education is required, since people must make decisions at many levels in order for new or strengthened mangrove management policies to take effect. At the national level, building general awareness and sensitivity, as well as a disposition to search for solutions at the highest political levels, can be accomplished through expanded television and print coverage of the condition and abuse of mangrove ecosystems, coupled with technical seminars, attention-raising events, and the use of mangroves as a theme in school curricula. At the local level, education efforts-such as talks by technical experts, oral histories of the role of a mangrove ecosystem in community life, school programs, mangrove tours, distribution of materials on local resources, small projects, and specific interventions in key decisions-can raise consciousness and prepare a community to give serious consideration to management proposals. This approach can bring together the groups who benefit from and who are damaging the mangroves, build participation in a planning process, and promote local vigilance and reporting of mangrove destruction.

The PMRC worked primarily with the Fundacion Pedro Vicente Maldonado to carry out national and local level awareness-building and educational activities-including work with the national press and local news media, programs aimed at ZEM residents, and programs and materials for the public education system. At the same time, the PMRC collaborated with the Center for Remote Sensing (CLIRSEN) to produce detailed inventories of mangrove forest cover change and shrimp pond construction, based on photography and satellite data. This is the primary documentation available on mangrove destruction coastwide, and is among the most complete and up-to-date information sources of its kind in Latin America. The results of these studies were published and distributed by the PMRC.

Provincial profiles

Mangrove issues received little press coverage and public attention at the onset of the URI-USAID CRMP in 1986. After the shrimp mariculture workshop held in August of that year, the CRMP commissioned a set of issue profiles for the four coastal provinces. These were carried out by the Fundacion Maldonado. The basic procedure involved the preparation of a draft document, followed by a provincial-level seminar in which local experts and leaders were asked to make presentations on coastal issues and to validate or correct the content of the document. Following publication of the profiles in 1987, the CRMP returned to discuss priority areas for management as part of designing the national coastal resources management program.

CLIRSEN reports on mangrove loss

The most frequently cited information source on the changing condition and use patterns of mangrove forest is the work carried out by CLIRSEN, which mapped and measured shrimp pond, salt flat, and mangrove forest cover for all major shrimp mariculture areas, at a scale of 1:25,000, for the years 1969, 1984, 1987, and 1991. CLIRSEN perfected its ability to use Landsat satellite data in conjunction with aerial photography and field inspections to complete the inventory at relatively low cost. The summary results of the 1987 study were published and distributed by the PMRC through the Fundacion Pedro Vicente

Maldonado technical series in 1988, along with the Spanish translation of the report prepared by Snedaker et. al on the siting of shrimp mariculture ponds and management alternatives in Ecuador. CLIRSEN subsequently published a separate technical analysis of mangrove and shrimp pond types and summary maps of the distribution of ponds and mangroves by estuary. The PMRC again funded part of the preparation of an updated mangrove and shrimp farm map inventory using remote sensing images for 1991. The results were released in the PMRC's Costas newsletter.

In addition to documenting the status of mangrove forest, copies of the scale maps provided useful baseline data for mangrove law enforcement efforts of the PMRC, although site-specific conflicts usually require reference to individual farm concession maps, which were not prepared in reference to the CLIRSEN data. Ecuador still lacks accessible, comprehensive shrimp farm data that compares the area granted by concession to actual constructed ponds, and documents the impacts on specific mangrove forest areas. As noted earlier, CLIRSEN data does not give a complete picture of mangrove ecosystem loss, and field verification of mangrove forest condition for selected sites has just begun.

Public education and outreach at the national level

Mangroves have been an important theme of the coastal management program's outreach efforts. Two editions of a student workbook on mangrove ecosystems were prepared and distributed by the Fundacion Maldonado during school years 1990-1991 and 1991-1992. The process included developing both the materials and teaching guide, working with technical consultants and the Ministry of Education, teacher training in the use of materials, and follow-up to evaluate use. Mangrove protection has also been a popular theme in many of the programs held during Environment Week in June-including contests in the arts on coastal themes, cleanup campaigns, parades, and talks on environmental subjects.

Mangrove issues have been featured in all of the outreach activities carried out for the PMRC by the Fundacion Maldonado, including the Costas newsletter that reaches 2,000 readers, media coverage, radio programs, a publication series that included a comic on mangrove conservation, and a 12-minute video produced for television and local events. The PMRC was able to build the press into an ally for improved management. One of the most extensively covered activities was the creation of the mangrove boardwalk in Atacames. In late 1993, extensive national press coverage on almost a daily basis focused on the construction of a shrimp farm near the mangroves of La Tola, where the largest remaining trees on the Pacific coast of the Americas are found.

Public education and outreach at local level

In addition to school programs, local education activities focused on furthering the ZEM planning process by building public interest and motivating participation directly. In the ZEMs, education efforts have often begun by reintroducing the historic importance of mangroves to community life, providing individuals who use mangroves with a group identity, and discovering ways in which intact mangroves can provide a local economic benefit. Guided trips to the mangroves have provided the first opportunity for both local residents and visitors to understand the social, economic, and ecological importance of the system. In Bahía de Caráquez, schoolchildren participated in a mangrove planting project on one of the emerging islands in the estuary. During the ZEM planning process, public education created a context within which shrimp farm operators or municipal decision-makers whose actions result in further mangrove loss can be confronted and convinced to halt their destructive actions. In cases such as the Estero El Morro, in the Playas ZEM, public education has been used to begin a process that later includes training, small projects, and the establishment of user group agreements to implement protection measures. (See Annex V for the text of the Atacames user group agreement).

Outcomes and assessment of information and public education activities

Education efforts by the PMRC, the Fundacion Maldonado, and many other Ecuadorian NGOs have expanded national press coverage of mangrove issues. The most recent example for the PMRC was the national mangrove symposium held in July 1993 and jointly sponsored by DIGMER and the National Forestry Institute (INEFAN). This was followed by extensive press coverage of mangrove issues. (See Strategy 5).

The PMRC has demonstrated that local groups can play an important role in generating enthusiasm and support. However, in the long run there must be a permanent presence who can distribute general information, generate local educational materials and learning experiences, and reach all of the different audiences who ultimately will determine whether mangrove management succeeds. Once general awareness is built, follow-up is necessary to focus on the issues and concerns of specific locations. This in turn may lead to the formation of local groups who not only require knowledge on which actions and decisions are best for the ecosystem, but on how to continue functioning as a resource user group.

Perhaps the group least effectively reached and influenced by education and outreach efforts is the shrimp mariculture industry. The PMRC needs to examine its outreach approach to develop effective ways for informing and persuading this major coastal resource user group to participate actively in resource management efforts and to contribute to workable mangrove ecosystem management solutions.

The inability of the URI-USAID CRMP to provide more funds for a consistent effort in documentation and outreach during project years 8 and 9 has been a source of frustration to staff and communities. This situation is expected to be corrected in part by the Inter-American Development Bank project. More timely and frequent production of the CLIRSEN mangrove inventory, and linkage of this data to other sources of information-such as shrimp farm concessions-are technically straightforward, and would boost efforts in enforcement by the Ranger Corps , and aid community-based stewardship through local groups. Modest funding for school materials, field trips, and small projects would have an immediate effect not only on science and environmental education in the coast, but on the attitudes of an entire generation of coastal resource users.

Strategy 3. Develop and test mangrove governance techniques.

At the shrimp mariculture workshop in 1986, Perez and Robadue (1989) observed:

> The use of coarse tools-such as prohibitions on all mangrove disturbances-that are difficult and costly to enforce must be replaced by area-specific mangrove management programs that can enlist the support and involvement of all those who depend directly and indirectly on the productivity of mangroves for their livelihoods.

The PMRC has experimented with innovative approaches to mangrove management in two distinct ways. Through the Ranger Corps, mangrove management projects were initiated by identifying traditional users and helping to organize them to participate in the ZEM planning process. The local ZEM committees unite authorities, resource users, and community members to discuss and approve the design and implementation mechanisms of site-specific management regimes.

The policies and actions in the ZEMs are summarized below. Variations in policies among the zones reflect differences in local environmental conditions, the presence or absence of organized groups to carry out specific actions, and the relative priority of mangrove management compared to other coastal issues.

Bahía de Caráquez-San Vicente-Canoa

Mangrove loss has been most dramatic (greater than 80 percent) in this ZEM, with episodes of cutting still taking place along the few remaining forested islands. The one remaining large (100-ha) stand at Buena Fe has been protected by local authorities, after some cutting for illegal shrimp pond construction. The Rio Chone estuary has been targeted by all scientific advisors as a key location for experiments in restoration, replanting, ecosystem-based management, freshwater inflow protection, ecotourism, and shrimp mariculture. Small groups of shellfishers have emerged who are interested in experimenting with shellfish bed management and aquaculture.

Examples of policies and actions in the ZEM plan:

- Prevent any additional destruction of mangroves, and manage existing areas for sustainable multiple uses. [Bahía De Caráquez 3.2.1]
- Protect important ecological areas in the Rio Chone estuary. [Bahía De Caráquez 3.4.1]
- Promote the forestation of sediment accumulating areas, emerging islands, and shrimp farm

discharge canals. [Bahía De Caráquez 4.5.1]

In this ZEM, a user group agreement was signed that focused on the mangrove resources of the Rio Chone, and several practical exercises were carried out to test the potential of reforestation.

Playas-Posorja-Puerto El Morro

The small, heavily utilized Estero Data de Posorja, which runs behind the 11-km tourist-oriented barrier beach between General Villamil (Playas) and Data de Villamil, has been subjected to hydrologic modifications by shrimp mariculture. The Estero de El Morro, on the eastern border of the ZEM, is at the edge of the large mangrove shrimp pond-dominated Guayas estuary. Although fishing for mangrove crab and other species is an important activity, the location of these areas on the periphery of ZEM settlements, away from existing tourist facilities, along with the dominance of tourism beach use conflicts, has given mangrove management and formation of user groups a lower priority in the ZEM plan and program activities.

Example of policies and actions in the ZEM plan:

- All mangrove forest in the ZEM will be protected or conserved with the objective of maintaining and improving their role in coastal ecosystems, as habitat of marine and upland organisms, and for renewable energy and tourism. [Playas 3.1.5]

A user group agreement was established in the Estero de El Morro that focused on the mangrove ecosystem.

Machala-Puerto Bolívar-Isla Jambelí

This ZEM is set in the coastal urban area of Machala-Puerto Bolívar, at the northeastern edge of a very large mangrove shrimp pond system along Estero Santa Rosa, which dominates the entire coast of El Oro province. The rate of mangrove cutting in the region as a whole has subsided since the early days of the shrimp mariculture boom, which began in this area. However, the ZEM is faced with every form of mangrove destruction, from urban expansion of Machala and Puerto Bolívar, to expansion of shrimp ponds, to effects of artisanal precriaderos (shrimp larvae fishermen) and wood harvesting. At the same time, nearby fringe mangrove and small mangrove islands remain intact, maintaining a surprisingly attractive passage for visitors to the island of Jambelí. There are thousands of artisanal fishermen who depend on the mangrove ecosystem, community groups have shown an interest in managing small mangrove ecosystems, and mangrove law enforcement has been an important theme of the work of the Ranger Corps.

Examples of policies and actions in the ZEM plan:

- The use of mangrove areas for multiple values-including scenery, shellfishing, wood harvesting, and education-will assure conservation of mangrove resources and sustainable forms of use. [Machala 3.4.1]

- Mangroves should be zoned to establish appropriate uses based on the characteristics of individual areas and local use needs, as the basis for a system to control mangrove cutting. [Machala 3.4.3]

- Public awareness and education programs must be developed in order to teach user groups and local communities basic mangrove management concepts. [Machala 3.4.4]

- Deforested mangrove areas should be replanted, along with discharge canals of shrimp ponds. [Machala 3.4.2]

Specific projects to conserve mangroves include restoration of mangroves in the Estero Huayla, which is located along the waterfronts of Puerto Bolívar and Machala; management of the use of mangroves on the Isla de Jambelí zoning of remaining mangrove forests; and an intensive public education campaign.

Atacames-Suacutea-Muisne

The remaining mangrove forests in the Atacames-Suacutea-Muisne ZEM are located near the two largest villages, Atacames and Muisne. The Rio Atacames had lost about 90 percent of its mangrove cover by the early 1980s due to legal shrimp pond construction. The rapid encroachment of illegal shrimp farms in Rio Muisne was underway as the ZEM program began in 1989. The ongoing conflicts generated by pond construction and urbanization demonstrated the need for action and also provided numerous opportunities for active intervention.

Thus, mangrove management emerged early on as an integrating issue in the Atacames-Suacutea-Muisne ZEM, and served as the testing ground for ideas in public education, conservation and enforcement, mangrove replanting, conflict resolution, and mangrove zoning. These were incorporated into the ZEM plan, as well as put into action through some formal PMRC projects and local initiatives.

The policy statements that govern mangrove ecosystem actions within the ZEMs are aimed at promoting sustainable use, but within the context of conserving all remaining mangroves, since all of these zones have suffered losses much greater than average:

Examples of policies and actions in the ZEM plan:

- All mangrove forest in the ZEM will be protected or conserved, with the objective of maintaining and improving its role in coastal ecosystems, as habitat of marine and upland organisms, and for renewable energy and tourism. [Atacames 3.1.2]

- The boundaries of shrimp ponds must be precisely fixed, with no future expansion permitted. Buffer strips should be established around the borders of shrimp ponds, including areas that can be managed for shrimp capture, and fish and shellfish cultivation. [Atacames 3.5.2]

The policy of limiting the borders of shrimp farms was adapted recently to the conflicts over new pond development outside the ZEM in northern Esmeraldas. An agreement between the community of Olmedo and the Purocongo company was prepared to protect the important mangroves of Majahual. The agreement among the shrimp farmer, community, and authorities was to maintain a 50-meter setback from the shrimp farms and the mangrove stand, a boundary that continues to be respected.

The PMRC concentrated its tests of mangrove management techniques in the Atacames ZEM, under the leadership of ZEM coordinator Rómulo Jurado and PMRC forester Alejandro Bodero. The initial focus was on the fate of the 52 ha of mangroves remaining in the Rio Atacames. The preparation of a community profile and mangrove management report provided the opportunity for community discussions and awareness building, working with local schools and mangrove users. The process involved presentations and field trips into the mangrove area. The fringe and remaining uncut mangrove forest were very close to the village center of Atacames, which has been constricted in its growth by the conversion of fields and mangrove to shrimp ponds.

The awareness building among members of the ZEM advisory committee, which represented all coastal communities and user groups, provided a vital forum for working with the village of Atacames. This was then followed by the emergence of mangrove user groups, and eventual involvement of the mariculturists responsible for the recent, rapid loss of mangroves and fishery access. This step-by-step approach has been applied to develop a constituency for mangrove management in the three other ZEMs, each of which has unique needs and conditions.

Table 1 summarizes how the local issues found in the Atacames-Suacutea-Muisne ZEM have been used to gain experience in most dimensions of managing mangroves for traditional uses and conservation. This set of activities was not mapped out in detail in advance, but emerged through the PMRC's annual work plan process and monthly ZEM committee meetings. Yet, in retrospect, the work appears to take the shape of a comprehensive approach to the mangrove issues of the ZEM.

Table 1. Analysis of mangrove management actions carried out in Atacames-Suacutea-Muisne.

Atacames ZEM Test	Strategy	Actions	Results
Education and awareness program 1989-1993	Introduce new information and materials. Make link to existing, past, potential uses.	Expert presentations, site visits, school programs, community discussions, simple education materials.	Increased sensitivity to mangrove values and consensus on need for conservation, awareness of management techniques
Sendero de la Casa Verde and boardwalk in Atacames 1990-1993	Create facility for direct education of local children and adults. Create tourism attraction that can add economic incentive for mangrove protection.	Construction of initial boardwalk in Rio Atacames; distribution of interpretive brochure; reconstruction of boardwalk (approved by national coastal commission in 1991); organization and support to guide group operating tours and walks; training of guides and materials development; solicitation of large amount of additional funds for project completion.	Successful, but first boardwalk deteriorated rapidly. Reconstruction was more expensive and slow. Access to site resulted in illegal cutting. Initial leadership lost when ZEM committee assigned responsibility to newly formed group of young guides. Full operation of tours found to be more complex, requiring business development skills. Full-scale project to be funded by Inter-American Development Bank.
Ranger Corps and community vigilance of mangrove areas 1991-1993	Unite port captain and agency field officers for more frequent, collaborative enforcement. Work with local residents for notification of violations.	Funding (in 1991) to provide an assistant to Esmeraldas Ranger Corps, with focus on Atacames and Muisne issues.	Joint patrols under leadership of Esmeraldas port captain. Organization of local residents. Participation of member agencies in ZEM planning process, with initiation of parallel projects. Identification of legal status of shrimp ponds. Participation in conflict resolution meetings.
Reforest shrimp canals in Rio Atacames 1991	Develop collaborative relationship with shrimp farmers to foster participation in ZEM process.	Planting of 10 ha of mangroves along canals and pond walls, especially near boardwalk.	Successful planting and growth. Complete loss of mangrove fringe, due to pond owners removing sediment from ponds and reinforcing pond walls, killing young trees. Relocation of planting efforts to Rio Muisne.
Involving the shrimp mariculture sector in Muisne 1992-1993	Ranger Corps action against the large number of illegal shrimp ponds (about 80 percent), nonpayment of fees. Collaboration of pond operators with community-based management efforts.	Survey of legal status of ponds. Invitation of pond operators to ZEM planning meetings. Intervention to resolve site-specific conflicts with pond operators.	Extended period of non-participation by pond operators. Actions taken by port captain against some illegal facilities. Conflicts between individuals and local groups and some pond operators. Few signed user group agreement on mangroves. Legal actions initiated on more than 70 violations. Growing number of pond operators participate in

			roundtables on the PMRC in 1993.
User group agreement on mangrove management 1992	Obtain personal local commitment by authorities and resource users on conservation of allocation of public access.	Preparation of a document stating principles of conservation, commitment to design, and protection of common use areas. Investigation of shellfish mariculture with concheras (cockle fishermen) in Bunche.	Adoption of user group agreement by authorities, user groups, PMRC. Illegal shrimp pond owners did not participate at first. Follow-up activities, local group organization, and initiatives. Action on research projects to test different techniques for supplementing incomes of collectors of mangrove cockles.
Resolving site conflicts: Comedores "El Manglar" in Rio Atacames 1991-1992	Use pending decision of municipality of Atacames to introduce better site planning and decision-making.	PMRC-funded development of alternative design for food vendors who wanted to fill Rio Atacames mangroves near foot bridge to tourist beach. PMRC and the Ranger Corps opposed local decision to approve house construction in site.	Agreement between municipality and food vendors to modify proposal for filling, although vendors demanded financial assistance for project development. Included project funding in Inter-American Development Bank project. Link to overall mangrove tourism proposal. PMRC site monitoring has prevented encroachment.
Shrimp farm canal controversy, Rio Atacames 1992-1993	To enforce existing mangrove agreements.	Intervention of Ranger Corps and PMRC ZEM office to prevent construction of new water intake canal by shrimp farmer in Rio Atacames. Proposal developed by PMRC to link need for controls of water pollution and solid waste in estuary, and to improve management of the shrimp ponds.	High-level involvement of Merchant Marine and Forestry Agency in developing resolution. Agreement by shrimp farmer to desist construction of new canal and cutting of mangroves. Analysis provided by PMRC of water quality issues faced by farmer.
Buffer zones around shrimp pond, Rio Atacames	Control of application of pesticides to agricultural land in small watershed affecting pond.		Shrimp pond owner in Rio Atacames reported to have purchased site of proposed banana plantation to avoid application of toxic chemicals near ponds and in microwatershed.
Replanting of mangroves, and forest management, Rio Muisne 1991	Rehabilitate degraded areas and demonstrate potential for local forestry management.	Planting of propagules in degraded forest area in several sites within Rio Muisne, using local participation. Development of monitoring techniques to evaluate results. Pretest of larger (200-ha) proposal included in Inter-American Development Bank project.	Good growth of replanted areas. Problems with mangrove crabs and with harvesting young plants, finding good source of propagules.

Outcomes and assessment of mangrove governance techniques

The PMRC has successfully tested local acceptability and the overall feasibility of initiating several innovative approaches to mangrove management. Funding is now in place from the Inter-American Development Bank to implement a number of actions adopted by the ZEMs and to expand the operations of the Ranger Corps. The concentration of effort over the past several years on two small sites in the Atacames ZEM revealed a great deal about implementation problems, and enabled the ZEM staff and PMRC technical experts to follow the evolution of community participation and small project implementation through complete cycles of design, execution, evaluation, and redesign.

The adaptive approach, as formulated by Jurado and Bodero (see below), suggests that there are preconditions to be met before a community is prepared to take on greater responsibility for mangrove stewardship. It seems that the PMRC or similar organization must play a continuing role in guiding, advising, and assessing the process and outcomes of each action. Other ZEMs have been anxious to begin implementing mangrove stewardship actions, but even within this supportive context, PMRC staff have wisely adopted a cautious approach to launching new initiatives.

As part of its continuing experimentation, the Ecuador PMRC should test just how necessary the ZEM planning framework is for generating local interest, support, adoption, and successful implementation of stewardship for sustainable use. If a simpler program of activities could be formulated, accompanied by sufficient technical support to follow the entire cycle of action outlined by Jurado and Bodero, the PMRC could make a more rapid, substantial contribution to reversing current mangrove destruction trends and to ushering in an era of stability for the ecosystems and the people who depend on them.

Jurado and Bodero used the ZEM plan preparation process, special mangrove projects, the practical exercises task of the ZEM committee, local decision-making events, and the daily operations of the ZEM office and ZEM committee to both initiate and provide follow-up to mangrove projects and conflict resolution. Guillermo Prado, a forester and student at the University of Esmeraldas, provided technical support and supervision to local planting efforts, site analysis, education, and monitoring tasks. Carlos Hernandez, the PMRC's Ranger Corps assistant, organized patrols and responses to individual cases. The PMRC's mariculture working group, led by Segundo Coello, carried out long-term applied investigations and technical assistance in both the mangrove shellfisheries and site-specific conflict resolution. The continuing presence of technical expertise, program support and ZEM committee oversight is a key factor in the ability of the ZEM to address the wide range of techniques involved in these mangrove management tests. The process can be summarized as follows:

Adaptive approach to mangrove management

Introduce theme to area and build constituency.

- Create awareness and provide education at the community, school, and user level on a continuous basis.
- Facilitate the forming of informal mangrove user groups with common interests, located within a specific mangrove ecosystem, in order to create forums to discuss common concerns.
- Strengthen user group organizations to serve as the basis for implementing mangrove stewardship projects.

Initiate practical actions.

- Work on specific tasks, such as small demonstration projects and action research on forest and shellfish management, providing technical assistance and funding.

Initiate planning process.

- Broaden involvement of user groups in overall ZEM planning process to create consensus on issues, goals, and objectives for mangrove management; expand the number of stakeholders in good mangrove management, including those involved in new economic uses.

Implement mangrove ecosystem management plans.

- Prepare agreements and resolutions that link user groups and authorities.
- Use case examples to implement, and therefore, reinforce the importance of the agreements.
- Elevate the importance of implementing ZEM plan policies to local and regional authorities.
- Pursue opportunities to gain private sector collaboration, especially from shrimp farmers.
- Maintain oversight of mangrove management efforts in the ZEM committee.

One effect of the progressive, adaptive approach to mangrove management in Atacames and Muisne has been the increasing local insistence on implementation of projects, and continual requests for PMRC ZEM office involvement in resource management conflicts. This shifts the arena of action from generating demand-a critical early phase of any development initiative-to providing the services and continuous follow up needed to keep the local management process going.

Enforcement of mangrove laws

The basic mangrove management policy and law in Ecuador continues to require the protection of all mangroves. Although the experience of the PMRC has led to the conclusion that controlled use and selective cutting should be permitted, a formal system for allowing this is not yet in place. In most estuaries of the coast-including mangrove reserves and the four ZEMs that have adopted policies calling for protection of all remaining mangrove stands-enforcement of this law remains necessary. Any agreements to permit controlled cutting or other alterations also require supervision and enforcement. A coercive approach to mangrove law enforcement is required by existing laws, yet Ecuador does not have the funding, political will, or administrative or staff capacity to inform all potential violators of the rules, to conduct regular patrols, or to follow up on violations with adequate punishment to deter other violators.

When a majority of community members supports an environmental law, these community members may also collaborate with authorities by assuring that violations are noticed and receive some form of sanction-by notifying authorities of a suspected violation, and by following up on the actions taken to resolve individual cases. This concept has been extended in Ecuador through the creation of the Ranger Corps, who attempt to make better use of existing and scarce enforcement resources through an assistant who works with the local port captain, and by using community monitors-community members who live and work near a particular mangrove ecosystem and can quickly detect violations.

In Bahía de Caráquez, the Ranger Corps has played a major role in mangrove protection. Their efforts have led to the offering of mangrove and estuary island tours by private guides in the Rio Chone estuary, and to a small planting effort by students. Some shrimp farmers have replanted canals and maintain a buffer around their ponds. Conflict resolution over shrimp ponds and mangroves still exist. Work was initiated in 1993 with small communities interested in managing and restoring shellfish resources in mangrove areas.

Some 40 legal actions against mangrove law violators have been initiated, especially through the Puerto Bolívar captaincy, which covers El Oro province. A key difficulty is the lack of sufficient resources to follow these actions through the legal system. The Ranger Corps has also participated in the drafting of user group agreements, which are an additional step toward instituting voluntary compliance, as well as toward defining more clearly which portions of a mangrove forest or fringe should be utilized for a particular purpose-such as reforestation, fishing, selective cutting, and conservation.

In Machala-Puerto Bolívar, initial enforcement efforts led by the Ranger Corps must confront a mangrove shrimp pond ecosystem many times larger than in Atacames or Rio Chone. The national forestry agency has recently issued concessions to a community to manage a 300-ha area of mangroves for conservation and traditional uses, with the PMRC providing some technical assistance in designing a management plan.

Long-term implementation prospects

Full-scale implementation of the mangrove management policies and actions in the Atacames and Muisne areas is planned under the Inter-American Development Bank project, with projects in the other three ZEMs to follow later, based on the initial experience gained in these two sites. The following projects will be funded:

- Mangrove boardwalk, Atacames;
- Protection and reforestation of Muisne estuary mangroves;
- Mangrove tour facilities, Rio Chone;
- Protection and reforestation of Rio Chone estuary mangroves;
- Mangrove tour facilities, Puerto El Morro;
- Protection and reforestation of El Morro estuary mangroves;
- Mangrove tour facilities, Jambelí; and
- Protection and reforestation of Isla Jambelí mangroves

Strategy 4. Test site-specific mangrove management methods.

Community groups can be educated and persuaded to take on a stewardship role. Special area management programs can provide all the social and managerial support necessary to keep mangrove users productively engaged in experiments and implementation. But will the actions proposed by scientists, mangrove users, and technical experts lead to sustainable use? Are they practical?

The PMRC carried out several small projects to explore this question. In the process, the definition of what each action entails has become much clearer, along with the requirements for successful execution and criteria for evaluating success. Perhaps the most important discovery is that actions that on the surface seem primarily local in nature often have a hidden requirement for national approval or specialized technical assistance. This section examines tests of ecotourism, harvest management, forestation, and multiple-use zoning.

Ecotourism in mangroves

Mangrove ecosystems in Ecuador contain an abundance of flora and fauna and provide a natural, permanent greenway along many coastal areas. Guided tours, scientific research, and carefully built public facilities such as boardwalks and interpretive paths can provide a unique opportunity to expand tourist offerings along the mainland coast, both to residents and to international visitors. This in turn creates an economic incentive for mangrove protection. The role of the public sector versus private enterprise in leading facility and service development remains a key question.

The Churute Mangrove Reserve in Guayas province is the only example in Ecuador of a government-operated reserve. To succeed, it requires continuous control over public access, strict limits on physical changes to the reserve, active research and monitoring programs, environmental interpretation, fisheries management, and mitigation of the environmental impacts of development of adjacent areas. The success of the Churute Reserve is due to the long-term commitment of INEFAN and other agencies, as well as NGOs such as Fundaci&oacuten Natura to provide adequate financial and personnel resources. The PMRC also made a contribution in helping support studies of the reserve.

Initial experiments in mangrove tourism and related facilities in Atacames, Bahía de Caráquez, and Puerto Bolívar show the need to involve private sector and local groups in providing services and resource protection, as part of a coordinated, but not necessarily publicly managed effort. The "Sendero de la Casa Verde" for the Rio Atacames encountered many operational problems as it grew in concept from a simple boardwalk to an addition to the tourism offerings of the popular Atacames beach (see Table 1). It required numerous support services, including reconstruction of the walk; river cleanup; organization and training of guides; interpretation; pricing and marketing of tours; protection of sites designated for a pier for tour boats; proper design of a facility for food, crafts, and folklore exhibitions; and management of activities.

A similar idea was developed in the Puerto Bolívar-Machala-Isla Jambelí ZEM as a practical exercise. Tourism is already well-established in Isla Jambelí. Visitors must take a small boat to reach the island, passing through a fringe of mangroves, as well as through evidence of shrimp pond operations and mangrove destruction. A boardwalk was built on the Isla de Amor, and visitors were brought to the site from Puerto Bolívar.

In the Rio Chone, local boat operators began to take visitors to mangrove islands such as Isla de Fragatas. Too many tours by untrained guides threatened to disrupt the bird nesting areas, so the ZEM office organized training, and the port captain now requires a permit for tour boats to enter the site.

Research and mangrove harvesting

One of the traditional uses of Ecuador's mangroves has been as a source of wood for pilings, poles, charcoal, and lumber. In the initial formulation of the PMRC's work in mangrove management, tests of harvest management and sustainable forestry practices were to be carried out in most of the coastal provinces. Funding limitations led to focusing this effort on a site in Esmeraldas province, in which 10 plots, 30 by 120 m, were clear-cut of Rhizophera to observe natural regeneration as a sustainable forestry practice. The work was carried out in conjunction with the University of Esmeraldas and involved Guillermo Prado, who has provided extensive assistance to PMRC projects in Atacames and Muisne. Blanchard (1983) reports on the results of this experiment, noting that the sites were very different in terms of elevation, tidal inflow, and in the number of large, propagule-bearing trees at the edge of clearcut sites. He also found large differences among the 10 plots in terms of density and size of seedlings, which were most abundant at the edges of the plots. The factor most important to plot regeneration was the presence of larger diameter trees on the edge of the cut plots. He recommended that clearest not extend to the water, and that they be reduced to 20 m, to increase the likelihood of regeneration.

In poor sites, it will also be necessary to leave high-quality seed-producing trees in the middle of the plot. In reviewing the results of the experimental cutting and regeneration study in Esmeraldas (Isla Tatabrera), Putz (1992) concludes that the 30-m-wide clear strips are too wide if natural regeneration is the only management technique employed. He recommends narrower cuts, leaving seed trees within clear-cuts, and continuous experiments with different cutting techniques in different mangrove environments. He strongly advocates identifying an applied researcher/advisor who can provide hands-on guidance to the ongoing work, follow up on the hypotheses that the Tatabrera experience suggests, and prepare publishable articles that will make a contribution to the world literature.

Putz (1992) observes that the clearcut method might be a reasonable approach if modified to address site-specific conditions and increase the chances of natural regeneration, since signs of advanced regeneration in the forest are not much in evidence before logging, and completely gone afterward. He proposes a set of hypotheses that should be tested as part of introducing mangrove forestry practices to Esmeraldas:

- Recruitment density in clearcut strips decreases with increasing distance from the edges of the retained forest; is concentrated around retained trees within clearest; varies with plot elevation; varies with elevation within sample plots; and decreases with increasing cover by Acrostichum ferns.
- Seedlings are concentrated where propagule movement is impeded by logging debris or other factors interfering with their movement by water.
- Propagule production by trees bordering clearest differs from production by trees in closed forests, and increases with tree size.
- Tree mortality rates are higher on clearcut edges than in the forest interior.

Putz observes that understanding the factors leading to the most successful natural regeneration is important for an effective forestry management approach based on controlled commercial harvest. However, social conditions might permit active management methods such as replanting by local groups or concession holders who have a long-term interest in the mangrove stand. "People are more likely to protect a stand that they planted than one that regenerated naturally," he points out. Putz notes that the PMRC needs to make its support of this approach more explicit.

Forestation

The PMRC has only begun to develop an understanding of how mangrove restoration and reforestation should involve private or community groups. An experiment with reforestation of the shrimp farm canals in Atacames was unsuccessful due to a lack of cooperation by shrimp pond owners. Ten hectares were planted with help from the PMRC, with good growth. However, shrimp farm owners excavated portions of ponds and dumped the dredged material on the young mangrove trees, which could not survive the physical destruction. There has been some cooperation in Rio Chone on mangrove forestation along some ponds, but

this has not become a widespread practice. An opportunity for working with shrimp pond owners may occur during the renewal of shrimp pond concessions over the next five years.

After the problems in Atacames, a successful test of planting in degraded areas was carried out in Muisne. Ten hectares have been growing well for two years. As a result, additional funding for mangrove planting will be provided by the Inter-American Development Bank.

Mangrove use zoning and the need for national policy reform

The establishment of clearly demarcated geographic zones with specific permissible and non-permitted uses, and performance standards for any allowable use is a fundamental tool of land use management. This tool has increasingly been applied to coastal resources as well. Predetermination of allowable uses is often difficult and time-consuming at the outset-the scientific and planning work to determine acceptable uses and to build a sufficient political consensus for adoption can be controversial. However, in the longer term, zoning usually makes administration and enforcement of permit decisions easier, assuming there is a technically competent, fair, and properly administered decision-making procedure.

A complete zoning proposal should include

- A specific list of allowable and non-allowable uses;
- Precise designations of the water, shore, and land areas covered by the zone;
- A regulatory procedure for issuing and enforcing permits;
- Sanctions for violating the terms of the permit, as well as of the zone; and
- Policies and procedures for giving variances to the zone or to nonconforming uses.

In practice, the term "zoning" is often used to signify many different kinds of mangrove management policies that are more complicated than a simple ban on all cutting. Zoning schemes can be adopted by a municipality, or regulatory or planning agency, that has the authority to make and enforce decisions. A planning document or informal mechanism such as a user group agreement may include strong indications of how specific areas should be used, but cannot be considered zoning, since it lacks direct enforceability.

The ZEMs have just begun to provide very early experiences on how zoning strategies could be used through user group agreements, municipal ordinances, and concessions granted to communities or individuals by the forestry agency, INEFAN, the Navy DIGMER, and the Subsecretary of Fisheries. Virtually all coastal municipalities lack an overall land management plan, and make decisions on mangrove filling or destruction case by case, with little or no technical input. The municipality of Atacames has only recently modified its approach to controlling the use of mangrove areas, as a result of strong PMRC involvement. In Rio Muisne, areas have been assigned uses by the user group agreement, and the need for clear markings of specific boundaries is fully recognized. However, the presence of a large number of illegally constructed shrimp ponds in the Rio Muisne makes it very difficult to set specific, enforceable boundaries for use zones, and questions of enforceability must still be answered. Despite these difficulties, it may be easier to develop site-specific use plans and zones in areas where controversies exist than it is to prepare a larger-scale zoning ordinance for a 10,000- or 20,000-ha mangrove ecosystem.

The PMRC's activities have led to a uniquely Ecuadorian innovation. Through the user group agreement, mangrove user groups have found it possible to create locally based written agreements for ZEM plan or site implementation, or for specific remedies. The agreements are signed by shrimp farmers and different mangrove users, as well as by public officials. Although these do not have a legally enforceable status, they serve to reinforce one of the most important characteristics of a realistic policy-a social consensus to support management initiatives. As of 1994, agreements have been reached in Atacames-Suacutea-Muisne (See Annex V), Estero de el Morro, and Bahía de Caráquez. Common elements of the agreements include a preamble stating the conditions and issues of the ecosystem; an acknowledgment of the ZEM plan findings and policies; mention of desired uses and conditions of specific areas; a list of actions that specific groups agree to undertake, such as assigning an agreed-upon use, or participation in enforcement patrols; and the signatures of a diverse group of organizational leaders and individuals directly involved in activities in the sites. The process for arriving at these agreements typically begins with an awareness campaign and with the involvement of the ZEM committee in a specific use conflict or controversy. Local staff and technical

advisors work with individual groups and then set up meetings of all key people from the area to work out points of understanding and specific actions. When details of management actions are determined, the ZEM committee should review them and consider including them in the ZEM plan.

Outcomes and assessment of site-specific mangrove management tests

The repertoire of practical measures to conserve and allocate uses of mangroves is expanding as a result of experimentation by the PMRC, INEFAN, and NGOs. These tests reveal the real-life complications that ensue from seemingly simple ideas, such as planting a few hectares of mangroves, attempting to put some order into how mangroves are harvested for timber, or creating a mangrove use allocation scheme that can satisfy user needs and resolve conflicts as they occur. In each case, it is vital to provide timely technical assistance and adequate resources to carry a project through. The natural mangrove forest regeneration study, for example, provides good insights into the skill needed to carry out even a simple scheme. Ecuador must build its expertise in assessing appropriate regeneration practices based on continued experimentation to test the hypotheses proposed by Putz, rather than adopt a single forest management rule and attempt to enforce it. Even trying to manage forest areas without requiring complicated reforestation or selective harvesting techniques is going to require competent administration.

PMRC experience shows that even the simplest schemes for controlling mangrove wood production involve identifying specific plots to be clear-cut, preparing and issuing a license based on studies of local conditions and recommended harvesting practices, and follow-up enforcement. More complexity can be introduced by issuing long-term management concessions that require rotated cutting within the concession, or by using stewardship agreements that call for selective cutting or reforestation within the mangrove stand.

It is perhaps not likely that selective forest stewardship, such as that practiced in the Philippines, could work in the short term in Ecuador, due to the degree of extension services required and the predominance of multiple-use issues that require community, rather than individual decision-making. Stewardship concessions that specify the sequence of cutting and siting of cuts, and that enforce protection of seed trees are now thought to be the most promising approach, but still need testing. Provincial forestry management offices in the coast would have to be given adequate staffing and operating budgets to successfully administer such programs-something they certainly do not have at present.

Social forestry approaches are likely to be accepted in some parts of the coast, but are not likely to succeed without action-oriented research that builds a group able to provide appropriate technical advice and extension support. Otherwise, early failures will probably discourage long-term implementation.

The Inter-American Development Bank coastal project will provide additional opportunities to improve services and gain experience in the four ZEMs with mangrove ecosystems. Many of the problems facing ecological tourism development relate to the formation or strengthening of small businesses. The PMRC and INEFAN may not be likely to succeed in actions that use local economic incentives, such as ecological tourism, that promise to be low-cost over the long run, but require skilled guidance on enterprise development-something the PMRC is not well-equipped to provide. In addition, the PMRC philosophy of self-development and community participation tends to encourage new and inexperienced groups to take on the complex task of providing high-quality recreation services. They will not be able to learn to do this quickly and, in some cases, will probably not be able to learn these skills at all.

Restoration of degraded areas and forestation of emerging islands in estuaries seems to function well technically, but there was considerable debate during the design of the Inter-American Development Bank project as to their cost-effectiveness compared to natural regeneration, ecotourism, and enforcement measures. Yet for areas suffering more than 20 percent mangrove ecosystem loss-including all four ZEMs-the symbolic value of both restoration actions and mitigation by shrimp farmers or others found to be destroying a mangrove area may more than justify initial costs. Studies to demonstrate the economic and ecological value of mangrove ecosystems could be especially useful in resolving this debate and in setting numerical targets for Ecuador's estuaries.

Finally, Ecuador's inexperience with land and coastal area zoning casts doubt on the ease with which the

PMRC can advance its own proposals. However, a breakthrough in mangrove area zoning, user agreements, or stewardship concessions could answer the critical question raised in the assessment of Strategy 3 by providing a feasible, lower-cost alternative to full-scale special area planning, creating long-term local efforts to achieve sustainable uses.

Strategy 5. Prepare a national mangrove policy proposal.

The mangrove working group and national policy proposals

Beginning in Project Year 7 (1991), the mangrove working group turned its attention to discussing the national policy implications of the ongoing ZEM planning and site-specific management actions. The National Commission on Coastal Resources Management encouraged the PMRC to advance this work. A workshop was held in Machala in 1992 that included INEFAN, and national environmental groups began to focus attention on the need for a basic new policy statement-one that not only permitted mangrove use, but relied on local stewardship as a fundamental policy for achieving sustainable use of the ecosystems.

The draft proposal for the first time identified policies that addressed both the objectives and the methods by which Ecuador should tackle the worsening problem of mangrove destruction:

- Develop multiple uses of mangroves that will not significantly alter the mangrove ecosystem resource base;
- Guarantee the development of mangrove vegetation to the level where optimal inputs and flow of energy is attained;
- Improve the efficiency in use of mangrove production at the community level;
- Involve communities in mangrove stewardship for sustainable use;
- Expand the area of mangrove ecosystem through forestation of emerging islands, sediment zones, and shrimp farm canals; and
- Develop plans for basic and applied scientific investigation, taking into account the role of mangroves in the productivity of other coastal ecosystems.

The formation of all seven Ranger Corps will create a specific opportunity for developing strategic approaches to the enforcement of mangrove management laws, and will raise a whole host of governance issues. In the five estuaries covered by ZEM plans, this will be relatively easy, since the Ranger Corps units have worked in these sites for two to three years, are familiar with ZEM plan issues and priorities, and have already made important contributions by increasing patrols and enlisting local volunteer monitors.

Most of the largest mangrove systems are outside the ZEMs. Table 3 builds on the 1993 Guayaquil workshop, and provides the outline for the different enforcement and stewardship strategies needed for these systems. A heavily damaged and conflict-ridden estuary such as Cojimíes-Bolívar-Chamanga may first require efforts to build awareness and support, perhaps linked to some restoration projects, rather than organizing local volunteer monitors. In San Lorenzo, where relatively little damage has occurred so far, the emphasis might be on interventions to prevent the initiation of indiscriminate cutting, rather than on extensive patrols. Estero Salado, near the city of Guayaquil, is under great pressure from urban development, and is fortunate to have a number of key institutions-such as INEFAN, CLIRSEN, and activist groups-who are interested in the preservation and conservation of mangroves, and might be encouraged to adopt and monitor the use of particular areas. In Taura, where mangroves are in relatively good condition, and play an important buffer and flood control role, government institutions with interest in the ecosystem and management of the surrounding watershed-such as CEDEGE and DIGMER-might be more appropriate than small user groups to form an agreement on monitoring and enforcement.

Table 2. Possible strategies and tools to address mangrove management in Ecuador's principal estuaries.

Estuary	Possible strategy	Key tools
San Lorenzo (rios Santiago, Cayapas, Mataje) 22,859 ha Largely undisturbed Total loss: 3.5 percent	Establish sustainable use patterns; avoid the initiation of indiscriminate cutting, work in biological reserves.	Work with newly formed user groups, and regional and local authorities; conduct public education; develop a technical assistance team; conduct user group training in management methods; carry out local projects; hold working group meetings; build mechanisms for interinstitutional work; conduct investigation and monitoring.
Rio Atacames 52 ha Heavily damaged Total loss: 9.5 percent	Protect remaining mangroves; conduct restoration and reforestation through ZEM committee.	Implement ZEM plan, including user group agreements, mangrove tourism
Rio Muisne 1,375 ha Heavily damaged Total loss: 59 percent	Protect remaining mangroves; conduct restoration and reforestation through ZEM committee.	Implement ZEM plan, including reforestation, multiple-use management, user group agreements.
Near Rio Chone (Z) (R) 783 ha Complete destruction Total loss: 51.3 percent	Protect remaining mangroves; conduct restoration and reforestation through ZEM committee.	Implement ZEM plan, including conservation, restoration, and forestation.
Cojimies-Bolívar-Chamanga 3,448 ha Heavily damaged Total loss: 80.3 percent	Introduce the concept of mangrove protection and ecosystem restoration.	Conduct public education program to build awareness and support; carry out pilot projects on reforestation and shellfish habitat management.
Posorja (Z) 3,313 ha Moderately damaged Total loss: 10.9 percent	Protect remaining mangroves; conduct restoration and reforestation through ZEM committee.	Implement ZEM plan.
Estero Salado 40,846 ha	Reduce rate of destruction; develop beneficial uses for the urban population.	Create protected areas managed by local groups such as DIGMER, Vendidores de Gas, Fundaci&oacuten Natura; conduct education campaigns.

Moderately damaged Total loss: 12 percent		
Taura 19,583 ha Moderately damaged Total loss: 12 percent	Protect mangroves for flood control and collecting sediments, buffer zone, and wildlife habitat.	Identify institutions to take lead in protection-such as CEDEGE, DIGMER, and INEFAN-through Ranger Corps mechanism; develop cooperation with shrimp farmers.
Churute Reserve 12,209 ha Total loss: 4.3 percent	Continue successful protection and management program.	Manage as natural reserve with studies, patrols, and interpretation.
Naranjal 11,833 ha Heavily damaged Total loss: 25.1 percent	Protect remaining mangroves and promote management for sustainable use of crab fishery.	Conduct public education aimed at users, shrimp farmers, and communities; organize user groups; develop user group agreements; manage and improve crab fishery; develop tourism; conduct monitoring.
Jambelí 5,625 ha Total loss: 52.8 percent	Protect remaining mangroves, restoration and reforestation through ZEM committee.	Implement ZEM plan.
Hualtaco 13,630 ha Heavily damaged Total loss: 25.5 percent	Protect remaining mangroves, introduce restoration proposals.	Conduct public education campaign; work with shrimp farmers; develop user group agreements and community management agreements; create plan for wood harvest; improve mangrove fisheries.

The national mangrove management symposium and draft national policy statement

In July 1993, 100 representatives of government agencies and NGOs participated in a national mangrove management symposium. The workshop featured an update of the status of mangrove resources, agency views on policy directions, and an extensive presentation of the PMRC experience in testing sustainable use policies and techniques, as well as a field trip to the Churute Reserve. Working group sessions focused on four aspects of mangrove management: legal and administrative problems, public education, tourism, and community participation. The symposium filled an important gap in previous meetings by examining the feasibility of implementing new policies. A new burst of print and broadcast media coverage of the mangrove issue followed the symposium, which coincided with the PMRC receiving the "Blue Planet Award" for its work in mangrove conservation in Muisne.

Symposium participants agreed that a mangrove ecosystem conservation policy based on exclusively coercive enforcement is simply not implementable. The largest untapped source of energy and resources for mangrove management remains the self-interest of mangrove users, and an enlightened citizenry that appreciates and acts

to maintain the values and functioning of a critical coastal ecosystem. The initial tests of new mangrove policies by the PMRC demonstrate that it is indeed possible to tap into this source of local power with relatively inexpensive techniques and projects.

Although the best solutions to the national mangrove management crisis may lie predominantly in mobilizing the efforts of communities and resource users, the path toward fulfilling this vision of coastal management will require decisive national leadership. The PMRC developed a draft text proposing a new mangrove management policy to the National Commission on Coastal Resources Management. The policy consisted of five key items essential to the improvement of mangrove management.

- Mangroves will be managed for sustainable use, guaranteeing conservation of the resource base;
- Participatory management techniques will be employed;
- Specific mangrove use plans for estuaries and ecosystems, based on local characteristics will be developed;
- The Ranger Corps and enforcement of mangrove conservation laws will be strengthened; and
- The process for mangrove ecosystem administration will be transparent and accessible to the public and resource users.

In contrast to the first set of policies developed by the mangrove working group, primary emphasis was on the mechanisms by which the overall sustainable use philosophy should be carried out. The full text of the mangrove policy proposal is provided in Annex A. The National Commission on Coastal Resources Management will consider adopting the policy statement, which then should be the subject of an interministerial agreement and published in the Official Register. In addition, the National Commission should develop criteria and serve as a forum for reviewing mangrove ecosystem management proposals for estuaries to ensure that these proposals are consistent with ZEM plans. During 1995, the PMRC worked with INEFAN to prepare new regulations for controlling the impacts of shore development on mangrove ecosystems.

A national mangrove ecosystem management strategy for Ecuador needs to be implementable, which suggests that it needs to have several important characteristics:

- A practical approach must address the entire problem, which in fact encompasses all of the estuaries, in order to avoid the collapse of additional places. The measures undertaken must be tied to the actual problems being faced; among the most important of these is the legacy of poor implementation at the local level. A practicable national strategy must permit flexibility in the selection of policies and actions to accommodate local circumstances.
- To produce an acceptable national policy, key actors at the national and local levels must be consulted, not only during policy formulation, but on a continuing basis.
- A feasible strategy must find low-cost methods of planning, decision-making and implementation, and address the question of what will happen after the initial intervention has been terminated. This is where investments in education, staff training, and awareness- and constituency-building can have large returns, decentralizing decision-making.
- Finally, a national strategy must be monitored, and the results must be measurable. The ultimate test is whether mangrove ecosystems are improving, maintaining themselves, or continuing to degrade. If the national strategy cannot be held accountable for the status of the resource, it lacks a practicable design.

Estuary-wide or local strategies will have difficulty meeting the criteria of implementability without a supportive national context. An estuary strategy would not be practicable if national agencies failed to apply their legal authority and expertise to new agreements. This in turn requires that the strategy achieve acceptability, not only among resource users, but among the entities with administrative responsibility over the resource. Lack of national support for an initiative in an estuary might also diminish feasibility if key sources of financial assistance have to be sought through government initiatives.

Outcomes and assessment of the national mangrove policy proposal

The process for formulating a national mangrove policy has succeeded in placing the spotlight on mangrove ecosystem problems and on the need to confront implementation issues. Of particular importance is the acceptance of the PMRC role in developing alternatives to existing methods and in serving as a catalyst for policy reform. The PMRC will continue to lead this effort, attract funding and supervise new planning and implementation efforts. The Inter-American Development Bank funding will continue the focus on demonstrating the feasibility of specific mangrove solutions within the ZEMs.

The creation of an effective system for mangrove management has involved the implementation of management actions that bring together scientists and national and international experts in ecology, forestry, public education, and planning. The new national policy proposal attempts to move beyond the ineffective "no use" policy, and shifts attention to site-specific plans for sustainable use and conservation. This approach has worked well in the ZEMs, raising new expectations for PMRC involvement in many other locations in the coast.

Modifying the national approach to mangroves needs to take place gradually, so that the integrated planning is done well, and implementation efforts are sustained, including making improvements to the legal, organizational, and coordination framework.

The practical exercises in the PMRC have shown the country how to integrate user groups and institutions. Advances made in Ecuador are now being examined and tried in other Latin American countries interested in trying to develop mariculture in a sustainable way.

The mangrove management plans in Ecuador must also emphasize the exchange of information and constant communication among managers, scientists, and user groups, in order to verify that management techniques work and to motivate practical efforts to reach national goals.

The PRMC, as a leader in the management process, must strengthen the mangrove working group and continue to sponsor national and regional workshops, seminars, and training events to keep examining Ecuador’s experiences in the light of international practices and knowledge.

Finally, it is essential to carry out a public education program that reaches all coastal residents. The contributions of NGOs should be recognized and encouraged, along with special recognition of the potential role of the private sector, since many investments that affect mangrove ecosystems are initiated by people living outside the regions where the projects occur.

Managing Shrimp Mariculture Development

Stephen B. Olsen
Segundo Coello

Since the late 1970s, shrimp mariculture has been one of the most powerful agents of social and ecosystem change along Ecuador's coast. Despite repeated efforts, Ecuador's Coastal Resources Management Program (PMRC) has found it difficult to establish a productive relationship with this industry. This has been frustrating, since an integrated resource management program has much to offer the industry that. If shrimp mariculture is to be sustainable, issues of competing coastal activities must be resolved, ecosystem qualities essential to the profitability of the industry need to be maintained. This paper describes three distinct periods in the program's attempt to understand the environmental and social issues affecting shrimp mariculture and to propose constructive management strategies. These three periods are:

- Formulation of a national strategy to promote a sustainable shrimp industry in Ecuador (1986-1987);
- Formulation of a national strategy to diversify mariculture operations (1988-1990); and
- A research and extension program directed at mariculture management issues in the special area management zones (1991-1994).

The PMRC's experience demonstrates the difficulties in promoting a long-term perspective within Ecuador's shrimp mariculture industry and in creating interest in more structured and participatory governance. The reluctance of mariculture industry leaders to engage in a dialogue with the PMRC contrasts sharply with the demand for improved governance and integrated approaches to problem solving among the poorer segments of Ecuador's society.

Shrimp Mariculture: The Costs and Benefits

Growth of the shrimp industry

The great monetary profits that can be made in shrimp mariculture prompted anarchic, gold-rush-like expansion of the industry in the 1960s, '70s and '80s. This occurred without any meaningful planning, controls, or consideration of long-term impacts. It was common in the early years of development for shrimp farmers to recover the entire investment in a new farm within a single year. Worldwide, it is still not unusual for shrimp farms to operate at annual profit margins that are 50 to 100 percent above operating costs (Weidner, 1992).

Shrimp farms expanded rapidly in the 1980s (Table 1), with construction frequently outstripping the regulatory system. By the mid-1980s, shrimp farmers were building in upland sites, rather than in the beach and bay zone.

Table 1. Estimated area, in hectares (ha), of shrimp ponds.

Year	Shrimp ponds detected by remote sensing (ha)	Authorized shrimp ponds (ha)	Illegal ponds (ha)
1984	89,368	81,075	8,293 (9 percent)
1987	117,729	114,385	3,344 (3 percent)
1991	145,998	131,961	14,037 (10 percent)

Sources: CLIRSEN (1992), Cámara de Productores de Camarón (1993).

The majority of shrimp farms are in the Guayas and El Oro provinces, bordering the Gulf of Guayaquil.

Figure 2. Distribution of shrimp farms by province, 1992.

Guayas=69%
Esmeraldas=4%
Manabi=9%
El Oro=18%

Nearly half of existing farms are of the extensive type: low-density ponds in which minimal or no supplemental feeding is provided (Figure 3). Relatively few are operating using the advanced technology required for the higher-yielding intensive and semi-intensive farms (Table 2). National production has grown, mostly due to expansion of cultivated area (Figure 4, Figure 5).

Figure 3. Types of shrimp farms in Ecuador, 1992.

Extensive=48%
Intensive=4%
Semi-intensive=10%
Semi-extensive=38%

Table 2. Yield per type of culture in 1987 and 1992.

Type of culture	**Yields** (kilograms of shrimp tails/ha/year)	
	1987	**1992**
Intensive		1,291
Semi-intensive	272	882
Semi-extensive	544	615
Extensive		405

Source: Cámara de Productores de Camarón (1989 and 1993).

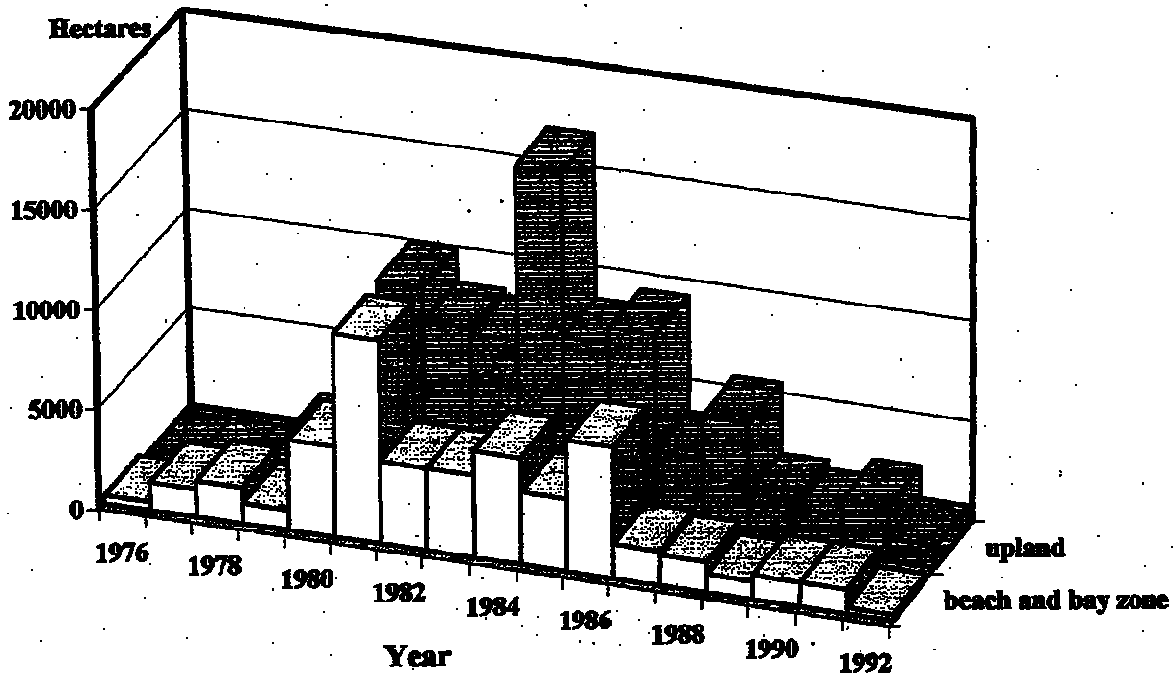

Figure 1. Number of hectares authorized for shrimp farms, by location.

The majority of shrimp farms are in the Guayas and El Oro provinces, bordering the Gulf of Guayaquil.

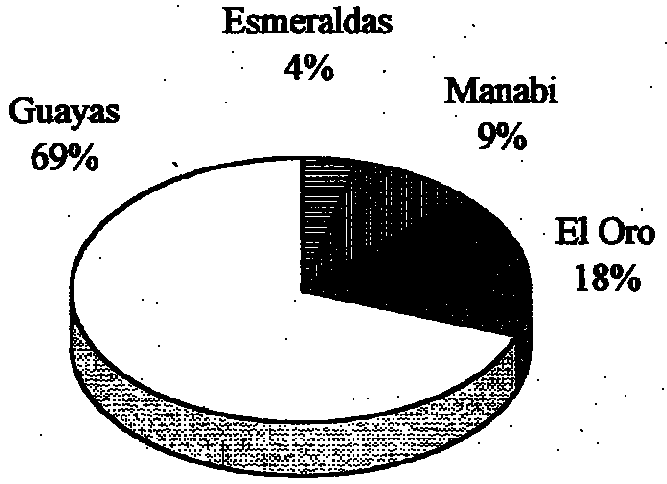

Figure 2. Distribution of shrimp farms by province, 1992.

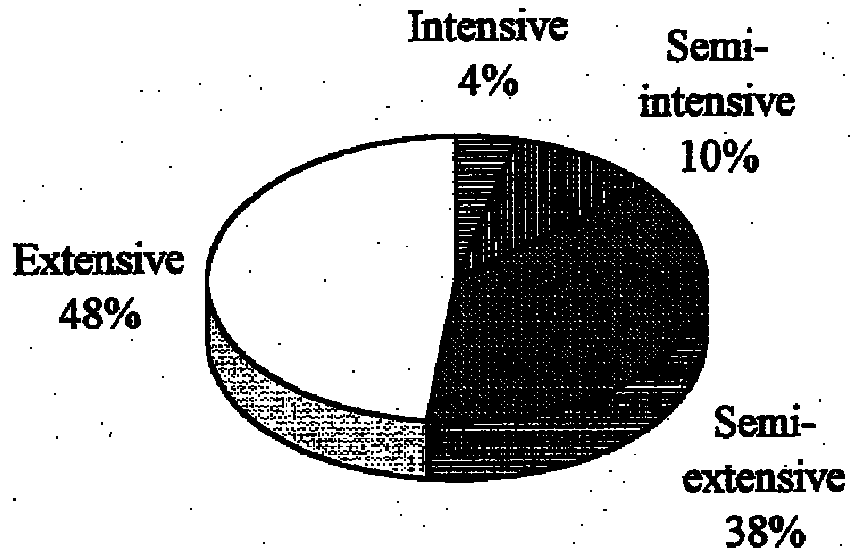

Figure 3. Types of shrimp farms in Ecuador, 1992.

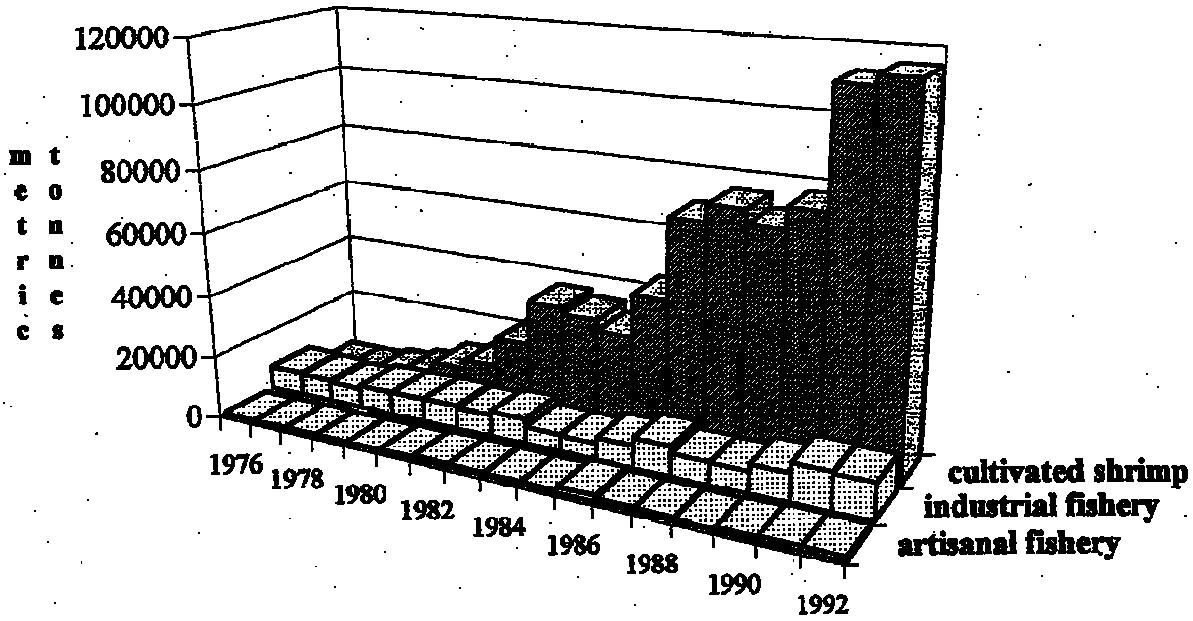

Figure 4. National production of shrimp, by production sector, 1976–1992.

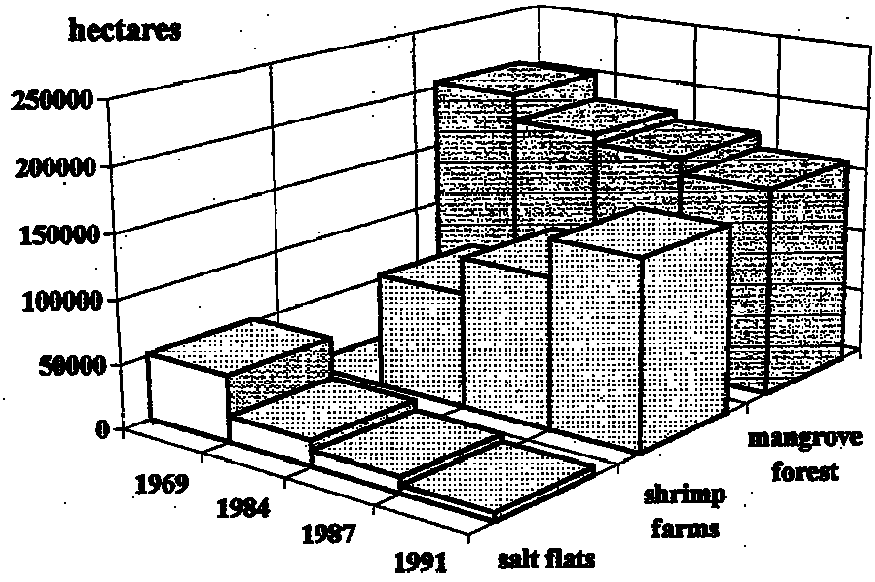

Figure 5. Changes in area of salt flats, shrimp farms, and mangrove forest, 1969–1991.

According to the Shrimp Farmers Association (Cámara de Productores de Camarón, 1993), in 1992, some 1,567 firms were involved in the shrimp farming processing and hatcheries, employing 195,000 people. In 1993, approximately 100 shrimp hatcheries were in operation. Overall, however, the employment produced on the farms is relatively low and ranges between 1 and 0.25 people per hectare of shrimp farm (Suárez et al., 1995).

Shrimp exports produce some $500 million per year (Table 3). However, the economic benefits of shrimp farming have flowed primarily to the farm owners. This concentration of wealth has been aided by two factors. First, and most important, the cost of large-scale culture methods that have characterized the industry in Ecuador has put shrimp farming out of reach to all but the wealthy. Second, the industry falls under the Fisheries Law, which requires that all commercial operations should be vertically integrated to include farms, packing houses, and shipping operations (Robadue and Pérez, 1989). This has encouraged the channeling of economic benefits to the wealthier segments of Ecuadorian society and to a number of foreign investors.

Table 3. Exports of Ecuadorian shrimp.

Year	Metric tons	Value, US$
1984	21,700	159,840,000
1987	48,912	383,136,000
1990	70,652	340,291,000
1991	103,222	491,371,000
1992	116,315	525,759,000

Source: Camara de Productores de Camarón.

Social costs and benefits

Shrimp farming has also had major impacts on the poorer segments of society. On the negative side, many thousands of families with largely subsistence livelihoods have been displaced, sometimes forcibly, from the mangroves and estuarine fishing grounds where they had traditionally made their livings (Bravo and Abarca, 1995). Mangrove wetlands, creeks, and flats have either been converted to ponds and intake channels or privatized as buffers to shrimp ponds to which many pond operators do not permit free access. In Bahía de Caráquez alone, communities of mangrove and bay fisherfolk had to migrate to other parts of the coast when shrimp farms destroyed 80 percent of that estuary's mangroves and its once-rich fisheries collapsed. On the positive side, the artisanal fishery for shrimp postlarvae (PL) has been a boon not only to fisherfolk, but to large numbers of agricultural workers and other low-income groups, some of which have migrated from the Sierra and formed new shorefront communities that are entirely dependent on this new fishery. In two or three days of moon tides, a family of larveros-PL fishers-can make as much from this fishery as they can in a month as agricultural workers.

In 1980, the U.S. National Marine Fisheries Service estimated 2,000 to 3,000 larveros at work. Sutinen et al. (1989), quoted estimates as high as 90,000 larveros by 1985. The shrimp farmers association (Cámara de Productores de Camarón, 1989) estimated 32,000 in 1989, and more recently, the Ecuador National Fisheries Institute examined effort and reported 17,000 people engaged in the fishery during peak periods. Most fishers are part-time and engage in other activities, such as agriculture or other fisheries (Coello, 1993).

An additional number of middlemen live by buying PL on the beach and selling to pond operators. The development of this fishery, however, has also led to important social and environmental issues (Coello et al., 1995). Thus, the shrimp farm boom has produced both winners and losers among the poorer segments of society and has certainly brought radical change to the way of life and the structure of communities all along the coast.

Impact on the national budget

Economic returns to the national budget are difficult to estimate. Firms should pay a percent of their net earnings as a tax, but tax evasion is widespread. Ecuador does not have a graduated income tax. A significant proportion of the ponds are sited below the high water mark, and therefore operate as concessions on public lands. The annual fee for such concessions is less than $10/ha, compared to potential net returns of up to $2,000/ha (Southgate and Whitaker, 1994). In the mid-1980s, the government required growers to export shrimp at a dollar exchange rate some 30 percent below the free market rate. The shrimp industry viewed this as a 30 percent export tax, prompting smuggling on a massive scale. Thus, unlike petroleum, which is a state-owned resource, a relatively small proportion of shrimp export earnings flow to the government to support its programs and meet the annual interest payments on Ecuador's massive national debt.

Impacts on coastal ecosystems

The impacts of shrimp farming on coastal ecosystems may prove to be more profound from a long-term perspective than immediate social impacts may suggest. By 1990, an overflight view would demonstrate that shrimp farming had, in just two decades, engineered every riverine estuary and lagoon along the entire coast, with the exception of the northern reaches of Esmeraldas. The impacts of this development include

- Degraded water quality from the release of nutrients, antibiotics, and other chemicals used in the production process;
- Destruction of wetlands, primarily mangroves, that have been replaced by ponds and water intake channels. Wetlands absorb the nutrients that can produce eutrophic conditions, serve as storm buffers, produce timber, and provide habitat critical to the life cycles of many organisms. They therefore provide services important to both sustainable shrimp farming operations and to estuary uses. Freshwater wetlands have also been affected;
- Diking sand and mud flats and shallow protected waters to make ponds, thereby reducing the area of estuary and its value as a nursery ground for fish and shellfish;
- Alteration of estuarine hydrology by channelization and by controlled flow of water into the ponds;
- Removal of all fish and shellfish, usually in the form of juveniles and larvae, who are carried with the water pumped into the ponds;
- Significant impacts on waterfowl, both in terms of changes in habitat and, on some farms, through the routine shooting of waterfowl that eat, or are believed to eat, shrimp; and
- Problems posed by the introduction of exotic species. There are no controls over the introduction or release of exotic species, and this can have significant effects on the ecology of the affected area.

Another set of impacts is brought by the need for large numbers of wild-caught postlarval shrimp, which are the backbone of Ecuador's mariculture industry, and by demand for the egg-bearing females required by many hatcheries. The combination of heavy fishing pressure by pre-existing trawler fisheries, new fisheries for shrimp postlarvae and egg-bearing females, and losses in estuarine habitat have led to major reductions in shrimp stocks in Southeast Asia, and are likely to eventually reduce the wild stocks in Ecuador.

Initial Objectives and Strategies in Mariculture: 1985-1987

In its proposal to the U.S. Agency for International Development (USAID) in 1985, the University of Rhode Island's Coastal Resources Center (CRC) recognized that shrimp mariculture is the most powerful agent of ecosystem change in Ecuador's estuaries, and presumed that the industry would be a major focus of the project. This was confirmed in early 1986, when Ecuador's ambassador to the United States contacted the CRC project director and asked for assistance in defining a closed season for the postlarvae fishery. At the time, Ecuador was in an inter-El Niño period of low rainfall and low sea temperatures, and

the wild postlarvae used to stock the shrimp ponds were scarce. Advisors to the government had concluded that this scarcity, which had brought crisis to the shrimp mariculture industry, was caused by overfishing in the artisanal postlarvae fishery and decided that annual closed seasons were the best remedy. The PMRC argued that a comprehensive review of the ecological, economic, and technical issues affecting the industry would be more appropriate and useful. The first-year work plan therefore called for drawing together some of the best available international expertise to work with the industry in Ecuador and formulating an integrated strategy for a sustainable shrimp mariculture industry. This became the dominant activity during 1986.

According to the Year 1 work plan, the objective of the collaborative analysis was "to build consensus on the scope and nature of the problems and opportunities now facing the shrimp industry in Ecuador and, if possible, to lay the groundwork for a coordinated governmental agency-industry strategy for managing the industry."

The major strategies selected for achieving this objective were to

- Use the crisis brought by the scarcity of postlarvae (half the ponds were idle in 1985) to bring together representatives of the government and the industry and internationally renowned specialists to jointly define the issues and a common approach to the problems and opportunities facing the industry. This collaborative analysis would be accomplished through the joint preparation of papers, teaming Ecuadorians with foreign specialists. These papers would then be the basis for a workshop in Guayaquil. Facilitated meeting procedures, which had been successfully used by CRC in similar efforts in the United States and Sri Lanka, would assure that all views were heard and, where possible, consensus achieved through an open but structured process. Simultaneous translation was used, and various social events arranged to promote dialogue. The conference room of the Banco Central in Guayaquil was selected as the only facility large enough to accommodate all the industry representatives that were expected to attend.

- Be ready to follow up immediately with selected activities. The USAID Mission pledged $50,000 for follow-up. Selected activities would actively involve the industry in resource management-related initiatives. Those with the biggest potential for producing tangible short-term impacts would be emphasized.

- Apply a legal/institutional team to an issue-driven analysis of the structure and procedures of the governance system that affects the mariculture industry.

An integrated strategy to promote a sustainable shrimp mariculture industry in Ecuador

The highlights of the ideas generated by the symposium were immediately integrated and summarized in An Integrated Strategy to Promote a Sustainable Shrimp Mariculture Industry in Ecuador (Olsen and Figueroa, 1986). The strategy consisted of seven elements:

1. Maintain water quality in estuaries and near shrimp hatcheries.

Low growth rates and occasional mass mortalities due to poor water quality are already problems for some hatcheries and growout operations. Development trends in coastal watersheds suggest that further reductions in water quality are to be expected unless mitigating actions are quickly taken.

2. Protect and manage the wild shrimp stocks that provide the most abundant and cheapest sources of seed shrimp to the industry.

This requires the protection of critical habitats, including mangroves, and safeguards against overexploitation by fisheries for adult shrimp and PL.

3. Engage in a strategic planning process to optimize the long-term economic vitality of the industry. Tracking trends in the world shrimp markets, ensuring product quality control, and forecasting the impacts of declining water quality on the industry are all urgent priorities.

4. Overhaul and simplify the permit system governing the siting and operation of ponds and hatcheries.

5. Critically evaluate the impacts of national policy on the shrimp industry as it is applied through the Fisheries Development Law.

6. Initiate a targeted technical assistance program to promote information exchange within the industry.

7. Initiate a public education program to help build support for the measures needed to protect the environmental quality that the shrimp industry requires.

The assessment process concluded that the greatest single threat to the sustainability of shrimp farming was declining water quality brought by a combination of

- Reductions to the absorptive capacity of estuaries caused by destruction of mangrove wetlands and reductions in water exchange;
- Increased loadings of nutrients from both shrimp pond discharges and untreated sewage from rapidly expanding urban areas;
- Increased loadings of toxics from agrochemicals and industrial wastes; and
- Reduced inflow of fresh water, and reduced periodic freshwater flushes brought by dams and the redirection of river water from estuaries to irrigated agriculture.

Unfortunately, declining water quality and other problems foreseen by the strategy have been borne out in subsequent years as the major issues that threaten the sustainability of the industry.
After the workshop, the project immediately committed to two follow-up tasks:

- Design a research and extension program directed at reducing the mortality of wild-caught PL; and

- To design and implement a coastwide water quality monitoring program

Mariculture industry response to the initial strategy

Participation of industry representatives in the workshop was very limited, due to a mix of logistical problems and a miscalculation of industry interest in such a broad-based assessment. Shrimp pond operators were highly skeptical of any attempt to address, with government, the resource management issues raised by their industry. They welcomed technical assistance on specific, immediate problems, such as water quality analysis in specific locations where problems were believed to exist, but not more open-ended activities. Furthermore, in 1987, when the strategy was distributed, the postlarvae were again abundant and the perception of crisis-and therefore the perceived need for resource management initiatives-evaporated. The government canceled the dual exchange rate, ending the tax on shrimp exports, and classified all mangroves as "reserved forest." This made any form of cutting or reclamation illegal-and this again was viewed as all that could reasonably be done by government and a "management program" about that problem. The net result was that there was little interest, on the part of both government and industry, in following up on the strategy as a whole.

Initial PMRC actions

Research on postlarvae mortality began immediately after the workshop. It included experiments at what later became the ESPOL-based National Center for Aquaculture and Marine Research (CENAIM) on the impacts of different handling methods on long-term survival, documentation of the composition of bycatch, and initial trials of extension to larveros, including field demonstrations and TV spots on the best

technologies. Problems with the quality of this work and disagreements over the working style of the consultant led to cancellation of the postlarvae mortality study late in 1987.

A water quality working group, modeled on the mangrove working group, was formed, and began its initial work of synthesizing existing data, identifying water quality "hot spots" and conducting intercalibration exercises.

Research on the ecological services and functions of mangroves was undertaken, funded through the USAID Office of the Science Advisor.

A Second Attempt: A National Strategy to Diversify Mariculture in Ecuador

In the 1980s, the shrimp industry began to experiment with the culture of species other than shrimp. Crayfish, Pacific oyster, mussels, several finfish, and algae have been raised at pilot and small commercial scale. Much of the work has been conducted at CENAIM, funded and partially staffed by the Japanese foreign assistance program.

Experience with a CRC project in Thailand demonstrated that different approaches to mariculture were not only technically possible, but could produce both a more sustainable mariculture industry and a better distribution of the benefits of mariculture within coastal societies. Observations in Thailand and reports from other nations in Southeast Asia suggested the following:

- Dense development of shrimp mariculture farms can have such a large impact on the ecology of the adjoining estuary that the industry collapses, and large areas of formerly productive shrimp ponds have to be abandoned.

- Culture techniques for a wide variety of fish, mollusks, and crustaceans can be adapted to a great diversity of coastal habitats. The livelihoods of traditional fisherfolk and mangrove dwellers have declined, the protein intake of Ecuador's population is falling, and an increasingly high proportion of the population is malnourished. These culture techniques can provide livelihoods for significant numbers of artisanal mariculturists, and can produce food at a reasonable price for local use.

- Shrimp mariculture can be conducted through a wide variety of production strategies that can greatly increase the yield per hectare and also provide greater benefits to the resident population than has occurred in Ecuador. We were intrigued, for example, by the strategies of Aquastar, a multinational company in southern Thailand, that was successfully transforming small-scale rice farms into shrimp farms that provided families with a greatly increased income without depriving them of the ownership of their land.

- Throughout Southeast Asia, fishing pressure for adults, gravid females, and, at the initial stages of shrimp mariculture, shrimp postlarvae, has drastically reduced wild stocks of shrimp.

This experience reinforced concern that the combination of habitat loss and increasing fishing pressure would eventually lead to major declines or a collapse in Penaeus vannamei stocks-with disastrous consequences for both the industry and large numbers of artisanal fishermen.

These observations reinforced the conclusion of the strategy released in 1986. They also reaffirmed that major benefits would result from national-level action to bring together the mariculture industry and government to increase the sustainability of the industry from both a social and an ecological perspective.

By 1988, the success of a provincial profiling process, and the development of a base of public support for coastal resource management at the community level prompted us to make another attempt to engage the shrimp mariculture industry at a national level.

The second strategy was to focus our efforts on diversification of the industry. It began by bringing two eminent people to Ecuador to view the situation and make specific, practical recommendations for action. The first of these was H.T. Odum, who, with his brother, has defined the contemporary science of ecology. He has subsequently developed new approaches to formulating management strategies based on the functioning and characteristics of specific ecosystems. The second, Chua Thia-Eng, pioneered diversified mariculture technologies in Southeast Asia, and subsequently became the director of the mariculture section in the U.N. Food and Agriculture Organization (FAO). At the time of his work in Ecuador, he was director of the International Center for Living Aquatic Resources Management (ICLARM) Coastal Management Project. Our strategy was that these two individuals would provide an impetus for reaffirming the concepts that emerged from the 1986 symposium, and provide specific ideas for a national plan on the concept of diversification within the mariculture industry.

Recommendations of H.T. Odum

Odum confirmed and amplified the concerns of other ecologists who had examined the prospects for a sustainable shrimp mariculture industry from a systems ecology point of view. These studies include an analysis made by Snedaker et al. (1986), and Twilley in (1989). Odum argued forcefully that the redirection of river water-and the organic and inorganic matter it contains-into irrigated agriculture would profoundly change the ecology of Ecuador’s estuaries, and in many cases could be expected to significantly reduce their productivity. Not only is the volume of fresh water and the nutrients it contains being reduced by the construction of dams in irrigation projects, but the periodic flushes of fresh water associated with El Nino events are being modified. During dry inter-El Nino periods, and when the rainfall associated with El Niño years is moderate, the average flow that these systems receive will be reduced. Odum argues that such changes will reduce the ecological advantage of P. vannamei, which is uniquely adapted to a highly variable fresh water-salinity regime. These changes, he says, will also reduce the mangrove production, fish and shellfish production, and associated mariculture production of Ecuador's estuaries. The increased loading of agrochemicals and human sewage that will result from more intensive agricultural production and a growing human population will only exacerbate these impacts. Some of these effects, unfortunately, are already being experienced in the Gulf of Guayaquil.

Odum made a series of observations and preliminary ecological models of shrimp ponds. The recommendations that he made based on an ecosystem analysis of these manmade systems are entirely consistent with those made by Chua a year later. Like Chua, he recommended making the average depth of ponds greater to reduce biological activity on pond bottoms, re-engineering the water delivery and flushing systems, experimenting with a number of polyculture techniques to reduce the nutrient loads in pond discharge waters, and managing the ecology of ponds to increase their stability and make better use of predator/prey relationships within these systems.

By far the most novel and controversial observations and recommendations are those stemming from the application of "emergy" analysis to shrimp mariculture in Ecuador (Odum and Arding, 1991). Emergy analysis has been developed by Dr. Odum as an accounting tool to calculate the value of a resource or a product based on its production process. This requires converting all measures of value into a common set of units-usually solar energy equivalents. Emergy analysis is not helpful when attempting to ascribe a market value to a product, but it is a powerful tool for analyzing the relative contributions of nature and human work to producing a product. It offers a means for estimating the value of natural resources, the "work of nature," human work and manmade products all on the same scale, utilizing common units. Traditional economics, on the other hand, ultimately relies on setting the value of something in terms of what people perceive that value to be, either through the forces of the market, or through a number of hedonic, non-market techniques. Neoclassical economics asserts that selfishly motivated individual free choice ultimately leads to maximizing benefits for society. Odum contends that market prices are largely irrelevant when attempting to estimate public wealth. The application of emergy analysis to shrimp mariculture in Ecuador can help elucidate the public policy implications of transforming the natural wealth of Ecuador's estuaries to an export commodity. This was presented in Odum

and Arding (1991), and is discussed in a paper by Olsen (in press).

Recommendations of Chua Thia-Eng

Chua was accompanied by Pinij Kungvankij, selected for his detailed knowledge of the techniques and technologies of shrimp production in ponds. Chua and Kungvankij concluded that a set of national policies and a national action plan were urgently needed. They were confident that such a plan, if effectively implemented, would have a major positive impact on the industry (Chua and Kungvankij, 1991). Their recommendations can be summarized as follows:

Pond production

Ecuador's very large, irregular, and shallow ponds are inefficient and difficult to manage. Production per unit area in 1990 was approximately 600 kilograms (kg)/ha/year (in two crops). Chua recommended adopting a national goal of increasing the average yield to 1,500 kg/ha/year. He was confident that in Southeast Asia, where government is more effective, and collaboration between government and the private sector has an established tradition, this goal would be readily achievable in four years. He recognized that in Ecuador, the social-institutional climate would make this more difficult. This dramatic increase in production would be achieved by:

- Modifying and standardizing pond design

  -Redesign ponds to standardized shape, 2 to 5 ha in size.

  - Increase the depth of all ponds to 1.8 meters.
  - Improve water exchange and water flow by re-engineering channels for intake and discharge waters, aerating ponds, and periodically removing pond sediments.
  - Improve feeds and feeding regimes.

- Reducing the area of ponds from 140,000 ha to 100,000 ha and prohibiting further pond construction.

  -Replant reclaimed ponds with mangroves and re-establish greater tidal exchange.

- Stabilize the availability of postlarvae to assure a base of 30 billion larvae per year from a combination of hatchery and wild caught-sources.

These strategies do not present any unusual technical difficulties. Any problems in implementation lie in the attitudes of the people concerned and in the absence of a traditions of collaborative action-both within the industry itself and between industry and government. Ten strategies are suggested for promoting such collaboration:

- Develop extension projects and demonstration farms to: promote technologies for increasing the productivity of individual ponds; promote small-scale hatcheries; and improve nets for harvesting wild postlarvae.

- Increase the quality and value of wild-caught postlarvae by improving collecting apparatus and establishing government-sponsored or foreign donor-supported seed banks at harvesting sites.

- Provide government incentives-such as low-interest loans and reduced taxes on highly productive shrimp farms-for the establishment of small-scale hatcheries.

- Replant mangroves in abandoned ponds and unused estuarine areas through foreign assistance projects and community initiatives. Not fewer than 27,000 ha of mangroves should be planted.

- Regularly monitor the estuarine water quality and publish the results widely.
- Strengthen the implementation of existing closed seasons in fisheries and strictly prohibit the use of all mechanically assisted means of harvesting shrimp postlarvae.
- Develop a critical mass of technicians in all aspects of hatchery and shrimp pond operations.
- Create a consultative commission for the development of mariculture-composed representatives of government, the private sector, and research institutions.
- Strengthen both human capacity and facilities of research institutions.
- Encourage the formation of a professional association to promote interaction among scientists, aquaculturists, and fishermen in order to improve the dissemination of technologies within the country.

Diversification of mariculture

Chua and Kungvankij saw many possibilities for diversifying the mariculture industry, thereby increasing its sustainability and distributing benefits more widely within Ecuadorian society. They also recognized that there was no tradition or experience with mariculture for species other than shrimp in Ecuador, and that this was the major impediment to progress. As long as the industry was controlled by individuals whose interest in mariculture is limited to making a substantial profit in an export business, it would be difficult to promote mariculture as a means for providing livelihoods to low-income groups and providing "food for the people." Echoing the recommendations of Odum, Chua saw a number of possibilities for promoting multiculture techniques that would have a direct benefit on shrimp farming by reducing the nutrient loads in shrimp pond discharge waters and thereby improve water quality in a given estuary. A number of suggestions were made for promising species and cultivation techniques. Chua also underscored the need for government to get involved in providing the initial research, extension, and credit to establish new forms of mariculture.

The recommendations of Odum and Chua provided a detailed agenda for action that was far more specific than the more conceptual strategy produced in 1987. The PMRC now had a set of ideas that could be debated at the national level and could lead to a productive relationship with the shrimp industry.

A structured dialogue between industry and government

In 1990, the second attempt was made to engage the shrimp industry. The objective, as in 1986, was to promote a policy dialogue at the national level. Representatives of the shrimp industry and the government agencies involved, we hoped, would work together to develop a national plan for a diversified mariculture industry that built on the observations and recommendations of Chua and Odum. We planned to discuss important topics in small working groups that would then present a high-level interinstitutional committee with elements of a plan of action.

The initial response to this initiative was positive, with both government officials and representatives of the industry agreeing that a coherent national strategy-developed through a collaborative process involving both the private and public sectors-was needed. All parties also openly recognized that the lack of trust between the public and private sector would be the principal obstacle to the preparation, and above all the implementation, of any plan. For example, there was considerable concern within the industry that any agreement on the basic characteristics of the industry and the opportunities that lay before it would sooner or later result in increased taxes. At an initial meeting, a spokesman for the industry observed that their primary objective was to maximize the value of exports. He suggested that the agenda should be limited only to those actions that could bring increased short-term earnings to the export of farm-grown shrimp.

Thus, once again, the broader objectives of the coastal management program found little support within the industry.

In February 1991, an outbreak of cholera produced a dramatic new threat to shrimp exports. In the atmosphere of a major national crisis, the Committee for the Prevention of Cholera in Bioaquatic Ecuadorian Products was created, through Ministerial Agreement 167. This was also structured as a public/private sector initiative, with many of the same agencies and individuals that had agreed to serve on the PMRC's interinstitutional committee. This new committee immediately set to work with great efficiency in designing and implementing a program of controls and assurances to protect the sale of seafood products both in-country and in international markets. The work of this committee and its effective collaboration with the ministries of Health and Education, as well as with government agencies involved in the industry, demonstrated that when incentives are high enough, collaboration among several agencies of government and the private sector is indeed possible. The positive impacts of a well thought-out and effectively implemented strategy were equally dramatic.

The epidemic began in February 1991, peaked in April, and then declined. Throughout this period, seafood products were sold, both nationally and internationally. Yet even after this display of effective public-private collaboration, the same agencies and individuals were skeptical of any broad-based attempt to collaborate in the overall development of Ecuador's mariculture industry.

The Third Strategy: Research and Extension Within the ZEMs

The special area management zones, as microcosms of the situation along the coast, reflected the wealthier segments of society's lack of interest in rethinking resource management: Only a few of the owners of large shrimp farms expressed any interest in an integrated planning process. By contrast, however, interest among user groups and commitment to a process that promised to resolve pressing resource management issues was at times overwhelming. The difference in the focus of national representatives of the shrimp industry and ZEM user groups was obvious. The focus of the industry was sectoral, short-term, and aimed at increasing profits and use of natural resources. In contrast, ZEM user groups had a holistic perspective of the use and management of natural resources. Their aim was to recover or maintain the resource base. Such contrasts were discussed at length at the PMRC's annual self-assessment and work plan formulation workshop in mid-1991. The result was a decision to focus the program's technical efforts on the five ZEMs and thus to once again reformulate our objectives and strategies to address issues raised by mariculture.

In the ZEMs it was clear that mariculture, fisheries, and mangrove management issues would have to be viewed as a closely interwoven set of issues. This was precisely what the project had hoped to do since it began in 1986. In the ZEMs we found large and vocal constituencies clamoring for the same approach that we believed would be most useful. Several aspects of the situation of mariculture development contributed to this need:

- A large portion of these outspoken constituencies were hunters and gatherers-shellfishers, crabbers, larveros, artisanal finfishers-who had been seriously affected by recent declines in the condition of estuarine ecosystems. To these people, the increasing scarcity of the resources upon which they depended was all too obvious. Not only did this reduce prospects for a cash income, but the need for money was becoming greater as they were forced to purchase what they could previously gather. The most dramatic case was in the Rio Chone ZEM, where a large community of estuarine fisherfolk renowned along the coast for their skills as crabbers, shellfishers, and harvesters of estuarine finfish saw, in the space of 15 years, 85 percent of the mangroves and all of the salt flats in their estuary converted to shrimp farms. The great majority of these families had been forced to move to other estuaries along the coast, and the few that remained had to supplement their incomes by working as agricultural day laborers and domestic servants.

- Many groups had been forcibly displaced from traditional fishing and gathering grounds. By giving concessions to use salt flats and mangrove areas for shrimp farming, the concept of "private property" has been introduced to areas used as common property by coastal communities. Not only did shrimp ponds convert former mangrove wetlands to ponds, but they claimed buffer zones around their farms, from which local people have been excluded by armed guards and dogs.

- Many subsistence coastal communities are ill-prepared to enter a market economy. Many people were proud of their abilities as fisherfolk and "mangrove people." In the new context, they found their knowledge and skills has little value. This affects their self-esteem, and leaves them without the necessary skills required to pursue other livelihoods. In the case of Bunche, a traditional village of "mangrove people" in the Esmeraldas ZEM, 55 percent of the shellfisherwomen and 13 percent of their husbands are illiterate. Ninety-five percent of the husbands have been unable to find stable jobs and frequently must survive as six to nine months with no employment. It is hardly surprising that 84 percent of the shellfisherwomen of Bunche believe that their quality of life has declined since shrimp farms began moving into their estuary (Bravo and Abarca, 1995). In some communities, the sense of poverty had reached profound levels. People have come to believe that there is no escape from a degraded existence. In addition, their low level of education, income and wealth limited their capacity to initiate alternative activities. The only viable options for these groups have been to intensify the use of the resource or to exploit a new one, for instance, PL.

- Alternative livelihoods in mariculture, agriculture, or tourism all depend on the condition of local ecosystems. It is obvious to coastal people that when both the magnitude and the condition of the resources available to them diminish, their future is bleak. A widespread concern, often expressed at meetings, is for their future and that of their children.

Such attitudes contrast sharply with those of the wealthier and better-educated segment of coastal society. The quality of life of these people does not depend directly on the quality of the local environment. To a considerable degree, they can isolate themselves from environmental degradation, and invest in a variety of activities that can, at least over the short term, maintain quality of life.

Developing the new strategy

In 1990, the first set of practical exercises in resource management were undertaken. Designed to encourage community structure, the design and execution of these projects was primarily the responsibility of the local people involved. While this strategy often produced excellent results for such activities as solid waste collection and disposal, the results were less than satisfactory when the projects required a greater level of technical competence. Two of these initial practical exercises involved the construction and operation of village collection centers for shrimp postlarvae in Valdivia (Guayas province) and Bunche (Esmeraldas province). Although similar centers are run successfully elsewhere on the coast, both of these projects failed due to poor design and lack of experience in setting up simple administrative procedures. Issues such as the physical design of the facility and ground rules for membership in a community-based center brought conflict and inefficiency. This experience convinced the PMRC staff that its limited resources (one full-time person and a very small operating budget) needed to be directed exclusively at mariculture and fisheries-related activities in the ZEMs. Thus, the conclusions that emerge from the PMRC's self-assessment process demonstrated that the staff lacked the basic information required to understand the priority mariculture management issues in the ZEMs as they are perceived by the poor. We needed to know whether it was feasible to culture any of the three species of cockles that are traditionally fished in Ecuador's estuaries, or what it would take to restore the abundance of mangrove crab. Perhaps most important, the staff needed to gain experience in offering technical assistance to rural groups. Thus, the objectives of the third and final strategy were to

- Develop the capacity of the PMRC to work on the priority issues posed by mariculture in the ZEMs. This would include providing technical assistance to user groups and developing the methods and tools for working with rural communities. We could then help them to develop their ideas and work with them to identify actions to help them succeed in selected activities. To accomplish this, the PMRC had to obtain the necessary information to understand the major issues posed by mariculture in the ZEMs, including differences in the priorities and points of view of different user groups, such as shellfisherfolk, shrimp growers, larvae fishers, and artisanal finfishers.

- Develop detailed policies and actions for mariculture-related activities in each ZEM that could be incorporated into the ZEM plans.

Implementing the strategy

A mariculture working group

The first step in implementing this third strategy was to assemble a mariculture working group. This drew together individuals from a number of institutions, primarily in Guayaquil, including a number of university students. Building on the experience of the mangrove and the water quality working groups, a set of principles governed the formation of this group:

- The members of the working group did not formally represent their institutions. Those who joined the group did so out of professional interest, and not because they were assigned to the project by their superiors. In several cases, the experience of individual members, however, eventually drew their institutions into the PMRC process and resulted in formal arrangements between the PMRC and that institution.

- The group was supported by a small operating fund assigned each year through the annual work plan design process.

- All members of the working group actively participated in planning the tasks to be carried out each year. All tasks were discussed and revised by the entire group before any proposal was made to the PMRC.

- Once a task had been incorporated into the PMRC work plan, disbursement of funds and administrative decisions required to implement approved tasks occurred quickly (usually within 48 hours).

- Monthly meetings assured that all members of the group were well informed of ongoing events and felt part of a collaborative learning process.

- Work tasks were based on the priorities of each ZEM, as expressed by the ZEM committee and the ZEM plan.

- A commitment was made to capacity building, since it is the policy of the PMRC to invest in those associated with the program-in this case, by offering training and support to attend relevant local meetings and workshops.

These principles contrast quite sharply with the traditional operating procedures of institutions and foreign assistance projects in Ecuador. The PMRC's strong emphasis on an open and participatory process is unusual and sometimes requires difficult adjustments. For example, the emphasis on involving members of the community in all phases of the working group's activities was particularly difficult for scientists who had never before been encouraged to explain to poor villagers what they were doing, why they were doing it, and what they hoped to accomplish. In most cases, however, such participants, after an initial phase of adjustment, found such this approach highly rewarding, providing them with a sense of purpose and feedback loops that they had not previously experienced. The working group began to assemble in the first months of

Project Year 7 (1991). In Year 8, after some initial experience in attempting to provide extension services to PL fishermen and shellfishermen, CRC organized a workshop on extension philosophy and techniques. The approach subsequently adopted by the working group comprises four basic steps:

- Identifying innovators within the target community;
- Focusing efforts to teach a new technique or approach to these selected individuals;
- Providing moral and technical support to the innovators during the period in which they try out and adopt the new techniques or tools.
- Recycling the experience gained by the extension team and community innovators before promoting wider use within the community or among user groups.

This approach served the working group well in a number of projects involving various groups of fishers in artisanal-scale mariculture activities. A summary of activities carried out by the working group in the ZEMs is given in Table 4.

Some examples of extension and applied research

Cockle growing program

The shellfisherwomen's association of Bunche was very concerned that the populations of concha prieta (Andara tuberculosa and A. similis), a cockle that grows in the mangroves, were diminishing. A decade ago, when the resource was more abundant, the fishers would leave behind cockles less than 3 centimeters long, which have no market value. Today, however, the practice has changed to keeping all shellfish harvested, regardless of size, and using the undersize portion of the catch to feed the family. The question posed to the mariculture group was, "Can you suggest some better way to use these undersized shellfish?" The response of the working group was to experiment with techniques for fattening cockles. One of the members of the team, a member of the biology school at the University of Guayaquil, worked 15 days a month in the community, testing growout of undersized cockles in an intertidal plot near the village and in submerged wooden boxes. The results (Bravo and Abarca, 1993) showed that cockles in the intertidal mud flats grew at an average rate of 0.12 millimeters (mm) per month, which is the expected growth rate under natural conditions. The cockles placed in wooden boxes, however, grew much more rapidly-1.49 mm per month, 1.31 mm per month, and 1.36 mm per month-at densities of 50, 100, and 200 cockles per square meter, respectively. The shellfisherwomen watched these experiments with great interest, but most were unwilling to invest in either form of culture while the experiment was underway. One woman, however, did start her own intertidal fattening plot, but her shellfish were robbed several months later. When the first harvest of cockles grown in boxes was made, there was a surge of interest, and many fishers set about building and seeding growout boxes. In 1992, each box could be built for approximately $3, or considerably less if local materials were used. Eventually, however, the fattening technique was abandoned. The reason given by the fishers is that each box contains the equivalent of a single day's harvest-between 100 and 300 market-sized shellfish-and that the costs and labor of building the box and watching over it for 10 to 12 months is not worth the effort.

Bycatch reduction

A major focus of the working group has been to reduce the mortality of bycatch in the postlarvae fishery. The group worked closely with a research project-initially funded by British foreign assistance, and carried out by the National Institute of Fisheries-that documented the size and composition of the bycatch. It was found to be very significant and included large numbers of larval mollusks, crabs, and finfish of economic significance. Unfortunately, numerous efforts to convince larvae fishermen that they should return the by-catch to the water, rather than dumping it on the beach, had no results. The fishermen pointed out that returning the bycatch to the sea increases their labor, since returning such "rubbish" to the same piece of water in which they and others are actively fishing merely means it will be caught and have to be resorted

again. An alternative, suggested by Chua, has been to design a new fishing net that allows a proportion of undesired species to escape, and reduces abrasion to the animals concentrated in the end of the net while it is fishing. Such a net was been designed, tested, and refined by a member of the working group and has proven popular with a number of fishermen. This therefore provides an example of a tangible success in extension.

Table 4. Summary of mariculture management actions carried out in the ZEMs

Mariculture management recommendation	**Action examples in ZEMs** (1990-1994)
Public education and awareness program 1991-1993	• Presentations, site visits, school programs, community discussions, simple education materials.
Water quality monitoring 1990-1993	• Focus on needs of Rio Atacames shrimp farmers. • Monitoring program and work with local volunteers in Rio Chone.
Reduce mortality of shrimp postlarvae capture 1992-1993	• San Pedro, Playas: training and extension program for PL fishers. • Shrimp larvae collecting training workshops in all ZEMs in 1992. • Development, testing, and dissemination of new net for larveros.
Establish larvae collection centers	• Bunche project to create collection center. • Assessment of precriaderos in Canoa and Machala. • Assistance to Valdivia precriaderos.
Reforest shrimp canals	• Test in Rio Atacames and initiatives in Rio Chone.
Diversify mariculture	• Identification of issues in Bunche. • Development of fattening techniques for cockles.
Criteria to control impact of shrimp ponds on surrounding areas	• User group agreement among traditional users, authorities, and shrimp farmers, resolution of conflict over shrimp farm water intake canal, Rio Atacames.
Buffer zones around shrimp ponds	• User group agreement, Rio Muisne.
Freshwater aquaculture	• Study of freshwater wetlands in La Segua, Rio Chone, funded by United Nations Environment Programme.

Mariculture and fisheries policies in the ZEM plans

A major feature of the each of the five ZEM plans is policies and proposed activities for mariculture and fisheries. As with the other issues addressed in the plans, the PMRC and the local ZEM committees generated and tested a number of ideas that have national policy implications. A list of the policies and actions proposed in the various ZEM plans is given in Table 5.

Table 5. Examples of policies and proposed actions on mariculture and fisheries in the ZEM plans.

Policies	Actions
Atacames-Suacutea-Muisne ZEM	
3.5.1 Regulate shrimp fisheries in all life cycle stages, from postlarvae to gravid female.	• Reduce mortality of PL fishery. • Study the distribution and abundance of shrimp. • Strengthen and enforce fishing regulations.
3.5.2 Fix the boundaries of shrimp farms and permit no further expansion; create buffer zones and areas for permitting artisanal shrimp, crab, and shellfisheries.	• Control shrimp pond concessions and enforce laws against illegal ponds. • Install buffer zones around shrimp farms.
3.5.3 Provide technical assistance to improve the efficiency of shrimp ponds, laboratories, and precriaderos (artisanal postlarvae growout ponds), diversify mariculture, and reduce the impacts of shrimp pond operations.	• Test methods for fish and shellfish culture in the Rio Muisne. • Conduct technical assistance program for shrimp ponds and laboratories.
Bahía de Caráquez-San Vicente-Canoa ZEM	
3.4.1 Prohibit construction of any additional shrimp ponds in the Rio Chone.	• Prohibit the expansion of shrimp ponds. • Protect ecologically important sections of the Rio Chone estuary, such as mangrove islands and freshwater wetlands; set precise boundaries for shrimp ponds. • Provide extension for *precriadero* operators.
4.1.1 Create an estuary management plan for the Rio Chone for the year 2000.	• Strengthen the estuary management process, including committees, working groups, special studies, management options, pilot projects, and public education.
4.3.1 Develop a program to restore the water quality in the Rio Chone.	• Identify point and nonpoint pollution sources. • Develop a water use zoning scheme to guide pollution control. • Create a permanent monitoring program for the estuary. • Implement a pollution source reduction program. • Assure a permanent flow of fresh water to the estuary.
4.4.1 Study the ecology of freshwater wetlands and promote sustainable uses.	• Investigate the biology of traditional cultivated species, and examine the potential for expanding this activity.
4.9.1 Promote sustainable mariculture by improving pond production efficiency, reduce negative environmental impacts, and experiment with new forms of mariculture.	• Improve the productivity of artisanal precriaderos. • Improve the management of shrimp ponds, by examining critical management intervention points, build shrimp farmer involvement and organization, install a water quality analysis lab. • Diversify mariculture activities, focusing on native species, pilot projects with multiple species mariculture, and local shellfish species.

San Pedro-Valdivia-Manglaralto ZEM	
3.4.3 Examine options for mariculture, focusing on open sea techniques.	• Study species with potential for cultivation. • Determine the potential larvae supply for cultivation. • Pilot mariculture projects. • Train local people in mariculture.
3.4.4 Reduce contamination from shrimp laboratory discharges.	• Evaluate the impact of laboratory discharges. • Experiment with discharge treatment techniques.
Playas-Posorja-Puerto El Morro ZEM	
3.5.2 Prohibit the construction of new shrimp ponds.	• Increase the efficiency of precriaderos. • Improve the efficiency of shrimp ponds. • Develop bivalve culture in the ZEM.
Machala-Puerto Bolívar-Jambelí ZEM	
3.5.4 Create the capacity to deal with shrimp diseases	• Determine extent of problem, develop prevention and treatment of shrimp diseases.

Activities proposed for IDB financing

Although mariculture policies and actions are featured in the ZEM plans, the Inter-American Development Bank (IDB) Coastal Resources Management Project contains only limited funding for shrimp mariculture-related projects. Funds will be available to reduce the negative environmental effects of the activity on estuaries and mangroves, contribute to the sustainable use of PL and juvenile shrimp, while also promoting optimal pond operation. The program will finance an analysis of the gravid female shrimp fishery, the operation of hatcheries, and the handling of shrimp postlarvae by artisanal fishermen. Following the diagnostic study, a field extension program will help disseminate selected practices for the industry.

The focus will be on: 1) better methods of capture, handling, and transport of gravid female shrimp and postlarvae to reduce losses due to stress and mortality; 2) optimization of the management of artisanal shrimp hatcheries; and 3) improvements in shrimp pond management to reduce the effects of pond effluents on estuarine water quality while also increasing productivity. In each case, the practices will be field tested with the active participation of fishermen, family groups that sort the postlarvae, local merchants, and other operators.

The program to create an estuary management plan for the Rio Chone estuary provides a major opportunity for working directly with large-scale shrimp farmers in order to understand the effects of industry growth on the estuary. The project will establish the decision-making information and tools needed to determine what environmental conditions are necessary for sustainable mariculture in this estuary.

Conclusions and Outlook on the PMRC's Role in Mariculture Management and Diversification

The mariculture agenda prepared by the PMRC in 1986 accurately foresaw the problems that Ecuador now faces in sustaining a vital sector of its national economy. The PMRC has tested many of the actions required to promote sustainable mariculture, and has developed strategies that begin to overcome the resistance of the mariculture industry at the ZEM level. However, efforts to spur a productive policy dialogue at the national level have not yet been successful. The PMRC must remain ready to pursue any opportunities to engage authorities and stakeholders in discussions and joint actions toward effective management of both artisanal and export-driven mariculture production. The framework of work for the PMRC is outlined in the following objectives. Success will require the active collaboration of the shrimp mariculture industry and a number of government agencies.

- Maintain water quality.

In 1994, environmental issues were finally being recognized as important to shrimp farmers, although perhaps too late. An August 1994 report by the U.S. Environmental Protection Agency (EPA) on the Taura Syndrome in the Guayas estuary, for example, stressed the need for a collaborative effort to improve and protect the environmental quality of the Gulf of Guayaquil. The PMRC's experience and accomplishments in fostering collaboration should be examined if this recommendation is followed. The Rio Chone research and estuary management work scheduled for implementation under the IDB project can serve as a national initiative for addressing the full suite of mariculture management issues in a severely stressed estuary.

- Manage wild shrimp stocks.

Development of a management plan that addresses the impacts of fisheries on all stages of the lifecycle of shrimp is contingent on expanding the national system for collecting catch-and-effort data, identifying shrimp populations and movements, and correlating trends with environmental and anthropogenic variables. Although the PMRC has incorporated such ideas into its ZEM plans, improving the state of shrimp fisheries management in Ecuador will not be easy. Closed seasons, gear restrictions, and bans on motorized equipment for shrimp postlarvae collection have been difficult to enforce. There is no restriction on the harvest of egg-bearing female shrimp, and conflicts continue between artisanal fisherfolk and commercial boats, which continually violate the 8-mile zone reserved for artisanal gear.

- Optimize the long-term viability of the industry.

The PMRC has been most successful in working to build relationships, setting innovative policies, and carrying out joint actions related to mariculture in the ZEMs. The participation of shrimp farmers in program activities at the local level is now increasing, after a long period of disinterest and skepticism. The PMRC has tried to establish cooperative working relationships with ministries and with the shrimp industry to promote the strategies and recommendations first made at the 1986 meeting. However, both government agencies and the mariculture industry have been reluctant to enter into meaningful discussions, except to address a major and immediate crisis.

- Overhaul the permit system.

The mariculture regulatory system needs to be simplified in order to meet site-specific coastal resource management objectives. Decision-making on new and renewed pond concessions must be based on habitat conservation, good shrimp farm construction and operating practices, and promotion of social well-being. Efficient shrimp farms are profitable enough to pay adequate fees for the use of common property, coastal resources and areas that could then be used to finance effective governance.

- Evaluate the impacts of national policy on the shrimp industry.

A more diversified mariculture industry would produce greater economic benefits and prove more responsive to changes in world markets and technologies. Southgate and Whitaker (1994) point to the low fees charged for shrimp pond concessions in the beach and bay zone as fostering inefficient, unstable operations that damage the environment. The authors view investments in human capacity and the scientific basis for the industry as essential for future success. They note that outside of Guayaquil, shrimp farmers have limited access to testing laboratories, and need to better understand the lifecycle of shrimp in order to improve the contribution of hatcheries to the postlarvae supply and diminish the impacts of overfishing of gravid females.

- Initiate technical assistance to the industry.

The government of Ecuador greatly expanded ESPOL's coastal laboratory into a center for aquaculture research and development in 1990 through a major donation by the Japanese foreign assistance agency. CENAIM has focused on providing technical information for large-scale producers, and is working on mariculture diversification activities. Up to now, CENAIM has not been able to play a major role in promoting broad-based extension services to those shrimp farmers unable to finance their own team of shrimp pond biologists and technicians. It also faces the obstacles presented by shrimp farmers' reluctance to share information on operating practices. This sharing of information is the hallmark of effective extension.

- Use public education to promote environmental quality.

The PMRC's collaboration with the Fundaci&oacuten Pedro Vicente Maldonado to strengthen public awareness and education programs in the ZEMs has changed the perceptions, attitudes, and actions of coastal resource users-including the local mariculture industry. A similar strategy has been formulated for the severe conflicts in 1995 over the development of mariculture in northern Esmeraldas province-the source of a heated national debate between industry leaders and environmental groups. The PMRC approach has helped resolve site-specific issues through awareness-building, negotiation, and user group agreements. This work requires adequate staffing, a long-term commitment to monitoring industry activities, supervision of permits and agreements, and reinforcement of the positive image that an open decision-making process creates for both the community and developers. It will be necessary in the future for the sectoral agencies themselves to adopt and carry out regulatory programs in ways that are feasible for farm builders and operators to accept and to implement.

Coastal Water Quality Monitoring and Management

Mariano Montaño
Donald Robadue, Jr.

Life-giving water flowing from the Sierra through the coastal plain and estuaries to the sea is the central image in the shield on Ecuador's flag. Water is the great pathway that ties Ecuadorians to their environment-in generation of electricity, irrigation of crops, drinking water, industrial production, fisheries, mariculture, transportation, and recreation.

Managing and protecting the quality and quantity of water for present and future generations of coastal people should be a central concern of both citizens and public officials. Unfortunately, this is not the case. Estuaries such as Taura, Rio Chone and the Estero Salado, which have clusters of shrimp farms are experiencing environmental problems that are causing a decline in farm-raised shrimp production-a key sector of the coastal economy. The raw sewage of the more than 2 million people living in Ecuador's large and small coastal cities passes untreated into nearby waterways. Hundreds of thousands of Ecuadorian vacationers visit coastal beaches that have few or no sanitary facilities. The result is episodes of high levels of fecal coliform bacteria-an indicator of sewage contamination-in swimming areas. Diversion of freshwater flow from estuaries to agricultural areas is changing the quantity and quality of the coastal waters that serve as nurseries for coastal fish and shellfish. In 1989, Ecuador adopted-but has seldom enforced-regulations that provide the legal basis for setting water quality standards, issuing and enforcing wastewater discharge permits, and requiring environmental impact statements, as well as for financing the construction of publicly owned wastewater treatment works.

The Coastal Resources Management Program, PMRC, has been concerned about coastal water quality since its inception in 1986, initially in relation to the sustainability of the shrimp mariculture industry, which is centered in the Guayas River and its associated estuary. However, the PMRC has wisely not tried to overreach itself by attempting to tackle the problems generated by the Guayaquil metropolitan area. Instead, it has concentrated its initial efforts on monitoring and management in the five special area management zones (ZEMs), where it has worked to identify and address water quality problems that are directly tied to the quality of life in coastal villages.

By focusing its resources on a few key issues, the PMRC has begun to overcome some of the important obstacles to water quality management in Ecuador, including

- A lack of credible data and low credibility of Ecuador's water quality analysis laboratories;
- The absence of practical experience linking the technical concerns about pollution control to the needs of coastal resource user groups; and
- The absence of clear priorities that could galvanize a pollution control campaign.

This paper reviews the PMRC experience in the monitoring and management of coastal waters, particularly in the ZEMs. The PMRC is now in a position to get coastal water quality issues on the agenda of national and local governments, as well as play an important supporting role to ensure that the legal and administrative tools already in place are applied effectively in coastal areas.

Water Quality Issues Along Ecuador's Coast

Sustainability of the shrimp mariculture industry

Findings from the CRMP's 1986 mariculture strategy

In August of 1986, the PMRC organized its first major activity, an international seminar on the preparation of a sustainable shrimp mariculture strategy for Ecuador. The top priority identified through the shrimp mariculture assessment process was the need to maintain water quality in estuaries and along the open ocean coast where most shrimp larvae hatcheries are located. In fact, the negative effects of declining water quality on shrimp mariculture have become a major economic threat to the industry in the 1990s.

Growing evidence of ecosystem-related problems for the shrimp industry

Since the preparation of the mariculture strategy in 1986, two important episodes have given further weight to the PMRC's concerns. The Gaviota Syndrome appeared during the final months of 1989 and the first half of 1990. It was first seen near shrimp farms on the Isla de Santay in the Guayas River, as well as in the Estero Salado. Later, it was noted in El Oro province, as well as in Bahía de Caráquez, Jam, Cojimíes, and Muisne. The total loss to the shrimp mariculture sector was estimated at $100 million. In afflicted ponds, the shrimp, due to suffocation, leap out of the ponds, where they are easy prey for gulls (gaviotas). Shrimp farms that normally had production levels of 90 percent of stocked larvae suffered reduced productivity, which was reflected in larvae survival rates of only 50 to as low as 10 percent. Then, as quickly as it had arrived, the crisis disappeared, without a clear diagnosis of the actual causes, or a strategy to prevent reoccurrence.

The Taura Syndrome has been the focus of attention of the shrimp industry since 1994. After shrimp ponds along the mouth of the Rio Taura were stocked with postlarvae in the winter of 1992, pond owners reported high mortalities and deformities in shrimp. This problem then expanded to impact about 60,000 hectares (ha) of the 100,000 ha of shrimp farms around the Gulf of Guayaquil. The shrimp farmers in the zone found themselves at "the edge of an abyss," with an estimated loss of $170 million per year if the problem persisted. Once again, there is no clear diagnosis of the problem, with studies up to now implicating the fungicides used by banana growers, including Calixin, Benlate, Topsin and Baycord.

The Taura Syndrome reinforces the conclusion of PMRC that there is a great need to convene the variety of conflicting actors and responsible agencies to address current water quality issues, and to take a longer term perspective on water quality management. Unfortunately, up to now, no agency has assumed a leadership role, and the shrimp mariculture sector is repeating its response to the Gaviota Syndrome by hiring experts and trying to place blame on a single culprit or competing industry.

Capability of effective joint action by the shrimp industry

Ecuador's effort to protect the sanitary quality of shrimp exports has been an unquestioned success, and provides a model for addressing other water quality problems. The poor water quality of coastal waters from a microbiological perspective (Montaño, 1993) made the cholera epidemic that struck Ecuador in 1991 almost inevitable. In this case, an aggressive government campaign, coordinated with and assisted by the shrimp growers to prevent and combat the disease was a notable success.

Before the outbreak, the shrimp mariculture sector focused on the shrimp packing sector, adopting intensive quality control practices in the facilities where exported products were processed. As a consequence, importers in the United States and other markets maintained their confidence in the quality of the Ecuadorian product. The program is now managed by the Federation of Shrimp Exporters (FEDECAM), which now has a strong base of experience for confronting similar problems in the future.

Unfortunately, this intense interest in regulating product quality has not extended to the more environmentally based water pollution concerns.

Effects of water pollution on human uses of coastal water bodies

The series of coastal issue profiling workshops held by the PMRC in each coastal province in 1986 and 1987 revealed a variety of local concerns about coastal and estuarine water quality, which continued to worsen during the late 1980s and early 1990s.

Water taken from coastal rivers for domestic use is often contaminated by agricultural pesticides, as well as by industrial and domestic sewage discharges from urban areas. Investments in potable water supply and liquid waste disposal have not kept up with population growth in urban centers, and water pollution control laws have not been implemented. In communities where environmental sanitation projects have been built, education and training in the use and maintenance of the systems has been overlooked, leading to poor administration and failure to recover system costs. In some cases, the facilities are abandoned.

According to the most recent national census, the proportion of coastal residents connected to potable water and sewage disposal systems dropped from 20 to 17 percent between 1982 and 1990. The majority of coastal cities suffer from serious deficits in municipal sanitation services, including solid waste disposal. The situation is most severe in communities of fewer than 5,000 people, where facilities and services are virtually nonexistent.

The heavy use of certain tourist beaches during peak holiday periods (January to March and July to September), combined with poor infrastructure, results in bacteriological contamination of bathing beaches and coastal waters, risking public health and depressing the recreational potential of these areas.

Fish processing plant discharges in Posorja, Chanduy, Monteverde, and Manta, along with shrimp larvae hatcheries in San Pablo, San Vicente-Canoa, and Atacames, are degrading local water quality-in several cases, near important recreation beaches.

Gold mining in the upper watersheds of Guayas province is generating concern about the discharge of mercury into coastal water bodies.

Table 1. Some specific water quality problems identified by the PMRC.

Water body	Type of discharge	Affected activities
Rio Atacames estuary	Residential sewage Shrimp ponds	Tourism Shrimp pond productivity Estuary productivity Shellfishery
Rio Chone estuary	Residential sewage Shrimp ponds	Tourism Shrimp pond productivity Estuary productivity Fisheries
Beaches of Playas-Data de Posorja	Residential and beach goers' sewage Fish cleaning and evisceration	Tourism
Estero Salado (city of Guayaquil)	Residential sewage Industrial waste Urban stormwater	Recreation Shrimp pond productivity Estuary productivity Fisheries
Estero Huayla (city of Machala)	Residential sewage Industrial waste Agricultural runoff	Potable water Estuary productivity Shrimp pond productivity Fisheries Recreation

Difficulty placing water quality on the national agenda

The cholera epidemic, a seemingly critical situation, was not sufficient to gain sustained national attention on the water quality issue. It was responsible for more than 900 deaths in 1991 and 1992, primarily in the margins of the urban areas of Machala, Guayaquil, and Esmeraldas, where more than 48,000 cases were reported in the respective provinces of El Oro, Guayas, and Esmeraldas. The focus of the government of Ecuador's response during this period was general public education and treatment of individual cases to prevent death due to dehydration.

A study team funded by USAID Quito evaluated direct and indirect factors prolonging the epidemic, and found a number of likely pathways for the bacteria-including serious deficiencies in the supply and handling of drinking water, especially in marginal urban areas; discharges of untreated sewage to local waterways; poor personal and food-handling hygiene; and direct contact with contaminated water during bathing or clothes washing (Chudy et al., 1993).

Chudy et al. observed that by late 1992, "The cholera problem was relegated to a position of secondary importance, both by the Ministry of Health authorities and by other organizations that have been involved since the epidemic broke out in 1991. This also applies to the community level."

Limited prospects for major public investments and initiatives for coastal water pollution

Ecuador's basic water law provides the legal framework for controlling water pollution, as well as for conducting a planning process that would enable the setting of goals for individual water bodies, designating uses, controlling discharges, and evaluating results. This law, however, has not been given any practical expression, even in areas of the coast that experience water quality problems. Ecuador also has a legal framework for regulating point discharges of pollution. Unfortunately, two interagency efforts to implement such controls in Guayas province during the 1980s ended in failure when the focus shifted from water pollution control to the procedures, including extralegal maneuvers, for discharge permits. The program was discredited and abandoned.

Even when municipalities are motivated to address their pollution and sanitation problems, they must take on the entire burden of paying for pollution control-even though the environmental resources at stake in many polluted areas have provincial, regional, and, in the case of shrimp mariculture, international importance. There are no urban grant programs of the type that have proven so successful in the United States. According to Chudy et al., Ecuador's capacity to plan and implement water supply and pollution control measures has declined dramatically in recent years. In reviewing the water supply and sewer service agencies in the growing cities of Machala, Guayaquil, and Esmeraldas, the USAID team found inadequate financing, poor cost recovery, and management and administrative problems that lead to failure to adapt to a changing demand for services.

For example, the city of Esmeraldas has a water and sewage system designed for a service area of 30,000 people, while the current population exceeds 170,000.

> The poor performance of utilities also arises from a lax regulatory environment. The Instituto Ecuatoriano de Obras Sanitarios (IEOS) has the sanction of law to set norms and oversee the performance of public water and sanitation utilities. However, IEOS has never actually performed this role (Chudy et al., 1993).

Municipal utilities now face a grave financial situation that further weakens Ecuador's ability to confront the growing pollution crisis. At best, municipal utilities are able to recover from 25 to 40 percent of their operating and maintenance costs from customer billings. Residents receiving water by tank truck delivery pay at least four times more than those receiving piped water. Billing for water and sewer service in Guayaquil did not take place for nearly all of 1992, creating large operating deficits for both the water and sewage service agencies. Illegal connections to water and sewer lines also plague these utilities.

PMRC Objectives and Strategies to Address Water Quality Issues

One obvious issue identified in 1986 was a widespread lack of confidence in the accuracy and comparability of water quality data being generated in Ecuador by shrimp farmers, universities, government agencies, and private laboratories. Shrimp farmers routinely sent water quality samples to the United States for analysis, and national government officials bickered amongst each other about the validity of methods and results. Without an accepted base of information, it was argued, there was no valid way to examine various claims that water quality was deteriorating, that toxic pollutants were entering the marine environment, that shrimp ponds were adversely affected by ambient conditions, or that mariculture itself was contributing to water quality degradation.

The PMRC included water quality monitoring as a new task for the Project Year 2 (1987) work plan. The work was initially called "Estimation of Water Quality Issues Affecting the Shrimp Industry," but was expanded to include "other users of coastal resources" in Year 3 as a direct follow-up to the shrimp mariculture workshop and the provincial workshops. The PMRC set out to

- Identify and assess the significance of water quality problems affecting mariculture, fisheries, and other coastal uses;
- Make recommendations for solving water pollution problems at the national and local levels;
- Assess the in-country capacity to conduct the type of analyses required to monitor important water quality parameters; and
- Design an integrated program for generating baseline data.

The PMRC adopted three strategies to address the problem and the factual basis for a management initiative.

Strategy 1. Design and implement a water quality sampling program focused on issues related to shrimp mariculture.

Following the 1986 shrimp mariculture conference, the PMRC established an interinstitutional water quality working group to review the existing data on water quality, discuss perceived problems, and address concerns about the quality of available data. This group succeeded in standardizing laboratory methods and establishing credibility in the data generated by agencies and by laboratories, in both Ecuador and the United States.

Strategy 2. Design an integrated approach to water quality monitoring and promote interagency cooperation through the water quality working group.

A sampling program targeted issues of priority concern to the shrimp mariculture industry, including direct measurements of those water quality variables that may be impacting the operations of the shrimp mariculture industry. The initial focus was on monitoring oxygen, coliform, and nutrient levels.

Strategy 3. Guide and promote public investments and private collaboration in pollution control in the ZEM plans.

The PMRC's work in the ZEMs led it to discover important social dimensions of water quality. This drew greater attention to community concerns over safe drinking water, sewage and solid waste disposal, beach and neighborhood cleanliness, and public health. An integrated approach to water quality concerns linked the concerns of the shrimp industry to those of poor coastal communities, and enabled the PMRC to build local constituencies for coastal resources management.

From 1990 to 1993, the PMRC focused its efforts within the ZEMs, primarily on public education

and practical exercises. All five ZEM plans adopted in 1992 contain policies and proposed actions to improve basic services and promote the construction and proper administration of water supply and solid waste and sewage disposal facilities.

The Water Quality Working Group

Organization of the water quality working group (WQWG)

The PMRC planned three major tasks for the WQWG to meet its objectives for water quality:

- Assess the strengths and capacity of in-country water quality laboratories;
- Design and implement a water quality sampling program; and
- Combine the results of these efforts into the design of an integrated program to generate baseline data and sustained water quality monitoring.

The PMRC saw the importance of improving the in-country capacity to assess water quality problems to provide mariculturists with confidence in the quality of data that these laboratories were providing. Several well-equipped labs had already been identified in Guayaquil. Their major problem appeared to be a lack of operating funds for expendable supplies, and in some cases, funds for laboratory technicians. The author and José Vásconez assessed the capabilities and needs of these labs. The PMRC provided funding for the necessary supplies and manpower so that intercalibration exercises and quality control procedures could be introduced. A technical advisor, Candace Oviatt of the Marine Ecosystem Research Laboratory at the University of Rhode Island Graduate School of Oceanography, collaborated in reviewing available data and designing the intercalibration activities.

The WQWG held its first meeting in March 1987. It was attended by the directors of the major research institutions on the coast. The WQWG has met continuously since then, serving as the focal point for the PMRC's work in water quality. The organizations represented by the members of the WQWG cover a wide range of legal mandates, administrative responsibilities, and research interests pertaining to coastal water quality:

> **The Coastal Polytechnical University**, ESPOL, was the most active academic institution in the group. Its primary interest was in scientific research that advanced scholarship and learning.
>
> **The National Fisheries Institute**, INP, is responsible for developing knowledge and policy proposals regarding fisheries, and for understanding the relationship between water quality and fisheries resources.
>
> **The Ministry of Agriculture**, MAG-DSV, was primarily interested in the relationship between the use of agrochemicals, such as pesticides and fungicides, and coastal resources.
>
> **The Guayaquil Wastewater Administration**, EMAG, is responsible for monitoring and managing the discharge of sewage from the municipal wastewater collection system to adjacent water bodies, including the Rio Guayas and Estero Salado.
>
> Since 1989, **The Ecuadorian Sanitation Works Agency**, IEOS; Ecuadorian Water Resources Agency, INERHI, and the General Directorate of the Merchant Marine, DIGMER, each share in the jurisdiction required to implement the regulations issued for the Prevention and Control of Environment Contamination. IEOS takes the lead in water bodies used for human consumption, domestic, or industrial purposes. INERHI is the primary agency working on inland and island water bodies. DIGMER is charged with protecting coastal and navigable waters.

The Oceanographic Institute of the Armada, INOCAR, is a part of DIGMER, and conducts basic scientific research in marine waters, as well as maintaining navigation markers.

The Commission for Studies of the Development of the Guayas Basin, CEDEGE, has the lead role in planning and implementing irrigation and dam construction projects in the Guayas estuary and the entire watershed and .

The PMRC's role has been to provide technical assistance, training and some supplies for field research and laboratory analyses. Leaders of the PMRC also maintain contact with the ministries and agencies to discuss national policy issues to protect coastal water quality.

The University of Rhode Island (URI) has provided technical expertise throughout the development of the group.

In addition to the active roles played by these institutions, the WQWG has contacts with the private sector, including the Association of Shrimp Growers.

Maintaining the cohesion of the group has been a constant concern and challenge. In the beginning, it was essential to be creative and persistent in building mutual respect and confidence within a group whose members had considerable mistrust of each other. The researchers were not used to working together, did not have a clear vision of what the group could accomplish, and had only a small budget to use for activities. In view of these uncertainties, the longevity of the group and its important role in the PMRC is all the more remarkable.

The PMRC succeeded in its effort to improve the reliability of water quality analysis and created a commitment among researchers and laboratories to follow standard methods in order to generate comparable results. The WQWG greatly improved the level of confidence in water quality data collected by different laboratories, and helped identify site-specific problems in Estero Santa Rosa, Estero Salado, Rio Chone, and Rio Esmeraldas.

The sampling program initiated by the WQWG monitored oxygen, coliform, and nutrient levels. Overall, Ecuador's water quality was found to be good, but a number of localized problems demanded attention.

The WQWG also demonstrated that it is possible to work with local collaborators on a volunteer basis, even with the mariculture industry. Shrimp farmers in the Rio Chone, for example, collaborated to monitor water quality conditions in the inner estuary. However, the industry as a whole has not shown much interest in the broader water quality issues raised by the PMRC since 1986.

The PMRC did not have the financial resources to expand water quality monitoring coastwide, nor did the WQWG succeed in raising funds on its own for its ambitious proposals. Greater interest in monitoring exists in specific locations where water quality problems are interfering with desired uses.

Intercalibration of sampling and measurement

When the WQWG first began to carry out water quality sampling projects, the discrepancies in the results between laboratories proved to be a great surprise and cause for concern. At the end of February 1988, the group surveyed sections of the Guayas River and the Puerto Bolívar urban waterfront, and were quite surprised at the wide range of measured results from the same samples, in some cases by two orders of magnitude difference.

The participating laboratories then carried out several intercalibration exercises-the only such effort in the country-to test the accuracy of both procedures and equipment in the different organizations. The goal was to attain consistency in results among the labs. In each exercise, a known standard sample was provided to participant laboratories to see how close they could come to the actual value. The first

exercise, conducted in June 1988 at the facilities of ESPOL, focused on measurements of nitrate, ammonium, and total phosphorus. Participating organizations were IEOS, ESPOL, EMAG, and INOCAR. The second round focused on nitrates and phosphorus measurements, and was held at the INOCAR laboratory.

Table 2. Combined results of intercalibration exercises at ESPOL and INOCAR.

Parameter	**Range of observed values** (µg/l)	**Actual value of standard sample** (µg/l)	**Best result, by group and equipment**
NH3 ammonium	55.8-66.7*	65	66.7 DIGMER -- DR Hach
NO2 nitrite	18.8-21.2*	21	21.2 EMAG -- Super Scan 3
NO3 nitrate	6.6-6.9*	6.8	6.8 EMAG + ESPOL
PO4 phosphate	3.1-3.7**	3.3	3.3 EMAG + ESPOL
Phosphorus total	40.5-53.6	50	52.9 INOCAR -- Leiss PMQ3

* Detection limit = .07
** Detection limit = .15

The variation among the participating groups was still between 10 and 25 percent of the actual value, but such a range is acceptable.

At the same time, ESPOL's Chemical Sciences Institute conducted a calibration exercise with the University of Rhode Island on the measurement of heavy metals in sediment samples. Samples were taken from the Guayas River (station RG25) and the Daule River at La Toma station (LT), where the freshwater intake for the city of Guayaquil is located. The results of this exercise showed that the two labs were in close agreement and that the procedures and equipment at ESPOL produce reliable data.

Table 3. Heavy metals in sediment samples from the Guayas (station RG25) and Daule (station LT) rivers.

	Zinc	**Lead**	**Copper**	**Cadmium**	**Chromium**
µg/g	LT -- RG25	LT -- RG25	LT -- RG25	LT -- RG25	LT -- RG25
ESPOL	39.6 -- 61.9	6.8 -- 15.2	21.0 -- 45.6	0.25 -- 0.24	25.0 -- 31.0
URI	40.0 -- 60.3	8.6 -- 12.8	21.5 -- 34.7	0.26 -- 0.25	23.4 -- 34.7

In April 1993 another successful exercise focused on the measurement of nutrients and was carried out at the facilities of CEDEGE.

As a result of this work done under the auspices of the PMRC, intercalibration is now standard operating procedure for the WQWG participating organizations.

Assessing water quality conditions in Ecuador

The most important result of the intercalibration exercises has been the establishment of a new way of addressing water quality issues where the precision and reliability of data can be assured. With confidence in results firmly established, it became possible to move on to the task of surveying water quality conditions in critical areas of the coast.

Approach to conducting the water quality assessment

This WQWG task consisted of two important steps. Step 1 initiated a water quality assessment process

that involved a review of the existing data on water quality-much of which had already been assembled by PMRC staff; a discussion of perceived problems, from the perspective of shrimp farmers and larvae hatcheries; and discussions of water quality problems from the perspective of local scientists, including their concerns about the quality of available data. The WQWG served as the primary forum for these discussions, as well as an important vehicle for identifying contacts with industry and the scientific community.

Step 2 required developing a sampling program that would target issues of priority concern to the shrimp mariculture industry. The first priority was to make direct measurements of those water quality variables that could affect the operations of the shrimp mariculture industry. Problems that had been identified to that date (1987) included concentrations of heavy metals (particularly mercury compounds) and organic chemicals (particularly pesticides) in the vicinity of selected hatcheries and shrimp ponds.

Significant contamination, if found, was expected to be highly localized. Assessments were directed at known "sinks" of these substances, such as fine-grain sediments; long-lived detrital feeders, such as oysters; and predators at the top of the food chain, such as long-lived fish and fish-eating birds.

The WQWG decided to focus their attention initially on measuring oxygen and ammonium levels in control (no-impact) and affected sites. In order to help define ecosystem dynamics, recommended pond monitoring variables included nutrients, turbidity, biochemical oxygen demand, temperature, and salinity. The sampling programs recognized the need to make use of existing field investigation capabilities. It was hoped that in-pond monitoring would be conducted by cooperating shrimp farm managers, many of whom already had the necessary sampling equipment. The sampling protocols developed by the Pond Watchers, a volunteer monitoring group initiated by the University of Rhode Island, were adopted as a model for organizing the program. The WQWG also targeted a few other contaminants of concern, especially petroleum hydrocarbons, to be assessed at control and impacted sites.

Determining baseline water quality conditions

Selecting monitoring parameters

The next step was to identify the most important sections of the coastal zone from the water quality perspective, identify the parameters that should be measured, and then proceed to create a baseline characterization of those areas. Four areas were identified:

Study Block 1: Estero Santa Rosa, Jubones and Siete rivers, 8 stations;
Study Block 2: Estero Salado, Posorja and Playas, 15 stations;
Study Block 3: Rio Chone estuary, 4 stations; and
Study Block 4: Esmeraldas-Teaone rivers, Atacames, Súa and Muisne, 11 stations.

These study areas selected by the WQWG coincided for the most part with the ZEM locations.

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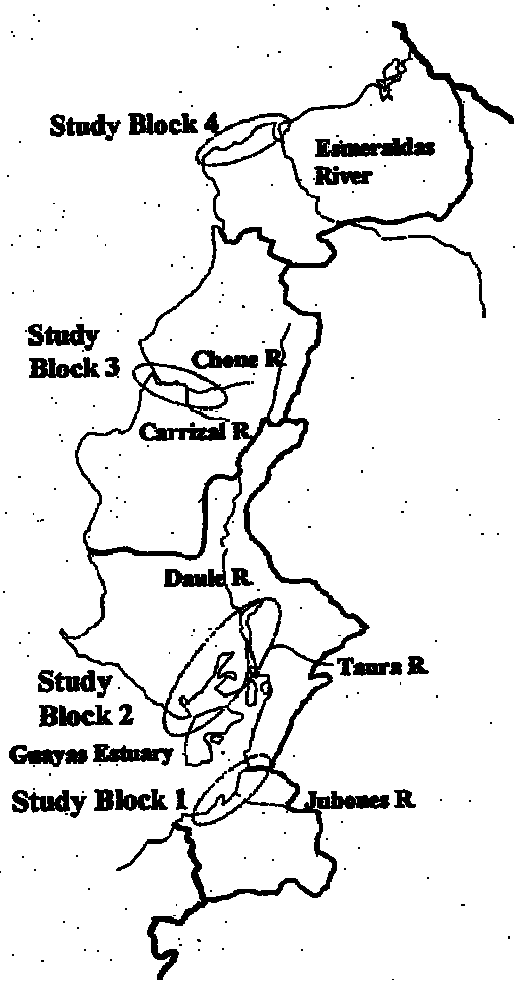


Figure 1. Water quality study areas.

Table 4. Principal coastal activities and their potential for water pollution.

Activities	Indicators of contamination								
	Dissolved Oxygen	**Bio-chemical Oxygen Demand**	**Solids**	**Micro-organisms** (coliform bacteria)	**Nutrients**	**Hydro-carbons**	**Heavy metals**	**Pesticides**	**p H**
Urbanization	X	X	X	X	X	X	X	X	X
Tourism	X	X	X	X		X			X
Industry	X	X	X			X	X		X
Agriculture	X	X	X	X	X	X		X	X
Navigation						X			
Exploitation of petroleum	X	X	X			X			X
Aquaculture	X	X	X	X	X	X		X	X
Mining			X				X		X
Fisheries and fish processing	X	X		X	X				
Infrastructure		X	X						X

The responsibility for conducting the analyses of different parameters was assigned to different members of the WQWG, according to the advantages each had in conducting the analysis:

DIGMER and EMAG	Microorganisms
ESPOL	Heavy metals and pesticides
IEOS	Physical and chemical parameters
INOCAR	Hydrocarbons
MAG-DSV	Pesticides

During 1989, sampling was carried out during the winter and summer in each of the four areas of concern. Baseline data on water quality conditions was compiled and presented at a public seminar in August 1990. More than 60 people attended the meeting from the academic community, the press, the city of Guayaquil, the shrimp industry, and water pollution control agencies. The session was cosponsored by the PMRC and the Foundation for Bioaquatic Resources, FIRBA. The findings presented at the meeting were later published in the report A Study of Ecuador's Coastal Water Quality (Montaño et al., 1993), which has become a standard reference for researchers and agencies.

Overall results of the sampling effort

About 1,700 data points were produced from the characterization survey. The working group concluded that overall, coastal water quality in Ecuador is very good, but there are many spots that raise concern.

Table 5. Range of results of the PMRC sampling program carried out by the water quality working group.

Parameter	Study Block 1 (El Oro)	Study Block 2 (Guayaquil)	Study Block 3 (Rio Chone)	Study Block 4 (Esmeraldas)
Dissolved oxygen (mg/l)	5.3-10.2	3.25-7.85	5.23-7.73	4.3-8.7
Biochemical oxygen demand (mg/l)	0.1-3.2	0.35-14.3	0.85-5.13	0.9-5.1
Fecal coliforms, most probable number per 100 ml.	7-1,000,000	ND*- 1,000,000	ND- 240,000	40-240,000
Nitrite NO2 (µM)	ND-1.7	0.06- 2.55	0.25- 1.35	0.06- 0.44
Phosphate PO4 (µM)	0.11- 4.04	0.44- 4.15	0.11- 5.34	0.05- 5.94
Hydrocarbons (#181g/l chrysene equivalents)	0.63-2.9	1.02- 3.27	0.6-1.37	0.77- 8.85
Pesticides	ND	ND	ND	
Temperature (C)	21.5-28.9	21.7-27.5	25-28.2	23.2-29.8
PH	7.4-8	7.1-8.5	7.7-8.27	6.8-8.4
Salinity (o/oo)	0.4-30.6	0-25	0.5-34.5	0.4-35

ND = Not detected
µM = Micromolar

Table 5 shows the lowest and highest values found for the various parameters selected. Stations included freshwater sites from rivers discharging to the coast, as well as estuarine and ocean water. Although the sampling program includes only a portion of the country's coastal waters, the stations include many critical sites that enable the working group to draw conclusions useful for setting management priorities.

Dissolved oxygen. The values of the samples ranged from 3.25 to 10.2 milligrams per (mg/l). Taking into account that the values are affected by the time of day of the samples, the lowest values were found in the sites most heavily contaminated by pollution discharges in each block: in the Estero Pilo and Estero Salado, near the city of Guayaquil, which has no wastewater treatment; at Cinco Bocas, in the interior of the Rio Chone estuary, where villagers' latrines are located over the water; and at the outlet of the Atacames River, a tourist area with no wastewater collection or treatment.

Biochemical oxygen demand. This parameter, used to measure the organic loading of municipal wastewater, was from 0.1 to 14.3 mg/l. BOD is a concern when values are 5 mg/l or more (Masterton and Slowinski, 1979). Such elevated levels were found in Playas, near the town center; in Cinco Bocas, which also has low dissolved oxygen, and in the Esmeraldas River in the City of Esmeraldas.

Fecal coliforms. High bacteria levels were found in all the water bodies sampled by the working group. Levels so high as to indicate a water body that is essentially raw sewage are found at the mouth of the Estero El Morro, in the Playas-Posorja-Puerto El Morro ZEM, and in the Esmeraldas River. Gastrointestinal diseases, the most important type of infection in the coastal provinces, can be attributed in part to poor water quality.

The WQWG has placed great emphasis on improving its ability to measure nutrients, which are found in elevated levels near shrimp farms, agricultural areas, and coastal cities.

Nitrite. This nutrient is found in coastal waters and where present at elevated concentrations is usually produced by the oxidation of organic matter and residues from fertilizers. Values ranged from not detected to 2.55 µM. According to the Fundaci&oacuten Natura, uncontaminated water can have up to 0.2 µM of nitrite. This criterion is exceeded in Estero El Pilo, Canal del Morro (near the city of Posorja), Cinco Bocas in the Rio Chone estuary, and at the beaches of Súa.

Phosphate. Phosphate is another nutrient that, at elevated levels, can be attributed to fertilizer and domestic wastewater. Ketchum (1969) recommends 2.8 µg/l as a benchmark maximum value in uncontaminated waters. The surveys done by the WQWG found values ranging from 0.05 to 5.94 µg/l, with the most affected sites including the Jubones River, the mouth of the Estero El Morro, Cinco Bocas, and the Teaone River in Esmeraldas.

Hydrocarbons. The levels of petroleum hydrocarbons found during the sampling program generally were below levels considered harmful. Site-specific problems may exist near petroleum transport terminals and refineries. A recommended maximum for aquatic habitat is 3 µg/l chrysene equivalents, according to the Permanent Commission on the South Pacific (Gutiérrez, 1989). Samples taken by the WQWG had values between 0.6 and 8.85 µg/l. The values generally were less than 3 µg/l, with the exception of the Teaone River near the Esmeraldas refinery, where the highest levels were found.

Pesticides. Pesticides were not detected in water and sediment samples taken during the baseline characterization project. This is not to say that there is no concern about them, given their toxicity and prevalence of use in coastal agriculture (Ulloa, 1989). Attention should continue to be paid to the potential impacts of these substances.

Temperature. This parameter varied 21.5 C to 29.8 C, depending on the time of day, season, and location of the sampling station. Temperatures tend to be higher in Esmeraldas and the Rio Chone than in the Gulf of Guayaquil or El Oro.

pH. Samples showed a range from 6.8 to 8.5. In general, the lower values were found in river stations, with higher values in stations close to the ocean. There were no particular differences among the blocks.

Salinity. Samples varied from 0 to 35 parts per thousand (o/oo), depending on location of the site closer to rivers discharging to the coast or the open ocean. Sampling sites in Bahía de Caráquez and Esmeraldas showed higher salinities than in El Oro and Guayas due to the strong influence of the Jubones and Guayas rivers in those respective blocks.

Assessing water quality concerns of the shrimp mariculture industry and other national issues

Early work sponsored by the PMRC resulted in an initial compilation of water quality data along the coast by Robert Twilley; an institutional analysis of water quality management by Efrain Perez; and an inventory of current (1987) water quality monitoring activities prepared by José Vásconez. The priority set in the Year 3 (1988) work plan was water quality issues affecting shrimp farms. The WQWG was assigned the task of designing a data collection program that focused on priority problems that would make the best use of the analytical capabilities developed through the intercalibration and sampling work. The PRMC was unable to finance a major initiative in water quality monitoring and management for the coast on its own.

The WQWG was very active in preparing proposals for other sources of funding, but almost none of these was successful. The variety of ideas and initiatives is reflected below. Much of the work in the following projects was aimed at characterizations of the principal water bodies and expanding the knowledge base on the presence of pesticides in the coastal environment-an important concern of the mariculture industry:

- *Integrated Monitoring Plan for Water Quality Pertaining to Ecuador's Mariculture Industry.* Presented to the Association of Shrimp Growers in November 1988.

- *Study and Control of the Impact of Pesticides in the Shrimp Mariculture Industry Using Gas Chromatography.* Presented to the PMRC, the Fundaci&oacuten Maldonado, the National Commission on Science and Technology (CONACYT) and the National Planning Agency (CONADE) in March 1989; to the Agriculture Foundation (FUNDAGRO) in June 1989; and to the Foundation for Bioaquatic Resources in June 1990.

- *Monitoring Water Quality in the Estero Salado Along the Waterfront of the City of Guayaquil.* Presented to the Foundation to Rescue the Estero Salado in April 1989.

- *Evaluation of the Use of Mercury in the Gold Mining Activities of the Siete River.* Presented to the PMRC, USAID Quito, and Fundaci&oacuten Natura in December 1989. The search for funding for this proposal was carried out in part with the researchers from the University of Florida and the U.S. National Institutes of Health.

- *Proposal to Conduct Seminars on Monitoring and Analysis of Water Quality.* Presented to the Ecuadorian Institute of Credit for Education in October 1990.

- *Master Plan for Monitoring and Managing Water Quality.* Presented to the European Economic Community in October 1990.

An additional set of projects focusing on the shrimp mariculture industry was presented to the PMRC's Inter-American Development Bank loan project in May 1992, to the National Commission on Coastal Resources Management, to the Shrimp Producers Association, and to the Fundación Estuarium in Bahía de Caráquez:

- *Evaluation of the Nutritional Potential of Shrimp Ponds Located in the Rio Chone Estuary, by Analyzing Fatty Acids Using Gas Chromatography.*

- *Characterization of the Lipids in the Plankton of the Rio Chone Estuary for Use in Mariculture.*

- *Determination of the Impact of Pesticide Use in Agriculture on the Shrimp Industry in the Rio Chone Estuary.*

- *Microorganisms, Gastroenteric Pathogens in the Rio Chone Estuary and Their Implications for Mariculture, Tourism, Fisheries, and Habitat.*

- *Evaluation of Nutrient Loadings in the Rio Chone Estuary in Relationship to Shrimp Mariculture and Fisheries Habitat.*

- *Analysis of the Water Quality Problems of Shrimp Farmers in the Interior Estuary of the Gulf of Guayaquil. Presented to the City Council of Guayaquil.*

A series of conversations was held in 1990 with CEDEGE, which was preparing a project to control flooding in the lower Guayas basin, to be financed by the World Bank. The idea was to have the WQWG monitor the lower estuary and initiate a pesticides measurement laboratory. These ideas also did not bear fruit.

Lessons from the Water Quality Working Group Experience

The methods chosen to organize and implement water quality monitoring efforts are a critical factor for success in building reliable sets of information. The WQWG has succeeded in developing intercalibration methods to ensure that measurements being taken by investigators working in different parts of the coast, or at different times, will generate data that enjoy credibility, and therefore merit distribution.

The work of the WQWG has generated several valuable lessons for the PMRC and the nation to consider in addressing the water quality issue.

The working group is a successful setting for creating a productive collaboration among institutions.

The ability of the WQWG to main good relations among a diverse group with a wide range of interests can be attributed to several factors:

- Stability of the role of the members within their own organizations, which allowed them to commit to long-term involvement in the group;

- A multi-institutional focus that brought a variety of perspectives to the group;

- Collegial relationships, including social activities and friendships that were fostered among participants; and

- Effective coordination based on the participatory approach common to all PMRC endeavors, and on the creative use of ideas from organizational management.

It is essential to focus and to prioritize efforts. The scope of water quality issues cannot be underestimated, and was found to require greater resources and support than could be sustained by the PMRC.

The WQWG learned that in order to support its efforts, it was necessary to

- Provide an adequate minimum base of funding;

- Assure communication with and continuing assistance from the international community;

- Facilitate clear thinking about goals and objectives for sampling strategies and proposals for analysis;

- Provide training on water quality management, not only technical analysis; and

- Maintain a full-time coordinator to make best use of the time of the busy researchers.

Although the resources available to the group were limited, the WQWG has advanced in a

sustainable, coherent way, moving from monitoring of the simplest parameters to more complex investigations, and sharing resources and knowledge among institutions. In this way, the group was able to use scarce resources to produce considerable benefits.

Focusing on site-specific issues is more likely to build user group and municipal interest and support.

The water quality working group found it valuable to work with local volunteer collaborators, who helped conduct water quality monitoring. Trained volunteer groups, following standardized procedures, can play a crucial role in tracking conditions, highlighting problems, and identifying successes when they occur. For example, the PMRC water quality working group has become involved with more than 10 shrimp farmers in the Rio Chone estuary who are concerned about monitoring water quality conditions in the inner estuary.

Unfortunately, the goodwill shown by individual shrimp farmers did not extend to the Association of Shrimp Growers itself. Although the mandate of the WQWG required it to work for, and along with the mariculture industry, the shrimp farmers as a group have been reluctant to improve the knowledge base of their industry. As a result, the WQWG shifted its attention to working more closely with the technical staff of the PMRC, especially with the mangrove management working group, and with some of the special area management zones-in particular, in the Rio Chone estuary and the Atacames River. The working group assembled information on the Rio Chone and developed research proposals for the Inter-American Development Bank project efforts there. In the Atacames River, the working group contributed to the practical exercises in management, the user group agreement, and ZEM office staff training.

Public education should be viewed as an integral part of monitoring.

High schools in Machala have used local water bodies to learn basic chemistry, and with technical assistance and minimal funding can generate credible long-term data. Most shrimp farmers and shrimp laboratories have skilled technicians and chemical analysis equipment that could easily be put to use in the regular monitoring of basic parameters. A major obstacle here is the prevailing reluctance to share information. This could be overcome by getting shrimp farmers to collaborate on the initiatives of a municipality, serve on a ZEM committee, or form a local monitoring group.

There is a strong, unmet need for building a constituency and knowledge base for water quality management in Ecuador.

The PMRC can make major contributions by preparing monitoring protocols, training and organizing local groups, providing technical assistance in data compilation and interpretation, and providing independent verification of local results.

Reports prepared on coastal water quality issues related to shrimp mariculture by the U.S. Environmental Protection Agency in 1994, and for urban areas by USAID's Water and Sanitation for Health project in 1993, confirm the PMRC's own conclusions on the need for a major initiative on coastal water quality in the Guayas estuary and for all major coastal cities. Policies and actions on water quality management are included in all five ZEM plans.

Policies and Actions to Improve and Protect Water Quality in the Special Area Management Zones

The prospects for implementation of Ecuador's basic water law, which calls for setting water quality goals and management plans for all coastal and freshwater bodies, are not good at present. Even in locations where local and national officials are committed to improving water quality, Ecuador's financial situation provides little incentive for municipalities to make major investments in wastewater collection and treatment. Ecuadorian cities do not receive grants or donations for pollution control. Instead, they must repay the loans for wastewater collection and treatment

facilities, even though at present they are capable of recovering only 25 to 40 percent of their operating costs. Rural communities are eligible for a combination of grants and loans, but still must repay 50 percent of the costs. In contrast, the U.S. federal government, in its successful drive to clean up rivers, lakes, and estuaries in the 1970s and 1980s, paid the full amount of state costs for planning and design, and up to 75 percent of construction costs for publicly owned treatment works.

The WQWG did not enable the PMRC to become an effective advocate for policy reforms in water quality management, in part because the group remained focused on carrying its first two tasks-quality control in sampling and water quality monitoring. Its membership was drawn primarily from the technical community, rather than from decision-makers. The group also remained geographically focused on the Rio Guayas and Guayaquil urban area, while the PMRC had its most active field presence along the ocean-facing coast.

For the PMRC, the integrated coastal planning carried out in the ZEMs proved a much more effective way to become involved in water quality management as an issue, since vital economic and social interests such as fisheries, mariculture, environmental sanitation, and tourism were all being discussed by the ZEM committees. As a result, the ZEM plans contain a number of specific measures to protect and improve coastal water quality.

Water quality as a coastal management issue in the ZEMs

Water quality management became an important concern during the development of the ZEM plans, although initially no specific technical work was undertaken to characterize local issues. The ZEMs have many issues in common, but different local circumstances played an important role in shaping both the specific policies and actions contained in the plans.

For example, tourism is one of the most important economic activities in Atacames-S&uacutea-Muisne, so the Atacames beach and the lagoon and small river system behind the beach became a focal point for cleaning up residential discharges and small dumps. However, the presence of shrimp ponds in the river, which continues to suffer from low oxygen levels and sewage contamination, led to a controversy with a shrimp pond owner. The farmer, who had been experiencing water quality problems, attempted to cut a new water intake canal through a mangrove stand. The WQWG sampled the water in the Rio Atacames and the shrimp pond, and concluded that the new, illegal canal would not improve the farm, since the water in the new intake location was just as contaminated as the existing canal site. The ZEM is also located along the route that tankers take after loading petroleum from the refinery in Esmeraldas. This has generated considerable concern about refinery discharges to the Rio Esmeraldas to the east: Local residents wanted the ZEM plan to include actions to examine the potential impacts of hydrocarbon discharges on local fisheries resources.

The Rio Chone estuary in the **Bahía de Caráquez** ZEM faces similar issues, but on a larger scale. The town of Bahía discharges its untreated sewage and storm runoff close to its principal beach. In the slowly flushing interior of the estuary, some shrimp farmers have become concerned about the poor quality of water in locations where pond operators are discharging and pumping from the same stagnant channels. In an incident similar to the mariculture case in Rio Atacames, a shrimp pond operator recently cut four hectares of mangroves to create a new canal closer to the estuary side of the operation.

The high volume of daily water exchange between shrimp ponds and coastal waters is resulting in low oxygen levels and eutrophication. For example, it is estimated that shrimp farms exchange 1,000 cubic meters (m3) of estuary water per second-25 times the average flow of the Rio Chone. Evidence of eutrophication has been found in Cinco Bocas, in the middle of the most heavily developed section of the estuary. In the Rio Guayas, shrimp farms pump about 1,700 m3/second, which is equivalent to the average flow of all rivers in the provinces of Manabí, Guayas, and El Oro.

The PMRC intends to prepare a more detailed, integrated water quality and estuary management plan for the Rio Chone.

The **San Pedro-Valdivia-Manglaralto** ZEM has very poor sanitary conditions in some of the coastal villages, making basic sewage and solid waste disposal a priority concern. In addition, the large number of shrimp laboratories in the ZEM, which lies just north of "hatchery row" on the Santa Elena peninsula, has raised local concerns about the direct discharges to the beaches of hatchery effluents, which contain antibiotics and other contaminants. The shortage of fresh water in this ZEM also makes residents conscious and concerned about the need to protect freshwater supplies from contamination. The ZEM plan specifically calls for the establishment of a volunteer water quality monitoring effort.

A principal concern in the Playas-Posorja-Puerto El Morro ZEM is water quality along the important tourist beach, as well as the effect of fish processing in Posorja. The problem in Playas is compounded by the presence of fish offloading and cleaning on the beach just a few hundred meters from the tourist area, and the poor stormwater drainage that often floods the fish-waste contaminated section of the beach. This ZEM plan also incorporates a volunteer monitoring proposal.

The Machala-Puerto Bolívar-Isla Jambelí ZEM has two types of water quality problems. The first affects the tourist beach cleanup and sanitation. A much more complex problem exists due to the presence of the city of Machala, where the watewater from more than 200,000 people finds its way through sewers, storm run-off, and direct discharges to the Estero Santa Rosa. The complex mangrove/mariculture-dominated coastline also receives the river discharges of the Santa Rosa, Jobones, and Siete rivers, which drain the extensive banana plantations of El Oro province, as well as the coastal mountains, where gold mining and soil erosion contaminate the rivers. With extensive shorefront barrios that have no sanitation facilities, this was among the first parts of Ecuador to experience the cholera epidemic of 1991-1992.

An Example of Problem Identification and Water Quality Sampling Analysis in the Rio Chone Estuary

Sampling scheme

The PMRC has sponsored six sampling efforts in the Rio Chone: two in 1989 (May 11, August 15); two in 1990 (April 9 and October 21); one in 1991 (February 24); and one in 1993 (April 19). In addition, a private firm carried out two sampling runs in 1987 (December 2 and May 12), along with the Manabí Water Project, which did sampling in 1988 (April 7).

Figure 2 shows the location of the WQWG's nine sampling stations. The shrimp industry is located primarily between Puerto Ebano and Barquero. In the last field sampling event, shrimp farm discharges near station 7A were also tested.

Key parameters for monitoring

The water used by shrimp farmers should be monitored for a variety of physical, chemical, and biological parameters, but a few simple indicators reveal much about the overall condition of the water body. Dissolved oxygen is essential, since shrimp take up oxygen through respiration and use it to oxidize the nutrients they consume. Low levels of oxygen stress in the juvenile shrimp, retard growth, and, in extreme cases, cause asphyxiation.

Results and conclusions

The table presents the oxygen levels in the sites of greatest concentration of shrimp farms during different seasons. The lowest value encountered was 2.0 mg/l in October 1990, and the highest was 9.2 mg/l in April 1993, in the station near Salinas.

The level of oxygen is affected by changes in seasons and climatic conditions. During the dry period of 1990, dissolved oxygen was low throughout the summer. In the winter of 1993, which had heavy rains, dissolved oxygen was generally higher. Generally, dissolved oxygen is higher in winter than in summer, at high tide rather than low tide, and at the mouth of the estuary, as compared to the interior. Near the shrimp farms at station 7, oxygen levels were consistently depleted.

The nutrients that best indicate a source of contamination are ammonium, nitrite, nitrate, and phosphate. The nitrogen forms and phosphate indicate overfertilization of shrimp ponds. As the table indicates, in 1993 the concentration of ammonium at the discharge of the shrimp pond was four times the level of the nearby estuary, while nitrite levels were twice as high, and phosphate 1.5 times higher.

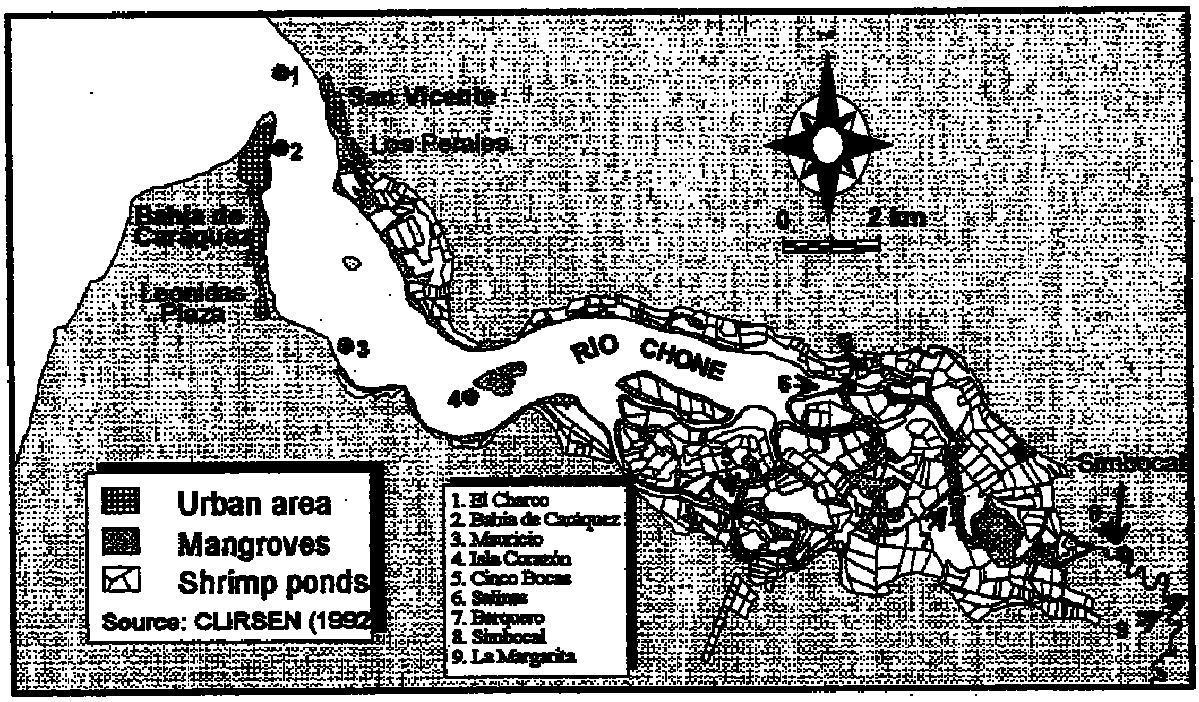


Figure 2. Location of sampling stations in the Rio Chone.

Table 6. Results of sampling in the Rio Chone Estuary.

Parameter	Date and site	Station 5	Station 6	Station 7	Station 7A*
Dissolved oxygen	87 Dec 2		6.9	4.7	
(mg/l)	87 May 12		6.2	5.6	
	89 May 11	5.9			
	89 Aug 15	5.2			
	90 Apr 9	4.0	4.0	6.0	
	90 Oct 21	2.7	2.0	4.5	
	91 Feb 24	5.5	6.6	6.6	
	93 Apr 19	8.2	9.2	4.5	3.8
Ammonium	87 Dec 2		1.10	1.70	
NH3 (µM)	93 Apr 19	ND	0.72	0.67	2.56
Nitrite	89 May 11	0.27			
NO2 (µM)	89 Apr 15	1.35			
	90 Aug 9	1.03	0.97	0.37	
	90 Oct 21	1.00	1.15	1.00	
	91 Feb 24	0.86	1.08	1.08	
	93 APR 19	0.49	0.35	0.33	0.62
Phosphate	89 May 11	1.50			
PO4 (µM)	89 Aug 15	5.34			
	90 Apr 9	4.27	9.26	5.71	
	90 Oct 21	4.18	8.63	10.11	
	91 Feb 24	7.69	15.90	16.01	
	93 Apr 19	4.31	5.07	7.22	11.75

* Discharges from the Telson and Rostrum shrimp farm

The PMRC has had very little funding for water quality management activities. However, a number of important actions have taken place in some ZEMs, which help indicate the growing interest in and support for water quality monitoring and pollution control. These are discussed in the following section. PMRC work in implementing latrine construction and other basic sanitation projects is discussed by Vasconez (see page 119). A new study of pollution sources and water quality is being undertaken prior to the design of an expanded sewer and wastewater treatment system in Machala-the only coastal city where such a study is being conducted.

Table 7 indicates how the ZEM plans have incorporated local water quality concerns and proposed a wide range of water quality management actions, including site-specific water quality plans, public education, monitoring, and pollution control.

The PMRC used practical exercises such as latrine construction, beach cleanups, and solid waste collection to explore how coastal villages in the ZEMs could improve environmental quality and health conditions through local initiatives. The results of these practical exercises showed the importance of education, involvement, and follow-through in even the smallest project-a feature missing from the many failed sanitation projects along Ecuador's coast.

Environmental sanitation committees have proven to be a key tool for long-term success in improving the conditions of coastal communities. Within the ZEMs, these groups should play the following roles:

- Form part of the special area zone committee and keep it updated on the problems and activities of its location;

- Actively participate in education campaigns related to water and land use and preventing pollution prevention;

- Monitor local water bodies to help prevent contamination and participate in watershed protection activities to maintain the natural water regime; and

- Provide annual reports to both the community and the PMRC.

An Approach To Water Quality Protection In Ecuador's Coastal Region

The key question in water quality management in Ecuador today is whether the PMRC can manage to instigate a much-needed national dialogue on coastal water quality and exert the necessary leadership to generate a commitment to act.

One of the principal reasons for the WQWG's inability to attract significant funding for water quality monitoring is the low level of public awareness or a constituency for water pollution control as an issue in Ecuador. The PMRC has enjoyed success in creating national and local constituencies for integrated coastal management, and has effectively used the ZEMs to make tangible progress in coastal management at the local level. Unfortunately, there has not been a similar effective advocacy campaign for water quality management. If the PMRC were to choose to fill this leadership and policy vacuum, it would have to carry out three new strategies:

- Build public awareness and understanding of coastal water quality issues;

- Select and establish site-specific goals and objectives for priority water bodies; and

- Guide and promote public investments in pollution control.

The PMRC is probably in the best position at present to spark interest in water quality coastwide, and should use the ZEMs to demonstrate how policies can be translated into effective action.

Building public awareness and understanding of water quality issues

The strategy for mariculture set out by the PMRC in 1986 accurately foresaw the onset of water quality as a major challenge to the sustainability of the industry. In 1994, environmental concerns finally reached the foreground for many shrimp farmers, although perhaps too late. An August 1994 report by the U.S. Environmental Protection Agency (EPA) on the Taura Syndrome in the Guayas estuary stressed the need for a collaborative effort to improve and protect the environmental quality of the Gulf of Guayaquil.

From the national perspective, the mariculture industry is probably the most important stake- holder for clean coastal waters. The PMRC has tried to do just what the EPA recommends in building a collaborative effort, and has found it difficult to engage the mariculture industry in productive dialogue at the national level. The PMRC is achieving the most success by working to build relationships, setting innovative policies, and carrying out joint actions in the ZEMs. The participation of shrimp farmers in PMRC program activities at the local level is now increasing, after a long period of disinterest and skepticism.

The PMRC can take the following steps to break through the current barrier of inertia and discouragement that has characterized coastal water quality management in Ecuador:

- Develop water quality monitoring and characterization protocols, and provide training and technical assistance to the WQWG to work coastwide and in site-specific areas to compile and interpret monitoring information.

- Foster local education on water quality and sanitation, and encourage community-based monitoring. Generating public attention and concern is feasible at the local level through talks, field trips, working with schoolchildren, river cleanup activities, short-term water sampling exercises, interviews with

tourists on their perceptions of the quality of beaches and tourism, training programs on community and personal sanitation, and response to local issues that pertain to pollution.

- Prepare and disclose the results of identification of local pollution sources by working with national and municipal authorities and the Ranger Corps.

- Publish annual assessments of the status of coastal water quality and pollution control activities in specific reaches of the coast, focusing on the themes of mariculture, tourism, and public health.

Through its work in the ZEMs, the PMRC has found it much easier to build awareness and concern at the local level, even when only small amounts of scientific data could be assembled to provide hard evidence that bolsters arguments on the need to control or prevent contamination Montafio of coastal water bodies. This may be due in large measure to the fact that many of the pollution Robadue problems faced in the ZEMs are obvious, from the tiny Rio Atacames where residents had traditionally disposed of garbage and raw sewage, to the large coastal city of Machala, which has no wastewater treatment system.

The PMRC needs to work with regional environmental groups to put greater emphasis on water quality issues in provincial governments and national agencies.

Establishing site-specific goals and objectives for coastal water bodies

By putting goals and objectives into place, information on waste loads from all sources can be combined with knowledge of ambient conditions and desired uses in order to accurately assign responsibility to all dischargers. In addition, a site-specific pollution control plan can help convince local and national government that implementation of pollution control laws is worth-while.

Generating the facts to characterize local water quality concerns is a major challenge in itself, but the PMRC has shown that it can be accomplished. Setting the direction for resolving pollution control problems-especially in the absence of a functioning national pollution control framework, is a more difficult and longer-range task. The PMRC can apply the fundamental elements of the ZEM process to set goals and tangible objectives for the condition and use of coastal ecosystems by

- Designating priority areas for the establishment of water quality standards and promoting local agreements to guide pollution control initiatives; and

- Setting goals for a coastal water body that build on monitoring information, as well as discussing desired uses for a coastal water body.

Data on existing conditions should be compared with water quality standards to determine whether the desired uses can be supported, and what improvements are needed. Areas of concern range from beaches, where bacteria can pose a significant public health problem, to the more complicated and multifaceted water quality issues found in shrimp ponds.

Water quality in and around shrimp ponds can be collected locally, and should be shared, analyzed, and discussed with shrimp farmers, community members, and public officials. More sophisticated questions-such as those about the impact of new technology or industrial processes-need to involve national and international researchers. Many ZEM residents are anxious to find out more about the possible impacts and control options of currently unregulated industrial practices.

The PMRC can start the work of setting and implementing pollution control programs aimed at achieving water quality standards, beginning in its own ZEMs, with the idea that areas of national importance such as the shrimp farms in the vicinity of Guayaquil and the tourist center of Salinas La Libertad can learn from and model this approach as well.

Guiding and promoting public investments in pollution control

Success in creating new constituencies for water quality management must be accompanied by an increase in national and local capacity to invest in the required solutions. The National Commission for Coastal Resources Management can play the role of catalyst in getting health and sanitation authorities to work together to address the public sector contribution to water quality management by

- Establishing agreements with agencies authorized by the water law to conduct water quality planning for selected areas and to maintain public information and files on the results of these programs;

- Working with the private sector-including shrimp farmers, businesses, port facilities, and other marine user groups-to examine current waste disposal practices and establish viable control strategies, possibly including a transparent permit system; and

- Sponsoring economic and social impact analyses of the importance of improving and maintaining water quality in targeted areas. Identify future economic development options, such as shellfish culture and exports, and new tourism investments, which will depend on a credible method of monitoring and supervising water quality conditions.

Some coastal cities in Ecuador are responding to the need to improve their basic services. For example, during the USAID study, the city of Machala was already preparing to enter into an agreement with the Ecuador State Bank to design and construct new wastewater collection and treatment facilities. Other coastal cities within the ZEMs that are pursuing urban sewage and stormwater management projects include Playas and Bahia de Caraquez. In addition, several municipalities in the fast-growing, tourist-oriented areas of the Salinas peninsula are developing projects. These include Salinas, La Libertad, and Santa Elena.

The financial resources already exist to enable the PMRC, through its Inter-American Development Bank project, to carry out important elements of the three strategies listed above over the next few years. Funds have been allocated for water quality monitoring activities, training and organizing of local monitoring groups, preparation of water quality standards in the ZEMs and other critical coastal areas, and publication of guidelines and status reports on water quality issues on the coast. By themselves, these activities will have a small, positive effect on individual water courses, lagoons, or beaches. When treated as part of a broader strategy, however, these same actions will have a national impact.

Environmental Sanitation Management

José Vasconez

Ecuador’s coastal cities and villages lack both basic sanitation services and active programs to protect and improve environmental quality. The seriousness of the deficiencies in drinking water, sewage disposal, and solid waste collection requires large investments will be needed in remedial facilities, as well as massive campaigns to provide basic sanitation and hygiene education.

Coastal cities such as Guayaquil, Machala, Esmeraldas, and Bahía de Caráquez have been unable to meet the demands of growing populations since 1974. In these cities, drinking water is not fit for consumption. The water that many urban residents receive by tank truck is equally undrinkable. Wastewater disposal is also inadequate. Only the smaller cities of Manta and Bahía de Caráquez have any system for treating raw sewage before it is discharged to coastal waters. Manta's oxidation lagoons have never been evaluated for their effectiveness, while the system in Bahía was never completed, and is not maintained. The other, larger urban centers simply collect and discharge the sewage directly to nearby rivers and estuaries.

The story again repeats itself for solid waste disposal. Collection systems offer only partial coverage of urban areas, and the methods of disposal generally are open pits or piles, or river banks where tides and river flow wash waste out to the coastline.

All of these systems suffer serious maintenance, administrative, and financial problems. The larger cities have recognized their needs, and have taken some actions to reverse the trend of declining coverage and quality of service. In the past four years, large investments have been made to improve freshwater supply to Guayaquil, Esmeraldas, Bahía de Caráquez, and Machala. Studies are also underway in these cities to upgrade wastewater disposal and treatment. Feasibility studies are being prepared for solid waste collection in many places, except Guayaquil, which has already moved to a private contractor system for collection and disposal. The municipal development project of the Ecuador State Bank is financing a large proportion of these initiatives.

In rural areas of the coast, the provision of basic services has declined as population growth and absence of projects have caused a drop in areas served by water systems-from 20 percent in 1982 to 17.4 percent in 1990. However, rural sanitation problems do not require such large financial investments and technically complex solutions as urban problems.

Although the special area management (ZEM) project did not originally plan to address environmental sanitation as a theme, it became clear during the community participation process that these basic needs have an important effect on the quality of life of coastal residents, as well as on coastal ecosystems. The ZEMs offer abundant examples of how careless waste disposal is damaging community life and local environments. Coastal-dependent economic activities, such as tourism, shrimp farms, and fisheries are all showing negative effects. As a result, each ZEM plan now contains a chapter of policies and findings on environmental sanitation topics. The issues surrounding water supply and waste disposal have also generated considerable public interest in the PMRC's efforts, since the participatory methods used to work on individual projects can be transferred to work with communities in an integrated fashion.

The Institutional Framework for Environmental Sanitation

The absence of planning, financing, and local participation has meant that for some time the projects initiated in communities have not been able to come close to meeting environmental sanitation needs. Several national agencies and nongovernmental organizations work in the field of environmental sanitation-for the most part, without talking to each other. The diversity of entities has produced an equally wide array of design standards, policies, and approaches for carrying out projects.

The Ecuadorian Sanitary Works Agency (IEOS) is charged with planning, design, and implementation of basic infrastructure at the national level. IEOS has a set of policies that it applies to its community projects:

- Any community that seeks to carry out a project financed through the government must form a water supply and wastewater treatment agency.
- This agency is a democratic organization, with an elected board of directors drawn from the community.
- User fees must be charged to cover all the costs of operating facilities and services.
- The residents must provide 25 percent of the cost of a works project, in labor, materials, or cash.

However, IEOS takes a sectoral approach to its projects, and focuses attention on the local agency during the planning, construction, and operation phases. There is no opportunity for community groups or the municipal government to become involved in setting priorities or designing the project.

There are hundreds of water and sewer projects planned, designed, and constructed according to IEOS specifications. Most of these are not currently in service because of poor follow-up, lack of maintenance, or administrative or technical problems. Supervision and monitoring must take place after a project is built until it is running properly and on a stable financial footing.

Municipalities and provincial councils often undertake projects with their own or external funding, without working with IEOS. The Ecuador State Bank has become the most important funding source for public sanitation works. The primary source of its resources are the World Bank, the Inter-American Development Bank, and capital of the bank itself, through the Municipal Development Program. In late 1993, the Municipal Development Program created a special line of credit, with initial capital of US $10 million dedicated to basic sanitation projects. Half the funds were in essence a grant, communities had to match with 20 percent of costs, and municipalities financed the remaining 30 percent at commercial interest rates. As of the first year of availability, not a single municipality had pursued this credit. The success of the program’s projects is likely to improve if it can more actively involve the municipalities in project planning, and help make them better organized and capable of setting fee structures that assure long-term success.

The Ministry of Health is carrying out a large program, FASBASE, to improve health services and sanitary conditions in rural areas and urban barrios, with funding from the World Bank. Regional development organizations-such as the Center for the Redevelopment of Manabí (CRM), the Commission for the Study of the Guayas River (CEDEGE) and PREDESUR, which handles development in the country's southern provinces-also initiate similar projects. Several nongovernmental groups specialize in projects in the poorest urban neighborhoods and rural locations.

Environmental Sanitation Problems in the ZEMS

Water use and water quality problems receive little public attention, except in the few major estuaries and rivers where pollution is so severe that restoration efforts are finally underway. The general trend along the coast is continued degradation of rivers, estuaries, and coastal water bodies.

The most important problems found in the ZEMs include raw sewage discharged to the Atacames River and from small communities to the Rio Chone estuary; depletion of freshwater supplies in the wells serving Olón and Manglaralto; fecal coliform contamination along the tourist beaches of Playas during the peak season; and declining water quality in tidal inlets used by shrimp farmers near Machala and Puerto Bolívar in the Estero Huayla and Estero Macho.

Much of the problem with inappropriate human waste disposal can be traced to the absence of good personal hygiene practices or of sanitation education. This is given relatively little attention by health officials and other authorities. Similar deficiencies in personal practices and knowledge can be found in

areas that lack clean drinking water, and where the local population does not boil its water to prevent the transmission of cholera, typhoid, and hepatitis. Water pollution is not an important issue to people living along the coast. This is reflected in the lack of concern about whether raw sewage is discharged without treatment, and in the common practice of dumping garbage on river banks.

Table 1. Summary of actions and results of environmental sanitation projects

Initiative	Strategy	Specificactions	Results
Public education and awareness	Initiate sanitary education and cleanup campaigns in villages and beaches.	Presentations on household hygiene practices; community cleanup days.	Improvement in personal hygiene practices. Recognition of need for local facilities to protect health and local environment.
Practical exercises 1989-90	Strengthen PMRC's ability to help local residents carry out community projects from design to administration.	Solid waste collection in Atacames; rehabilitation of water cisterns and wells in El Morro, Puerto El Morro, water cistern in Jambelí island.	Greater overall involvement of communities in PMRC's activities. High participation constructing the projects. Very poor follow-up.
Practical exercises 1990-91	Same as above.	Drinking water well for Galera, done in conjunction with Social Security Agency program; waste receptacles on Playas tourist beach.	Greater involvement in PMRC's activities and successful construction phase. No follow-up on either project.
Practical exercises 1991-92	Improve the planning and implementation of sanitation projects with more community involvement.	Construction of 40 latrines in San Pedro.	Initial enthusiasm of participants not followed with education campaign. Not successful.
Practical exercises 1992-93	Improve the planning and implementation of projects with local participation and involving other authorities.	Technical assistance in a solid waste service for Atacames; improvement of similar services for Súa; latrines for Salínas and solid waste collection in Canoa; latrines for Data de Posorja and Data de Villamil; solid waste collection on Jambelí island.	Awareness and education campaigns preceded successful projects, with high level of beneficiary involvement and shifts in personal hygiene and local sanitary practices.

The Role of the PMRC in Searching for Solutions

The PMRC sought the assistance of IEOS early on in the preparation for the ZEM planning process. Joint meetings were held among staff from both groups in 1988 to assess the sanitation situation in each ZEM. The result of these field trips, interviews, and discussions formed the basis of the environmental sanitation profiles. The following year, practical exercises were introduced to the ZEMs. The communities frequently proposed sanitation and water projects, examples of which are discussed below. All five ZEM plans devote an entire chapter to identifying policies and actions needed to provide basic services and improve the sanitation aspects of living conditions. All of this work led to the inclusion of a component on environmental sanitation in the Inter-American Development Bank project. In the final approved loan design, the largest single element was water, solid waste, and wastewater projects.

Formulating a solution to sanitation problems

The basic method used to plan and implement infrastructure projects contains the following elements:

- Help organize villages through environmental sanitation committees. The majority of these

communities do not have associations that facilitate work with all the residents. The committees focus attention on the various dimensions of coastal management and the objectives of the PMRC. Each ZEM office has been responsible for the organization phase.

- Compile and prioritize the sanitation projects in the ZEM-a role carried out by the ZEM advisory committees.

- Prepare a technical design for the problem, giving particular attention to the administration of the project once it is built. This was typically done by PMRC staff, then reviewed locally.

- Implement the projects with the direct participation of beneficiaries, including matching contributions of materials, labor, or cash. The Fundación Maldonado provided assistance in this element, along with the ZEM offices and beneficiary group representatives.

- Provide follow-up to assure that financial matters were handled properly, and that technical problems are solved in the operation phase. This is an important role for the ZEM office and support groups such as the Fundación Maldonado.

ZEM plan policies and actions

The rich mix of technical analysis, public debate, and practical exercises strengthened the quality of the environmental sanitation policies and actions chapter in each ZEM plan. The policies promote the expansion of basic services, restoration of the quality of coastal water bodies, and improvement of the hygienic practices of coastal residents.

Since the needs of coastal communities is overwhelming, it was essential to set priorities in the implementation of the ZEM plans. This was done through the consultation process during final public reviews in each ZEM. The level of participation by communities improved as a result of awareness and education efforts led by the ZEM offices. By working simultaneously in the five ZEMs, the PMRC encountered and addressed a wide range of situations. The experience has been a good training opportunity for each ZEM team. The Inter-American Development Bank project will provide about $3 million, with a 30 percent local match, to help 36 communities fulfill needs for 18 drinking water systems, 5,600 latrines in 26 different localities, and solid waste collection and disposal systems. These will benefit an estimated 41,470 people.

Implementing just these projects, which are a fraction of the needs in the coast, is a large, complex undertaking. CARE has been selected by the Government of Ecuador to be the lead agency, given its broad base of worldwide experience and a working style fully compatible with the PMRC.

Case Studies

A number of practical exercises in the ZEMs pertained to improvements in solid waste disposal, water supply, and wastewater treatment. This section examines three cases that are typical of the range of situations and issues that arose as the PMRC worked with communities to learn how to successfully carry out these small projects.

Solid waste collection and disposal in Atacames

Selection and design

There were four key objectives for this initiative:

- Initiate a low-cost, efficient system for solid waste collection along the tourist beach of Atacames;

- Involve the users of the system in the planning and operations;
- Improve the water quality of the Atacames River; and
- Maintain the attractiveness of the Atacames area for tourists.

The preparation of this project occurred at the same time that the mangrove boardwalk was being constructed to enhance ecological tourism offerings. In the early site visits to the river to design a tour, the community and PMRC staff encountered considerable quantities of garbage along the river banks. This had to be removed and prevented from reoccurring if a tourist trip along the river was to be attractive. Two groups interested in the projects formed a local environmental sanitation committee, which included hotel operators, the caipiriñeros (drink vendors) from Atacames beach, and the association of tourism operators.

The first step was planning and implementation of a large cleanup campaign along the river, from its mouth to the mangrove preserve, which mobilized residents and local and provincial authorities. With loaned equipment and a strong turnout, the entire river was cleaned of waste.

Following this successful event, the sanitation committee initiated planning for a regular system of solid waste collection. Funding was not a problem for project start-up, because the initial system was simple: a mule and cart made periodic trips through the village streets and hauled material to a disposal site away from the Atacames River. The sanitation committee decided to charge a small fee to finance the waste collection system. The service area centered on the sector of Atacames that had hotels and cabanas. This temporary measure was enough to maintain the gains of the river cleanup campaign.

Technical and financial resources

The project received initial financial support from the PMRC, as well as technical assistance from the Technical Directorate in Guayaquil. The Atacames ZEM office provided continuous coordination and support, along with collaboration from the governor's office in Esmeraldas and the provincial health directorate. Administration and planning of the projects was supervised by the Fundación Pedro Vicente Maldonado as part of their work managing the practical exercises program throughout the ZEMs. The PMRC funded the construction of the cart, while the community provided the mules used in the service. The waste collection system was governed by a formal agreement between the Atacames sanitation committee and the Fundación Maldonado. The collection service worked well during the entire period it was handled by the sanitation committee. When Atacames succeeded in its petition to become a canton and municipality, the newly elected authorities decided to take over the management of the system.

Project impacts

The direct impacts of the project were:

- Organization and training of residents and hotel owners to resolve the solid waste disposal problem;
- Improvement in the cleanliness of the tourist areas in Atacames, with full coverage of the sector, and full participation of hotel owners and businesses;
- Cleanup of the banks of the Atacames River, and awareness-raising about the trash disposal problem; and
- Strengthening of the ZEM process and the development of effective methods for working in the ZEM.

Lessons from experience

The Atacames river cleanup experience provided the PMRC staff with valuable lessons on how to work effectively with small coastal communities:

- The creativity and initiative of the sanitation committee and the ZEM office made it possible to address the problem directly without petitions, paperwork, or pleading with outside authorities to solve the problem;

- Organized and trained community residents could successfully operate sanitary services without major interventions by government agencies;

- Public awareness, education, and training made it possible for the system to be self-financing once it reached an acceptable quality of service;

- Unresolved issues faced by the volunteer initiative included the legal basis for the user fee, the formal creation of the organization running the system, and building of administrative and technical capacity; and

- The success of the Atacames project served to motivate other coastal communities to try the same approach, for example in the village of Salínas (Bahía ZEM), Jambelí (Machala ZEM), and San Pedro (Manglaralto ZEM).

Latrines in San Pedro

Selection and design

The objectives of the project were to

- Carry out a pilot project in latrine construction;
- Change the hygienic practices of residents; and
- Apply the participatory methods used by the PMRC in planning and implementation of the project.

A major part of the population lives on the side of a hill that has no vegetative cover. Since the village streets are unpaved and there is no storm drainage system, large muddy areas form that serve as a means of transmitting infectious diseases.

Since 1991, San Pedro has not had access to potable water; people defecate in the open, especially on the beach; solid waste is thrown into disposal sites on the banks of the two tidal inlets that run through the village; and domestic animals such as cats, dogs, pigs, and chickens walk freely through the streets and leave their droppings everywhere.

The cholera epidemic in 1991 hit hardest in rural communities with no basic services, and where local personal hygiene fostered the transmission of disease. Not surprisingly, San Pedro was one of the unfortunate places that suffered from the outbreak.

The villagers decided to work to improve the environmental quality and their hygienic practices. They formed a public health committee that worked with the local health clinic, the PMRC office in the ZEM, and other institutions to initiate actions to correct the problem. The ZEM advisory committee felt that latrine construction was required throughout its area. The PMRC staff assisted by helping design a pilot project that would build a total of 40 latrines in two stages. The Fundación Maldonado managed the project. The groups met with the project beneficiaries to establish the design, construction, and financing criteria for the first stage of work. Agreements were signed with each participant.

Technical and financial resources

The Fundación Maldonado took on the task of public education and project oversight, while the PMRC staff in Guayaquil provided technical assistance. The San Pedro public health committee was the local

counterpart who selected the families, and took lead responsibility for implementing the cooperative agreement with the Fundación.

The PMRC recommended the use of a VIP-type latrine, which has been used with great success in World Bank-funded projects in many countries. Detailed construction budgets were prepared, and local meetings were held to review the basic characteristics of the latrines and the construction details required in order for them to work properly over the expected life of each unit.
Half of the cost of the project was to be financed through the PMRC, with the remainder supported through beneficiary contributions in labor, materials, or cash.

Project impacts

The implementation of the first stage of the project encountered a number of difficulties, and did not produce the intended results:

- Latrines were built without following plans, and critical engineering details were omitted. Only about one-third of the latrines were properly constructed.
- Local hygiene customs changed little.
- The public health committee was strengthened, and it was in most cases successful in obtaining the matching contribution from project beneficiaries.
- The PMRC method of working with community groups in the ZEM was only partly followed.

Lessons from experience

- Although the community of San Pedro was a good candidate for initiating the project, the project did not succeed because of improper construction of the latrines, and a weak education process.
- The participation process favored by the PMRC was not adequate, due to poor coordination among the ZEM office, the public health committee, and the Fundación Maldonado.
- The ZEM office staff were not trained in providing the needed support and follow-up in the public education process, in construction of the latrines, or in following up on their use and maintenance.
- Project beneficiaries did not change their personal hygiene habitats, nor was any change observed in the community.
- Beneficiary matching contributions were slow to materialize.
- Resolving the problems that appeared during the implementation of the latrine project will be much more costly and time-consuming than taking the appropriate measures to avoid them in the first place.

Latrines in Data de Villamil and Data de Posorja

Selection and design

This project had the same objectives as the program in San Pedro. The ZEM advisory committee in Playas-Posorja-Puerto El Morro decided in 1991 that it was essential to carry out a pilot project in latrine construction for the communities of Data de Villamil and Data de Posorja. In 1992, a project proposal was submitted to the PMRC and incorporated in the national work plan. Twenty latrines were to be built in each of the villages.

During the planning of the project, the Fundación Maldonado placed a strong emphasis on working to organize the communities and to carry out a program of sanitation education and training with the residents, especially the group of potential beneficiaries.

Technical and financial resources

Before beginning this work, the ZEM office staff in Playas and the other ZEMs were provided with training on basic elements of sanitation and on the process for working to build community interest and participation. The PMRC, the national sanitary works agency, and CARE all participated in the training session.

The beneficiaries of the latrine project were selected by their own communities after having shown interest through participation in the early meetings. The villages were also responsible for assembling the matching contributions, coordinating the construction project, and assuring that people participated in the training projects.

The PMRC technical staff in Guayaquil prepared the engineering design, taking into consideration the cost, technical complexity, administrative capacity, and education level of the communities. The VIP design was again chosen, especially in view of the absence of potable water in the villages. The technical staff, ZEM office, Fundación Maldonado, and villages worked closely together at each stage.

The PMRC offered to cover half of the project costs, to be matched equally by the beneficiaries. Administrative and logistical expenses for technical advisors and the education efforts were not charged to the latrine project budget. In a majority of cases, the beneficiaries provided more than their minimum share of the costs.

The villages made an arrangement with the rector of the "Rashid Torbay de Playas" school to provide follow-up to the project. Senior students made visits to the communities to check the status of the latrines and to help with the sanitation education sessions.

Project impacts

The more careful project planning and implementation procedures used in Data de Villamil and Data de Posorja had a number of positive effects:

- The objectives of the project were fully accomplished, and the sanitation conditions of the communities improved substantially;
- The constituency for the PMRC in the communities expanded considerably, both in the number of people and the depth of interest, due to the effort put into public education;
- The two communities were able to strengthen their local organization, which previously was not possible, and served to inspire self-development efforts;
- There was a noticeable change in the personal hygiene customs resulting from the education program conducted before, during, and after the construction of the latrines; and
- The attitude of village residents toward the environmental and health reasons for building and using latrines became positive.

Lessons from experience

- Proper use of the participatory methods of the PMRC enabled community and user groups to develop creative solutions to their own problems;

- The Fundación Maldonado made effective use of basic principles, such as community organization, sanitary and environmental education, training, and motivation;
- The project gained the support and assistance of the national sanitary works agency;
- Providing technical assistance throughout the project ensured that the latrines were properly built;
- The ZEM office staff received enough training to carry out their work, and took great pride in the success of the project; and
- The changes in personal hygiene adopted by the projected beneficiaries became accepted by the communities as a whole.

The PMRC Strategy for Environmental Sanitation

The PMRC has as one of its primary objectives the reduction and control of environmental degradation of estuaries, mangroves, and other resources. Environmental sanitation is viewed as a key issue in coastal management. The PMRC views this issue as the need to eliminate the health and environmental risks caused by human settlements and the creation of healthy environmental conditions. The PMRC experience has centered on rural communities and marginal urban barrios, where drinking water, sewage disposal, solid waste collection, and control of pollution are common. The approach is the same in both settings:

- Sanitary education;
- Fostering home health and cleanliness;
- Organization of user groups; and
- Creation of a participatory process where consensus-based decisions yield choices that are respected by the community as a whole.

The PMRC's experiences have shown that this is the correct direction to pursue, and in doing so should consider the following guidance in setting priorities and initiating programs:

1. Highlight rural sanitation in coastal communities as a national issue.

There has been no progress in confronting the worsening environmental sanitation situation along the coast in the past decade, and recent trends offer little hope that a sudden change in government interest will occur. The PMRC must focus national attention on the need to implement actions in collaboration with communities.

2. Use environmental sanitation as a link to coastal management issues and sustainable development.

Once a sanitation project has been completed with the assistance of the PMRC, the program must reduce its role and encourage local and national authorities to provide follow-up. The emphasis of the PMRC should be on coordination, planning, and fostering local participation in integrated coastal management.

3. Work closely with municipalities.

Local government has an essential role to play in improving water supply, wastewater control, and solid waste disposal services. The PMRC must ensure their involvement in every phase of project planning and

implementation. Municipalities need to learn from the PMRC how to undertake the public education and community organization tasks that have proven to be vital to long-term success.

4. Recognize that public awareness and education are critical for success.

Raising community consciousness and knowledge about sanitary practices and conditions must continue to be a central feature of environmental sanitation projects. PMRC experience clearly shows that the construction of facilities alone will have few long-term benefits. Results of latrine construction and small water supply and solid waste projects are much better when a carefully planned education program precedes and follows construction. Community members must play a direct role in building any facility, and need to make changes in hygiene practices if an investment in sanitation is to have an actual beneficial impact.

5. Emphasize project evaluation and follow-up.

It is essential to observe the results of community projects and carry out follow-up to make sure the facilities are properly used and maintained. The PMRC and other authorities must be prepared to offer administrative and technical help to resolve problems such as the operation of a water supply or garbage collection service. Lack of follow-up is one of the greatest weaknesses of existing government projects, often resulting in the failure of a major project within a few years.

6. Support the role of the local sanitation committees in fostering self-help initiatives.

Without adequate financing, good quality services cannot be maintained. Without basic information, water supply systems for drinking and agriculture will not work. Without careful management, there will not be enough water to cover all needs. The sanitation committees provide an essential function in the process by which communities assume greater responsibility for providing the funding, administration, and planning needed to reach environmental sanitation goals. The specific actions they could carry out include:

- Become a part of the zone committees and keep them informed of needs and of work being carried out to improve conditions in their respective communities;
- Sign agreements to implement, administer, and maintain water supply, sewage disposal, solid waste collection, and latrine construction;
- Assure that the matching contributions from beneficiaries are provided in a timely and complete way;
- Take responsibility for the proper administration and maintenance of a service;
- Actively participate in the sanitation education campaigns aimed at promoting proper land and water uses and at preventing contamination;
- Monitor and protect the local water bodies from pollution, and assist in protecting the watersheds of coastal rivers and streams; and
- Prepare and distribute an annual financial report, so that the community, the zone committee, and the PMRC can stay informed of the status of the service.

The experience of the PMRC and others has clearly shown that success is possible if organization and education accompany project development and implementation.

Strategies for Addressing Shoreline Management Issues

Donald D. Robadue, Jr.
Ricardo Noboa

Shore Use Management Issues in the Coastal Provinces

Ecuador's four mainland coastal provinces encompass about 2,900 kilometers (km) of coastline, divided between open ocean (45 percent) and interior waters, including estuaries and embayments. There is a wide range of geological and manmade features along the coast, including bluffs, barrier beaches and strand plains, estuaries and lagoons, and engineered shoreline structures. Major economic activities that utilize, and are influenced by, these coastal systems include the vitally important shrimp mariculture industry, ports and shipping, fisheries, tourism, forestry, and agriculture.

Coastal residents benefit from opportunities to earn income and harvest coastal resources along the shore for family consumption; yet they also suffer from the effects of coastal storms and flooding, shore erosion, water pollution, overfishing, habitat destruction, and use conflicts that have increased as traditional access and harvesting areas are lost to tourism and to shrimp mariculture development.

Along its 1,256 km of highly varied ocean-facing coast, Ecuador has more than 100 sandy beaches, hundreds of small fishing villages and rural towns, and thousands of vacation homes and recreational complexes. There are four sprawling coastal cities with populations of over 100,000 people (Machala, Guayaquil, Manta, and Esmeraldas) and a total of 22 urban centers. Approximately 2.5 million people live in the 12 largest coastal urban centers. The coastal population continues to grow at a faster rate than the country as a whole, quadrupling since 1950, while the national population increased only three-fold.

Other development trends are making the rural coast more accessible for recreational use. The road network has begun to expand beyond the principal highways between Guayaquil and the major port cities of Machala, Manta, and Esmeraldas, and the recreational center of Salinas. Other important recreational areas in Guayas province that have become more accessible to residents of Guayaquil include Posorja, Playas, Ballenita, Palmar, Chanduy, Ayangue, and Manglaralto. A coastal highway project is planned for the central coast of Manabí province, and will connect Puerto Cayo and Manta. Important tourist areas in Manabí province now include Puerto Lopez, Puerto Cayo, Jama, San Vicente, Manta, and Bahía de Caráquez. Tourism in Esmeraldas is still concentrated just outside the capital city in Atacames, Súa, and Las Palmas. A road project to improve access to the San Lorenzo area in the extreme north of the province may also encourage tourist uses. In El Oro province, the principal focus of activity is the Isla Jambeli, which visitors reach via a short boat ride from Puerto Bolivar.

The increased accessibility of the coast is creating new economic opportunities that will employ some of the expanding coastal population, but it also poses a major challenge, and in some instances, an immediate threat to the quality and productivity of the coastal environments that attract people and investments.

To better understand the specific nature of the local issues posed by shore development, the Coastal Resources Management Program (Programa de Manejo de Recursos Costeros-PMRC) in

1986 commissioned the preparation of issue profiles for each coastal province. This included workshops held during 1987 in each of the coastal provinces to discuss development trends, problems, and potential solutions. The results of this consultation process were incorporated into the Ecuador Coastal Province Profiles published by the Fundación Pedro Vicente Maldonado in 1987. This work led to the publication of Executive Decree 375, which created the legal basis for the Ecuador PMRC.

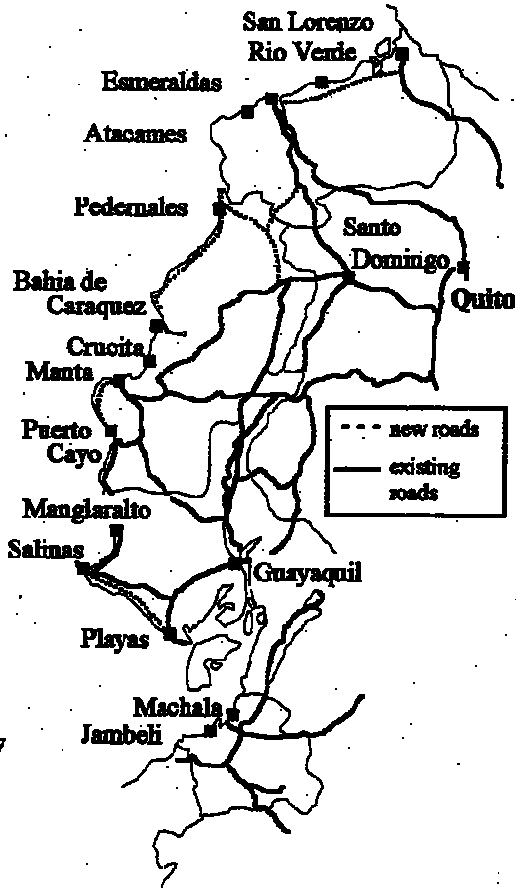


Figure 1. Principal urban centers, tourist beaches and coastal highway projects in Ecuador.

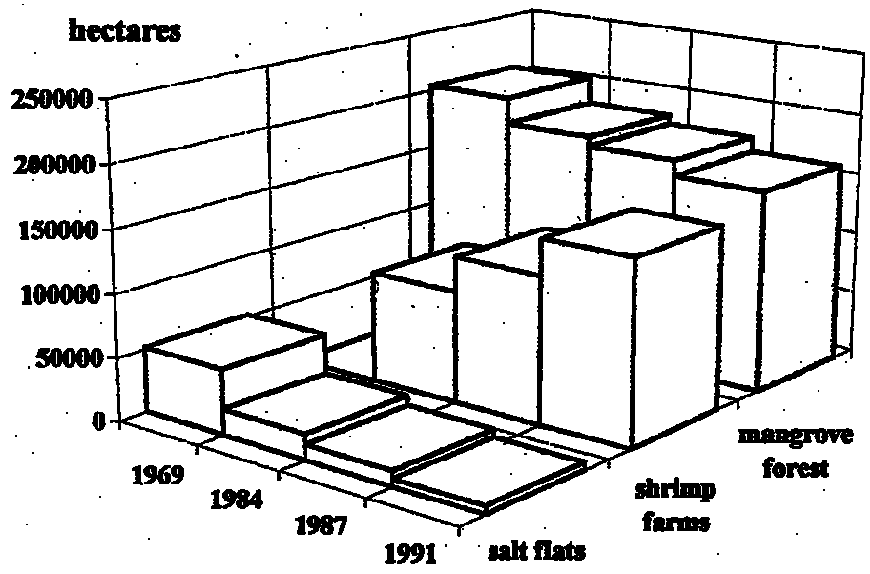


Figure 2. Change in coastal areas from mariculture development and mangrove loss.
*Source: CLIRSEN, 1992

Each coastal province has a distinct character and mix of concerns over shore use, as expressed in the regional workshops.

Esmeraldas province: the need for coastal economic development initiatives

Twenty-six of Ecuador's 107 beaches are located in Esmeraldas province, with nine considered sufficiently attractive for regional tourism. Investment in the region was low during the 1980s, due to poor highway access to sites of tourist interest. Problems in promoting tourism in available sites included chaotic patterns of beach front development, lack of basic services for tourists, and limited hotel facilities. In developing the profile for Esmeraldas, the Port of Esmeraldas was found to be underutilized, failing to live up to its promised potential. Problems had also been encountered in coastal construction practices, including placement of structures and infrastructure on unstable slopes in Rio Verde and Tachina, growth of settlements on the flood-prone sand banks in the Rio Esmeraldas, and erosion of barrier beaches in the important tourism centers of Atacames and Súa.

The province had lost only 2,775 of its 32,033 ha of mangroves by 1987. The mariculture industry, which consisted of only 2,643 ha of ponds in the entire province, occupied just 668 ha in shore areas. Unmanaged timber harvest was viewed as the major threat to the mangrove ecosystem in 1987, but by 1994, this was replaced by concerns that an unmanaged boom in shrimp pond construction in the province would repeat the mistakes of unmanaged mariculture growth farther to the north.

Manabí province: tourism and port development

Manabí has extensive lengths of open, relatively undeveloped coastline with high bluffs. The shoreline includes 48 beaches considered suitable for tourism, 16 beaches that are regional tourist attractions, and two undeveloped sites, located south of Machalilla (the beaches of San Vicente-Canoa and the bird nesting sites and scenic beauty of the Rio Chone estuary). Despite the abundance of attractive shore areas, tourism development faced major difficulties in the province during the 1980s because of a lack of protection and maintenance of beaches, poor highway connections from major demand centers to coastal destinations, and absence of a strong promotion program. Manab' also has other resources of tourist interest-such as mangrove ecosystems, folklore, cultural sites, and natural areas with flora and fauna-that are not well known or promoted. Other shore development problems identified in Manab' in 1987 included sedimentation, which affects navigability, in the estuaries of Cojimies and Rio Chone, as well as at the fishing port in Manta. Erosion was seriously affecting the main beach in Bahía de Caráquez, which for several decades had been expanding its urban center toward the ocean as the shoreline had grown; as land for expansion was scarce, houses and apartment buildings were constructed on unstable hillsides. The commercial port of Manta was also experiencing problems of underutilization. Awareness of the need for effective shore use controls was emerging. The need to manage the national park in Machalilla was identified as another area of considerable concern. The expansion of the mariculture industry in Cojimies and Rio Chone had resulted in a loss of 6,000 of the province's 12,400 hectares of mangrove forest by 1987. In 1987, a total of 10,238 ha of shrimp ponds had been constructed, but only 8,145 of these were legally registered as of 1986.

Guayas province: chaotic growth along the coast

Nine of the 36 beaches in Guayas province were classified as particularly important for tourism, including the international attraction of Salinas. The increasingly intensive use of beaches has led to conflicts among artisanal fishing, tourism, shrimp farms and laboratories, and industrial fish processing plants. Heavily used beaches such as Playas were found to be poorly maintained and unmanaged. Other beaches in Manglaralto and La Libertad were suffering from erosion. As in other parts of the coast, tourism heavily emphasizes beach-going; little attention is given to archaeological resources in the northern part of the coast near Valdivia or to the extensive

mangrove ecosystems and natural areas of the Guayas estuary. Coastal cities, especially Guayaquil, are expanding rapidly without urban development plans, detailed rules for shore development, or the provision of basic municipal services such as potable water and sewage collection or treatment.

Failure to consider the hazardous and dynamic nature of coastal features on the open ocean coast has led to construction of roads and buildings in unstable bluffs and flood- prone areas. Much of the filling of the shoreline in the estuary of Guayaquil has been done with unstable materials such as dredged sediments. The profile process found that coastal cities and cantons did not have urban development plans or detailed rules for shore development.

The Guayas estuary has seen the most dramatic expansion of the shrimp mariculture industry, although much of this has occurred in salinas, or salt flats, so relative loss of mangrove forest (7 percent of the 125,500 ha mapped in 1969) was less than in smaller estuaries such as the Rio Chone. More farms were legally registered (78,580 ha in 1986) than actually constructed or in production by 1987 (75,126).

El Oro province: rapid migration to the Puerto Bolivar-Machala urban area

The most pressing problem in El Oro province was identified as accelerated immigration, which has completely overburdened the urban infrastructure. The beach on Isla Jambeli is the only site recognized as regionally important for tourism, and had been the focus of local investment in a simple but attractive plaza with restaurants. The urban waterfront is dominated by the port of Puerto Bolivar and by a waterfront walkway and dock for passengers departing to Isla Jambeli. The Estero Huayla, on the southern edge of the city of Machala and Puerto Bolivar, is experiencing pressure from rapid growth of the mariculture industry, expansion of urban barrios, and the relocation of fishing facilities and other commercial uses. Mangrove loss has also been found to be dramatic, with 9,200 ha destroyed of the 33,600 existing in 1969. Some 29,721 ha of shrimp ponds had been constructed by 1987, but only about 20,000 were legally registered in the province, which was the first location for the development of the industry in the 1970s.

High risk shore construction and siting practices

All four coastal provinces have an abundance of examples of the physical siting problems caused by inappropriate construction practices. There is a strong need to promote sustainable forms of tourism, and to improve the ability of coastal communities to share in the economic benefits of recreational shore use. The principal issues coastwide include

- low awareness among residents and builders of dangers present in shore areas;
- absence of regulations that address the hazards of construction along the shoreline, on unstable bluffs, and in flood-prone lowlands; scarcity of examples of appropriate use of existing laws to zone and control the use of shore lands;
- limited published knowledge of the location and characteristics of fragile or threatened natural and scenic areas, flood hazard zones, and cultural sites;
- and decision-making procedures that do not permit citizen participation in major development decisions.

PMRC Objectives and Strategies to Address Shore Use Management Issues

Effective planning and land and shore use zoning and construction controls do not exist in the coastal provinces. Coastal municipalities and cantons have sufficient legal authority, but no experience in planning or in allocation of uses of intertidal areas, beaches, and adjacent

sections of the coast. Firms and individuals who undertake coastal construction projects such as piers, shrimp ponds, houses, and restaurants must apply for local and national permission to build or to occupy the beach and bay zone. These authorities-from municipalities on the local level, and from the Navy's General Directorate of Maritime Interests on the national level, make their decisions case by case, since Ecuadorian and municipal agencies do not have regulations and codes that specifically cover projects located along the coast.

The joint project agreement in 1986 between the government of Ecuador and the U.S. Agency for International Development made special note of the need to establish an integrated water and shoreline use classification scheme. "Areas would be assigned to a use category according to the ability of the area to support sustainable development, based on an understanding of the existing and projected environmental characteristics of the area." In addition, while recognizing that much of the Ecuadorian coast remained undeveloped, the agreement stated that "there are examples of inappropriate siting and poor shore front construction practices," a fact solidly confirmed during the preparation of the coastal issue profiles. During the provincial profile workshops, the PMRC did not hear about advances in coastal and land use zoning and development control initiated by municipalities. Instead, workshop participants made a plea for help to take the first steps toward creating such systems.

To address these concerns, the project agreement called for

- The identification of coastal features that must be protected from development;
- A set of construction standards, including setback provisions, that will govern routine activities such as house construction and small-scale shoreline protection projects; and
- A review process for all major construction proposals.

The legal framework established for the Ecuador PMRC does not provide it with any legal authority to regulate shore uses. The role of the PMRC has been to formulate, test, and promote the use of knowledge about coastal processes, and to encourage the application of consistent decision-making criteria in shore use decisions. To carry out this role of catalyst, the PMRC employed two strategies:

Strategy 1: Map all coastal features, analyze problems and opportunities for use of the shore, and prepare recommendations on good development practices.

Strategy 2: Focus efforts to prepare and implement shore use plans and zoning in the five special area management zones.

Implementing the Strategies

Developing information and guidelines on shore use

> The coastal processes atlas: A scientific basis for siting and evaluating the effects of development in coastal areas

Hector Ayon, a coastal engineer from the maritime faculty at ESPOL (Escuela Superior Politecnica del Litoral, a university located in Guayaquil) prepared the first descriptions of shore management issues in Ecuador for the coastal province issue profiles published by the Fundación Pedro Vicente Maldonado in 1987. In a 1988 technical report, he added a set of recommendations for addressing the key concerns raised by workshop participants and the profiling team. These recommendations focused on the need for information, training, and education, as well as on specific planning and control actions to resolve problems.

In 1987, the Coastal Resources Management Project (CRMP) began a project to

- Identify and map the shoreline systems of the coastal provinces in detail;

- Analyze problems and opportunities in the use of the shore from the perspective of

recognizing and respecting coastal geological processes; and

- Prepare recommendations on good development practices for use by public officials and the private sector.

Special funds from USAID/Quito were provided to carry out the work. The project team was led by Jon Boothroyd, chairman of the geology department at the University of Rhode Island, and Hector Ayon. The resulting volume, Shoreline Characteristics and Management Recommendations for the Coast of Ecuador, by Boothroyd, Ayon, and others, provided the first detailed identification of shoreline features and coastal processes for the entire ocean-facing coastline. More important, the authors identified hundreds of site-specific shore use problems and management recommendations, as well as development guidelines for each key shore feature.

Aerial photography (oblique shots taken in a light airplane) of the Ecuadorian coast, and field work for this first draft report were carried out in February 1987. A workshop was held at the University of Rhode Island in June 1988 to analyze issues and prepare recommendations for individual map panels. The scale of base maps selected was the 1:50,000 series of topographic maps prepared by the Military Geographic Institute, supplemented with the 1:25,000 mangrove mapping series prepared by CLIRSEN (The Center for Remote Sensing of Natural Resources. Report drawings were prepared by piecing together sections of the 1:50,000 maps to provide a series that covers both the ocean and interior coast. This level of detail was 20 times greater than in Ayon's original report.

A follow-up workshop was held in La Libertad, Guayas province, in July, 1989 to review and approve the findings and recommendations in the document. In 1990, the PMRC coastal processes working group began monitoring beach profiles in Atacames, Esmeraldas; the open-facing coast of the Rio Chone estuary; Manglaralto; and Playas. Boothroyd and Ayon introduced several concepts for managing bluffs, beaches, and coastal lagoons new to Ecuador:

- **Setbacks:**

  Designate a line parallel to, and away from, the tops of bluffs, and prohibit construction between this line and the coast. This will prevent siting on unstable soil and avoid rebuilding in collapsed areas.

  Designate a line parallel to, and away from, the shore a distance at least 30 times the annual erosion rate in beach areas.

  Site roads away from the toe of bluffs, or from areas where hillsides are falling.

- **Prohibitions:**

  Keep permanent structures off the El Niño overwash areas, which are clearly visible from aerial photos and site inspections, as well as off actively growing barrier spits and the mouths of tidal lagoons and estuaries.

  Halt sand extraction on beaches, and find alternate sources of construction materials.

- **Proper siting practices:**

  Locate discharge pipes from shrimp larvae-raising laboratories and other direct discharges under beaches and out into the surf zone.

  Maintain natural drainage in esteros (tidal inlets) and estuaries, where shrimp farms are constructed, to prevent local flood damage and poor water circulation.

Avoid filling coastal lagoons, to prevent both flooding and ecological damage.

- **Conservation:**

  Protect unique geological formations as tourist resources.

  Recognize that many forms of coastal agriculture are a good use of shore areas.

Most of these specific proposals were subsequently incorporated into chapters of the five ZEM plans, and will be implemented as part of the new Inter-American Development Bank project (see p. 14, 46-8, 8 yrs). However, outside the ZEMs, the PMRC has not played an active role in shore management policy setting or decision-making. (see Section E)

Monitoring shoreline changes through beach profiling to assist in public education and decision-making

A need for understanding coastal processes

Over time, atmospheric and oceanic forces, coupled with the continuous interference of humans in natural shore processes, have provoked dramatic changes in the coast. On many occasions, coastal infrastructure has been damaged or destroyed, generating large economic losses that are particularly difficult for a developing country to endure. The PRMC began to realize early on that coastal residents and developers had little appreciation or understanding of the powerful natural forces at work along the coast, even though coastal flooding and erosion is an annual occurrence, and the evidence of failed shore protection and poor construction practices can be found everywhere. This became particularly important in the ZEMs, where virtually every municipality was considering one proposal or another to fill wetlands, cut channels through barrier beaches, allow the extraction of sand from eroding beaches, and build urban infrastructure in dynamic coastal features.

There is very little scientific work on the dynamics of the Ecuadorian coast. INOCAR, the Navy's research institute, is charged with carrying out oceanographic work in the country, and has focused its efforts on maintaining up-to-date bathymetric charts for navigable waters. ESPOL has carried out a number of site-specific projects to better understand coastal processes, for example in the design of the National Center for Aquaculture Research in San Pedro, but most of the coast has not been surveyed or studied. As a result, Ecuador suffers from a lack of basic knowledge of morphological changes to its shore. This deficiency in site-specific information makes it particularly difficult to educate Ecuadorians on the importance of caution in causing modifications to beaches, bluffs, and littoral systems.

A better understanding of coastal processes, combined with quantitative information on particular sites, would also enable the formulation of shore development policies that prevent future alterations of natural processes, as well as assure that needed coastal construction is well-built and properly sited.

PMRC activities

During May 1990, the coastal processes working group identified specific points along the coast where it would be important to initiate beach profile monitoring stations within the ZEMs. Criteria for selecting the sites included proximity to areas experiencing rapid development, and a high degree of geomorphological change. The beaches of Atacames, Bahía de Caráquez, and Manglaralto were chosen.

Monthly monitoring of the beaches was carried out by a group of students at ESPOL until May 1992, when Ricardo Noboa of the PMRC began to train local groups to carry out the profiles. These local groups enabled the work to be carried out at low cost, and also served as a way to foster local awareness of the importance of understanding coastal processes.

To date, the beach monitoring work has permitted identification of eroding and accreting areas in the three beaches, and enabled the PMRC to provide local data to back up its recommendations to local and federal authorities on proposed shore modifications. The most dramatic example is the beach Punta Norte, in Bahía de Caráquez, where the loss of 150 m of vital tourist beach was recorded between June of 1990 and May of 1992.

Shore Use Management Policies and Actions for the ZEMS

Shoreline Characteristics and Management Recommendations for the Coast of Ecuador helped target the places where the PMRC should focus in carrying out Strategy 2. The same team that prepared this document then carried out a more detailed series of field visits, interacted with the local ZEM advisory committees, and prepared extensive recommendations for both guiding future shore development and for resolving existing shore use problems.

Using the ZEMs to address shore use issues

The ZEMs comprise only about 8 percent of the Ecuadorian continental coast, but are the location of 20 percent of beaches suitable for recreation and tourism, including the majority of important tourist beaches used by Ecuadorian vacationers. More important, the ZEMs contain a significant portion of the most actively developing sections of the coast. Between January 1989 and August 1993, 33 percent of the 399 concessions issued by DIGMER in the beach and bay zone were located within the five ZEMs, as well as 26 percent of the total of 9,810 ha involved. Eleven coastal cantons account for 87 percent [349] of the 399 beach and bay zone permits issued during this period. ZEMs are located in 7 of these cantons. This has made the ZEMs a good avenue for exploring the issues involved in improving shoreline-use decision-making.

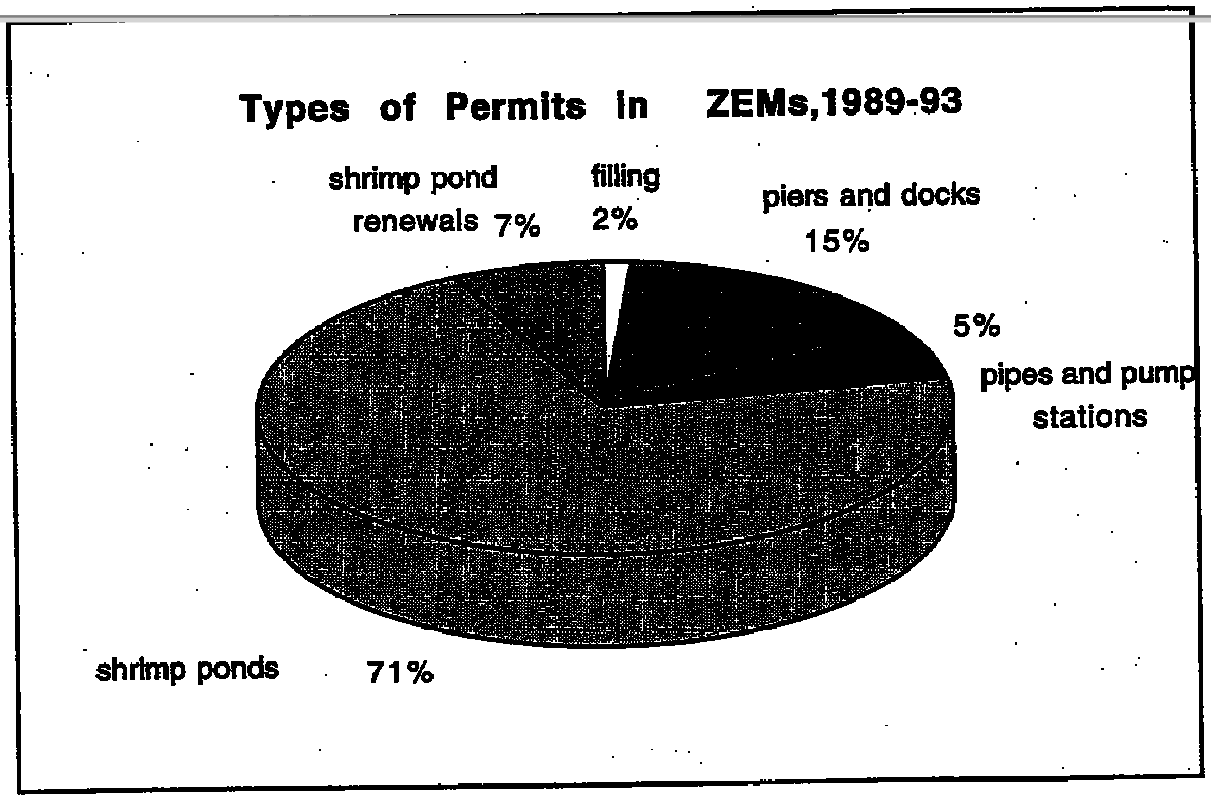


Figure 4. Types of permits issued in the ZEMs, 1989–1993.

Types of permits issued in the ZEMs 1989-1993.

Shrimp Ponds	71%
Shrimp Pond Renewals	7%
Filling	2%</TD
Piers and Docks	15%
Pipes and Pump Stations	5%

Concentrating the PMRC's attention on the ZEMs was intended to help discover what form of implementation would be feasible at national and local levels. Up until then, the government of Ecuador had been unable to bring order to the development of the rapidly expanding shrimp mariculture industry, or to control cutting of mangroves for urban expansion and timber production. The PMRC concluded that a centralized regulatory program to govern these and other shore uses would need to be supplemented by a local role in coastal management.

Between 1990 and 1991, draft chapters on shore management and tourism were prepared for each of the five ZEMs, as part of the development of integrated environmental and resource management plans. As microcosms of the larger issues faced by Ecuador, the ZEMs share not only similar types of shore conflicts, but the need to build the capacity of municipal and canton governments to plan and manage urban and rural coastal development, and to evaluate the environmental effects and spillovers from public decisions. The findings and recommendations were discussed by each advisory committee, along with policy proposals for mangrove management, mariculture development, fisheries, environmental sanitation and watershed management. As a result, the 25 policy proposals, as well as a total of 88 specific actions to implement them are intermixed in various theme chapters of the plans, reflecting the integrated nature of the ZEM planning process.

Shore use policies in the special area management plans

The ZEM plans contain a number of specific proposals for municipalities and national regulatory authorities to improve the quality and extent of shore use decisions. While the plans are adopted by the National Coastal Resources Management Commission, they are not regulatory documents. Thus, to meet the goal of the PMRC to incorporate environmental criteria into shore regulation, both municipalities and agencies must adjust their own decision-making procedures.

Municipal shore use controls

Municipal governments usually take the lead in controlling waterfront development in heavily urbanized areas. Many of the ZEMs, particularly Bahía de Caráquez and Machala, face development problems on hillsides, as well as in the narrowly defined beach and bay zones and on urban waterfronts.

However, none of the coastal municipalities within the five ZEMs have experience in preparing and implementing land or shore use zoning ordinances. In fact, the planning capacity of local governments in the ZEMs, like that of the entire coast, is very weak. To help remedy this situation, the ZEM programs in Atacames and Playas actually played a role in encouraging coastal residents to establish new cantons and municipalities, which are now building their own planning capacities.

All of the ZEM plans call for zoning and allocation of shore uses, which would have to be jointly implemented by local and national authorities. Many site-specific policies based on the shoreline characteristics study are included in the five plans. Both Atacames and Bahía de Caráquez ZEM plans for example, call for upland zoning in coastal hillsides used primarily for agriculture. The coastal communas in San Pedro-Valdivia-Manglaralto also expressed the need for site-specific plans, since each communa controls use of the upland and coastal territory. The newly created municipality of Playas needs an overall urban development plan. In most of the ZEMs, specific shore construction criteria are needed for the beach, estuary, and low and high bluff shore environments.

While development of plans and policies has been a critical first step, successful implementation will require a much more detailed level of community planning in order to properly classify and prepare clear, legally binding regulations and decision-making procedures.

Port development

Two ZEM plans call for specific guidelines on port development. During the preparation of the Bahía de Caráquez plan, considerable interest was expressed in constructing a fishing facility in Punta Bellaca, on the southern ocean-facing coast, which could have cut sand supply to the heavily eroding beach of the town. Although this proposal is not currently active, the complex circulation and sedimentation patterns of the estuary suggest the need for careful site studies and a good economic evaluation of any proposed facilities. In Machala, expansion of the commercial shipping activities has come at the expense of artisanal fishing, which has been dislocated and forced into the already overcrowded Estero Huayla.

Public access to the shore

Public access emerged as an important issue in Atacames-Súa-Muisne and in Playas-Posorja-El Morro due to the continuing increase in the construction of hotels and recreation complexes that seek to keep beach areas for use of their clients and residences, blocking shore access. Concern about physical protection of unique natural sites was most important in Atacames and Bahía de Caráquez, both of which have the greatest amount of relatively undeveloped landscape, as well as varied coastlines with especially interesting landforms.

Restoration of degraded shore areas

Finally, within all the ZEMs are shore areas that are in need of remedial action to restore aesthetic qualities, and to resolve often serious physical development problems. For example, the Quebredo Charco, north of San Vicente, is occupied by an abandoned upland shrimp farm, forcing all traffic into the beach and surf zone. Most of the small villages in the San Pedro-Valdivia ZEM are located on the edges of unstable tidal inlets. Estero Huayla is a confusion of fishing boats, shrimp ponds, barrios, shrimp laboratories, and other commercial facilities. It also receives a large portion of the untreated wastewater of the urban area.

Lessons from the ZEM Experience in Shore Management Issues

The PMRC was not able to finance main implementation actions to follow up on the major recommendations of the ZEM plans. However, the presence of the ZEM committees and offices has increasingly placed the PMRC in the position of serving as a forum for addressing both immediate controversies and stimulating longer-range thinking at the local level. A brief review of some of these experiences is suggestive of the constructive role that the PMRC can play, and indicates that other agencies can adapt principles of coastal planning to their own decision-making.

Characteristics of an effective shore management program

One of the objectives of the USAID Coastal Resources Management Project was to share and adapt the U.S. experience in coastal zone management to the developing country context. The Ecuadorian strategy of focusing efforts in the ZEMs enabled the PMRC to understand what it will take to introduce an effective system of shore management controls. The URI Coastal Resources Center was in a particularly good position to carry out this work, based on its 15 years of prior experience in formulating and revising the Rhode Island coastal program. This experience showed that an effective shore use management system has several characteristics:

- An efficient permit system for coastal projects-one that carefully evaluates the environmental factors involved in siting and operation of coastal construction, and that integrates local and national decision-making authority;

- A capable local staff that can prepare objective assessments of a shore use proposal and offer technically sound recommendations and mitigating measures as part of a fair and efficient administrative process;

- A local planning committee and board of review, which have participated in planning assessment, have worked out many potential shore use conflicts in advance through zoning and construction standards, and that publicly consider petitions for granting exceptions to those rules; and

- Ready access to a competent expert group that can advise and support local staff.

The ZEM planning program provided the PMRC with a range of experiences in how to help in shore use decision-making. The essential characteristics of an effective program in the United States work well when applied to individual decisions in the rather different context of coastal Ecuador. Creating the permanent capacity to achieve this effectiveness also seems possible in light of the ZEM experience.

- Municipalities and national agencies need to create or strengthen their ability to plan and regulate effectively in site-specific cases.

Staff from national agencies with regulatory authority have been willing to engage in ZEM and other PMRC conflict-resolution activities, but are stretched very thin, and typically do not have the planning and public participation background of ZEM and PMRC staff members.

There is an even greater weakness at the local level, both within the ZEMs and coastwide. Only the city of Machala and the newly created municipality of Playas have urban planners. No municipalities or cantons in the Ecuadorian coast have adopted land use plans or zoning ordinances, and they continue to make land use decisions on a case-by-case basis. Most urban areas in the ZEMs are plagued by "invasions" of poor settlers

into wetland areas and unstable hillsides. Expensive homes and hotels are constructed in similar areas. The only positive aspect of the local governance situation in the ZEMs, aside from increasingly strong participation in PMRC activities by municipalities and the newly formed cantons of Playas and Atacames, is that municipalities are free to establish site- specific plans and zoning in critical areas. The challenge is to put this authority into action.

- The ZEM process can help improve how public authorities regulate the use of the shore.

The ZEM offices and the Ranger Corps units have played a role in identifying projects that should be captured by the local and national regulatory process. They have also shown that early intervention in decision-making is valuable both to developers and decision-makers. Review of applications before they are submitted, and project design assistance during project formulation, enables the proponents of a project to reduce or eliminate negative impacts, while achieving their economic and use goals.

Municipalities are also faced with crises and need good advice before responding. For example, in Bahía de Caráquez, the principal tourist beach began to erode rapidly after decades of accretion. The first reaction of public officials was to propose an emergency solution to the problem, consisting of armoring the entire shore with large rocks at an estimated cost of $175,000. Hector Ayon and Jon Boothroyd opposed this idea, recommending instead a temporary measure of small groins made of bags filled with sand and cement. A coastal defense committee was formed and managed to raise local donations to build the temporary beach protection project, using fabric sacks filled with sand and cement. A portion of the beach was restored, and the town decided to wait until a more detailed study could be conducted to determine the best solution.

The ZEM offices themselves were not set up to provide ongoing technical assistance to municipalities or national agencies. The ZEM coordinators depend almost completely on the Guayaquil-based technical staff of the PMRC to provide the necessary technical review and rethinking of shore projects and use conflicts that do arise. The ZEM offices provide a rapid channel of communication and offer the ability to convene authorities, key actors in a conflict, and community members-a capability that no ministry's regulatory staff can match. As a result, the ZEM committee and staff have successfully provided the valuable service of public disclosure and public hearings in those cases that have been brought before it.

A key difference between the ZEM office and committee role in shore management, and the regulatory approach of DIGMER or the Subsecretary of Fisheries, is in the focus on solving problems, rather than responding to petitions for a concession or operating permit. The repertoire of solutions for the conflicts and cases handled by the ZEM committees covers a considerable range:

- encouraging a developer to withdraw a proposal (such as the case of constructing a permanent shore protection in Punta Norte beach, Bahía de Caráquez);
- stopping a project already in progress (a shrimp pond water supply canal in Rio Atacames);
- encouraging redesign of a project to solve a group's needs without destroying a natural area (a proposal to build small restaurants in the mangroves of Atacames village);
- negotiation of a space allocation scheme (fishermen and tourist conflicts in Playas, user group agreement in Estero El Morro);
- establishing acceptable mitigation measures (Calle Larga, in Rio Chone).

Some specific conflicts identify or reinforce the need for additional information (sand mining in Punta Napo near San Vicente, and Playas beach), planning studies (Canton Atacames), or experiments (beach protection in Punta Norte, soil erosion control in La Chipornia).

Several critical success factors need to be present in order for the ZEM office and ZEM committee to continue to play this problem-solving role related to shore management:

- The PMRC first conducts a planning assessment of the broader issues.
- The ZEM office is specifically asked to provide assistance.
- All parties to the conflict are brought together to address the concern.

- ZEM intervention results in identifying the actual concern of the initiator of the conflict, as well as common interests to lay the groundwork for solution.
- PMRC technical staff prepare site-specific analyses and recommend options as the basis for local debate.
- Local and national authorities, including the Ranger Corps, are important participants.
- Information and debates remain open to the public.

It is important to note that while most of these characteristics are absent from the routine administrative approaches, ZEM committee leaders and coordinators in many cases have exercised considerable skill in managing meetings to ensure fairness and a full hearing of all points of view, while simultaneously making progress toward a solution.

- ZEM committees and municipal governments require adequate technical support in order to play an effective role in addressing site-specific cases.

The PMRC has a small number of technical staff in mangrove and mariculture management, coastal geology, civil engineering, and water quality. This staff acted as a team in preparing the chapters of the ZEM plans, and have carried out a number of small-scale implementation projects in the ZEMs. ZEM coordinators also have technically oriented staff primarily trained in fisheries and mariculture, but who lack the broad experience of the national staff. ZEM coordinators and Ranger Corps assistants frequently call on the technical staff to meet with local residents and initiators of shore development actions to clarify the nature of the conflict, and develop recommendations for discussion among the parties. Requests for this type of assistance have come increasingly from locations outside the ZEMs, putting considerable pressure on the PMRC to expand its technical response capacity.

- The ZEM committee possesses an important power of assembly to address shore management conflicts

ZEM coordinators have had to walk a fine line between responding to the pressure to participate in resolving the endless flow of immediate controversies, and the need to develop the capacity of the ZEM committee to incorporate crises and conflicts as part of a longer-term effort to implement ZEM plan policies. The ZEM committee has played a particularly valuable role in cases where it acts to assemble resource users engaged in a dispute and provide a public forum for resolving the issue. In some cases, members of the Ranger Corps and representatives of national ministries have been brought together through the ZEM office to solve specific problems. The ZEM committee's review and recommendations have also helped authorities to make better decisions and take a greater interest in doing a good job in carrying out their own planning and environmental management functions.

The establishment of the permanent ZEM committees by the government of Ecuador creates a unique institution that can provide leadership, participation, and services to implement the policies and the actions in the ZEM plan, without interfering with the roles and responsibilities of the legally empowered officials to make and enforce decisions. Key phrases describing its role include "inform," "suggest," "catalyze," "recommend," "stimulate," and "orient" actions to local authorities, national agencies, and the national Coastal Resources Management Commission. It is perhaps the only public entity given the explicit charge to "evaluate" progress toward ZEM plan implementation, a task rarely performed by government. Open deliberations, full disclosure of information, and active vigilance are innovations in Ecuador's coastal resources management. These norms of governance behavior are transferable to other locations even if a formal ZEM program is not started for an area.

ZEM Committee effectiveness depends, of course, not only on its formal charge, but on the skill with which it performs its duties. The successful experiences of the hundreds of people now involved in the five committees demonstrates the great potential for this approach in tackling the difficult task of creating fair and effective systems for guiding and controlling shore uses.

A Look Ahead to the CRMP's Role in the Next Five Years: Preparing and Testing Integrated Shore Use Controls During the IDB Project

The Inter-American Development Bank will finance shore management projects to build local and national capacity.

The PMRC has chosen a priority segment of each ZEM's shoreline as an initial focus for planning and regulation. The PMRC will collaborate with municipalities to set shore use priorities and establish zones and technical criteria for evaluating individual cases. The sites include:

- The tourist zone between Súa and Puerto Gaviota in the Atacames ZEM;
- Canoa to Punta Napo in the Báhia de Caráquez ZEM;
- The 5-km section of shore between Olon and Manglaralto in the San Pedro ZEM;
- The major tourist beach of Playas-Data de Posorja in the Playas-Posorja ZEM; and
- Isla Jambeli and the urban waterfront of Machala in the Puerto Bolivar ZEM.

In addition, support will be provided for a facility to help resolve beach use conflicts and improve services in each ZEM and guide visitors to facilities in the area. The work will be scheduled so that the experiences in the first ZEM project can be transferred to other sites.

Part of the overall IDB project implementation strategy is to initiate a project in the ZEM of Playas-Posorja-Puerto El Morro, and, based on the experience gained in this location, begin similar projects in each of the other ZEMs.

The PMRC must take a national leadership role in providing information, education, and awareness for public officials and individuals.

- Examine the effectiveness of existing policies.

In addition to carrying out site-specific projects to build local capacity for shore management in the ZEMs, the PMRC should continue its work in defining shore management needs from a national perspective. Ecuador also needs to examine recent experiences with flooding and damage to residences and coastal infrastructure, and to review earlier decisions on the siting of hotels, houses, discharge pipes, and shore protection to determine whether past decisions have worked out as expected. Coastal areas, both within and outside the ZEMs, have experienced danger from flooding since the late 1980s, including severe floods in 1992. The PMRC, in cooperation with civil defense authorities could easily compile the nature and extent of flooding problems in an updated shoreline characteristics document , which would show for the first time the risks to life, property, and infrastructure from poor siting, land use, and watershed management practices. In addition, the PMRC could work with DIGMER and the Ranger Corps to examine the effectiveness and level of compliance of applicants with the more than 400 concessions that have been issued in the beach and bay zone since 1989. Insights from this work would reveal the technical soundness of past decisions and help set the stage for the Navy and municipalities to adopt the specific recommendations proposed in the shoreline characterization report.

- Create public awareness and interest.

Just as it is difficult to perceive shore dynamics that take place over periods of months or years, these economic losses are readily forgotten, or remain unknown unless careful documentation takes place. Most coastal residents, and many owners of property and buildings constructed in unstable bluffs and eroding beach areas, remain unaware of the risks present in these dynamic coastal features. The PMRC's beach monitoring work is a low-cost way to build up a base of local knowledge about shoreline changes. Increased awareness strengthens the credibility of arguments in favor of setbacks and minimal use of shore protection structures. Such monitoring and education should be extended to other areas where shore development is occurring at a rapid pace.

Four groups need to be targeted, using approaches tailored to each:

Key investors. Contractors, architects, and engineers, and investors and financiers of major projects make most development decisions, and represent both good and bad coastal building practices. This group is likely to be interested in reducing the technical design and siting-risk aspects of projects.

Individual home or property owners. Most of these individuals will have little knowledge or experience in the dynamics and risks of building in coastal areas, but, if educated, may have a financial and personal interest in conforming to site development criteria. Basic information on home and business ownership on the coast can be prepared and distributed through financial institutions, municipalities, and real estate brokers.

Poor Ecuadorians who move to urban areas. Members of this group are not likely to become homeowners in the conventional sense, yet this group is perhaps the most at risk from health and safety hazards due to living in marginal shore and hillside areas. Strict enforcement of laws against occupation of the beach and bay zone, or of areas designated unsuitable for habitation need to be accompanied by the much more difficult task of addressing the underlying social and economic problems that force people into unsafe areas.

Shrimp farmers. This sector is perhaps the single most important source of coastal environmental change and degradation, and has invested hundreds of millions of dollars in building, reconstructing, and protecting shrimp pond walls, often by creating further environmental degradation through creation of quarries on hillsides in order to reinforce pond walls (as can be seen in the Rio Chone, for example). The sector has an interest in discovering economical methods of protecting investment. Local residents who traditionally harvested fish and shellfish from mangrove areas in formerly mangrove-dominated estuaries would now benefit by techniques such as using mangroves and corals along shrimp farm walls instead.

The PMRC must promote careful environmental assessments of new coastal highways and tourism infrastructure.

- Create mechanisms for public involvement.

The best time to identify and resolve problems in the siting and design of construction projects in the coastal zone is during a project's initial planning stages. Environmental assessment procedures are now routinely carried out for projects that require international financing, in addition to regulatory reviews in the coast by DIGMER, INEFAN, and the Subsecretary for Fisheries Resources. These reports are usually prepared by consultants or in-house technical staff, who determine which issues and interests are at stake, as well as recommend mitigation measures or design changes. Local information and participation in the assessment process does not take place, therefore excluding the people most likely to be affected adversely by a project. Similar closed procedures are followed when Ecuadorian agencies review shore development proposals. The ZEM process provides ample evidence of the desirability and feasibility of providing public information about planned projects and of obtaining local reaction and concerns in order to ensure an adequate design.

- Integrate coastal management into regional development decisions.

Although the pace of coastal construction appears to have slowed considerably since 1993, new infrastructure projects are in the planning stages that will have an effect on stimulating coastal development. An important project is the proposed coastal highway between San Jose and San Lorenzo, in Manabí province, part of road improvement between the coastal cities of Puerto Cayo and Manta. Current practice in Ecuador does not impose requirements such as presenting the road alignments and preliminary information on potential road impacts in public forums, or ensuring that design and mitigation options be discussed in public with people from affected areas.

The PMRC should participate in the environmental planning process for this highway to ensure that information and experience in shore management is incorporated into the issue-scoping process. In addition, the PMRC should work with the Ministry of Public Works to establish community and public review procedures that can serve as a model for other shore infrastructure projects. It should also take the opportunity to provide interagency consultation, to address both project design problems, and, where

mitigating measures and stipulations are applied, to mobilize the Ranger Corps to help supervise the construction process.

The Special Area Management Process

Emilio Ochoa

The five special area management zones (zonas especiales de manejo, or ZEMs) are a key element of Ecuador's Coastal Resources Management Program. Covering about 8 percent of Ecuador's mainland coast, the ZEMs can be found in all four of the coastal provinces. The five locations encompass a wide range of coastal environments, from mangrove-dominated estuaries to intensively used beaches and high bluff shoreline. They also incorporate a variety of governance settings, including remote fishing villages and farming communities, tourism centers, and urban areas-including a large and sprawling provincial capital. Executive Decree 375 set a two-year deadline for completion of detailed coastal management plans for each ZEM.

The special area management project served as an experiment to find out whether the PMRC could engage local residents, resource users, and authorities in an open planning process to address the future use of coastal resources. It also sought to use the planning process to build a bridge toward implementation by creating local capacity and by establishing a national commitment for implementation. Coastal communities were asked to formulate pragmatic, achievable visions for the future environmental quality and development of critical areas; to develop a local consensus on the policies and actions needed to achieve this vision; and to identify practical actions to create the capacity to govern coastal resource use in a context where all existing agencies and policies had failed.

The ZEM planning project has attempted to address several important questions:

- Is it possible to use participatory methods for planning and decision-making in a developing country that has had no prior success in environmental planning in the coastal region?
- Can local resource users be convinced that coastal resources management is desirable and useful?
- Can existing laws and regulations serve as the basis for an effective approach to coastal management?
- Will local and national governance institutions be able to respond effectively if there is pressure in favor of plan implementation?

This paper explores the strategy, structure, and process followed by the PMRC to successfully complete an extensive public review process and to achieve local approval of the five plans, as well as adoption by the National Coastal Resources Commission. The ZEM process has expanded the identity of the PMRC considerably-from a technical assistance project administered in Guayaquil to a multi-layered, diverse, and decentralized initiative of coastal people.

Selection of the ZEMS: Issues and Opportunities

The idea of using ZEM plans as a principal technique for helping Ecuador discover a practical approach to coastal management emerged from initial project activities begun in 1986 by the Fundación Pedro Vicente Maldonado, which had been retained to conduct a participatory issue profiling process in the four coastal provinces. The project team carried out literature reviews, interviews, and a series of well-attended workshops prior to publishing Ecuador: A Profile of Its Coastal Resources (Ochoa and Macías, 1987). This work is a practical example of techniques that can involve the private and public sector in data collection and issue analysis.

At the same time, the PMRC formed working groups composed of Ecuadorian experts and international advisors to analyze the legal and institutional framework for coastal resources management (CRM) and to gather basic facts about mangrove destruction, water quality, and the uses and problems of shoreline development. A second set of workshops was held in the provinces in 1987 to present copies of the final coastal issues profile. During these sessions, participants identified the critically important segments of the coast where immediate action was required. Meetings held in the four provinces to select the priority sites for ZEM planning focused on several important criteria:

- The likelihood that positive results could be generated in a short timeframe;
- Likelihood that a CRM initiative would benefit a large number of people;
- Likelihood that programs can be formulated with a limited financial investment;
- A capacity for local self-development and a positive climate for working with both government and the private sector;
- Likelihood of creating a local system for planning and conflict resolution;
- Presence of local issues that reflect national concerns; and
- Likely relevance of planning techniques and action proposals to other coastal areas.

These criteria were discussed and applied during the provincial workshops. In the Guayaquil meeting, for example, a variety of options for ZEMs were considered for Guayas province. The most pressing concern was the Guayas estuary, a resource of great complexity and interest. It contains the largest amount of mangrove and the greatest extent of shrimp farms in the country, the most productive marine system, the highest population density, and major sources of pollution from industry, commerce, and residences. However, workshop participants decided not to select this area because major financial investments were needed, and the situation was too politically and institutionally difficult for test of new approaches to planning.

The Esmeraldas province workshop gave serious consideration to the city of Esmeraldas, which has a multitude of coastal management issues. However, upon careful reflection, this area also did not meet the criteria. The city and provincial governments did not provide the stable institutional setting required for an initiative, since many vital government functions were controlled from outside the province. Public works projects were managed from Santo Domingo de los Colorados, malaria control projects and fisheries management efforts were supervised from Guayaquil, Portoviejo handled activities related to cooperatives, and tourism issues were addressed from Ibarra. In addition, during 1987, the province suffered greatly from a labor dispute affecting road maintenance, the mayor of Esmeraldas was accused of mismanagement of funds, and the lack of public confidence in other public institutions dominated political debate.

By using the criteria, the provincial workshops generated lively conversations and consensus among a broad range of groups who traditionally had a great deal of difficulty working together. The PMRC emphasized finding a balance among interests. Conservationists, researchers, political candidates, government officials and members of the political opposition, clergy, and universities each found their own reasons for supporting the PMRC and the ZEM program. In this sense, the diversity of people involved in the consultative process enabled the PMRC to achieve balanced decisions.

The PMRC's own expectations for the ZEM program were diverse. The main hope was to learn new ways to effectively address the array of issues faced in each ZEM, and once an initial success was achieved, to expand the scope of the ZEMs, start new ones or address larger environmental systems such as the Guayas estuary or an entire coastal watershed. Many PMRC staff and consultants felt that the program would be doing well if three of the five ZEMs made it through the planning process.

Each coastal province has at least one ZEM site, with 25- to 75-kilometer (km) shorelines. While the ZEMs encompass only a small portion of the coast, they represent the full range of coastal environments and issues: the urban poverty of Machala, the crowded beaches of Playas, the need for alternative livelihoods and small watershed management in Manglaralto, the potential for tourism development and crisis in the Rio Chone estuary and the need for protection of mangroves in Atacames ZEM (Table 1).

Table 1. Characteristics of the five special area management zones.

ZEM	Population 1990	Shoreline length (km)	Coastal features and issues
Atacames-Suacutea-Muisne, Esmeraldas province	27,000	75	Beach tourism and second home development; mangrove destruction in two small estuaries; basic needs of small towns; illegal mariculture ponds; artisanal fishing
Bahía de Caráquez- San Vicente-Canoa, Manabí province	36,000	20 km ocean; 40 km interior	Estuary management; freshwater diversion (mangrove loss and mariculture); resort development on long sandy beaches; shore erosion; critical natural areas
San Pedro-Valdivia-Manglaralto	18,000	27	Artisanal fishing; agriculture as an alternate livelihood; archaeological resources; tourism and beach use
Playas-Posorja-Puerto El Morro	34,500	30	Tourism and beach use by urban residents; artisanal fishing; coastal community development
Machala-Puerto Bolívar-Isla Jambelí	15,000 directly affected	32	Water pollution; poverty in coastal barrios; disorganization of urban shorefront; mangrove management and mariculture; tourism; artisanal fishing

As the PMRC decided to concentrate its limited resources in these areas, the academic community in Ecuador initiated a debate on the definition of the coastal zone-a concern that also arose as the PMRC worked with CONADE, the national planning agency. The PMRC's view was that the boundaries of a zone very much depend on the nature of the issues involved and on the areas they influence. This focus on issues was just as important as the need to identify and work with key actors and to set clear objectives for the plan.

The ZEM Planning Program

The basic elements of the ZEM process included:

- Establishing field offices in the five ZEMs, led by a locally hired "coordinator";
- Appointing advisory committees (citizens and resource users) and executive committees (public officials) to oversee and promote local participation in the plan preparation process;
- Assembling a team of Ecuadorian and international experts to prepare technical reports on critical issues for all of the ZEMs, supervised by the in-country project director in Guayaquil;
- Identifying short-term action recommendations and implementing selected projects at the local level;
- Preparing draft chapters of the ZEM plans for committee review;
- Reviewing of integrated draft plan, followed by revision and local adoption; and
- Submitting each plan to the National Commission on Coastal Resources Management for review and approval.

Special area planning projects, by definition, are a technique for concentrating limited funding, staff, and expertise in a few places. While the same planning approach is used in each location, there is a clear expectation that local differences and innovations will eventually emerge, and will be reflected in the resulting management proposals. A key role of the ZEM plans was to shape national-level planning decisions and to create a systematic method for extending coastal management to other critical areas. A single project management structure and the same technical support team were used to prepare the planning documents across the five field sites, in order to lend cohesion to the

overall effort. Local teams were formed to manage the planning process and build expertise, so that implementation could be done as much as possible by experts from the zone itself.

The ZEM planning task was included for the first time in the USAID-funded annual project work plan in Project Year 4 (fiscal year 1989) and completed in Year 7, allowing just two more years to complete the transition to new sources of funding and new institutional project in 1994. USAID funding directly provided about $500,000 for the five years of planning and operating costs in the ZEMs-out of about $3,300,000 in total program costs (including technical assistance to all tasks). This amounted to only about $20,000 per ZEM per year, due to the government of Ecuador's expansion of the project to cover five areas.

Advisory and executive committees appointed by the president of Ecuador began working in early 1990 to review technical documents, build public awareness and support, and guide the drafting of policies and actions on issues that included artisanal fisheries, tourism development, mangrove and shore use and conservation, water supply and sewage disposal, mariculture, and the organizational structure for management.

Once each of the five ZEM plans was prepared with the advisory committees, three to four workshops were held in different locations in each ZEM to obtain wider user group and citizen views of each ZEM plan. These local ZEM plan workshops attracted from 20 to as many as 80 residents, public officials, and representatives of resource user groups. The program's strategy of building participation into every stage of plan development paid off, as participants expressed satisfaction with the overall content of the plans and quickly focused their attention on identifying necessary changes to specific policies and proposed actions. Considerable attention was given during the workshops to evaluate the feasibility of implementing different portions of the plans.

The process took considerably longer than the two years anticipated in Executive Decree 375. All the plans were given final local endorsements in March and April of 1992, and were approved by the National Commission on Coastal Resources Management in May of the same year.

ZEM Plan Policy Innovations

Table 2 illustrates some of the basic ideas to emerge from the various ZEM plans. A common theme in all ZEMs was the need to build local capacity and create mechanisms to respond to resource management problems on a consistent basis. As a result, permanent ZEM committees were appointed to oversee and promote plan implementation. These groups are charged with setting policy, assessing progress, and recommending actions on an annual basis for funding. Local activities of the PMRC must be approved by the ZEM committees before they can be carried out.

Some themes are much more important in certain ZEMs than in others. For example, due to the great pressure to destroy remaining mangroves, the plan for Atacames-S&uacutea-Muisne in Esmeraldas province placed a great deal of importance on mangrove management. The effort to protect a 50-hectare strip in the municipality has generated a series of community actions and attracted national attention. The Rio Chone estuary has become the focus of the Bahía de Caráquez ZEM (Coello et al., 1993). In San Pedro-Manglaralto, an extended drought has made small watershed management and alternative livelihoods a major issue, along with community sanitation and shrimp larvae fisheries. The Playas-Posorja ZEM continues to be affected by peak inflows of beach goers during weekends and major holidays, keeping this ZEM centered on managing short- and long-term shore use conflicts.

Table 2. Summary of selected policies and innovative actions in the five ZEM plans.

Theme	Policies	Actions
Mangrove ecosystems	Preserve remaining mangrove areas; allow multiple use; reforest areas with highest losses.	Public awareness, community vigilance with Ranger Corps, mangrove tourism, user group agreements, monitored replanting.
Mariculture and artisanal fisheries	Protect habitats; change shrimp larvae fishery practices; improve mariculture efficiency; reduce environmental impacts; build local self-regulation of fisheries.	Demonstration projects; outreach and extension programs on improved techniques; local fisheries monitoring and fish handling improvements; estuary protection.
Shoreline use management	Protect public areas; create setbacks from hazardous areas; conduct careful site reviews of tourism developments.	Identification and protection of access sites, community-based planning and zoning; non-structural beach protection; shore construction criteria, analysis and options for erosion areas; control of hillside development; tourism facilities and visitor planning.
Community sanitation and water supply	Provide basic needs for sanitation, solid waste disposal, water supply and sewage disposal; and foster successful systems through education and training.	Hydraulic resources studies and small- basin management; construction of solid waste systems and disposal sites in rural areas, urban barrios; selected facility development and training; water quality management.

The ZEM Committees

The critical factor for the success of the ZEM planning program was the establishment and functioning of the ZEM advisory and executive committees. The ZEM coordinators were given the responsibility of doing everything possible to assure that the committees worked effectively.

The first task facing the ZEM coordinators was to present the idea of the special area management zone to the residents of the ZEM, and to explain how the program had originated. The coordinators began to build the local constituency for coastal management-even before Executive Decree 375 had been signed and published-through outreach, direct contact with community members, and gathering of local data needed to prepare a detailed profile of each ZEM.

The process to formally create the ZEM committees began in March, 1989, two months after Executive Decree 375 had been published. The National Coastal Resources Management Commission decided to hire a public opinion survey firm to learn more about ZEM residents' views on who should serve on the advisory committee. After the meeting in Quito to review candidates for doing the poll, PMRC staff realized, however, that this would be a long, bureaucratic process that did not correspond at all with the need to make quick progress in the coastal communities. The reasons that the National Commission wanted to conduct the poll were clear. They were not opposed to the committee candidates recommended by the ZEM coordinators and by the PMRC, but wanted the people of each zone to play a direct role in the nomination process. One advantage of this approach-which has since become a hallmark of the PMRC-was that the ZEM advisory committees were viewed by everyone as being free of partisan political influence: an unusual, but critically important condition. MARKOP (Marketing and Public Opinion) was selected to conduct the survey, but the death of one of the principals in the firm delayed the poll.

A year passed from the time the first ZEM office was opened to the initial formal meeting of an executive committee. Fortunately, the PMRC had been holding informal meetings with both authorities and coastal resource users throughout this period. The public opinion poll was finally completed in October 1989. On November 6, the National Commission met to designate the presidents and vice presidents of the executive committees, and charged Cornelio Martian, the General Secretary of CONADE, with preparing the lists of advisory committee members. These were approved by the president of the National Commission. The ZEM coordinators, Fundación Maldonado, and the PMRC then moved quickly to formally start the ZEM process.

Between November 1989 and January 1990 all five executive and advisory committees were constituted. In each ZEM, the inauguration included a public ceremony, a fiesta, folklore exhibition, and the signing of agreements of support for the program by the members of the executive committee. These documents were intended as pledges of support that each member was obliged to provide to the effort. Later on, the members of the advisory committees used these signed pledges as reminders to public officials. Even though contemporary political and commercial life seems to have devalued the idea of individual honor in living up to agreements, this form of pledge has a special importance in Ecuadorian culture and among traditional resource users. The user group agreements that emerged during the ZEM process are based on this same principle.

While waiting for the ZEM committees to be nominated, the Fundación Maldonado worked with the coordinators to carry out an intensive outreach and education effort. At the same time, the technical experts working on individual issue papers-including fisheries, tourism, water quality, mangroves, and shore processes-were meeting with local resource users during their field trips to collect and verify information and solicit views on possible solutions to problems. Between 1987 and 1989, no other project in Ecuador held a wider range and larger number of meetings than the PMRC did in launching the ZEM initiative.

A snapshot of the ZEM process, August 1991

Each year, the PMRC held an internal review session with all of its staff and consultants to review progress and difficulties, and then jointly design the following year's work. A recounting of the conclusions of the review session of August 1991 provides a window into the dynamics of the ZEM project. At that time, 15 people-including project leaders, the University of Rhode Island (URI), and the government of Ecuador, consultants, and ZEM coordinators-met to discuss events of Project Year 6, and to prepare the workplace and budget for Year 7. The following is drawn from the summary of these meetings made by the project's director, Luis Arriaga.

Understanding the importance of coastal ecosystems and resources

The initial response of the members of the ZEM advisory committees was to plead for specific projects to help their communities and to benefit the economic sector. This attitude changed when the user groups and community representatives began to understand that their economy and quality of life depended on conservation of their coastal resources and on maintaining the condition of ecosystems.

This new understanding is also reflected in the key role the committees are assuming in the ZEM planning process. The important techniques the PMRC has used to stimulate this change include

- Analyzing the ZEM profile and each technical report in cooperation with the advisory and executive committees;
- Identifying problems and conflicts related to coastal resources in each community of the ZEMs;
- Identifying and discussing options for managing resources;
- Designing and implementing practical exercises in coastal management; and
- Public education and outreach programs.

Understanding the economic value of coastal ecosystems and resources

The early experiences of the PMRC in the ZEMs showed that progress could be made when the program was able to link short-term economic concerns and problems to the need for resource management. The Atacames-S&uacutea-Muisne ZEM provides a good example of how many different groups can find a common interest in solving a coastal management problem. The hotel owners of Atacames, for example, realized the economic potential of a mangrove forest boardwalk-built to provide schoolchildren with access to the last remaining stand of mangroves-when it also began to attract the interest of tourists. For this new tourist interest to expand, the hotwires realized the

need to clean up the trash lying along the banks of the river, and formed a sanitation committee to look for permanent solutions to the problem. At the same time, the shrimp farm owners of the area realized that they could change their image within the community from "mangrove destroyer" to friend of the ecosystem by helping in reforestation efforts. The caipiriñeros, who run small kiosks on the nearby beach, took on responsibility for keeping the site clean and attractive for visitors, improving public safety, and incorporating folklore groups into area tourism. Local schoolteachers found the boardwalk a valuable way to introduce environmental themes into their curricula. By emphasizing education and training for user groups, the PMRC helped people of the ZEM to recognize the relationships between their activities, and the vital links between economic development and environmental quality.

The evolution of the advisory committees

The initial composition of the advisory committees placed emphasis on selecting local leaders and prestigious individuals from both within and outside the ZEMs. As the program activities unfolded, the ZEM process began to gain the confidence of user groups and local communities. This could be seen by

- The degree of acceptance of the integrated planning process over the usual approach of petitioning for public works and projects;
- The increase in the contributions made by local communities in carrying out practical exercises; and
- Recognition of the need for stronger local organizations to manage resources and develop communities.

As a result, members of the advisory committees (appointed based on the MARKOP survey) who were not involved with a resource user group lost interest, while user group and local community representatives expanded their involvement to the point of completely reforming the advisory committees. This process happened in each ZEM. An additional benefit of this expanded interest by user groups was the reactivation, strengthening, and formation of new local groups.

The types of organizations most commonly found in the ZEMs are community improvement associations. However, the PMRC encouraged resource users such as shellfishers, larvae collectors, mangrove charcoal makers, and hotel owners to form their own groups and to learn to identify and articulate their common issues and needs, thereby creating a common basis for action. Because the emergence of these groups needs to be spontaneous, the PMRC limited its role to helping improve the administration and operation of these groups. The idea of sustainable development includes the need to have the continuous involvement of local stakeholders over a long period of time.

The composition of the ZEM committees

In the period from February to April 1992, 128 user group and community organizations, along with 19 different government agencies from the national and regional levels, participated in reviewing the draft ZEM plans. These groups had equal status on the committees. The following year, from May to July 1993, the ZEM committees were reconstituted to form single zone committees that combined public officials with community and user group representatives. Only legally registered groups were permitted to have voice and vote in the new committees. Of the 160 groups involved in the new committees, 77 qualified for all privileges, while 83 have the capacity to speak, but not to vote (Table 3). The combined committees also have a total of 36 different government units represented.

Groups that are still in the process of becoming registered have been formed for the most part as a result of the ZEM process, and are more likely to reflect user group interests than to be general associations. In this sense, the PMRC has created its own institutional framework both within and outside of government. The ZEM with the largest number of unregistered members is Bahía de Caráquez, which reflects the fact that it was much slower in working to build a broad constituency for the program.

Table 3. Composition of the newly convened ZEM committees, 1993.

ZEM	Voice and vote			Voice only			Total		
	Govt.	NGO	Total	Govt.	NGO	Total	Govt.	NGO	Total
Atacames	9	17	26	0	18	18	9	35	44
Bahía	11	26	37	2	26	28	13	52	65
Manglaralto	8	29	37	1	14	15	9	43	52
Playas	10	17	27	7	17	24	17	30	51
Machala	10	15	25	0	15	15	10	29	40
TOTAL	48	104	152	10	90	100	58	194	252

Another aspect of participation on the committees is the practice of having large delegations, or sometimes the entire membership of a group, participate in a committee meeting. This is consistent with the tradition of a group arriving en masse to meet with a public official, and is regarded as a sign of the group's strong interest and respect for the process. This is quite likely to continue in the future.

The installation of the new zone committees was done with the assistance of the appropriate port captain-who is the ex-officio vice president of the committee-rather than by the presidents, since the National Commission, following its own tradition, was late in making its nominations. The commission approved the operating rules for the ZEM committees in October 1992, but they were not published for six more months. Table 4 summarizes the participation in the inaugural events in comparison to the official membership.

Table 4. Participation in meetings to inaugurate the ZEM committees, 1993

ZEM	Date	Attended/Total					
		Natl. govt.	Local govt.	Community	Users	Education	TOTAL
Atacames	May 93	6/6	0/3	3/8	5/6	0/3	14/26
Bahía	July 93	6/7	3/4	1/2	16/19	3/5	29/37
Manglaralto	July 93	4/6	1/2	3/3	16/20	4/6	28/37
Playas	June 93	6/7	1/3	1/1	10/13	3/3	21/27
Machala	June 93	7/7	2/3	1/1	10/10	1/4	21/25
TOTAL		29/33	7/15	9/15	57/68	11/21	113/152

It is too soon to tell if the new method of allocating membership privileges according to legal status will interfere with the work of the zone committees. In the past, the committees all operated on the basis of consensus. The switch to a voting system for decision-making could considerably change the atmosphere and style of the committees. Mixing authorities with user group and community representatives is also a new experience. In the early stages of ZEM process, there were many times when advisory committee members railed against the government. This tension has abated over time as the committees adopted a more realistic approach to achieving their goals.

Once formally initiated, the zone committees were empowered to designate new members without review by the National Commission. Some began this process on the same day the inauguration events took place. The convocation of this array of groups has proven to be advantageous on numerous occasions, as the public authorities see the benefits of collaborating. The Navy has been especially important, since its port captains also lead the Ranger Corps units.

The zone committees involve a wide range of nongovernmental groups (NGOs). The most important users-mariculture and fisheries-comprise 20 percent of zone committee membership. Communes and agriculture organizations are the second largest group, followed by tourism service groups, and parish councils. Manglaralto has the longest tradition of community organizations, due to the 10 agricultural communes that exist along this coast. Playas has eight different groups focused on the use of its tourist beach.

In August 1993, 41 leaders of the zone committees met to discuss their views on the priorities for the ZEM office and technical teams. Out of a list of 10 items, there was unanimity that the most important priority was to build community leadership and to help user groups strengthen their ability to function and participate effectively in the ZEM process.

Table 5. Composition of ZEM committee membership in 1993.

ZEM	Government	Fish and shrimp	Mangrove users	Tourism	Community	Sanitation, water
Atacames	9	12	2	5	11	0
Bahía	13	13	2	4	4	4
Manglaralto	9	8	0	2	3	3
Playas	17	11	0	10	2	3
Machala	10	8	1	6	6	1
TOTAL	58	52	5	27	26	11

ZEM	Foundations	Education	Agriculture	Press	Others
Atacames	1	2	2	0	0
Bahía	2	4	8	1	10
Manglaralto	2	6	19	0	0
Playas	1	5	2	0	0
Machala	2	3	0	2	1
TOTAL	8	20	31	3	11

The Atacames-Súa-Muisne ZEM: A case study

Coastal issues and community needs

Atacames-Suacutea-Muisne is the largest of the five special area management zones. Rómulo Jurado has been the coordinator of the ZEM since 1988. For him, the size of the ZEM is not measured in kilometers, but in the time it takes to meet and communicate with resource users living in an area that until recently depended mostly on boats rather than vehicles to move goods and people among the coastal villages.

> In the beginning, the ZEM seemed immense. I worked as a school teacher in Atacames, and I knew everybody here, but the rest of the ZEM was just places on a map as far as I was concerned. Now it is different. The village residents and user groups have organized themselves and they have come to be a part of the PMRC. They feel the need to be part of a group in order to look after their problems.

The traditional isolation of the coastal communities of the ZEM makes the changes that have taken place since the 1940s all that more dramatic. The economy of the region was until recently, centered on subsistence agriculture, artisanal fishing, and some tree cutting and wood products. Dramatic changes have taken place in this way of life since the 1960s in agriculture, rapid urbanization, fisheries, and the introduction of mariculture and tourism. The natural resource base of the ZEM is stressed beyond its capacity; the loss of one resource is quickly followed by overuse and collapse of another in a disastrous downward spiral. The price of this form of development in this ZEM is high.

The final draft of the chapter on Esmeraldas province in *Ecuador: A Profile of Its Coastal Resources* contained three options for the location of a special area management zone. Atacames-Súa-Muisne was not on this list. However, at the meeting held in Esmeraldas the following year to select a site, consensus was

reached that the site should be the priority. Rómulo feels that if a different site had been chosen, the issues would shift, but it would still be possible to work there. He also does not feel that it was a problem that the people of the ZEM did not have a significant role in the selection process. In his view, this way of doing things is typical for Esmeraldas, and it does not surprise anyone.

Since the PMRC approach is based on identifying and addressing salient local issues, the boundaries of a particular site is of less importance than the process by which issues are identified and defined, what local people think can be done, and the way the program works to develop and implement a plan.

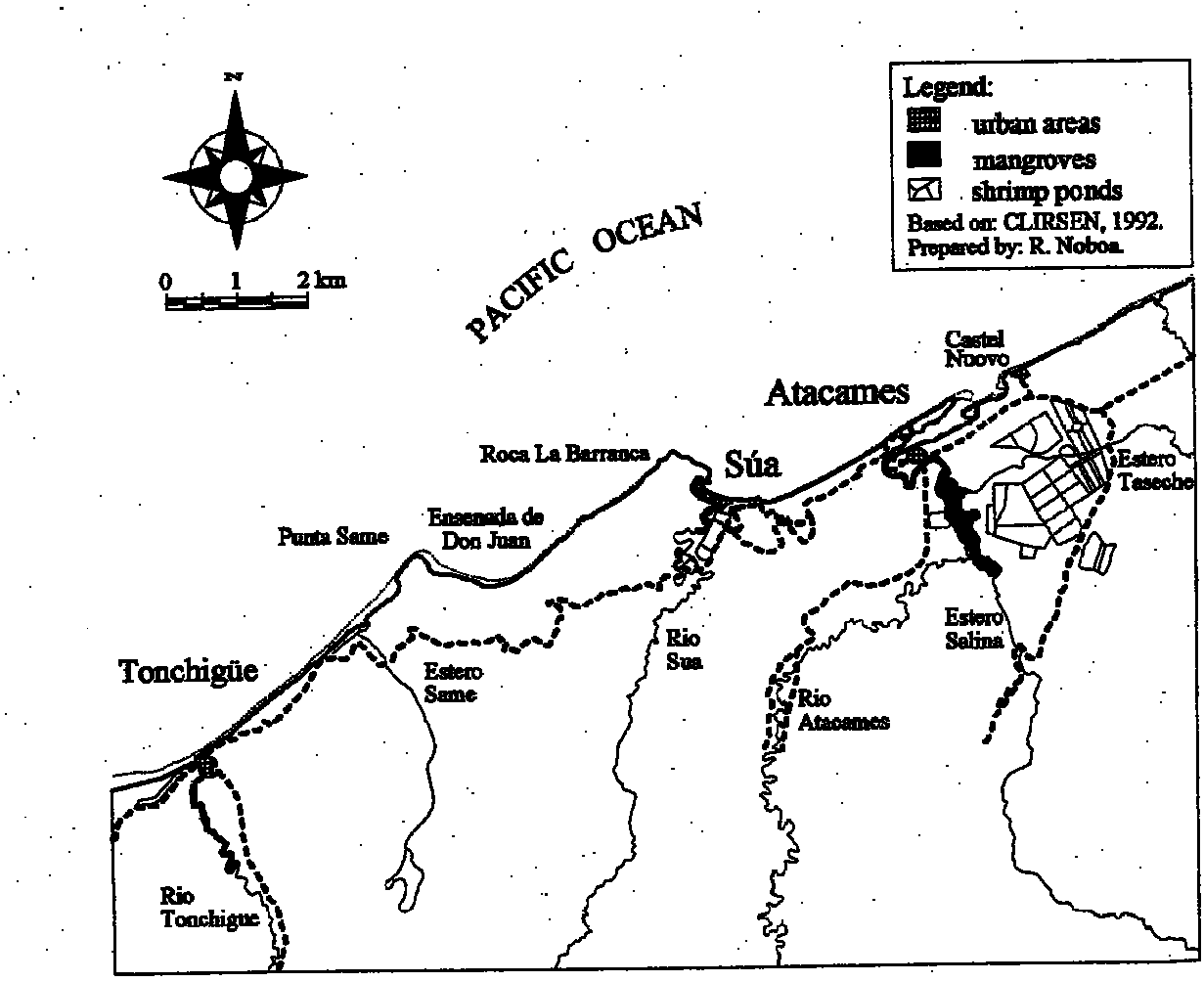


Figure 1. Atacames and Súa.

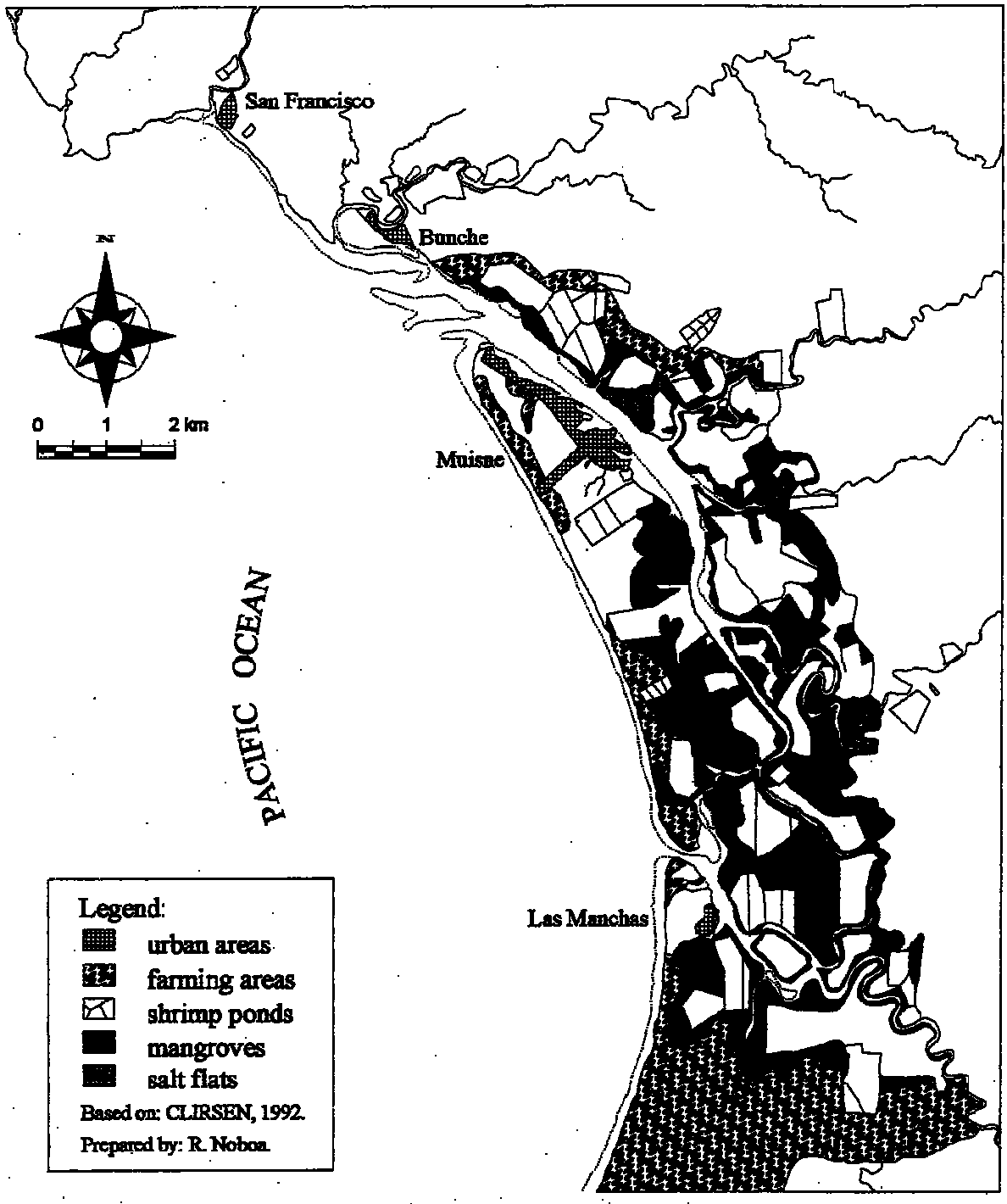
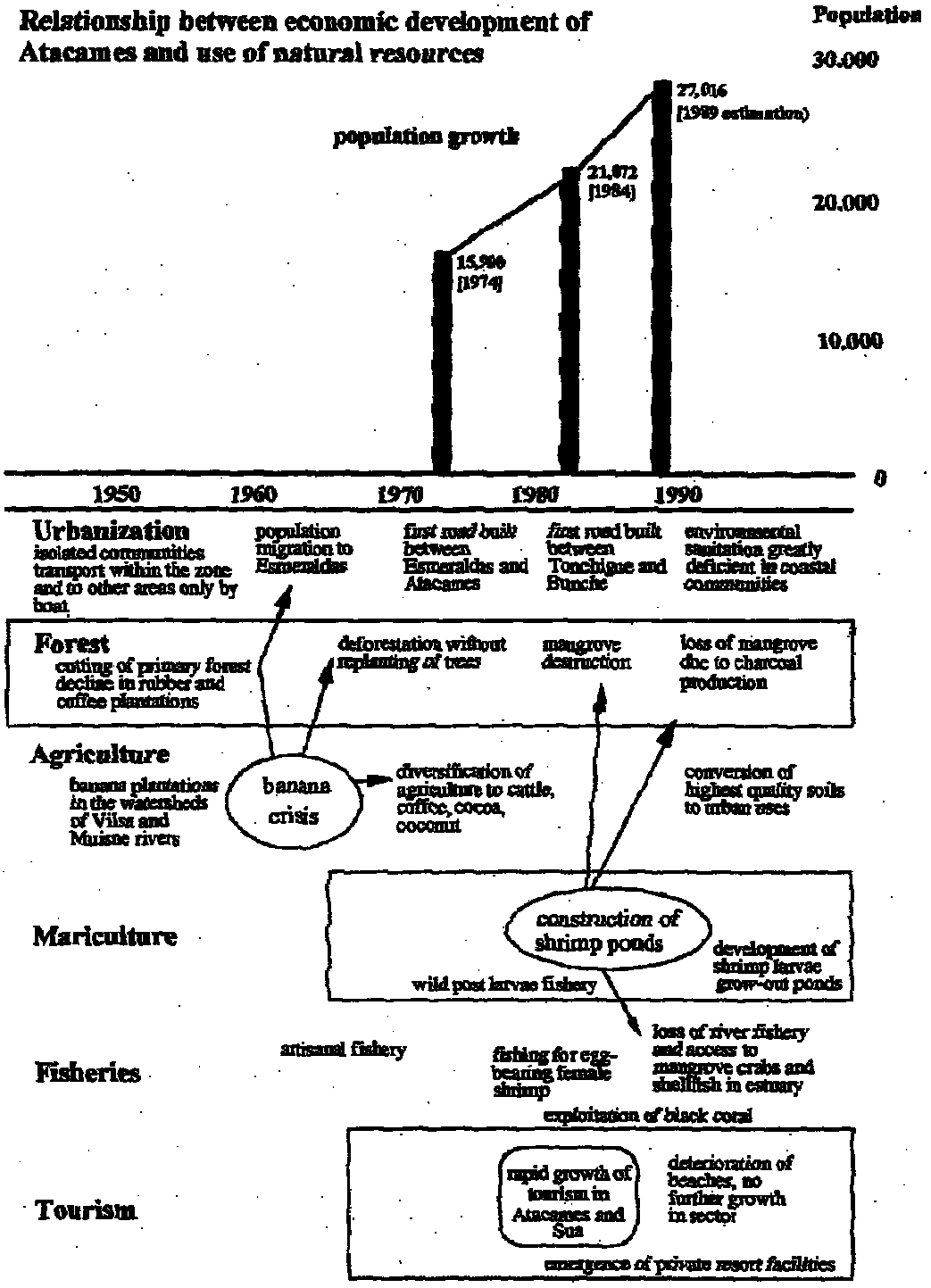


Figure 3. Muisne.


Relationship between economic development of Atacames and use of natural resources
Population
30.000
20.000
10.000
0
population growth
15,900 [1974]
21,872 [1984]
27,016 [1989 estimation]
1950
1960
1970
1980
1990
Urbanization
isolated communities transport within the zone and to other areas only by boat
population migration to Esmeraldas
first road built between Esmeraldas and Atacames
first road built between Tonchigue and Buncfe
environmental sanitation greatly deficient in coastal communities
Forest
cutting of primary forest decline in rubber and coffee plantations
deforestation without replanting of trees
mangrove destruction
loss of mangrove due to charcoal production
Agriculture
banana plantations in the watersheds of Viiss and Muisne rivers
banana crisis
diversification of agriculture to cattle, coffee, cocoa, coconut
conversion of highest quality soils to urban uses
Mariculture
construction of shrimp ponds
development of shrimp larvae grow-out ponds
wild post larvae fishery
Fisheries
artisanal fishery
fishing for egg-bearing female shrimp
loss of river fishery and access to mangrove crabs and shellfish in estuary
exploitation of black coral
Tourism
rapid growth of tourism in Atacames and Sua
deterioration of beaches, no further growth in sector
emergence of private resort facilities

Stages in the ZEM process in Atacames-Súa-Muisne.

Rómulo identifies four distinct stages of development of the ZEM:

- *Forming the social structure of the ZEM:* Establishing the ZEM committees, which provided the social context needed for preparing a profile of the local issues;

- *Early experiences in management:* Measures such as the practical exercises, the formation of the Ranger Corps, and the membership change in the first committees;

- *The ZEM plan:* The conflict resolution process, the signing of the user group agreement, and completion of the ZEM plan; and

- *Expansion:* Outreach to other parts of Esmeraldas province, and the inauguration of the new, integrated zone committee

Forming the social structure of the ZEM

When the workshop to choose the ZEM site was held in Esmeraldas City in early 1988, there were only three representatives of Atacames-Súa-Muisne in attendance. After the MARKOP opinion survey led to the nomination of ZEM advisory committee members, three members of the new committee came from outside the ZEM. This first committee did not survive even one year. Even so, the MARKOP survey had succeeded in identifying the individuals held in the most esteem by local residents and this gave the committee credibility early on as an impartial, nonpolitical group.

The current ZEM committee president, Augusto Vera, learned about the advisory committee when he received a letter from then-governor Roque Lopez, who said that he had been nominated to serve on the group by the Presidency in Quito. He was intrigued by the idea and pleased to be considered.

Augusto Vera is a native of the tiny village of Galera. His parents were from Manabí province, and he was born in the city of Esmeraldas. A small businessman, since the 1970s, he has served as the chief of the Civil Register of Galera. He is a natural leader, and throughout his life has promoted the construction of better roads, churches, schools, health centers, electricity, and other improvements for the communities of the ZEM. He is also widely regarded for his skills in public meetings. In his view, one of the most important reasons for the success of the PMRC is the distance it maintains from partisan politics: "The day the program loses this trait will be the day of its death," he says.

In the first meeting of the advisory committee there were more than 50 people in attendance, even though only 24 people had been officially nominated. Since the meeting was announced over local radio, people felt free to show up and participate. Participants paid their own costs to get to Atacames; the PMRC offered only lunch.

One of the first decisions made by the committee was to rotate its meetings among the three principal villages: Atacames, Tonchigüe, and Muisne. This helped to bring the committee together as a working group. The meetings were held in a home, a school building, or in a municipal hall. Staff members of the PMRC and the Fundación Maldonado were always in attendance, even though the ZEM was an eight-hour trip by car from Guayaquil. Radio advertisements were purchased in order to ensure people were aware of meetings. Although roads have been built since the 1970s to connect the principal villages, many of the ZEM communities remain inaccessible from land, and there is no postal service.

Meetings of the advisory committee usually attracted 50 or more people, two-thirds of whom participated on a regular basis. The style of these meetings was open and all people spoke freely. The initial focus was on preparing a profile of issues in the ZEM. Rómulo and the PMRC staff worked to draw out the collective memory of the extent and patterns of coastal resource use in the past, the current situation, and what people expected would happen in four or five years if things stayed on their present course. The elders of the ZEM surprised everyone with the richness of their experience, and their detailed and integrated knowledge of coastal ecosystems. The realities and dynamics of the ZEM were revealed community by community

through this process of dialogue and recollection.

By the fourth advisory committee meeting, it became clear that the MARKOP nominations had several gaps, and that new members of the committee were needed. However, the changes in the committee composition took place informally, without any new official nominations or correspondence to formally terminate members who had not participated. The transition to a resource-user-oriented group occurred without conflict. Through this evolution, the advisory committee expanded and assumed control of the direction of the ZEM program, a pattern followed by the other four ZEMs.

Early experiences in integrated coastal management

The direction and purpose of the ZEM unfolded during these early months, according to Rómulo, with open meetings and frequent contact between the advisory committee and the authorities. As the technical side of the planning process proceeded, the ZEM committee centered its energies on a series of practical exercises carried out by both committee members and user groups. The Ranger Corps for Esmeraldas was initiated in this period, and the overall character of the ZEM began to emerge.

The PMRC did not operate as a project that had ready-made answers to be passed out by project experts for whatever problem arose. The "learn by working together" methodology, however, was at times very frustrating for the ZEM coordinator. The Project Year 6 (1990-1991) work plan for the ZEM reflects the nature of the challenge:

- Prepare the special area management plan;
- Promote the active participation of the advisory and executive committees;
- Analyze the institutional options for implementing the ZEM plan;
- Promote community support and participation in preparing and carrying out the plans; and
- Support technical studies needed to complete the issue chapters of the plan.

The only thing clear to the coordinators about this intense program of work was who had to participate, and the general method to be followed. The content of the work was developed jointly among project leaders, technical experts, and the ZEM office.

The practical exercises were intended to provide the ZEM committee with experiences in self-development and governance, to build local confidence, and avoid the traditional paternalism seen in local political campaigns and in the operating style of regional and national authorities. Without a strong base of local initiative, it would be impossible to identify and resolve problems and sustain a management effort. The projects built toward the idea of management very slowly, sometimes inspiring just a single individual to take greater care of the resource base. At other times an entire group would realize how the practical exercises, taken together, added up to an important initiative in management.

In Atacames-Suacutea-Muisne, a total of 16 practical exercises were carried out in seven different places. With one exception, all the exercises addressed issues subsequently raised in the ZEM plans. Four out of six mangrove projects, and one of the three sanitation projects were carried out with the close collaboration of PMRC technical experts. None of the other projects received such technical support. The greatest amount of learning and insight took place in the projects in which collaboration was the greatest.

Table 6. Practical exercises in the Atacames-Suacutea-Muisne ZEM.

Issue and location	Project Year	Project title	Status
Mangroves			
Atacames	6 & 7	The mangrove boardwalk	In use
Muisne	7	Ecotourism in the mangroves	Inactive
Muisne	6	More efficient charcoal ovens	Completed
Bunche	7	Reforestation with help of shellfishers	Completed
Ranger Corps	5	Repair Forestry District boat	Does not work
Bunche	7	Outboard motor for charcoal makers	In use
Tourism			
Atacames	5	Lifeguard project, with caipiriñeros	Active
Atacames	6	Improve bathrooms in beach area	In use
Súa	6	Improve bathrooms in beach area	In use
Atacames and Súa	7	Local marimba group	Not active
Mariculture and fisheries			
Tonchigüe	6	Resale of fishing boat lubricants	Active
Bunche	6	Larvae recollection center	Not in use
Environmental sanitation			
Galera	7	Construction of a well	In use
Tonchigüe	7	Solid waste collection	Not active
Atacames	7	Collection and disposal of solid waste	Active, transferred to municipality
Community development			
Galera	7	Kindergarten, school, community projects in conjunction with PRONADES	In use

Except for the mangrove projects, which were a central focus for the PMRC, the practical exercises were small activities that cost no more than several hundred dollars each, plus community contributions. Several of the activities were eventually linked together. The mangrove boardwalk, built in 1990, spurred the solid waste collection project the following year, which then inspired the marimba folklore group. This led in turn to the active involvement of the shrimp farmers around the Atacames River, and to an agreement to establish use zones for the area. When the chapters of the ZEM plan were reviewed and the final version approved, the interconnections among different resource users and the issues faced in the coastal environment reached an even broader level of understanding. In practice, as would be expected, the depth of common understanding is greater for some issues than for others.

The Atacames-S&uacutea-Muisne ZEM is regarded by the PMRC as the location where the broadest and deepest experiences in coastal management have been achieved. The relatively low cost of the investments in the ZEM program are felt to be inversely related to the richness of the experience that the ZEM has generated. The ZEM coordinator explains this success by the particular focus taken by the PMRC:

In mangroves, for example, the focus was on conserving the ecosystem to assure the continuity of traditional economic activities of the people. This permits the shellfishers to continue collecting, the charcoal makers to

continue their activity, and the crab catchers and the artisanal fishers and the shrimp farmers to continue theirs. Beyond these uses, the mangrove will be allowed to maintain itself, and in turn it will continue to provide the shelter and benefits we need.

The coordinator continues to feel that for the future success of practical exercises and ZEM plan implementation, it will be essential that the ZEM be capable of providing all the technical support needed for success, and that the technical team learns to provide consistent, integrated advice and recommendations.

The ZEM plans and the power of the advisory committee

The third stage of the ZEM process consolidated the identity of the program. Rómulo says that the advisory committee assumed a leadership role during this period. This is reflected in the user group agreement and the ZEM plan, and from this new stage, management actions began to occur.

According to Augusto Vera, the face of the PMRC could finally be seen because the advisory committee became an authoritative body within the ZEM. It created the user group agreement, convened local and regional officials, met with the Ranger Corps, made proposals to the National Commission, hosted delegations from the Inter-American Development Bank, was aware of the use conflicts, supervised the practical exercises, and approved the ZEM plan.

The indicator used by Augusto Vera is surprisingly simple and clear: If there is a functioning committee, then the PMRC must be an authority. The question is, how and why does an advisory committee acquire such power? An important local initiative that helps reveal the source of this local power was the presentation the committee made to the National Commission to promote three mangrove management projects for Atacames and Muisne. The National Commission met in Atacames in August 1991, and reviewed and accepted the projects. The resolution accompanying the decision requested that government agencies and the municipalities of Esmeraldas and Muisne provide all the assistance necessary for successful implementation of the projects, and that the PMRC technical secretary provide minimal funding and technical assistance. This was a considerable achievement for the advisory committee.

The capstone of this phase occurred the following February, when the user group agreement was signed by the president of the advisory committee, the members of the Esmeraldas Ranger Corps, and leaders of 28 user groups. The agreement did not address a particular conflict; rather, it was aimed at establishing a cooperative zoning system for use of mangroves and estuaries. The agreement also did not include signatures from shrimp farm owners, although the advisory committee persistently sought to involve them as one of the principal groups having an impact on the ecosystems of the ZEM. Their organization, The Association of Cultivators of Bioaquatic Species (ACEBAE) had always been invited to join, with the hope that sooner or later this would come to pass. This positive outlook on the need to involve the shrimp farmers has proven indispensable as the advisory committee has engaged in managing the conflicts that have followed since the signing ceremony.

In general, a businessman operates within the rules imposed by the market in which he or she participates. Before the user group agreement, complying with environmental laws was not an issue in the marketplace for local businesses. After the agreement was signed, the businesses of the ZEM made sure that coastal ecosystem protection was a key factor. They have acted forcefully to put the words into action.

In theory, power exists when it is recognized by the organization itself, and is widely accepted by others. The decision by the National Commission to approve the mangrove management plans and the recognition of the PMRC provided by local user groups when they signed the user group agreement both served to provide legitimacy to the authority of the advisory committee. The success of this initiative, due in large measure to the work of the ZEM coordinator and the mangrove technical advisor, gives the ZEM process its special quality and character, which in turn is reflected in the power of the committee.

Relationships with shrimp farmers improved slowly over time. In April 1993, ACEBAE finally nominated its president to serve on the newly constituted zone committee. In October of that year, it took steps toward signing the user group agreement, and in December proposed a joint agreement with the PMRC to reforest 200 hectares of degraded mangroves in Muisne.

The shrimp farmers have not yet signed the agreement, because their lawyers advise them that public authorities cannot sign a document containing a zoning plan, which must have distinct legal procedures and characteristics. In other ZEMs, the authorities have signed as a pledge of good faith. Under the expanded PMRC program to implement the ZEM plan, agreements remain only among user groups, and the public authorities will be invited to carry out specific actions through their role in the Ranger Corps. During the inauguration of the zone committee, many of the members expressed their satisfaction at seeing ideas from the Atacames-S&uacutea-Muisne ZEM experience incorporated directly into the procedures of the PMRC.

Throughout this third phase, the zone committee acted increasingly as an organization with a considerable capacity for learning from experience.

Expansion of the ZEM process

As each new governor of Esmeraldas province has been sworn into office, Rómulo Jurado has advised the PMRC in Guayaquil that there is a new opportunity to expand the work of the program, stressing the need to respond positively to the governor's requests for assistance. The province continues to lose a great deal of its natural resources and is dominated with the typical political emphasis on filling public service job vacancies and promoting economic development projects.

The newest change in provincial government took place in November 1994, making a total of four governors who have sought to apply the PMRC approach to the problems of the province. The PMRC has not been able to respond effectively to these requests. A project to prepare a revised coastal issues profile for the province (following up on the workshops and report in 1987 that led to creating the PMRC) was not funded.

The area of northern Esmeraldas had been identified in the original Esmeraldas profile as a critical area. It had not been accessible by road, and saw virtually no degradation until about 1990. In the past two years, this situation has changed dramatically as shrimp farmers race to mark out and exploit concessions in an attempt to escape the pollution and productivity problems of the southern provinces. Shrimp farmers are attempting to use both uplands and mangroves in the hope of benefiting from the as yet undamaged environmental conditions.

One of the most important areas is in La Tola, in the Olmedo precinct, which is reported to have the tallest mangrove trees on the eastern Pacific coast. The trees are within a private hacienda, which was recently purchased by a shrimp farmer who is building ponds and needs to build canals for saltwater intake and discharge. The site is very far from the ZEM of Atacames-S&uacutea-Muisne, and out of the jurisdiction of the Esmeraldas Ranger Corps. In 1994, the Ranger Corps of the port captaincy of San Lorenzo was not organized or receiving financial support from the PMRC.

This crisis of shrimp farm construction in northern Esmeraldas broke out during the difficult period of transition of PMRC funding from USAID, which ended in March 1994, and the IDB project, which had not moved into full-scale operation as of mid-1995. The program could barely support activities in the five ZEMs and three Ranger Corps. This did not discourage the Esmeraldas Ranger Corps and the ZEM office in Atacames from working on their own initiative to develop a user group agreement for managing the mangroves of La Tola. The agreement was signed in December 1993 among the villagers in Olmedo, the shrimp farmers, the director of the National Forestry Institute, the port captain of San Lorenzo, and PMRC staff members. The initiative of the ZEM staff generated an intense debate within the PMRC on how to provide a credible, sustained response to issues outside the ZEMs and the three functioning Ranger Corps without abandoning core tasks and responsibilities. There are many such conflicts throughout the coast, as well as great unmet needs within the ZEMs, and the PMRC realizes it will have to designate new ZEMs, expand into other issues and critical areas, and build up the Ranger Corps. Yet, the lessons of the ZEM of Atacames-Súa-Muisne are also clear: There must be adequate technical backup and follow-through if crisis interventions are to succeed, and without follow-up it is usually better not to get involved.

Gaps and risks facing the Atacames-Suacutea-Muisne ZEM

Rómulo Jurado feels that artisanal fishing, a mainstay of communities such as Tonchigue, Súa, Galera, and Cape San Francisco, is an important issue that needs much more attention. A recent project run by PRAPESCA, a nongovernmental fisheries project in Esmeraldas, has generated new information showing that fish stocks are

heavily overfished, and that dramatic changes are needed in fishing practices to combat the prevailing attitude of exploitation among fishers. The Ranger Corps needs to become actively involved in fisheries management and to pay attention to the senseless slaughter of sea turtles that are caught in fishing gear. Augusto Vera confirms this, stating that white fish and shrimp larvae are the species most at risk under current harvest patterns. He feels that the situation with mangroves and tourist beaches is, fortunately, improving.

Rómulo blames existing fishery laws for much of the problem:

> The laws do not say anything about sustainable use. This concept is still new to Ecuador. Some of the lawyers who have tried to help in the ZEM are interested in the new approach and see possibilities for change. Others only think within the framework of the existing law, and they are a menace to solving the problem, rather than a help. The user group agreement, for example, is not a law or regulation, it is a statement of how things should work in practice. What we need is an outlook that promotes change, not the posture that the law is the law.

A central issue continues to be the capacity of the PMRC to expand its efforts to meet growing demand. The direction and impetus of the program will be lost if it does not speed up its decision-making, and if it puts the brakes on initiatives in the ZEMs, according to Rómulo. At the other extreme lies the trap of public works projects. If the ZEM office is consumed by managing a large number of work tasks, its role as coordinator and integrator will be diminished, and the core of the ZEM process that has taken so many years to build will be disrupted.

Cases on managing resource use conflicts in the ZEM

Protecting mangroves in the Atacames River

Since it was formed in 1989, the advisory committee has made a variety of initiatives to reverse the downward trends in coastal resource condition and use. The mangrove boardwalk has made perhaps the greatest contribution toward integrating the various resource users-including hotel owners, caipiri–eros, shrimp farmers, schoolteachers at the elementary and secondary levels, young people interested in the local environment, and women involved in producing crafts for the local tourist market. As a result, until late 1992, not one mangrove tree was cut along the river.

Things changed in December of that year when a conflict erupted, provoked by two longstanding friends of the PMRC-a shrimp farmer who had strongly advocated mangrove conservation, and a former advisory committee member who had become the president of the municipality of Atacames. The shrimp farmer decided to build a 500-meter-long, 8-meter-wide canal through an area of mangrove to improve the quality of water drawn into his shrimp ponds, where productivity had declined considerably. The Municipal Council had approved permits to construct houses in a mangrove area designated for implementation of one of the advisory committee projects approved by the National Commission.

The advisory committee requested the intervention of the PMRC on December 7, 1992. By chance, the staff in the PMRC in Guayaquil were at the time involved in a course on conflict resolution with other program partners, so the case was put before the assembled group. The PMRC recommended taking an integrated approach that would involve the broadest participation possible by the user groups involved, the municipality, and other local authorities with direct jurisdiction, under the leadership of the advisory committee of the ZEM, which had been waiting for many months to be rededicated as the zone committee.

Four months of hard work followed to resolve the situation, which gained the attention of the print media and national television. Legal actions were taken against mangrove cutters, equipment was seized, the entire team of the PMRC was involved in site inspections, the highest-level officials in the forestry district became actively involved, and the advisory committee met frequently with the Ranger Corps to keep up to date on the situation.

PMRC technical advisors found that the initial concern about water quality in the shrimp ponds could not be solved by cutting a new channel, since the river was already contaminated throughout its length. Instead, the PMRC redefined the issue as one of solid waste and water pollution control. The shrimp farmer also

needed to improve the way his ponds were managed during the production cycle. Actions to restore the mangrove stand were identified, as well as the need to redefine the direction of urban growth in Atacames. With the advisory committee effectively asserting its leadership, a plan was mapped out that addressed each concern, and accepted by both the municipality and the shrimp farmer. The success in resolving the conflict served once again to confirm the authority of the committee.

The case of the shrimp farmers association, ACEBAE

ACEBAE represents 65 of the 80 shrimp farmers in the ZEM. The group charges a membership fee based on the volume of production of each member. Its principal concern is the 50 legal actions pending against its members for violation of mangrove conservation laws. In Muisne, 1,500 hectares of shrimp ponds have been constructed, many without permits. The vice-president of ACEBAE, Rúben Mac'as Andrade, is originally from Manab', has a degree in sociology, and says that the group was reactivated with the help of the PMRC in mid-1992. The leaders of the group now view conservation of mangroves as essential for their economic survival. Their greatest fear is that large operators from outside the region will buy up the small ponds run by their membership, and disrupt the user group agreement. The members of ACEBAE are themselves outsiders, primarily from Manab', Pichincha (in the Andes), and Guayaquil. Only 15 percent are from Esmeraldas. They have a wide range of professional backgrounds. Some of the estimated 350 laborers in the farms are local hires, with a farm typically employing five permanent workers.

The social tensions that existed for many years during the period when the members of ACEBAE built their ponds, often illegally, and displaced traditional users, have abated considerably. The shrimp farmers now permit the shellfishers, primarily women and children, to collect along the ponds banks once the shrimp harvest is completed. Ponds have been producing three, and sometimes four harvests of shrimp per year, yielding 800 to 900 kilograms of small shrimp per pond per year, which is very low compared to intensively managed commercial ponds in southern provinces. The farmers believe that ponds built in former mangroves are more productive than other sites. Some shrimp farms in Muisne have failed, victims of over-ambitious investments that the environment could not support.

A mangrove reforestation plan proposed by ACEBAE in 1994 sets out a collaborative relationship between the shrimp farmers and the PMRC that was unimaginable a few years earlier.

The PMRC has been asked to agree to

- Plan the reforestation projects;
- Provide technical assistance for the field work;
- Foster the participation of other user groups in the effort throughout Muisne; and
- Conduct a public education campaign as part of the reforestation initiative.

The shrimp farmers proposed to support the following measures:

- Maintain and protect the replanted areas.
- Coordinate with other user groups to implement the actions in the plans.
- Directly participate in reforestation activities specified in the plans.

Table 7. Areas set aside for mangrove reforestation.

Sector	**Area to be reforested (hectares)**
San Francisco	5
Bunche	7
Chontaduro	10
Isla de Muisne	10
Vilsa	2.5
Tortuga	32
Tortuguita	4
Las Machas	14.5
El Firme	8
San Gregorio	5.5
Bolívar	32
Daule	30
S&aacutelima	18
Chamanga	12
Isla Esmeraldas	10
TOTAL	199.5

Local voices and perspectives on the PMRC and the Atacames-Suacutea-Muisne ZEM

Farmers

Carlos Hernández Olaya is the president of the Esmeraldas Agricultural Center (CACE), which has 4,000 members, 40 percent of whom are native residents of the province. He is also vice-president of the Farmers Association for Ecuador, Region II, based in Guayaquil. He was not familiar with the early phase of PMRC activities, but became involved when the meetings began to take place in the ZEM.

> I encountered the PMRC through its work in the villages. We were never opposed to this initiative, because the farmers in this province are also fishers. Now, we help wherever we can, for example in the convocation of the new ZEM committee. We see the PMRC as a resource, the problem is that it is too limited in its ability to act. The program needs to have a stronger presence because people here have so little access to help. You should be working 40 kilometers inland, in my opinion.

The leaders of Esmeraldas province are obsessed with the need for economic development. Hernádez Olaya is promoting the formation of a civic association, or development council for the province. He feels the municipalities have very little capacity to act on this front. Rural areas are neglected because they just do not provide enough votes to interest provincial politicians. Mismanagement of the public sector is a reflection of the existing political system.

Hotel owners

Pablo Palomeque is president of the Hotel Owners Association of Esmeraldas, which has 22 members. He is originally from Quito, but has lived in Esmeraldas the past 14 years, at first coming for short visits, but married and decided to settle there. He is a cheerful man, yet has great concern for his adopted province. He tells about how one solution seems to be followed by another problem in Esmeraldas, using the example of the recently completed water supply for the city. Once the contractor completed the construction of the much-needed system, the city found itself suddenly paralyzed by a two-year strike of sanitation workers. The University of Esmeraldas has also been the victim of a strike that has gone on for more than 11 months.

> The government and the municipality are the same when it comes to politics; in fact, the labor unions are also a part of the political problem. Public officials circulate back and forth between the different posts: the same person who was in charge of the city yesterday is in the governor's office tomorrow. The groups are constantly fighting among themselves. To top it off, the political style here is rough. Serious people who could help the province or the city do not want to be involved in this dance.

The local population is dependent on employment in the public sector such as the port, the refinery, government, education, the university, and public works units. The productive sector of the economy, in effect, is managed by outsiders.

> The port captain of Esmeraldas

CPFG-EM Walter Nieto Bueno has been in charge of the Ranger Corps on behalf of the PMRC for about a year. As is the custom within the Navy, he will likely be transferred to another post in about seven months. Each of the port captains has been very effective in his work with the PMRC, yet just as he is making his mark, he must leave. The Navy recently decided to upgrade the post of port captains in Esmeraldas, Puerto Bolívar, and Manta. Captain Nieto is pleased, because much of his work involves more than military and administrative duties, and it takes additional experience and maturity to perform them well.

Captain Nieto sees the Ranger Corps as his most challenging duty, because of the diverse backgrounds of the people involved.

> The Ranger Corps must not view itself as an entity of control, rather it is one of coordination. In my role as leader of the Rangers, and as vice president of the zone committee of Atacames-Súa -Muisne, I can meet in one place all of the people and institutions that pertain to my duties as port captain. If there were no PMRC, I would have to invent one to get my job done. Without this ongoing relationship with the fisheries inspectors, the forestry rangers, and the tourism agency, I do not know how I could accomplish my work. They are always available to help.
>
> The PMRC has a strong sense of civic responsibility, and it is important that the Navy be involved in it. Conserving natural resources is not just a task to perform, it is essential for the country, just as it is vital that agencies and user groups work together to enforce environmental laws. The Ranger Corps is one of the best projects in Ecuador, in part because it is a patriotic activity and is building a sense of citizenship. Nothing could be more important than that.

Captain Nieto feels that relations and confidence between the public and the government entities charged with managing coastal resources has improved significantly since the establishment of the Ranger Corps.

> The ZEM coordinator

Rómulo Jurado remembers that in the beginning, when he was the only person on the ZEM staff, it was not clear to him where the PMRC was headed, and recalls that the other ZEM coordinators felt much the same way. At times his impression was that a process had been started that did not know where it would end up. Now, his office has expanded to include three technical assistants, a secretary, the Ranger Corps coordinator, and a vehicle. He was always expecting more specifics from the URI advisors, but in his view they never provided precise instruction. What he got were tasks and schedules: start the office, collect information, organize meetings, and so on. At the beginning he saw tasks, not the process itself.

> The office in Guayaquil warned me to be careful or the people would overwhelm me with their demands. I was told to restrict my work to just a few organizations and not to promise "works" or projects. This was simply being careful. They kept asking me for things that were not essential: reports, formal letters, and so on. I believe that at times nobody really knew where we were going. Sometimes the program seemed like a conservation initiative, other times it was a technical assistance effort, other times a planning project. At one point there was a system of co-leaders for technical tasks, then it shifted to a looser team of consultants who seem to know what they are about. It did not always have an integrated character the way it does now.

Rómulo's views echo the experience of the Fundación Maldonado in preparing the original coastal province profiles. The URI staff, led by Stephen Olsen, never laid down pre-defined blueprints to follow. For the team preparing the documents, as for the ZEM coordinators, the sense of freedom and danger was very strong. Arturo Maldonado, coordinator of the Machala ZEM, has said that the people at URI deserve thanks for the harvest of self-reliance that this approach eventually produced.

In 1990, Rómulo spent a month at a Quaker retreat in Costa Rica to attend a course on ecological principles for resource conservation and sustainable use. He is the only coordinator to receive this type of training, and it was at his own initiative.

Rómulo feels that the ongoing support to the ZEM in public education should be generated out of the ZEM itself and from resources within Esmeraldas province, as has already occurred with outreach. He feels that rather than producing programs for elementary and high schools, associations, and universities, the PMRC ought to be creating the local capacity to generate such initiatives. Those local institutions are perhaps among the most important constituents of the PMRC.

Rómulo looks upon his experience to date in the ZEM, and sees three areas of success: working with the user groups; relationships with the port captain, the forestry agency, and other Ranger Corps members; and working with the local media. The critical factors accounting for those successes are the leadership of the zone committee, the respect given local efforts by the national commission and local authorities, the work of the mangrove consultant, and the freedom and cohesiveness which the ZEM team has pursued its work.

The presence in the ZEM of the National Commission and the various missions of the Inter-American Development Bank and USAID staff since 1991 has helped demonstrate that the program is a serious effort. The communities appreciate the visits of these authorities because they feel respected. Enrique Sosa, the political affairs officer in Galera, says that the PMRC is the only group that can bring the authorities together with the communities. "Here we forget who is governor and who is captain, because we are all equals. These are real meetings."

Lessons, Commentary and Conclusions on the ZEM Process

The current status of coastal management in Ecuador was not brought about through a single initiative directed by the PMRC. In fact, the daily life of coastal management in Ecuador is a complex mixture of research, development projects, organizational strengthening efforts, outreach and communication, leadership and interagency coordination, extension work, and monitoring.

This simple truth about the PMRC often seems to be forgotten by the program's technical specialists, who sometimes place their own agendas ahead of the global one. At times, the conflict between specialists within the program has been more intense that those taking place among competing resource user groups. Management is not the action of a single person, it is created by the functioning of a team and through disciplines upon which it draws.

The experience of the PMRC to date does not offer proof of permanent success, but only of the successful completion of the first cycle. At least we know now that making the journey is possible, and we know how to carry through all the steps. New experience will no doubt provide new lessons. The future of the PMRC lies in the recognition of all the work that remains to be done and the hope that Ecuador can accomplish it, rather than in the accomplishments it has already achieved.

One of the most attractive features of the PMRC from the perspective of user groups and communities, the press, and politicians is the concept of sustainable development. At the same time, this idea generates considerable skepticism among the business community, some academics, some sectors. Like any idea that goes against current thinking, the recommendations to change established patterns of behavior in Ecuador is controversial.

On building a constituency for the ZEM process

- The PMRC requires social and political will in order to function and be effective. The

construction of such will is at the heart of the work of the PMRC: It is built step by step and renewed day by day at both the national and local levels by bringing stakeholders who normally act independently into a new role as members of the constituency for improved coastal management. The first time that representatives from each province-resource users, officials, leaders-sat together at the same table with the PMRC, the context for coastal management immediately began to improve.

- The deepening understanding of the social changes required to foster sustainable resource use practices and improve quality of life along the coast has served to keep the PMRC initiative on track, both in working with its constituencies, and within the project team itself.

- The number of people who consider themselves active participants in the coastal management program reaches far beyond the paid staff and officially designated committee and commission members. The boundaries of the PMRC are not definite in this sense, and continually expand. The PMRC's responsibility is to encourage this growth in the number of resource users, citizens, and public officials who see themselves as coastal managers, both at the local and national levels. The extent and force of this process of social change was revealed at a preparatory meeting for the national mangrove conference held in 1993. Several women shellfish collectors from Bunche, Esmeraldas had been invited to Guayaquil to recount their experiences in the ZEM process. The chair of the meeting was a longtime PMRC project leader from URI. In making a point about how they felt about their involvement in the program, one of the shellfishers pointed to the URI staff member and said "I do not know who that person is, but we are the PMRC."

- The growth of the local ZEM staff, including changes in leadership, has taken place naturally over time. As the staff reached its full complement, it also created its own internal organization. As the ZEMs moved from startup to planning to implementation, they worked with a variety of Guayaquil-based consultants and technical staff who have only gradually learned to understand the emerging situation in the ZEMs. The stability of the working relationships between the ZEM teams and the technical direction in Guayaquil is critical to the evolution of the PMRC.

- The emergence of this larger, actively involved constituency for coastal management-which scarcely distinguishes project staff from other active participants and resource users-occurs slowly, through successive efforts that occur during the constant flow of meetings, contacts, and consultations that bring people closer together, while respecting their independence and differences.

- Working together to gather, discuss, and analyze information about the nature of coastal problems helps greatly in generating common understanding of key problems and issues and in building the goodwill vital to a successful collective endeavor. The shift in peoples' own perception of their status in the PMRC's coastal management activities-from the role of passive bystanders to engaged actors-is helped when the ideas that are generated through planning meetings are formally acknowledged and acted upon, as in the case of the advisory committee's success in getting its mangrove management proposals adopted by the National Commission. Progress is possible only when each actor takes responsibility for the creating the atmosphere of mutual respect and protection of the process. It does not matter where the initiative starts.

- The relationships among resource users and management authorities are quite varied, and contain elements of cooperation as well as conflict. It is essential that the tensions in relationships are fully recognized, and that each one of the actors in coastal management feels responsibility for ensuring that those problems are addressed through the program.

- The coastal management program is a creative learning process. The solutions to the

specific issues faced in the ZEMs ultimately must be found within the ZEM, and this will only take place if the local program has the capacity to learn from its own experiences, as well as from the outside. The frequency and skill with which the ZEM actors take time to review what has taken place, compare notes and perspectives, and rethink how the program should proceed, is improving dramatically. This process is most effective when resource users and program technical experts sit together to create this new understanding. This in turn requires that each actor have the self-confidence to participate effectively.

- The PMRC has, since its inception, functioned as a flexible, adjustable process. It has focused on the ZEMs, but aspires to bring integrated coastal management to the entire coast. It has used small projects to learn how to deal with the serious problem of implementation. It maintains a flexible structure that allows each level of the program a considerable say over the direction of effort and activities. It has worked hard to make existing laws function better through coordination and cooperation, while at the same time exploring alternative mechanisms for management, especially at the local level.

On the use of information and language in the ZEM process

- The mutual understanding of the language used by the actors in the coastal resources management process is essential for building a common, integrated vision. The world of technical experts and public officials is based on the written word, but in general the best channel for communication in the ZEMs is oral.

- Given that each actor has a distinct preference for the way he or she receives information, the PMRC releases information in many different formats at the same time. For example, during the process of developing and reviewing the ZEM plans, the material on each issue was presented in full-length documents, summary pamphlets, a comic book series, workbooks for schoolchildren, public meetings, radio programs, newspaper and television reports, and workshops.

On finding the starting point in the ZEM process, and setting objectives

- The PMRC usually did not determine the starting point for an intervention. Rather, it was dictated by the situation. The constituency and the key actors determine what issues the program will address, and periodically revisit and adjust the definition of those issues.

- A coastal management program, above all, must create what it requires to maintain itself and support its work. The most important need is for an appropriate and effective operating style that governs how the program is organized and work is carried out. In Ecuador, this is called the mistica, or essential spirit, of the PMRC.

- Progress toward sustainable development in the ZEMs is through a continuous process of trial and error. The cycles of thinking and doing begin with questions such as "Where are we now?" and "Where are we going?" This thinking is done out loud in plenary sessions of PMRC staff and collaborators. The people carrying out the objectives of the PMRC must all be engaged in this dialogue, in order to create the organizational capacity for learning and growth.

On initial training of PMRC staff, and learning by doing

- No one received training in the philosophy and practices of coastal resources management-a complaint heard frequently from the ZEM coordinators. The process of reflection that takes place as each new cycle of the program is initiated must, in some ways, be considered sufficient training for the project team, since they together must make the effort to create the next cycle.

- The limited opportunities for formal training provided through the PMRC, Escuela Superior Politechnica del Litoral (ESPOL), or the University of Rhode Island was provided primarily to the Guayaquil-based technical staff. The leaders of the ZEMs and the coordinators were given their first joint training workshop just eight months before the eight-year USAID-funded project was terminated.

- The groups operating at the local level in the different ZEMs have never had a chance to meet, compare experiences, and help each other. This is a serious oversight that hinders the growth of the program.

On identifying key issues, research, and the technical issue working groups

- Using the issues identified by resource users and key actors has proven essential for concentrating and organizing the energy of the program and its constituency. Over time, issues change, and these variations are a normal part of the evolution of the program.

- Focusing on key issues also ensures that any research that is undertaken is closely linked to management concerns.

- Research that is useful for management needs the participation of both resource users and technical experts. Researchers appreciate that their work will be immediately useful, and resource users can participate in advancing knowledge about the environment upon which they depend.

- The technical issue working groups (such as the mangrove and water quality groups) were able to create a network of professionals that brought local issues to the attention of national agencies and provided additional expertise to situations that otherwise would be overlooked.

On the preparation of the project design for financing from the Inter-American Development Bank.

- The working style and philosophy of the PMRC, with its incremental design, open participation, and flexibility has been incorporated directly into the operational regulations of the new project.

- The program's operating style has proven itself durable and sustainable, since the IDB proposal was supported by two successive PMRC directors, as well as a newly formed National Commission under a new president of the republic.

On setting the direction of the coastal program

- The goals and direction of the program are set by the participants in the program, not from the top. People at all levels work together to make these decisions. The ZEM that has hosted the greatest number of meetings of the National Commission and gained the most help from the Guayaquil-based technical directorate is the one with the strongest local support and project team. In turn, when elements of the national government change, the ZEM is able to provide the best examples of new directions to take.

- The continuity of the PMRC is also related to the fact that it is viewed as an entity of the state, not a particular elected government or political party.

- The biggest threats to the work of the PMRC at the local level are the potential dispersion of the ZEM teams during the transition to IDB funding, and the tacit or even active opposition of local authorities. If the former happens, the local communities will lose a crucial channel of communication and integration, and much of the newly strengthened local capacity will perish. It is less likely that local government opposition will emerge, but even so, office holders change frequently and the ZEM process has so far been strong

enough to weather these storms.

- At the national level, the key risk factors are the inability to expand the technical team sufficiently to meet demand-a problem illustrated by the frustrations in expanding PMRC methods and presence throughout Esmeraldas province-and a paralysis or bureaucratization of the National Commission and its technical directorate. Although the PMRC has established itself at the national level, it has not as yet made a secure enough place for itself to avoid such problems.

- A final risk factor is the likelihood of becoming so overwhelmed with projects and demands that the PMRC loses the flexibility and vision needed to maintain the incremental learning style that has served the program so well. A flood of new experiences without a framework or opportunity to learn from them will send the PMRC spiraling in too many directions at once.

Public Education

Washington Macías P.

Before the inception of Ecuador's Coastal Resources Management Program, coastal communities in Ecuador had little exposure to environmental education, and no role in environmental decision-making. Technical experts working on coastal issues seldom consulted residents and resource users; coastal communities were not given the opportunity to express their views on decisions affecting coastal resources. The PMRC recognized from the outset that public education on environmental issues and participation in decision-making was critical to both launching and sustaining coastal resource management initiatives.

Public education and dialogue formed a cornerstone of the early development of the PMRC. Educating coastal residents about certain aspects of resource management issues was only part of the picture. Just as important, the PMRC needed to receive information about the problems and concerns faced by coastal communities. This details how a public education and outreach strategy was developed that provided many channels for communication and joint learning. The initial successes achieved in creating the PMRC can be attributed in large part to this public involvement and information exchange with and among the people of the coastal provinces.

Once the PMRC had been formally created by executive decree in 1989 and the ZEMs established, it was clear that public education would be an ongoing need. In this phase of the program's development, however, the content and style of the public education effort turned from issue identification and planning to the governance process itself, with the ZEMs as the focal point for activities. The ZEM field coordinators were faced with the challenges of announcing their presence to the community, developing local understanding of project goals and activities, and fostering cooperation and credibility for their initiatives. This presented an entirely new situation, both for the PMRC's professional staff and the communities themselves, since no such initiative had ever before been undertaken along the coast.

Summary of Results of Public Education for Coastal Management

- The ZEM committees have successfully carried out their functions. Communities, local authorities, resource users, and educational groups have come together and used the committees as a useful, democratic mechanism for addressing resource management problems, including those that extend beyond the borders initially established for the ZEMs.

- Authorities and user groups with conflicting interests and very different social and economic backgrounds have worked together as equals to address critical coastal resource issues. Before the ZEM process started, opinions such as these were frequently heard:

    "I am not going to meet with that port captain because he always favors the shrimp farmers" - Traditional resource user

    "Meeting with the authorities is a waste of time because they are only interested in money" - Community member

    "Don't ask to meet with the shrimp larvae fishers because we have nothing in common to talk about" - Marine biologist

Now, working groups and committees sit and work together without differentiating by social status or legal authority.

- In the past three years more than 30 resource user groups have organized themselves in order

to participate in the activities of the PMRC.

- User group agreements have been accepted as a feasible, necessary, and useful tool for preventing the escalation of coastal resource use conflicts. They have also made it possible to implement rational management policies, enabled public authorities to carry out their mandates, and solidified the commitment of users and communities to participate in determining how resources will be used and allocated. User group agreements have been signed in the Atacames, Playas, Machala, and Bahía de Caráquez ZEMs. In Bahía, the President of the Episcopal Conference of Ecuador and the directors of local press and television also signed agreements as Witnesses of Honor.

- The mass media and journalists are showing greater interest in coastal themes and are using the concepts, policies, and strategies of the PMRC to guide their perspective in covering these issues. The Ecuadorian press has passed through the stage of sensationalism about ecological problems, to an approach that seeks to educate viewers and readers about coastal resources management. This change has been accompanied by a tremendous expansion in press attention. Some journalists serve on ZEM committees.

- The PMRC created an outreach effort that built solid relationships with good contacts in the print, radio, and television media nationally, and especially throughout the four coastal provinces.

- Elementary and high schools in the ZEMs have incorporated coastal resource themes into their curriculum and school activities. Particularly popular are projects related to environmental sanitation, mangrove reforestation, and ecological tourism. Some teachers serve on ZEM committees.

- The staff and consultants who work on specific technical subjects are now convinced that coastal management is only possible with community participation using methods that emphasize local initiative and development.

- There is a clear understanding in coastal communities that the PMRC is not an entrenched bureaucracy, that it always plays fair and clean, and it has served as an important ally in building local capacity and initiative, and in actually carrying out management actions.

- There is considerable international interest in what the PMRC has accomplished as demonstrated through the loan approved by the Inter-American Development Bank to implement parts of the ZEM plans.

The Provincial Profiles and the Regional Manifesto in Support of Coastal Management

From the outset in 1986, the PMRC found itself faced with major challenges that served as opportunities for learning how to work with and educate others. The two major initiatives in the first stage of the PMRC were (1) addressing the specific problems faced by the shrimp mariculture industry, which focused on the needs of a single resource user group; and (2) analyzing the condition and use of coastal resources nationwide, identifying priority issues with the participation of coastal residents and assessing the legal and institutional framework for coastal management. The approach and methods used in each initiative were significantly different, and led to a rift early on within the project itself over whether the principal goal of the PMRC was to provide technical assistance to the mariculture industry, or to create an opportunity to reorient Ecuadorian society toward sustainable use of its coastal resources and ecosystems. The outcome was a change to in-country project leadership, which, from that point on, favored Ecuadorian nationals in all management roles and as counterparts to international advisors. The preparation of profiles of resource management issues in the coastal provinces became the focal point of this shift and helped the PMRC develop its sense of identity and direction as an agent of change in favor of sustainability and broad-based public participation.

The Fundación Pedro Vicente Maldonado was contracted by the PMRC to prepare the profiles of

each province, examining the dynamics of each region since the 1960s; identify coastal resources, their condition, and trends in their use; and prioritize management issues and identify options for solving them. The profiles also identified major development projects in each province, examined potential or actual impacts, and made observations on information needs and on the institutional context for coastal management.

Compiling the basic literature

In 1986, an inventory of available articles, data, and books on coastal resources revealed three basic characteristics: the information was scattered, incomplete, and not very reliable. The first challenge faced by the Fundación Maldonado was to compile and organize available information on resources and productive activities, understand and interpret the economic and social development process which affects the four coastal provinces and specify the major changes observed in the coastal provinces since 1950. While reviewing the literature, the Fundación Maldonado assembled a team of Ecuadorian experts to prepare a series of technical papers on subjects that included

- Geomorphological features of the coast;
- Fisheries and mariculture;
- Agriculture and forestry;
- Livestock production;
- Oceanography and water quality; and
- Coastal resource management in pre-Columbian Ecuador.

Field work

Much of the information about coastal resource uses and activities was undocumented, stored only in the minds and experience of the older traditional coastal resource users and the businessmen involved in new uses such as tourism and mariculture. This information was gathered in two ways, through "talking maps," which were used with elders, who in most cases were illiterate or had very little schooling; and in workshops in which business leaders and provincial experts presented their perspectives on the current situation and reacted to the first draft of the profiles for their provinces.

The first step taken to prepare the "talking maps" was the selection of communities in each province that typified the key activities in the coast. A group of key informants in each place was identified, who included the major resource users-including fisherfolk, shellfish collectors, charcoal makers, mangrove wood sellers, and tourist operators-and prominent local individuals and authorities.

The talking maps were produced by asking people a series of questions individually. They did not know that others were being interviewed at the same time. Questions included:

- What resources existed before and now?
- When did big changes in the resource occur?
- What were the economically important activities before and now?
- When did new economic development take place?
- When did changes in the techniques for using the resource change?
- What have been the principal social, environmental and economic impacts caused by the new activities and techniques?

This information was compiled and compared by locality, and where there were differences in views, new rounds of interviews were made with other informants or technical experts. The talking maps initially focused on problems directly on the coast, but later included observations about agriculture and livestock production in the interior. They proved immensely helpful both in preparing the draft profiles and in the provincial workshop discussions. Altogether, 22 businessmen, 40 technical experts, 34 traditional users, five government officials, and three

regional development authority personnel participated in the talking map process. These individuals also became the target of efforts to build the social and institutional framework for coastal management within the provinces.

The first draft

The writing process for the first draft of the profiles took three debate-filled months, in which the authors discussed the purpose of the documents, the amount of information to include, and the writing style.

The first test of the document came when the authors at the Fundación Maldonado presented a copy of the first draft to Gonzalo Ortiz, editor of the daily newspaper Hoy (Today) to see if he would consider running an article on the project. Ortiz said he had 10 minutes available, but after seeing the talking maps and the information in the draft, the 10 minutes became 80 minutes, and the editor decided to write the feature article himself. A few years later, Ortiz was appointed by newly elected president Rodrigo Borja to serve as secretary of public administration, which made him president of the National Commission on Coastal Resources Management. He proved a valuable ally to the PMRC in this role, felt very much a part of the program, and thoroughly understood its aims and methods. Ortiz was responsible for enabling the PMRC to become an administratively decentralized unit, a status attained by few government units on the coast, yet necessary for carrying out its flexible, responsive style of program management.

Verifying the drafts through provincial workshops

The second test came in the provincial workshops held in 1987 to verify the content of the profiles and to discuss the issues in the province. In each workshop, no fewer than 40 people attended, representing the private sector, technical experts, authorities, and fishing groups. The draft was distributed to the participants in advance, along with the request that they come to the meeting prepared to point out any errors in the presentation of information, to elaborate on points that should be covered, and to propose specific changes. Each workshop began with a panel of presenters and commentators who spoke on the various issues in the province. By the end of the day-long sessions, a clear consensus emerged on the modifications to the text that should be made.

The verification process lasted two months, and was a rich educational experience for the Fundación Maldonado staff, as well as for participants. The idea of integrated management and local initiatives in management also gained many adherents through the discussion process.

Publishing the final draft

The final draft document was prepared as a single volume *Ecuador: A Profile of its Coastal* Resources. The Fundación Maldonado sought out resources for its publication and distribution. The coastal universities joined together to support the document, including ESPOL, the Technical University Luis Vargas Torres in Esmeraldas, the Technical University and Laica Eloy Alfaro University in Manabí, and the Technical University of Machala.

The book received wide distribution and generated considerable interest in the last quarter of 1987, especially in light of the fact that it was released during the elections for mayors, representatives, and city council presidents. Many politicians used the book as a source of information in formulating their political platforms, and for the first time began to discuss environmental issues. A number of the candidates for office had been involved in the profile workshops and interviews, and those that won their contests for office became important supporters of the PMRC.

The regional manifesto

In order to assure that the coastal management program would continue its work, the workshop participants decided to support a regional statement favoring the creation of a national coastal

management program. In returning to the provinces to prepare and revise the text of this statement, the Fundación Maldonado staff found that local people were taking on a sense of ownership of the program. The manifesto explained to the newly elected government of President Rodrigo Borja the reasons for creating a program, and the essential elements it needed to contain, and demonstrated the desire of the region to see national policy change. The manifesto was published two weeks before the change of presidents, signed by 66 prominent leaders from a wide variety of institutions and businesses in the four provinces. Never before, and not since, have the coastal provinces come together to produce a regional statement of needs to the national government.

The Public Education Effort in the PMRC

In 1990, the Fundación Maldonado began working with the coordinators of the five ZEM offices and with ZEM committee members to develop individual annual work plans for local public education activities. The term "public education" was chosen to indicate that much more was needed in the ZEMs than environmental education or school programs alone. The education component of the PMRC sought to create a common base of information, attitudes, and values among communities, user groups, and the general public, in order to help people work together productively in preparing integrated coastal management plans for each ZEM. In addition to fostering participation, the public education strategists found it necessary to promote a new model of personal behavior toward coastal resource use. Developing positive attitudes among community members had to be accompanied by sharing practical knowledge of more appropriate ways to harvest and handle fish, to use mangroves, and to develop tourist beaches.

At the local level, the PMRC focused on motivating citizen and user group involvement in resource management activities. Although each ZEM presented a wide range of problems in the use of coastal resources, the limited budget and time available to the project team required careful selection of the topics for which high-quality materials would be developed.

Outside the ZEMs, the public education and outreach effort sought to inform regional and national leaders, as well as the Ecuadorian public, of the importance of coastal resources for economic and social development. It also explained the significance of the ZEM experiment, and showed how ideas tested in the ZEMs were advancing both the philosophy and practice of sustainable resource management. The long-term support of these groups continues to be vital for program success.

Considerable effort was put into creating messages on resource management that spoke directly to leaders and community members. Key points conveyed in the communication strategy included

- The need for political will and consensus to integrate public and private actions affecting coastal development;
- The vital importance of coastal resources in view of the fact that virtually every major sector of the coastal economy depended on the use of renewable coastal resources;
- The fact that the majority of population of coastal provinces lives along or near the shore;
- The dependence of the national economy on coastal activities-after petroleum, the most important productive sectors are based on the use of coastal ecosystems;
- The reality that economic development in the coast has generated a host of problems, including water pollution, mangrove ecosystem destruction, possible extinction of species of economic importance, and chaotic, conflict-ridden development of shore areas; and
- The need for all Ecuadorians to work together to assure further social and economic progress, both today and for the future.

The response of coastal communities has been to organize themselves or strengthen local groups, increase their involvement in activities sponsored by the PMRC, and search for new alliances with those who share the philosophy of self-development and management of resources for sustainable use. Management for sustainability implies a change in the pattern of relationships of people and the resource base that supports their existence. The education program emphasized the need for communities to establish relationships that harmonize economic uses and ecological productivity. Public participation and self-development implies group effort and a community perspective.

Changes in the relationships between a village or group of residents and their environment come through organization, training, and the adoption of appropriate technology for using resources and ecosystems.

To build a new social organization in the ZEMs and create a constituency for coastal management, the PMRC used a permanent process of consultation with coastal communities, user groups, and local authorities. All available channels were used, including mass media, the school system, and working with local leaders who were coastal resource users. The program also emphasized learning by doing, through practical exercises in resource management.

Many of the PMRC's activities have been carried out through local workshops where citizens became directly involved in the writing process for the issue profiles in each ZEM, and then the preparation of the special area plans themselves, following the methods employed to write *Ecuador: A Profile of its Coastal Resources*. The workshops served to integrate the information, experience, and perspectives of individuals and groups living and working in the zones into a broadly shared understanding of the nature of the place and its problems and prospects. This new awareness was extended back through two or three generations of the relationship of people to their places through extensive consultation with, and capturing of the stories of elders. The workshops also addressed present-day conflicts in a new way when a variety of perspectives were brought to the discussion. More than a convenient way to compile information, the ZEM workshops served to motivate individuals to collaborate with coastal management initiatives.

The public education and outreach program sought to capture, process and use the experience of the people of each place as a key element in what essentially was a self-education process. Changing the patterns of exploitative relationships between people and the environment is a very complex process requiring changes in basic values. Public education in this context does not have its own agenda, but it works as one of the principal tools of the overall management endeavor, drawing its messages, content, and focus from the strategic interventions that the program is implementing.

General objectives of the public education program

- Contribute to forming the constituency and collaborators of the PMRC;
- Raise the level of awareness of the PMRC presence and philosophy with the public in order to engage their participation in preparing and implementing resource management plans;
- Carry out education activities to support management activities such as environmental sanitation, mangrove ecosystems, fisheries, mariculture, tourism, and shore development;
- Promote positive attitudes toward natural resources so that community members can establish new use patterns and engage in management activities;
- Strengthen resource user groups so they can actively engage in local management initiatives; and
- Involve the formal education system in local management actions.

Major activities

- The public education program consisted of three components:
- Informal education that focused on organizing and training community and resource user groups;
- Formal programs that created school materials on PMRC themes such as mangroves and fisheries, and conducted field trips, community projects, and writing and arts contests; and
- Outreach, which included weekly radio programs and newspaper and television coverage in each ZEM, as well as a quarterly bulletin, *Costas*, which was distributed throughout the country.

Informal education initiatives

When the ZEM program was initiated, a few of the coastal resource users were already well organized as formal groups, such as fishing pre-cooperatives and groups of *caipiriñeros*-people who operate kiosks on the beach that sell specialty drinks. Many other groups, for example,

shellfisherwomen, shrimp postlarvae collectors, and charcoal makers, had achieved some social cohesion and sense of identity, but had no formal organization to formulate positions and carry out group projects. Most resource users had not achieved any sense of identity when the ZEM program started, making it difficult to engage these individuals in the planning process.

Objectives

The PMRC's informal education initiative identified five main objectives:

- Actively involve communities in the PMRC planning and implementation process;
- Provide the information contained in management programs and proposals on the conditions, causes of problems, and potential solutions for coastal ecosystems and resources;
- Promote adoption of proven sustainable resource use methods, and motivate people to change their behavior in favor of resource management;
- Strengthen and promote the development of community organizations to guarantee their ability to participate in the management process; and
- Integrate activities and key actors such as governmental and nongovernmental organizations into the management process, through continuous interchange of information and opportunities for collaboration.

Support to the ZEM committees

- Assistance was provided to the PMRC committees in the ZEMs-first the executive and advisory committees, then the merged zone committees-and the Ranger Corps, including
- Identifying potential members of the ZEM committees;
- Organizing the formation and inauguration of the committees;
- Helping the ZEM advisory committees in the process of analyzing issues, developing policies, and making decisions;
- Assuring that the proposals made by the advisory committees were included in the management plans;
- Serving to facilitate the analysis and approval of the ZEMs; and
- Training in the procedures and operating rules of the PMRC.

Strengthening user groups

One of the preconditions for membership with voice and vote in the zone committees is to be a legally registered organization and to have the government of Ecuador approve the organization's statutes. Between 1992 and 1993, dozens of organizations requested help from the education team, both to prepare the paperwork and to assist in creating functional groups. The Fundación Maldonado proposed that each organization would prepare its own charter in a way that reflected the characteristics, interests, and operating style of the group. At the same time, the process would help train the ZEM office staff in methods that would be of long-term benefit, and would also provide a means by which the PMRC would have direct access to each organization to explain the purpose of the program and to influence the goal and purpose statements of the groups.

Activities of the public education staff to help strengthen user groups have included

- Promoting the formation of user group organizations;
- Helping groups write their own charters and prepare the necessary statutes for becoming registered organizations;
- Training in how to implement the charter, and record and track decisions made in meetings;
- Training in parliamentary techniques;

- Training in financial administration; and
- Organizing community events and contests.

The final training events sponsored by the PMRC were held in March and April of 1993, and involved workshops in the five ZEMs that attracted 31 user groups. The sessions focused on organizational and management issues in such groups, and on financial accounting and business operations.

The community contests proved a very effective way for the ZEMs to bring people together, and including events such as the "Silver Hook" fishing contest in Bahía de Caráquez, the "Golden Corvina" fishing event in Puerto Bolívar, and the balsa fishing boat regatta in Playas. Private sponsors covered much of the costs of these events.

Assistance in coastal resources management activities

The PMRC focused its work with local groups according to the major theme areas of the ZEM plans. To address environmental sanitation, for instance, activities included door-to-door campaigns by students and teachers on the importance of clean water, methods of wastewater and human waste disposal, and solid waste collection and disposal. Practical actions such as community cleanup events or latrine construction were reinforced with radio messages.

To educate the public about mangrove ecosystem protection, the PMRC first carried out a series of talks and slide shows for the people most actively engaged in using mangroves, and conducted workshops on how replanting mangroves could be done as part of small reforestation projects. Mangrove users were also targeted in other educational activities.

To address tourism issues, the education program formulated radio program segments to help community members appreciate the importance of local environmental quality, and helped organize beach cleanups, where the *caipiriñeros* in Atacames, for example, played an important role. Special training events were held, frequently featuring experts from the national tourism agency. These included sessions that provided information on legal requirements and administration of tourist services, workshops for lifeguard training, guide training, and on new types of artisanal crafts. The guide training course held in Bahía de Caráquez attracted the attention of the local television station, Manavision, which recorded 120 minutes of interviews with participants. The mangrove boardwalks developed in Atacames, Muisne, and Machala and other tour sites, such as Isla de Frigatas in Rio Chone, also became a focus for education visits, for tourists and students alike.

Preparing and reviewing the ZEM plans

The final stage of preparing the ZEM plans consisted of overview presentations in each ZEM, a total of 12 local workshops, and five final meetings by the ZEM committees to review changes and approve the documents.

Some of the key results from this process are

- The high degree of participation by communities and user groups (with the notable exception of shrimp farmers), to validate information and better focus proposed actions to solve problems;
- The acceptance of the ZEM plans as a faithful reflection of the views and opinions of the people who participated in the meetings and workshops held throughout the process;
- The identification of the ZEM committee as the locus of local initiative and authority, and as the place where conflicts among user groups can be addressed and viable solutions found, and finally through its capacity to conduct a dialogue with authorities to foster their efforts to enforce coastal laws and implement the plans; and
- The credibility gained by the PMRC due to its working style, the transparency of decision making and the feasibility of carrying out actions and projects. One expression of this is the petitions by various

local communities to be included in the ZEM program.

Formal education activities

There remains a strong need for reform in the Ecuadorian school system to improve environmental science education and practical information about coastal resource use issues. Part of this need is for education on appropriate use methods for the hundreds of thousands of children whose family livelihoods depend on productive and clean coastal ecosystems.

Objectives

The PMRC set three principal objectives for its involvement in formal education:

- Incorporate coastal themes in the curriculum at all levels;
- Involve teachers in the activities of the ZEMs; and
- Create a network of university teachers who had expertise in coastal management.

This last objective was actually the first one pursued by the program, but was never successfully implemented. The effort encountered numerous obstacles, including a limited budget; the diversity of offerings, curricula, and structures among coastal universities; and the incompatibility of academic calendars. Internal university politics also posed difficulties for building solid relationships with academic institutions.

School workbooks

PMRC school education activities centered on specific coastal resources or uses in the ZEMs, and were aimed at students at different age levels. For example, 5,000 copies of a workbook on fisheries was created for fifth graders during 1990 and 1991. A workbook on mangrove ecosystems was prepared for sixth grade students, and distributed in 1991 and 1992. In each case, teacher training workshops were held to guide proper use of the materials. Reprinting of these materials unfortunately has not been funded, so the teachers now use the materials only as guides.

Environment week

World Environment Day served as the focus of an entire week of school activities that reached out to ZEM communities, including parades in which groups of students wore costumes and carried messages about coastal flora and fauna and school cleanups. Painting contests were aimed at developing the skills of children in art by using images of the coast taken from daily life. A story contest enabled children to develop creativity by preparing stories about the customs of their people in the coastal environment. These contests were directed at students in the fifth and sixth grades in the schools within the ZEMs. The theme of the stories was left open to the students, and each author received a participation certificate. Prizes were awarded for the best work. The newspaper El Comercio published some of the work in its weekly children's page. A compilation of these stories, *By Children for Children*, was published by the Fundación Maldonado, and has been adopted as a standard reading text in coastal schools.

The regional contest for the children's reader

One of the partners in coastal education was a consortium of groups led by the Direction of Maritime Interests and the Ministry of Education, PEAMCO. From 1990 to 1992, this group sponsored a regional contest to incorporate coastal themes in middle schools, to restore the identity of coastal communities, and to involve students and professors in producing unedited stories about the customs, lifestyles, and traditions of shore communities and users of coastal resources.

High school students from all four coastal provinces were eligible to participate. In the first phase of the contest, each province organized the event and selected three finalists for the national

contest. In Guayaquil, a panel of prestigious intellectual leaders reviewed and chose winners from among the twelve finalists. Prizes included trips to the Galapagos Islands and the Amazon. El Universo newspaper, the Ministry of Education, and the Ecuadorian Cultural Institute (Casa de Cultura Ecuatoriana) were the principal sponsors of the event.

In 1993, the contest was not held, to the great disappointment of the Fundación Maldonado staff, due to the decision by the PMRC that the investment to produce the book and organize the events was not a priority for the program. Although views of the merits of producing the book of coastal stories differed considerably, the basic principle of focusing the scarce resources of the public education program on the priority needs of coastal management continues to be respected.

Outreach efforts

Objectives

PMRC outreach efforts supported six major objectives:

- Create an awareness and acceptance-within coastal communities and nationally-of the philosophy of the PMRC regarding management of coastal resources for sustainable use;
- Build national interest and support for initiatives that address coastal issues;
- Provide information on the development of the PMRC throughout the coast;
- Generate support among institutions and individuals for the coastal management program;
- Facilitate community involvement in the PMRC's planning activities, the Ranger Corps, the zone committees and municipal initiatives; and
- Create a consistent outlook, vision, and working style within the principal organizations carrying out the PMRC agenda-including the technical teams and consultants, the University of Rhode Island staff, the Fundación Maldonado, and the government of Ecuador.

Outreach activities have included publication of an information bulletin, broadcast of radio programs and announcements, creation of publications, and cultivation of relationships with the media to ensure coverage of coastal issues.

The evolution of the information bulletin, Costas

The first and most consistent outreach effort of the PMRC was the *Information Bulletin*, later renamed *Costas*, which first appeared in 1987 and had produced 28 editions as of late 1994. The quarterly publication is distributed widely-in the ZEMs, to agencies and organizations involved in coastal resources management, to people interested in the PMRC and Fundación Maldonado, and to international readers. Circulation began at 1,000 copies and has grown to 2,000 per issue. The Fundación Maldonado prepares and produces the newsletter, with editorial review by the PMRC director.

The Information Bulletin evolved through three stages. During the first period, 1987 to 1988, it focused on providing basic information about coastal resources, candidate sites for ZEMs, proposals for structuring the PMRC, and a chronology of the activities of the program and working groups operated by the PMRC.

The second stage occurred as the ZEMs were created, with the bulletin providing more information about specific issues, technical studies, and developments in the ZEMs. Beginning with Edition 16, major changes were introduced to the publication, which was then renamed *Costas* The layout was redesigned, and included both color and photographs, and an editorial was included. In addition, the content shifted from a chronicle of project activities to features on the ZEMs. The newsletter also included a summary of the principal findings and conclusions of a technical study sponsored by the PMRC.

Building a relationship with the print and television media in Ecuador

A journalist working for the Fundación Maldonado has been responsible for building relationships

with national and local television and newspapers. The emphasis has been on changing the attitudes of editors and journalists in order to expand the coverage of coastal issues, rather than on preparing press releases or using paid announcements.

If the press seeks to contribute to the process of changing behavior, it must (1) address a broad audience; (2) stimulate community participation in the process; and (3) promote the organization or strengthening of groups interested in making the change happen.

Until 1986, very little information was provided in the print and television media on coastal resource problems, issues, or management options. Environmental groups active at that time focused on accusations and charges against developments that were damaging resources, particularly mangrove ecosystems. However, in the coast, few journalists had the technical knowledge or awareness that would enable them to present reports or investigations that would illustrate the opportunities or direction for solving problems through management. All they were able to do was to write stories in the style of "environmental sensationalism" that did not identify reasonable solutions.

The limited ability of the journalists to understand issues and solutions also characterized all of Ecuador's coastal society, and demonstrated how poorly equipped journalists were even in the late 1980s to address the environmental issues their country faced.

Jimmy Jairala, who in 1992 was the vice minister for information and tourism, provided the Fundación Maldonado with some valuable advice on how to engage journalists and the mass media in coastal management. In simple, precise language he said:

> Never pay a journalist to prepare a story or report, because you will corrupt them, damage the image of the program, lose credibility, not gain a single ally, and in the process of giving them money, you can create an enemy.

Jairala recommended a different approach:

> Organize trips of three or four days with a mixed group of journalists from different media. Provide them access to coastal resource user groups, local authorities, and experts. Do not skimp on money to arrange and organize these trips. Be sure that the transportation is good, as well as food, rooms, and entertainment. You must ensure that the journalists focus on analyzing and discussing coastal issues. During the trips, make sure there are opportunities to participate in local meetings and activities. In this way, you can transform the journalist from a note-taker to an active participant in making the news.

The idea of changing the traditional role of the journalist had been mentioned even earlier by Rafael Guerrero in 1987, when the first draft of the Guayas province issue profile was being reviewed:

> Try not to send out press releases. It is much better to meet with each journalist and talk about the issue you are trying to disseminate. A press release mechanizes the journalist, while dialogue and participation will provide education, provoke change, and enable the reporter to move beyond what you call environmental sensationalism toward a channel for promoting ideas on coastal management.

These ideas were confirmed through conversations with Teo Villon, director of a national television news program, who showed by his optimism and sincerity that indeed, dialogue was the correct strategy to pursue. He helped organize the first coastal field trip for journalists to the Atacames ZEM in July 1990, which attracted reporters for two television networks, two major radio networks, and two national newspapers. This created a new group of journalists and raised awareness of the PMRC among an important group of people within Ecuadorian society.

The outcomes of the first trip included

- Five television reports about the ZEM;
- Four major articles in national newspapers;
- Short reports and photographs on coastal themes;
- A change in the tone of press coverage in Esmeraldas, which had been typified by negative, sensational stories, to an image of the tourism potential and attractions of the province;
- Creation of new friendships among journalists who participated
- Establishment of a relationship between the hotel owner's association of Esmeraldas and the Guayaquil-based press; and
- Creation of support for PMRC initiatives in the province by the hotel owners' association, as well as *caipiriñeros* in Atacames.

During 1990 and 1991 the Fundación Maldonado strategy mobilized the interest of the mass media based in Guayaquil, who provide the bulk of television and newspapers for the coast, resulting in a significant measure of national coverage for coastal management. A number of group trips were arranged, covering all of the ZEMs. Atacames and Bahía captured the greatest attention from coastal journalists because of the diversity of themes, their attractiveness from a tourist's perspective, and the greater distance from Guayaquil, which made them more interesting as report locations.

More than 400 stories, photographs, editorials, and notices have appeared in the print media. Every month, television stations carry a report on a coastal theme. The most heavily covered single items have been the mangrove boardwalk in Atacames and the Rio Chone estuary in the Bahía de Caráquez ZEM. For all of this press coverage, the PMRC has not paid a single penny.

Table 1. Reports in the print media in Guayaquil and Quito for the period February-August, 1990.

Publication	Number of reports
El Telegrafo	39
El Universo	19
La Segunda	23
Meridiano	37
Extra	8
El Expreso	6
La Razon	19
El Comercio	4
Others	25
TOTAL	180

In 1992 and 1993, the outreach strategy shifted to place more emphasis on the press in the provincial provinces of Manabí and El Oro, where the Bahía de Caráquez and Machala ZEMs were located (Esmeraldas only recent has had a daily newspaper). In those two provinces, an average of 15 items appeared each month. In addition the television station in Manabí, Manavision, had reports every month on a coastal issue.

Table 2. PMRC appearances in printed media in Manabí and El Oro provinces, October 1992-November 1993.

Category	El Oro	Manabí	Total
News items	66	90	165
Radio reports	60		60
Editorials	4		4
All media			220

Radio programs

Along with the work with the commercial press and television, the outreach program began producing radio shows, starting in 1989 in two of the ZEMs, as well as a program done in cooperation with National Radio of Ecuador, based in Guayaquil. Entering into this activity proved frustrating and unproductive at first because of the limit on the outreach budget.

In Esmeraldas and Machala, the radio programs were directed by local journalists, who received information from the ZEM coordinators in order to produce the programs. The Fundación Maldonado prepared the national radio program with the help of two professional radio announcers. The format of the programs was improved over time with the assistance of a public education advisor from URI.

The radio programs were eventually expanded to include all of the ZEMs. Initially, the ZEM coordinators were charged with this task, which then passed to the newly hired education assistants after a training course in 1992. In 1993, a professional radio journalist supervised the programs done for the Bahía, Manglaralto, and Playas ZEMs. Two other stations picked up the Bahía program without charge. This proved to be the most successful of the programs, due to the coverage, the audience it captured, and its regularity. The programs aimed at Esmeraldas and Machala were suspended because of the limited impact they had on the ZEMs. In Atacames-Súa-Muisne, for example, few of the radio stations in the province reach the entire ZEM, and there are no local stations. In Machala, the fourth largest city in Ecuador, it proved more effective to provide information to the various stations for broadcast than to design a program by the PMRC.

The format of the programs broadcast in the ZEMs included news from the ZEMs, interviews, technical recommendations, ecological news, editorials, and coastal stories.

Television documentaries

The Fundación Maldonado prepared a series of 12- to 15-minute television documentaries, which were broadcast and also used in public education activities in the ZEMs:

- Toward Management of Coastal Resources
- The ZEM Atacames-Súa-Muisne
- The ZEM Bahía-San Vicente-Canoa
- The ZEM San Pedro-Valdivia-Manglaralto
- The ZEM Playas-Posorja-Puerto El Morro
- The ZEM Machala-Puerto Bolívar-Jambelí
- Fisheries in Ecuador
- Mangroves in Ecuador
- Geomorphology of the Coast
- Coastal Tourism in Ecuador
- Shrimp Mariculture in Ecuador
- Coastal Water Quality

These documentaries were prepared to achieve the following objectives:

- Provide a national audience with basic information about major coastal resources and their uses;
- Characterize the problems and management options for each of the ZEMs; and
- Give the public education system and the mass media visual materials on the coast.

All of the documentaries were well-received by the national television stations, as well as by the stations serving Esmeraldas and Manabí provinces. It proved difficult to find sponsors for broadcasting the programs, especially in the highly commercial stations in Quito and Guayaquil. Even so, the stations were always provided ready access to the programs when they needed coastal materials.

The ZEM offices were not sufficiently equipped to use the videos on a regular basis, but people in the community provided televisions and tape players when they were needed to show information about their own location.

In addition, five types of documents were produced as part of the outreach effort, including a series of technical studies, a report series, popular materials, the ZEM plans, and a variety of special documents.

Organization and Methods of the Education Program

Staffing

By 1991, a full-time educator and a journalist formed the Fundación Maldonado's core PMRC education team, based in Guayaquil. Education activities in the ZEMs were the responsibility of the ZEM coordinators, who worked under separate contract to the University of Rhode Island. A URI consultant began work in 1992 to bring coherence to the activities of both groups, and to conduct training. The consultant advocated that each ZEM office should have its own public education staff member, preferably drawn from the school system. By May of 1994, the education program had expanded to eight people, including five ZEM assistants, two educators, and a journalist in the Guayaquil office. The Playas ZEM also received a great deal of help from the local director of education.

The direct audience for the education program included the 120,000 people in the five ZEMs, taking into account that the Machala ZEM concentrated on the barrios of the Estero Huayla, not on the city as a whole. Coastwide, the PMRC worked with 215 elementary schools and 25 high schools.

The education program has also helped motivate adults to participate in the coastal management program. In early 1992, 128 user groups and communities had become involved in the ZEM planning and approval process, along with 19 government agencies. When the new Zone Committees were inaugurated in 1993, the level of participation expanded significantly to include 160 groups and communities (71 met the criteria for having voice and vote) and 32 government organizations from the national and local levels. As of 1995, 33 more groups have met the legal criteria for having vote on the Zone Committees.

The Fundación Maldonado education team initiated school education programs for elementary students by first offering teacher training programs. The teachers then used the recommended education materials and activities in their individual classrooms.

Work plans

The set of initiatives in the education program was determined as part of the PMRC's overall work plan process in September of each year. Education efforts were developed in light of overall priorities, as well as based on the needs of individual ZEMs. A debt swap financed by USAID

provided the primary support for the public education activities carried out through the Fundación Maldonado after June 1991. A $100,000 purchase of debt generated $200,000 in local currency for public education through May 1994. Beginning in 1991, the program of activities approved by the Ecuador financial agency that governed the use of debt swap funds also was factored into the scope of potential activities. Each year's work plan was based on several basic criteria:

- All the activities of the public education element must assist in furthering the management initiatives of the PMRC;
- The public education work has to help build community participation in the planning and implementation activities of the PMRC;
- A portion of the education program must aim at building national opinion in favor of coastal management;
- School programs should be aimed at public education systems to strengthen the network of primary teachers and schools that was being created; they should also target middle schools;
- Priority should be given to addressing the need for community and user groups to strengthen their ability to carry out projects and participate in management actions;
- Community-based projects must take into account the unique characteristics of the people and the place;
- Any community project must motivate local contributions and cooperation, both of organizations and of individuals; and
- The ZEM public education programs must concentrate on themes common to all the ZEMs, since the level of awareness, knowledge, and concern of residents is similar; and the PMRC was focusing on a few priority themes across all the sites. At the same time, the unique characteristics of each ZEM were to be taken into account in selecting activities.

All the activities of the public education program were tied to the following strategies:

- Communicate the most significant resource use trends, as well as concerns about the environmental, social, and economic impacts of these changes;
- Interest user groups in changing behavior and adopting actions that would lead to sustainable use patterns;
- Create a broader audience-within the ZEMs and nationwide-that is aware of the actions taken by coastal communities, user groups, zone committees, and government, and of the outcomes being achieved through these initiatives; and
- Collaborate with user groups and communities to identify key management issues, identify and select solutions from alternatives, and work on methods for fostering local initiatives and cooperation.

In sum, during the past four years, the public education program has followed the development of the PMRC closely, through concentrating on organizing the executive and advisory committees in the ZEMs, formulating and implementing practical exercises, strengthening the legal and organizational foundation of resource user groups, preparing and approving the ZEM plans, and creating the capacity for negotiated conflict resolution through user group agreements. The ZEM office staffs have kept close track of the identity, number of participants, and the outcomes of public education program activities (see Table 3).

Principles Guiding the Work of the PMRC in Education and Outreach

The Fundación Maldonado brought much experience and many fresh ideas to the task of public education, and through a collaborative process, all the participants in the PMRC-staff, consultants, ZEM committee members, authorities, and resource users-have contributed to the evolution of a set of principles that still guide the PMRC's work.

Learning from the people

Journalists are fond of saying that the obvious is not news; that to have impact, a writer must report on the exceptional and unusual. That people in the coast need to learn from technical experts in coastal management is also obvious and not worthy of discussion. However, to say that

the technical experts in the PMRC have learned much from the people of the coast, most of whom are unschooled and read little, is to say something quite worthy of mention. This is what has happened to all of us.

When the ZEM plans had been adopted, the PMRC reflected on the problems experienced with the dual-committee structure created by Executive Decree 375. The advisory committees worked well, but the executive committees, composed of the authorities, did not carry out their responsibilities. When, in 1992, a new executive decree changed the structure to form zone committees that combined public and private sector representatives, considerable doubts began to emerge that this forum would work-in most ZEMs, it could potentially consist of 80 or more people.

The PMRC began to view participation using the phrase "a table needs four legs," meaning that the program required the active support and help of authorities, the private sector, communities, and organized groups such as the school system, mass media, and user groups.

Together, these compose the constituency and the key actors in the program, and work as a single unit. If one of the groups is not present-that is, if a leg is missing-the table falls over. No one wants the table to tip over, but the question was how to make decisions in groups so heterogeneous and large as the ZEM committee? One solution was to make the table smaller, and reduce the number of people permitted to sit around it. However, reducing the size of the committee probably meant that community and user group representation would be diminished, depriving the program of its most vocal allies and supporters.

The troubling question of the composition of the ZEM committee was put on the agenda of the plan review sessions in each ZEM. In Bahía de Caráquez in particular, great doubts were raised about whether an expanded committee could function. Yet it was during the meeting there that the solution to the problem was found. One of the members of a small village on the estuary solved the controversy with a simple, pragmatic statement:

> If someone believes that it is too big, which authority, which community, which organization do we remove? If we take away anyone, the table will fall, so we must keep it the way it is. Here, all who are present are needed.

There was complete silence in the hall, interrupted only by a motion to approve the proposal to retain a full-size committee. Any operational difficulties with the expanded committee would be resolved by creating commissions and working groups on special topics.

Without participation there is no education

International advisors always talk about public education and public participation as if they were two different things. For the PMRC, it is hard to keep the two ideas apart since they are part of the same process of modifying the behavior of the people involved in the process of resource management.

People's behavior in using a resource will not change just because an expert shows up to tell them what they are doing wrong and how to correct it. For social change to occur, several elements must converge:

- New social values must be formulated;
- These values must satisfy a need;
- The participant in education must have an interest in adopting the new values; and
- The people to be educated must participate actively in identifying, assimilating, and putting the values into action.

What used to be called public education was in fact principally instruction. A teacher presenting knowledge that a student is obligated to learn, whether or not the information is needed or useful to the learner. This instructional activity converts both teacher and student into objects of an external educational imperative, rather than active seekers and creators of knowledge through

participation in a process of change.

This bias is present in environmental education, as well as in resource management, where newly trained specialists believe at the outset of their careers that the focus must be on making technically solid decisions, and not recognizing that a social process must be one of the underlying supports of scientific and technical understanding. When the specialist tries to bring new knowledge from the outside to a community, without interacting with people, without letting them help shape and nurture a process of assimilation and appropriate change, he or she does not become a learner. This is an insidious tendency that has given rise to the call to "educate the educators."

The first outcome of the process of education in coastal management in Ecuador has been the change in attitude of the technical specialists. One of the stories that illustrates this point comes from the village of Bunche, home of a group of women shellfishers. The PMRC had initiated a project to investigate the cultivation and growing of a small shellfish. A biologist was hired to carry out the field work. In one of the PMRC's periodic project review meetings, he expressed distress at how little the shellfishers understood or appreciated the work he was doing. A sharp response from the group was quick in coming: "The biologist," someone said, "needs to understand the interest of the shellfishers." After receiving that advice, the work in Bunche was reoriented to ensure that the scientific aspects of the work were supplemented by an effort by the technician to help with the needs of the shellfishers. With this mutual respect, the project moved forward productively.

Another example comes from work with shrimp farmers. Shrimp farmers always say that they recognize the economic and ecological importance of mangroves. However, when the profits in mariculture were very high, the same shrimp farmer would not think twice about cutting a mangrove stand and building another pond. There have been few exceptions to this pattern-such as in the Rio Chone, where a shrimp farmer actually guarded a 100-hectare forest area. The government authorities who also recognize full well the value of mangroves have not taken effective action to control forest destruction. The problem in both cases is not the absence of technical knowledge and understanding. When the choice is between what is right and the chance for easy money, money always wins.

The change in behavior of the shrimp farmers began when the productivity of their ponds declined, and it became clear that to protect their investments, they had to maintain the remnants of the mangrove ecosystem. With this personal investment at stake, they have actively participated in the ZEM process and signed user group agreements. It is through this direct involvement and action that education has taken place.

There is no substitute for the "sujeto social," or participant-actor

Among the most interesting aspects of the collaboration of the PMRC, Fundación Maldonado, and the URI has been the struggle to translate fundamental concepts from English to Spanish, as well as the reverse. The Americans always spoke about participation and education as separate ideas, which made little sense to the Ecuadorians. We spoke about the *sujeto social* of the process, which had no simple English translation but, perhaps awkwardly, means "participant as actor." The constituents for coastal management must also become the managers of the coast. In terms of education, coastal people and stakeholders are not targets or objects of a management process implemented by someone else. Rather, they are the subject or actor in the process, alongside government officials.

Paternalism and environmental "assistance-ism" are also both firmly rooted in Ecuador, but at last are giving way to other approaches. The paternalism of the state has had two critical moments in Ecuador. During the 1970s, the boom in petroleum production and exportation in Ecuador, supervised by the military dictatorship then in power, fostered a spree of project giveaways sponsored by the national government. To ask for projects and favors became a way of life in communities all over the country.

Then, after 1979, when democracy was reintroduced to the nation, it was common to hear national and local politicians say "give me your vote and I will be sure to send projects your way." Under the military regime, everything had been possible, because the country had had plenty of oil revenue to share with the communities. When politicians resumed control, there were no funds to carry out the promises they had made. In the meantime, the ability of cities and villages to take care of themselves and seek their own solutions had been greatly diminished. Their creative energy had been lost.

The more recent trend of environmental assistance is new. An example of this movement is community campaigns to clean up streets. Everywhere along the coast, solid waste collection and disposal is nonexistent or disorganized. On a number of occasions, the government has declared Guayaquil to be in a state of emergency caused by the mountains of garbage accumulating in the streets. Throughout the coast, it is not unusual to see the armed forces and students working to clear the streets of trash.

In Ecuador, it is quite common to create new public agencies that-at least in theory-seem necessary to solve an urgent problem. After a short time, such units become part of a rigid structure that adds to the bureaucracy and slows the state down even further. While the national government can start an effort such as the PMRC, but will have no life or sustainability without a firm foundation of "participant-actors."

For example, the Ecuadorian government had preconfigured the embryo of the participant-actors in the ZEM process when it split public authorities and resource users into two different committees, and appointed locally prominent people who had little interest in coastal resource issues. As a result, the executive committees never worked, since they were separated from the key resource users, and the advisory committees were limited because some of the important stakeholders were not invited to the table. The executive committees did not meet, and the advisory committees set out to reconstitute themselves informally until user groups and communities were fully represented. Perhaps the most curious example occurred in Bahía de Caráquez, where the president of the ZEM committee, a shrimp farmer, was not a legal member of the committee. This individual later became the executive director of the PMRC.

Creating the participant-actors for the coastal management process is not something that can take place through legal decrees or administrative orders. It takes place when the consciousness of entire communities, resource users, technical experts, and journalists takes shape as they participate in a process, arrive at decisions, and realize that the PMRC agenda is not to establish another refuge for bureaucrats or demagogues. Instead, the PMRC mission is to bring together all the people who are interested in coastal management, sustainability of resource use, and the health of ecosystems-all of which contribute to the quality of life of coastal people.

In practical terms, the participant-actors for coastal management emerged during the preparation of the ZEM profiles; in the work to design and implement practical exercises; during the review and approval of the ZEM plans; and, most dramatically, in the signing of user group agreements and in the recognition that the zone committee is the best forum for arriving at practical solutions to management problems.

When the PMRC began to talk about resource management in coastal communities, many people asked what projects the program was going to implement, and it struck many as quite strange when the response was a clear "none." Immediately afterward, the PMRC initiated an open dialogue with the community about what the PMRC needed and was trying to do, the potential that existed within the community to pursue resource management objectives, and the advantages of developing themselves rather than depending on others.

One of the projects that was always seen as important was the cleanup campaign. There were always people who thought it was the job of the PMRC or the Fundación Maldonado to clean up their streets. The idea that it was really the community's responsibility to keep its own streets clean, and that people who used the beach should keep the beach clean was new and slow to catch

on. The first groups to adopt this new view were the tourism facility operators. The role of the PMRC and the Fundación Maldonado was to help organize the sanitation committees and the campaigns, prepare educational materials and announcements. The task of the community was to do the actual cleanup work.

The PMRC and the Fundación Maldonado learned another lesson in the Machala ZEM about the fact that the "participant-actors" cannot be replaced. That ZEM focused its work on the barrios of the Estero Huayla, a waterfront section of the Puerto Bolívar-Machala urban area used by fishermen and shrimp larvae collectors. One of the problems of the area was solid waste disposal. A meeting to address the problem was scheduled for 7 p.m. one evening. Two important things were learned that night. First, in urban areas such as Huayla, the problem of solid waste belongs to the entire community, not just the fishermen, who can act only to motivate action, not to implement. The second lesson is that it is a bad idea to schedule important meetings at the same time as a popular television program or a soccer game. Between 7 and 8 p.m., the local television station broadcast a Brazilian television series that was very popular in the barrio. Only a few leaders of local groups arrived at the meeting before 8 o'clock. As soon as the show was over, everyone showed up to begin the session. For the environmental sanitation issue, the entire population of the barrio, not just the group leaders, is the "participant-actor" of coastal management.

In the Bahía de Caráquez ZEM, during 1992, the ZEM coordinator tried to follow the example of the Atacames ZEM and organize a user group agreement among fishermen, shellfish collectors, tourist guides, and small communities. However, because he did not manage to get the shrimp farmers involved, the agreement was never signed. In the following year, a conflict over the cutting of 4 hectares of mangroves created a major dispute in the Calle Larga section of the Rio Chone. The Ranger Corps pursued the violation and the leadership of the PMRC met with the shrimp farmer involved to assess the situation from an integrated perspective. The matter was brought before the zone committee, where the shrimp farmer appeared as well to participate in the debate. In this instance, the committee was able to arrive at a fair settlement of the dispute because "all who were necessary" sat at the table to talk. This resulted in the replanting of almost four times as much mangrove as had been cut.

The public education program does not generate its own content

A central principle of the PMRC's work in the ZEMs was to ensure that the content of public education programs was tightly linked to the planning and policy development work. Emphasis was placed on having technical experts review the content of educational materials, and to incorporate education techniques in their own field activities. A distinction was made between materials used to facilitate policy discussions and more permanent educational materials that directly addressed the daily relationship of community members with natural systems. The multiple educational needs identified by the program required the PMRC to work hard to create new relationships and collaborations among technical consultants, education experts, and community members.

Public education within the PMRC was initially viewed as a way of getting support-from the president of the Republic down to the user groups in the mangroves-by creating awareness of coastal resources and their critical role in the future of the country. By 1991, the PMRC had adopted a simple but powerful new mission statement, declaring that it should "promote the sustainable use of coastal resources through participatory and self-development methods." This set the role of education as a catalyst for change: a way to experiment with techniques, to try out and encourage the implementation of better strategies for management, to draw out and use the ideas and visions of coastal people; and emphasize the expectation that local people would develop the capacity to work as part of the coastal management program.

The public education element, therefore, did not promote its own content, independent messages, or policy perspective. The work centered instead on the policies and values that the PMRC was trying to introduce, and has continued to refine as the base of "participant-actors" has continued to

grow.

Table 3. Summary of results of the public education and outreach program.

Element	Observations
ZEM committees	A broad range of stakeholders met in each zone, creating a practical, democratic means for debating issues, and for solving those that can be addressed at the local level.
Awareness of coastal issues	Within the limited budgets of the Fundación Maldonado and local ZEM offices, about 33 percent of the 120,000 zone residents received public education messages from the PMRC within the first two years of work. Environment Day has become institutionalized in the local schools.
Involvement of authorities	The PMRC has collaborated with the Navy, including port captains and the National Directorate of Maritime Interests; local schools; the Ecuador Tourism Corporation; the Ministry of Health; municipalities; and the National Fisheries Institute, among others.
User group organizations	More than 30 organizations have worked to become legal entities and participate formally in PMRC activities. Assistance was provided to 23 groups to develop goals and structure, and to complete their registration process as a formally constituted organization.
Curriculum improvements	Tourism, mangroves, and fisheries themes have been incorporated into local primary school curriculum; high school students have prepared final papers on coastal themes. Some teachers are members of the ZEM committees. Interpretive field trips have been conducted for both local and inland students.
Perception of role of the PMRC	To date, the PMRC's role as catalyst, rather than another bureaucracy, has become clear and appreciated, along with openness, transparent decision-making, and its emphasis on the self-development of communities and ZEMs.
Outreach	The network of local and national media provides increasingly complete and extensive coverage of coastal issues and PMRC activities, shifting from an emphasis on sensational ecological crisis reporting to more even-handed coverage of the challenges of balancing development and conservation.

Community-Based Practical Exercises

Donald Robadue, Jr.
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Since the first state coastal resources management programs were initiated in the United States in the 1960s and early 1970s, citizens have pressed public officials to take action against problems such as unwanted proposals for shore-based power plants, ports and oil refineries; filling of coastal wetlands; and water pollution, and to expand shore access and coastal recreation facilities. At the same time, coastal resource users wanted states to plan ahead to provide adequate sites for coast-dependent economic activities such as fishing, shipping, and recreational boating, and to restore degraded coastal ecosystems. In order to satisfy the public demand for action, some newly created coastal resources management programs struggled to strengthen regulatory agencies, while others launched major planning studies. All of these new programs were soon faced with problems that stemmed from a lack of about the environments they were charged to protect. State legislatures frequently failed to give public officials clear decision-making guidelines for how to handle specific cases, leading to confusion among permit applicants, and to legal challenges, until proper regulations were put into place. Coastal programs that produced elaborate coastal policies and plans built on careful technical studies and ample public involvement often found themselves without the legal and financial means to carry them out.

Developing tropical coastal nations, which in the 1990s are just beginning to formulate coastal management programs, are facing a crisis in implementation that is more profound than that encountered by any U.S. state program. Tropical coastal ecosystems are being degraded rapidly, extensively, and severely. Shore use conflicts are widespread and intense, and affect the daily well-being of a broad spectrum of socioeconomic groups. Yet, even in countries with new laws, policies, and plans, there is little capacity for regulation or ability to implement sustainable development programs in coastal environments. Worse still, there is no solid national constituency for closing this wide implementation gap, and little time and money are available to create the kind of new regulatory capacity at the national, provincial, and local levels that has taken over two decades to evolve in the United States.

These countries are searching for ways to quickly test the feasibility and acceptability of coastal resource policies, stewardship practices, and regulatory tools. They especially need to discover how existing institutions, groups, and decision-making mechanisms can realistically be used to take on new responsibilities.

The Ecuador coastal resources management program (PMRC) directly addressed these concerns when the decision was made to prepare coastal management plans for just five specific locations (the special area management zones, or ZEMs). The objective was to learn as quickly as possible how to formulate feasible, acceptable policies, and to build successful national-local partnerships. The work of local ZEM advisory committees demonstrated that there were important untapped constituencies for coastal management at the local level. Tourists, coastal residents, fishermen, and especially the poorest groups, whose daily well-being depends on harvests from coastal waters and estuarine ecosystems, all feel the impact of lost productivity or access to resources. This creates a significant opportunity to design and test tools for addressing coastal problems. These tools combine regulatory and action-oriented approaches; and are inexpensive, locally led, and adapted to the social and political environment where the problems and conflicts are occurring.

This report examines how the PMRC has employed a simple technique, called "practical exercises in integrated coastal management," as a key tool in its effort to narrow the gap between planning and implementation during the preparation of the special area management plans. The idea was to help build the community structure that would be needed to later implement a formally adopted plan, and to test the feasibility of implementing a variety of proposed policies and actions. Each of the five ZEM advisory committees was provided with small amounts of funding to be used over a two-year period to carry out

projects. As a result, the ZEMs were able to test resource management policies on the priority national themes of managing mangrove ecosystems, mariculture, community sanitation, water quality, shore use, and tourism. Thus, the practical exercises enabled a large group of people involved in the advisory committees to conduct their own explorations of what a feasible policy or action means. These experiments in resource management have had a positive impact on the development of the Ecuador coastal program far in excess of the tiny fraction of the budget that they consumed.

Selection and Administration of the Practical Exercises

Preliminary work for what would later become practical exercises was begun in early 1989, when technical teams were assembled to prepare the initial issue assessments for each ZEM, almost one year before the government actually appointed the ZEM committees. Each group of consultants was directed to prepare a tentative list of short- and long-term actions to be taken to address the issues raised by their initial issue profile. These were to be discussed with the resource users and the advisory and executive committees that were assigned under Executive Decree 375 to oversee the planning process.

The government of Ecuador deferred the constitution of the advisory committees until late in 1989, at the beginning of Project Year 5, so most of the groups were inaugurated after January of 1990. Considerable local consultation had already taken place during the visits of the technical teams and the daily activities of the ZEM coordinators, with lists of possible short-term actions for each zone identified for the theme areas of artisanal fisheries and mariculture, community sanitation, and tourism.

In early 1990, the ZEM advisory and executive committees began working to review technical documents, build public awareness and support, and guide the drafting of policies and actions on issues such as artisanal fisheries, tourism development, mangrove conservation, shore use, water supply and sewage disposal, mariculture, and the organizational structure for management. The small "practical exercises in management," selected and executed by the committees, provided initial trials of ZEM policy implementation.

A total of about $40,000 in direct financial support was allocated for practical exercises during 1990 and 1991, out of a budget of close to $500,000 for preparing the ZEM plans and supporting field offices between 1989 and 1993. (Figure 1) This provided a total of about $8,000 to carry out the exercises in each of the five ZEMs. The funding was supplemented by local contributions of labor, materials, or money.

Administration

Working with the ZEM committees to identify, design, and execute practical exercises was the Fundación Pedro Vicente Maldonado (FPVM), a nongovernmental organization. This Guayaquil-based had worked in each province on the selection of the ZEMs, and was already responsible for the PMRC's public education and outreach activities nationwide. They had also been asked to help inaugurate the advisory committees and to manage local public education efforts in each zone. The FPVM provided a part-time community organizer who visited each ZEM periodically to assist advisory committees in selection and implementation of the exercises. Responsibility for the task was jointly shared with a co-leader who was a University of Rhode Island (URI) staff technical advisor. This arrangement reflected the overall structure of the special area management project, which paired an Ecuadorian expert with a URI-based staff member or international consultant.

The FPVM distributed and maintained records on the use of funds for individual projects, as well as helped prepare letters of agreement and other documents needed to carry out the actions. The hope in 1990 was that the government of Ecuador could negotiate a debt swap to provide substantial funding to the FPVM to support its public education work, as well as to carry out an additional number of small projects. This debt swap did take place, but on less favorable terms, which did not allow for additional funding for practical exercises.

Purposes of the practical exercise task

The design of the ZEM planning task for Ecuador recognized the need for some short-term implementation

activities that could be carried out at the local level to supplement the main work of reviewing expert reports, drafting policies, and designing longer term projects and actions. This in turn was based on the experience of the URI Coastal Resources Center staff, who had carried out a number of special projects for the state of Rhode Island. The reasons for carrying out practical exercises in Ecuador are clearly reflected in the guidance provided to the PMRC staff and the advisory committees as they began to identify and discuss candidate actions.

The first purpose for the practical exercises was to build the community structure needed to help implement the policies and actions in the ZEM plans. The advisory committees were asked to examine each candidate exercise to determine whether

- The project strengthens the contribution of the community, or specific coastal resource user groups to the ZEM process (contributions can be in work, materials, transportation, land, or money);

- The community as a whole will benefit in some way, especially strengthening community or group structure; and/or

- The project promotes direct community participation in managing local coastal resources.

The second purpose was to test the local conditions for plan implementation. This involved the local advisory committee in helping test the feasibility of specific actions that promoted integrated and sustainable management of coastal resources. The committees were provided with a broad range of criteria to consider in choosing their projects, including whether the project

- Promotes the restoration, improvement of sustainable use of the resource base;

- Has a well-thought-out management strategy, or solicits technical assistance in project planning, management, or implementation;

- Will enhance the benefits derived from existing activities-for example, helping to increase the price received by producers for local products by improved marketing or quality, reduces waste in producing a product, or, in the case of shrimp post larvae fishing, shifts fishing pressure to less-utilized resources;

- Integrates human activities and resource concerns-for example, building a clean fish auction facility, opening an artisanal crafts shop that helps resolve a user conflict, or incorporating mangroves into shrimp ponds;

- Raises the awareness of resource users and promotes sustainable resource use-for example, education and training of tour guides;

- Introduces an appropriate resource use technology;

- Preserves cultural heritage or identity;

- Generates employment without resource base degradation; or

- Uses construction or siting techniques that minimize environmental damage.

The initial project guidance used by the PMRC technical team on practical exercises recommended that their technical reports be used as the basis for ZEM advisory committee discussions for activities, but stressed that the committees were also free to propose other projects. The advisory committees were asked to consider the project selection criteria listed above, in order to help set priorities, especially in light of uncertainty about the amount of funding that would be available.

Implementation

The guidance provided to the ZEM advisory committees stated that the PMRC would be responsible for

designing the priority projects, but that the committees could also solicit local expertise. The ZEM executive committees, composed of local and regional public officials, were assigned the role of approving the choices of the advisory committee, although the two groups were encouraged to do this jointly. In fact, the executive committees did not function as independent supervisory bodies, and public officials made their most important contributions when working directly with the advisory committees. The FPVM and the PMRC staff ultimately had to determine which actions were financially and technically feasible and would meet the objectives of the endeavor.

There are three distinct phases of the evolution of practical exercises during USAID Project Years 6 and 9 (fiscal years 1990-1993). These phases were not a part of the original task design, but they emerged as the PMRC addressed implementation problems during its annual project review process, and as the ZEM plans were completed and the citizen advisory committees were reconstituted into permanent ZEM committees composed of resource users, community representatives, and public officials.

The status of each proposed practical exercise selected in Years 6 and 7 was examined through field visits and interviews in late 1992 and early 1993. The status rating of each exercise at that time was based on the following categories

Full success: The exercise was carried out as designed and has worked well.

Partial success: The exercise was carried out as designed, experienced some difficulties, but largely serves its original purpose.

Completed, not successful: The project was carried out but encountered serious difficulties that prevented meeting initial expectations.

Started, not completed: Work was begun, but the project did not reach an operational stage.

Not started: Funds were not made available or the project idea was dropped in favor of another activity.

Phase I: Advisory committee implementation

The practical exercises selected by the advisory committees during Project Year 6 (FY 1990) were supervised and often implemented by committee members themselves, with limited supervision and technical assistance from the PMRC. Many of the part-time and full-time consultants who were preparing the ZEM plans were made available to provide some assistance in the design and oversight of various practical exercises.

Of the 42 practical exercises selected by the committees in Phase I, all but two were started, and only five were started but not completed. Seventy percent of those started managed to fully or partially meet expected results of the exercise. Despite this record, the PMRC project team became very concerned that the majority of projects were focused on building small public works or economic assistance (31 of 42), and relatively few were helping to test the feasibility of implementing resource management policies. Those aimed at resource management were also having more implementation problems. None of the resource-oriented exercises could be classified as a full success, compared to two-thirds of the non-resource projects meeting this criteria.

Phase II: Expanded technical team and ZEM office roles

The advisory committees were asked to revise their lists of proposed actions for the second round of practical exercises planned for funding in Year 7. This yielded a shift so that about half the selected exercises were more closely related to resource management; however, only half the exercises proposed by the committees were ever started. Nearly all those exercises that were started, however, were eventually completed with partial or full success.

Most practical exercises were chosen or approved by the advisory committees, but the implementation burden shifted to place more responsibility on PMRC's technical experts and ZEM office staff. The co-leader system to manage the task that had been created in Year 6 did not function well due to philosophical differences on the relative importance of technical performance versus community enthusiasm in carrying out the actions. This ongoing debate among PMRC staff is discussed extensively under Objective 6 . Although fewer projects were started in Phase II, there were significant time delays in implementation, so that many were not completed until Project Year 8. Mangrove projects were managed directly by the PMRC mangrove staff, with the help of a local technical expert and the ZEM office. The same pattern was followed in the community sanitation projects and the La Chipornia erosion control project. The lifeguard project in Manglaralto was one of the few that a user group implemented successfully with only PMRC financial aid. Of the 55 practical exercises selected during the three phases, three were not started, five not completed, 10 did not yield expected results, and the remaining were considered a partial or full success in all aspects.

Table 1. Summary of practical exercises selected and implemented in Phase I.

Theme and site	Title	Status
Mangroves		
Atacames**	Mangrove boardwalk	partial success
Muisne	Ovens for more efficient mangrove charcoal-making	partial success
Tourism		
Atacames	Improvement to public bathrooms near beach	not started
Súa	Improvement to public bathrooms near beach	success
Bahía	Palm tree planting	partial success
Bahía	Tourist signs on the entrances to the ZEM	success
Bahía	Informational signs for mangroves	not initiated
Bahía-Canoa	Trash receptacles on beach	partial success
Canoa	Palm tree planting	partial success
San Vicente**	Construction of landing site on pier	finished, not working
San Vicente	Trash receptacles	partial success
San Vicente	Palm tree planting	partial success
San Agustin	Construction of park	success
Montanita**	Lifeguard group formation and equipment	success
Playas	Trash receptacles on beach	partial success
ZEM Playas	Palm tree planting	partial success
Jambelí	Freshwater supply	finished, not working
Jambelí	Lifeguard equipment	started, not completed

Jambelí*	Public service posters	started, not completed
Machala	Tree planting on waterfront walkway	partial success
Fishing and mariculture		
Tonchigue	Resale of fishing boat lubricants	success
Bunche	Center for shrimp larvae collection	finished, not working
Leonidas Plaza	Resale of fishing boat lubricants	finished, not working
Valdivia	Center for shrimp larvae collection	started, not completed
Posorja	Resale of fishing boat lubricants	finished, not working
Playas	Resale of fishing boat lubricants	finished, not working
Puerto Bolivar	Completion of pier for fishing cooperative	success
Sanitation		
Puerto El Morro	Water cistern repair	completed, not working
Data Villamil	Water cistern construction	partial success
Data Posorja	Water cistern repair	partial success
Puerto El Morro	Repair of well	success
Posorja	trash receptacles	success
Others		
Barquero	Completion of school and water supply	success
Barquero	Sewing machine repair; lighting for local center	success
Salinas	Water supply for school	success
La Chipornia	Sanitary facilities for school	completed, not working
La Chipornia**	Soil erosion control	success
Simbocal	Electricity and water for school	success
Portovelo	Sanitary facilities for school	success
Posorja	Classroom construction	success
Jambelí	Completion of school construction project	success

*** implemented over two years**
**** implemented over three years**

Phase III: Transition to implementation of the ZEM plans

Specific funding for practical exercises was not made available after Year 7 in the PMRC budget, and

administrative responsibility was shifted from the FVPM to the URI in-country technical experts based in the Guayaquil offices of the PMRC. Delays in selection and approval of projects meant that funds allocated for projects in three zones had not been completely spent. In the San Pedro-Valdivia-Manglaralto, Bahía de Caráquez, and Machala-Puerto Bolivar-Jambelí ZEMs, longer lists of proposed actions were replaced in project years 8 and 9 by a few, much larger, projects. A latrine construction project replaces smaller fisheries projects in San Pedro, along with an intensive effort to introduce new shrimp larvae fishing gear in the area. In Bahía de Caráquez, a long list of small activities was replaced by a major commitment to complete the soil erosion project in La Chipornia. The Machala ZEM shifted its focus from small actions to help fishing cooperatives, to a single project to promote mangrove conservation and tourism. All of these projects were completed in Year 9.

The adoption of the ZEM plans in May 1992 was accompanied by the need to designate new permanent committees and to search for implementation funding. PMRC staff focused greater effort on resolving the technical difficulties encountered in attempting to implement the resource management practical exercises. The technical staff had also become committed to ZEM plan implementation, and attempted to carry out small pieces of the plans, even though the USAID-funded CRMP was nearing its end. The impact of the practical exercises on the design of the Inter-American Development Bank project and other efforts at ZEM plan implementation is discussed later in this report.

A Review and Assessment of Practical Exercises Undertaken in Project Years 6 and 7.

Selecting criteria for assessing lessons from the practical exercises

The practical exercises had two basic purposes for the PMRC: to build community structure, and to test the local conditions for plan implementation. The potential lessons to be learned from the experiences in designing and carrying out the actions can be found at many levels, reflecting the PMRC's multiple objectives for this activity. These objectives included

1) Resolving user conflicts and preserving traditional economic activities;

2) Integrating human activities and economic development with resource management;

3) Refining participatory decision-making and implementation processes;

4) Creating local community structure and capacity for implementing ZEM plans;

5) Building constituency within a ZEM for a democratic, community-based coastal resources management program; and

6) Testing and enhancing the ability of the CRMP to select, design, implement, and evaluate actions that advance coastal resources management.

The assessment presented in this section examines how well the practical exercises served each of these basic program purposes. It is based on a review of earlier documents that stated the rationale for each of the initiatives; a review of advisory committee project selections; on-site inspection of most of the exercises initiated in project years 6 and 7 (1991 and 1992); and personal consultation by the authors with ZEM residents, user groups, field office coordinators and staff, local authorities, and technical experts working for the CRMP. Reviews of initial findings and recommendations took place during several meetings with CRMP staff during 1993. Detailed case studies of a number of the practical exercises have been prepared as part of the documentation of the CRMP experience in the key coastal issues since 1986.

Objective 1: Resolving user conflicts and preserving traditional economic activities

The advisory committees have been extremely creative in using practical exercises as a mechanism to resolve use conflicts, in particular those that threaten the continuation of traditional economic activities. Successful examples include the zoning of areas such as beaches and mangroves for single or multiple use,

agreement on use regulations for areas of conflict, convenios assigning property rights to user groups, and the construction of infrastructure that promotes more orderly and rational resource use. For example, tourists, artisanal fishermen, *larveros* (shrimp larvae fishermen), fish vendors and fish transporters/buyers-all with conflicting needs-were competing over the use of the beach in Playas. The advisory committee worked closely with the municipality and user groups to develop a zoning scheme that facilitated multiple use of the beach. Tourist operators are now caring for palm trees they planted to beautify their sections, and the municipality is collecting garbage along the beach. Fences to protect palms and trash containers were built with PMRC practical exercise funds. The PMRC and advisory committee have been educating larveros about the importance of beaches to tourism and the local economy and these fishermen have agreed to collect postlarvae elsewhere during periods of peak tourist demand. Practical exercise funds have also financed the construction of traditional sail-powered balsa fishing vessels that date back to pre-Columbian times, and remain in use only in the Playas area. In addition to maintaining the cultural heritage and providing a means of livelihood to fishermen, a balsa regatta has been held off the beach, and is quickly emerging as a tourist attraction. Local tourist operators and private businessmen are contributing funds to purchase trophies and prizes for contestants. Order and cleanliness have been promoted at the end of the beach reserved for artisanal fishermen and fish buyers by constructing a clean, open-air facility where fish are sorted and sold. These small actions have taken seemingly conflicting activities and made them complementary, thus increasing the benefits to all beach users.

An important innovation developed in part as an outgrowth of the practical exercises has been the "user group agreement," which is a written document signed by local user groups affirming their commitment to implement policies and actions, often with specific details on individual actions to be taken by resource users such as shrimp farmers, fishermen, and local communities. Although these agreements do not have a legally enforceable status, they serve to reinforce one of the most important characteristics of a realistic coastal management policy, which is the social consensus to support implementation.

Observations

Emerging and alternative resource uses that threaten traditional economic activities are, to a degree, being mediated on a case-by-case basis. This is essential, as many of these traditional activities have disappeared, displacing user groups. In Bahía, where over 90 percent of the mangroves have been cut and replaced with shrimp ponds, people are no longer able to collect cockles or mangrove crabs-both of which are dependent on mangroves-or to selectively harvest mangroves to produce charcoal for cooking, or to sell to augment family incomes.

User conflicts are being solved in some areas by transferring use rights to groups and communities, that have historically been dependent on accessing the area and its resources. Practical exercises are being used to help these areas recuperate, and the Ranger Corps is actively involved in resolving conflicts when they arise.

Significant tracts of mangroves are now better protected than previously and methods are being developed to accommodate conflicting uses. There are, however, no indications that the rates of mangrove deforestation within the ZEMs have slowed. Community cleanups have visibly increased the aesthetic appearance of key estuaries and tourist areas. Communities are currently demanding that greater attention be given to improving water quality. Exercises intent on improving the capture of shrimp postlarvae in nursery ponds have encouraged larveros to return the bycatch of "undesirable" species to the ocean, rather than throw them on the beach to die. The offshore fisheries fleets have expressed considerable concern about the latter.

Recommendations

1. Given that user conflicts can be expected to increase in coastal Ecuador, PMRC technical and field staff should receive specialized training in conflict resolution. Technical information can contribute to finding solutions to conflicts, but ultimately the ability to arbitrate the disagreement by creating public support and political power will dictate the final result.

2. Given continuous changes in technologies and local communities, the PMRC and user groups should

search for innovative methods and technologies to enhance the value and sustainability of *traditional economic activities.*

Objective 2: Integrating Human Activities and Economic Development With Resource Management.

Realizing that the status of ecosystems and the quality of life for coastal residents are interdependent, the PMRC has not insisted that funds for practical exercises be used exclusively on resource protection, but rather, has encouraged local populations to perceive themselves as part of the ecosystem and to attempt to resolve environmental and social issues within this context. Some user groups whose existence depends on accessing or exploiting a given resource, are being educated on the implications of resource exploitation. They are learning to accept responsibility for their actions and to consider alternative actions or management efforts that will increase the value and/or sustainability of their activity.

There have been numerous successes in promoting the concept that socioeconomic development can be integrated with resource management. Some specific examples include:

Reforestation: User groups-such as *carboneros*, who have traditionally harvested mangrove for the production of charcoal, and *concheras*, who have historically collected cockles that grow on mangrove roots-have joined forces with the PMRC in replanting and restoring areas of mangrove previously cleared or degraded by shrimp pond construction. Small-scale shrimp mariculturists in Atacames have been taught that mangroves contribute to better water quality, and have consequently experimented with planting mangroves along canals and berms to enhance the quality of water being pumped in and out of their shrimp ponds. Each group is also working with technicians from the PMRC to develop realistic plans for managing the areas that were replanted. The groups have also signed convenios with the government that, subject to specific criteria, assign each group asserting a claim to the area. These have been developed in outline form through the user group agreement for Atacames and Muisne, which will be followed up by a specific mangrove management project to complete this work under the Inter-American Development Bank.

Similar activity has taken place in Bahía, where farmers planted rows of *Leucaena spp.*,-a fast-growing tree that fixes nitrogen in the soil-across steep hillsides to enhance soil fertility and crop production while simultaneously reducing erosion. One of the large shrimp growers in the region was sufficiently impressed with this initiative to duplicate it on the hillsides adjacent to his shrimp ponds. These groups are motivated by economic considerations and by the simple fact that they have been afforded the opportunity to improve their environment.

Ecotourism: In Atacames, a boardwalk was constructed through the small area of remaining mangrove. Planning is currently underway to construct a second boardwalk near the island of Jambelí. These projects have the following multiple and integrated objectives:

- To protect mangroves;
- To diversify tourist attractions;
- To generate employment and income for tourist promoters and naturalist guides; and
- To increase the appreciation for mangroves by providing tourists, residents, and school children with firsthand knowledge of this resource.

Postlarvae management: The training and education of larveros provided this group with the opportunity to increase their incomes while diminishing negative environmental impacts from the harvesting of shrimp postlarvae (PL). This was attempted through efforts to design new nets, and better PL handling and cleaning procedures. The larveros will maintain, or possibly increase the rate and value of the catch, while simultaneously reducing the amount of bycatch, and of stress on PL during capture and initial handling. Simply decreasing stress should add value, as PL in better condition have greater survival rates, and consequently should receive higher prices. Larveros in the impoverished community of Bunche have formed an association and have used funds from practical exercises to construct a holding area (*centro de acopio*). Here, PL can be stored under better conditions, and in sufficient quantities to give bargaining power and thus, a higher price.

It is worth mentioning that the Playas ZEM committee expressed concern over the introduction of a capital-intensive mechanized device with hydraulic arms to harvest PL, and requested that the Subsecretary of Fisheries conduct a study to determine the appropriateness of the device. The committee was not against the PL fishery, but expressed concern over the impacts that mechanization could have on stocks, displacement of labor, and accelerating erosion of the beach. The device was voluntarily taken out of operation. By placing emphasis on the values most important to the community-for example, employment concerns, as opposed to economic efficiency-the committee realized the inappropriateness of the mechanism for their given set of circumstances. This type of forethought should be initiated in the planning stages of all practical exercises.

Observations

It is evident that practical exercises have created short- and long-term employment, reduced multiple use conflicts, improved sanitary conditions, increased the efficiency-and consequently, the value-of resource use, and prolonged or enhanced the benefits that can be derived from resources over time by promoting sustainable use. The consideration of the human factor in coastal management initiatives is essential to building consensus, and practical exercises have been instrumental in promoting this consciousness.

Recommendations

1. *An effort should be made to collect the baseline information required to document potential social,* environmental, and economic impacts of practical exercises.

Greater emphasis should be placed on identifying the anticipated social, environmental, and economic benefits that can be reasonably expected to flow from a practical exercise. In many instances, these benefits are not easy to quantify, so a concerted effort is required to capture their nature and essence.

In addition, the absence of baseline data relevant to all resources and resource-dependent activities makes it difficult to set priorities, or to assess the impacts of practical exercises. Research and basic data collection activities should be expanded, as they are primary inputs to the learning and decision-making processes, and should be more fully incorporated into implementation.

2. *User groups and businesses need help from resource managers who are technically competent* and can understand social and business issues. One of the more important aspects of practical exercises is that they have involved groups that exploit and are economically dependent on the resource, thus fostering a sense of appreciation and stewardship. For example, concheras are openly discussing the issue of harvesting small cockles with little market value, as well as seeking ways to augment natural production by reseeding areas, protecting the mangrove habitat where cockles flourish, by initiating mariculture efforts. More recently, shrimp growers, whose ponds border the estuary in Atacames, have approached the PMRC to work with them in developing better management practices to improve water quality and yields.

There is, however, a lack of training and expertise in areas such as marketing, planning, or project management. Expertise in community and small business development is also scarce. There has been a pattern in the ZEMs of failing to seek outside help for practical exercises when necessary, or to assign enough staff resources to practical exercises.

Several of the practical exercises that are, in essence, small businesses that integrate human activities and resource management have not fared well. This is, in large part, attributed to a failure to appreciate the complexities and management skills required to oversee a small business. The PMRC currently does not have staff skilled in enterprise development and management, and needs to help groups in the ZEMs gain access to this expertise. To improve their chance of success-feasibility studies-which include such components as setting economic criteria, assessment of managerial capabilities, gaining a detailed knowledge of the undertaking, assessment of alternatives, operational planning, and risk analysis-should be conducted before the project is started. If deemed necessary, arrangements must be made to strengthen or create managerial capacity within the group(s) that will oversee the exercise. There has also been a tendency to involve as many groups as possible in most exercises, which greatly complicates operational and administrative aspects.

3. If resource management and socioeconomic development are to be sustainability integrated, substantive knowledge and management techniques are required. Much of the technical information required to efficiently manage the natural resource base is lacking in Ecuador. For example, mangrove management initiatives are poor at incorporating the sciences of forest mensuration (measurement) and silviculture.

Objective 3: Testing and customizing the decision-making and implementation processes advocated by the PMRC.

Traditionally, the responsibility for selecting, financing, and implementing resource management or community development projects in Ecuador has rested with organizations at the national or regional levels. Community involvement has been minimal at best. Experience worldwide has demonstrated that laws, actions, or initiatives designed to protect resources and/or stimulate economic development are not sustainable over the long term if they are not supported by, or are contrary to, the interests of communities or user groups. Similarly, public works projects that are instigated from outside the community often fail to reflect the priorities and realities of the community, and tend to create controversy, conflict and, often, do more harm than good.

During the ZEM planning process, the PMRC spent a great deal of time and effort creating an educated constituency and empowering this constituency by providing technical and financial support and political linkages to the highest levels of government. Practical exercises attempt to empower participants by providing them with the opportunity to test the decision-making process by executing activities. They are also a foray into creating enduring groups that accept responsibility for managing their actions and environment.

Observations

It has become obvious that there has been a transition in how communities exert pressure or initiate action to address issues of local concern. User groups and communities that once had no means of expressing their needs are now placing demands on municipalities, the Ranger Corps, and the PMRC to help them in addressing problems, conducting research, and coming up with suggestions that will facilitate practical solutions to a host of issues. For example, concheras in Bunche are actively supporting research on the growth rate of cockles, techniques for reseeding natural areas, and the development of economically viable techniques for culturing cockles. Communities in Bahía solicited help in reseeding cockles and developing a management plan to resolve user conflicts and to promote the rational multiple use of Isla de Corazon. In Machala, larveros that were prohibited from accessing traditional fishing areas by a shrimp pond owner petitioned the port captain, who supported their rights and negotiated with the owner of the ponds. The advisory committee and two cooperatives of vessel owners that transport tourists between Puerto Bolivar and the Island of Jambelí have requested that the PMRC and the local university assist in designing a plan to encourage protection of mangrove areas by promoting ecotourism.

Recommendations:

A timeline of planned events should be agreed upon and periodically evaluated to promote compliance and increase the chances of success of practical exercises. Efforts should not be allowed to proceed until each phase or step has been satisfactorily completed.

1. *User groups in each ZEM would benefit greatly from opportunities to exchange implementation experiences. Although the ZEM plans reflect an active interchange of ideas at the planning level, implementation experience has not been similarly shared.* It is clear that an exchange of experience among ZEMs would be productive. A thorough examination of the ZEM process and group dynamics can shed light on how to strengthen the process required to produce successful practical exercises. Channels and interaction between the committees and local or national government agencies should be examined. Linkages between the committees, the PMRC, and the national commission, in particular, have not been sufficiently tested. This is mandatory if larger and more costly and complex practical exercises are to succeed. Other agencies dealing with community, infrastructure, sector, and resource development or

protection could also contribute to, and benefit from, observing the PMRC experience.

2. *The PMRC must be prepared to provide adequate support to field-based implementation efforts, so that the exercises are a fair test of local variations and difficulties.* Administrative complications within the central offices in Guayaquil and Rhode Island have hampered practical exercises in achieving their full potential. For example, many of the exercises initially approved by the advisory committees were never implemented, reflecting shifts in priorities as well as administrative, work load, and cash flow difficulties within the program (see discussion of Objective 6 below), as well as a realization that a number of the projects were not feasible given available funds. Nonetheless, from the ZEM perspective, these delays and lack of availability of technical assistance caused frustration and confusion. Communication and coordinated, timely responses are required to increase the success rate of practical exercises.

Objective 4: Creating local structure and capacity for special area management plan implementation

It is evident that practical exercises have strengthened community and user group solidarity and capacity to govern the areas where these people live. The advisory committees have successfully integrated diverse sets of interest groups into a body that is striving to resolve resource management and social issues, as well as to formulate a cohesive vision of what goals each ZEM should prioritize and pursue. Residents in each ZEM have come to view the advisory committees, the PMRC, and the Ranger Corps as responsible entities that are responsive to local demands.

Observations

One of the more interesting, as well as controversial, products of the ZEM participatory process has been the emergence of approximately 380 user groups, associations, precooperatives, cooperatives, and committees that have organized to pursue everything from income- and employment-generating projects to concessions over the use of specific resources. Similar groups have long existed within Ecuador, but the rapid increase in their appearance within the ZEMs is largely attributed to the Executive Decree 3399, which mandated that groups working with the PMRC be legalized. Field and technical staff, who have received no training and have little experience in organizing and strengthening groups, have had to divert considerable energy to respond to requests for assistance from groups wishing to be formalized. Given the limited PMRC funds that have been made available to assist these groups, it is fairly evident that they are motivated by the program's philosophy, rather than by financial expectations.

The experience to date has demonstrated that the advisory committees have learned from past experience, and have enhanced their ability to represent constituent communities and groups in identifying and resolving a wide range of issues. The design phase is taking more time than in previous years, and the committees are more involved. Greater demands are also being placed on the PMRC's technical staff, and there appears to be a general realization that exercises are more complex and time-consuming than previously thought. For example, after reviewing the experience in Atacames, the mangrove boardwalk in Machala has been drastically simplified, and infrastructure reduced from what was originally envisioned.

The advisory committees are still young and struggling to take advantage of the new opportunities afforded by practical exercises and by the ZEM process in general. If they are to continue to grow and mature over time, the degree of empowerment, technical support, and training must increase. A variety of training opportunities, (such as short courses in conflict resolution, community planning, and project management) would strengthen the advisory committees.

The successful implementation of the ZEM process and practical exercises relies on the creation and/or strengthening of user and community groups, yet very little attention or expertise has been devoted to this. Most of these groups are young, all are fragile, and each must be nurtured over time. The capacity to assist these groups must be created and centered within each ZEM. Workshops are a constructive, albeit limited, tool. It is also evident that building human capacity is a more complex, costly, and time-consuming activity than building physical structures or reforestation, and the PMRC still tends to underestimate this crucial stage.

Recommendations:

1. *Caution must be exercised to avoid inadvertently encouraging user groups to become cooperatives, or to take on tasks for which they are ill-prepared.* A few words of caution appear to be necessary, as the PMRC is working with an increasingly large number of diverse groups, some of which have been recently formed, that are administering specific practical exercises. Many of these groups appear to be headed toward forming associations or cooperatives. Given the experience worldwide, as well as in Ecuador, with cooperatives, a great deal of thought should be put into the best ways to interact with these groups, and how to ensure their success. In some instances, it may be wiser to deal with individuals, private companies, or family units. With the exception of garbage collection, the private sector has not actively participated in practical exercises, and several projects (for example, fuel oil supply for the fishing cooperatives in Playas) have failed because they deliberately attempted to bypass or exclude the private sector. It would be worthwhile to identify methods or incentives that encourage private sector involvement in practical exercises.

2. *The PMRC must take advantage of available experience and expertise in Ecuador to strengthen user groups.* The interorganizational structure in Ecuador can be improved. The PMRC has been working in relative isolation, and has not taken full advantage of the experience and expertise of other organizations working in the areas of conservation, research, and community or cooperative development. Similarly, the opportunity of success for practical exercises may well increase if the PMRC's technical staff is better integrated.

Objective 5: Building constituencies in the ZEM for a democratic, community-based coastal resources management program

The initial years of the development of the PMRC were spent gaining credibility by developing insights into issues, concerns, and trends. Through encouraging an open dialogue with the PMRC, national institutions, user groups, and local communities, mutual respect, and trust were established. Issues of national importance-such as, mangroves, water quality, and law enforcement-were addressed by organizing working groups made up of institutions charged with overseeing specific resources or activities. The participatory process encouraged constituency building at the local level. Offices were established in each of the ZEMs so that PMRC staff would be easily accessible and responsive to local demands. Through an ongoing process of open consultation within each ZEM, consensus was reached on such issues as economic development, infrastructure, basic services, education, and resource deterioration. The participatory process has been strengthened through formal and informal education campaigns. Emphasis has continually been placed on human relations to establish trust and goodwill. For example, traditional rights of user groups, no matter how small or poor, have always been recognized.

Observations

It has not been possible to capture the full richness of the process of the selection and implementation of practical exercises. However, the level of attendance at committee meetings, the presentation of numerous projects, and number of public contributions provide an indication of the level of commitment and the constituency for community-based resource management. The advisory committee discussed scores of practical exercises in meetings that were open and often lively forums for public debate and decision-making. Seemingly simple issues, such as use of beaches, were found to be complex, and became the ongoing focus of community attention. For example, 18 practical exercises, ranging from the donation of a sewing machine to a women's group, to garbage collection and reforestation projects, were executed in the Bahía ZEM during the first year alone. Decision-making and issue resolution have been inventive, and have generated confidence that solutions can be reached without outside intervention. The use of practical exercises as a tool to promote self-determination by soliciting local participation in coastal communities appears to be succeeding.

One quantifiable measure of constituency is the value of in-kind contributions to practical exercises. Admittedly, it is difficult to accurately quantify the value of a community's contribution, which includes such diverse inputs as labor, local building materials, and land. However, attempts to do so for about half of the projects implemented reveal that for each dollar contributed by the PMRC, the value of the community's contribution in all the ZEMs over a two-year period was 94 cents, or nearly one to one. There were slight differences in the amounts of contributions between ZEMs, as well as by project type. Also, the

value of the community's or user group's contributions was higher in Year 1, and higher for public works and economic development projects than for resource management projects. This can be largely attributed to the fact that contributions to Year 1 projects, such as labor, materials, or deeded land, were relatively easy to quantify, whereas Year 2 project contributions tended to include more common property resources, such as intertidal areas where mangroves were reforested, that are more difficult to place value on.

Recommendations

1. *Constituency can be strengthened if user groups receive better education on their potential role in resources management.* The PMRC has experienced praiseworthy advances in using practical exercises to encourage constituency for community-based initiatives, but more effort should be directed to educating the advisory committees, communities, and user groups on the intricacies of managing resources. Residents of the ZEMs are now cognizant of the fact that economic development is not contingent on environmental degradation, and that they are capable of taking control of the situation; but they require sound information on how to do this. The experiential learning process generated by practical exercises, coupled with continued general and technical education, and financial support, will ensure constituency and commitment to sustainable development. Even without the PMRC, there are indications that the spirit of self-determination and involvement in resource management will endure.

2. *The PMRC needs to build a constituency within local and regional government units.* Since the inception of the PMRC in 1986, there has been a significant change in the way coastal communities perceive and value coastal resources, as well as a new willingness and enthusiasm to accept responsibility for managing resources that sustain their existence. Despite a great deal of interest, particularly in the Office of the President, the PMRC has failed to create a strong constituency among other relevant institutions, programs, and private volunteer organizations at the national level. The quarterly publication *Costas* highlights program activities, but no additional energy has gone into sharing the experience, successes, and failures with organizations working on similar projects in other areas of Ecuador.

3. *ZEM coordinators and technical advisors need training and increased support in working with user groups.* The success or failure of a practical exercise and of the program in general is, to a large extent, dependent on the initiative and skill of the coordinator or technical expert(s). It is the coordinator that is on the front line representing the PMRC and interacting daily with the communities in each ZEM. It follows that constituency and field morale, in general, can be strengthened by supporting and rewarding the coordinator's initiatives. Despite numerous requests for training, the PMRC has done little to enhance the skills of its coordinators, field staff, and technical experts. The coordinators are the holders of much of the goodwill, so efforts to enhance their effectiveness will increase the PMRC's following.

4. *More attention should be given to involving the private sector in coastal resources management.* While advocating the privatization of resources among user groups, individual entrepreneurs have been basically ignored or mistrusted. Practical exercises rely heavily reliant on the formation of fragile social groups, and generally fail to capitalize on, or provide incentives to, private sector initiatives. If the PMRC has an official stance on private sector involvement, it should be clarified. It is suggested that potential roles for the private sector in practical exercises be thoroughly addressed. Experience has repeatedly demonstrated that projects that deliberately attempt to bypass or neglect to involve the private sector tend to fail. Similarly, there is overwhelming evidence that creating formal user groups such as fishermen's cooperatives is not an effective way of promoting development. If practical exercises are to meet expectations, serious time should be devoted to examining the issues and alternatives posed by forming social groups, and to strategies for private sector involvement.

Objective 6: Testing and enhancing the ability of the PMRC to select, design, implement, and evaluate actions that advance coastal resources management

There is an opinion broadly shared by technical and field staff and ZEM committee members that the practical exercises have made an important contribution to strengthening the credibility of the PMRC, to building local understanding of the need for self-initiated local management, and even to helping create

new capacity for local management.

However, there is not a similar widely held consensus on the PMRC's own success in managing the practical exercises work during the period when the project staff was engaged in the very intense ZEM planning process between 1990 and 1992. From one perspective, the PMRC was correct in giving local advisory committees the chance to try implementing small tasks on their own, while another viewpoint argues that the PMRC provided too little technical support and was too slow or nonresponsive in helping advisory committees make good choices, or in intervening when projects went off course.

Some ZEM coordinators, a few of the technical experts, and the staff supervising implementation during Phases I and II at the Fundación Pedro Vicente Maldonado have consistently emphasized the importance of giving local resource users opportunities to explore how to make small projects work on their own. These staff members feel comfortable with the PMRC's level of technical support to the practical exercises. Proponents of this view are relatively untroubled by the fact that many selected exercises were eventually not initiated, or were replaced by a few larger efforts, and acknowledge that some exercises faced design and implementation difficulties that the PMRC technical staff did not succeed in resolving.

A different view of the PMRC's performance is held by some of the technical staff and advisors, who believe that better extension and support is vital for the success of practical exercises, and that the PMRC itself has much to learn about how to provide proper support to field staff and the ZEM committees. Bolstering this perspective is the fact that of 42 projects selected during Phase I, one-third were completed with satisfactory results, one-third were initiated, and produced some positive results, but were never fully completed, and the remaining one-third either failed, or were never completed. Despite a significant reduction in the number of activities during the second year of practical exercises, implementation results appear to be much poorer than those experienced the previous year. For example, the percentage of projects completed with the anticipated results fell slightly, from 32 to 29, and nearly half of the projects were never initiated.

Problems in management occurred at various stages in the project cycle of some of the exercises. Funds set aside to aid a group of shrimp larvae fishermen in the community of Valdivia were not spent once it was learned that the small organization was already committed to another large activity that was encountering serious technical difficulties. A series of smaller projects proposed by the advisory committee in the Puerto Bolivar-Machala-Isla Jambelí ZEM were subsequently dropped in favor of a single project to promote mangrove tourism and protection in the surrounding fringe wetlands of this major port and tourist center. Even the scope of this substitute practical exercise had to be reduced and redefined during execution in 1993, due to its high costs. The practical exercise in Atacames, which started as a simple, crudely constructed boardwalk to allow schoolchildren to study a small mangrove forest, expanded in size, scope and cost into a means for creating ecological tourism. As the project concept evolved, implementation difficulties, organizational problems, and the inadequacy of existing facilities became more evident. Nonetheless, this is viewed with considerable pride as an important success of the local ZEM planning program. Now the action is a part of the mangrove management projects to be funded at a much larger scale under the Inter-American Development Bank project.

Many practical exercises were not implemented due to the need for detailed project proposals providing specific designs and evaluation mechanisms. The one notable exception appears to be exercises related to sanitation, which consistently had feasibility studies complete with blueprints, costs, benefits, and a discussion of administration. In a few other instances, elaborate architectural drawings were prepared to guide construction, but were not always followed-often because the designs were too elaborate. Preparation before execution appears to have been limited in many instances. Workshops on project management, which were basically restricted to an introduction to bookkeeping, were conducted for about 25 selected groups, but little else was done to create local management capacity to execute and maintain projects.

Observations

CRMP staff appear to be agreement at least in concept on how an action in the field should be implemented, and they also agree that in many cases practice diverged greatly from this theory.

The World Bank's Economic Development Institute recently addressed the challenge of community development in a report on planning small housing projects (Goethert and Hamdi, 1992) which argues that small project implementation must be designed to reflect the basic reality that no implementation process is linear. The report outlines the ongoing debate between those who emphasize rational project design as essential for success, and those who focus on carrying out site-specific actions that may satisfy local needs, but do not reflect any broad set of principles or concepts that might enable transferring knowledge from one place to the next. The authors recommend taking a problem-oriented approach, creating a planning process that involves all key actors, promoting community leadership, providing a balance to dominant economic interests and continually setting priorities based on considerations of timing, opportunity, and geography. These all seem to be reflected in the design of the ZEM planning program.

Goethert and Hamdi also argue that while short-term actions are usually most important, small projects often do need a longer planning horizon, better technical design, more complicated coordination measures, or greater funding than is available. Many of the PMRC's practical exercises actually fit into the "long-term project" category by this definition. The World Bank study also highlights the need for immediate documentation and feedback when projects are planned, and as a point of reference later on as the experience is reviewed. Relatively little of this happened during the implementation of the practical exercises, which suggests that the PMRC was not fully prepared to learn as much as it could from the exercises once it launched them.

One additional important point raised by the World Bank study is the importance of maintaining an inherent bias toward follow-up when working with communities. In reviewing a number of small project case studies, Goethert and Hamdi felt that merely having a local community organize itself to pressure public officials to respond to their concerns was a major advance over traditional project administration styles that place local residents in a passive, recipient mode. The practical exercises actually pushed this boundary much farther when the PMRC expected the community itself to carry out implementation of Phase I projects within very tight budgets and vague promises of technical support. A third approach, which typifies the PMRC's Phase III, is to place more responsibility for implementation with the ZEM offices, under supervision and leadership of technical staff, with additional supervision and collaboration from the advisory committees.

The ZEM committees have thought carefully about defining their own role in implementation. One proposal that emerged from the ZEM plan review process in Atacames in late 1991, and was quickly adopted by other advisory committees, was the qualification that the PMRC cannot carry out activities in the ZEMs that have not been approved in advance by the ZEM committees and that are not a part of the adopted plan. This places the local committees a considerable distance away from the passive recipient model that prevents the emergence of sustainable development.

Recommendations

1. Exercise Selection

a. *The selection process should consist of two phases: pre-selection and selection.* All exercises should be rigorously evaluated before implementation begins. The advisory committee and field and technical staff should thoroughly examine each proposal and select those that have the greatest chance of successfully fulfilling the objectives.

b. *Local committees need to have critical experiences though which mutual learning can take place, especially in situations in which there is no prior experience.* Developing sound judgement and a well-functioning local committee may take several rounds of exercises to establish.

2. Exercise Design

a. *All practical exercises, no matter how inexpensive, should be supported by comprehensive and professional feasibility studies*. Proper preparation and planning is one of the backbones of coastal zone management, yet the PMRC did not allocate sufficient resources to adequately address this preliminary, essential stage. Seemingly small and simple projects have proven to be complicated and require the same

amount of attention as larger, more costly projects.

b. *Advisory committees and resource user groups should be provided with a small quantity of funds that they are responsible for allocating and supervising, without excessive direction from program managers*. Coastal programs seeking to foster local stewardship need to know what local capabilities are, and must allow local groups the same opportunity for learning through experience that project experts are provided.

3. Role of experts

a. *Technical experts should be constantly involved in all phases of practical exercises.* The success or failure of practical exercises are, to a large degree, dependent on having projects that are technically viable. Strengthening the managerial capabilities of user groups or the advisory committees is a futile exercise if the undertaking is not technically sound. It is clear that most practical exercises are multifaceted, so it is mandatory that technicians with a diverse range of skills and expertise work on specific projects as a team.

b. *Over-dependence on outside technical experts is a major obstacle to responsiveness to design and implementation problems*. Greater attention should be given to creating technical capacity in field offices and at the local level.

4. Evaluation

a. *Evaluation and assessment should be an ongoing and flexible process capable of identifying pitfalls and making corrections before it is too late*. The economic, social, and environmental situation in each ZEM is constantly evolving, so an adaptive approach is required during all phases of practical exercises.

b. *Opportunities for learning and self-assessment must be fostered at many levels simultaneously*. Technical experts, project managers, advisory committees, and user groups need to exchange observations among themselves frequently in order to learn from each other and to overcome the complaint that experts who arrive to work in a community often contradict each other.

5. Work load

a. *Given the lack of experience among PMRC, Fundación Maldonado, URI-based staff, and ZEM advisory committees in implementing activities and ideas, fewer, but better-designed projects should be undertaken.* Considering the low number of practical exercises that were initiated and achieved their anticipated objectives, it is clear that the staff was spread quite thin, and is still in the learning phase. Their efforts would be used more efficiently if directed toward fewer projects.

b. *The PMRC should foster local creativity while clearly recognizing the difference between experimentation and the more rigorous operational requirements for plan implementation*. Some of the most important innovations in the ZEM plans-such as user group agreements-emerged from unofficial or complementary project activities generated at the local level.

6. Accountability

a. *One representative from the PMRC should be designated to assume responsibility for providing the assistance and guidance required to ensure success for specific practical exercises.* To be effective, the PMRC representative must have the experience, authority, and support necessary to make prompt and sound decisions. If the exercise fails to meet anticipated goals, that person should be held accountable.

b. *ZEM offices should be better prepared to oversee projects and to help the ZEM committees assess the lessons being learned*. Groups, rather than individuals, must do the learning from the exercises, in terms of assessing progress in building community structure, and for testing implementation feasibility.

The Effects of the Practical Exercises on Initial ZEM Plan Implementation Efforts and on the Design of Inter-American Development Bank Project

Practical exercises are evolving into the centerpiece of Ecuador's coastal management program. Villagers have demonstrated their enthusiasm by mobilizing an astonishing array of contributions, ranging from labor, unused or underused buildings, materials, tools, and land. User groups are formalizing their status in the hope of gaining access to the participatory process and to obtain technical or financial assistance for desired activities. Despite problems in implementation during project years 6 and 7, practical exercises have proven to be a vehicle that has built constituency, competence, and stewardship by motivating participation,

The practical exercises assumed a new importance for the PMRC during Phase III, attention was shifted to preparing the Inter-American Development Bank (IDB) project. In this new effort, ZEM plan implementation projects were organized and designed by theme (mangroves, mariculture, shore management, community sanitation, and artisanal fisheries). The project also charged key technical experts in each area with completing practical exercises or following through on local plan implementation initiatives. Finally, as the USAID-funded Coastal Resources Management Project was approaching its end, the project team began to assess the lessons learned in the ZEMs from the perspective of solving critical national coastal issues.

Adjustments to practical exercise management during Phase III

Several of the previously discussed recommendations on how to improve technical performance were incorporated into projects in mariculture management and environmental sanitation completed in Year 8, when responsibility was shifted to the technical experts based at the PMRC. For example, the construction of latrines in the villages of Data de Villamil and Data de Posorja in the Playas ZEM was designed and led by the PMRC sanitary engineer, with extensive community training and education conducted by the FPVM and the ZEM field office staff prior to construction. The result was a complete success, and local contributions were estimated to exceed the PMRC financing. A similar approach will be employed to complete a latrine project in the San Pedro ZEM.

Work with shrimp larvae fishermen to reduce the environmental impact of their gear and larvae handling techniques was carried out in two ZEMs during Phase III, based on greatly expanded training and education of prospective participants prior to implementation, and creation of a system of follow-through, which involved both technical experts and ZEM staff. This ZEM plan implementation work also produced good results and a demand for similar activities in other ZEMs, which have had to be turned down due to PMRC staff concerns about lack of local staff readiness and insufficient funding to complete the project cycle successfully.

Impact of the practical exercises on the policies and actions proposed in the ZEM plans

Taken together, the practical exercises involved all the theme areas of concern to the national program. Table 3 illustrates that an exercise in one ZEM often had an effect on the policies and actions included in another. The concept of providing local school children with a boardwalk in order to visit nearby mangroves led to a much broader interest in testing how tourism could become a force in mangrove ecosystem protection. The difficulties encountered in helping artisanal mariculture projects succeed was expanded into policies calling for better technical assistance. Small community sanitation projects were seen as necessary not only to supply basic human needs, but to achieve environmental quality goals. The experiment with soil erosion control in La Chipornia highlighted the need to test similar actions with community groups and landowners in other coastal watersheds.

The practical exercises also influenced the institutional framework adopted in the ZEM plans. The ZEM committees have a major role to play in selecting actions to be implemented, and in monitoring progress and facilitating execution-including creating subcommittees on themes, sites, or specific decisions. In addition to creating an annual zone work plan, each coastal community that wants to be involved in implementing a ZEM project has also been encouraged to prepare its own work plan, especially since

implementation of special area policies does not always require a specific project or a great deal of technical support.

Table 3. Impact of practical exercises on ZEM plans, and links to IDB project.

National coastal policy theme area	Important practical exercises	Impact of exercises on policies in the ZEM plans	Link between practical exercises and IDB project
Mangrove ecosystem management	Mangrove boardwalk and tours in Rio Atacames	Tourism added to most plans as a strategy for motivating local mangrove vigilance and stimulating economic development. The exercise helped form the user group agreement concept, now being tried in all other ZEMs.	Funds will be provided to solve the financing and management problems resulting from expansion of the boardwalk tour concept. IDB will provide funds for an improved boardwalk, and many related facilities in Atacames, Playas, and Machala zones.
	Experimental shellfish production in Muisne. (Initial action not successful, but followed up by detailed feasibility studies by the mariculture group.)	Experimentation with artisanal mariculture is now featured in most ZEM plan, and is also linked to the user group agreement concept.	Only a limited amount of support will be provided by the IDB for these activities.
	Small mangrove reforestation efforts. (Test in Rio Atacames failed due to lack of shrimp farmer support, but succeeded in Rio Muisne.)	A strong policy on mangrove reforestation has been included in most plans.	Funding will be provided for expanded reforestation efforts for Rio Muisne and the Rio Chone estuary, as well as for Puerto El Morro and Isla Jambelí.
Water supply, sewage, and solid waste disposal	Latrine construction, cistern rehabilitation, trash collection and disposal carried out in most zones. (These projects worked best when careful attention was given to training and education before execution. Some ZEMs replaced original practical exercise selections with sanitation projects-for example, San Pedro and Playas.)	All plans contain detailed findings and policies on basic community needs that also affect the coastal environment.	Basic sanitation and services for small coastal communities otherwise ineligible for financial assistance comprise the largest single component of the IDB project.
Mariculture	Activities included a	Artisanal mariculture	IDB will provide additional funding for

	shrimp larvae collection center in Bunche, (resulting in the decision not to fund completion of similar activities in Valdivia), and work to develop less destructive fishing gear.	issues are a key theme of all zone plans, including the need for technical support to local projects.	activities aimed at the shrimp larvae fishery and artisanal precriaderos. Mariculture will be an important focus of the Rio Chone estuary management plan, which will receive major funding from the bank.
Artisanal fisheries	Small docks, fishing gear supply depots, preservation of balsa wood sailboats. (Many proposed projects were not started.)	All zone plans have policies on fisheries management, as well as measures to improve the conditions for local fishermen.	IDB will finance artisanal infrastructure in each zone.
Tourism and shore management	Mangrove tours (see above), tree planting, lifeguard projects, tourist signs and information. Funding was provided to develop information for addressing shore planning in Atacames and Estero Huayla. (Many projects proposed in Bahía de Caráquez were not initiated.)	All ZEM plans address shore management and tourism development in great detail, and propose zoning and regulation, tourism development activities, and tourist resource protection initiatives.	IDB provides funding for shore management in specific sites in the five ZEMs, as well as funds for completing tourism information projects, and for creation of a multipurpose tourist service facility in a critical beach in each zone.
Watershed management	The La Chipornia project demonstrated a good solution to erosion problems faced by farmers in the Rio Chone watershed, and involved working with a single landowner. Community groups now want to follow this example on other lands.	Most zone plans address the need to manage the landscapes of coastal watersheds, in Atacames to protect scenery, in Rio Chone to protect agriculture and prevent erosion, and in San Pedro to maintain water for agriculture.	IDB only provides funding for a small watershed activity related to aquifer recharge in the San Pedro zone.

Importance of the practical exercises in shaping the design of the Inter-American Development Bank project

The practical exercises appear to have played a surprisingly important role in influencing the initial priorities for implementation by the Inter-American Development Bank's coastal resources management project, as well as some of the techniques chosen to program the work. IDB funding in mangrove management focuses on the Atacames-Súa-Muisne ZEM, including the mangrove ecosystem tour which

began as an exercise, and the test of reforestation in the Rio Muisne. Funding will be provided later in the project to follow up on similar practical exercises started in Machala and Playas ZEMs. Community sanitation, projects which formed one of the largest categories of practical exercises, are featured in IDB implementation funding in all ZEMs. A key concern in the design of these projects was providing the extra resources needed to have a good public education and training program before individual projects were started. As a result, sanitation is the largest single category of projects. Tourism and shore management activities such as tourist signs, tourism service training, shore zoning, and multipurpose facilities to serve visitors will also receive funds, with project initiation in some cases scheduled to begin in one zone to gain experience before starting in others.

The IDB project is providing relatively little funding in other theme areas, for example, watershed management and artisanal fisheries, where most of the ZEMs have little practical experience, even though they are featured in the plans. Follow-up to the mariculture exercises and Phase III plan implementation efforts incorporates the PMRC's ongoing work with shrimp larvae fishermen and artisanal precriaderos in terms of providing technical assistance and gathering information. Direct work with the mariculture industry, however, is focused on just one site, the Rio Chone estuary of the Bahía de Caráquez ZEM, where a major management plan featuring issues surrounding the mariculture industry will be prepared.

In effect, the IDB project provides substantial additional resources for implementation work already underway or stimulated by the practical exercises, and takes a cautious approach to other actions, preferring to conduct a project in a single site before launching similar projects in other zones. This strategy appears to respond to concerns raised in the previous section about the need for more careful project design, supervision, and execution. In fact, during the IDB project design work, the concept of continuing to provide ZEM committees with a fund for practical exercises and short-term actions was debated and not included in the final project. However, the IDB design does include the formulation of work plans each year, based on annual progress assessments, and since not all projects are fully designed, provides continued opportunities for adjusting the choice of work to be carried out in each zone.

The idea of the PMRC as a process that requires adaptive planning, implementation, and management, acknowledging trial and error as fundamental to learning, will be greatly tested by the IDB initiative. Although execution of most tasks will be handled by contractors or professional staff, the role of the beneficiaries is expected to be much more active than the simple roles of pressure group and monitor.

Using practical exercises in new special area management zones

The PMRC should continue to employ practical exercises as a tool to work within the social structure and to use the participatory process to promote solidarity within existing and new ZEMs and to encourage commitment to common goals. It is essential that the program deliberately seek out strong local leadership and build on existing capabilities. The program has been skillful in avoiding favoritism, and in not aligning itself with specific groups or actively supporting the creation of cooperatives or user groups to manage certain practical exercises.

The ZEM planning projects have tapped local creativity in addressing coastal issues, and pointed out the clear need for practical approaches and solutions. The practical exercises, on the whole, demonstrate that local groups can choose and implement specific actions that advance acceptance of coastal management, and can use coastal resource management methods to resolve resource-use conflicts, thus helping to preserve traditional economic activities at sustainable levels. Even small exercises in management can generate positive social, environmental, or economic impacts. Just as the ZEM planning processes demonstrated the feasibility and advantages of extensive local public involvement, the challenge of implementing the exercises illustrates-and can lead to filling-the need to promote the creation of community structure and formation of strong user groups that have the ambition and capacity to engage in and help execute coastal management initiatives. Finally, the practical exercises have made a contribution to closing the gap between plans and implementation, which in turn helps establish the credibility necessary for creating a long-term local constituency for coastal resource management, as well as perhaps establishing a new tradition of community-based resource management that will provide a foundation for the program of implementation actions now being prepared by the government of Ecuador.

The Ranger Corps

Luis Arriaga M.

In the mid-1980s, compliance with Ecuador's environmental protection and management laws and regulations in coastal areas. Closed seasons for fishing and shellfishing were not widely respected; the complete ban on mangrove cutting adopted in 1985 by the Ministry of Agriculture was followed by increasing rates of cutting coastwide; and many shrimp farmers built their ponds without first obtaining all required licenses to occupy areas and operate their farms. Ecuador has not succeeded in implementing effective controls for discharges of wastewater by industries, businesses, and municipalities to estuaries, rivers, and coastal waters. Coastal municipalities have the authority to zone shore and upland areas, but few have initiated any urban planning, and most make decisions without technical guidelines.

Structures of the Ranger Corps

Executive Decree 375 defines the Ranger Corps as follows:

Within the jurisdiction of each port captain, a Ranger Corps will be established composed of the personnel in the various agencies who are directly responsible for enforcement of coastal resource management laws and regulations, principally the Subsecretary for Fisheries Resources, the General Directorate of the Merchant Marine and Coast (DIGMER), and the National Forestry Agency within the ministry of agriculture.

This was supplemented in 1992 by Executive Decree 3399, which added language to define their function as "promoting awareness and compliance with the various laws and regulations and technical requirements which refer to the protection, preservation, and proper use of coastal resources."

In practice, a typical Ranger Corps unit is led by the port captain, the fisheries inspector, the forest district officer, and by other agencies, depending on the locale for example, the Ecuadorian Water Resources Agency (INHERI), municipalities, the Ministry of Health, the Ecuadorian Tourism Corporation, and the Land Reform Agency. Early on, at a training workshop, the members of the Ranger Corps agreed that the port captain's role "was not to be interpreted as resulting in the subordination of one agency over another, nor in any way a statement that the member agencies are giving over their authority to the port captain or creating any new authorities."

There are seven port captaincies on the continental coast, plus the archipelago of Galapagos. Together they cover the entire coastal zone of the country.

The Rationale and Design of the Ranger Corps as a Tool to Improve Compliance with Coastal Laws.

The same approach that characterizes other PMRC interventions has been applied to the Ranger Corps, involving technical studies, consensus-building among agencies, use of outside experts, and testing of mechanisms and tools. Initial legal and institutional studies by Pérez et al. (1988) helped create the CRMP in 1989 and for the first time clearly laid out the scope of laws and regulations affecting the coast. These studies identified several features of current Ecuadorian coastal laws and enforcement that were obstacles to effective management.

Policies that do not recognize geographic differences. Pérez noted that the entire coastal zone is treated as though it were a uniform entity under existing Ecuadorian law. The regional development authorities in Manabí, Guayas, and El Oro provinces are an exception to this, yet they too are subject to the same uniform system of laws, as are the municipalities and provincial councils. This means that it is virtually impossible

to craft policies and regulations that recognize the unique characteristics of coastal ecosystems located in the different provinces.

A sectoral, top-down approach. The Ecuadorian legal system assigns coastal resource management responsibilities to the sectoral agencies such as Fisheries, Tourism, Agriculture, and the Merchant Marine. There are few effective methods that these agencies can use to work together. Administrative procedures follow a steeply vertical direction: issued from the top, and implemented at the bottom. Land use planning, natural resource management, and the provision of basic community services and environmental protection cannot be carried out in an integrated way because of a lack of linkages.

Low awareness of regulations. The broad-based absence of compliance with environmental regulations is also explained in part by a low level of public awareness of correct procedures for complying, ignorance of the content of government rules and regulations, and little public knowledge of the justifications for restrictions on resource use. Unfortunately, the PMRC has long observed that public authorities themselves do not have extensive familiarity with the body of regulations and procedures that apply to typical cases.

Overlapping jurisdictions. The current regulatory framework introduces ambiguity into regulation and enforcement. For example, control of the use of mangrove forests is allocated as follows:

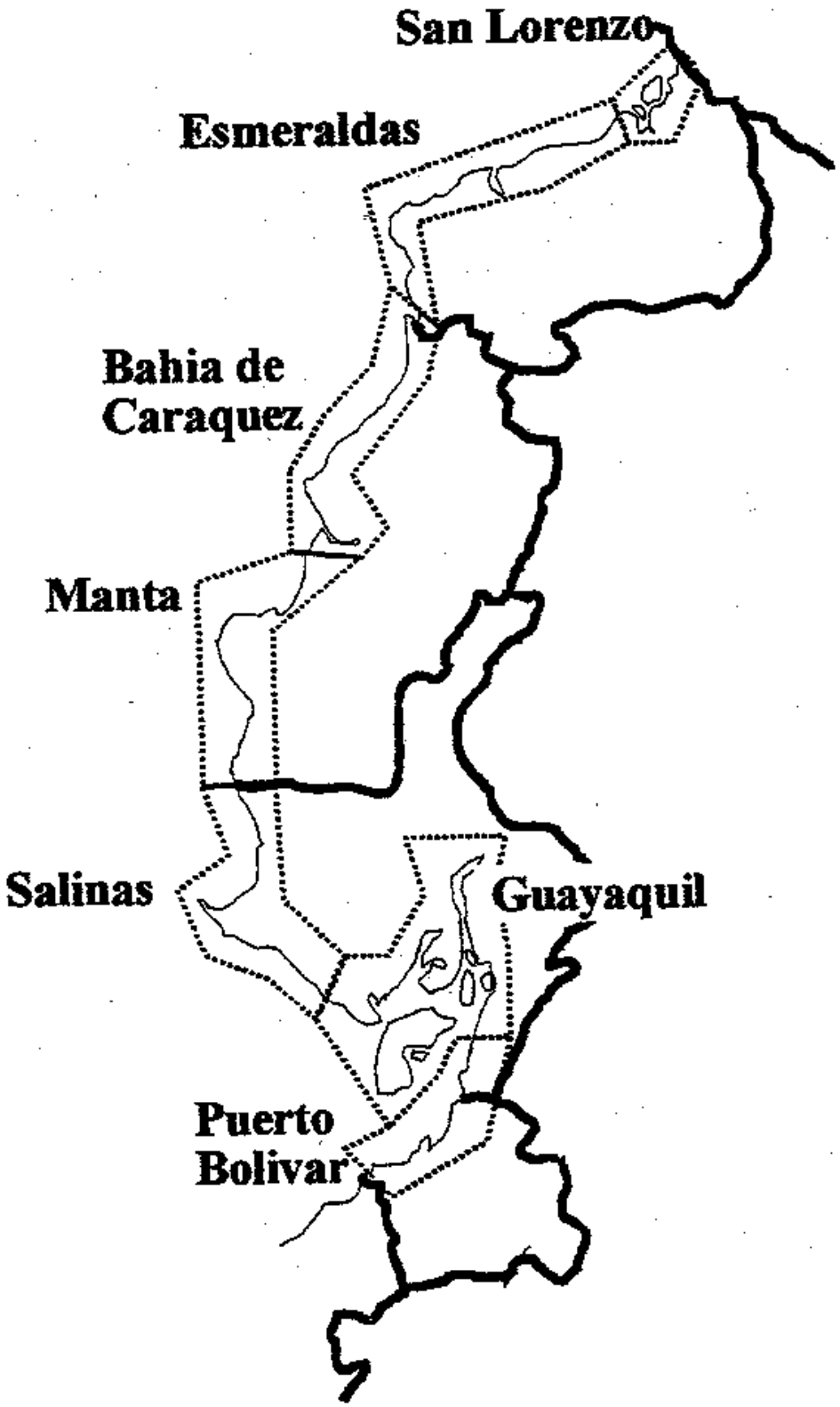
San Lorenzo
Esmeraldas
Bahia de
Caraquez
Manta
Salinas
Guayaquil
Puerto
Bolivar

Table 1. Sanctions for cutting mangroves by different authorities

Procedure **Institution**

	Navy (DIGMER)	Forestry Agency (INEFAN)	Fisheries Agency (SRP-DGP)
Permit or license	x	x	x
Site inspection	x		x
Fine for infraction	x	x	x
Confiscation of property		x	
Demolition of illegal project			x
Prison term	x		x

Such a system might work if the authorities routinely consulted one another and had an easy way of dividing responsibility for enforcement. This is not the case, however. Many agency staff do not know what each others' powers are because of limited training and the lack of sufficient resources to initiate patrols and inspections, or to follow up on legal cases. While DIGMER exercises close coordination with its seven port captains, who are in charge of enforcing laws and decisions, other agencies do not have similar command-and-control links to field inspectors. There is even less contact among agencies, and little sharing of resources or information. This built-in ambiguity more often than not leads to agencies blaming each other for enforcement lapses, rather than initiating joint action to maximize the use of scarce resources.

The legal basis for integrated coastal management

While integration has not been traditionally a part of law enforcement, a wide array of Ecuadorian laws make a contribution to integrated coastal management (Table 2).

Table 2. Laws contributing to integrated coastal management.

Law	Legal citation
Code of Maritime Policy	Official Register 1203, supplement, August 20, 1960
Forestry, Natural Area Conservation, and Wildlife	Official Register 64, August 24, 1981
Fish and Fisheries Development	Official Register 497, February 19, 1974
Water	Official Register 69, May 30, 1972
Tourism	Official Register 292, October 11, 1989
Agriculture Reform and Colonization	Official Register 877, July 18, 1979
Petroleum	Official Register 711, November 15, 1978
Provincial Legal Regime	Official Register 112, February 10, 1969
Municipal Legal Regime	
Ports	Official Register 67, April 15, 1976

Critical institutions involved in coastal management

The success of the PMRC depends on effective regulation and enforcement by the member agencies of the

National Coastal Resources Management Commission-the only entities that have decision-making powers and the authority to sanction violations. These include the following entities:

- Ministry of Defense, General Directorate of the Merchant Marine, DIGMER
- Ministry of Industry, Commerce, Integration and Fisheries, Subsecretary for Fisheries Resources
- Ministry of Agriculture National Forestry Institute, INEFAN
- Ecuadorian Tourism Corporation, CETUR
- Ecuadorian Water Resources Agency, INHERI
- National Planning Council, CONADE
- Ecuadorian Institute for Agrarian Reform and Colonization, IERAC
- Ecuadorian Sanitation Works Agency, IEOS
- Ministry of Energy and Mines, Subsecretary for Environment, SMA
- Ministry of Energy and Mines National Petroleum Directorate, DNH
- Municipalities and cantons
- Provincial councils in Esmeraldas, Manabí, Guayas, and El Oro
- Regional development agencies such as the Center for the Redevelopment of Manabí, CRM; Watershed Studies Agency for Guayas, CEDEGE; and the southern provinces development agency, PREDESUR.

Approaches to enforcement

The two basic strategies for environmental law enforcement are *coercion* and *voluntary* compliance. The coercive enforcement approach seeks to create a set of disincentives so strong that it would be irrational for an individual to violate the law. In order for this to succeed, there must be widespread awareness of the law; understanding of what constitutes an infraction-especially among those most likely to commit one; a certainty of being caught and sanctioned; and an equal certainty that the penalties and inconvenience imposed on the violator more than outweigh the financial gain of the violation. Actions that are prohibited must be identified and stopped immediately. People initiating potentially legal uses of the coast without required permits must cease work and have their projects captured and treated by the permit system. A project that receives a permit and terms for operation must comply with those terms, and any violation of the permit must be sanctioned. Frequent patrols and rapid response to suspected violations is crucial. Rapid and firm handling of cases, and sure and swift penalties are vital for establishing and maintaining credibility and deterrence.

The voluntary compliance approach also requires public awareness. In addition, this type of compliance depends on public and user group support for the law, and on a constant process of reinforcing the benefits of compliance. Voluntary compliance often involves reliance on informal control mechanisms implemented by the resource users and but citizens themselves, such as the labeling or ostracizing of violators. Rules and guidelines for proper resource use must be clear, and citizens often play a role in shaping their content. Resource users who comply with such rules voluntarily are rewarded by an increase in their social status, as well as by the knowledge of long-term benefits to themselves and their community. When a majority of community members support an environmental law, they may also collaborate with authorities by assuring that violations are noticed and receive some form of sanction, by notifying authorities of a suspected violation, and by following up on the actions taken to resolve individual cases.

The PMRC strategy

The PMRC has attempted to improve basic law enforcement strategies by

- Developing an open, participatory working style for enforcement;
- Identifying critical legal problems that the PMRC must address; and
- Defining basic principles for improving the legal and institutional framework for coastal management.

These concepts have been applied in Ecuador through the creation of the Ranger Corps which attempt to better use existing and scarce enforcement resources by assigning an assistant who works with the local port captain, and *vigilantes comunitarias* -community members who live and work near a particular mangrove ecosystem and can quickly detect violations, due to their presence and knowledge of past conditions. The Ranger Corps is an

integral part of the overall structure of the PMRC at the national and local levels, since the government of Ecuador chose not to create any new institutions with management authority.

The working style of the Ranger Corps

The origin of the concept of the Ranger Corps followed an intense consultative process in 1987 and 1988, and is illustrated as follows:

Critical legal and institutional problems

A technical team carried out interviews and meetings with local and national authorities, businesses, important public figures in the coast, academic institutions, and others to identify the key issues related to the institutional framework for compliance with coastal management laws. Their principal findings were:

- Ecuador had no strategy to help shape existing laws toward the goal of integrated coastal management.
- There was no interagency cooperation to formulate coastal management rules.
- Local government had no entity to work with to coordinate the decisions of the different sectoral agencies.
- Local authorities had no legal or technical capacity to help in enforcement.
- Agency staff received little training to carry out their work.
- The public and resource users were generally unaware of coastal rules and regulations.

Principals for the design and orientation of the Ranger Corps

The national coastal management strategy developed in 1988 drew the following conclusions, which have direct relevance to why the Ranger Corps concept was important:

- The PMRC must concentrate on coastal resource issues in coastal waters and adjoining land.
- No new laws are required; rather, improvements are needed in implementation and coordination of the existing framework.
- Before reassigning responsibilities for coastal management, Ecuador should explore ways to improve coordination, especially in areas where there are overlaps in jurisdiction.
- Any changes in laws or procedures should be arrived at through consensus, and should involve the private sector.
- Each section of the coast is different and has its own conflicts and potential problems. Public authorities need to focus on priority issues and critical areas.
- Public education and outreach will have to be a major part of any effort to improve compliance with laws. This should include expanding the understanding of the importance of coastal resources of regulations governing coastal resources, and of the importance of public participation in resolving conflicts.
- A system that permits the different authorities to work together is essential if law enforcement is to be effective often, and efficient.

The Ranger Corps manual

A grant from the United Nations agency for crime prevention and treatment of offenders, ILANUD, helped finance preparation of the first-ever operating guidelines for coastal law enforcement. An enforcement expert from a similar group established in Puerto Rico provided technical assistance to the PMRC.

This section of the manual was aimed at helping the Ranger Corps carry out its work in the field by enabling field personnel to

- Identify what management theme is related to the particular infraction of the law, covering topics such as protected areas, water quality, land use, ecology and environment, mariculture and the shrimp industry, construction projects, mangroves, navigation, fisheries, and tourism;
- Determine exactly which laws and regulations are being violated; and
- Understand the technical basis for the laws and rules, and provide explanations and extension to resource users.

The Manual also makes it easier for sectoral agencies to facilitate joint actions and to understand what each

other needs to accomplish in field visits.

The manual also includes a set of documents developed by Perez et al. (1988), that encompassed the basic laws and procedures for each agency, so that teams of local inspectors could work from the same information base. The manual also incorporated basic environmental information that helps explain why the policies and rules were put into place. Finally, the manual contains a set of tables and a format that focuses attention on which sanctions and procedures are most relevant for a wide variety of specific infractions.

The manual covers nine theme areas: protected areas; water quality; land use; ecology and environment; shrimp farming and aquaculture; construction and siting of structures; mangrove ecosystems; navigation; fisheries; and tourism.

Although the enforcement manual has proven useful, the port captains have concluded that several improvements are needed. First, it has to be kept current with changing rules and regulations in an easily modified format. It should also be distributed more widely than at present. It also must be part of a continuing process for member agencies, since there is considerable turnover of personnel in the departments, and it is easy to lose the institutional memory regarding enforcement program experiences.

The operational experiences of the Ranger Corps

For the two years following publication of Decree 375, it was not possible to fund Ranger Corps activities, due to restrictions by USAID on funding groups that involved policing duties or used firearms-such as the Navy and local police, whose presence is crucial in many enforcement actions. Lead responsibility was given to the General Directorate of the Merchant Marine, DIGMER, and activities to organize the Ranger Corps took place during 1989. Material support to this effort was provided only once USAID lifted its restrictions in 1990.

The PMRC was only able to provide very limited funds (about $2,000 per year per unit) to cover the costs of an assistant and patrols for three Ranger Corps units, each of which was near a ZEM. During the initial phase (1989 to 1991), the Ranger Corps was assisted by the Fundación Pedro Vicente Maldonado. The newly formed Executive Directorate then took up the role of managing this element of the PMRC.

Since the Rangers Corps was operating primarily from within ZEMs, some confusion arose about the difference between the Ranger Corps and the ZEM executive committees, which had a similar membership. This problem was resolved only after the special area plans were adopted in 1992 and the executive committees were eliminated. Executive Decree 3399 created a single zone committee composed of authorities and user groups. Continued contact between the port captains and the PMRC is assured since the captains now serve as vice-chairs of the zone committees.

Table 3. Evolution of the Ranger Corps

Key milestones	Ranger Corps activities
Creation by decree in January 1989	· Workshop 1: Defining the Ranger Corps manual (May 1989) · Workshop 2: Analyzing the draft manual with authorities (June 1989) · Workshop 3: Final revision of manual text (June 1989)
Publication of Ranger Corps Manual, (December 1989) Inauguration, organizing, and training of Ranger Corps (1989-1993)	· Inventory of critical problems in five Ranger Corps areas (October 1989) · First work plans prepared · Training sessions on the use of manual in the three operational units (March to July 1991) · Preparation of the operating rules for the Ranger Corps (1993)

Operations of the Ranger Corps in Esmeraldas, Bahía and Puerto. Bolívar	· Designation of Ranger Corps assistants (April 1991) · Inspections, patrols, and overflights, (1991-1993) · Selection and training of community enforcement volunteers in Bahía de Caráquez (July 1992) · Legal actions generated by the Ranger Corps (first offender sentenced in August 1991) · User group conflict resolution agreements in conjunction with the zone committees (1992-1993)

Annual Work Plans

Each Ranger Corps unit prepared an annual work plan covering routine patrols, inspections for individual infractions, involvement in resolving conflicts among resource users, collection of information, and some outreach activities. The Ranger Corps helped compile inventories of shrimp farms and tourist facilities as part of determining levels of compliance with laws; posted signs; participated in radio and print reports about law enforcement issues; and worked in community cleanup campaigns. Often, the Ranger Corps sought to engage in planning and education activities outside their mandate, budget, and technical capacity. This was prompted in part by the fact that no such services were being provided to the many locations that fell under their jurisdiction but which did not benefit from a ZEM.

Routine (weekly or monthly, depending on the site) field inspections represent a major improvement over the enforcement situation in areas without an active Ranger Corps. Direct contact with community groups and resource users, along with continued participation of authorities in the ZEM planning process, has built credibility and stronger relationships among traditionally alienated actors. Enforcement issues have become an important topic of ZEM committee meetings. There has also been an expansion of press coverage of the enforcement issue in local and national press. Within the three Ranger Corps that the PMRC has been able to fund, relationships among authorities has improved notably, especially in the enforcement of mangrove laws. To date, less emphasis has been placed on enforcement of fisheries laws and shorefront construction, although the Ranger Corps has initiated cases against illegal crab fishing in Machala and has intervened in beach sand mining.

User group conflicts

The legal framework in Ecuador focuses attention on sanctioning individual infractions, but actual experience in the coast shows that most situations are more complicated, and involve longstanding disputes among resource user groups. The sectoral structure of the law and administration is poorly equipped to resolve these disputes. Ranger Corps members frequently confront problems for which no easy solution can be found in the enforcement manual: blocked access to fisheries resources in estuaries-often caused by shrimp farmers; competing uses for sections of tourist beaches; emergence of new types of activities on the shore, such as shrimp laboratories, or construction of large hotels or highways; disputes over land ownership and encroachment of uses upon each other. In these cases, the Ranger Corps has worked with the ZEM committee, sometimes in locations outside the boundaries of the ZEM, to seek consensus and mutually acceptable solutions, while insisting that existing laws and rules are observed. The results are either "agreements to resolve a particular conflict," or more elaborate "user group agreements" that expand on the ZEM plans themselves.

The range of experiences encountered by the Ranger Corps can be seen in Table 4.

Table 4. The range of experiences encountered by the Ranger Corps

Location, issue, and key users	Resulting actions
Location: El Arenal (Playas ZEM) November 1992-May 1993 **Issue:** Access to the ecosystem for traditional uses. **Key actors:** Community of El Arenal and shrimp farmers.	· ZEM committee meetings and reports to the Ranger Corps in Guayaquil · Technical study of the conflict conducted by Fundación Maldonado and PMRC · Work sessions with the ZEM, Rangers, and the key actors · Agreement among the principal parties · ZEM committee and Ranger Corps monitoring
Location: Rio Atacames estuary (Atacames ZEM) July-December 1991 **Issue:** Dispute over land tenure in mangroves. **Key actors:** Food vendors association "El Manglar," a group of investors, and municipality of Atacames.	· ZEM committee analysis of the restaurant project of the food vendors in relation to mangrove protection · Municipality assignment of use of the area to food vendors group under specific conditions · IDB project financing offered by PMRC · ZEM committee monitoring
Location: Bajo Alto (Machala ZEM)November 1992-March 1993 **Issue:** Expansion of a shrimp farm into mangroves. **Key actors:** Community of Bajo Alto and shrimp farmer.	· Complaint by community · Ranger Corps meetings· Site study by the PMRC and proposed solution · Agreement between the two parties · Ranger Corps follow-up, along with ZEM committee
Location: Rio Atacames estuaryNovember 1991-February 1992 **Issue:** New canal dug through mangroves by shrimp farmer. **Key actors:** User groups and shrimp farmer.	· Complaint to PMRC and ZEM committee · Ranger Corps inspection and confiscation of equipment · Technical study of problem · Advisory committee meetings with all parties · Agreement to terminate the offense
Location: La Tola (Esmeraldas province) Since October 1993 Issue: Construction of new shrimp farms. Key actors: Community of Olmedo, firm of PUROCONGO, and local development authorities.	· Complaint to the Ranger Corps by the community of Olmedo · Site inspections · Forestry Institute orders work to cease · Ranger Corps and PMRC meeting with actors · Agreement with PUROCONGO and Olmedo · Follow-up by Ranger Corps of Esmeraldas

The basic approach that has emerged through these cases of Ranger Corps intervention are generalized in Table 5.

Table 5. General method employed by the Ranger Corps to address user conflicts.

Step	Key actors

1. Ranger Corps is informed of conflict.	Inspection by the Ranger Corps Complaint made to the PRMC or Rangers
2. Site inspection made by Ranger Corps.	Ranger Corps, with the assistance of the PMRC and consultants
3. Preparation of a field report.	Lead agency
4. Analysis of the case.	PMRC helps examine the conflict and candidate solutions
5. Presentation of the case to the ZEM committee where appropriate, or within the Ranger Corps for sites outside a ZEM.	Ranger Corps assistant
6. Agreement sought among the parties to the conflict.	ZEM Committee and Ranger Corps
7. Agreement is monitored and followed up.	Ranger Corps and ZEM committee

Community enforcement monitors *(vigilantes comunitarias)*

One of the innovations introduced through the Ranger Corps is the designation of local enforcement monitors, who are volunteers that observe a coastal area on a regular basis and initiate or transmit complaints of infractions to the port captain. Very limited training and resources have been provided to these groups, but the level of willingness to participate has been a surprisingly positive indicator of the potential for building cooperation among authorities and community members. Local communities themselves need to understand and accept resource management laws, but they also need authorities to demonstrate that they intend to take their enforcement functions seriously and to follow up on local complaints.

Relationships with the zone committees

In the Atacames-Sua-Muisne ZEM, there has been a very close and successful relationship between the ZEM and the Esmeraldas Ranger Corps, particularly in preparing user group agreements for the conflict-ridden Muisne mangrove ecosystem, for the use and condition of the Atacames River, and for beach use disputes between fishers and tourism facilities in Tonchigue.

In Puerto Bolivar, the Machala ZEM office and the Ranger Corps have also worked well together, particularly on mangrove enforcement issues in El Oro province. ZEM committee members participate in Ranger Corps patrols, as well as in sessions that have produced site-specific agreements-for example, in Bajo Alto.

The Ranger Corps in Bahía de Caraquez has not been as successful in distinguishing the respective roles of the ZEM and the Rangers. The zone committee also has had less experience and success in addressing resource user group conflicts. The recently adopted operational regulations for the Rangers should go far in resolving the difficulties.

Legal actions by the Ranger Corps

The majority of actions of the Ranger Corps have been focused on enforcing mangrove management regulations. Very little attention has been given to the other themes addressed in the Ranger Corps manual. The Ranger Corps has made some effort to address fisheries management concerns, especially related to the periodic closure of finfish, lobster, crab, and shrimp fisheries that are set annually by the Subsecretary

of Fisheries. For example, the Ranger Corps of Puerto Bolivar carried out a series of inspections on the Jambelí islands chain during the crab fishing closure in 1993, in which they confiscated eight sacks of crabs caught illegally, and returned them to the mangroves. The members of the ZEM committee in Playas worked with authorities in 1992 to help enforce a shrimp larvae closure, and were designated honorary fisheries inspectors. The Ranger Corps in Bahía de Caraquez has carried out some work to enforce Beach and Bay laws related to illegal construction on beaches and sand mining.

Controlling the cutting of mangroves

Continued illegal cutting of mangroves demonstrates the limitations of a coercive approach to enforcement. If captured and sentenced, the fine for cutting mangroves amounts to one to 10 times the minimum daily salary, or about $3 to $31. The Ranger Corps in Esmeraldas has conducted many patrols and initiated more than 80 legal actions, but fines may end up being imposed in relatively few cases. The violator can appeal the fine to a second level within the forestry agency, for example; that may take more than a year to resolve. These delays only compound the other issues facing the Ranger Corps, such as the political influence exerted by some of the violators, the difficulty in providing follow-up to legal cases so that the files and the individuals involved do not become lost in the process, and the need for increased unity in operations of the Ranger Corps, so that gaps and lapses in enforcement are reduced through joint effort and action.

An assessment of the Ranger Corps experience

It is not possible to examine the results and difficulties in launching the Ranger Corps without including mention of the overall challenges faced by the PMRC during the period 1991 to 1993. Much of this has to do with the close relationship that emerged between the zone committees of the ZEMs and the newly formed Ranger units.

Institutional structure of the Ranger Corps

The member organizations of each Ranger Corps together comprise the full complement of government agencies needed to carry out integrated coastal resources management. The composition of the local units also reflects the membership of the National Commission on Coastal Resources Management and fits well with the PMRC's strategy to work on the national and local tracks at the same time. When a ministry is requested by the National Commission to take a particular action, its Ranger Corps members are in a position to follow through quickly.

Each Ranger Corps can incorporate other regional and local authorities as needed to fully carry out its work. The units do not need to create their own expanded staff, but increase the effectiveness of existing capacity by improving how scarce resources for enforcement are used. They also can set their own priorities based on the characteristics and problems of the geographic region administered by the port captain.

This new integrated approach has yielded several benefits:

- Interinstitutional and intersectoral coordination has become possible.
- An ecosystem perspective has been introduced into the enforcement process.
- The law enforcement process has become more effective as agencies argue less about jurisdiction, and find it more difficult to evade their duties because of the open procedures used in the Ranger Corps.
- The staff of each agency has a much improved understanding of both its own laws and the rules and requirements of other ministries.
- For the first time, government authorities are working closely with resource users to foster voluntary compliance and awareness of legal requirements.

The designation of the port captains as the leaders of the Ranger Corps has proven to be a great success. The captains bring solid administration and operational effectiveness through patrols, inspections, and legal actions, and they have worked to improve the confidence held in the Ranger Corps by community members

and resource users.

The key problems facing the Ranger Corps in its initial years of operation include:

- The need to involve additional agencies such as muncipalities, the Land Reform Agency, and the National Water Resources Institute. In the three existing Ranger units, the primary actors in field operations up to now have been the port captains, the district forestry officers, and the fisheries inspectors. All the other groups have participated in meetings, are familiar with the Ranger Corps manual, and are aware of other Ranger Corps activities, but have not taken up their share of the responsibility through direct involvement.
- Ranger Corps member institutions have differing degrees of legal power. For example, the forestry district officer can act as a judge in certain cases, so that infractions are handled quickly, while the fisheries inspectors have a limited scope of action and depend much more on decisions made in Guayaquil.
- During the ZEM planning process, considerable confusion was generated as local authorities tried to sort out the roles of the ZEM executive committees versus the broader mandate of the Ranger Corps, since the same officials were involved in both groups. This difficulty was only resolved when Executive Decree 3399 abolished the executive committees.

Organization and training of the Ranger Corps

A workplan for the first year was prepared in each of the five designated Ranger Corps units. These usually included a number of tasks outside the mandate of the Ranger units, resulting in generated confusion and duplication of effort with the ZEM offices and in a dispersion of energy.

Even though the amount of money-$2,000-provided to the three funded Ranger Corps units in Esmeraldas, Bahía de Caraquez, and Puerto Bolivar was small it generated significant improvements in the level of enforcement effort. This is especially true in Puerto Bolivar, where enforcement of mangrove conservation laws became a major focus for the unit. The Rangers also received technical assistance from PMRC staff. In the future, it is essential to increase the funding for field operations, which appears to be one of the major bottlenecks for enforcement. It also was not possible to provide much-needed training to many of the agency staff, especially the Navy, where personnel turnover is high. The Inter-American Development Bank loan will provide sufficient funding to start all seven mainland units.

The Ranger Corps manual

The port captains and members of the three functioning Ranger Corps have made a number of important observations about the manual, which brought together for the first time information about how each agency, from legal and operational perspectives, was to carry out its enforcement responsibilities.

The manual is seen as a vital instrument for focusing the activities of the Ranger Corps and to improve how legal procedures are applied to specific infractions. It must be constantly updated to include the many changes that have taken place since it was originally prepared on the growing field of coastal resources management.

Recently, however, the manual has lost its importance and is not used by all Ranger Corps members for a variety of reasons. There have not been any recent workshops on its content and application. Authorities change frequently, especially port captains, so there is a continuing loss of people who understand the important of the document and how to apply it. The document has not been reprinted, so there are few copies available for public officials to use, and no outreach within the areas under the responsibility of the Ranger units.

Ranger Corps operations

Interviews with the leaders and members of the three active Ranger units generated considerable insight into how field operations have affected the quality of coastal law enforcement.

The system of site inspections, land and sea patrols, overflights of critical areas, and joint exercises by the Ranger Corps have led to greater compliance with resource management regulations, especially in respect to mangrove conservation. This has been accompanied by an increase in awareness and support by the resource users and community members themselves, and has been helped by the activities of the ZEM committees. The mass media and conservation groups have also played an important role in placing coastal resource conservation on the national political agenda.

The annual work plans prepared by the Ranger Corps have often included many activities beyond their immediate scope of responsibilities. The units have put considerable effort in activities that strengthen local resource user groups, conducted tourist facility inventories in a ZEM, and sponsored fishing contests to improve tourism.

The PMRC has provided technical assistance to Ranger Corps units, but the greatest unmet need has been for legal support. A part-time legal advisor was provided only for a several month period at the end of the USAID-funded project.

The government enforcement units based in the coastal provinces are provided with very little funding for operations or basic supplies and equipment. The Ranger units were completely dependent on the small budgets provided through the USAID project and the boats and vehicles that the port captains have been able to provide.

The relationships between the Ranger Corps units and the ZEM committees and offices have overall been very good, especially in addressing user group conflicts. Much less successful have been attempts to improve the link between local enforcement efforts and the decision-making levels within the sectoral ministries and the National Commission. Little progress has been made in improving the decision-making and enforcement procedures for coastal law enforcement. Operating rules for the Ranger Corps which draw upon its early experiences, were adopted in mid-1994.

Table 6 summarizes the changes that the Ranger Corps units have been able to influence related to the key challenges faced in coastal law enforcement in Ecuador.

Table 6. Changes resulting from Ranger Corps activities.

Coastal law enforcement situation in 1986	Changes observed in 1994 as a result of PMRC initiatives
Absence of institutional mechanisms for integrated coastal management	Creation of the National Commission on Coastal Resources Management, which has established integrated policies, and the Ranger Corps, which facilitate implementation at the local level.
Overlapping and duplicated responsibilities among agencies	Joint actions by authorities through patrols, site inspections, and reporting.
Poor intersectoral coordination, which prevents addressing of all the pertinent dimensions of resource use problems	Specific rules to guide Ranger Corps actions at the local level; preparation of a manual that includes explanations of the ecological systems as well as the laws.
Increasing conflicts among competing coastal resource users	Public involvement in solving coastal use conflicts, especially in the five ZEMs. Several important cases resolved through this method.
Low public awareness of environmental issues and management principles	Growing recognition, particularly in the ZEMs, of the importance of ecosystems, how they function, and what this implies for sustainable uses.
Nonexistent local technical and planning capacity for integrated coastal management	User group agreements in several ZEMs have been developed among communities and user groups, addressing resource conservation and environmental protection.
Increasing rate of mangrove cutting	Pressure exerted against cutting by both user groups and communities, especially in Atacames and Machala ZEMs. Community members actively participated in monitoring mangrove areas, for example in the Rio Chone. A number of legal actions have been taken against violaters, particularly by the National Forestry Institute, as a result of patrols carried out through the Ranger Corps.
Absence of a planning framework for integrated decisions on resource conservation	Preparation of a national mangrove management strategy that emphasizes site-specific plans prepared through local participation and in conjunction with local authorities.
Low awareness and support for coastal management at the national level	Continuous press coverage of coastal ecosystem issues helps place and keep the issues on the agendas of national leaders.

Conclusions and recommendations on the Ranger Corps

The three existing Ranger Corps have been in operation for a relatively short time, yet they has provided the PMRC with some important lessons and insights into promising approaches to improving compliance with coastal management policies and regulations.

The Ranger Corps has successfully tested the new principles, structure, and functions it has been assigned, and is an effective method for creating an integrated approach to gaining compliance with coastal management laws and the policies established by the PMRC.

The local respect and confidence that the Ranger Corps has fostered among user groups and communities has seen tangible results in terms of better compliance with conservation laws and follow-up of legal actions carried out by the Ranger Corps through sanctions and fines.

The Ranger Corps has also participated in developing new methods for resolving conflicts among resource users that are both more democratic and more effective in addressing site specific problems. Government authorities now have available the means to resolve such cases with much less social friction and tension.

The resources that have been available to launch, organize, and maintain the Ranger Corps program are insufficient for the goals set out for the program in Executive Decree 375. It is essential to increase both financial and technical resources in order to start the five other Ranger Corps groups, which could not be supported under the USAID-URI project.

The annual operating plans of the Ranger Corps must focus on the essential tasks of organization, field operations, training, and effective follow-up on the legal actions taken. At this stage, the Ranger Corps must be careful to avoid overextending itself with activities not central to its mission. The priority areas should include

- Patrols, site inspections, and legal actions to implement laws and administrative decisions and to sanction infractions;
- Assisting in resolving conflicts among coastal resource users, working in conjunction with the zone committees and the Executive Directorate of the PMRC as set forth in the operating rules of the Ranger Corps;
- Conduct public education and outreach on the basic legal and regulatory requirements that govern coastal resource use;
- Train the members of the Ranger Corps both in the law and the nature of the ecosystems they are assigned to protect; and
- Provide the essential equipment that the member agencies of the Ranger Corps units need to carry out their work.

The Ranger Corps manual must be completely revised and produced in a format that will permit easy updating as the statutes and regulations of each agency change. Workshops are needed in how to effectively employ the manual in day-to-day operations, and assure that it reflects the most recent practices and procedures.

The expansion of the Ranger Corps must proceed step by step given the large area and broad range of issues within its responsibilities. Each Ranger Corps must identify and concentrate its efforts on critical areas where the largest number of infractions occur, or where due to a unique characteristic or vulnerability, special protection is needed. Critical areas could include mangrove ecosystems, heavily used tourist beaches, sites that are potentially attractive to shrimp farm expansion, or locations of major pollution discharges.

The Ranger Corps assistants provided by the PMRC must take on the following roles:

- Coordinate with the various units of the PMRC;
- Facilitate relationships among the agencies that comprise the Ranger Corps;

- Organize Ranger Corps operations;
- Provide follow-up to legal actions and proceedings intiated by the Ranger Corps activities; and
- Promote and coordinate community enforcement monitor programs.

The designation of community enforcement monitors as honorary members of the Ranger Corps has yielded good results in controlling coastal resource exploitation. This activity needs to be provided with consistent rules and procedures in how monitors are designated and their relationship to the Ranger Corps. Their role in implementing user group agreements must also be clarified.

Finally, the executive directorate of the PMRC must take on the responsibility for coordinating and promoting the expansion of the Ranger Corps. The essential needs include effective legal counsel, technical assistance in handling individual cases, evaluating the units, and helping the Ranger Corps to organize and carry out their missions.

THE INTERNATIONAL SYMPOSIUM ON INTEGRATED COASTAL RESOURCES MANAGEMENT IN ECUADOR

Guayaquil, Ecuador, 15 to 17 November, 1994.

The International Symposium on Integrated Coastal Resources Management in Ecuador was cosponsored by the Ecuador Coastal Resources Management Program (PMRC), the University of Rhode Island Coastal Resources Center (CRC), and the National Advisory Commission on the Environment. Participants included representatives of Mexico, Colombia, Ecuador, Peru, Chile, and the United States. Javier Dueñas V., executive director of the PMRC, presided over the working sessions.

The primary objective of the symposium was to analyze the Ecuadorian experience in integrated coastal management as it has developed over the period 1986 to 1994, and, in light of the experience of other Latin American countries, to draw out practical approaches for achieving the mandate of *Agenda 21*.

INAUGURAL SESSION

Representing the president of the republic, Mauricio Montalvo, general subsecretary for public administration, presided over the inaugural session.
Luis Carrera de La Torre, executive director of the National Advisory Commission on the Environment, made a presentation on the commission, which has been operating for about one year. Carrera indicated that sustainable development must be environmentally sustainable, economically profitable, and socially just. Of the 11 environmental issues facing Ecuador, nine involve coastal resources.

Presentation of Ronald P. Brousseau, Ecuador representative, Inter-American Development Bank (IDB)

It is a great privilege for me to represent the Inter-American Development Bank in this inaugural session of the International Symposium on Integrated Management of Coastal Resources. I would like to congratulate the National Advisory Commission on the Environment, the Ecuador Coastal Resources Management Program, and the University of Rhode Island for their initiative in organizing this important event.

I would also like to thank the U.S. Agency for International Development (USAID) for funding this symposium and, more important, for having had the vision to initiate integrated coastal management in Ecuador in the mid-1980s. This pilot project sponsored by USAID has greatly facilitated the preparation of IDB's program of coastal management actions for Ecuador. This collaboration also provides a good example of complementary efforts between international organizations. The advantages of such an approach will help assure effective assistance toward providing for the well-being of the beautiful country of Ecuador.

We are also sure that the deliberations conducted throughout the course of this meeting will permit the achievement of a basic consensus regarding practical strategies for coastal resource management in Latin America. This will enable us to help put into action the mandate of *Agenda 21* resulting from the United Nations conference in Río on environment and development.

IDB and coastal resources in Latin America

Coastal and marine resources are of vital importance for the social and economic development of Latin America and the Caribbean. In many member countries of IDB, the coastal zones represent important centers of productive activity, particularly in agriculture, fisheries, mariculture, and tourism. At the same

time, coastal areas support important economic infrastructure, including ports and industrial plants, which are of national importance.

Unfortunately, the coastal resources that are so important to the economic and social well-being of the countries of this region are suffering serious degradation, caused in part by rapid changes in land use. It is very common to encounter in our region water pollution from land-based sources, rapid loss of mangroves, dangerous sedimentation of estuaries, and destruction of coral reefs. If effective action is not taken to protect coastal areas, and if these areas do not form part of a strategy for sustainable development in each one of our countries, we run the risk of rapidly losing an important source of economic development and a corresponding decline in the security of the future of our hemisphere.

As a response to the interest in, and the urgent need to resolve conflicts in the use of coastal resources, the bank is helping to start and sustain coastal resources management programs in many countries in the region. It is in Ecuador that the bank approved its first project at the end of 1993. The Ecuador program deserves to be examined as a pilot project for the region, in order to draw lessons and recommendations for future projects.

This first initiative of the bank is perfectly in line with its environment and natural resources strategies, which are part of the Eighth replenishment for funding approved in Mexico. As is well known, this strategy has two basic objectives:

- To improve the quality of life, especially in low-income groups, by reducing environmental deterioration and providing basic services; and

- To promote the rational use of renewable natural resources, with the purpose of increasing their contribution to social and economic development without compromising the options of future generations.

To illustrate the bank's initiatives in coastal resources management, permit me to summarize the current portfolio of activities that the bank is developing in the region.

We are close to approving a second loan for the Bay Islands of Honduras, an excellent area for ecotourism. For the first time, the bank will finance investments and basic studies in a marine protected area, one of the 10 largest such sites in the world. The project will directly address the problem of sustainable financing of coastal management programs, and the bank hopes to learn from this experience in order to design cost recovery systems in all of its member countries. We have incorporated similar aspects in another project this year in Barbados.

The bank and the government of Guyana are working on a project that, to a great extent, will resolve the problems of soil erosion and flooding that afflict the coast. The coastal zone of Guyana is of strategic importance for the national economy, and is home to 90 percent of the total population. The project includes measures for controlling erosion, and a strong program of mangrove management, similar to the project we are financing in Ecuador. It is noteworthy to mention that all bank projects incorporate a strong component of participation by user groups and communities.

In addition to these loan programs, the bank is handling a variety of technical cooperation agreements, for example:

- In Brazil, assistance to a marine conservation initiative;
- In Honduras, management of the resources of the Gulf of Fonseca; and
- In Ecuador, preparation of an integrated management program for the Galapagos.

The importance of coastal resources in Ecuador

In the case of Ecuador, host country of this symposium and the focus of attention in the next few days,

the coastal zone and coastal resources have great importance to the national economy. Permit me to simply illustrate this importance with some indicators, which I am sure will be discussed in depth during the meeting.

- The continental coast of Ecuador extends about 2,860 kilometers, with a great variety of shore features, from beaches and bluffs to mangroves and estuaries, including the Gulf of Guayaquil, the largest estuary in the eastern Pacific. The coastal area covers four provinces and contains over 43 percent of the national population.

- The coastal zone has the nation's largest city, Guayaquil, which is the economic and commercial center of the country and the principal port in Ecuador-85 percent of imported goods enter the country here.

- The coastal region has been, and continues to be, the source of traditional agricultural exports, from cacao to banana.

- In recent years, the coastal zone has seen an economic boom from shrimp mariculture, which is one of the most important coastal industries, and the principal private sector activity of the country. Exports have increased fourfold in 10 years, from US$122,000,000 in 1982 to US$526,000,000 in 1992, comprising 31 percent of private exports, and second only to petroleum in overall value. This activity generates employment of 195,000 people and provides income to 90,000 artisanal fishermen. About 140,000 hectares of shrimp ponds have been constructed, of which about 40 percent are concessions in the littoral zone.

- Finally, in speaking of marine and coastal resources, one cannot forget the Galapagos Islands, which to Ecuadorians, and to the world as a whole represent a site of natural richness and biodiversity without equal in the planet. The islands are also an important source of income for Ecuador, from ecotourism and international scientific research. Nonetheless, this treasure is in danger of being lost if immediate management measures are not taken.

As it is true for many other countries in the region, Ecuador's coast faces conflicts and problems of environmental deterioration caused by irrational use of natural resources. The principal estuaries, such as the Gulf of Guayas and the Rio Chone, are affected by land use in their upper watersheds, and by the rapid expansion of small coastal cities that are outgrowing infrastructure and basic services such as solid waste disposal and wastewater treatment.

If these trends continue, these negative impacts will damage fisheries, mariculture, agriculture, tourism, and public health-indeed, the quality of life of coastal communities.

Our support for the Coastal Resources Management Program in Ecuador clearly demonstrates the bank's emphasis on strengthening environmental protection at the national level, as well as through decentralized activities that involve the participation of communities. The PMRC is seen as a pilot project for all of Latin America, enabling the bank to move forward with its strategy to address critical aspects of environmental degradation that have impacts on productive sectors and low-income groups, direct beneficiaries of sanitation, water supply, and ecotourism projects. In addition, the PMRC incorporates women as active participants and direct beneficiaries of the project.

The success of the PMRC can only be measured in the medium and long term, and the outcomes will be positive only if a sense of urgency to preserve coastal resources and to introduce environmental considerations into economic and social investment decisions can be communicated and accepted by national authorities, provinces, municipalities, and local population.

Conclusion

In summary, we can emphasize that IDB fully shares in the concerns of our member countries in the need for sustainable development of coastal resources and areas in the region. We are committed to joining forces to establish efficient and effective programs that will provide measurable environmental and

economic benefits for the population of our member countries, especially those people most dependent on coastal resources.

We wish that the discussions of the coming days are fruitful, and we are sure that the recommendations that are produced by the symposium will be of as much value to Ecuador as to the region as a whole.

Thank you very much.

Presentation of Mauricio Montalvo, Ecuador representative, Inter-American Development Bank

Without a doubt, coastal environments encompass the most important natural resources and the richest variety of productive activities of any ecosystem. This is especially so in Ecuador, where coastal resources are particularly important to our limited economy, holding enormous development potential that in turn promises benefits for all sectors of Ecuadorian society.

Ecuador's coastal environment is one of its richest ecosystems, with an impressive diversity of ecosystems that includes mangroves, estuaries, coral reefs, coastal lagoons, and beaches. The agricultural lands on the coast are the most important in the country.

An obvious outcome of this great economic potential and the natural attractiveness of the shore to Ecuadorians is that these resources are clearly in danger from irrational use, from the uncontrollable growth of population and human activity, from resource use patterns that cause conflicts and are inconsistent with sustainable use, and from the inadequate management efforts of national, regional, and local government.

Consequently, there should be great concern about the ability of these ecosystems to support such intensive use and exploitation, and about the need to preserve the natural resources enabling sustainable economic development with full respect for the environment.

The Ecuador Coastal Resources Management Program is a serious effort to prevent the continued loss of critical coastal habitats and the decline of rich fisheries resources, as well as to protect water quality and to avoid conflicts among resource users.

This effort, with all its attendant challenges and adversities, thanks to public and private support and help from international donors, has carried on a valuable effort for more than eight years. During these years, the PMRC has undertaken a variety of activities and policies, which include allocating the use of the coastal zone among a diverse set of users; improving the practices of mariculture and fisheries; protection and rational development of tourist and recreational areas; improvement in the enforcement of and compliance with environmental policies and laws; and the formulation of adequate programs for local development in coastal communities. The PMRC has also placed emphasis on mangrove ecosystem management.

The development of these coastal management strategies has been accompanied by an intense outreach and training campaign at all levels that has generated both a philosophy and new methods for resource management-which you will learn more about through this symposium. Permit me to highlight the participatory planning techniques, the integrated approach to managing resource use, and the creation of an appropriate way of self-development, based on the principles of conservation of natural renewable resources and protecting environmental quality through the special area management zones and the Ranger Corps.

The evolution of the PMRC, in response to the urgent needs of Ecuador, is also helping to advance the world capacity to manage resources and protect environmental quality.

As a member of Ecuador's delegation to the United Nations during the fourth preparatory meeting to draft *Agenda 21*, I can personally confirm that the Ecuadorian proposals and initiatives, based on the experience of the PMRC, were received with great interest by the other delegations, and I am certain that more than a few of the contributions of the PMRC program were incorporated into the final *Agenda 21* statement adopted in Rio.

It is important not only to review the experiences of the Ecuadorian case on its own terms, but to examine how the work of the PMRC is contributing to putting into practice *Agenda 21*, which reflects the state of the art of thinking in integrated marine and coastal resource management.

The Rio conference advocated more effective management of coastal zones as an essential element of sustainable economic and social development of our communities. As a representative of the national government, I can affirm that efforts such as the PMRC enable us to effectively move in that direction. I recognize that there still is much to do and improve upon in Ecuador, and that all our human endeavors can benefit from improvements and adjustments. I am sure this symposium will contribute to identifying these new directions for the PMRC.

I propose that the Coastal Resources Management Program of Ecuador can serve as a valuable point of reference that other Latin American countries can use to create their own coastal resources management programs.

The PMRC has received the full support of the president of the republic, which is vital for the program's long-term success. President Sixto Durán Ballén is aware of the issues facing the coast, and has made his support available through the Secretary of Public Administration. The government has spared no effort in carrying out the program, including the creation of a special office dedicated solely to the PMRC within in the Secretary of Public Administration. Once the USAID assistance program concluded, we moved quickly and effectively forward with negotiations with the Inter-American Development Bank to provide financing and continuity for the PMRC, we continue to work closely and cooperatively to ensure the program's growth and proper administration.

Along these same lines, President Durán Ballén created an advisory commission on the environment at the highest possible level, to focus on, among other things, giving attention to and working with the PMRC. It is this commission, one of the sponsoring groups of this symposium, that is following the same simple, clear, and unique philosophy described by Luis Carrera earlier this morning. To inaugurate this symposium, I would like to put forward that the PMRC is not only a serious effort by this government to address one of the country's most important problems, but it is a concrete, effective, and intelligent approach for managing coastal resources for the year 2000, in the spirit and substance of the challenge set forth in *Agenda 21*, Chapter 17.

I would like to thank the cosponsors of this symposium: USAID, the University of Rhode Island, and the president's Advisory Commission on the Environment, as well as the Inter-American Development Bank for its help in the current phase of the Ecuador PMRC.

In the name of the president of the republic, I officially inaugurate this event, with the certainty that your presentations, debates, and conclusions will contribute to a better use of our coastal resources, and to social development with the goal of improving the quality of life for those most in need, in complete harmony with nature.

SUMMARY OF THE INTRODUCTORY PRESENTATIONS ON THE PMRC EXPERIENCE

Presentations of Luis Arriaga M., director, CRMP; Stephen B. Olsen, director, URI CRC; Emilio Ochoa, Fundación Pedro Vicente Maldonado.

A brief overview of the development of the PRMC was presented by Luis Arriaga M., encompassing an analysis of the nature of the challenge faced by the program; the importance of coastal ecosystems and their resources in the national context; the most important management problems from environmental, social, economic, and legal perspectives; and the need for integrated coastal resources management in Ecuador. Finally, he discussed the current institutional framework of the PMRC, summarizing as well its development over the period 1986-1994.

The conceptual and strategic approach of the PMRC was presented by Stephen Olsen. This included the need to create systems of governance that directly address local concerns, and strategic considerations in coastal management, including the creation of local capacity, and the use of a learning approach that continually adapts to new issues and needs.

Public education and the development of an audience for the PMRC was presented by Emilio Ochoa, of the Fundación Pedro Vicente Maldonado, who discussed the process followed in creating the PMRC, where it was crucial to develop the "social subject," or constituent of the process; the role of communication and language in building a consensus, the continuing capacity-building efforts of the program; the methods used to identify key issues; research; the formation of working groups; and guiding the unfolding of the process. He cited risk factors that must be overcome for the future development of the PMRC. He expressed concern for-at the local level-possible "paralysis and dispersal of the ZEM teams and opposition to the PMRC, be it tacit or vocal, by local authorities" and-at the national level- he reduction of the scope of action or size of the technical team, and for the paralysis of the National Coastal Resources Management Commission and the national program directorate.

THE PMRC EXPERIENCE IN PUBLIC EDUCATION AND OUTREACH (SUMMARY)

Presentations of Washington Macías P., Fundación Pedro Vicente Maldonado; and Oscar Ugarte, TC-Televisión.

Macías outlined important targets for successful public outreach and education: private sector and politicians; communities and user groups; the intellectual sector (experts, education system, communications media); and the government and public officials. It is important to recognize and communicate with all of the stakeholders involved in the management of the nation's coast. The purpose of outreach and education is to build participation, without which it is impossible to arrive at a consensus on the direction of coastal policies. He explained the various techniques used by the PMRC at the local and national levels, including contests, brochures, a comic book series, conferences, radio programs, and workshops with newspaper and television reporters. Ugarte described the experiences of reporters who participated in the workshops and in PMRC-sponsored field trips to coastal areas, and how these events helped the media to better understand and become sensitized to coastal issues. This has led to a permanent media interest in the theme, and persistent follow-up reporting by the press on coastal issues and conflicts.

EXPERIENCES OF THE PMRC IN THE MAJOR MANAGEMENT ISSUES: SUMMARIES OF CASE STUDY PRESENTATIONS

Mangrove management

Presented by Donald Robadue, Jr., URI CRC.

This case study examined the problems and trends in use of mangrove ecosystems and the PMRC's initiatives in mangrove management. The first task of the PMRC was to generate local awareness of the importance of mangroves in coastal development. From the national perspective, policies and decisions are made in view of the average rate of cutting, which is not dramatic and does not reveal the seriousness of some local situations. The situation appears very different at the local level, such as in the Rio Chone, where mangrove cutting has almost completely eliminated the ecosystem. Robadue noted that increasingly harsh penalties against mangrove cutting have not accomplished their goal, and studies by CLIRSEN have revealed that, in fact, the rate of cutting actually increased during the period 1969-1991, following adoption of the new policies. The development of practical exercises in mangrove ecosystems (reforestation, boardwalks for tourists, and schoolchildren) is beginning to yield results for mangrove conservation, through the participation of communities and user groups of these systems. Finally, Robadue outlined the PMRC's new strategy for managing mangrove ecosystems, which has been developed jointly with the

national forestry agency INEFAN, the Navy DIGMER, the Subsecretary of Fisheries Resources, local communities, and user groups.

Mariculture management

Presented by Segundo Coello, technical director of the PMRC.

The PMRC's work in this area unfolded in three stages: (1) preparing a strategy to promote a sustainable industry (1986-1987); (2) preparing a strategy to diversify the mariculture industry (1989-1990); and (3) a program of applied research and extension to help mariculture management in the ZEMs (1991-1994). A key activity was the investigation of the causes of mortality of shrimp postlarvae. Since 1991, the PMRC's work in mariculture has centered on the ZEMs, with the purpose of developing user group capacity to carry out small-scale mariculture projects. The creation of a "mariculture working group" was a major tool in advancing this work. The group had a small operating fund that enabled it to carry out participatory work in ZEM communities. Techniques such as "rapid rural appraisal," originally created for the design, implementation, monitoring, and evaluation of rural development projects, were heavily utilized by the mariculture group to obtain basic information, understand the perceptions of different user groups, and assign priorities to the many projects proposed by communities.

Water quality and environmental sanitation

Presented by José Vásconez G., consultant to the PMRC.

The deficiency of basic services (potable water, wastewater disposal, solid waste collection) and sanitation education is one of the most important problems facing coastal communities. The PMRC did not incorporate these issues into its efforts until it began working in the ZEMs. This theme, as the PMRC discovered, is tightly linked to the quality of life of community residents, to the condition of coastal habitats, and to the productivity of ecosystems, and has a great appeal to members of small coastal villages. The initial interest in water quality was linked to the production problems faced by shrimp mariculture, and only later was expanded to include sanitation and basic services. Since 1989, the planning process in the ZEMs included practical exercises, which led to forming sanitation committees in the communities. The PMRC conducted specific studies on the theme to include in the issue profiles of each ZEM. In the practical exercises on sanitation, carried out by the ZEM committees-involving latrine construction and solid waste disposal projects-it was found that the process of organizing, awareness building, and education prior to the construction of any facilities was crucial for having a long-term project success. When these preparatory procedures are not followed, projects fall apart, and are abandoned in a short time.

Experiences in the special area management zones

Presented by the coordinators of the ZEMs: Arturo Maldonado (ZEM Mahcala-Puerto Bolívar-Isla Jambelí); José Luis Villón (ZEM Playas-Posorja-Puerto El Morro); Manuel Arellano (ZEM San Pedro-Valdivia-Manglaralto); and Ramón Zambrano (ZEM Bahía-San Vicente-Canoa).

Each coordinator explained the process used to organize local resource users, based on locations and type of activity they are involved in-such as fishermen, shrimp larvae collectors, and hotel owners. Each ZEM had a small technical team, usually composed of local professionals whose skills matched the issues in the ZEMs. These teams constitute the front line of "integrated coastal managers" in Ecuador, since they have the closest relationship with users and responsible authorities. One of the initial problems facing the coordinators was to overcome the skepticism of local authorities about the PMRC, and to convert this into a positive response that would attract broad local participation in preparing the ZEM plans and in implementing the practical exercises. To achieve this, it was necessary to carefully identify and help organize local resource user groups and the communities to create a viable local institutional mechanism for coastal management-which now comprises the ZEM committee and the Ranger Corps.

The Ranger Corps experience

Presented by the port captains who coordinate Ranger Corps units: CPNV-EM Mario Oliva (Guayaquil); CPFG-EM Marcelo Zapata (Esmeraldas); TNV-UN Hugo Alvarez (Bahía de Caraquez); and CPFG(SP) Julio Navarrete, coordinator of the Ranger Corps program.

The panel briefly explained the roles of the Ranger Corps, who coordinate local authorities with responsibility for coastal resources; control coastal resource use; assure compliance with laws and regulations; and promote public awareness of the purpose of rules for coastal resource use. The captains discussed some of the basic activities of the Ranger Corps units, which include: conducting patrols and site inspections in the coastal zone; resolving conflicts among resource user groups through consensus building; and following up on legal actions initiated against violators. One useful tool has been the designation of community monitors who help the Ranger Corps by informing them of potential infractions-primarily related to mangrove cutting-and by aiding in field visits of the Ranger Corps. The captains also provided specific examples of how the coordinated enforcement efforts of the Ranger Corps were carried out, and the outcomes of those cases.

PRINCIPAL COMMENTARIES BY SYMPOSIUM PARTICIPANTS IN RESPONSE TO THE PMRC EXPERIENCE

One common element in the work of the PMRC is the method of entering coastal communities-where it is necessary to provide knowledge of the importance of coastal ecosystems and of the problems generated by certain uses over the long run. This method needs to be widely applied by PMRC staff, coastal residents, and user groups to generate a common definition of problems. This method can be carried out through consultations, workshop discussions, and continued outreach on the progress of the program. It is best to use simple, direct methods. It is essential that there is openness and acceptance of the views of all the stakeholders involved in an issue; in this way it is possible to generate an atmosphere of mutual respect, which is vital for integrated management.

In activities related to sanitation, such as solid waste collection, it is possible to incorporate the creation of small businesses for recycling, taking into account economic feasibility so these businesses can be sustainable.

A comment was made in relation to the Forest Guards, who have recently been organized by the National Forestry Institute, INEFAN. It was noted that this new group represented an important advance in the enforcement efforts of INEFAN. In the case of coastal areas, it is essential that this group, like those responsible for fisheries, public health, and the Navy, become actively involved in the Ranger Corps-just as the district forest officers have already done. This would ensure a broad-based effort to control the use of coastal ecosystems through coherent actions by the various institutions responsible for coastal area administration.

In regard to the development of local agreements to manage the mangroves in La Tola, Esmeraldas province, the National Forestry Institute has been monitoring to see whether there have been positive results. In this case, it is important to follow up to ensure that the methods used are adequate. According to recent information, the buffer zone around the mangroves, which was set at 50 meters from the edge of the shrimp pond dikes, has been respected. The respect given to the agreement by the private sector and community represents a major advance in the work of the Ranger Corps, which provides the operational link between local authorities while respecting the individual jurisdictions of each unit.

DECLARATION OF THE SYMPOSIUM

CRC director Stephen Olsen described several initiatives aimed at improving communication among organizations throughout the world who are involved in coastal resources management. There is support for building a network of professionals in coastal management. Since 1991, CRC has been conducting training courses in coastal management, including two courses carried out with the PMRC and ESPOL in Ecuador, aimed at Caribbean and Latin American countries. In the United States, a network for coastal management has recently been formed, and another is being developed in Southeast Asia, where the International Center

for Living Aquatic Resource Management (ICLARM) held a symposium on coastal management in the Philippines. The "Baguio Declaration" was issued from this symposium. CRC is working with the International Center for Sustainable Economic Development in Chile to publish *FARO*, a Spanish newsletter devoted to coastal management.

A draft Guayaquil Declaration was distributed for discussion and review by the symposium participants, who analyzed the statement in detail and made many recommendations for revisions. A final version of the declaration was reviewed carefully during the closing session of the symposium, and then approved by acclamation.

VISIT TO THE SPECIAL AREA MANAGEMENT ZONE OF PLAYAS-POSORJA-PUERTO EL MORRO.

In order to gain firsthand experience of the special area management process, symposium participants traveled to the ZEM of Playas-Posorja-Puerto El Morro to participate in an expanded session of the ZEM committee. The meeting involved members of resource user groups and local authorities. The president of the committee, José Mero, welcomed the visitors. The coordinator of the ZEM, José Luis Villón, provided a summary of the organization and activities. Gabino de la A., president of the Canton Council of Playas, explained the activities developed in conjunction with the PMRC. Various other members of the committee described projects being carried out in the ZEM, including local shrimp farmers, fishermen, and the two sanitation committees that have been formed. Other local authorities, including the chiefs of the local Navy detachment and the sanitation authority, made brief presentations on their experiences and activities in the ZEMs.

The field visit included the sector of Playas (General Villamil), the communities of Data de Villamil and Data de Posorja, and Puerto El Morro, where practical exercises had been carried out.

SYMPOSIUM CLOSURE

The closing session was held in the hall of the Hotel Owners' Association. The principal activity was final review and approval of the Guayaquil Declaration on coastal resources management in Latin America, adopted by acclamation. It was recommended that promoting the networking of Latin American professionals and disseminating the declaration could be carried out with the help of the new newsletter *FARO*. Rómulo Jordan, speaking for the participants in the symposium, expressed appreciation and thanks for the sponsoring institutions and the administrative personnel who were responsible for the success of the conference. Finally, Javier Dueñas, executive director of the PMRC, expressed his appreciation for all the contributions of the participants, and the symposium was closed.

GUAYAQUIL DECLARATION ON INTEGRATED COASTAL RESOURCES MANAGEMENT IN LATIN AMERICA

Considering:

1. That the population of Latin America is becoming more concentrated along its coasts and increasingly dependent on coastal resources and ecosystems;
2. That the coastal region contains productive, diverse, and richly endowed ecosystems that have a great capacity to provide goods and services to sustain fisheries, agriculture, commerce, tourism, and other economic activities, as well as the traditional artisanal uses of coastal residents;
3. That current use trends in coastal ecosystems favor forms of economic development that are focused on short-term profits for individual gain, rather than sustained ecosystem productivity for broad social benefit;
4. That degradation and conflicts over access and use of coastal ecosystems is increasing in Latin America;
5. That it is the responsibility of the nations in the region-including governments, the private sector, researchers, and nongovernmental organizations-to provide for the long-term well-being of society through integrated coastal management; and

6. That integrated coastal management, with its capacity to reduce, and eventually reverse the degradation of coastal ecosystems, needs to directly address the social values and behavior that are the root cause of these alarming trends.

Recognizing that integrated coastal management has as its objectives:

1. Promoting by all viable means the idea that the prosperity and progress of human settlements is profoundly linked to the sustainable use of resources and the coastal environment; and
2. Providing an equitable, transparent, and dynamic process of governance that involves and serves the public, persists in its effectiveness for this and future generations, and conserves the productivity and qualities of coastal ecosystems for coastal residents.

Taking in to account that these objectives require the collaboration of governmental institutions, nongovernmental organizations, communities, and businesses-since no one sector by itself is capable of successfully surmounting the challenge of sustainable development-it is necessary:

1. To integrate all sectors and disciplines in the preparation of management plans to address both short- and long-term goals;
2. To share experiences and information about advances in theory, practice, and the effectiveness of management tools and techniques, in order to increase the effectiveness of integrated coastal management programs;
3. To develop the institutional and local capacity to involve and work with the public to carry out integrated management actions;
4. To adopt an incremental process for learning through each stage of program development, emphasizing practical experience and socially responsible forms of community-based management; and
5. To incorporate the views of the many different users of the coastal zone in the establishment of integrated coastal management.

The participants declare that:

1. Successful implementation of coastal management programs requires the use of a coherent management framework that can be tested, modified, and transferred throughout the region.

The elements of this methodology that have yielded positive results include:

a. A strategy for working at the national and local level at the same time (two tracks). The first track is the structure and legal framework of central government. This is complemented by the second track-the coastal communities, each one of which is a microcosm of the larger problems affecting a nation's coast. This two-track strategy is an inexpensive, quick way to gain practical experience and build the audience needed to promote coastal management reforms;

b. The use of practical exercises in integrated management, which test new resource management methods at a small scale before embarking on a large project or major policy reform at the national level;

c. Recovering traditional management practices that promoted sustainable use of coastal resources, and adapting these techniques to modern policy frameworks and programs;

d. Placing field agents directly in coastal communities to stimulate local experiments in community management, learning, and public participation;

e. Organizing informal technical working groups that permit experts from government and private agencies to work together on priority management issues;

f. Creating interinstitutional mechanisms with a formal structure and operating procedures, in order to increase the effectiveness of local authorities, all of whom share responsibility for monitoring and implementing existing laws, rules, and regulations on coastal resource use and for conservation, taking into consideration issues such as fisheries, shoreline development, public health, and tourism.

2. Steady progress in initiatives in integrated coastal management also requires the formation of a regional network in Latin America for bringing together the people and institutions involved in education, research, and the practice of coastal management.

November 17, 1994

ANNEX 1

Structure and Objectives of a Coastal Resources Management Program for Ecuador

*And…*A Manifesto in Support of the Program

STRUCTURE AND OBJECTIVES OF A COASTAL RESOURCES MANAGEMENT PROGRAM FOR ECUADOR

THE IMPORTANCE OF ECUADOR'S COASTAL ECOSYSTEMS

Ecuador's coastal region, when defined to include the provinces that encompass the lowlands between the ocean and the Andes, has emerged as the stronghold of progress and development for the country. Ecuador's future economic development in large measure depends on how its coastal ecosystems are utilized and managed.

The recent boom in shrimp mariculture along the coast has made this the largest private-sector activity in the country, second only to petroleum in the value of goods exported. The estuaries provide critical habitat for fish and shellfish populations that support more than 100,000 artisanal fishermen who produce a critically important source of protein for the region's rapidly growing population. Ecuador's coastal ecosystems contain the nation's best farmland and produce virtually ah of the nation's agricultural exports. The condition of Ecuador's coastal ecosystems is today more important than ever, since the population in these lowland provinces has more than doubled since 1950. The growth is most rapid in coastal cities where birth rates are the highest in the nation. Guayaquil, the nation's largest and most quickly growing City, is the center for banking and industry, and is a thriving seaport.

It is of the utmost importance that the resource base that could indefinitely produce a rich bounty of agricultural products, lumber, fisheries, and cultured seafood is not needlessly degraded or loses its ability to produce the goods and benefits that are of central importance to Ecuador's economy and political stability. Today, both the opportunities and problems posed by how the coast is managed has reached a critical juncture. Once-luxuriant coastal forests that supported a booming shipbuilding and lumber export trade a century ago have virtually ah been replaced by low-yielding, frequently eroding pastures. The construction of over 120,000 hectares of shrimp ponds has brought the almost complete eradication of mangroves in many estuaries. The industry continues to threaten this critically important habitat that, among many other benefits, is of vital importance to sustaining the wild shrimp populations that produce the seed with which the mariculture ponds are stocked. Similarly, declining water quality is a threat to both public health and the ability of estuarine habitats to support fisheries and the mariculturists who require high-quality water for their operations. Both estuarine habitats and water quality will be under increasing pressure in the years ahead as upstream dams that will alter the volume, timing, and quality of river discharges are built, and as coastal cities and their associated industries expand.

Conflicts among incompatible activities-such as fish processing and tourism, poor siting of coastal structures, and the ill-conceived development activities that abound along coasts around the world are also all too apparent along Ecuador's 2,859-kilometer shore. Not only are such mistakes expensive and avoidable, but they threaten to undermine the potential for tourism that is attempting to capitalize on the sandy beaches and scenic bays of this extraordinarily diverse coastline. The situation is further complicated by major new activities, such as the search for petroleum hydrocarbons in the gulf of Guayaquil and in some areas of the continental shelf. The production of natural gas from the Campo Amistad field in the gulf of Guayaquil is scheduled to begin in 1989.

A COASTAL RESOURCES MANAGEMENT AND DEVELOPMENT PROGRAM FOR ECUADOR

Ecuador faces some major challenges if it is to sustain the flow of economic benefits from existing uses of the coast, and succeed in increasing the contribution that underutilized coastal resources could make to the coastal provinces and the nation.

Allocating coastal areas among competing uses

Although much of the Ecuadorian coast is undeveloped, many different uses are trying to squeeze into the few areas where access is relatively easy. For example, recreation competes with fishing for use of beaches; urban development is spreading into mangroves and flood-prone lowlands; and shrimp ponds replace the mangrove ecosystems upon which shrimp larvae depend.

Environmental quality for coastal fisheries and aquaculture

Ecuador has succeeded in developing innovative uses for coastal areas, such as its vast shrimp mariculture industry. But shrimp hatcheries and ponds are now threatened by declining water quality. Specific concerns include eutrophication and declining oxygen levels, pesticide and herbicide residues, and toxic heavy metals. In addition, dam construction and irrigation projects will drastically alter the timing, quality, and volume of freshwater inflow to estuaries.

The protection and proper development of tourism and recreation sites

Ecuador's coast has a significant unrealized tourist and recreational potential. However, existing areas are polluted, and lack facilities, accessibility, and development plans.

The enforcement of existing laws and policies

Ecuador has already adopted many laws relating to water pollution control, mangrove use and protection, fisheries management, and control of shore uses. These policies have been assigned to organizations that do not have adequate programs of action and enforcement capability of sufficient magnitude and scope to cover the coast effectively.

Formulating and implementing well-designed local development programs

Coastal provinces lack effective mechanisms at the local level to design and implement development plans and guide urban growth and private development activities.

Although these problems are faced by many coastal nations, Ecuador must choose a strategy that takes into account its specific local circumstances, the resources available for solving coastal area problems, and level of commitment to participation in program implementation by the public and private sectors.

Placing special emphasis on the coast is timely for several reasons:

- There is already a high level of public and private investment in the nation's coastal zone, and much of this investment (in shrimp farms, fisheries, and tourism, for example) depends on the continued good health of coastal ecosystems.
- A large share of future economic opportunities exist in coastal areas (such as agriculture, aquaculture, oil and gas production and transport, and urban development).
- The coastal population is increasing faster than the rest of the country.
- Ecuador cannot afford to fix problems-such as water pollution, loss of people and buildings in hazardous shore areas, and coastal flooding from El Niño events-once they are created.

Ecuador needs a program of action for its coastal resources that enables a variety of resource users to gain a sustained flow of benefits in terms of income, livelihood, nutrition, transportation, and recreation. This in turn requires a skillful blending of national policy objectives with viable implementation mechanisms that have an impact at the local level. Successful coastal management in other countries employs technical information; local knowledge and preferences; planning studies; and implementation programs to allocate uses, mitigate development impacts, and undertake restoration efforts through a continuing decision-making process. The following pages put forward a specific proposal for coastal management in Ecuador.

THE COASTAL MANAGEMENT PROJECT, 1986-1988

Recognizing the conflicts that are emerging and the many cases of overexploitation of the resources, the Office of Science and Technology of the U.S. Agency for International Development (USAID) selected Ecuador as the first of three countries in which to start a pilot project on integrated management of coastal resources (the other programs are in Thailand and Sri Lanka). In March 1986, the government of Ecuador and USAID signed a technical assistance agreement to implement the Coastal Resources Management Project (CRMP). The Office of the Environment in the Ministry of Energy and Mines (DIGEMA) and the Coastal Resources Center of the University of Rhode Island are responsible for implementing the project. Additional support is being provided by the USAID Mission in Ecuador. The agreement provides for four years of technical and financial support for an issue-oriented program with the following specific objectives:

- To examine existing information on the condition and use of the nation's coastal resources and identify the priority resource management issues;

- To analyze the legal aspects and the institutions related to coastal resources management and recommend tactics for more effective cooperation and enforcement of the existing statutes;

- To provide assistance in formulating a coastal policy and in the design of an improved administrative structure for managing coastal resources;

- To design a research program directed at priority issues posed by coastal ecological processes, particularly the declining water quality in estuaries; and

- To improve the technical capacity of the personnel involved in coastal resources management.

At the request of the government of Ecuador, the project began in 1986 with an assessment of the reasons for a decline in productivity in the shrimp industry during 1984 and 1985. An interdisciplinary group of environmental experts, economists, technicians, and sociologists was assembled who examined the experience and information available at national and world level on this issue. Based on this information, a strategy to promote the sustainable development of the shrimp industry was designed (Olsen and Figueroa, 1986) and presented in April 1987.

During the second year, the Coastal Resources Management Project focused on synthesizing available information on the condition and uses of the resources in the four coastal provinces. The Fundación Pedro Vicente Maldonado, a Guayaquil-based private voluntary organization, led this activity. The methodology included workshops in each coastal province, where causes of the existing problems and the alternatives for their solution were examined. The major result of this activity was the publication in November 1987 of *Ecuador: Perfil De Sus Recursos Costeros Profile of Ecuador's Coastal Resources).*

Concurrent with these two major efforts to identify specific issues for coastal management and place them in the broad context of the development history and current needs of coastal Ecuador, a number of other activities were sponsored. Efrain Pérez and Associates have examined the legal and institutional aspects of key resource management issues, and have produced a computerized catalog of existing legislation as it relates to environmental management topics. A major effort is being made to assess water quality problems along the coast, with a focus on potential impacts of water pollution on shrimp mariculture. This is producing reliable data to identify the location and magnitude of water pollution, which can be followed by source identification and consideration of practical control options. An assessment of the Ecuadorian coast from the perspective of its shoreline characteristics and processes is being completed that provides development guidelines for siting and construction of buildings and activities in the shore zone. The mangrove conversion problem 15 being quantitatively analyzed in pilot projects under the oversight of the project's mangrove management working group. Finally, training and public education activities are helping to strengthen the base for a sustainable coastal resources management program.

COASTAL MANAGEMENT PRINCIPLES FOR ECUADOR

A series of workshops and discussions has been sponsored by the project to discuss the institutional structure for a coastal management program for Ecuador with government officials and private sector representatives. This process has led to the identification of the following 10 basic principles, which served as a guide in the design of the administrative components of the program.

- The focus of the program must be on issues and conflicts that are truly coastal in nature; that is, in matters related to the sea and the adjacent land areas. Coastal management should not be expected to deal with all the education, health, and infrastructure problems of the coastal provinces, nor it will simply duplicate the missions of other government agencies, and become lost in the complexities.

- There is no massive critical problem or problems common to all coastal areas. Rather, there are specific issues and problems in each sector of the coast, and some identifiable geographic areas where serious conflicts among users are either present or likely to emerge in the near future if no action is taken.

- There are already in place sufficient laws and authorities to properly manage coastal resources. New laws are not necessary. What is required is better coordination and enforcement of existing legislation.

- There is a general lack of knowledge on the part of public officials of the precise nature and extent of the laws they seek to carry out. Generally, this manifests itself in self-imposed limits on the exercise of enforcement authority. Occasionally, it results in unnecessary duplication of government activity.

- There is a serious shortage of adequately trained enforcement personnel in nearly all agencies. Their salaries and logistic support are also inadequate. The result is a high level of frustration on the part of those seeking to have the laws enforced, and a general attitude on the part of the public that the government does not really expect the laws to be obeyed.

- There are many overlapping areas of jurisdiction in government entities. In the case of coastal resources management, it would be more productive to improve coordination among government entities than to try to reorganize the existing distribution of responsibilities.

- The private sector does not have a high level of confidence in the ability of the government to simplify procedures, expedite decisions, or enforce regulations on coastal resources. This attitude cannot be expected to change until real improvements can be shown.

- An important element of coastal resources management must be an extensive education program at all levels to create a civic consciousness about coastal resources and the critical role they wil1 play in the future of Ecuador.

- Apart from the need of specific mechanisms to improve coordination among government entities in aspects related to coastal resources, the adequate management of the different areas will require several administrative levels in order to be effective.

- Recognition and support of the management programs must come from presidential and ministerial levels. This support will ensure (a) that the different government entities improve their cooperation and the enforcement of policies; (b) that the regional and local entities become more concerned about solving conflicts affecting their areas; and (c) that public sector and general public opinions be considered in areas that are important to their interests.

PROPOSED COMPONENTS OF THE PROGRAM

As a result of the first two years of work, the special resource studies, and estuarine consultation with representatives of both the public and private sectors, a set of seven components is proposed to make up the structure of the Coastal Resources Management Program:

- Form, in each of the seven port captain jurisdictions, an *Unidad de Conseivacion y Vigilancia* (Ranger Corps) composed of enforcement personnel from all the responsible coastal regulatory agencies, to improve enforcement of existing statutes throughout the coastal area.

- Formally designate, by presidential decree, those special management zones where it is especially essential to improve coordination among governmental entities to deal with real or impending conflicts.

- Create advisory committees in each special management zone, to be composed of citizens representing the full range of interests in the area, as well as of appropriate local and regional government entities.

- Establish in Quito a small, simple, and precise structure to provide high-level governmental support to the program, to assure central political and administrative backing to solve conflicts, to obtain international support for the program, and to promote interagency cooperation.

- Establish a public education program for the Republic with special emphasis on the coastal areas, in order to convey to the public the importance of the role that coastal resource management plays in tile present and future of the country.

- Establish a research program on coastal issues directed at improving our understanding of specific resource management issues.

- Develop a training program at all levels participating in coastal resources management.

Each of these components is addressed in turn.

A. Ranger Corps

Form, in each of the seven port captain jurisdictions, an Unidad de Conservacion y Vigilancia *(Ranger Corps) composed of enforcement personnel from all the responsible coastal regulatory agencies, to improve enforcement of existing statutes throughout the coastal area.*

All agencies with important regulatory responsibilities exhibit significant shortages of personnel and funds to adequately enforce the laws and regulations related to coastal resources. This deficiency leads to lack of respect for the regulations on the part of the public, and to an unnecessary loss of resources. This encourages action to "strengthen" the laws by making them even more strict, thus making enforcement even more difficult. It is essential to break this cycle if the government hopes to be able to exercise sufficient control over the nation's national assets. A number of steps are suggested:

1) The number of enforcement personnel needs to be substantially increased to assure adequate coverage of coastal areas, and a sufficient amount of support equipment- including vehicles, radios, and small vessels-needs to be provided. While these changes will cost money, the alternative to this short-term investment is the permanent loss of the resources themselves.

2) Enforcement teams should be organized with personnel from the Merchant Marine (DIGMER), the National Forestry Institute (DINAF), the Subsecretariat of Fisheries Resources (SRP), and other appropriate agencies. Team members would work together in a particular geographic area, would be familiar with each others' programs and authorities, would have ready radio access to each other, and would generally support each others' duties and responsibilities. These teams, forming a unified Ranger Corps, could be set up through a formal ministerial agreement.

Team members would also serve as extension agents to educate the public on the importance of coastal resource conservation. Each team would operate out of one of the seven port captain offices located in coastal cities. This office would act as coordinator for each team of rangers. Thus, the seven teams will cover the entire coast. The problem of frequent turnovers of port captains could be overcome through the hiring of retired naval officers who could be permanently located in the same community and would serve as a DIGMER member of each team.

B. Special management zones

Formally designate, by presidential decree, those special management zones where it is especially essential to improve coordination among governmental entities to deal with real or impending conflicts.

In some coastal areas, there are few conflicts between the operating agencies. However, a rapid alert system should be developed to allow for the protection of public and private investments in cases of significant environmental impacts when they are detected: for example, a risk of water pollution as a result of agricultural practices. This system should operate throughout the coastline.

A number of other zones have been identified in which a variety of development activities-nearly all funded or with a permit from the national government-threaten to work at cross purposes, or to the detriment of coastal resources. It is urgent to formulate coordinated management strategies in these areas. Examples are places where the decline in water quality will threaten shrimp farm activities, shrimp larvae hatcheries and/or tourism; or where large infrastructural works could dangerously alter natural processes. If adequate management strategies are not formulated and implemented, these conflicts will result in the inefficient expenditure of limited public and private funds and an unnecessary destruction of the natural resources that serve as a base for the economy.

The answer to this dilemma is not for government to stop the activity. Rather, the full implication of the activities needs to be openly explored and discussed by affected parties. This requires changes in the way government agencies make their decisions, and the way political pressures are exerted to get the projects done.

The proposed approach for addressing such problem areas is to designate as special management zones where there are existing or potential conflicts that require issue-specific strategies and interagency coordination. In order to maximize the chances of success, the zones should be limited at first to one in each of the four coastal provinces.

The designations of special management zones should be made by executive decree of the president of the Republic in order to assure compliance by all institutions, as well as to provide a framework within which to resolve differences for the overall benefit of the Republic. The designation decree should clearly lay out the geographic extent of the zone itself, the activities to be addressed within the zone, and the government agencies to be part of the management program.

An essential feature is that the time period be limited for formulating an integrated plan for each special management zone. This will prevent the cooperative effort from becoming bureaucratized and fossilized. Two years is probably the optimum term; by then it should be clear if the conflicts can be resolved, and the differences negotiated. A time frame of less than two years may not provide for the startup effort. More time will simply allow for unnecessary delays. Once a strategy, in the form of a special area management plan, has been agreed to, a second and more protracted implementation phase would begin.

The purpose for designation of a zone should be clearly laid out, as should its manner of operating. First, an executive committee representing the major national agencies involved in the identified conflicts should be established. These representatives should be familiar with the changes at the local and regional level, and should be able to exercise authority to commit their agencies in the discussions and negotiations of the executive committee.

The chairman of the executive committee of each special management zone will be appointed in the presidential decree. Depending on the issues within each special management zone, this could be the governor or prefect of the province, or the regional representative of one of the key national government agencies. The chairmen of the executive committees for each of the special management zones could meet regularly to exchange experiences.

The first task of the executive committee should be to define more specifically the scope of the planning and coordination effort to be undertaken, and to determine if there are other national agencies that need to be invited to participate in the sessions. Once constituted, the committee should be known formally as the "Executive Committee for the Special Management Zone of -."

The second task of the executive committee should be to review the key projects and activities creating the special conditions of conflict or resource abuse that led to creation of the zone. Within each of these key projects and activities, major decision points should be identified, and a consolidated timetable for all these discussion points should be developed. As part of the process, special efforts should be made to assure that the full implications of each decision on the resources and the other planned activities are understood before the action is taken. The development of an integrated and consolidated timetable will therefore be a major series of negotiations carried out in open forum by the representatives of key agencies.

The third task of the executive committee should be to expedite the decisions once a timetable and a sequence are agreed to. Various mechanisms can be used to assure timely decisions. Formal notice to agencies as a critical date approaches is one means. Another would be to set dates after which identified pending actions would be considered legally approved if they had not been specifically denied by the appropriate authority; there is some precedent for this in Ecuadorian law. Finally, the formation of a special management zone could provide the opportunity to develop a "one-stop"

permit system. This would unify all required approvals for a project into a single application, with an internal checking system to assure timely agency action.

The executive committee will be assisted by the PMRC in conducting the research and investigations necessary to understand the parameters of the projects and activities proposed in the special zone. To conduct this research, the committee shall, as much as possible, rely on the technical resources of scientific and educational institutions present in the zone.

Designation of Special Management Zones

The first zones proposed for designation are:

- **In Esmeraldas:**
The Atacames - Sua - Muisne Zone

Here, regional tourism has the potential for significantly improving the economies of these three small towns. Development, however, is proceeding in an uncontrolled manner and the potential attractiveness of the area is severely compromised by the absence of wastewater treatment, inadequate water supply systems, and the improper siting of shorefront buildings. The local economy is heavily dependent on artisanal fisheries, but many coastal-dependent stocks are overfished and suffering from the needless destruction of their habitats. In the Muisne vicinity, shrimp mariculture on an artisanal scale not seen elsewhere in Ecuador is emerging, and offers an interesting test case for a form of mariculture that could benefit poor local inhabitants. A program to define and protect the natural resource base of this stretch of coastline could directly benefit traditional fisheries and enhance the possibilities for growth in tourism.

- **In Manabi:**
The Bahia de Cardquez Zone

Here, the key issues are maintaining the shrimp mariculture industry in the Bay of Cardquez, and dealing appropriately with severe erosion along the ocean coast. The great majority of the Bay's once-extensive mangroves have been converted to shrimp ponds, and pressures are intense on the remaining fragments of this habitat, including pressure to dike off portions of the Bay itself. These wholesale changes in the ecosystem are producing unquantified impacts on the postlarval shrimp fishery and other important nearshore fisheries. Furthermore, dam projects and expanded agriculture in the Bay's watershed are likely to bring changes in water quality that may affect the viability of the shrimp mariculture operations. The town of Bahía is confronted by major decisions on the siting of a new fishing port and beachfront tourism facilities along a coast where processes of erosion and sedimentation have already caused dramatic problems.

- **In Guayas:**
The Playas - Posorja - Puerto El Morro Zone

In this zone, the conflicts among artisanal and industrial fisheries, tourism, and shrimp mariculture are intense and urgently require immediate action. The infrastructure required for the important fisheries of the zone is inadequate, and fishermen compete directly with tourists for sandy beaches. Problems of waste disposal and inadequate sewage treatment become acute in the tourism season. Declining water quality is of concern to tourists and mariculturists alike. Here, too, pressures to convert the remaining mangroves into shrimp ponds are intense. Land use controls are required to impose some order on second-home developments, mariculture, and polluting industries, which are all expected to continue to rapidly expand in the next decade.

- **In El Oro:**
The Machala - Puerto Bolívar Zone

Water quality problems are most acute in this area. Pesticides and herbicides are believed to be affecting human health, and have made several shrimp hatcheries inoperable. As in Esmeraldas, the stocks that support artisanal fisheries are rapidly declining, and wholesale changes to the ecosystem are being brought by the uncontrolled proliferation of shrimp ponds.

C. Advisory committees

Create advisory committees in each special management zone, to be composed of citizens representing the full range of interests in the area, as well as of appropriate local and regional government entities.

There is a strong feeling among those who have participated in formulating this proposal that successful coastal management efforts in Ecuador require active involvement by interested parties from both the public and private sectors. There are three main reasons:

1) There is a high level of interest and concern for the present and future quality of coastal resources. This concern has emerged from several coastal ecology studies carried out for the shrimp farmers, who want secure supplies of good quality water and seed shrimp for their ponds.

2) Many public policy issues and choices involved in coastal resource management should evolve from open discussion and debate, building on the style developed through formulating the environmental profiles of the coastal provinces.

3) The education and the evolution of a civic consciousness concerning Ecuador's coast and its resources will be greatly strengthened if meaningful public participation is built into issue definition and the formulation of management strategies.

The institution suggested to handle these requirements is an advisory committee of citizens, to work with the executive committee of each special management zone.

The advisory committee would be composed of representatives of major private-sector interests-such as shrimp farmers, shrimp hatchery owners, larvae collectors, fishermen, fish processors, other industrialists, hotel owners, environmental foundations and clubs, and universities.

Membership should also include representatives of local and provincial councils, regional planning and development bodies, and national agencies that have interest in coastal issues, but do not have sufficient regulating authority to justify membership on the executive committee. The advisory committee would formulate opinions and suggestions for each step of the executive committee's work in the special area management zone, as outlined under Section B above.

Being tied to a special zone would give the advisory committee a two-year life to operate. In this way, it would not go through a period of decline, as many such committees do before they are disbanded. As advisor to the executive committee, the advisory committee would be in the best position to provide views on the conflicts under resolution and on the various plans, timetables, and projects under review.

D. Central government structure

Establish in Quito a small, simple, and precise structure to provide high-level governmental support to the program, to assure central political and administrative backing to solve conflicts, to obtain international support for the program, and to promote interagency cooperation.

There are a number of essential elements to the program that require high-level authority:

1) To assure a sufficiently strong base of political and administrative support to resolve conflicts and enforce cooperation by all agencies;

2) To provide a mechanism to assure the observance of the executive decrees in the creation of the special management zones and other aspects of the program;

3) To facilitate access to international institutions; interest in Ecuador's coastal management innovations will likely provide opportunities to obtain funds for the program from public and private groups, as well as requests for information from other nations wishing to learn from the Ecuadorian experience; and

4) To develop a public awareness program, aimed at the general population, concerning the coastal resources of the nation.

Several alternatives were identified and analyzed to place this structure within the central government. Among those considered were: CONADE (the national planning agency) or a group under this entity; individual ministries; an interministerial council; an agency connected directly to the presidency, and a group attached to the General Secretariat of Public Administration. This last alternative, combined with an interministerial council, is the preferred approach.

The proposal is to constitute, through an executive decree, an interministerial group, including those with the greatest interests in coastal resource management, under the name of the Interministerial Committee for the Management of Coastal Resources. The president of this committee would be the coordinator of administrative development in the Office of the Presidency; this office is part of the General Secretariat of Public Administration, and has direct access to the president of the Republic.

A technical secretariat will further support the president of the national committee and the executive committee in the special zones. It will administer the various components of the program. The technical secretariat must have enough strength and capability to coordinate and promote the tasks defined by the executive decree and the interministerial agreements for the integrated management of coastal issues. It will provide technical support to the different levels of the program, both at the policy level in Quito and with the groups participating in the special management zones. This secretariat would be organized from the DIGEMA-PMRC office that is operating now in Guayaquil.

E. Public education

Establish a public education program for the Republic, with special emphasis on the coastal areas, in order to convey to the public the importance of the role that coastal resource management plays in the present and future of the country.

If a significant portion of the people most directly affected by the Coastal Resources Management Program do not understand its goals and support the actions being taken, the program will fail. The three years of work undertaken by the CRMP have identified the major themes for a public education program and the target audiences. The resources must now be assembled to develop materials for newspaper articles, radio, and TV to make people aware of the key issues the program is attempting to address, and the importance of resolving them. A strong base for building such a program exists thanks to the remarkable success of Fundación Natura's environmental education programs and the excellent contacts of Fundación Maldonado along the coast.

F. Research

Establish a research program on coastal issues directed at improving our understanding of specific resource management issues.

The main objective of this program will be to support research that will directly assist in making appropriate resource management decisions. The CRMP working groups, such as those established to oversee the mangrove ecosystem management and water quality initiatives, should serve as prototypes of the level of structure required to orient, coordinate, and evaluate results. Three top priorities for research have been identified that will require significant long-term funding. The first is to address the potentially catastrophic impacts of a collapse in shrimp stocks due to a combination of overfishing and habitat destruction. The wild stocks support a 260-vessel trawler fleet, an artisanal postlarvae fishery that is the major supplier of seed shrimp for the mariculture industry, and a gravid female fishery that supplies the shrimp hatcheries. The postlarvae fishery involves 50,000 to 100,000 fishermen, and has brought an economic renaissance along stretches of the coast. A well-conceived research program is needed to differentiate among stocks, monitor recruitment and fishing mortality, and provide a basis for regulating fishery effort. Key habitats within estuaries need to be defined and protected. Another priority is to set up a sustainable water quality monitoring system targeted on those variables and sites known to be particularly important to the continuing viability of the mariculture industry. The monitoring must be complemented by research that documents the impacts of those pollutants that are known to pose major concerns. The third priority is to better understand the role and functioning of Ecuador's mangrove systems in water quality and flood control, and as a key habitat for commercially important fish and shellfish.

G. Training

Develop a training program at all levels participating in coastal resources management.

The objective of this program will be to train personnel involved in coastal management activities, with special attention given to the training of the seven teams of the Ranger Corps to help them carry out their enforcement and extension duties.

Ranger Corps programs will include training in coastal ecosystems and their importance and value; in objectives for management of coastal resources, relevant laws, and regulations; and in public education/contact techniques. A major objective of the ranger training programs will be to enhance the stature of the corps within government, and to build their credibility with the private sector and general public. Training of policymakers and government technocrats is also essential for an effective coastal management program. A high-level, prestigious policy seminar series is envisioned for the policymakers. Appropriate forums for training that combine representatives from these three groups will be included in the overall training program.

MANIFESTO

To the President and Vice President-Elect and the Nation: A Call for the Balanced Development of Coastal Resources

Local officials, representatives to Congress, businessmen, university presidents, leaders of political parties, public servants in governmental and developmental agencies, experts, journalists, and other representatives and members of the regional community have an participated in the preparation of a proposal for the management of resources in the coastal zone.

This proposal reflects the will of each of the coastal provinces and constitutes a common commitment to join together and unify public and private initiatives, in order to achieve the priorities we have together identified for coastal development.

This is the first time that such an initiative has been formulated in the country. We trust that the next administration will transform the will of the region into tangible actions and statements of national policy.

We have considered the following:

Almost all productive activity along the coast depends on renewable resources. This rich base for development will be sustainable only if it is managed and administered in a balanced manner.

The majority of the region's population is concentrated along the coast. The four major coastal cities already contain 38 percent of the urban population of the country

There is not a single activity or sector in the national economy that is not directly or indirectly linked to the use of our coastal resources.

The income generated by marine resources in 1987 was three times that produced by industry (excluding petroleum); was equivalent to that produced by coffee, cocoa, and bananas combined; and was 65 percent of those generated from petroleum.

Excepting those associated with petroleum production, the most profound and complex changes that have occurred in the country are seen in coastal areas and ecosystems.

These major changes (ports, roads, tourism, dams, shrimp farms, fishing, population growth, urban development, pollution, ecosystem destruction, and deterioration of the environment) have all occurred in the past 20 to 30 years, or are taking place today, and the associated problems, impacts, and dangers have yet to be fully manifested.

All indications are that coastal areas will experience rapid growth, assume growing importance, and be subjected to increasing pressures and conflicts.

These and other concerns were reviewed in a series of provincial workshops during which the following key problems and issues were identified:

- Deterioration in water quality caused by urban, industrial, and agrochernical discharges;
- Degradation of mangrove ecosystems;
- Threat of extinction of some resources:
- Chaotic and conflicting use of coastal land;
- Fragmented legal and administrative functions, uncoordinated and overlapping jurisdictions, and disregard of coastal and environmental laws;
- Lack of awareness in the regional and national community of the changes to the resource base that have taken place over the past few decades, as well as lack of awareness of the implications of these changes; and
- Limited research on topics that could contribute to the resolution of priority problems.

These factors tend to create a situation that in a few years could become critical and possibly irreversible. If this occurs, the disastrous outcomes will multiply.

Because of our political, social, and familial responsibilities, we declare that it is essential, if we are to continue the development of our country and to provide for our children and future generations, that we correct the current deficiencies and utilize renewable resources for sustained production and not exhaust them. It has become clear during the workshops that this will be possible only if, simultaneously with the enactment of decrees and legislation, we transform the attitude of communities toward these problems. To this end, we propose to:

1) Unite the necessary governmental institutions and private sectors linked to coastal resources with integrated management strategies;

2) Transform the Coastal Resources Management Project into a governmental program, with a flexible and simple structure that secures political support of the national government, efficient local management, and the active participation of the community;

3) Provide adequate means for ensuring the compliance with the execution of the laws and regulations that govern the coastal zone and its resources;

4) Launch these initiatives in the special management areas selected by each province;

5) Support programs of education, training, and research related to coastal issues; and

6) Implement a strong management program for the protection of water quality and mangrove ecosystems along the entire coast.

The great diversity within the group that has endorsed this manifesto-a group that also cuts across the political spectrum-is a clear expression of cooperation and democracy and of a common concern to avoid the degradation of the renewable coastal resources that sustain the national economy.

We call upon our elected government officials to endorse and support this new initiative, which has been shaped in the coastal provinces through a closely coordinated and collaborative process.

Ju1y 22, 1988

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PROFILE OF GOVERNMENT AGENCIES RELATED TO THE MANAGEMENT OF COASTAL RESOURCES

A number of public institutions are currently active in the management of coastal resources. Others are potentially important because of the impact that their activities have or might have on the future of coastal resources, or because they could participate if their tasks were modified or clarified. In addition, the creation of new entities or the reorganization of present authorities has been suggested to fill in some gaps or deal with weaknesses in the present structure. This annex presents a brief profile of the most important agencies related to coastal management, and then offers a list of suggestions made by those interviewed on how present authorities might be restructured.

The strong consensus of those interviewed was that it was preferable to improve the existing structure rather than reorganize it to meet the objectives of coastal management. This point of view recognizes that reorganization by itself seldom results in the kind of management improvements that are considered important. Some of the suggested organizational changes are worth bearing in mind as the coastal program takes shape.

KEY NATIONAL AGENCIES POR COASTAL MANAGEMENT

The Merchant Marine and Coastal Service of the Ecuadorian Navy (DIGMER)

This agency has full regulatory authority over all activities in coastal waters and adjacent beaches, generally up to 80 meters from high tide, and regulates ah municipal and industrial discharges into coastal waters. Although it is a respected institution, DIGMER suffers from shortages of manpower and resources to enforce existing laws and regulations, especially those related to pollution from untreated discharges. Activities are well organized under seven port captains at major locations, whose authority extends throughout the entire coast. DIGMER is a key asset to any successful coastal management program. However, a leadership role is made difficult by the practice of changing port captains frequently to meet other career objectives of the officers, and by the general public concern over reliance on what is essentially a military force to carry out the program.

The National Forest Service (DINAF), Ministry of Agriculture and Livestock

DINAF has regulatory authority over mangroves and designated forest areas in the coastal zone. it has suffered from a severe shortage of enforcement personnel and resources, which has not allowed for the control of forestry exploitation practices. However, the illegal destruction of mangroves for the construction of shrimp ponds appears to be happening at a slower rate than in previous years as the shrimp industry begins to see the danger of the continuous destruction of a habitat crucially important to the sustainability of their industry.

The Subsecretariat of Fisheries Resources, Ministry of Industry, Commerce, Integration, and Fisheries

This agency regulates all fisheries-related activities in the coastal zone, including approval of all shrimp farms (in coordination with DINAF and DIGMER). In addition, it assists in the encouragement and development of both artisanal and industrial fisheries. At the same time, the agency has responsibilities in the conservation of fisheries habitats in coastal areas. In general, it is thought to handle its regulatory, developmental, and conservation roles well, with a minimum of conflict.

OTHER NATIONAL AGENCIES RELATED TO COASTAL MANAGEMENT

The National Development Council (CONADE)

This is the national "super agency" for the planning and approval of development projects. Although the Coastal Resources Management Project does not contemplate a program that will either seek to carry out specific development projects or try to develop a "plan" for the entire coast, the support of CONADE will be essential to convincing the various ministries and independent authorities that the improvements proposed in coordination of activities and enforcement of regulations are worth pursuing.

The Ecuadorian Institute of Hydraulic Resources (INERHI)

The Institute is involved in the planning, design, and construction of a large number of upstream dam projects. These projects have important effects on coastal areas, ranging from the reduction of freshwater flow into estuaries to problems in drinking water supplies for coastal communities. The Institute's main interest is related to the irrigation of farmlands. To date, there has been little involvement in coastal issues.

The Ecuadorian Institute of Sanitary Works (IEOS)

This Institute has a broad charter to deal with water quality and pollution issues on a broad scale, but has focused nearly all its efforts on the provision of safe drinking water and water treatment works in rural areas. It sees itself as a development agency with no regulatory role.

The Office of the Environment, Ministry of Energy and Mines (DIGEMA)

This is the sponsoring agency for the Coastal Resources Management Project. Although it attempts to take a broad view of the full range of environmental issues facing the Republic, it must do so from its current location within one of the ministries. In addition, it exercises no regulatory authority over coastal resources. Nonetheless, it serves an important liaison function for the development of a coastal management program, in part precisely because it is not a threat to existing regulatory authorities or development interests.

The National Tourism Office (DITURIS)

This agency is responsible for the programming, development, and supervision of tourist activities in Ecuador. While it has no regulatory powers, it has established good working relations with local governments in those areas with potential tourist activity, which helps its integration into a coastal management program. On the coast, this is particularly important because of the large economic role that tourism plays during the winter season. Relations between DITURIS and the other national agencies with responsibilities in the coastal zone do not appear well developed.

LOCAL AND REGIONAL AGENCIES

Study Commission for the Development of the Guayas River Basin (CEDEGE)

This commission is working on the project of the Daule-Peripa dam, in the Guayas Basin, which includes new irrigation areas, flood control, water transfer to the Santa Elena Peninsula and to the Province of Manabí, and the generation of electricity. Its activities may have significant impacts on the quality and quantity of freshwater flow into the estuary. Commission staff are increasingly aware of these issues and are studying possible project impacts.

Program for the Development of the South (PREDESUR)

This institution operates in the province of El Oro and in adjacent highland areas. Because of its activities and the impact they have on the Gulf of Guayaquil, PREDESUR should participate in the coastal management process.

Municipal and regional service corporations

There are a number of important services, such as the provision of drinking water and sewage collection and treatment, that are carried out by local and regional service corporations. Probably the most important of these is the EMAG, the Municipal Sewage Corporation of Guayaquil. The decisions made by EMAG in coming years with respect to services such as the treatment of domestic and industrial water discharges and waste disposal will be critical for the management of the Guayas River estuary and the Estero Salado.

Provincial councils

These are entities for the planning and development of the provinces. They have focused mainly on the development of roads and school infrastructure. The perspective of the provincial council should be included in the consultation process through the advisory committees to help resolve conflicts and make necessary choices.

Cantonal councils

Like the provincial councils, the local councils in each canton affected by the special area management plans should have a part in the development and the operation of the coastal resources management process.

CHANGES SUGGESTED IN THE STRUCTURES OR CHARGES OF GOVERNMENT ENTITIES

Although in some interviews, suggestions were made to change the existing structure of government agencies or to alter their tasks and charges, the general consensus was that the improvement of cooperation among existing authorities is more important than the creation of new institutions and regulations. The major suggestions were the following:

1) Expand the charter of INERHI to require full consideration of the effects of projects on downstream flows and estuarine resources. It appears that the agency is already beginning to do this, and it is not clear that changing the charter of the agency will speed up the process.

2) Expand the charter of IEOS to include nationwide supervision of all aspects of water quality. This could assure the enforcement of water quality standards and control water discharges that could be important sources of chronic contamination. Currently, there is no agency with nationwide authority to regulate water quality.

3) As DIGMER has enough authority in coastal areas to control all kinds of discharges, the main point to consider would be to strengthen the operative capacity of this entity and assure coordination with INERHI and IEOS.

4) Create a Ministry of the Environment or Ministry of the Environment and Renewable Natural Resources. It is not to be assumed that the integration of numerous government units related to natural resources in one ministry will solve existing administrative problems related to the management of coastal resources. Furthermore, it is not clear what units should be part of such a new ministry. Some suggested that the fisheries

section should remain in the Ministry of Industry, Commerce, Integration, and Fisheries; others suggested that it should be part of the new ministry mentioned above. No one suggested moving DIGMER from Defense to the new ministry, but DIGMER has much of the regulatory authority in the coast. However, some think that a ministry with interests and responsibilities on the natural resources of the nation would bring the advantage of focus on environmental problems.

5) Create an Institute of the Environment or of Natural Resources. This option has similar advantages as the previous one, with the exception that there would be no integration of existing agencies. The national Congress is considering a project to create an institute with these characteristics.

6) Establish a National Comptroller for the Environment to oversee all activities of agencies related to natural resources. This concept is relatively new and is still being developed; it is an interesting idea for overall monitoring of public and private activities.

NAMES OF PARTICIPANTS IN THE DISCUSSION WORKSHOPS ON THE STRUCTURE AND OBJECTIVES OF A COASTAL RESOURCES MANAGEMENT PROGRAM IN ECUADOR

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March 25, 1988

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Sr. Sigifredo Velasquez, Architect
Consultant

Sr. Nelson Suquilanda, Engineer
Director, Office of the Environment

Dr. Luis Arriaga
Director, Coastal Resources Management Project

Sr. José Vásconez, Engineer
Co-director, Coastal Resources Management Project

Sr. Washington Macías, M.A.
Fundación Maldonado

March 16, 1988

Guayas

Sr. Jaime Aspiazu
Representative-elect

Sr. Mario Hurtado, Biologist
Advisor to the Subsecretary of Fisheries

Sr. Cesar Benalcazar, CPNV

Merchant Marine and Coastal Directorate of the Navy

Sr. Lino Delgado, Engineer
Chief, Forest District of Guayas

Sr. Daniel Toro, Engineer
Guayas River Basin Development Commission

Dr. Franklin Gonzalez
President, Fundación Natura

Sr. Luis Yagual, Lawyer
President, Committee for Tourism Development
(General Villamil)

Sr. Hector Montero
National Federation of Fishing Cooperatives of Ecuador

Sr. Oswaldo Castro
National Federation of Fishing Cooperatives of Ecuador

Sr. Julio Cornejo, Engineer
Forest District of Guayas

Sr. Jose Cattan
Hoteliers of Playas

Sr. Nelson Suquilanda, Engineer
Director, Office of the Environment

Dr. Luis Arriaga
Director, Coastal Resources Management Project

Sr. Emilio Ochoa, M.A.
Executive Director, Fundación Maldonado

March 18, 1988

El Oro

Sr. Franco Romero
Provincial Prefect-elect

Dr. Jorge Sanchez
Representative-elect

Sra. Myriam Fernandez, Architect
Regional Director, Southern Development Program

Sr. Wilfrido Pena, Engineer
Provincial Chief, Ecuadorian Institute for Sanitary Works

Sr. Rene Herrera, Engineer
Director of Potable Water, Municipality of Machala

Sr. Oswaldo Crespo, Architect
Urban Planning Director, Municipality of Machala

Sr. Fulton Romero C., Engineer
Forestry Director, Ministry of Agriculture

Sr. Hector Yerovi, Lawyer
Legal advisor, Ministry of Agriculture

Dr. Enrique Ortiz M.
Dean of Faculty, Agronomy, Veterinary, and Aquaculture School, Technical University of Machala

Dr. Walter Paredes S.
Director, School of Aquaculture, Technical University of Machala

Sr. Alcibiades Moscoso
Inspector of Fishing

Sr. Servio Carrion, Engineer
Jubones Project

Sr. Dalton Burgos, Sociologist
Department of Planning, Technical University of Machala

Mr. Bruce Epler, Economist
Consultant, University of Rhode Island

Dr. Fausto Maldonado
Sector Specialist, U.S. Agency for International Development/Quito

Sr. Nelson Suquilanda, Engineer
Director Office of the Environment

DL Luis Arriaga
Director, Coastal Resources Management Project

Sr. Jose Vdsconez, Engineer
Co-director, Coastal Resources Management Project

Sr. Emilio Ochoa, M.A.
Executive Director, Fundaci6n Maldonado

February 26, 1988

ANNEX II

The Legal Basis of the Ecuador Coastal

Resources Management Program

EXECUTIVE DECREE NO. 375 ESTABLISHING. THE ECUADOR COASTAL RESOURCES MANAGEMENT PROGRAM

Official Register 117, January 26, 1989

Rodrigo Borja, Constitutional President of the Republic of Ecuador

Considering:

That it is necessary to develop, administer, and implement a Coastal Resources Management Program for Ecuador, with the participation and authority of the various Ministers of State, representatives of the public sector, private institutions, the social sector, and organized communities;

That coastal resources should be preserved, protected, and used rationally, based upon sound technical, scientific, and planning criteria, for the direct benefit of the Ecuadorian people, avoiding irrational destruction and poor use practices, and promoting the ecological functioning of the coastal region;

That there is direct support for the proposal to create a Coastal Resources Management Program carried out through the Ministry of Energy and Mines Directorate of the Environment (DIGEMA) and the University of Rhode Island, from public and private institutions as well as representatives of communities in the coastal provinces;

That citizens representing the coastal provinces have urged the National Government to create a Coastal Resources Management Program;

That it is the obligation of the state to serve as steward in protecting the environment and, in using its powers,

Decrees that:

Article 1. The Coastal Resources Management Program of Ecuador is established, with the purpose of integrating government efforts for the preservation and development of the coastal resources in the provinces of Esmeraldas, Manabi, Guayas, El Oro, and Galapagos.

Article 2. In order to successfully carry out this program, a National Commission on Coastal Resources Management will be created, composed of the following authorities or their permanent delegates:

a) The Minister of Industry, Commerce, Integration, and Fisheries (MICIP);
b) The Minister of Defense;
c) The Minister of Energy and Mines;
d) The Minister of Agriculture and Livestock (MAG);
e) The Secretary General of Planning of the National Development Council (CONADE); and
f) The Secretary General of Public Administration.

The President of the Republic will designate one of the members of the Commission as its President. The President of the Commission will convene meetings and will designate a Secretary.

Article 3. The functions of the National Commission on Coastal Resources Management Commission are

a) To recommend national coastal resources management policies to the President of the Republic and to oversee compliance with these policies;
b) To approve the annual work plan and the budget and evaluate its implementation;
c) To approve the operating plans of the special area management zones submitted by the Executive Committees;
d) To designate the Technical Secretary of the Program and the Director of the Executive Committee in each one of the special area management zones, as nominated by the President of the National Commission;
e) To issue administrative orders to the public officials of the offices represented in the National Commission, so that they coordinate their management actions in the coastal areas; and
f) To urge those ministers who are not a part of the National Commission to carry out the actions necessary to accomplish the goals pursued by the resolutions of the Commission.

Article 4. Every member of the Commission will have a voice and a vote in the meetings; the resolutions will be approved by simple majority of votes, but the members will seek unanimous agreement on every Occasion. The resolutions of the National Commission will be published

in the Official Register, in accordance with Article 136 of the Law of Administrative Regime. The National Commission will establish by-laws for the functioning of the Program.

Article 5. The Technical Secretary of the Program, with its seat in Guayaquil, is structured as an agency of the General Secretary of Administration, with the following functions:

a) To administer and execute the program;
b) To provide technical assistance to every level of the program;
c) To present work plans and annual budget proposals for consideration by the National Commission; and
d) To conduct studies and design plans on issues that affect the Ecuadorian coastal zone.

Article 6. The following coastal areas shall be special area management zones, for a period of two years:

a) In Esmeraldas, the zone Atacames-Súa-Muisne;
b) In Manabí, the zone Bahía de Caráquez-San Vincente;
c) In Guayas, the zone Playas-Posorja-Puerto El Morro and the zone San Pedro-Valdivia-Manglaralto;
d) In El Oro, the zone Machala-Puerto Bolívar-Isla Jambelí; and
e) In Galápagos, a zone that will be delimited by the National Commission.

Article 7. The Technical Secretary will recommend to the National Commission the creation of additional special area management zones in the areas where there are or could be an indiscriminate use of resources. The National Commission has the power to create new special area management zones, based upon the recommendations of the Technical Secretary and the merits of the case.

Article 8. An Executive Committee composed of the institutions with management responsibilities for the coastal resources of the area will be established in each of the special area management zones. The leadership of this Committee will be assigned to a provincial authority or to an entity of regional development that will be designated by the National Commission, as nominated by the President of the Commission.

The Executive Committees will present to the National Commission an integrated coastal resources management plan for each zone, prepared with the support of the Technical Secretary, along with a specific program to implement each management plan.

Article 9. The Executive Committees of the special area management zones shall

a) Determine the priority issues for coastal management;
b) Present the plans and programs, prepared with the assistance of the Technical Secretary, to the National Commission;
c) Design specific short- and medium-term projects to be implemented in the respective zones;
d) Adopt decisions to promote the coordination between authorities and institutions that play roles in the coastal management of the zone;
e) Assure that the members of the Committee comply with the decisions of the Committee as a whole; and
f) Inform the Advisory Council about the progress of the Management Plan and the programs of the special area management zone.

Article 10. An Advisory Council to the executive committee will be established in each special area management zone, composed of the representatives of the private sector (both artisanal and industrial), academic institutions, organizations, and other entities interested in the management of the coastal resources of the zone. In cases where there are no organizations representing the productive sectors, the Executive Committee will solicit the participation of persons who are able to represent the concerns and interests of the major activities of the zone.

The Advisory Council will help the Executive Committee reach decisions on coastal management and identify issues and solutions for development projects. It will also promote the cooperation of the citizens and of the representatives of every organization.

Article 11. The plans, programs, and proposals for each special area management zone, as approved by the National Commission, will be presented to the national planning agency CONADE to be included in the National Development Plan and in its yearly operational plans.

Article 12. A Ranger Corps will be constituted within the geographical jurisdiction of every port captain, composed of the officials of the agencies that must enforce the legal and administrative provisions for the management of the coastal resources, principally those provisions that pertain to the Subsecretary of Fisheries, the Merchant Marine Directorate (DIGMER) and the National Forest Directorate (DINAF) of the Ministry of Agriculture and Livestock.

To carry out their responsibilities, the Ranger Corps will receive training and logistical support. Each Ranger Corps will be coordinated by the port captain or by an official of the captaincy, as named by DIGMER.

Article 13. When the Advisory Council determines that accusations and complaints have not been properly taken into account by an Executive Committee, it will raise the issue with the President of the National Commission, who will order an inquiry within the realm of the ministry's jurisdiction and will coordinate its administrative action with the various agencies and authorities established in this program.

PROVISIONS REGARDING TRANSITION:

FIRST. Continuity must be maintained between the Coastal Resources Management Project and the Technical Cooperation Agreement between the Government of the Republic of Ecuador and the Agency for International Development to carry out a Coastal Resources Management Project signed on March 3, 1986. An addendum to the Convenio will be proposed to merge the current Coastal Resources Management Project with the functions of the Technical Secretary created in this Decree.

SECOND. The Ministry of Energy and Mines will continue to pay the expenses of the office of the Coastal Resources Management Program as it has been doing up to the present time, until new entries are created in the budget of the General Secretary of Administration.
FINAL PROVISION. The execution of the Decree is entrusted to the Vice President of the Republic, and to the Ministers of National Defense; Energy and Mines; Agriculture and Livestock; and Industry, Commerce, Integration, and Fisheries, and to the General Secretary of Administration.

Enacted in the Palacio Nacional, in Quito, January 19, 1989.

Signed by
Rodrigo Borja, Constitutional President of the Republic
Luis Parodi Valverde, Vice President of the Republic
General (r) Jorge Félix, Minister of National Defense
Diego Tamariz, Minister of Energy and Mines
Enrique Delgado, Minister of Agriculture and Livestock
Juan José Pons, Minister of Industry, Commerce, Integration and Fisheries

Certified by Washington Herrera, Secretary General of Public Administration.

EXECUTIVE DECREE NO. 3399 ESTABLISHING THE ECUADOR COASTAL RESOURCES MANAGEMENT PROGRAM

Official Register 950, June 4, 1992

Rodrigo Borja, Constitutional President of the Republic of Ecuador

Considering:

That through Executive Decree No. 3 75, published in the Official Register 117 of January 26, 1989, the Coastal Resources Management Program was created with the purpose of assuring that Ecuador's coastal resources should be preserved, protected, and used rationally based upon sound technical, scientific, and planning criteria, for the direct benefit of the Ecuadorian people, avoiding irrational destruction and poor use practices, and promoting the ecological functioning of the coastal region;

That on March 3, 1986 Ecuador entered into a Convenio of Technical Cooperation with the Agency for International Development (USAID) and the University of Rhode Island to undertake the Coastal Resources Management Project;

That through an addendum to this convenio with USAID, additional financial resource were provided and the agreement was extended through May 15, 1995, in view of it having completed its initial objectives;

That the Coastal Resources Management Program for Ecuador develops its activities with the participation of representatives of the public sector, private institutions, the social sector, and organized communities;

That the Coastal Resources Management Program has completed the special area management plans, making it now essential to enter into a phase of implementation, which will be financed with international credit;

That it is the mandate of the national government to recognize the justifiable desires of the sectors and institutions to fully participate in the Coastal Resources Management Program, which requires introducing modifications in the current structure of the Program so that the adopted plans can be implemented, and coastal resources management can be extended to the remainder of the coast;

and in using its powers,

Decrees that:

Article 1. The Coastal Resources Management Program of Ecuador is established as an entity within the Office of the President of the Republic, decentralized in terms of financial administration, and with its seat in the city of Guayaquil.

Article 2. The Program has as its purpose the preservation and development of the coastal resources in the provinces of Esmeraldas, Manabi, Guayas, El Oro, and Galapagos.
To carry out its objectives, the Program will formulate and execute the activities and projects it deems necessary, with the participation of public and private entities, and will continue implementing the Convenio of Technical Cooperation signed on March 3, 1986 between Ecuador and USAID, and its addenda, either directly or through convenics or contracts with the public and private sector.

Article 3. The Coastal Resources Management Program will have the following basic structure:

a) National Commission
b) Executive Directorate
c) Local management zones
d) Rangers Corps units

The organization, functioning, and authorities of the units of the Program are subject to those terms set forth in this decree and in the internal regulations that are issued to implement it.

Article 4. The National Commission is the highest authority of the Program and is composed of the following authorities or their permanent delegates:

a) The Secretary General of Public Administration, who will serve as president;
b) The Minister of Defense;
c) The Minister of Agriculture and Livestock (MAG);
d) The Minister of Industry, Commerce, Integration, and Fisheries (MICIP);
e) The Minister of Energy and Mines;
f) The Secretary General of Planning of the National Development Council (CONADE); and
g) The Executive Director of the Ecuadorian Tourism Corporation (CETUR).

The members of the Commission can assign permanent delegates who will serve with the same obligations and authority.

Article 5. The functions of the National Commission on Coastal Resources Management are

a) To recommend national coastal resources management policies to the President of the Republic and to oversee compliance with these policies;
b) To approve the annual work plan and the budget and evaluate its implementation;
c) To approve the plans of the special area management zones (ZEMs);
d) Create, reduce, or expand the size of a ZEM, designate critical areas, and become involved in those areas to address ecological problems or use conflicts that urgently need management policies and administration;
e) To designate the Executive Director of the Program based on the nomination of the Commission President, as well as remove him/her as the case arises;
f) To determine the rules of establishment and functioning of the contracting committees of the Program;
g) To approve the administrative measures necessary for coordinated management actions in the coastal areas; and
h) Other tasks as they are assigned by the President.

Article 6. The' resolutions of the National Commission are obligatory on the public sector, and will be published in the Official Register.

Article 7. The President of the National Commission has the following responsibilities:

a) Periodically inform the President of the Republic on the principal activities of the Program;
b) Convene and chair the meetings of the National Commission;
c) Promulgate internal rules, agreements, instructions, and other measures to implement the Executive Decree; and
d) Other tasks as assigned by the President of the Republic.

Article 8. The Executive Director has the following responsibilities:

a)Administer the Coastal Resources Management Program and honor the agreements and contracts undertaken to carry out the work of the program, as delegated by the Secret General of Public Administration;
b) Submit an annual work plan for the program and special area management zones for review by the National Commission;
c) Submit an annual budget for National Commission review;
d) Authorize spending to carry out the program and provide reports on expenditures;
e) Recommend and justify the creation or termination of the special area management zones to the National Commission;
f) Approve the annual operating plans for the special area management zones;
g) Assign and remove program staff according to personnel procedures;
h) Act as the Secretary to the National Commission; and
i) Other tasks as assigned.

Article 9. The special area management zones will promote cooperation and coordination among public and private institutions, user groups, and communities to establish priorities in the ZEM, formulate and approve management plans, and submit them for adoption by the National Commission, and finally, assure their proper implementation.

The management plans are aimed at sustainable stewardship of coastal resources in the special area management zones, and improving the quality of life of its population. No project can be included in a management plan unless it has first been approved by the zone committee.

The creation and functioning of the zone committees, which are made up of delegates of local user groups and community groups that are legally registered, and local authorities, will be determined by the internal regulations of the National Commission. These rules will also establish the procedures for public consultation for the implementation and preparation of the plans.

Article 10. The Ranger Corps will promote the awareness and compliance with the various laws and regulations, as well as technical and administrative requirements pertaining to the protection, preservation, and proper use of coastal resources. A Ranger Corps will be constituted to include the relevant personnel of institutions and agencies charged with applying legal and administrative procedures governing the use of coastal resources, integrating the efforts of these institutions within the geographical jurisdiction of every port captain. Each Ranger Corps will be coordinated by the port captain or by an official of the captaincy, as named by DIGMER. The functioning of the Ranger Corps will be determined by the internal regulations of the National Commission.

Article 11. Special area management zones are geographic areas within which the Program prepares integrated management plans. The following coastal areas are recognized as special area management zones:

a) In Esmeraldas, the zone Atacames-Sfia-Muisne;
b) In Manabi, the zone Bahia de Cardquez-San Vincente;
c) In Guayas, the zone Playas-Posorja-Puerto El Morro and the zone San Pedro-ValdiviaManglaralto;
d) In El Oro, the zone Machala-Puerto Bolivar-Isla Jambeli; and
e) In Galdpagos, a zone that will be delimited by the National Commission.

Article 12. The plans, programs, and proposals for each special area management zone, as approved by the National Commission, will be presented to the national planning agency CONADE, to be included in the National Development Plan and in its yearly operational plans.

Article 13. The assignment of local funds managed by the government for the operation of the Program and execution of projects will be included in General Budget of the State.

PROVISIONS REGARDING TRANSITION:

A new addendum to the Convenio of Technical Cooperation will be prepared to harmonize the requirements of this decree.

FINAL PROVISION. This decree supersedes Executive Decree 375, published in the Official Register of January 26, 1989, and any other orders contrary to this decree.

The implementation of this decree, which goes into effect upon its publication in the Official Register, is charged to the Ministers of Defense; Finances and Public Credit; Agriculture and Livestock; Industry, Commerce Integration, and Fisheries; and Energy and Mines.

Enacted in the Palacio Nacional, in Quito, June 1, 1992.

Signed by
Rodrigo Borja, Constitutional President of the Republic
Jorge Félix, Minister of National Defense
Pablo R. Better, Minister of Finance and Credit
Alfredo Saltos Guale, Minister of Agriculture and Livestock
Juan Falconi Puig, Minister of Industry, Commerce, Integration, and Fisheries
Rafael Almeida Mancheno, Minister of Energy and Mines

Certified by Gonzalo Ortiz Crespo, Secretary General of Public Administration.

INTERNAL REGULATIONS OF THE ECUADOR COASTAL RESOURCES MANAGEMENT PROGRAM

Official Register No. 2, August 12, 1992, No. 315

Gonzalo Ortiz Crespo, Secretary General of Public Administration, President of the National Commission on Coastal Resources Management

Considering:

That through Executive Decree No. 3 75, published in the Official Register 117 of January 26, 1989, the Coastal Resources Management Program was created;

That Article 1 of the decree states that the Program has as its purpose integrating government efforts for the preservation and development of the coastal resources in the provinces of Esmeraldas, Manabi, Guayas, El Oro, and Galapagos;

That Article 5 created a Technical Secretary for the Program as a unit of the General Secretary of Public Administration;

That Executive Decree 3399 of June 1, 1992, published in the Official Register of June 4, 1992, created a Coastal Resources Management Program (PMRC) as an entity within the Office of the President of the Republic, decentralized in terms of financial administration and with its seat in the city of Guayaquil;

That it is necessary to create a functional organizational structure for the program as an entity within the Office of the Presidency and, in using its legal powers,

Agrees:

To issue the following internal operating and functional regulations for the Coastal Resources Management Program:

TITLE I

THE NATURE AND PURPOSE OF THE PMRC

Article 1. The Coastal Resources Management Program of Ecuador is established as an entity within the Office of the President of the Republic, decentralized in terms of financial administration and with its seat in the city of Guayaquil. The Program has as its purpose the preservation and development of the coastal resources in the provinces of Esmeraldas, Manabi, Guayas, El Oro, and Galapagos.

Article 2. To carry out its objectives, the Program will

a) Formulate and execute the activities and projects with the participation of public and private entities, either directly or through convenios or contracts with the public and private sector;
b) Analyze the available information regarding the condition and use of coastal resources of Ecuador and identify the priority coastal management problems that the country must address;
c) Analyze the legal and institutional aspects of coastal resources management, and recommend strategies for improving cooperation and the implementation of existing laws and regulations;
d) Provide assistance in formulating policy and a strengthened administrative framework for coastal resources management;
e) Design a program of research directed at key issues and priority problems of coastal ecosystems; and
f) Improve the technical capability of personnel engaged in coastal resources management throughout Ecuador.

TITLE II

PROGRAM STRUCTURE

Article 3. The structure of the Coastal Resources Management Program consists of the following levels:

- Directorate level
- Executive level
- Advisory level
- Auxiliary or Support level
- Operational level

CHAPTER 1

PROGRAM STRUCTURE

Directorate Level

Article 4. The Directorate Level is composed of the National Commission on Coastal Resources, which consists of:

- The Secretary General of Public Administration, who will serve as president;
- The Minister of Defense;
- The Minister of Agriculture and Livestock (MAG);
- The Minister of Industry, Commerce, Integration, and Fisheries (MICIP);
- The Minister of Energy and Mines;
- The Secretary General of Planning of the National Development Council (CONADE); and
- The Executive Director of the Ecuadorian Tourism Corporation (CETUR).

The members of the Commission can assign permanent delegates, who will serve with the same obligations and authority.

The Executive Director of the Coastal Resources Management Program serves as its Secretary.

Executive Level

Article 5. The Executive Level consists of the Executive Director, who reports directly to the Secretary General of Public Administration.

Advisory Level

Article 6. The Advisory Level consists of the Direction of Legal and Technical Assistance.

Auxiliary or Support Level

Article 7. The Support Level consists of the Direction of Financial Administration.

Operational Level

Article 8. The operational level comprises the special area management zones, which are organized in the following manner:

• Management zone committees
• Coordinators of the Coastal Resources Management Program
• The Ranger Corps

a) The special area management committees will be constituted in the following manner:

1. Representative of the national forest agency (DINAF);
2. Representative of the land reform agency (IERAC);
3. Representative of the General Directorate of Fisheries;
4. Representative of the national tourism agency (CETUR);
5. Representative of the public sanitary works agency (IEOS);
6. Port captain who pertains to the zone;
7. President of town councils, or a delegate;
8. Prefect of the province, or a delegate;
9. Representative for each community in the zone;
10. Delegate from each environmental organization of the zone;
11. Delegate for primary education teachers; and
12. Delegate for secondary education teachers.

The coordinator of the zone will act as the committee secretary.

b) The coordinator of the special area management zone is a staff member of the Coastal Resources Management Program, whose work corresponds to the boundaries of each zone.

c) The Ranger Corps consist of the following members:

1. The port captain, who acts as coordinator;
2. The Chief of the Forest District;
3. The Provincial or Canton Inspector of Fisheries;
4. A delegate from CETUR;
5. A delegate from IERAC;
6. The Chief of Public Health for the Province, or a delegate;

and other administrative authorities with responsibility for coastal resources, whose seat is in the area of jurisdiction of the Ranger Corps.

TITLE III

CHAPTER I

FUNCTIONS

Directorate Level

Article 9. The National Commission on Coastal Resources Management is the highest level of authority. It formulates, guides, plans, directs, and implements the policies of the Coastal Resources Management Program.

Article 10. The functions of the National Coastal Resources Management Commission are to

a) Recommend national coastal resources management policies to the President of the Republic and to oversee compliance with these policies;
b) Approve the annual work plan and the budget and evaluate its implementation;
c) Approve the plans of the special area management zones (ZEMs);
d) Create, reduce, or expand the size of a ZEM, designate critical areas, and become involved in those areas to address ecological problems or use conflicts that urgently need management policies and administration;
e) Designate the Executive Director of the Program based on the nomination of the Commission President, as well as remove him/her as the case arises;
f) Determine the rules of establishment and functioning of the contracting committees of the Program;
g) Approve the administrative measures necessary for coordinated management actions in the coastal areas; and
h) Other tasks as they are assigned by the President.

The resolutions of the National Commission are obligatory on the public sector, and will be published in the Official Register.

The President of the National Commission has the following responsibilities:

a) Periodically inform the President of the Republic on the principal activities of the Program;
b) Convene and chair the meetings of the National Commission;
c) Promulgate internal rules, agreements, instructions, and other measures to implement the Executive Decree; arid
d) Other tasks as assigned by the President of the Republic.

CHAPTER II

EXECUTIVE LEVEL

Article 11. The Executive Director has the following responsibilities:

a) Administer the Coastal Resources Management Program and honor the agreements and contracts undertaken to carry out the work of the program, as delegated by the Secretary General of Public Administration;
b) Submit an annual work plan for the program and special area management zones for review by the National Commission;
c) Submit an annual budget for National Commission review;
d) Authorize spending to carry out the program and provide reports on expenditures;
e) Recommend and justify the creation or termination of the special area management zones to the National Commission;
f) Approve the annual operating plans for the special area management zones;
g) Assign and remove program staff according to personnel procedures;
h) Act as the Secretary to the National Commission; and
i) Other tasks as assigned.

CHAPTER III

ADVISORY LEVEL

The Direction of Legal and Technical Assistance

Article 12. The functions of the Direction of Legal and Technical Assistance are to

a) Provide legal advice to the Executive Director and program staff in all matters related to the application of laws and regulations that govern the Program;
b) Issue opinions on the actions that the Program undertakes, in accordance with laws and regulations;
c) Defend the Program in legal actions that it undertakes or becomes involved in;
d) Prepare decrees, regulations, agreements, convenios or contracts, and resolutions related to the work of the Program;
e) Advise the Executive Director on topics related to coastal resources management;
f) Coordinate with the preparation of the annual operating plans for the special area management zones;
g) Conduct technical and economic analyses on issues addressed by the Program and provide guidance and recommendations to the Executive Director;
h) Present monthly reports to the Executive Director assessing progress toward achieving the annual work plan, along with relevant conclusions and recommendations;
i) Compile, maintain, and make available the statistical data required for the operation of the program, including that of the Direction of Legal and Technical Assistance;

j) Work with the Executive Director to evaluate and follow up on the activities developed by the Program;
k) Participate in identifying and formulating specific projects that the Program needs to undertake to fulfill its mission;
1) Provide technical assistance to the special area management zone coordinators and communities in implementing specific projects and actions;
m) Coordinate and assist in the public education and training activities carried out by the Program;
n) Advise the Executive Director in preparing the annual operating plan; and
o) Carry out other tasks as assigned by the Executive Director.

CHAPTER IV

AUXILIARY OR SUPPORT LEVEL

The Direction of Financial Administration

Article 13. The functions of the Direction of Financial Administration are to

a) Organize, direct, and control the administrative and financial activities of the Program, in conformance with applicable laws;
b) Administer and supervise the proper functioning of financial systems, in accordance with the accepted practices and applicable laws;
c) Carry out the function of financial controller in approval of expenditures, including the review of their legality, nature, suitability, appropriateness, truthfulness, and availability of budget;
d) Maintain a current inventory of the vehicles, equipment, furniture, and other assets of the Program;
e) Prepare administrative and financial reports for the information of the Executive Director and other control units;
f) Prepare the annual budget of the Program in accordance with the requirements specified by the Executive Director;
g) Advise the Executive Director on administrative and financial matters that require a decision;
h) Enable the Program to conform with the requirements of the Law of Civil Service and Personnel Administration, the Law of Financial Control and Administration, Rules of the General Controller of the State, and other laws pertinent to the functions of the Direction;
i) Provide financial balances, status reports, and other reports required by the General Controller of the State;
1) Supervise the services of cleaning, maintenance, and protection of the offices and furniture of the Program;
k) Supervise the security, maintenance, and collection of Program documents, according to standard practices;
1) Control the use of vehicles, material, and equipment, in coordination with the technical units of the Program;
m) Manage activities related to human resources;
n) Maintain accounts of cash flow in the Program;
o) Organize, direct, control, and maintain up-to-date program accounts in accordance with legal requirements;
p) Maintain a system of internal rules and regulations related to the Manual of Government Accounting;
q) Provide data on account balances for the information of the Executive Director;
r) Refuse any payment orders that violate applicable law, or rules of the General Controller of the State; and
s) Comply with other functions established by law and assigned by the Executive Director.

CHAPTER V

OPERATIONAL LEVEL

The special area management zones

Article 14. Special area management zones are geographic areas within which the Program prepares integrated management plans. The following coastal areas are recognized as special area management zones:

a) In Esmeraldas, the zone Atacames-Súa-Muisne;
b) In Manabí, the zone Bahía de Caráquez-San Vincente;
c) In Guayas, the zone Playas-Posorja-Puerto El Morro and the zone San Pedro-Valdivia-Manglaralto;
d) In El Oro, the zone Machala-Puerto Bolívar-Isla Jambeli; and
e) In Galápagos, a zone that will be delimited by the National Commission.

Article 15. The role of the special area management zone (ZEM) coordinators is to

a) Prepare the annual operating plan and budget for the special area management zone;
b) Coordinate the work required to implement the programs and activities of the ZEM;
c) Supply the technical assistance in planning and implementation required for the ZEM committee;
d) Maintain permanent contact with the communities and people of the zone;
e) Coordinate and collaborate with regional groups in the ZEM;
f) Prepare a monthly report for the Executive Directorate regarding progress in completing tasks and other issues in the ZEM when necessary;
g) Participate in the internal meetings, workshops, and other activities organized by the PMRC;
h) Provide assistance to the Executive Director and Zone Committee in identifying, selecting, and preparing projects.
i) Carry out tasks assigned by the Executive Director, as well as tasks needed to implement mandates and resolutions of the National Commission;
j) Help organize Zone Committee and Ranger Corps meetings,, and advise on public education activities;
k) Represent the Executive Director of the PMRC in the ZEM;

1) Participate in PMRC meetings;
m) Promote and assist in the formation of resource user groups;
n) Analyze projects selected by the Zone Committee prior to their approval by the National Commission; and
o) Carry out any additional assignments given by the Executive Director in order to carry out the resolutions of the National Commission.

The zone committees

Article 16. The functions of the committees are to

a) Promote cooperation and coordination among public and private institutions, user groups, and communities;
b) Identify the coastal resources management problems in the zone;
c) Recommend to the Executive Directorate of the PMRC modifications and updates to the plans;
d) Assess the annual operating plan for the zone and make recommendations for its approval;
e) Designate commissions on special topics;
f) Promote the implementation of the annual operating plans in accordance with established goals for the zone;
g) Oversee public education and outreach activities in the zone;
h) Analyze coastal resource management issues, and serve as a mechanism for addressing them;
i) Make recommendations on steps to be taken to resolve coastal resource use conflicts;
j) Sponsor and recommend provincial and municipal planning and zoning projects, and resolutions of the National Commission on coastal resources management actions.
k) Incorporate new members and elect the President and Vice President of the Committee; and
1) Other functions within the scope of the Committee in benefit of the special area management zone.

The Ranger Corps

Article 17. The functions of the Ranger Corps are to

a) Promote the awareness and compliance with the various laws and regulations, as well as technical and administrative requirements pertaining to the protection, preservation, and proper use of coastal resources.
b) Ensure the proper use of coastal resources, in accordance with the management plan;
c) Inform resource users on the policies for conserving and protecting coastal resources;
d) Conduct outreach to make the public and resource users aware of the legal and judicial requirements of proper coastal resource use;
e) Apply sanctions in accordance with internal regulations on interagency coordination;
f) Assure the development and implementation of projects recommended by the zone committees;
g) Coordinate activities with local authorities, and the special area management zones, in order to achieve compliance with coastal resource conservation and management regulations; and
h) Other activities as required to assure the wise management of coastal resources of the special area management zones.

GENERAL PROVVISIONS

Article 18. This current regulation can be revised through resolutions signed by the President of the National Commission, with prior notice to the National Secretary of Administration Development.

FINAL PROVISION

Article 19. This resolution is effective immediately, without prejudice to its publication in the Official Register.

Signed in the Presidential Palace, in Quito, July 31, 1992.

Gonzalo Ortiz Crespo, Secretary General of Public Administration.

ANNEX III

Mariculture Strategy:
Summary of Findings and Recommendations

SUMMARY: AN INTEGRATED STRATEGY TO PROMOTE A SUSTAINABLE SHRIMP MARICULTURE INDUSTRY IN ECUADOR-FINDINGS AND RECOMMENDATIONS

INTRODUCTION

The following findings and recommendations are an attempt to extract an integrated management strategy from the papers presented in *An Integrated Strategy to Promote a Sustainable Shrimp Mariculture Industry in Ecuador*, the discussions at the Guayaquil workshop in August 1986, and subsequent discussions with governmental agencies and industry representatives in Ecuador. Only if progress is made simultaneously on a number of disparate fronts can the base for a sustainable shrimp mariculture industry in Ecuador be formulated. The priorities we recommend comprise seven elements:

1. Maintain water quality in estuaries and near hatcheries; low growth rates and occasional mass mortalities due to poor water quality are already problems for some hatcheries and growout operations. Development trends in coastal watersheds suggest further reductions in water quality are to be expected unless mitigating actions are quickly taken.

2. Protect and manage the wild shrimp stocks that provide the most abundant and cheapest sources of seed shrimp to the industry. This requires the protection of critical habitats, including mangroves, and safeguards against overexploitation by both the adult shrimp and postlarvae fisheries.

3. Implement strategic planning to maximize the long-term economic vitality of the industry. Tracking trends in the world shrimp markets, product quality control, and forecasting the impacts of declining water quality on the industry are all urgent priorities.

4. Overhaul and simplify the permit system governing the siting and operation of ponds and hatcheries.

5. Critically evaluate the impacts of national policy on the shrimp industry as it is applied through the Fisheries Law.

6. Initiate a targeted assistance program to promote information exchange within the industry.

7. Initiate a public education program to help build support for the measures needed to protect the environmental quality that the shrimp industry requires.

FINDINGS AND RECOMMENDATIONS

A. Declining water quality

Findings

Good water quality is critically important to the success of the cultivated shrimp industry as well as the protection of suitable habitats for juvenile shrimp. A number of development trends are working in combination to reduce water quality in Ecuador's estuaries and coastal waters. Increasing urban development, further industrial growth, and the losses of freshwater river discharge and greater agricultural production brought by dams are all expected to result in further declines in water quality in the years to come. Poor water quality is already having a negative impact on both the productivity of growout ponds and hatcheries. The available, albeit incomplete, data on water quality documents the presence of high concentrations of heavy metals and pesticides, the frequent occurrence of toxic red tides, and high concentrations of organics that cause 10w oxygen levels. Hatchery operators and growers report occasional mass mortalities that they attribute to contaminants in their water supply. Some growers are experiencing blooms of microscopic algae in their ponds and reduced growth rates may also be attributable to the poor quality of the water they pump from estuaries into their ponds.

Recommendations

1. A top priority should be to evaluate the many ongoing monitoring and baseline data collection programs and organize them into a sustainable integrated scheme for monitoring water quality in rivers, estuaries, and nearshore waters. This would be the first step in prioritizing problems and then tracing them to their sources. The integrated monitoring and research program that should emerge from this process must build upon existing institutions and not duplicate capabilities already in place.

2. The shrimp industry badly needs access to an in-country diagnostic laboratory capable of analyzing water samples for both hatchery operators and growers. Such a laboratory could be developed by building on one of the existing capably run and well-equipped laboratories operating in Ecuador.

3. Once the levels of pollution are known, steps must be taken to reduce contaminants known to have adverse impacts on the cultural shrimp industry and wild shrimp stocks. At present, the high priorities for immediate attention are pesticide residues, mercury, and the organic loadings from domestic sewage.

B. The shortage of postlarvae

Findings

Warm water temperatures in nearshore shrimp spawning grounds and the abundant material-rich runoff from the land that accompany periodic El Niño years bring enormous increases in postlarvae (PL) abundance. Thus, the abundance of PL brought by the intense El Niño of 1982-83 raised unrealistic expectations and spurred the overconstruction of ponds. The dry periods between El Niño years dominate, and the industry, if it is to be sustainable, must be capable of adjusting to cyclic patterns of high abundance interspersed with consecutive years of relative scarcity. During dry periods, a number of man-induced changes to the coastal ecosystem may reduce the abundance of PL. Since wild-caught PL will always be the cheapest source of seed for growers, and hatcheries are unlikely to offer an alternative source in sufficient volumes for many years to come, it is crucially important to minimize actions that will reduce PL abundance. These actions fall under two major headings: loss of habitat and overfishing.

Loss of habitat. Research conducted worldwide shows a strong correlation between the area of coastal wetlands and the size of the associate penaeid shrimp stocks. There is already widespread concern that the destruction of mangroves in Ecuador's estuaries must be halted, because this is known to be an important habitat for shrimp. Data compiled by the Center for Remote Sensing (CLIRSEN) document that 11 percent of the mangroves present in Ecuador in 1969 had been destroyed by 1984. Estimates that consider mangrove habitat, and not stands of mangrove trees alone, suggest that 25 percent of this habitat type has been destroyed. Data do not exist to evaluate whether 10w water quality in the upper reaches of Ecuador's major estuaries is making large areas of formerly important PL habitat unsuitable, but there is some evidence that suggests that some *esteros,* tidal inlets, are much more productive of shrimp PL than others.

Overfishing. The PL fishery has within a single decade expanded explosively to a massive effort involving as many as 90,000 artisanal fishermen who work ah areas of known abundance. Unfortunately, there are no systematic data on this fishery. We do not know the species composition of catches from different areas or during different seasons, or what proportion of the catches are of species not utilized by the growers. The fishery, however, is so large that it is capable of having an effect on the species structure and abundance of Ecuador's shrimp stocks.

It is known that mortalities between capture and acclimation to pond conditions are high. Fifty percent mortality is a likely overall average. This suggests that measures taken to reduce the mortality of the PL already being harvested could result in greater benefits in terms of increased productivity from the industry overall than any other single action.

Recommendations

1. The immediate priority is to reduce the mortality of the captured PL. A well-designed extension program could produce an immediate and significant increase in the numbers of PL available to stock ponds. The Coastal Resources Management Project, utilizing funds provided by the USAID Ecuador Mission, is moving immediately to work with the industry and the National Fisheries Institute (INP) to quantify the mortality associated with various handling methods and to implement an extension program for PL fishermen.

2. It should be assumed that the abundance of wild penaied shrimp stocks during dry years is directly related to area of wetland habitat. Every effort should therefore be made to encourage the effective enforcement of existing bans on the further destruction of mangroves and to safeguard conditions, such as adequate water quality, that make estuaries valuable habitat for juvenile shrimp. Protecting mangrove habitat, rather than mangrove trees alone, should be given careful consideration.

3. Ongoing studies at the INP that can lead to the identification of the most productive PL habitats should be expanded and accelerated. If particularly important habitat can be identified, it should be protected from both overfishing and biophysical forms of degradation.

4. Related studies should be conducted to produce data on the PL fisheries. The absence of such data makes it impossible to assess the impact of the PL fishery closures implemented in 1985 and 1986. It is also not possible, in the absence of data, to evaluate the optimal timing and location of closures or the likely benefits of other controls over the PL fishery. Given the magnitude of the fishery, however, any measures that reduce fishing effort can only have a beneficial effect on the stocks.

5. An urgent planning priority is to develop demonstration plans for the management of mangroves. It is not feasible to expect that there will be no further destruction of mangroves. Realistic and implementable management strategies that can accommodate the continuing utilization of coastal resources must therefore be developed. In addition, an assessment should be made of techniques to integrate mangroves into shrimp pond operations as a means of stabilizing dikes and alleviating water quality problems. Such techniques could benefit shrimp pond operators while simultaneously replacing lost mangrove habitat.

C. Management of wild shrimp stocks

Findings

Careful attention should be given to managing Ecuador's wild shrimp stocks, since these will continue to be the cheapest source of seed to the cultivated shrimp industry while simultaneously supporting an important trawler fishery. Catches of adult shrimp by the trawler fleet have been remarkably consistent for nearly a decade. However, the gradual increase in the number of vessels participating in the fishery has resulted in a very low catch per unit of effort. There have recently been significant changes in the species composition of catches that may possibly be related to large numbers of juveniles removed by the PL fishery. Data being compiled currently of the adult shrimp fishery are inadequate for evaluating the likely impacts of fishery management techniques.

Recommendations

1. The programs already underway at the INP with the support of the Mission Brittanica, should be built upon to provide the information needed to develop an integrated management plan for the shrimp fishery. The System of collecting catch data should be expanded. Studies should also be undertaken to determine whether there are distinct shrimp populations and to trace migration patterns. Fisheries data should be correlated with trends on such environmental variables as rainfalí and temperature. The management plan should be developed in close collaboration with the fishing industry. It should set clear objectives for management and consider the full range of management techniques, including closed seasons and grounds, and a limited entry program. This plan must be integrated with steps taken to protect prime PL habitats in estuaries.

2. The bycatch incidental to the shrimp trawler fishery produces volumes and sizes of fish that should be evaluated for better utilization, including export markets and a source of raw material for shrimp feed mills.

D. Measures to safeguard the economic vitality of the industry

Findings

Ecuador's success with shrimp mariculture is the envy of other countries hungry for foreign exchange and with land suitable for shrimp production. Ecuador can expect increasing competition in the future. Several nations in South Asia and Southeast Asia have long traditions in mariculture and are moving rapidly to expand their production of shrimp for export markets. It is also conceivable that technological breakthroughs could make shrimp production in controlled environments economically feasible in non-tropical countries. Although new producers must overcome numerous hurdles to develop the necessary infrastructure and establish markets, it is not unlikely that competition from growers in other countries could place Ecuadorian producers in a future cost price squeeze.

More than 90 percent of the shrimp currently produced by growers in Ecuador is exported to the United States. The industry now enjoys a reputation for consistently high quality. One discovery of contaminants in shrimp grown in Ecuador could jeopardize this market. The growing water quality problems in Ecuador, and the treatment administered to shrimp to counteract disease must be carefully monitored as possible sources of contamination.

It is currently impossible to monitor the economic health of the industry, because tile database is inadequate. It is not possible to trace trends, identify bottlenecks, or prioritize needs for extension services and research.

Recommendations

1. The shrimp growers, through one or more of their trade organizations, should monitor trends in world markets and be in a position to advise their members on developments in world production and markets.

2. The shrimp growers, working in association with government, should strengthen a program to monitor and certify the quality of all shipments of shrimp to foreign markets.

3. A program to gather and analyze basic economic data on the industry should be designed and implemented.

4. A study should be made of the economic impacts of present and potential future water pollution conditions on the cultured shrimp industry.

E. **Government involvement in the industry**

Findings

The existing permit system for granting concessions in government-controlled tierra baja and authorizing the construction and operation of shrimp ponds is highly complex and is a major expense for applicants in both time and money. One grower at the workshop commented, "It is far easier to successfully raise any variety of shrimp than to obtain the necessary permits. It is also not at all clear what benefits, in terms of protection of critical habitats, appropriate siting and constructive practices of safeguarding the public trust, accrue from the existing system." The complexity and expense of the existing system does explain why it has been ignored by many participants in the industry.

Shrimp mariculture is governed by a number of laws and governmental policies, the most important of which is the Fisheries Law. The laws were designed to govern activities that differ in many important aspects from the shrimp culture industry. The Fisheries Law favors large-scale, vertically integrated companies. It is questionable whether the application of this policy to the shrimp mariculture industry is in the best interest of either the industry or the nation. Current incentives to remote hatchery development may be ill-founded.

Recommendations

1. The permit system should be overhauled and greatly simplified. The first step should be to define the objectives for the system and then to design a process that assures the participation of the necessary governmental agencies in a coordinated and timely manner. A one-stop permit process would be preferable to the existing sequential approval process. The evaluation and disposition of permit applications should be based on criteria designed to minimize impacts on important habitats and foster good construction practices.

2. Governmental policies that shape the shrimp industry should be critically studied. It may be appropriate to consider legislation designed specifically to govern shrimp mariculture. In particular, policies designed to encourage large-scale, vertically integrated operations, and restraints placed by various regulations, should be re-examined. A diversified industry that includes a large number of small-scale businesses may bring greater benefit to Ecuador, and be better able to respond to changes in world markets than an industry dominated by a few heavily capitalized large operations.

F. Technical Assistance

Findings

The shrimp growers and hatchery operators working today in Ecuador are among the best in the world. The industry, however, has grown in a gold rush atmosphere and a number of adjustments must be made if it is to successfully stabilize. Generally speaking, there is good communication among hatchery operators and the best worldwide expertise is available to them. However, there is a real need for a carefully targeted extension and research program for the growers. Here, information exchange has been stifled by an atmosphere of intense competition and secrecy among growers. Priorities for extension include assistance in monitoring water quality and setting pumping rates, in feeding, and in the design of ponds.

Recommendations

1. An extension program targeted on specific aspects of shrimp culture should be designed and implemented in close coordination, and with the active support of, the industry. Such a program could be supported by a levy imposed on all exports.

2. Greater support should be given to the hatchery technician training program offered by the Polytechnic Institute of the Coast (ESPOL). The absence of trained personnel to operate hatcheries is an urgent problem that must be addressed.

G. Public Education

Findings

There is little appreciation among governmental officials and the public at large for the interrelationships among human activities that alter the environment and the quality of services that the environment can sustain. In the absence of an appreciation for these relationships, it will be difficult to obtain the public support necessary to make environmental management programs a success. A recurring theme at the workshop was the need for broad dissemination of information on the conditions and problems affecting the quality of the ecosystems that support shrimp mariculture. It was also frequently repeated that governmental policies and programs need to be prepared with great participation from those who will be affected, particularly when their cooperation is a prerequisite to the successful implementation of such policies and programs.

Recommendations

1. A commitment should be made to public education on environmental matters. It should be targeted on priority issues and seek to inform society at large on the need for controls over activities that degrade the resource base on which all depend.

NEXT STEPS

The effective implementation of an integrated strategy for sustainable shrimp mariculture will require both commitment and a concentrated effort on the part of the industry, government, and the research community. The planning, research, and policy development outlined here will also require a significant commitment of funds. However, much is already being done, and a major challenge lies in the coordination of existing programs and institutions. The Coastal Resources Management Project could, if judged appropriate by ah concerned, assume primary responsibility for coordinating the implementation of the initiatives proposed. This would include periodic evaluations of progress and re-examination of priorities with all the participants. Although shrimp mariculture is only one of the topics that the coastal management project must address, it is sufficiently important to justify a major commitment of funds and energy.

ANNEX IV

Proposal for a National Mangrove Ecosystem Management Strategy

ANNEX V

The User Group Agreement on

Coastal Resources Management
in the Atacames-Sua-Muisne ZEM

PROPOSAL FOR A NATIONAL MANGROVE ECOSYSTEM MANAGEMENT STRATEGY

1. A MANAGEMENT PERSPECTIVE ON MANGROVE ECOSYSTEMS

Mangrove ecosystems in Ecuador are composed principally of shrub and tree vegetation of five species of the *Rhizophera* (red), *Avicennia* (black), *Lagunculafia* (white), *Conocarpus* (mangle jell) and *Pelliciera* (pinuelo) genera. Mangroves grow in muddy, anaerobic soils that are periodically influenced by salt water from tides. They are both a source and a sink of energy, and are closely linked to other coastal ecosystems. Their ecological role and functioning includes recycling of nutrients; production of wood, leaves, and detritus; retention of sediments and erosion control; preservation of estuarine water quality; and habitat for wildlife.

2. FINDINGS ON MANGROVE MANAGEMENT IN ECUADOR

2.1 Mangrove ecosystems continue to provide essential services and benefits

Ecuador has 162,055 hectares (ha) of mangrove forest (CLIRSEN, 1992). Along Ecuador's coast, mangrove ecosystems are found in the estuarine zones of the river basins of Muisne, Cojimies, Chone, Guayas, Jubones-Santa Rosa-Arenillas, and the Mataje-Santiago-Cayapas system.

Coastal communities have a wide range of uses for these mangrove systems:

The shrimp mariculture sector-with 160,000 ha of ponds that produce 115,000 metric tons of shrimp for export annually-depends on the water quality of the estuaries and the continuing supply of 7.65 billion to 8.93 billion shrimp postlarvae each year. (Chua and Kungvankij, 1991). Water quality and the supply of postlarvae are closely linked to the functioning of mangrove ecosystems, which serve as nursery grounds for shrimp and other valuable shellfish, as well as a provide a mechanism for keeping estuary water clean.

Mangrove trees are harvested to supply posts and pilings for construction of buildings, piers, bridges, and houses in flood-prone areas-especially in the area of the SantiagoCayapas and Mataje rivers in northern Esmeraldas province, which until now has seen the lowest rate of mangrove loss.

Mangroves from the Gulf of Guayas have provided wood for construction of houses for about 300,000 poor people in the urban barrios of the sprawling coastal cities of Guayaquil and Machala.

Throughout the coast, mangrove wood is used for furniture, charcoal, and firewood.

Coastal fishers who supply much of the seafood available in the country also depend on the mangrove ecosystem for crabs, shellfish, shrimp, and finfish.

Mangroves play a vital role in the ecological functioning of estuaries.

2.2 The legal and administrative framework for mangrove management is inadequate for carrying out effective measures against destructive mangrove uses. It does not provide sufficient leadership to promote sustainable use practices and conservation.

An examination of Ecuadorian environmental legislation reveals a collection of overlapping, contradictory laws and rules that serve as obstacles to effective management actions by the agencies that have some jurisdiction over mangrove forests.

The judicial and administrative structure for managing natural resources remains sectoral. This prevents the emergence of an integrated approach to mangrove management, and interferes with coordination of governance efforts. For example, the Subsecretary of Fisheries has jurisdiction over the harvesting of aquatic resources; the Hydraulic Resources Institute controls the use of fresh water to estuaries; the Ecuadorian Institute of Sanitation Works, as well as local municipalities and cantons, regulate solid waste and wastewater disposal. Each has a role to play in mangrove management, yet they find it impossible to join forces. Water quality for fisheries and marine species is affected by solid waste and water discharges from urban centers, the degree of wastewater treatment, and the harvesting practices in upland and mangrove forests.

It is also easy to see the impact of confusion caused by overlapping jurisdictions and responsibilities for mangrove law enforcement. Legal rules and tile policies of the sectoral agencies often do not agree and there is a low level of awareness and support for environmental protection. As a result, enforcement efforts are disorganized and ineffective. Natural resources management in Ecuador is carried out through the National Development Council and individual ministries that set national policy. The Ministry of Agriculture issued Ministerial Agreement 498 in 1986-which classified mangroves as a protected forest resource-without taking into consideration the traditional uses of mangroves by coastal residents. There was no local

participation in the design or implementation of this policy. In one step, the ministry transformed traditional mangrove uses into criminal acts. People who benefit from the sustained flow of goods and services provided by the mangroves became outlaws.

During the growth of shrimp mariculture, a large portion of mangrove ecosystems were converted into shrimp ponds. The majority of these investors are not local residents and can easily pay the small fines imposed for mangrove cutting. They can also obtain concessions. In many cases, this economic activity has deprived coastal communities, and the country as a whole, of a commonly held and used resource. Local resource users have had a limited capacity and low interest in addressing this issue. More recently, the loss of mangroves is becoming an increasing source of social conflicts as access to mangrove areas for harvesting for fish and wood is cut off by shrimp farmers. The work of the PMRC in the special area management zones (ZEMs) has helped user groups get established and become actively involved in monitoring and protecting local resources.

Existing government agencies with responsibility for mangrove protection have little administrative capacity to carry out their mandates, lacking personnel, budget, and equipment. For example, the National Forestry Institute (INEFAN), responsible for the management of Ecuador's 162,000 ha of mangrove forest, has only 10 part-time persons to carry out its control functions.

A review of the different mangrove estuaries reveals different rates of deforestation. The management situation varies dramatically among sites. For example, the Churute Mangrove Reserve has received the greatest attention from INEFAN, which has assigned seven full-time staff, vehicles and boats, an information center and patrols, with the result that mangrove loss has been only 4.3 percent since 1969. In the inaccessible reaches of the San Lorenzo-Mataje area in the northern coast, the losses to date have been less, only 3.5 percent. However, where shrimp mariculture dominates the landscape, such as the Rio Chone near Bahía de Caráquez, loss exceeds 80 percent. The following table illustrates the situation for the period 1969 to 1991, as reported by the Center for Remote Sensing (CLIRSEN).

Zone	Conversion rate (percent)
San Lorenzo	3.5
Atacames	69.5
Muisne	59.0
Cojirnies	51.3
Bahía	80.3
Posorja	10.9
Estero Salado	12.0
Taura	12.0
Churute	4.3
Naranjal	25.1
Jambelí	52.8
Hualtaco	25.5

2.3 The PMRC experience demonstrates that agreements among local resource users and a clear vision of the desired condition for maintaining a mangrove forest are essential ingredients for promoting effective management within the strong pressures for exploitation.

Since 1986, the government of Ecuador has worked, through the PMRC-in conjunction with national authorities and the private sector, as well as with international assistance-to introduce new perspectives and practices for mangrove management.

Three Ranger Corps units have been created after the publication of Executive Decree 375 in 1989, whose operations coincide with the port captaincies of Puerto Bolivar (El Oro province), Bahia de Caraquez (Manabi province), and Esmeraldas (Esmeraldas province).

The Ranger Corps comprises the officials of agencies with jurisdiction over mangroves and other coastal resources, principally the Navy (DIGMER), INEFAN, the Subsecretary for Fisheries, and the National Tourism Corporation (CETUR). To promote compliance with coastal management laws, the Ranger Corps has fostered dialogue among user groups, worked to solve site-specific conflicts, and signed user group agreements to manage specific coastal areas.

In 1989, five special area management zones, ZEMs, were created, one each in Esmeraldas, Manabi and El Oro, and two in Guayas.

To carry out the work in each ZEM, executive and advisory committees were formed, the first made up of local and regional authorities, and the second of representatives of user groups and communities. Recently, as a result of Executive Decree 3399, these two groups were combined into one group, the zone committee.

In the ZEMs, small projects on integrated coastal management, called practical exercises, were carried out. These included projects in mangroves, such as passive recreation facilities for Atacames, Bahia, and Jambeli; reforestation in Muisne; shellfish production in Bunche; and managing mangroves for energy production in Muisne.

The public education program has emphasized the theme of mangrove management, and has built awareness among user groups and citizens to respect and value coastal resources and become aware of measures needed to protect coastal ecosystems and to adopt sustainable resource use practices.

About 200 user groups have been organized in the ZEMs, which include about 6,000 to 8,000 individuals, including shrimp larvae fishers, fin and shellfishers, shrimp farmers, tourism promoters, and artisans. These groups represent a potential capacity for participants to carry out stewardship actions in the ZEMs that is many times greater than that of the sectoral ministries assigned to manage the coast.

The results of the PMRC experience show that it is feasible to generate awareness and engage local groups and communities in mangrove management, as well as to establish collaboration and voluntary compliance with mangrove management programs. The PMRC has also shown how to create an effective approach to planning and local monitoring of resource use, and to develop tools such as user group agreements, which have great potential for giving a voice to the growing social desire to participate in solutions to mangrove management problems

3. NATIONAL POLICY PROPOSALS POR MANGROVE ECOSYSTEM MANAGEMENT

Policy 1. **Mangroves shall be managed for multiple uses in a manner that preserves the resource base.**

Explanation

This policy is aimed at reversing the depletion-oriented use of mangroves promoting integrated, multiple-use management instead.

The purpose of integrated management is to maintain the resource base in a way that provides a continuing flow of benefits and services for future generations. As a result, use patterns and practices must be linked to the capacity of each system to support such levels.

The method for managing mangroves must consist of an integrated use of legal and institutional means. It is essential that adequate financial and human resources are made available to promote a social awareness and consensus when decisions are made and implemented, and in carrying out rehabilitation projects. Continuing evaluation of progress is also needed to continually improve the management effort.

Use categories for mangroves

The national policy on mangrove ecosystems recognizes three types of uses:

(1) Acceptable forms of mangrove use include

- Establishing protected areas, such as national parks, ecological reserves, and sanctuaries for flora and fauna;
- Honey production;
- Passive recreation; and
- Protection from flooding and other natural hazards.

(2) Traditional uses by local groups, along with facilities needed to conduct those uses as specified in municipal ordinances or management plans. Examples include

- Infrastructure for ecotourism and education;
- Restoration and rehabilitation of mangrove forests;
- Siting of facilities that must be located in the coastal zone (when there is no other reasonable siting option); and
- Harvesting of mangrove wood under silviculture plans in areas assigned for this use.

(3) Unacceptable uses, or activities permissible only when a public benefit is clearly demonstrated include, but are not limited to

- Fill for urbanization and housing construction;
- Infrastructure for cultivation of shrimp or other species;
- Destructive forms of wood harvesting; and
- Construction or projects causing physical changes in the environment that impede the normal flow of water, or that have serious impacts on the growth or size of the forest or other elements of the mangrove ecosystem.

Indicators of success

- Reduction in the rate of mangrove cutting and recuperation of previously damaged areas.
- Positive evaluations of the structure of mangrove forest and related ecosystems.
- Outcomes of the user group agreements, stewardship concessions, and site-specific management plans, in terms of the extent and condition of the mangrove ecosystem,
- Results from reforestation and restoration projects.
- Increase or recuperation in the fauna typically associated with mangroves, and ecosystem productivity.
- Increase in income and food supply for local families and user groups.
- Outcome of specific mitigation measures required to address problems resulting from mangrove disturbance.
- Continuous monitoring and evaluation of mangrove management efforts, and dissemination of the results.

Policy 2. **Comanagement initiatives will be undertaken to develop plans for specific mangrove forests, estuaries, and critical areas, taking into account the unique conditions of each site.**

Explanation

The central objective is to implement mangrove management with the active participation of citizens, user groups, and authorities, in decision-making as well as day-to-day management actions. The primary benefit of this approach is to fully engage local communities in sustained management, together with government authorities responsible for mangroves.

The method of work is based on interagency coordination, and on strengthening the capacity of both agencies and municipalities. At the local level, it is necessary to establish planning techniques that specifically determine acceptable uses. At the same time, it is essential that the competent authorities facilitate the design and approval of management schemes for each estuary, and ensure that legal and administrative measures are used to carry the plans out.

Measures that can be used to carry out this policy include

- Preparation of plans for areas under protection;
- Implementation of the actions already adopted in the five ZEM plans;
- Study of the environmental impact of infrastructure projects in the watersheds of mangrove estuaries;
- Exercising care in the renewal of concessions for the use of the beach and bay zone, especially for mariculture operations;
- Preparation of municipal ordinances, user group agreements, and government decisions on site specific cases;
- Authorization of concessions for managing mangroves for purposes such as wood production, fisheries, recreational use;
- Establishment of buffer zones, reserves, and other measures needed to protect a mangrove area; and
- Action plans to orient the work of the Ranger Corps in the issue of mangrove conservation.

The frame of reference for reaching the objectives of this policy, and the management actions for specific estuaries, has to include both environmental and social considerations. The recommended approach for accomplishing this includes

- Identifying and characterizing management areas;
- Developing a procedure to build awareness and consult with user groups and authorities when a plan is being developed or a decision being made;
- Establishing goals, policies, and actions that meet local needs and priorities;
- Building and strengthening local capacity for resolving mangrove use conflicts; and
- Selecting variables to monitor progress in carrying out projects and in the impact of decisions.

The National Commission on Coastal Resources Management is charged with approving policies, plans, and projects for mangrove ecosystem management, and will address how to promote and manage project preparation and implementation.

Indicators of success

- The level of awareness and understanding of resource users, the coastal population, and authorities regarding the value and appropriate uses of mangroves.
- The distribution and availability of basic information about mangroves and about local action plans adopted by the government.
- The number of people participating in groups or management projects.
- The use of citizen comments and perspectives in decision-making.
- The role of user groups in evaluating and following up on management actions.

Policy 3. **Strengthen the Ranger Corps.**

Explanation

The control and monitoring of resource use, along with the enforcement of management laws and regulations, are the responsibility of competent authorities acting in an integrated manner through the Ranger Corps. In areas where a ZEM exists, these oversight functions will be carried out in cooperation with the zone committee. This involves active participation in assuring that the ZEM plans are carried out, and in preparing the site-specific actions included in the plans.

The approval or renewal of use concessions in mangrove areas must be consistent with the ZEM plans which have been approved by the National Commission on Coastal Resources Management. The zone committees in each ZEM can assess and recommend management and conservation actions, for example in the renewal or licensing of shrimp pond construction or other facilities within or adjacent to mangroves. To guide decisions, the zone committees must use studies of the condition of mangroves and knowledge of the permits and installed mangrove facilities.

The administrative mechanism for every site-specific mangrove plan needs to include a coordination and consultation system that incorporates regional authorities such as INEFAN, DIGMER, and SRP, and local authorities such as the municipality and parish. For example, the Ranger Corps in a particular management area should include implementation of the site-specific plan as part of its own annual operating program.

It is also necessary to have an effective procedure for decision-making on whether proposed uses of mangroves in a site are acceptable, for formulating an estuary management plan, for promoting social agreements to accompany official policy declarations, and for providing free access to information.

Indicators of success

- Development of annual work plans for the Ranger Corps, including tasks, equipment needs, and joint operations with member agencies.
- Level of training achieved by Ranger Corps personnel in mangrove management projects and tasks.
- Extent of outreach, training, and extension activities in the communities, and the degree of organization and planning for critical estuaries.
- Patrols, inspections, authorizations and renewals issued, approval of management plans, and the involvement of the PMRC and municipalities in Ranger Corps activities.
- Quality of relations between the zone committees, PMRC offices, and the Ranger Corps. Implementation of recommendations made by the zone committees.

Policy 4. **Maintain an administrative framework for mangrove ecosystems that is transparent, and keeps information available and open to the public, and to resource users.**

Explanation

The National Commission on Coastal Resources Management will assure that there is a regular flow of information on progress in mangrove management, on the condition and use of mangrove ecosystems, and on the preparation and enforcement of strategies and decisions on particular cases. In the same manner, the commission will solicit the opinions and concerns of users and people who live near mangrove areas or who depend on the resource for their sustenance, before making decisions on adopting a management plan or regulations.

The steps for implementation of this policy include

(1) Adopting rules and regulations for approving mangrove ecosystem management plans. These rules will be developed through consensus of the authorities that have jurisdiction over the areas and resources. The rules will be published through resolutions of the National Commission, in the form of interministerial agreements.

(2) Management plans for specific areas will include the following elements:

- Detailed design of the categories of use cited in Policy 1 for the area in question. This includes description of the existing condition and use, the changes hoped for through plan implementation, and the indicators to be followed in evaluating progress in carrying out the plan;
- Definition of the responsibilities of each management entity at the national and local level, and of the implementers of the specific plan or project involving use of the ecosystem;
- In places that have an integrated coastal resources management plan approved by the National Commission, such as the special area management zones, new mangrove management proposals must be consistent with the ZEM plan, and should be prepared in consultation with the zone committee prior to presentation to the National Commission;
- In mangrove management plans prepared for sites outside the ZEMs, the National Commission will adopt methodologies that assure local participation and the full integration of authorities into carrying out and monitoring progress in mangrove management actions. This will require the collaboration of the Ranger Corps;
- With respect to mangrove restoration plans or other ecosystem rehabilitation activities, the PMRC will provide technical staff or the assistance of its technical working groups to define the technical elements needed for a site-specific plan; and
- Multiple-use management projects or other actions that a sectoral agency approves must be consistent with the rules and policies of the National Commission on Coastal Resources Management.

THE USER GROUP AGREEMENT ON COASTAL RESOURCES MANAGEMENT IN THE ATACAMES-SÚA-MUISNE ZEM

1. INTRODUCTION

The special area management zone of Atacames-Súa-Muisne of the Ecuador Coastal Resources Management Program, under the national coastal resources management strategy of the nation; the Ranger Corps, led by the port captain of Esmeraldas, and including the Forest District of Esmeraldas, the Direction of Fisheries of Esmeraldas, the Provincial Office of the Corporation for Tourism in Esmeraldas; and the users of coastal resources in the ZEM, represented by:
Atacames Tourist Operators
Fisheries Cooperative of Atacames
Environmental Sanitation Committee of Atacames
Food Vendors Precooperative "l5th of October"
Artisans Association of Atacames
Coral Artisans of Atacames

Association of Caipiriñeros "Playa Viva" of Atacames
Association of Hotel Owners of Súa
Fisheries Cooperative of Tonchigue
Fisheries Cooperative of San Francisco
Development Committee of Tonchigue
Fisheries Association of Galera
Association of Residents of Galera
Fisheries Cooperative of Quingue
Association of Residents of Quingue
Association of Resource Users of San Francisco
Association of Farmers of Bunche
Fisheries Association of Bunche
Larvae Fishers Cooperative of Bunche
Larvae Fishers Association of Bunche
Shellfishers Association of Bunche
Development Committee in Defense of the Resources of Bunche
Charcoal-makers Association of Muisne
Women's Committee for the Development of Bellavista Barrio, Bunche
Ecological Foundation of Muisne
Artisanal Fishing Cooperative of San Gregorio
Committee of the Campesinos of San Gregorio

meet together today, Thursday, February 14, 1992, in the canton of Atacames, province of Esmeraldas, to sign the following user group agreement with the purpose of achieving sustainable use and management of the natural resources of the ZEM, which consists of the following elements:

2. ELEMENTS OF THE AGREEMENT

1. Before the Spanish conquest the aboriginal populations residing in the coastal zone of what today is called the ZEM Atacames-Súa-Muisne used the benefits and services provided by the natural environment in a careful manner, which permitted them to maintain a permanent source of sustenance for their families and their society.

This form of relationship of society and nature was based on a wise comprehension on the part of aboriginal communities that the ability of the natural resources to support their society depended directly on how they managed their own use of these systems.

2. With the passage of time, little troubled these people. They were completely secure that the future of their families could be sustained, and could always count on an adequate natural resource base. Our forebears thought about us.

3. It is understandable that centuries later the residents of these locations still had abundant resources to sustain them. Crabs, shellfish, fish, wood, and fruits remained plentiful. Various records indicate that the life in these villages was pleasant; in the winter the crabs left their burrows, and one could simply grab them by their large pincer in order to catch and eat them.

4. Today, things are different. We use resources based on another concept altogether. We have come to think that the land, the rivers, and the sea are an infinite source of production and we exploit them rapidly. We have the outlook of consumers. We want to accumulate wealth. This is a pursuit in which we all are involved.

5. We exploit resources full-time, we improve our harvesting methods and techniques, and perhaps we do not understand the full magnitude of what we are doing. In many locations, there is now evidence of irreversible environmental damage, which calls into question future hopes of maintaining supplies of seafood and farm products. It is certain that we are thinking the opposite way of our forebears: We do not consider the needs of future generations.

6. It is time to think about and understand that in today's world, population is growing rapidly, cities and population centers of the children of our children will have many more inhabitants (each year the world grows by another 110 million people), and these places will need far more resources than we do at present to maintain progress in health, nutrition, housing, and energy.

7. A brief look at the coastal resources of the ZEM and their capacity to produce benefits and services provides us with some alarming facts:

- Mangrove forest area has declined considerably, and the presence of large trees has diminished practically to extinction, along with the number of plant species found within these mangroves.

- The population of crabs has been decimated. Today they are much smaller and scarcer. To collect a string of crabs, it now takes almost half a day of work, whereas in the past it took little time to collect that amount. This is because we have destroyed their caves and burrows, we overexploit them, and thus interfere with their ability to reproduce and grow.

- Reptile species have disappeared. Who can bring back the crocodile? Many of us and our descendants know them only from photographs and drawings.

- Estuaries, where the rivers discharge to the sea, are the habitat of fish, shellfish, crustaceans, and many other forms of life, and are capable of producing an abundance of benefits through a harmonic relationship with river and sea. Now, we contaminate these with every sort of waste (trash, plastic, petroleum, gasoline, diesel fuel, pesticides, dead animals) and alter the physical and chemical balance that affects the organisms who need a clean and healthy estuary.

- Our young people do not know of things that only their parents or grandparents can remember, for example dried *lisa* is no longer an ingredient of tapao, a typical food of this area, and all because the fish is now difficult to find. Before, you could quickly catch enough *lisa* for the family at the nearest location.

- We build everywhere along the beach, we occupy the beaches and fill them with many foreign objects (bottles, plastic, wood, trash) until we have forgotten that turtles, clams, and snails live there. We do not understand that the beach is a place for the inexhaustible regeneration of life as well as for human recreation.

- We view coral as a personal decoration, but at the cost of destroying it as an aquatic lifeform. We know very little about coral, and perhaps we will exploit it to extinction as we have many other life forms, and will never understand its existence.

- We spent thousands of years wisely using forests, but in less than 500 years we have virtually destroyed them. Today there is very little forest left.

- We have complicated things a great deal. We have lost the best soils from erosion, the ability of the land to support farming has declined, drought is common in many places, sediments have entered and altered the rivers, wood is now scarce and the woodland wildlife virtually nonexistent. In the summer, floods are now common.

- All this evidence clearly demonstrates that we have altered the functions and ecological role of the forest. The vegetative cover no longer provides shelter or food for animal life, does not provide us with enough wood, does not protect the soil, and can no longer regulate the hydrologic cycle.

8. In our hands is the responsibility to improve all that we have damaged if we can understand the need to manage resources in a prudent and integrated way.

Authorities and users, working together to apply practical policies, can develop positive action in the direction of sustainable management of the resources of the ZEM.

9. Reversing the tendency to take an exploitative approach to resource use, and promoting integrated management is a viable path to solving the problems we face. Thinking about future generations obligates us to manage resources for sustainable productivity. We do not own these resources, we have inherited them from our ancestors and must pass them in better shape than we received them to our children.

10. In January 1989, the national government established the Coastal Resources Management Program, which represents an integrated strategy for governing coastal resources. In working on the issue of mangrove management in the ZEM, the PMRC has put forward an approach based upon the following policies and principles:

(a) Avoid the conversion of mangroves into other uses.
(b) Develop the possibilities for multiple uses of mangroves without significantly altering the vegetative cover.
(c) Regenerate degraded mangrove areas.

3. AGREEMENTS AND INSTITUTIONAL ARRANGEMENTS

1. The following institutions play a role in managing the coastal resources of the Atacames-SúaMuisne ZEM:

Ministry of Agriculture and Livestock (Subsecretary of Renewable Forestry Resources, and the Institute for Agrarian Reform)
Ministry of Defense (General Directorate of the Merchant Marine)
Ministry of Industry, Commerce, Integration, and Fisheries (Subsecretary of Fisheries)
Ecuadorian Corporation for Tourism

all of which are members of the Ranger Corps, agree

a) To develop a coordinated effort within the framework of integrated management for the coastal zone, and maintain permanent relationships with the communities and user groups for the implementation of plans for the sustainable management of natural resources; and

b) To permanently support the faithful implementation of this user group agreement.

2. The community organizations and user groups identified in the introduction of this document resolve to coordinate activities among themselves and with the Esmeraldas Ranger Corps to properly manage the coastal resources of the ZEM and follow the implementation of existing agreements.

3. To achieve the conservation and multiple use of the coastal resources of the ZEM, related to exploitative and nonexploitative uses, it is agreed that

a) Areas of existing shrimp farms will not be enlarged, in order to avoid irreversible degradation of the environment and to enable mariculture activity to remain within the levels of sustainable production.

b) The areas of mangroves located in the courses of the rivers Tortuga, Bunche, Barro and Muisne, which have been mapped, as well as marked on land, will be assigned for uses including the reproduction and growth of shellfish, along with areas in which the shellfish collectors can carry out their management and harvesting activities.

c) Certain areas of mangrove located in Satinga, Barro, Congal, Tortuga, and Ostional, which have been mapped and marked on land, are assigned for harvesting of trees for the production of charcoal and firewood. This activity will be managed through specific silviculture plans.

d) The areas of mangrove located in Ostional, the island of Muisne, and the estuary of the Atacames River, as mapped, and marked on land, are assigned the use of passive recreation, and will be governed through specific management plans.

e) The areas of mangrove located on the edges of the intertidal zone in the estuaries of the rivers Atacames, Tonchigiie, San Francisco, Bunche, Vilsa, Barro, Tortuga, and Muisne, will be protected as habitats for fish and shellfish.

f) The intertidal zones of the rivers Atacames, Tonchigue, San Francisco, Bunche, Vilsa, Barro, Tortuga and Muisne, as mapped and marked on land, will be conserved for the collection of shrimp postlarvae.

g) The areas of mangrove located in Bunche, San Francisco, San Gregorio, and El Roto, as shown on maps and marked on land, are reserved as areas of research and scientific investigation.

h) The zones located between upland and the mangroves of Atacames, San Francisco, and San Gregorio, will be conserved for the reproduction and growth of blue crabs. Management programs will be implemented for these sites.

i) All areas that have been cut so extensively that the vegetative cover is lost will be reforested, under the guidance of reforestation plans. These areas are mapped and marked on land.

j) The user groups and communities signing this user group agreement promise to contribute to efforts to stop the cutting and devegetation of mangroves; to conserve and manage the quality of estuaries and rivers in the ZEM; to protect native and migratory birds that are threatened, rare, and in danger of extinction in the ZEM; to conserve the stocks of species of flora and fauna in the ZEM; and in general to protect critical habitat of land-based flora and fauna. In addition, the organization of charcoal makers promises to manage the areas assigned for its activities under silviculture plans.

k) The present user group agreement will be carried out in a framework of equality and respect among the different signature organizations to avoid conflicts among users.

1)The user groups promise to strengthen their organizations to help the strategy for integrated coastal management of the ZEM, and to help the efforts of the Ranger Corps of Esmeraldas to implement this agreement.

4. GENERAL CONSIDERATIONS

The distinct agreements established in this document will be monitored by the zone committee and the entities that are represented in that body, in order to learn from the experiences in implementation and to make improvements to institutional arrangements as they become necessary.

The Coastal Resources Management Program will provide technical assistance irl designing the management plans called for in this agreement and will coordinate its actions with the signatories to this document.

Signed in Atacames, February 14, 1992.

REFERENCES

Ander-Egg, E. and M. Aguilar. 1991. How to Do a Project: A Guide to Designing Social and Cultural Projects. Institute of Applied Social Sciences, San Isidro, Argentina. Reprinted by the Fundación Pedro Vicente Maldonado, Guayaquil, Ecuador. [Spanish]

Ayon, H. 1988. *Major Geomorphological Characteristics of the Ecuadorian Coast.* Ecuador Coastal Resources Management Program, Guayaquil, Ecuador. [Spanish]

Blanchard, J. 1993. *Natural Regeneration of* Rhizophora *Mangle in Northwest Ecuador*. Final report to the Coastal Resources Management Program. University of Florida, Gainesville, Fla.

Bodero, A. 1993. Mangrove ecosystems of Ecuador. In: L.D. Lacerda (coordinator). *Conservation and Sustainable Utilization of Mangrove Forests in Latin America and Africa* Regions. IIO TS-13, Vol. I. International Society for Mangrove Ecosystems. International Tropical Timber Organization, Okinawa, Japan.

Boothroyd, J., H. Ayon, D. Robadue, J. Vasconez, and R. Noboa. 1994. *Shoreline* Characteristics and Management Recommendations for the Coast of Ecuador. Coastal Resources Center, University of Rhode Island, Narragansett, R.I.

Bravo, M. and W. Abarca. 1995. The cockle fishers of Ecuador, trapped between environment degradation and poverty. *Coastal Zone '95*. American Society of Civil Engineers, New York. Pp. 209-210.

Cámara de Productores de Camarón. 1989. *Shrimp White Book.* Cámara de Productores de Camarón, Guayaquil, Ecuador. [Spanish]

Cámara de Productores de Camarón (1993). *Guide to the Shrimp Mariculture Sector 93-94*. Cámara de Productores de Camarón, Guayaquil, Ecuador. [Spanish]

Chua, T.-E. and P. Kungvankij. 1991. *An Evaluation of Shrimp Culture in Ecuador and a Strategy for Its Development and Diversification*. Coastal Resources Center, University of Rhode Island, Narragansett, R.I.

Chudy, J., E. Arniella, and E. Gail. 1993. *Water Quality Assessment in Ecuador*. U.S. Agency for International Development Water and Sanitation for Health Project. Report No. 390. Camp, Dresser, and McKee, Arlington, Va.

CLIRSEN. 1992. *Trends in the Area of Mangrove Forest, Shrimp Farms, and Salt Flats on the Coast, Using Remote Sensing Information*, 1991. Technical Report of the Cooperative Project of DIGMER-PMRC-SRP-CLIRSEN. Quito, Ecuador.

Coastal Resources Management Program. 1992. *Atacames-Súa-Muisne Special Area Management Plan.* Ecuador Coastal Resources Management Program, Guayaquil, Ecuador. [Spanish]

Coastal Resources Management Program. 1992. *Bahía de Caráquez-San Vicente-Canoa Special Area Management Plan*. Ecuador Coastal Resources Management Program, Guayaquil, Ecuador. [Spanish]

Coastal Resources Management Program. 1992. *Machala-Puerto Bolívar-Isla Jambelí Special Area Management Plan.* Ecuador Coastal Resources Management Program, Guayaquil, Ecuador. [Spanish]

Coastal Resources Management Program. 1992. *Playas-Posorja-Puerto El Morro Special Area Management Plan*. Ecuador Coastal Resources Management Program, Guayaquil, Ecuador. [Spanish]

Coastal Resources Management Program. 1992. *San Pedro-Valdivia-Manglaralto Special Area Management Plan.* Ecuador Coastal Resources Management Program, Guayaquil, Ecuador. [Spanish]

Cobb, L., S. Coello, and D. Silimperi. 1993. Population, Cholera, and the Estuaries of Guayaquil, Ecuador,

1991-1993. Presented to the 1993 Conference of the National Council for International Health, Washington, D.C., June 22, 1993.

Coello, S., J. Rosero, N. Gaibor, M. Bravo, P. Flores, and M. Altamirano. 1995. Principles for the management of the shrimp postlarvae fishery in Ecuador. *Coastal Zone '95*. American Society of Civil Engineers, New York. Pp. 230-232.

Coello, S., D. Proaño-Leroux, and D. Robadue. 1993. Special Area Management Planning in Ecuador's Rio Chone Estuary. In: J. Sorenson, F. Grable, and F. Bandarin (eds). American Society of Civil Engineers, New York. Pp. 78-94.

Department of Environment and Natural Resources, Government of the Philippines. 1991. *Policy Guidelines for the Award and Administration of the Mangrove Stewardship Agreement*. Department Administrative Order No. 03, Series 1991.

EPA Reconnaissance Team. 1994. *Report of Recommendations to the Government of Ecuador* Concerning the "Taura Syndrome." U.S. Environmental Protection Agency, Washington, D.C.

Epler, B. 1993. *An Economic and Social Analysis of Tourism in the Galapagos Islands*. Coastal Resources Center, University of Rhode Island, Narragansett, R.I.

Epler, B. and S. Olsen. 1993. *A Profile of Ecuador's Coastal Resources*. Coastal Resources Center, University of Rhode Island, Narragansett, R.I.

Fast, A.W. and L.J. Lester. 1992. *Marine Shrimp Culture: Principles and Practices*. Elsevier Press, Amsterdam.

Goethert, R. and N. Hamdi. 1992. *Microplanning: A Process for Community-Based Programming and Development*. World Bank Institute for Economic Development, Washington, D.C. [Spanish]

Gonsalez, E. 1993. *Determining the Best Uses of Mangrove Areas: An Application of Dynamic Optimization to the Case of Shrimp Mariculture in Ecuador*. Master's Thesis, University of Rhode Island, Kingston, R.I.

Gutiérrez, F. 1989. *Diagnosis of Marine Contamination in the Southeastern Pacific from Heavy Metals, Pesticides, and Eutrophication*. Report of the Permanent Commission on the South Pacific, United Nations Environment Programme, and the International Oceans Commission, Bogata, Colombia. [Spanish]

Hamilton, L. and S. Snedaker (eds.). 1984. *Handbook for Mangrove Area Management*. United Nations Environment Programme and Environmental Policy Institute, East-West Center, Honolulu, Hawaii.

INEC. 1982. *IV Population Census, 1982*. National Statistic and Census Institute, Quito, Ecuador. [Spanish]

INEC. 1990. *V Population Census, 1990*. National Statistic and Census Institute, Quito, Ecuador. [Spanish]

Ketchum, B.H. 1969. Eutrophication of estuaries. In: *Eutrophication: Causes, Consequences, Correctives*. Proceedings of an International Symposium on Eutrophication, University of Wisconsin, Madison, 1967. National Academy of Sciences, Washington, D.C. Pp. 197-209.

Kunstadter, P., E. Bird, and S. Sabhasri. 1986. *Man in the Mangroves: The Socioeconomic Situation of Human Settlements in Mangrove Forests*. The United Nations University, Tokyo, Japan.

Masterton, W.L. and E.J. Slowinski. 1977. *Advanced General Chemistry*. Editorial Interamericana, Mexico City. [Spanish]

Matuszeski, W., E. Perez, and S. Olsen. 1988. *Structure and Objectives of a Coastal Resources Management Program for Ecuador*. Coastal Resources Center, University of Rhode Island, Narragansett,

R.I.

Merschrod, K. 1989. In search of a strategy for coastal zone management in the third world: Notes from Ecuador. *Coastal Management* **17(1)**:63-74.

Montaño, M. et al. 1993. *Study of the Water Quality of Ecuador's Coast.* Ecuador Coastal Resources Management Program, Guayaquil, Ecuador. [Spanish]

Ochoa, E. and W. Macías. 1987. *Ecuador: A Profile of Its Coastal Resources*. Fundación Pedro Vicente Maldonado, Guayaquil, Ecuador. [Spanish]

Odum, H.T. and J.E. Arding. 1991. *Emergy Analysis of Shrimp Mariculture in Ecuador.* University of Florida, Gainesville, Fla.

Odum, H.T., B. Odum, D. Campbell, and S. Olsen. 1991. *A Review of Environmental Issues in the Coastal Zone of Ecuador and Its Special Area Management Zones*. Coastal Resources Management Program, Guayaquil, Ecuador.

Olsen, S. 1987. A collaborative effort in developing the integrated coastal resources management project for Ecuador. *Coastal Management* **15**:97-101.

Olsen, S. 1993. Will integrated coastal management programs be sustainable: The constituency problem. *Ocean and Coastal Management* **21**:201-225.

Olsen, S. In press. Struggling with emergy analysis: Shrimp mariculture in Ecuador. In: C. Hall (ed.). *Maximum Power.* University Press of Colorado, Niwot, Colo.

Olsen, S.B. and E. Figueroa. 1986. *An Integrated Strategy to Promote a Sustainable Shrimp Mariculture Industry for Ecuador.* Coastal Resources Center, University of Rhode Island, Narragansett, R.I.

Olsen, S., D.D. Robadue, and L. Arriaga. 1993. *Atacames Special Area Management Plan*. Coastal Resources Center, University of Rhode Island, Narragansett, R.I.

Parra, D. and E. Landivar. 1989. *Characterization of Tourism and Recreation Use of Ecuador's Special Area Management Zones*. Report to the Ecuador Coastal Resources Management Program, Quito, Ecuador. [Spanish]

Parra, D. and J. Rodriquez. 1990. *Study of Tourism Demand and Spending Patterns in the Special Area Management Zones*. Report to the Ecuador Coastal Resources Management Program, Quito, Ecuador. [Spanish]

Parsons, T., M. Takahashi, and B. Hargrave. 1988. *Biological Oceanographic Processes*. Pergamon Press, New York.

Pérez, E. 1991. *Proceedings of the Workshop on the Manual of Enforcement of Coastal Laws and Regulations at Punta Carnero, Ecuador*. Pérez and Associates, Quito, Ecuador.

Pérez, E. and D. Robadue. 1989. International issues of shrimp mariculture in Ecuador. In: S. Olsen and L. Arriaga (eds.). *A Sustainable Shrimp Mariculture Industry for Ecuador*. Coastal Resources Center, University of Rhode Island, Narragansett, R.I. Pp. 71-88.

Pérez et al. 1988. *Legal and Administrative Aspects of Coastal Resources Management in the Republic of Ecuador*. Report Series No. 2. Ecuador Coastal Resources Management Program, Guayaquil, Ecuador.

Putz, F. 1992. *The Coastal Resources Management Program and Mangrove Silviculture in Ecuador: Observations and Recommendations.* University of Florida, Gainesville, Fla.

Robadue, D. 1990. Special area management as a basic method for planning and guiding the development

of Ecuador's coastal resources. Presented to the Coastal Society Twelfth International Conference, San Antonio, Texas, October 21-24, 1990.

Saenger, P., E. Hegerl, and J. Davie (eds.). 1983. *Global Status of Mangrove Ecosystems*. Commission on Ecology Papers, No. 3. International Union for the Conservation of Nature and Natural Resources, Gland, Switzerland.

Schaeffer-Novelli, G. and Y. Cintron. 1982. *Mangrove Forests.* National Technical Information Service, U.S. Department of Commerce, Springfield, Va.

Scriabine, R. 1993. Coastal zone project model for development. *Frontlines* ***33(1)***:8-10. U.S. Agency for International Development, Washington, D.C.

Snedaker, S., J. Dickinson, M. Brown, and E. Lahmann. 1986. *Shrimp Pond Siting and Management Alternatives in Mangrove Ecosystems in Ecuador*. Final Report to the Office of the Science Advisor, U.S. Agency for International Development, Washington, D.C.

Southgate, D. and M. Whitaker. 1992. Promoting resource degradation in Latin America: Tropical deforestation, soil erosion, and coastal ecosystem disturbance in Ecuador. *Economic* Development and Cultural Change **40(4)**:787-808.

Southgate, D. and M. Whitaker. 1994. *Economic Progress and the Environment: One Developing Country's Policy Crisis*. Oxford University Press, New York.

Suárez, L., J. León, J. Woolfson, D. Ortiz, E. Suárez, F. Rodriguez, R. Sierra, P. Zurita, R. Murriagui, P. Guerrero, and C. Torres. 1995. *Study of Management Options for the Area Between the Cayapas and Mataje Rivers in Esmeraldas Province*. EcoCiencia and the National Forestry Institute, Quito, Ecuador.

Sutinen, J., J. Broadus, and W. Spurrier. 1989. An economic analysis of trends in the shrimp cultivation industry in Ecuador. In: S. Olsen and L. Arriaga (eds.). *A Sustainable Shrimp Mariculture Industry for Ecuador*. Coastal Resources Center, University of Rhode Island, Narragansett, R.I. Pp. 19-44.

Twilley, R. 1989. Impacts of shrimp mariculture practices on the ecology of coastal ecosystems in Ecuador. In: S. Olsen and L. Arriaga (eds.). *A Sustainable Shrimp Mariculture Industry for Ecuador*. Coastal Resources Center, University of Rhode Island, Narragansett, R.I. Pp. 91-120.

Twilley, R., A. Bodero, and D. Robadue. 1993. Mangrove ecosystem biodiversity and conservation in Ecuador. In: J. Cohen, C. Potter, and D. Janczewski (eds.). *The Potential of Biodiversity: Case Studies of Genetic Resource Conservation and Development.* American Association for the Advancement of Science Books, Waldorf, Md.

Ulloa, M. 1989. *Guide for the Use and Management of Pesticides on Tropical Crops*. Graduation thesis. Faculty of Agricultural Science, State University of Guayaquil, Ecuador.

United Nations Conference on Environment and Development. 1992. *Agenda 21*: *Programme of Action for Sustainable Development.* United Nations, New York.

El Universo. 1993. August 24. The shrimp farm sector asks for an investigation of contamination. Guayaquil, Ecuador.

El Universo. 1993. November 23. Mortality in shrimp ponds caused by toxics. Guayaquil, Ecuador.

USAID. 1986. A Joint Project Agreement for Technical Cooperation Between the Government of the Republic of Ecuador and the Agency for International Development to Implement a Coastal Resources Management Program. Office of Forestry, Environment, and Natural Resources; Bureau of Science and Technology; U.S. Agency for International Development, Washington, D.C.

Vannucci, M. 1988. The UNDP/UNESCO mangrove programme in Asia and the Pacific. *Ambio*

17(3):214-217.

Yerovi, Y. 1993. *Report on the Functioning and Situation of the Ranger Corps Units in Esmeraldas, Bahía de Caráquez, and Puerto Bolívar, Ecuador.* Ecuador Coastal Resources Management Program, Guayaquil, Ecuador.

Weidner, D. et al. 1992. *World Shrimp Culture*. Volume 2. National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Md.

Yanez-Arencibia, A. 1991. *Technical Consultation and Assistance to the Ecuador Coastal Resources Management Program on Mangrove Ecology, Fisheries Aspects, and Environmental Impact.* Coastal Resources Center, University of Rhode Island, Narragansett, R.I.