Technical Report 2077

Atacames Special Area Management Plan

Atacames—Súa—Muisne

Stephen Olsen • Donald D. Robadue, Jr. • Luis Arriaga

Coastal Resources Center
University of Rhode Island
Narragansett, Rhode Island

International Coastal Resources Management Project
Bureau for Research and Development
United States Agency for International Development

The four major goals of the International Coastal Resources Management Program (CRMP) are to: 1) apply, as appropriate, existing experience in coastal resources management to low-income countries; 2) assist these low-income nations in the design and implementation of integrated coastal resources management programs; 3) advance the state of the art of coastal resources management; and 4) build the University of Rhode Island's capability to assist nations with coastal resources management.

The CRMP works with the cooperating countries to:

- formulate and implement integrated coastal resources management strategies
- develop procedures for the assessment of the impacts of coastal development proposals
- develop institutional and technical solutions for resource-use conflicts
- support research to better understand the issues that affect the condition and use of coastal ecosystems
- improve the capabilities of in-country professional staff to plan for and manage coastal development.

The International Coastal Resources Management Program is funded by the Office of Environment and Natural Resources, Bureau for Research and Development, U.S. Agency for International Development through a cooperative agreement with the University of Rhode Island.

For information on the project, contact:

Stephen Olsen, Director
International Coastal Resources Management Program
Coastal Resources Center
The University of Rhode Island
Narragansett, RI 02882

Telephone: (401) 792-6224
Fax: (401) 789-4670

ISBN 1-885454-01-5

Foreword

The Atacames Special Area Management Plan is one of five such plans prepared for the Ecuador Coastal Resources Management Program between 1990 and 1992. It is an example of the work of the USAID/URI International Coastal Resources Management Project in developing special area plans in Ecuador, Thailand, and Sri Lanka. The Atacames plan contains a consensus view of the problems and opportunities facing the residents of this rural and underdeveloped region of Esmeraldas province, and puts forward an integrated vision of the policies and actions that should be carried out over the next five years to move toward sustainable use of the area's coastal resources, and improved quality of life for coastal residents.

The field staff in the Atacames special area management zone, led by coordinator Romulo Jurado, and the technical team, directed by Dr. Luis Arriaga, worked hard to build public awareness and involvement in all stages of plan formulation. The advisory committee played an active role in identification of issues, framing of problems, formulation of policy, and testing of feasibility of solutions. During the planning process, the government of Ecuador was actively seeking to determine whether participatory methods were feasible, and whether practical measures to provide stewardship for coastal resource use could be identified and tested. Implementation of a large proportion of the actions recommended in the plan are now incorporated in a project to be financed by the Interamerican Development Bank, beginning in 1994. Other donors working in Esmeraldas province have also used the plan and the local field office to help guide and coordinate their own efforts.

While the plan was undergoing public review, a considerable amount of attention was given to the need to establish strong coordinating mechanisms to implement the plan. These relationships among key actors are described in detail in Chapter 4, which was substantially revised as a result of public comments and recent developments in the national program. Although the executive directorate of the Ecuador coastal program has overall responsibility for carrying out the plan, the permanent local special area management committee established by Executive Decree 3399 is expected to play an important role in shaping and overseeing local implementation efforts, as well as serving as a forum for open debate and resolution of coastal area use conflicts in Atacames-Súa-Muisne. The national government cannot carry out projects in the special area zone without prior review and acceptance by the local committee.

The successful adoption and financing of the Atacames special area management plan and of four other sites located in Manabi, Guayas, and El Oro provinces, offer the hope that similar consensus documents can be prepared for other critical areas of the Ecuadorian coast. However, the most important challenge for the next five years will be putting the vision, ideas, and policies of the special area plans into action in order to create local/national partnerships to achieve sustainable uses of coastal resources. Coastal managers in all tropical developing coastal nations will be able to learn from Ecuador as its new experiment in plan implementation unfolds.

Donald Robadue, Jr.
Luis Arriaga
October, 1993

Introduction

The experience of formulating the special area management plans has been a learning process for all involved. The work began in 1990 with the preparation of profiles for each special area management zone (zona especial de manejo, or ZEM) followed by technical reports on agriculture and watersheds, coastal geomorphology, mangroves, fisheries, mariculture, water supply, wastewater and solid waste disposal, and tourism.

During the following two years, the committees, user groups, and authorities involved in the coastal management program participated in identifying the key issues of each ZEM, as well as in formulating policies and determining priority actions in a draft plan.

The advisory committees reviewed and revised the plans and approved them in joint session with the executive committees of each ZEM. Twenty-two public meetings were held during the process, involving 68 coastal user groups; 60 communities; 19 government agencies; two nongovernmental organizations; radio, television and press; two universities; and supervisors from primary and secondary schools.

The plans received final approval from the National Coastal Resources Management Commission in May 1992.

The highly participatory manner in which the plans have been prepared demonstrates that it is indeed possible to achieve consensus on the proper use of coastal resources. The planning process has served as a means of local self-development, and as an aid in finding sustainable uses of coastal resources to support quality of life in coastal communities.

The presentation of this publication is an auspicious moment in the history of the Coastal Resources Management Program (CRMP). The foundation of this new effort has been the active participation of communities and user groups and interagency coordination. This must continue to be the emphasis of the CRMP in the future to assure the sustainability of this pilot effort undertaken by the government in its search for sustainable uses of Ecuador's natural resources.

Miguel Fierro
Executive Director

Technical group that prepared basic information and documents for the plan:

Agriculture and Watersheds:	*Rolando Vicuña*
Coastal Geomorphology:	*Héctor Ayón*
Mangrove Ecosystems:	*Alejandro Bodero*
Mariculture:	*Segundo Coello*
Fisheries:	*Bruce Epler*
	Miguel Fierro
Water Supply, Wastewater and Solid Waste Disposal:	*José Vásconez*
Tourism:	*David Parra*
Social and Economic Information:	*Rómulo Jurado*
institutional Issues:	*Washington Macías*
Supervision:	*Stephen Olsen*
	Donald Robadue
	Luis Arriaga
Editing of Final Plan:	*Luis Arriaga*
	Washington Macías
English Version Translation:	*M. Iris Allen*
	Donald Robadue
	Jennifer Pereira
Editing:	*Elizabeth Gibbs*
	Tony Corey
Production:	*Annette Burgess*

Table of Contents

Chapter 1

EVOLUTION OF THE ZEM PROCESS IN ATACAMES-SÚA-MUISNE

1.1 Background

The Coastal Resource Management Project (CRMP) was established by a Technical Cooperation Agreement, adopted March 3, 1986, between the United States Agency for International Development (USAID), the University of Rhode Island (URI), and the Government of Ecuador (GOE). Its primary objective was to provide technical assistance to create and strengthen a national coastal resources management program. The Coastal Resources Center of URI (CRC/URI) is responsible for implementation.

The first phase of the project led to a proposal in 1988 to create a permanent national coastal management commission, to establish a ranger corps to improve law enforcement, and to prepare local coastal plans in critical areas of each province. Public officials, private institutions, and resource users along the Ecuadorian coast came forward to support this initiative. The Government of Ecuador published Executive decree No. 375 (Official Register 117, January 26, 1989). This Decree formally established "Coastal Resource Management Program of Ecuador," CRMP, and determined the strategy, legal framework and institutional structure of the program.

The "National Plan of Economic and Social Development 1989-1992" (Executive Decree No. 753, July 17, 1989) incorporated for the first time "Management of Coastal Resources" in its "Natural Resources and Environment" program.

Executive Decree No. 375, in its 6th Article, chose the following Special Management Zones (ZEMs) of the coastline (Figure 1.1-1):

a) Esmeraldas, the **Atacames-Súa-Muisne** zone;

b) Manabí, the **Bahía de Caraquez-San Vicente** zone;

c) Guayas, the **Playas-Posorja-Puerto El Morro** and the **San Pedro-Valdivia-Manglaralto** zones;

d) El Oro, the **Machala-Puerto Bolívar-Isla Jambelí** zone; and

e) Galápagos, to be determined by the National Commission of Coastal Resource Management

Decree No.375 stipulated that each ZEM has: **(a) an Executive Committee**, formed by representatives of government institutions legally competent in the management of coastal resources; and **(b) a Consultative Committee**, formed by "representatives of private, industrial and artisanal sectors, academic institutions, organizations, and other entities interested in the management of the coastal resources of the zone".

These committees, with the support of "technical teams" and the technical secretary of the CRMP, were charged with developing management and development plans of the coastal resources of the ZEM and submitting them to the National Commission of Coastal Resource Management for consideration within two years. The committees were established, except in Galápagos, through Resolutions No. 3 and 4 by the National Commission of Coastal Resource Management, published in the Official Registry No. 402 of March 23, 1990.

Table 1.1-1 Summary of the Coastal Resources Management Project, Ecuador

1986	Signing of the Technical Cooperation Agreement among United States Agency for International Development -University of Rhode Island - Government of Ecuador, for the development of the CRMP in Ecuador.
1987	**Phase 1 of the CRMP.** Gathering and analysis of existing information about coastal resources in Ecuador. Extensive consultative workshops. Result: **Ecuador: Profile of its Coastal Resources.**
1988	**Phase 2 of the CRMP**. Design and extensive consultation concerning the structure and objectives of coastal management in Ecuador. Manifesto of support from the authorities, managers, and representatives of the coastal communities, and request to the president and vice-president to establish a governmental program for the rational management of coastal resources. Result: **Structure and Objectives for the Coastal Resource Management Program in Ecuador**, July 1988.
1989	Publication of Executive Decree No. 375 establishing the "Coastal Resource Management Program in Ecuador" (CRMP) and designation of the Special Management Zones (ZEMs).
1990	**Phase 3 of the CRMP.** Development of the "ZEM Process" for the planning and selection of specific management projects for the five ZEMs of the continent. Establishment of field coordinators and their offices, establishment of the technical team, and preparation of technical reports. Inauguration of advisory and executive ZEM committees.
1991	Preparation of drafts of plans for each ZEM.
1992	Analysis and approval of the plans by the ZEM committees and National Commission.
1993	**Phase 4 of the CRMP**. Publication of Executive Decree 3399, strengthening the structure of the CRMP. Issuance of internal regulations governing the operations of the Special Area Management Zones and the Coastal Resources Management Program.

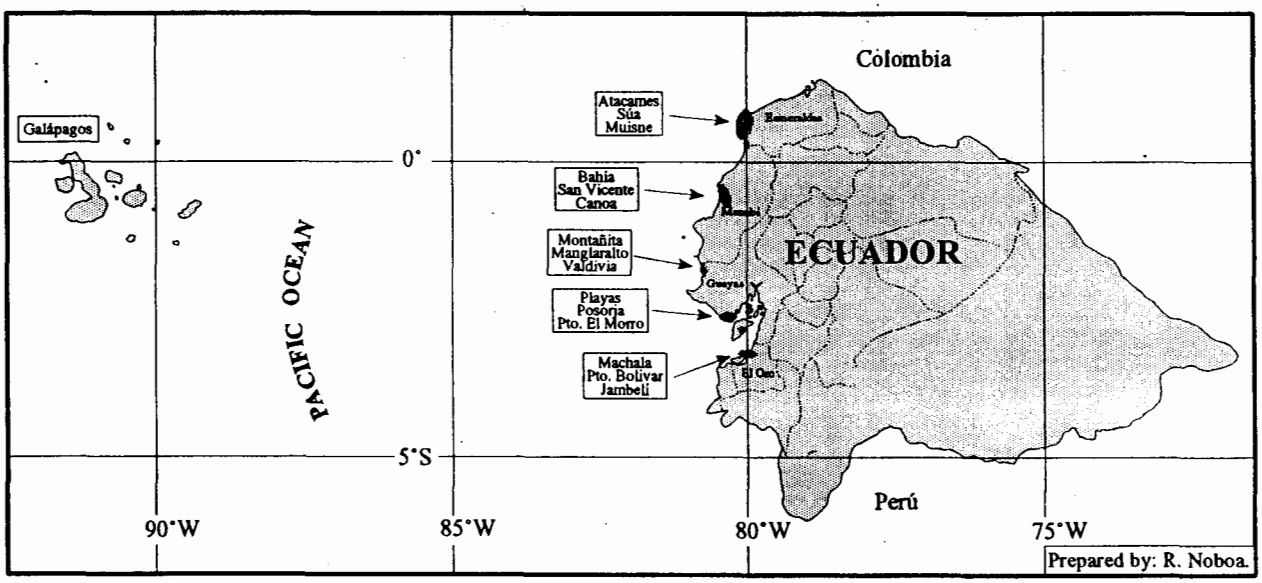

Fig. 1.1-1 Special Management Areas (ZEMs) created by Executive Decree # 3399.

1.2 The Atacames-Súa-Muisne ZEM

The Atacames-Súa-Muisne ZEM embraces part of the cantons of Esmeraldas and Muisne, Esmeraldas province. It starts in Puerto Gaviota to the east of the mouth of Atacames River and ends in the basin of Muisne River to the south. It encompasses the mountainous areas of Atacames and Muisne, reaching an altitude of up to 300 meters. Several hydrographic basins originate here and drain into the Pacific Ocean; their lengths vary between 15 and 35 kilometers. The largest basin is the Muisne River, which covers 471 square kilometers (Figure 1.2-1).

The zone between Tonchigue and Galera has a dry tropical climate, with an average temperature of 23 to 25 degrees centigrade and an annual average precipitation of between 1,000 and 1,500 mm. The rainy season is from December to May, and the dry season is from June to November, with precipitation only in the form of a very light drizzle.

The areas of Muisne, San Francisco, and Atacames have subhumid tropical weather, with specific variations during the year of an average temperature between 23 and 26 degrees centigrade and an average annual precipitation between 1,500 and 2,000 mm. The rainy season is from December to June; however, there is a tendency to rain throughout the year.

The ZEM population is approximately 27,000 inhabitants (1990), who live within the following villages:

Canton	Zone	Area
Atacames	Atacames (1)	Tonsupa (1)
		Castel Nuovo (1)
		Piedra Final (2)
		Taseche (2)
		Cumba (2)
	Súa (1)	Guachal (2)
		Muchín (2)
	Tonchigue (1)	Barlovento (1)
		Macará (2)
		Estero Ancho (2)
Muisne	Muisne	San Gregorio (1)
		Las Delicias (1)
	San Francisco (1)	Bunche (1)
		Tongorachi (1)
		Boca de Chipa (*)
		Llano de Chipa (*)
		Partidero El
		Cabo (*)
		Crisanto (*)
	Quingue (1)	Caimito (2)
		Tóngora (2)
	Galera (1)	Estero de Plátano (1)
		Galerita (2)
		Salto de Estero de Plátano (2)
		Mocora (2)
		Quitito (2)
		Boca de la Chonta (2)

(1) Located in the coastline
(2) Interior
(*) Will be considered in future actions of the ZEM.

According to employment estimates, approximately 44% of the ZEM economy depends on activities related to coastal resources, while 36% is a combination of short-term agriculture, permanent plantations, and extensive cattle raising. (Figure 1.2-2).

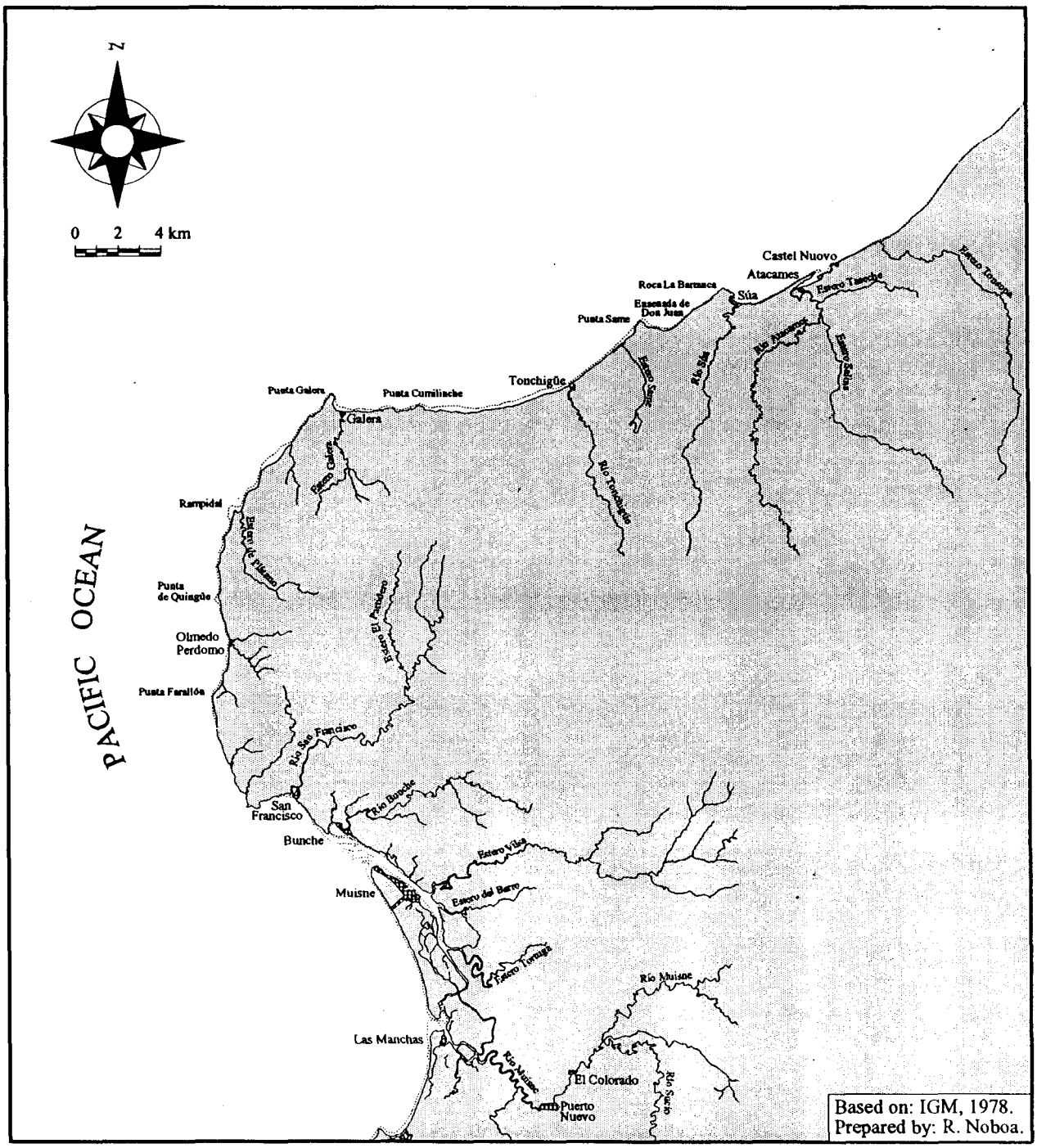

Fig. 1.2-1 Atacames - Súa - Muisne Special Management Area.

Atacames-Súa-Muisne has changed dramatically since the 1940s, when the region was isolated and the economy was based primarily on subsistence agriculture and fishing. This ZEM has been subject to cycles of economic growth and environmental degradation, which have left residents vulnerable to the following environmental problems: collapse of near-shore fisheries; negative changes in the public image of tourist beaches and facilities; drought; epidemics of waterborne disease; decline in the price of farm products; and loss of soil productivity.

Primary forest was cut in the 1940s and 1950s. The subsequent development of banana plantations created a temporary spurt of prosperity that was cut short during the banana crisis of the 1960s. Economic decline caused migration to the city of Esmeraldas as plantation owners attempted to diversify their activities into cattle, cacao, coffee, and coconut. Deforestation continued. Roads from Esmeraldas were built in the 1970s, first to Atacames, then to Tonchigue and Bunche. New uses of coastal resources emerged, including tourism, mangrove cutting, shrimp mariculture, and intensive fisheries for postlarval shrimp and gravid female shrimp. Population in coastal villages grew considerably during this period.

Figure 1.2-3 illustrates the pattern of accumulation of resource uses followed by problems in the Atacames-Súa-Muisne ZEM. The diversification of uses of the coastal resources in the ZEM would normally be a great strength of the local economy except for one crucial fact: today, each one of these sectors is overexploited and degraded. The demise of one will quickly be followed by overuse and collapse of the others.

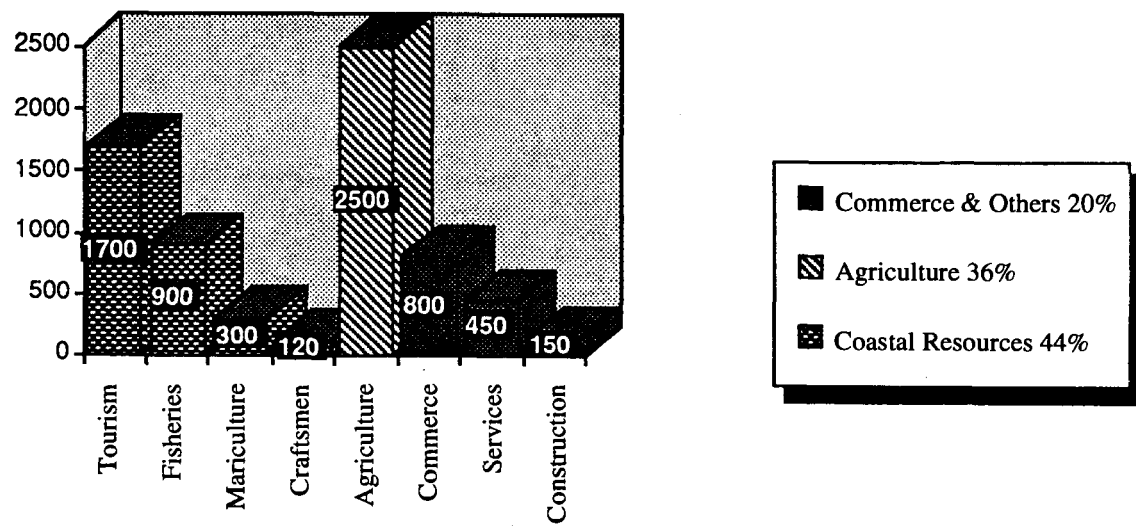

Figure 1.2-2 Employment estimates for the ZEM Atacames-Súa-Muisne, 1989 (Source: R. Jurado, 1989)

Relationship between economic development of Atacames and use of natural resources

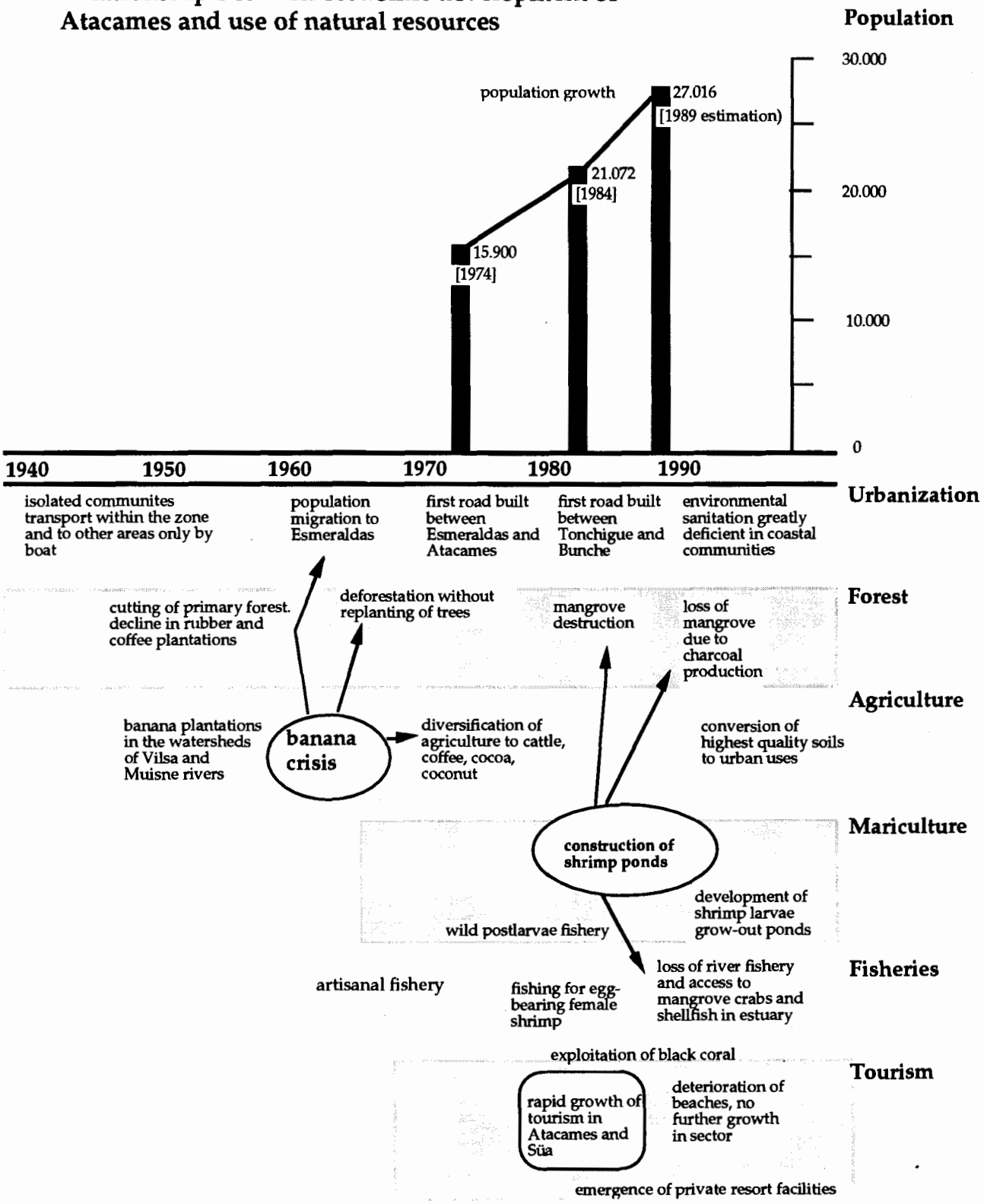

Figure 1.2-3

1.3 Present Situation of the Use and Management of Coastal Resources

Presently, the Atacames-Súa-Muisne ZEM sees a careless exploitation of coastal resources due to the communities' and resource users' lack of adequate management plans and lack of knowledge of the ecological basis of the interrelation between ecosystem components. The consequence is the progressive degradation of resources that can be summarized by the following facts:

- The indiscriminate destruction of mangroves for the construction of shrimp ponds, urban expansion, and charcoal and firewood production
- Progressive deforestation of the coastline for pastures and enlargement of agricultural and cattle-raising areas
- Reduction of traditional fishing areas due to the destruction of the habitat for species of commercial importance
- Degradation of environmental quality due to solid waste and sewage disposal in watershed and recreational areas, such as beaches
- Overfishing and excessive gathering of biological resources, such as black coral and shellfish, associated with the mangrove ecosystems
- Less access to the resources from traditional users who are displaced by outside business people, furthering the uneven distribution of goods

Until the establishment of the Atacames-Súa-Muisne ZEM, there had been no significant efforts to harmonize development with the conservation needs of the natural resource base or with environmental protection. The traditional role of the communities has been to prepare lists of needs or demands for action on specific issues, present them to the authorities, and wait to see if there would be any financial assistance to carry them out.

The pre-existing national policies and procedures applicable to coastal management have been very general and, in many cases, not very helpful in guiding the solution of specific coastal management problems. In the past, most of the solutions to local problems have been formulated a great distance from the problems' occurrence, in the provincial or country capital, without consideration of views or needs of the area residents.

Public institutions have not acted effectively to confront the continual degradation of environmental quality or to accelerate progress toward social and economic development to match the needs of a rapidly growing population. This is because national coastal resource management institutions do not have the personnel, financial assistance, or administrative means to organize an effective field presence. Without this continuous presence in coastal areas, these institutions cannot properly evaluate the use of resources or counteract illegal actions.

There are few specific rules and regulations that apply to the protection of resources and environmental quality, and for the most part, those that do exist on paper are not observed. In practice, there is a lack of coordination among authorities in dissemination, awareness-raising, and collabo-

ration among resource users regarding management norms. For example, the annual bans on shrimp fishing lack effective enforcement, and the fishermen who are expected to comply are not provided with an explanation of what the hardship of a ban is expected to accomplish. The larvae fishermen continue to capture young shrimp, and laboratories continue to purchase impregnated females during closed seasons. A similar pattern occurs with lobster- and crab-fishing bans. Industrial vessels also frequently operate in areas reserved for artisanal fishing.

As in the control of development in urban areas, the rules governing uses of recreational areas are not well developed. In the case of control of beach use and conflict resolution between sectors, only very simple guidelines exist, and they are enforced only sporadically, without the support of educational awareness campaigns.

There are notable variations among the ZEM communities regarding the extent of local participation in the construction of potable water sources. The variations have greatly affected the success of these vital projects. In Atacames, Tonsupa, and Súa, the structure and management of a committee promoting water supply improvements resulted in the construction of an emergency system until the regional potable water supply project is implemented. The estuaries of Plátano, Quingue, and Cabo San Francisco have water sources built by Ecuadorian Institute for Sanitary Works with community participation. Boards of Potable Water, formed by residents of each community, are in charge of the management of the systems. In contrast with these projects, which have worked relatively well, is one in Muisne: This project, served by a source built by IEOS without community participation, is not performing properly and has an inadequate management system.

There is also a wide range of situations in the ZEM regarding the disposal of fecal waste. In Quingue, almost all houses have their own latrines due to the active participation of village residents; yet, in villages like El Plátano estuary, the latrine program was stopped due to the lack of community participation.

Although the problems that the ZEM resource users face differ depending on which part of the ecosystem is important to them, there are at least three common elements that should be considered in the search for viable solutions:

a) Most problems are tied to one another to a certain degree; consequently, the solution to one requires actions that will affect the others. For example, the protection of the Atacames River through promotion of nature tourism requires control of water pollution, garbage collection, etc

b) Groups of users can learn better ways to handle planning and organizational problems. The steps required to successfully manage small water supply projects can be equally useful in organizing a small workshop on the repair of outboard motors or a tourist beach cleanup campaign

c) Groups of resource users and communities can act jointly through the planning process and the ZEM framework plan to attract attention and obtain the political support, financial resources, and technical assistance they need to reach environmental quality goals

1.4 Development of the ZEM Process in Atacames-Súa-Muisne

The initial activities of the CRMP in the Atacames-Súa-Muisne zone faced some resistance and distrust due to a history of unfulfilled promises of assistance programs and actions that would benefit the area. The process of preparing the ZEM plan included the organization of meetings and workshops to analyze information, determine problems and conflicts in the use of resources, and select alternatives and priorities. This time-intensive process generated a participatory work system and a greater awareness of the management and rational use of resources. It also created more credibility and support for the CRMP, which will facilitate the implementation of the activities of the ZEM's Management and Development Plan.

The steps followed in the Atacames-Súa-Muisne ZEM process can be summarized as follows:

a) Selection of the Atacames-Súa-Muisne area as a Special Management Zone (ZEM) based on the "Profile of Coastal Resources of Esmeraldas Province" analysis

b) Formation of the ZEM Advisory Committee, which included 23 distinguished residents of the community and representatives of important ZEM activities. The organization of the committee (January 1990) included defining responsibilities and guidelines for its operation

c) The organization of the ZEM Executive Committee, under the management of the governor of Esmeraldas, integrated with the following provincial authorities: Prefect of Esmeraldas; Chief of Forestry District; Provincial Delegate of the national tourism agency; Captain of Esmeraldas Harbor, Zone Chief of IERAC and the Subsecretary of Fishing Resources (Decree of the National Commission of Coastal Resource Management, Official Registry No. 402, March 23, 1990).

d) The preparation of "Basic Documents of the Atacames-Súa-Muisne ZEM" (November 1989) included:

   - Legal documents of the CRMP
   - Profile of the Atacames-Súa-Muisne ZEM
   - Reports from the CRMP technical teams on specific subjects: tourism, mangroves, artisanal fishing, environmental sanitation, geomorphology, and coastal processes

   The initial basic documentation was reviewed in detail by the Advisory Committee, which both promoted broader awareness of the condition of coastal resources and helped select locally appropriate options for management.

e) An intensive effort of dissemination and public education was carried out in conjunction with the technical discussions and focused on environmental problems, conservation of resources, and promotion of the ZEM development process. Teacher training and school activities at the primary and secondary levels were also included

f) An important activity in the ZEM process was the implementation of the "Practical Exercises in Integrated Management". These included low cost projects or activities designed to address priority problems in the communities. The selection of "exercises," control of their execution, evaluation of the results, and necessary follow-up were done by the Advisory Committee, with personnel support and consultants from the CRMP. The objective of these exercises was training of the Advisory Committee and the communities for carrying out more complex tasks that will take place with the implementation of the ZEM development plan. Some of these exercises were:

- Organization of a "commissary" for the sale of fuel, lubricants, and materials for the Tonchigue artisanal fishermen

- Rehabilitation of public sanitary services in Atacames (in the village and next to the beach) and in Súa

- Construction of a collection center in Bunche for shrimp larvae

- Management of the Atacames mangrove through passive recreation. The objective of this exercise is to protect the small mangrove (52 ha) that still exists in the estuary of Atacames River and to promote its recuperation through reforestation. The exercise includes a recreational and educational walk through the estuary, mangroves, and shrimp ponds. The exercise has produced additional actions, such as:

- Formation of an "Environmental Sanitation Committee" in charge of organizing the clean-up of the Atacames River shoreline (which had become a garbage dump) and establishing a permanent system of garbage collection

- Organization of a "Folkloric Music and Dance Group" with the participation of the School of Tourism, "Estrella de Mar," of Atacames

- Organization of a group of "tourist guides" for the walks in the mangrove

- Use of the mangrove for energy resources. This exercise involves the use of 20 ha of mangrove forest per year in a rotating cycle of 10 years for the production of charcoal and firewood. The cycle includes the reforestation of exploited lots and the production of charcoal in metallic ovens, which are more efficient than the traditional dirt ovens. The participants in this exercise are the producers of charcoal and firewood in the Muisne River mangrove estuary, who had been indiscriminately destroying the mangrove.

- Organization of an "Association of Caipirinheros," uniting small businesses that offer drinks (caipirinha) to the visitors of the Atacames beach. The CRMP has provided them with some equipment and means for maintaining the orderliness and cleanliness of the beaches, as well as with lifeguards for swimmers at risk.

To date, the "ZEM Process" has generated positive benefits in the construction of a new coastal planning system, in which the communities, government authorities, and resource users have participated and share implementation responsibility. As the exercise for the protection of the Atacames River mangrove demonstrates, a new orientation is emerging in the ZEM favoring the achievement of important goals for the conservation of the ecosystems, which means the attainment of continued productivity for the environment and local economy.

Chapter 2

COMPONENTS OF THE ATACAMES ZEM PLAN

This plan is an important tool to strengthen the local capacity to achieve the development objectives of the ZEM. It is a framework created with the help of user groups and coastal communities to guide their joint efforts to implement the specific resource protection, restoration, and appropriate use projects included in the plan.

2.1 Objectives of the Management Plan

a) To formulate and implement through a highly participatory process site-specific resource management strategies that integrate conservation and development as mutually reinforcing actions

b) To initiate and strengthen community-level forms of government capable of implementing such integrated management strategies

2.2 Preconditions for Implementation

In order to ensure that conditions for the successful implementation of any actions are present, the following preconditions must be met:

a) Participation of the community in planning the action and community commitments to its implementation and maintenance. Evidence of such participation may include formal commitments of labor, cost-sharing, and formal agreements to abide by management strategies

b) Demonstration of acceptance of any agreements with municipal authorities and the Ranger Corps necessary to the success of the project

c) Demonstration that needs for training required to carry out and sustain the activity or facility have been identified and provided for

2.3 Strategic Considerations

The following criteria should be applied when setting priorities among the actions to be undertaken during any given period:

a) The action contributes directly to sustaining or restoring ecosystem quality

b) The action is supported by a significant segment of the community(s) affected

c) The action will generate experience transferable to other coastal areas

d) The action can be implemented with the time, funds, and technical experience available

The central criterion for selecting initial projects will be the extent to which the projects increase the interest and participation of the communities and promote the local self-development and initiative required to successfully carry out development projects in the long term.

2.4 Major Management Issues

The plan for the ZEM gives priority to the following issues, taking into account the characteristics of each part of the ZEM, its communities, and the condition of its coastal resources:

a) Managing shore uses

b) Managing and promoting tourism

c) Improving water quality and community sanitary conditions

d) Managing fisheries resources

e) Managing mariculture

f) Managing small coastal watersheds

g) Developing local institutional capacity

Six aspects of each issue are treated in the plan:

a) Importance and management options

b) Characteristics of the sector

c) Principal management problems

d) Objectives

e) Policies and specific actions

f) Expected results from implementation

This chapter sets forth the options for managing coastal resources, and the resource management polices and specific actions accepted by local communities, resource users, and authorities. The focus of the proposed actions is on steps that can be taken in the next four years and that can contribute to maintaining or improving the capacity of coastal environments to provide economic development and quality of life for the residents of the ZEM.

The first part of each section focuses on key management issues, followed by the policies, actions, and expected results of implementation in the places where projects would be carried out.

The success of the proposed actions will depend in large measure on the organization and capability of resource user groups and on the help of regional and national institutions through technical assistance, financing, and, most important, the persistent effort to carry out the ZEM plan despite political changes at the national level, where major planning and development decisions are made.

The emphasis of the proposed actions varies from issue to issue, depending upon the outcome of the local consultative process and the amount of available information. The projects are grouped in the following manner:

a) Zone-wide projects which will provide a benefit to the entire ZEM; for example, actions which strengthen the institutional structure, public education, and outreach

b) Community projects aimed at resolving specific local problems; for example, building latrines, collecting solid waste in small villages

c) Integrated management projects for a coastal watershed, such as hillside reforestation, family gardens, agriculture development. These initial efforts will permit working progressively toward land use planning and

assigning appropriate use for the larger and more complex watersheds of the ZEM, such as the Atacames and Muisne rivers.

The implementation of projects can also be divided into two groups: 1) pilot projects that will test management techniques and serve as examples to promote community interest, and 2) projects aimed at directly solving a fundamental problem in the ZEM.

This plan is a means for working out new techniques and planning policies that can be applied to other coastal areas and eventually to the national development process.

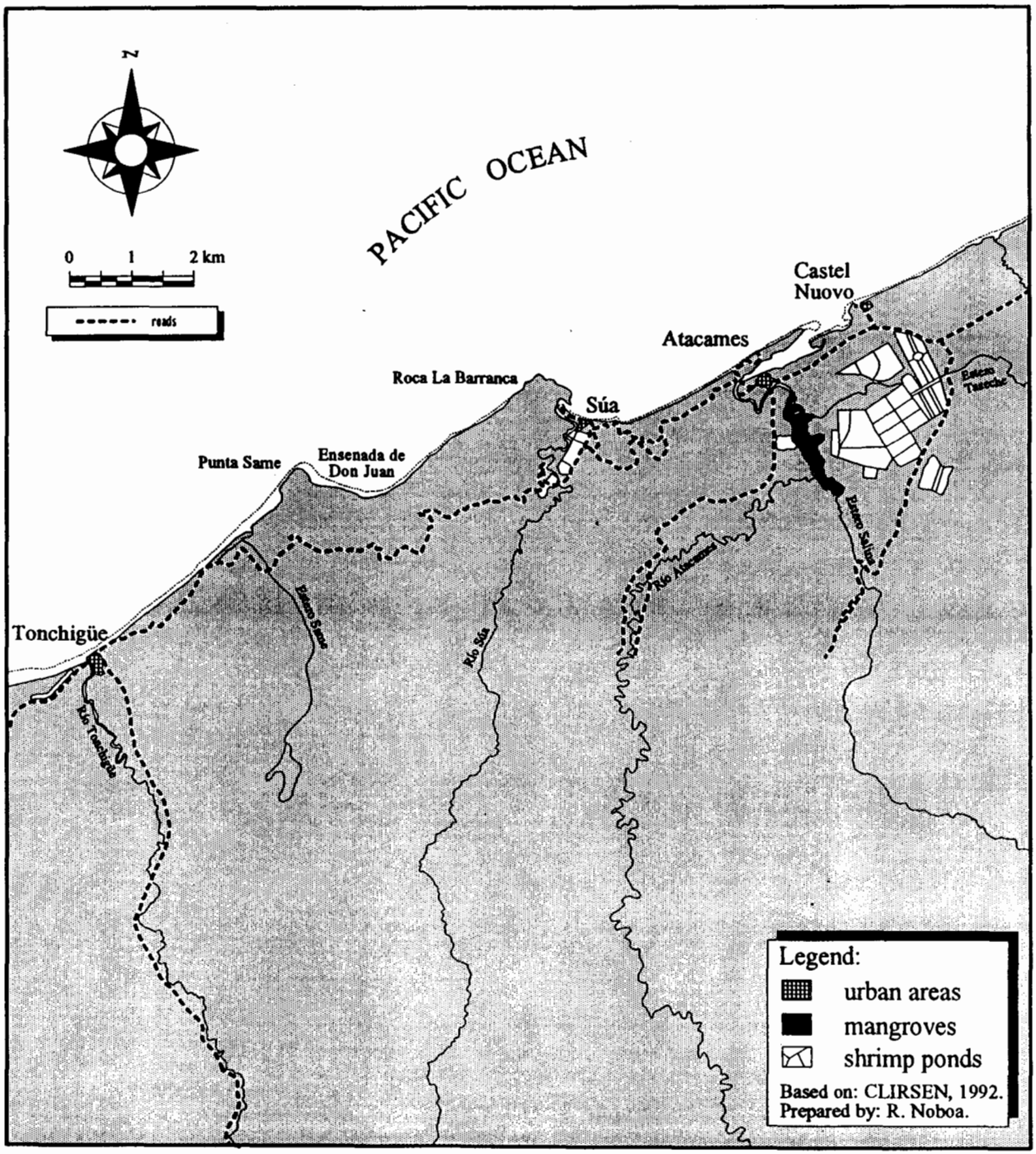

Fig. 2-1a Main features of the coast of the Atacames - Súa - Muisne ZEM, Atacames area.

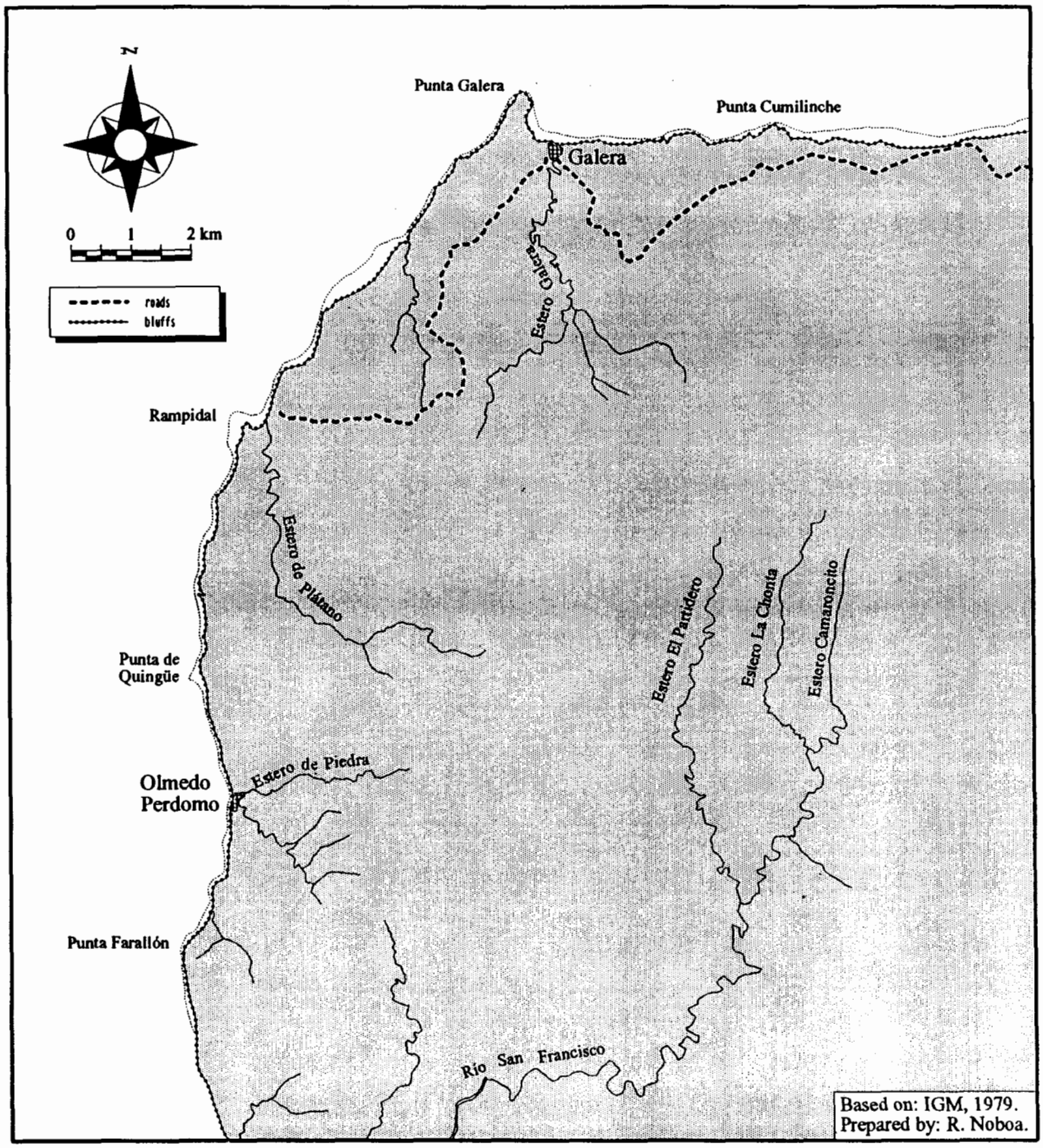

Fig. 2-1b Main features of the coast of the Atacames - Súa - Muisne ZEM, Galera area.

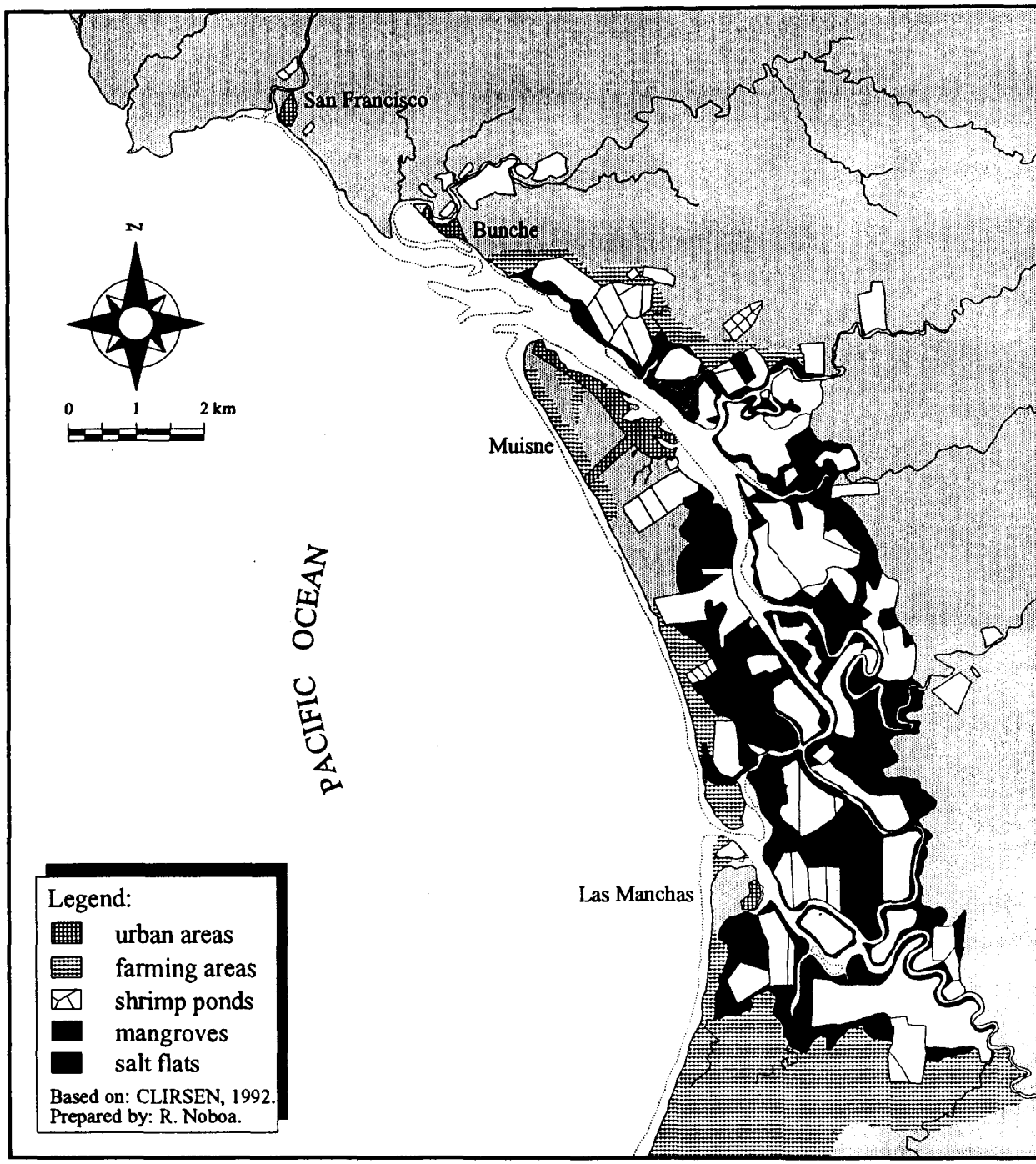

Fig. 2-1c Main features of the coast of the Atacames - Súa - Muisne ZEM, Muisne area.

Chapter 3

KEY MANAGEMENT ISSUES, POLICIES, AND PROJECTS

3.1 Management of the Coastline

A. Importance and Options

The coastline is the resource that created tourist activity in the ZEM and maintains the traditional fishing activity. The beaches, landscape, estuaries, cliffs, and mangroves form the base on which tourism and estuary fisheries depend.

If the development of the coastline is not well-managed, economic costs and social conflicts will increase significantly, and the potential to support tourist activity can be destroyed. Specifically, improper development of the coastline has caused or could cause in the ZEM:

- Collapse of infrastructure and roads in unstable areas or naturally eroding areas
- Reduction of beach area
- Loss of public access roads to the coastline for tourists, fishermen and other users
- Degradation of the aesthetic value of the zone
- Loss of habitat important to species associated with the coastline, including most of the traditional fisheries of mollusks, crabs, shrimp, and estuarine fish
- Loss of lives of swimmers and risks to recreational users

B. Characteristics of the Sector

From north to south, the coast has elevated and lower cliffs bordered by sandy beaches. A series of streams fed by small basins has created plains of fertile land. The sediments of these rivers, and the natural erosion of the cliffs and their rocky plateaus, feed the beaches. The cliffs are unstable and inappropriate for any kind of construction.

The Atacames sector is a coastal strip of lowland surrounded by hills between 50 and 150 meters that form cliffs in certain places, marking physical divisions among the beaches. The soils are deep and argillaceous, with mangroves and sandy-calcareous marine deposits.

The mouths of the Atacames and Súa rivers and estuaries form barriers that limit beach access and allow for variations in the intensity of use depending on the availability of perpendicular access from the coastal road.

The Muisne zone is composed of a beautiful and extensive estuary that drains the small mountain range of Mache. The principal center of Canton Muisne is located in a flat and low island created by coastal processes. The mouth of Bunche River and the Muisne plain are subject to rapid changes when the Muisne River cuts new paths to the ocean, severely affecting infrastructure, traffic, and agricultural activities. The Muisne River estuary system has many mud flats, which were naturally covered by mangroves. There are no salt flats in the ZEM.

According to CLIRSEN's study (1987), in 1969 approximately 3,452 ha of mangroves were present in the ZEM, representing 10.8% of the mangroves in Esmeraldas Province (32,032 ha). Approximately 1,000 ha were lost between 1969 and 1987, mostly for shrimp ponds. In 1969 Atacames had 170 ha of mangrove; presently it has 52 ha. According to CLIRSEN, approxi-

mately 840 ha of mangroves were reduced (from 3,282 ha to 2,446 ha) in the Muisne River estuary.

The destruction of mangroves in Muisne has continued since 1987. Additionally, traditional mangrove use for charcoal production still persists. The production of charcoal from mangrove wood in the Muisne zone is approximately 1,200,000 pounds per year. Another traditional activity in Tonsupa and Atacames is the extraction of "blue crab". An abundance of crabs and shells has existed in the Bunche and Muisne mangroves.

C. Important Management Problems

The diversity of coastline features of the Atacames-Súa-Muisne ZEM reflects the variety of problems found along the entire Ecuadorian coast. These can be summarized as follows:

- Construction of tourist residences in coastal sand deposits formed by the storm surges of "El Niño". Construction over or near eroding beaches. Construction in active unstable barrier spits adjacent to tide entrance. Extraction of beach sand or berms that absorb waves, causing erosion.

- Development of shrimp ponds and construction of flooded zones. Disturbance of the natural drainage, causing flooding of residential, construction, and agricultural areas. Filling of small coastal lakes and soft grounds, including mangrove areas.

Certain ZEM areas have beaches of black sand rich in minerals of substantial economic value. Some of these beaches have been completely destroyed, causing severe impacts on fishing activities and the scenic value of the zone. This exploitation continues without a management strategy.

By far the most dramatic change to the estuaries of the ZEM and the traditional way of life is rapid and continuous destruction of mangrove wetlands, caused primarily by the construction of shrimp ponds. This destruction has brought the virtual disappearance of once important fisheries for mangrove crab, conch, and oyster, and the timber that supported charcoal production. As recently as the 1970s, mangrove fisheries and charcoal production were a major source of income for residents. In Muisne, and to a lesser degree in Atacames, the shrimp ponds have produced negligible employment. Both the pond owners and their employees are almost all newcomers to the area.

The destruction of the mangroves also results in a large reduction of habitat for the wild shrimp that are the basis of the shrimp mariculture industry. Mangroves play a major role as a natural filter, absorbing and treating nutrients and other potential pollutants. Yet, this water treatment capacity is being lost at a time when population and human waste are increasing rapidly. The destruction of mangroves also brings major deterioration of scenic values and the tourism potential of the area.

The Atacames-Súa-Same area, whose roads are the oldest in the ZEM, is threatened by major damage due to improper infrastructure construction and the effects of the natural erosion and flooding.

When the seasonal road that borders the Tonchigue - Bunche coast is paved, the intensity and character of the zone's development will change noticeably, and control and management of land use will be more difficult.

A common problem throughout the ZEM is continuous deforestation. This will have a great impact on the coastal strip, causing:

- loss of scenic value
- advance of desertification
- loss of possibilities for tourist diversification

The specific problems of the Atacames-Súa-Muisne coast include:

- instability of cliffs and other slopes
- changes in the rivers' mouths, causing restrictions on navigation
- habitat destruction of estuary species, caused by fast sedimentation and changes in the flow of clean water.
- and a reduction of freaticos levels

(a) Impact of the poor siting of roads and urban development

Place	Problems and Issues
Puerto Gaviota	Construction of tourist residences on the eroded coastal flat plain
Castelnuovo	Construction of tourist residences in overwash areas during "El Niño"
Atacames	Construction in flooding areas during "El Niño"; lack of building regulations; construction on unstable barrier spits; filling of small coastal lagoons; destruction of mangroves
Súa	Construction over the barrier without needed regulations; erosion of coastal road
Same	Conflict over beach access
Tonchigue	Coastal road built along the cliff; shrimp ponds disturbing the natural drainage of Tonchigue River
Galera to San Francisco	Deforestation near the cliff edges; construction of coastal road
Bunche	Use of undeveloped barrier beach; barrier spit; shrimp ponds in Bunche River
Muisne	Beach erosion, Muisne Island

(b) Mangrove ecosystem alteration

Place	Problems and Issues
Atacames	Conversion of mangrove habitat to other uses
	Less availability of wood for firewood, charcoal, and timber
	Reduced areas for crab reproduction and development, decreasing the volume and quality of crabs available for the population
	Overexploitation of crab population
	Changes in the structure of fish species communities; less mullet exists, greater quantity of other species of less commercial value
	Changes in the places of sediment deposits and formation of new islands in the mouth of the river; those that started to form 10 years ago are presently covered with mangroves
	Scarcity of shellfish
	Worsening river water quality in the estuary zone
	Decreased production and exportation towards the estuary waters of detritus and foliage originated in the mangroves
	Habitat loss for birds, crustaceans, shellfish and reptiles. Before, there was a high presence of crocodiles in Atacames; today, crocodiles are nonexistent
Muisne	Conversion of mangrove to shrimp ponds
	Uncertainty of future wood supply for charcoal production; less wood for construction and timber
	Reduced areas where edible crab population is developed
	Reduced quality and quantity of fish of higher commercial value (snapper, porgy)
	Scarcity of shellfish
	Conflicts in the use of areas for crab and shell collection among shrimp growers and shellfish collectors

D. Objectives

1. Organize the process of development and ecosystem change along the shorefront by designing and implementing plans, ordinances, and permit systems

2. Obviate economic, social, and environmental costs brought about by

inappropriate location of roads, buildings and shoreline protection structures

3. Preserve and restore (where possible) important natural habitats and coastal features that are prerequisites for sustainable tourism

4. Assure public access to (and along) the shore

E. Specific Policies and Actions

Although the Atacames-Súa-Muisne ZEM still maintains most of its rural character, the exploitation of its beaches during the last ten years has severely deteriorated small estuaries and mangroves—the natural resources upon which the local economy depends. Hence, the ZEM needs strong policies to protect what is left of coastal resources, and to start the long and expensive recuperation process of severely affected areas.

The loss of mangroves has become a critical management issue for the ZEM. The new approach developed by Ing. Alejandro Bodero and the Mangrove Work Team of the CRMP proposes four elements: recuperation, protection, public education, and rational use. The activities to promote awareness and support for mangrove management started in 1990 with the design of specific plans for the Atacames and Muisne mangroves.

The Atacames River Mangrove Plan was initiated in 1990 through a "practical exercise of integrated management" that included: reforestation; recreation and environmental education through field trips to the mangrove, the river's estuary, and shrimp ponds; protection of the 50 ha of mangrove remaining in the estuary; clean-up campaigns and systematic collection of garbage dumped on the river's shore. These innovations are conducted by local people and institutions.

The Muisne River Mangrove Plan includes: organization of mangrove charcoal producers; improvement of technology by using metallic ovens that increase output; limitation of mangrove wood extracting area; establishment of reforestation cycles to maintain designated areas for the attainment of raw material for charcoal production.

Previous experiences have already shown large local support for the management of coastal resources and give valuable evidence of the feasibility of the new concepts proposed by this plan.

Policy 3.1.1
Construction of buildings, roads, hotels, restaurants, houses, and parking areas must not be allowed in hazardous coastal areas where damage or loss of life is highly probable, including erosion zones, or in the zone flooded by the El Niño storms of 1982-1983, as determined by the overwash line. Wherever possible, setbacks and alternate sites, rather than seawalls, breakwaters, and riprap, should be employed to provide protection for water-dependent facilities from waves and currents.

The specific actions to implement this policy include:

3.1.1(1)
Zoning and designation of coastal use

Zoning of the ZEM coast strip to assign ground use and marine space adjacent to the shore.

Establishment of rules (including municipal regulations) aimed at: strict enforcement of designated limits; restrictions for future urbanization and filling of estuary and mangrove areas; and establishment of limits for urban development. The urban development and regulation for the coastal strip will be based on balancing water transportation needs, access to fishing, balancing commercial activities, and, especially, the environmental quality of the Muisne, Súa, and Atacames river estuaries.

Development of maps showing the zoning of present territorial use and marking risk areas and intensive processes of the coastline, such as: lines of maximum flooding of "El Niño;" narrows and other sites of increase; erosion; unstable cliffs; physiographic elements with risk of erosion and collapse. Presentation of this plan to the appropriate authorities for approval and execution, including training programs, public education, and the necessary support for its implementation. (See Section 4).

3.1.1(2)
Norms for construction in the coastline

Developing norms for construction of bridges, water transportation services and economic activities that require direct access to the coastline. The purpose of this is to minimize the impact on coastal ecosystems. Determining the minimal distances for construction in relation to the annual rate of erosion in the critical zones of the coastline.

3.1.1(3)
Protection of the coastline

Development of necessary regulations and other norms to: avoid dumping residual waters and untreated waste on the beaches; ensure that pipes are buried to avoid exposure; ensure that dumping and seawater intake are located outside the breakwater zone. The regulations will attempt to prohibit modifications of natural drainage patterns of the rivers in the estuaries and in the coastline. Wherever possible, and especially in flooding areas where shrimp ponds have been built, specific projects will be designed to restore natural drainage channels.

3.1.1(4)
Protection of special recreation areas

Development of norms to protect the ZEM's topographic coastal features that have beauty and unique characteristics appropriate for tourist activities and ecological protection. These areas will be carefully determined by developing maps and legal norms to protect against overuse and destruction.

3.1.1(5)
Coastal road Same-Tonchigue-Galera-Bunche-El Relleno de Muisne

Improvement of the Same-Tonchigue-Galera-Bunche-El Relleno de Muisne coastal road while respecting the zone's coastal process and tourist potential, with particular attention to the remaining primary forests and scenic beauty of the coastline.

Since the present design only reaches Bunche, it should be extended to El Relleno de Muisne. The entire road should be permanent and paved.

inappropriate location of roads, buildings and shoreline protection structures

3. Preserve and restore (where possible) important natural habitats and coastal features that are prerequisites for sustainable tourism

4. Assure public access to (and along) the shore

E. Specific Policies and Actions

Although the Atacames-Súa-Muisne ZEM still maintains most of its rural character, the exploitation of its beaches during the last ten years has severely deteriorated small estuaries and mangroves—the natural resources upon which the local economy depends. Hence, the ZEM needs strong policies to protect what is left of coastal resources, and to start the long and expensive recuperation process of severely affected areas.

The loss of mangroves has become a critical management issue for the ZEM. The new approach developed by Ing. Alejandro Bodero and the Mangrove Work Team of the CRMP proposes four elements: recuperation, protection, public education, and rational use. The activities to promote awareness and support for mangrove management started in 1990 with the design of specific plans for the Atacames and Muisne mangroves.

The Atacames River Mangrove Plan was initiated in 1990 through a "practical exercise of integrated management" that included: reforestation; recreation and environmental education through field trips to the mangrove, the river's estuary, and shrimp ponds; protection of the 50 ha of mangrove remaining in the estuary; clean-up campaigns and systematic collection of garbage dumped on the river's shore. These innovations are conducted by local people and institutions.

The Muisne River Mangrove Plan includes: organization of mangrove charcoal producers; improvement of technology by using metallic ovens that increase output; limitation of mangrove wood extracting area; establishment of reforestation cycles to maintain designated areas for the attainment of raw material for charcoal production.

Previous experiences have already shown large local support for the management of coastal resources and give valuable evidence of the feasibility of the new concepts proposed by this plan.

Policy 3.1.1
Construction of buildings, roads, hotels, restaurants, houses, and parking areas must not be allowed in hazardous coastal areas where damage or loss of life is highly probable, including erosion zones, or in the zone flooded by the El Niño storms of 1982-1983, as determined by the overwash line. Wherever possible, setbacks and alternate sites, rather than seawalls, breakwaters, and riprap, should be employed to provide protection for water-dependent facilities from waves and currents.

The specific actions to implement this policy include:

3.1.1(1)
Zoning and designation of coastal use

Zoning of the ZEM coast strip to assign ground use and marine space adjacent to the shore.

Establishment of rules (including municipal regulations) aimed at: strict enforcement of designated limits; restrictions for future urbanization and filling of estuary and mangrove areas; and establishment of limits for urban development. The urban development and regulation for the coastal strip will be based on balancing water transportation needs, access to fishing, balancing commercial activities, and, especially, the environmental quality of the Muisne, Súa, and Atacames river estuaries.

Development of maps showing the zoning of present territorial use and marking risk areas and intensive processes of the coastline, such as: lines of maximum flooding of "El Niño;" narrows and other sites of increase; erosion; unstable cliffs; physiographic elements with risk of erosion and collapse. Presentation of this plan to the appropriate authorities for approval and execution, including training programs, public education, and the necessary support for its implementation. (See Section 4).

3.1.1(2)
Norms for construction in the coastline

Developing norms for construction of bridges, water transportation services and economic activities that require direct access to the coastline. The purpose of this is to minimize the impact on coastal ecosystems. Determining the minimal distances for construction in relation to the annual rate of erosion in the critical zones of the coastline.

3.1.1(3)
Protection of the coastline

Development of necessary regulations and other norms to: avoid dumping residual waters and untreated waste on the beaches; ensure that pipes are buried to avoid exposure; ensure that dumping and seawater intake are located outside the breakwater zone. The regulations will attempt to prohibit modifications of natural drainage patterns of the rivers in the estuaries and in the coastline. Wherever possible, and especially in flooding areas where shrimp ponds have been built, specific projects will be designed to restore natural drainage channels.

3.1.1(4)
Protection of special recreation areas

Development of norms to protect the ZEM's topographic coastal features that have beauty and unique characteristics appropriate for tourist activities and ecological protection. These areas will be carefully determined by developing maps and legal norms to protect against overuse and destruction.

3.1.1(5)
Coastal road Same-Tonchigue-Galera-Bunche-El Relleno de Muisne

Improvement of the Same-Tonchigue-Galera-Bunche-El Relleno de Muisne coastal road while respecting the zone's coastal process and tourist potential, with particular attention to the remaining primary forests and scenic beauty of the coastline.

Since the present design only reaches Bunche, it should be extended to El Relleno de Muisne. The entire road should be permanent and paved.

Policy 3.1.2
All mangrove forests and fringes will be protected and conserved in order to sustain and enhance their role in the estuarine ecosystems of the ZEM as fisheries and wildlife habitat, their value as a renewable energy source, and their contribution to the attractiveness of the ZEM for tourism.

The specific actions to implement this policy include:

3.1.2(6)
Control of the mangrove areas by the Conservation and Surveillance Unit (UCV)

Establish commitments and procedures in the Conservation and Surveillance Units (UCV) to: (a) disapprove new concessions for shrimp ponds or filling of mangrove areas; (b) monitor mangrove resource and enforce relevant laws; and (c) establish criteria and procedures for the renovation of concessions in areas that affect the mangrove.

3.1.2(7)
Recuperation of the Atacames, Súa, and Tonchigue mangroves

Reforestation of 45 ha of mangrove in the Atacames River estuary. Reforestation in areas adjacent to the Súa village and shrimp ponds. An analysis should be done on the outreach and feasibility of reforestation of the Súa mangrove and mangrove areas that used to exist in Tonchigue.

Complete protection of the 50 ha mangrove still left in the Atacames River and the small mangrove of the Súa River through a specific management plan and strict enforcement of municipal norms and regulations. In order to implement this action, the UCV should have adequate means and should rely on the zoning tasks and the designation of coastline uses foreseen in action 3.1.1(1).

3.1.2(8)
Use of the Atacames mangrove for recreational purposes

Program for the development of tourism through walks in the mangrove and estuary. There are associated campaigns and actions for the clean-up of the estuary, garbage collection, and elimination of waste disposal to restore and maintain water quality in the estuary. Development of cultural actions, such as the dissemination of local folklore (marimba) and mangrove walks for students. This involves follow-up actions to the "exercise" initiated in 1990.

3.1.2(9)
Public education and awareness for mangrove conservation

Continuous awareness and educational programs regarding the ecological role, economic value, and appropriate technology for sustainable mangrove use directed at ZEM residents, school and college students, and mangrove users in adjacent areas.

The program should include the establishment of libraries in ZEM communities, training of local personnel in library management, and promotion of the permanent use of the libraries to reinforce knowledge of mangrove resource management.

3.1.2(10)
Reforestation of the Muisne River mangrove

Reforestation of 200 ha of mangrove in different places of the Muisne River estuary between Bunche and El Firme estuary.

A second phase of reforestation will be carried out in the El Firme-San Gregorio area, where the destruction has intensified in recent years due to the construction of shrimp ponds. Reforestation will also take place in abandoned shrimp ponds.

3.1.2(11)
Protection of the Muisne River mangroves

Development of a management plan for the conservation of natural resources of the ecosystem of the Muisne River estuary, including: enforcing present legal norms and new regulations from the Muisne municipality to protect mangrove and mangrove strips adjacent to shrimp ponds; conflict resolution among users of ecosystem resources (larvae, shrimp growers, artisanal fishermen, charcoal producers); training and negotiation on the shared use of resources through workshops with those interested in conservation and resources utilization.

3.1.2(12)
Use of mangrove for energy creating purposes

Promote efficient techniques in the production of mangrove charcoal in Muisne through forestry management of 200 ha of mangrove (rotating cycles of cutting and replanting mangrove using small lots of about 20 ha per year). This action is designated for local families that traditionally produce mangrove charcoal.

Policy 3.1.3
Public access to the shore for tourism, recreation, fishing, and boating must be protected throughout the shoreline. The right of lateral passage up to the high tide line must be guaranteed. Specific access points to the high tide zone must be identified and protected.

The specific actions to implement this policy are:

3.1.3(13)
Public access zone to the coastline

Preparation of a policy to propose a public zone adjacent to the coastline that will guarantee access and prohibit construction. The conditions and procedures to authorize construction in this zone will be determined and limited to exceptional cases.

3.1.3(14)
Policy of access to the coastline

Creation of an inventory of traditional coastal access points; preparation of maps marking these points and their established legal condition. The Zone Committee of the CRMP will carry out a consultative process and mediation to establish agreements when there is conflict between groups that require coastal access and owners of adjacent land, for example. Designs will be established to meet demands for places that require special public access facilities, such as beaches of high tourist demand, intense fishing activity, or commercial piers.

F. Expected Results

The above actions are closely interrelated and once implemented should produce the following

major improvements in the use and management of the shoreline:

1. Halting of further destruction of mangroves

2. Selected restoration of mangroves through replanting

3. Improvment in condition of remaining mangroves through specific multi-use management schemes

4. Implementation of detailed procedures and standards for shorefront management of the entire ZEM

5. Assurance of continued public access to the shore

3.2 Management of the Basis of Natural Resources for Tourist Development

A. Importance and Options

The Atacames-Súa-Muisne ZEM has 27 km of beaches, and its resorts have among the highest tourist demand. Atacames and Súa, in particular, are resorts of national and international demand, with visitors from the Ecuadorian sierra and the coast as well as Colombians from cities adjacent to Ecuador. No less than one-fourth of the economically active population (an estimated 1,700 inhabitants in 1989) is directly involved with the tourist sector of the ZEM.

The impact of tourism on the local economy is reflected in the high cost of living. This is a result of the constant increase in the transient population, which in turn increases the demand for goods and services and produces environmental problems.

Besides the quality of the beaches, tourists are attracted by the exuberant nature and richness of black folklore with its diversity in music, dance, and handicrafts.

Local business people feel that the growth in tourism will continue in the next decade, increasing employment and development of housing and hotel establishments in Playa Ancha, Tonsupa, and Castelnuovo. This will increase the demand for medium- and high-quality tourism, internal and foreign tourism, and for high-volume recreation in Atacames and Súa.

Same is a special case. This area has a concentration of strong private investment in high-income tourism. However, the location of five shrimp larvae laboratories could affect the future direction of tourism on this beach.

The Muisne island at the south end of the ZEM has potential for recreation and tourism. However, the characteristically beautiful natural scenery of the ideal tropical beach, with its sand, palm trees, and tranquillity, is accompanied by the lack of basic services and policies to control environmental degradation; the latter is beginning to appear due to vacation facilities and the unregulated sale of food.

The need to plan Muisne's tourist and urban development is evident. This island has a unique atmosphere that harmonizes the natural scenery with the restoration of surroundings of particular architectural and cultural value. Muisne should have its own identity, associated with the image of a peaceful and restful corner connected with nature, where pedestrians are privileged and automobile access is limited.

An immediate problem is the saturation in use of Atacames and Súa beaches. This is why there is a need to diversify recreational options in the ZEM. Options might include sea travel from Súa to Muisne, the use of the Atacames mangrove for tourism, visits to areas that still have primary forests, excursions to the caves, family tourism in Muisne, expanded access to handicrafts, etc.

The introduction of tourism to small communities will require that they be provided with basic services and equipment, including fire prevention and control.

B. Characteristics of Tourism

1. Tourist Facilities and Activities

The development of tourism in Tonsupa-Atacames-Súa was initiated in the 1960s. The construction of the first hotels and restaurants started in the mid-seventies. During the eighties tourist promotions and facilities grew significantly, especially real estate and hotel investment. Presently, urbanization and building of vacation homes have increased throughout the coastal zone.

The ZEM's total capacity for visitors in 1989 was 89 establishments; 1,561 rooms and 5,934 beds (Parra and Landívar, 1989). The distribution was as follows:

The ZEM's lodging registry includes a total of 490 rooms, mostly (37.9%) the "cabaña" type; 24.1% in hotels; 13.4% in inns; and 10.2% in residences.

The Atacames-Súa area has also developed the so called "vacational complexes" operated by bank entities and private and public institutions. There are also vacation sites and family residences managed by organizations such as the Catholic University and National Army.

Opportunities for water recreation in the ZEM are very limited. There are no installations for sailing, such as marinas or clubs. Sports such as surfing, wind surfing, fishing, or diving have not been promoted.

The Tonsupa-Castelnuovo sector shows a noticeable increase of land subdivisions. Six subdivisions have been identified that occupy about 16 ha with a total of 320 vacation lots. Vacation facilities in Same are characterized by larger sites with extensive beachfronts.

The increase of shrimp exploitation competes with tourism because it occupies large areas of beachfront for the installation of post-larvae laboratories and grow-out facilities as well as interior land for pond construction.

C. Problems and Conflicts

The main ZEM problems can be summarized as follows:

- Garbage on the beaches of Atacames, Súa, and the entire ZEM
- Pollution in the Atacames River water due to dumping and trash on the shore
- Destruction of green areas, especially mangroves
- Unplanned growth of lots, urbanization and vacation houses
- Lack of parking space and chaotic traffic
- Invasion of public road by merchants
- Installation of shrimp laboratories and water intake and discharge pipes on tourist beaches
- Deterioration of tourist image of the Atacames-Súa zone due to social problems, mainly drug addiction, delinquency, and begging children; in addition, excessive noise from night entertainment, which disturbs tranquillity

2. Characteristics of the ZEM's tourist beaches

Beach	Surrounding	Form	Sand	Water	Negative Characteristics
Playancha	Pastures, estuary with palms, flatland at beach level	Open	Light gray	Semiturbid	Rocks
Tonsupa	Pastures, estuary, embankment, rustic houses, pipes, labs	Open	Light gray	Turbid	Logs, trash
Castelnuovo	High palms, mouth of Atacames river, dunes, villages, hotel, urban area	Open	Dark gray	Semiturbid	Logs, trash
Atacames	Palms, contaminated estuary, shorefront streets, construction without rules	Open 4 km	Dark gray	Turbid	Logs, trash
Súa	High and low bluffs, contaminated estuary, shorefront streets, construction without rules	Closed	Dark gray	Turbid	Logs, debris, trash
Same	Palms, dunes, mangrove estuary, cliffs, rock, cabañas, hotel, discharge pipes, shrimp labs	Open	Light sepia	Semiturbid	Logs, stone rocks
Tonchigue	High and low bluffs, shoreline filling, shorefront streets, rustic houses, vessels, abandoned wharf	Open	Dark sepia	Turbid	Logs, stone debris, trash
Muisne	Palms over dunes, low vegetation, cabañas, rustic kiosks, concrete seawall	Open	Light gray	Semiturbid	Logs, trash

- Lack of basic infrastructure, especially potable water, sewage treatment, garbage collection, and telephone service
- Speculation and increase of land value in the coastal strip, particularly in the Tonsupe-Same area
- Conflict between shrimp larvae fishers and tourists over the use of Súa Beach

D. Objectives

1. Rearrange tourist-recreational locations and activities to reestablish attractiveness and environmental conditions of the Atacames-Súa zone
2. Regulate the provision of tourist services and establish control mechanisms that contribute to qualitative improvement of tourist offerings
3. Train service providers to support the ZEM's tourism improvement initiatives

E. Management Policies and Specific Actions

Tourism is the most important sector of the coastal economy of the Atacames-Súa-Muisne ZEM, second only to agriculture. The success of tourism has depended on several factors, such as the proximity of the area to Quito and Colombia, and the physical beauty and culture of the region. These factors have generated a rapid increase in vacation homes, development of coastal property, and land speculation. This growth did not motivate the preparation of a solid program for tourism planning.

Some important steps have already been taken through the ZEM process to address tourism development issues. A characterization of tourism in the ZEMs was prepared jointly with the Ecuador Tourism Corporation and National Planning Agency, followed by a detailed market study of the Atacames-Súa-Muisne area. At the same time, local initiatives have begun to address the problems of environmental contamination and protection of the tourist resource base. These include the mangrove boardwalk in Atacames, which involves creating a tour of the remaining mangroves and tidal estuary in the Rio Atacames; an educational campaign led by the Hotel Association to remove sewage discharges and garbage dumps along the river, a beach clean-up and monitoring program led by the "caipirinheros" - managers of beach kiosks selling local specialty drinks, especially during Carnival and Holy Week; and improvement of public bathrooms in two important beaches.

The policies and specific actions on tourism are aimed at protecting the natural resource base that visitors seek to enjoy, improving and diversifying the quality of services for and amount of spending by each visitor, and promoting tourism in the ZEM. The initial practical efforts and experiences in tourism during the ZEM planning effort have led to an emphasis on the interrelationships among issues (for example, tourism services, mangroves, and water quality) and the need for local leadership and community action to implement policies and plans.

> ***Policy 3.2.1***
> *Tourism in the Atacames-Súa-Muisne ZEM must be promoted in an integrated manner, both to the external market area and within the ZEM to residents and the business community. The emphasis of this promotion should include environmental quality and diversity of attractions, high level of service, local culture, music, and crafts. Creating and maintaining this identity will serve as a powerful economic rationale for coastal resources management.*

Specific actions to implement this policy include the following:

3.2.1(15)
Updating the tourist inventory

With an updated ZEM tourist inventory, the location of attractions, facilities, services, roads, etc. will be identified, classified, and arranged in the national information system that CETUR maintains.

3.2.1(16)
Tourist guide in the ZEM

Preparation of a bilingual map-guide of the ZEM with exact information about tourist attractions, location of basic and complimentary tourist services, roads, accesses, etc. Careful consulta-

tion with experienced people from each community will be carried out in order to avoid leaving out important tourist or traditional attractions.

The publication should be artistic and of high quality for national distribution.

3.2.1(17)
Campaign of tourist awareness

Awareness and promotional campaigns of tourist attractions of the ZEM will take place among the local population, and will touch on recommended behavior with visitors. The campaigns will be supported by ZEM schools and colleges. There will also be promotional campaigns oriented toward visitors regarding norms of conservation of the ZEM's natural resources and ways of obtaining information about the ZEM.

Policy 3.2.2
The quality of tourism services and facilities in the ZEM must be upgraded to retain and properly handle a clientele that spends a higher amount per day in local businesses.

The specific actions to implement this policy include:

3.2.2(18)
Tourist informational signs in the ZEM

Based on the tourist inventory of the ZEM, an informational road sign plan guiding visitors to beaches and other recreational areas will be developed. The location and types of signs in each tourist area will be identified. The program will be developed in coordination with CETUR and the Ministry of Public Works (MOP).

3.2.2.(19)
Tourist information booths

Establishment of two information booths through an agreement with CETUR and with the participation of students from Colegio Estrella de Mar de Atacames specializing in tourism and hotel management. The booths would function as part of the "El Manglar" complex of small restaurants near the Rio Atacames.

3.2.2.(20)
Improving the quality of tourist services

Reinforcment of programs and actions aimed at promoting artisanal production, training personnel for tourist services, promoting music and folk dances, and creating high quality handicrafts, hotel and restaurant services, etc.

Theory and practice courses and workshops will be developed with support from CETUR, the Hotel Association of Ecuador (AHOTEC) and local businesses.

3.2.2(21)
Tourist multi-service module of Atacames

Construction of a multiservice module for visitors of the Atacames beaches, including parking zones, dressing rooms, showers, bathrooms, sports courts, etc.

3.2.2.(22)
Basic tourist services in Súa

Construction of basic services and rest areas for visitors and Súa residents. Offerings will include parking areas, dressing rooms, bathrooms, sports courts, etc.

3.2.2(23)
Basic services for visitors to Muisne

Determination of the needs and available sites to establish basic services and recreational areas in Muisne Island, in relation to the urban development plans in Muisne.

> ***Policy 3.2.3***
> *The natural features, appearance, and environmental quality of the ZEM must be restored and protected by placing greater emphasis on environmentally oriented tourist visits in order to prevent a further loss of the tourism market share of the ZEM.*

Specific actions to implement this policy include the following:

3.2.3(24)
Land use regulation in the ZEM

Development of land use control plans for Atacames, Súa, Muisne, and other communities of the ZEM that require urgent attention to zoning land use in order to solve conflicts created by the competition of uses and to protect important scenic values and natural habitats.

3.2.3(25)
New tourist development options in the ZEM

Options for diversifying tourism recreation in the ZEM should be studied and designed; for example, a scenic overlook at the entrance of Atacames; access to the Peñón del Suicida and the Tonchigue cliff; walks throughout the caves and farms and the primary forest of Galera-San Francisco; family excursions to Muisne; and a facility to exhibit the great diversity of wildlife and vegetation (for example through a diorama).

F. Expected Results

1. Zoning plans supporting ordinances and the measures required to bring order to the development process in each of the resort communities of this ZEM

2. Provision of basic infrastructure required if the attractiveness of the area for tourism is to be sustained while absorbing a greater number of users. This includes parking, public bathrooms, changing facilities, garbage removal, and life guards

3. Management strategies for cultural and environmental features that diversify tourist attractions while providing alternative livelihoods for residents who can no longer subsist from traditional mangrove activities, fishing, and lumber harvest

4. Information programs and training that improve the management of tourism while protecting the area environment

3.3 Environmental Sanitation and Coastal Water Quality

A. Importance and Options

Water is central to family life, community health, environmental quality, and the economy of the Atacames-Súa-Muisne ZEM. Adequate supplies of clean water simply do not exist. It is imperative that watersheds are managed for surface and ground fresh water supply and that careful attention is given to protecting the quality of sources. Distribution systems must be properly designed and maintained, and water bodies must not be used for waste disposal. Yet these basic steps have not been taken.

The health indicators of the ZEM population show that, of the three causes of mortality, two correspond to water-originated diseases: parasites (28.9%) and gastroenteritis (17.5%). This data reveals the poor sanitary conditions of the villages and the close interrelationship between the environment and the residents' quality of life.

The ZEM's economy depends greatly on environmental quality and basic services such as potable water and appropriate domestic and industrial waste disposal. For example, research regarding tourist demand carried out in August 1990 revealed that two-thirds of the visitors felt that the water supply was bad or mediocre; nearly one-fifth indicated that the garbage, sanitation, and potable water were bad and that they did not wish to return to the zone. Similarly, the general opinion of the ZEM residents is that the potable water supply, sewage disposal, and garbage collection should have higher priority in order to improve quality of life in the ZEM. An important objective of the ZEM plan is to demonstrate that the maintenance of environmental quality, through active leadership, is vital for the economy as well as for the well-being of the ZEM residents.

B. Characteristics of water supply and sanitary situation

1. Water supply and environmental quality

The ZEM has an average of 1,000 to 2,000 mm of rain per year, but during the dry season, the amount of water carried by small rivers diminishes drastically and disappears in some cases. In general, the rivers of the ZEM, particularly the basins of Atacames, Súa, Tonchigue, and Galera, have registered a gradual reduction of water volume produced during the dry season. The main cause is considered to be the destruction of forests within the basins. Therefore, the availability of clean water is limited and irregular. The use of groundwater systems is an alternative that should be thoroughly analyzed.

The dispersion of population, which typifies the ZEM, suggests that water supply solutions should focus on individual, and not regional, systems.

In Atacames, Súa, and Muisne, there is an existing system of potable water, but the supply is deficient in terms of quantity and quality. In some cases there are studies or works in progress to improve or extend this service. For example, the first studies on potable water for the villages of Atacames-Súa were done in 1968. The system was designed for a 30-year period for a population of 7,300 inhabitants of Atacames, Súa, and Tonsupa. It was built by the Municipal Water Company of Esmeraldas. Presently, there are serious interruptions of the service due to

flaws in the water distribution from Esmeraldas, as well as operating problems in the pumping station. This explains why cisterns remain the main source of water.

Water for human consumption is presently provided from a variety of sources, including:

- Rainwater collected during winter season
- Groundwater
- Potable water transported by tank truck from Esmeraldas to cisterns for the hotels
- Water collected from Unión River
- Water collected directly from rivers or estuaries, some of which flows only intermittently during the dry season
- Hand-dug wells, which do not always provide adequate quality water due to high content of minerals and bacteria

These sources have limitations and risks and do not ensure meeting residential and business needs.

2. Disposal of wastewater

It is not surprising that health statistics and data from tourist surveys clearly show that there are few villages with waste disposal and sewage systems. The use of septic tanks is very limited. Many tourist hotels and facilities are built with internal potable water distribution systems which generate wastewater that is discharged into a nearby waterbody. The Atacames-Súa-Muisne ZEM is a rural zone, and most residents are concentrated in a few villages located at the edge of a river or coastline. Storm water in urbanized areas, when collected by drains, is often mixed with domestic sewage before being discharged to a river.

3. Disposal of solid waste

The collection, transportation, and final disposal of solid waste are not handled adequately. Service, in every community, is poor. Where collection systems do not exist, residents dispose of their garbage by burning or simply leaving it in empty sites or near water channels. Trash also accumulates on beaches, and tidal and river areas, where it is trapped on piling, fences, and estuary vegetation, and presents visual and sanitation problems. In Súa the sanitation problem is complicated by the disposal of wastewater and accumulation of garbage at the river and shore edges. When the rainfall is intense in the high part of the basin, the river overflows and carries the accumulated waste to the Súa beach. There is a proposal that would change the course of the river so it would discharge in another location; however, before any action is taken, studies should be done to determine the effects this could have on the environment and on the flow of the Súa River and tidal estuary.

The present state of the services is the following:

Community	Potable Water Collection	Waste Disposal	Garbage Disposal
Atacames	Piped water, tank trucks	Latrines, septic wells, open air dump	Carts
Súa	Piped water, tank trucks	Latrines	None
Tonchigue	Wells	Latrines	None
Galera	Wells, river	Latrines	None
Plátano Est.	Potable water	Latrines	None
Quingue	Potable water	Latrines	None
San Fco.	Potable water	Latrines	None
Bunche	Wells	Latrines	None
Muisne	Piped water, wells	Sewer	Collectors dispose on beach

C. Problems and Obstacles for the Improvement of the Sanitary and Potable Water Situation in the ZEM

ZEM residents have always been frustrated by inadequate design and execution or operation of potable water and sewage systems. There are more examples of failures than successes. Community participation has been limited or nonexistent in most cases; only in the last five years has there been community participation in the implementation and maintenance of services.

The Ecuadorian Institute of Sanitary Work (IEOS), which has vast experience in the construction and management of basic rural sanitation, also believes that community participation assures program success. IEOS contributes 20%

4. Chronology of Environmental Sanitation Services in the ZEM

Year	Project Description	Result	Observation
1965	Potable water in Muisne	Poor	Poor management of system
1970	Potable water in Súa, Atacames	Poor	Poor operation of treatment plant in Esmeraldas and of distribution system
1977	Sewage in Muisne	Regular	
1982	Potable water in Plátano Estuary	Poor	Abandoned system with no community participation
	Potable water in Quingue	Poor	
	Potable water in San Francisco	Poor	
1983	Potable water in Tonchigue	Poor	Abandoned
1987	Potable water in Galera	Poor	Poor design
1988	Potable water in Quingue	Good	With community participation
	Quingue Latrinization	Good	75% coverage
1989	Piped water in Atacames-Súa	Satisfactory	With community participation
	San Fco. Latrinization	Satisfactory	50% coverage
	Plátano Estuary Latrinization	Poor	Lack of community support
1990	Potable water in Plátano Estuary	Good	
	Potable water in San Francisco	Good	

of the program costs for community sanitation works. IEOS organizes the community, naming a committee of system users, and creates a legally established administrative board that is responsible for providing community contributions. The communities in the ZEM typically have not offered their total support to the proposed system in terms of local contributions and necessary maintenance.

Providing the opportunity for greater local involvement is not sufficient. Communities and others who finance and construct needed facilities and systems must be strongly motivated by the commitment to solve the quality of life issues which are posed by water supply deficiencies and contamination. The inability of a small community to obtain clean water and properly dispose of sewage and trash is not just an inconvenience for residents, but represents a public health issue for the entire ZEM. Waterborne gastrointestinal diseases do not respect village boundaries; tourists are just as prone to sickness as local residents; and the pollution generated in one community degrades fisheries, habitats, and resources used by all.

D. Objectives

1. To promote awareness through education and monitoring of the vital link between contamination of water and land from waste disposal and deterioration in quality of life

2. To gain the commitment of ZEM communities to develop and maintain adequate supplies of clean water and to adopt waste disposal practices that will protect community health and cleanliness

3. To provide training and technical support for locally managed water supply and waste collection facilities and services

E. Management Policies and Plan of Action

The improvement of water supply, adequate disposal of used water, and collection and final disposal of garbage are matters that affect the health and quality of life of all ZEM residents. These matters also affect economic activities, mainly tourism. Good water quality and good practices for waste disposal are essential for maintaining the quality of estuary habitat and the ZEM environment.

The specific policies and actions regarding environmental sanitation emphasize the implementation of well-conceived small projects, many of which have already been designed and, in some cases, partially implemented. In addition, technical evaluations of the need to rehabilitate some existing services have been carried out. In all cases, the key to success will be the participation and responsibility of the community and local groups. In addition, help from entities like IEOS and municipalities in construction, operation, and service maintenance is a key factor. Consequently, the ZEM plan considers the first phase to include both the rehabilitation of deficient services and community training.

Policy 3.3.1
Adequate supplies of clean fresh water must be made available throughout the ZEM using a mixture of sources and distribution systems that can be operated and maintained to the greatest extent possible by local communities. Projects must be accompanied by public education campaigns in the treatment of drinking water, food handling, and in training local personnel.

Specific actions to implement this policy include:

3.3.1(26)
Design, construction and maintenance of potable water source systems for Muisne-Bunche, Atacames, Súa, Tonchigue, and the Galera-San Francisco zone.

Provision of potable water for Muisne through a system that will guarantee water quality and quantity for human consumption. Undertaking studies to consider superficial sources of the continental area. Studies of sources and of a potable water supply system for Bunche. Improvement in service management from local boards and municipal authorities.

Improvement in potable water supply for Atacames is included as an emergency project because the Regional Plan of Potable Water of Esmeraldas does not yet have the financial support to finish the work in this village. This project is aimed at improving the organization and operation of the present service that supplies potable water to the Atacames population. The activities will involve an evaluation of the situation and of the operation of the present emergency system, and design and implementation of proposed solutions.

Expansion and improvement of the potable water supply system in Súa. Training for service management.

Rehabilitation of water wells for Tonchigue and complementary works that cover basic supply needs. If possible, rehabilitation of water distribution system.

Rehabilitation of water wells that supply the small communities between Galera and San Francisco. Organization of distribution systems.

3.3.1(27)
Campaign for sanitation education

Carry out door-to-door campaigns throughout the ZEM concerning appropriate techniques of water purification and food handling to prevent contamination and the spread of diseases.

3.3.1(28)
Training for operation of water supply systems

Provide training and support to groups involved in the management of potable water supply systems to ensure appropriate operation and maintenance.

Policy 3.3.2
The water quality in tourist areas, estuaries that serve as fish and shellfish habitat and harvest areas, and rivers that are used as water supply sources or discharge directly into tourist zones must be protected and improved, especially in the cases of Atacames and Súa. This requires use of well-designed and well-situated latrines and septic systems, and the introduction of centralized wastewater treatment techniques, such as oxidation lagoons and wetlands in certain urban areas.

Specific actions to implement this policy include the following:

3.3.2(29)
Protection of coastal water quality in Atacames

Study and prepare policies and regulations for coastal waste discharge and disposal facilities in Atacames-Puerto Gaviota. The activities will involve: analysis of geomorphologic studies;

selection of basic rules; control, surveillance, and inspection; and determination of basic requirements for proper septic tanks and latrine construction.

3.3.2(30)
Sanitary installations on the coastline

Construction of septic tanks and latrines in Súa, Tonchigue, and small coastal communities between Galera and Bunche.

The activities in Muisne involve the following: improvement of public restrooms located near the pier; preparation of a manual of operations and maintenance for the wastewater pumping station; cleanup of the sanitary sewage system; and preparation of a study on effectiveness of offshore discharge and the need for improvements in dispersion.

3.3.2(31)
Centralized treatment of wastewater

Investigate the feasibility of establishing centralized treatment techniques of wastewater, such as oxidation lagoons. Selection of appropriate areas and sites for pilot projects of wastewater treatment through slow discharge into wetlands.

Specific actions to implement this policy include the following:

3.3.3(32)
Collection and disposal of garbage in Atacames, Súa, Tonchigue, and Muisne

Collection and disposal of solid waste in the Atacames-Puerto Gaviota area are needed through an emergency project made up of several elements: inspection of the area; determination of basic needs for garbage collection, and option selection; design of collection and final disposal routes; selection of practical operation means; and campaigns to obtain community support and service implementation.

Collection and disposal of solid waste in Súa, Tonchigue, and small ZEM communities.

Increase coverage of solid waste collection in Muisne. This requires that the garbage truck be rehabilitated and that some streets be improved so that the truck may enter districts presently not served. Furthermore, the open air dumps must be changed to buried forms to create a sanitary landfill system. Until the truck is rehabilitated, a low cost operating system should be designed to collect and dispose of garbage on the island.

Policy 3.3.3
Solid waste disposal on beaches, coastlines, and rivers must be halted, and degraded areas restored. Locally managed collection systems need to be put in place, along with the identification and proper operation of landfill sites for Atacames, Súa, and Muisne. Recycling and composting techniques should be introduced, along with a sustained public education campaign—aimed at residents, businesses, and tourists—on the proper disposal of solid waste.

Policy 3.3.4
Routine monitoring and reporting on the water quality, beach cleanliness, and habitat conditions should be conducted with the involvement of local groups and technical experts. Specific environmental quality criteria should be established to measure the seriousness of degradation trends and the effectiveness of specific environmental sanitation improvement actions.

Specific actions to implement this policy include the following:

3.3.4(33)
Monitoring of water quality and environmental sanitation

Selection of areas with contamination problems (disposal of wastewater, poor water quality in shrimp ponds, intensive use of pesticides). Design of a plan for monitoring water quality in estuaries and important recreational areas for productivity of bioaquatic resources. Whenever possible, local personnel will be used to support sample taking, identify contamination sources, and evaluate results of the analysis.

Develop facilities to carry out sampling and basic analysis of the water quality in the ZEM. This will require coordination with institutions and laboratories located in the province.

Monitor beaches and shores for garbage disposal, land filling, sand extraction, and other destructive practices. Prepare periodic reports regarding the condition of areas where cleanup and maintenance are carried out, as well as places that have not been cleaned.

E. Expected Results

1. Provision of adequate supplies of uncontaminated fresh water for each of the coastal communities

2. Installation and maintenance of sewage disposal facilities adequate to protect water quality and human health

3. Implementation of environmentally sound solid waste disposal practices

4. Public awareness campaigns, monitoring and training to ensure continued functioning of installed systems, and adoption of sanitary practices in communities and businesses to protect public health

3.4 Management of Fishing Resources

A. Importance and Options

Artisanal fishing is one of the main economic activities of the ZEM. It is in third place after agriculture and tourism. It is least developed in terms of technology employed by fishermen. Shrimp mariculture, which, for the most part, is small scale, is rapidly growing.

Artisanal fishermen are concentrated in the villages of Tonchigue, Galera, San Francisco, Atacames, Súa, and Muisne.

Although artisanal fishing of the ZEM produces a low volume of product, it has a great impact, especially on the exploitation of black coral and capture of gravid female shrimp used in shrimp larvae laboratories throughout the Ecuadorian coast.

There has been a loss of ecosystem quality and a decrease in the productivity of certain fish species, but overall, there is no indication of irreversible damage in the coastal habitat and fisheries resources of the ZEM, except perhaps in several small mangrove areas in Atacames. There still remains the opportunity to initiate integrated fisheries management in order to increase benefits provided by the sector to the local economy and improve the quality of life for fishermen and their families.

B. Characteristics of fisheries

Basic information about fish and shellfish stocks and landings, geographic distribution, and trends over time is needed to set policies and take specific actions to manage near-shore fishing grounds and habitat. Unfortunately, such information is simply not available except through the observations of the local fishermen themselves. A study of the vitally important shrimp post-larvae fishery has only recently been carried out by the National Fisheries Institute. As a result, information and issues regarding fisheries in the ZEM tend to focus on the needs and problems of fishermen rather than fish stocks.

White Fish: In 1987 there were nearly 230 artisanal vessels and about 700 fishermen in the ZEM. The biggest concentration, about 140 people, is in Tonchigue. In 1992 there were more than 300 small vessels operating in Tonchigue; more than 60 in Galera; and about 40 in San Francisco. Fishing is of less importance in tourist areas like Atacames.

The most widely utilized fishing techniques are: trammel nets for lobster and shrimp; nets of up to 700 meters in length; 300-600-hook longlines; drag nets for shrimp; and hand lines. Most of the vessels are built with trunks from trees, enlarged with boards, and reinforced with frames. About one dozen fiberglass vessels were observed.

Two or three buyers frequent this ZEM, and each one has considerable power. Most of the catch is transported by intermediaries to the city of Esmeraldas. Because fishermen do not always have the species, quantities, and required sizes to meet local demand, part of the catch in the ZEM does return to be resold to restaurants and hotels.

This ZEM has no wharves, ice plants, facilities for holding fish, fishing supplies, or spare engine parts. Usually the engines are sent outside the ZEM for repair. Fishing gear is not always available locally and is usually more expensive in other coastal areas.

Capture of post-larvae and gravid female shrimp: There are no reliable data on the number of people who depend on post-larvae shrimp fishing, but in some places, it is a very important activity. For example, most of the Bunche population is dedicated to this activity as a means of livelihood. It is very common throughout the ZEM for fishermen to keep post-larvae in small ponds or hatcheries until they reach a young size and can be sold at higher prices. Gravid female shrimp are available throughout the year in this zone and the Esmeraldas Province.

Black coral harvest: This ZEM is one of the two centers in the country where black coral is exploited, the other being the Galápagos Islands. The total production was attributed to two divers who use a "hookah" to harvest black coral in depths of 30 to 40 meters. Each diver extracts nearly 70 pounds per day, diving close to 20 days per month. In 1989 the selling price in the vessel was 1,000 sucres per pound; the monthly income of this harvest was close to 2,800,000 sucres. However, the real value is in the processing and marketing sectors. Atacames is the only center in which 20 commercial locales polish the coral and make necklaces, bracelets and figurines.

Other fishing activities: There are approximately 30 people in the ZEM who fish for the blue crab that live in high tide zones. Approximately 25 years ago, there was excellent striped mullet fishing at the mouth of Atacames and Muisne rivers. Similarly, good quantities of "California walker" are caught when coastal lagoons form. There are collections of oysters and black cockle in the estuaries, although their availability is diminishing.

C. Problems in the Fisheries Sector of the ZEM

1. Fisheries potential

Presently there is no information about or monitoring of the volume, species, sizes, and variations of the catch. Fishermen have expressed concern that their catch is diminishing, and they have asked for information regarding the potential of other fisheries resources. Likely causes of this decrease are overfishing, loss of estuary habitat due to mangrove destruction, construction of shrimp ponds, and water pollution.

2. Decrease of artisanal fishing yield

The declining catch by artisanal fishermen is due to an increased number of fishermen, increasing efficiency of techniques (shrimp larvae fishermen, coastal fishermen, use of outboard engines on canoes), and reduction of estuarine mangrove habitat.

3. Social structure and development of fishing sector

The fishing sector of the ZEM is poorly developed. There are no unloading facilities to properly process and handle the fish. There are no stores or shops that sell parts and basic vessel equipment or that repair and maintain engines.

Social cohesion among fishermen is not strong but should be strengthened if any coastal development and management effort is to succeed. For example, Tonchigue does have a cooperative and some pre-cooperatives, but these do not operate adequately.

4. Black Coral

There is no regulation to control the exploitation of black coral. The extent and potential of this high-value but slow-growing resource is unknown.

5. Conflicts between fishermen and other users of the marine coastal zone

The weak enforcement of fishing laws has led to commercial-scale fishing near the beach, which directly competes for stocks that have been traditionally caught by artisanal fishermen. Shrimp growers from other locations have settled in the ZEM, increasing the destruction of mangrove and other habitats of important species like crabs, shellfish, and finfish. Artisanal fishermen complain that the shrimp farmers do not allow them to capture blue crab and other estuarine species as they have traditionally done. Artisanal fishermen continue to use beach sectors to clean fish and dock their vessels, often interfering with tourist uses.

D. Objectives

1. Establish a fisheries stock information base in the ZEM and promote the participation of artisanal fishermen in complementing specific fisheries management policies

2. Identify and promote local stock management, especially for estuarine-dependent species, as well as habitat protection

3. Promote better organization of fishermen through self-help projects, including those that can reduce conflicts with tourism

E. Management Policies and Plan of Action

The challenge for artisanal fisheries management and development in the ZEM is to find the balance between improving the efficiency of artisanal fishing and placing appropriate restrictions on fishing certain species or grounds during specific times to protect stocks. The problems of fisheries management in Atacames-Súa-Muisne ZEM are compounded by the lack of information about the life cycles of important species and the absence of stock assessments. The tradition of poor enforcement of fisheries laws and regulations further aggravates the situation.

Successful completion of small projects and local initiatives to increase fishing efficiency and profitability will be essential for building the capacity of fishing communities to participate in more complex endeavors. Such endeavors include habitat protection, stock assessment, and fishing activity and fishing grounds management. The ZEM program in Atacames-Súa-Muisne has already made important progress through the active participation of fishermen in the technical assessment and design of small-scale practical exercises. One project, a storage and distribution center for supplies in Tonchigue, was funded during the first round of small projects approved by the ZEM Advisory Committee. Another project, aimed at developing a tour of the mangroves in Río Atacames, includes a component to protect and restore the estuarine habitat of the river, larvae collection center, and larvae grow-out ponds.

> ***Policy 3.4.1***
> *Local management of estuarine and near-shore fisheries stocks is essential to prevent a collapse of overfished species.*

Specific actions to implement this policy include the following:

3.4.1(34)
Fishing zones

Establish enforceable agreements to set precise boundaries between the designated zones for artisanal and commercial fishing. Develop a zoning plan for estuarine and coastal areas to designate allowable shellfish and artisanal fishing harvests in the ZEM.

3.4.1(35)
Collection of basic fisheries data

Establish and maintain a system of basic statistics on the artisanal catch, and utilize this information to experiment with local fisheries management regulations.

3.4.1(36)
Management of important estuarine and coastal resources

Develop and implement a system for the mangrove fisheries of blue crab, shellfish, and oyster in the ZEM through coordinated action among fishermen and local fishing authorities. Specific plans will be included for the management of lobster stocks in the Quingue-Galera area; these stocks are showing signs of overexploitation.

3.4.1(37)
Rational exploitation of black coral

Study black coral resources and develop a conservation plan to include extraction and efficient use systems; identify alternative raw material for the artisans that process black coral.

Policy 3.4.2
Fisheries habitats must be protected from physical destruction as well as degradation of water quality.

Specific actions to implement this policy include the following:

3.4.2(38)
Protection of fisheries habitat

Identify critical habitats in the life cycle of economically important species in the ZEM, especially native endangered species such as oysters, shellfish, and mullet. Prepare habitat protection plans consistent with other ZEM plan activities, such as mangrove protection and shore use zoning.

3.4.2(39)
Study and control of petroleum contamination

Verify whether petroleum discharges from oil tanker loading and transport in the terminal at Balao are affecting fisheries resources. Recommend monitoring strategies.

3.4.2(40)
Effects of wastewater and solid waste on fisheries

Include the impact on fisheries and the safety of fish harvesting as considerations in the design and implementation of wastewater collection, treatment, and discharge proposals.

> ***Policy 3.4.3***
> *Primary emphasis in the development of artisanal fisheries in the ZEM must be placed on increasing fishermen's incomes through better quality, variety, and marketing of fish, as well as lowering costs and improving safety and convenience of fishing effort.*

Specific actions to implement this policy include the following:

3.4.3(41)
Infrastructure and services for artisanal fishing

Promote fishermen's participation in self-development activities, with emphasis on improving safety and resolving conflicts with other beach users. Several activities will be included:

a) Establish a commissary for fishing and vessel supplies in Tonchigue; It will be associated with a processing and marketing fishing center. Establish a similar commissary on a smaller scale in Galera, operating either as an extension of the one in Tonchigue or independently.

b) Develop a supply center for fuel and lubricants and a repair shop for outboard engines in Tonchigue.

c) Construct small facilities for unloading, cleaning, and handling production in the communities between Galera and San Francisco.

d) Establish a communication system for the ZEM fishermen to support their activities and improve their safety and protection. This system would operate in coordination with the Ranger Corps of Esmeraldas to be more efficient and to improve coastal resource management.

e) Develop recommendations for a credit system oriented towards the specific needs of artisanal fishermen of the ZEM.

3.4.3(42)
Training of artisanal fishermen

Design and implement a training program for fishermen to include repair of engines and vessels, fishing techniques, fish handling and storage, commerce and small business organization, and key aspects of biology and ecology for fisheries management.

F. Expected Results

1. Assessments of stocks and harvests for important fisheries in the ZEM

2. Trials of locally based controls on fisheries effort, including enforcement of existing restrictions on commercial fishing in nearshore waters

3. Implementation of specific measures to protect remaining habitat for estuarine species

4. Construction and maintenance of facilities, such as landing piers and fish-cleaning and marketing areas, to eliminate conflicts over use and cleanliness of beach areas

5. Strengthening the organization of local fishermen so they can be active partners in the implementation and refinement of plans

3.5 Management of Mariculture

A. Importance and Options

Shrimp harvesting is the main mariculture activity in the ZEM. There is a temporary harvest of "chame" (*Dormitator latifrons*) during the winter when lagoons form near Atacames and Tonchigue. It is estimated that approximately 50 people are dedicated to this activity and that the natural harvest areas reach about 30 ha. However, this activity remains very limited.

Shrimp harvesting is a relatively new activity in the ZEM, although its growth has been quite fast. It contributes significantly to the income of a large number of inhabitants of the zone, and there are entire communities, such as Bunche, which depend on shrimp mariculture.

A wide range of activities associated with shrimp mariculture can be found in the ZEM. These include post-larvae and gravid female shrimp harvesting; production of post-larvae shrimp in laboratories and spawning stations; growth of larvae (for sale and for harvest of young ones in ponds); growth and fattening of shrimp in ponds.

There is great potential to improve the production by harvest without having to expand the present infrastructure of the zone or increase the pressure over the natural stock. The shrimp stock in the zone is unknown; however, there is speculation that the expansion of shrimp ponds and/or an increase in the fishing pressures would result in a drastic reduction of the resource. This is due to the pressures on fishing sources (catches of larvae, gravid females, and adults) and the trend of decreased stock productivity (decreasing abundance of adult shrimp, larvae, and gravid females).

In the small coves of El Roto, Ostional, and Tortuga, and in the estuary of the Muisne River, the practice of growing and fattening fish like mullet and "pargo" through artisanal methods of fencing has been established. Technical assistance for this activity is needed by fishermen in organization, handling, and marketing.

B. Characteristics

Shrimp larvae and gravid female fisheries, production of larvae in laboratories, and shrimp production in ponds are all found in the ZEM.

Shrimp larvae fishing is done through a process known as "piernón" (a fishing art known as "tijereta" in other parts of the coast) in which a "chinchorro" (trammel net) is spread across the mouth of the estuaries. It is estimated that the ZEM has some 100-500 larvae ponds.

Artisanal fishermen of Tonchigue, Súa, and Tonsupa are dedicated to gravid female shrimp fishing. These areas have installed collection centers for gravid shrimp that are sold to buyers from other zones. Gravid shrimp fishing is done in small canoes or boats and shrimp vessels ("arrastreros"). The shrimp boats fish for gravid shrimp between 17h00 and 20h00 (between 5 and 8 p.m.) in areas very near the coast, causing conflicts with artisanal fishermen and residents who feel that these shrimpers are destroying the resources. The females captured in this manner are considered to be of low quality (low percentage of "eclosion") due to the stress to which the female is subjected during the catch.

It is estimated that Esmeraldas has 13 laboratories and approximately 20 spawning centers for larvae production in the Tonsupa-Atacames-Súa-Same-Tonchigue area. Most of the laboratories are located in Tonsupa. The larvae produced in

these laboratories are sold, for the most part, to producers out of the ZEM.

The production of shrimp in ponds in the Esmeraldas province is characterized by the use of pre-nurseries because the ponds for fattening are small, generally about 10 ha.

There are a number of families in the ZEM that have small larvae nurseries (usually near their homes) to grow larvae for sale at a better price than the post-larvae caught wild.

The ZEM shrimp growers are mostly small producers. Most of the shrimp ponds and nurseries are located in Muisne. It is estimated that about 1,300 ha of ponds exist in Muisne River and its systems. Additionally, it is estimated that there are about 150 ha of ponds in Atacames River.

C. Problems and Conflicts in the Sector

The Atacames-Súa-Muisne ZEM is the main source of gravid females for the entire Ecuadorian shrimp mariculture industry; however, there is no basic information about this fishery, and it is not regulated. The need to capture these "wild"post-larvae is high due to the great loss that occurs during capture and handling.

Most of the problems of shrimp farms result from the lack of knowledge of appropriate technology and lack of capital. However, there are also environmental problems that result from the impact of the growth of shrimp harvest in the ZEM during the 1980s. It is estimated that cutting and other uses of mangrove have reduced the habitat of species that in one way or another depend on the estuary. The loss of forest cover in the upper portions of coastal watersheds has also had a negative effect in the estuaries.

The principal problems are the following:

1. Supply and production of shrimp larvae

a) Unavailability of shrimp larvae; excessive pressure over the stock

b) Lack of knowledge of proper handling techniques, resulting in unnecessary loss of shrimp larvae

c) Impact on the environment; in the Esmeraldas ZEM the larvae fishermen do not return the rest of the species to the ocean (as other larvae fishermen already do in other parts of the coast, such as Bahía de Caraquez) after separating out the larvae of *Penaeus vannamei*. There is unnecessary loss due to the capture of larvae of other species like crustaceans and fish

d) Lower survival rates of laboratory-raised larvae

e) Observed decline in the availability of gravid females as well as in the percentages of eclosion. There are also regional differences in the quality of females. The best females are captured to the south of the city of Esmeraldas

2. Management of shrimp ponds

a) Purchase of larvae: The purchase of larvae in the zone is done in a very rudimentary manner. The buyer does not know the number of larvae he receives or the percentage of *Penaeus vannamei* larvae; he receives all the other larvae that come with the desirable shrimp larvae. This explains, in part, the role of larvae grow-out ponds as selection units. Under primitive conditions, larvae are subjected to high stress,

and only sturdier species, such as *P. vannamei*, survive. None of the larvae fishermen and very few shrimp growers of the zone know how to determine the percentage of this species or the quality of the larvae.

b) General design: The design of the ZEM shrimp ponds and grow-out ponds is typically irregular. Most of the infrastructure has been built by hand. The main problems include:

- The water supply and discharge systems in the ponds are inefficient and poorly designed. Few producers have pumps, so they depend on gravity systems for water exchange. Many shrimp ponds lack filters in the water inlet, so during each water change, there is an invasion of other species, including fish and crabs

- The pond bottoms do not have adequate slopes to allow efficient draining and harvesting

c) Management of larvae grow-out ponds:

- The larvae grow-out ponds of the zone are managed in a very primitive manner

- Operators mention an average depth of 30-40 cm, but the observed depth is actually closer to 20 cm. This implies that the larvae are subjected to extremely stressful conditions

- The larvae grow-out ponds also mix larvae purchased at different dates

d) Management of shrimp ponds:

- Few producers maintain an adequate population control (estimation of the biomass in the pond, measurement of shrimp growth, current state of change) and do not recognize the usefulness of doing this job. In some cases, the entire biomass of the larvae grow-out pond is transferred to the production pond (including fish larvae and other crustaceans) without control of the seeding density

- Most of the producers do not have water quality control in the ponds

- Few of the zone producers use adequately balanced food. The ones who do, use charts that come with the product. Few producers fertilize the ponds

- Few producers conduct pond maintenance after the harvest

e) Harvest and Marketing: Most of the shrimp producers do not know how to estimate the composition of their harvest and depend entirely on the shrimp packers. Many shrimp growers produce between four and nine categories of shrimp size per harvest.

3. Investment capital

The financing capacity of the producers of this zone is very limited. It was estimated that in the ZEM there are about 1,500 ha of shrimp ponds; however, only 20 percent of this total is operating due to a lack of capital. Few shrimp growers of the zone possess operating permits that would enable them to be candidates for credit.

4. Organization of shrimp producers

There is a lack of representation of producers in the zone within the commercial associations. Shrimp growers of the zone feel that none of the commercial associations (National Chamber of Fisheries, Chamber of Shrimp Producers, Association of Shrimp Growers of Esmeraldas) represents the interests of small producers.

5. Closed seasons and fishing restrictions

Most of the shrimp producers feel it is necessary to implement closed seasons to protect stocks of wild larvae and gravid females. However, there is doubt that these bans will have much effect, due to the lack of enforcement. According to producers, bans are not observed. There is discontent about the choice of closed periods (December, January, and August) and the evaluation procedure for determining the results of the closures.

D. Objectives

1. Establish an information base and specific required policies for sustainable management of shrimp stock. Create interest and participation among local fishermen in the design and implementation of fisheries policies

2. Significantly reduce the loss of post-larvae and gravid female shrimp; improve capture and handling techniques through demonstrations, training, and technical assistance

3. Halt the construction of new shrimp ponds and thereby prevent the related environmental degradation and use conflicts that arise between shrimp mariculture operations and other coastal resource users

E. Management Policies and Plan of Action

The future of the shrimp industry, at least short-term, seems to be linked to the supply of gravid female shrimp, which, for the most part, are captured in the Atacames-Súa-Muisne ZEM. Mariculture is an important sector of the ZEM's economy.

The CRMP has initiated some activities directed toward the establishment of a sustainable mariculture in the ZEM. During 1990 a Peace Corps volunteer contributed to the design of a technical assistance project for the larvae grow-out ponds of Bunche, with implementation in 1991. Also, many meetings have taken place with shrimp growers, community members, and public officials in Muisne in relation to the loss of access to traditional fishing sites in mangrove areas due to the construction of shrimp ponds.

> ***Policy 3.5.1***
> *The capture of shrimp in all the phases of its biological cycle, from larvae through adulthood, and especially of gravid females, should be carefully controlled in order to assure a sustainable supply of wild post-larvae for local activities.*

The specific actions to implement this policy include the following:

3.5.1(43)
Reduce the mortality of shrimp post-larvae

Establish a training and information program about handling post-larvae to reduce the mortality rate during capture. This can be done through

improvements in nets and fishing techniques; selection of larvae; handling methods during sales on the beach; and beach sale, transportation, and placement in the larvae grow-out ponds to obtain more advantageous sizes for marketing.

3.5.1(44)
Study of distribution and abundance of shrimp

Conduct studies to define the stock (geographic distribution, size, composition) that is utilized by shrimp growers of the ZEM, and outline management strategies to regulate capture of post-larvae, gravid females, and adults to obtain sustainable stock levels.

3.5.1(45)
Strengthening and application of management rules

Develop organizational and operational capacity for efficient enforcement of fishing administrative laws and norms, using the Unit of Conservation and Monitoring (UCV) of Esmeraldas and local methods of self-management.

> ***Policy 3.5.2***
> *The boundaries of existing shrimp ponds should be established with precision to prevent future expansion. The ponds should be surrounded by mangrove buffer zones, including the areas that should be managed to maintain shrimp habitat and fin-, shellfish, and traditional fisheries of estuarine ecosystems.*

Specific actions to implement this policy include:

3.5.2(46)
Control of shrimp pond concessions

Revise all concessions and permits given for the operation of shrimp ponds in the ZEM; identify conditions and renewal dates; prepare maps; compare actual extension with authorized development. Identify possible inconsistencies with implementation of the permits.

3.5.2(47)
Mangrove buffers around shrimp ponds

Establish mangrove areas, shellfish collection zones, and fishing areas that will act as buffering zones surrounding shrimp ponds. Prepare specific regulations and rules to formalize this zoning. Utilize the renovation process of concessions for shrimp ponds to ensure the enforcement of protection plans. Develop extension and demonstration programs. The implementation of policies in section 3.1.1 will contribute to this effort as well.

3.5.2(48)
Fish mariculture in the estuary of the Muisne River

Provide technical support for organization, training in handling, and marketing of caged fish in Caletas, El Roto, Ostional, and Tortuga in the estuary of the Muisne River. Gather information to support management decisions.

3.5.2(49)
California walker harvest in Tonchigue and Las Brisas

Improve and promote "chame" harvest in the natural lagoons of Tonchigue and Las Brisas through organization and training of a group of 50 people presently carrying out this activity.

Policy 3.5.3
A program of technical assistance will be implemented to improve the efficiency and viability of shrimp ponds, laboratories, and larvae grow-out ponds in the ZEM, as well as to reduce the loss of the natural stock of post-larvae, diversify the mariculture industry, and reduce environmental impacts of mariculture operations on estuaries and coastal waters of the ZEM.

Specific actions to implement this policy include:

3.5.3(50)
Technical assistance for shrimp growers and laboratories

1. Develop and implement a program of technical assistance to improve the operation of the shrimp sector of the ZEM (larvae grow-out ponds, laboratories, spawning stations, production ponds) and increase their production, beginning with the existing infrastructure and resources.

2. Design and implement programs for mariculture diversification using local species like cockles, oysters, "chame". Each project will include selection of a site, infrastructure, management techniques, marketing, and necessary investments.

   Technical assistance will be provided to improve the quality of water that the larvae grow-out ponds use in Bunche and other areas of the ZEM. Work will be done with laboratories that produce post-larvae, to reduce contamination and water quality impacts from their discharges.

F. Expected Results

1. Evaluation of abundance, distribution, and biological cycles of the shrimp stocks, and establishment of specific policies that assure sustainable harvests

2. Implementation and evaluation of local fishing regulations, using strong local participation

3. Reduction of mortality of post-larvae and gravid female shrimp during handling; higher profit (for the same effort) for larvae grow-out ponds and shrimp production ponds of the ZEM

4. Cessation of shrimp pond expansion

5. Elimination of water contamination from shrimp ponds and laboratories; elimination of conflicts among shrimp and larvae fishermen and other coastal resource users

6. Establishment of techniques of fish growth and fattening (mullet, "pargo") through artisanal methods

7. Harvesting of "chame" in natural lagoons of Tonchigue and Las Brisas

3.6 Management of small watersheds

A. Importance and Options

Agriculture remains the single most important source of employment and the predominant use of a series of small watersheds that drain the hilly interior of the ZEM. Rainfall ranges from 900 mm per year in the northern part of the ZEM (the basin of Atacames River) to 2,200 mm per year in the moist Muisne River watershed. Water flows throughout the year in nearly all rivers. Most of these watersheds have a fertile but narrow river floodplain. Drainage through steeply sloped hills in pastures or woodlands empties onto broader coastal plains. In the past decade the coastal plains have been rapidly converted from agriculture to shrimp ponds, villages, and tourism zones. The production of livestock, fruits, and vegetables is for local markets in the ZEM and the city of Esmeraldas. Small quantities of coffee and cacao as well as some timber are produced for export.

The primary forest between Galera and San Francisco offers an environment of special attraction within the Ecuadorian coast. Deforestation and exploitation practices have deteriorated ground productivity and increased desertification. This peculiarity should be used to promote conservation plans of the area and to promote ecological tourism.

Unfortunately, few technical resources are available in the ZEM to put into place the planting, livestock management, and land use practices that could make the zone more productive over the long term, both at the family and the commercial levels. Instead, poor land management and harvesting practices have degraded this potential in a number of the watersheds. Deforestation creates soil erosion upland and undesirable sedimentation in coastal plains and estuaries. It also reduces the water supply potential. Upstream water pollution affects the major villages located in the coastal zone as well as the estuaries.

B. Characteristics

The main hydrographic basins in the ZEM area are:

Rivers	Area (Km2)
Atacames	300
Súa	47
Tonchigue	57
San Francisco	110
Bunche	80
Vilsa	198
Muisne	471

The ZEM area of Esmeraldas includes a dry tropical forest bordering the coast between Tonchigue and San Francisco; lowland forests (mangrove) located in Atacames, Bunche, and Muisne (estuaries); and humid tropical forests located in the interior.

For the most part, pastures have replaced the forest cover of the region. The most important remaining forested areas are located on the slopes of the cliffs of Galera-Quingue.

Livestock in these areas ranges freely at a low density of one head per hectare. Cattle are from local stock and are not managed. Animal products are marketed mainly at the local level, with their final destination the city of Esmeraldas and tourist centers of Atacames, Súa, and Muisne. The production of pigs and chickens is primarily for family consumption.

Coffee, cacao, citrus, and fruit are grown in the fertile lowlands of small coastal rivers. Some coffee is produced for export, but the volume is not of great importance compared with national production. Fruits and citrus are also grown mainly for family consumption, with any surplus sent to the provincial market. Corn is harvested in the rainy season. The average production fluctuates between 25-30 qq/ha and is destined for local consumption. Coconuts are grown along a number of beaches; the estimated production is between 1,500 and 2,000 units per ha per year, sold locally as dry or young coconuts.

The patterns of land tenure contribute to the stagnation of agriculture. One-fifth of the owners controls more than half of the ZEM land.

Size of Farm (Ha)	Owners % of Total	% of Area
0-50	50-60	30-40
50-100	20-30	30
More than 100	20	50-60

The way land possession takes place is as follows: The peasants invade the forest and cut existing vegetation. They then proceed to plant pastures as required by the Ecuadorian Institute of Agricultural Reform and Colonization (IERAC) in order to establish property limits. Later the property is sold to large investors for cattle ranching. In the final step, IERAC legalizes the initial occupation.

C. Problems and Options in Small Watersheds

The basic problems can be summarized as follows (see annex II for more details on each basin):

- Intense deforestation, in some basins up to 50 percent, in order to establish pastures for (extensive) livestock production (less than one head per ha)
- Intermittent water flows: most rivers are dry during the summer and have peak flows, or any water at all, only during the rainy season
- Elevated discharge of sedimentation in rivers
- Great loss of agricultural potential in coastal valleys due to urban expansion, tourist development, and construction of shrimp ponds
- Poor access to agricultural steep slopes, very humid weather in many areas, and lack of a strong local agricultural tradition. The low density of population in the high parts of the basins explains why some highlands have not been converted. This has meant that there is still the strong possibility of increasing food and wood production, water supply, and important scenic attractions in the ZEM
- Inadequate production of vegetables and fruit in the ZEM for local needs, resulting in a dependence on sources outside the area. However, there are good sites for raising these crops in the river flood basins of the Atacames (La Unión, Salima, Cumba), Súa (Guachal), San Francisco, and Muisne (Puerto Nuevo, El Sucio, La Colorada and Tortugita) rivers.
- Agriculture and logging are the most important economic activities in the upper

basins and continue to be the main source of employment in the ZEM. However, there are no specific efforts to develop and try techniques for better use of the highlands. There are no efforts to modify destructive practices of clear cutting, or to establish forest management in order to conserve resources, or to protect the quality and quantity of water resources.

- No agricultural extension programs for the proper use and conservation of land, farm management practices and productivity, or the development of family gardens.

- The remainder of the primary forest in the area of Cabo San Francisco (Galera-San Francisco) maintains habitat for indigenous animal species (deer, squirrels, monkeys, wild turkey, gray fox, etc.). However, the destruction of this tropical humid forest continues. The driving forces observed involve:

The IERAC requires that 90 percent of the area be cleared in order to give land to the farmers. This accelerates forest destruction by peasants.

Concessions are still being given for wood exploitation in this zone, with no responsibility for forest conservation on the part of permit holders.

The woodcutting and collecting practices of local inhabitants still continue without causing damage to the ecosystem. Outsiders are primarily responsible for deforestation in order to plant coffee, banana, and cacao, and to establish pastures.

The harvest of freshwater shrimp that occurs in May each year is being adversely affected by the use of pesticides (as observed in the basin of Estero de Plátano).

To manage the river basins, small dams should be built and native species such as "pechiche" should be replanted along the valley sides both to provide good quality wood and to protect water quality.

D. Objectives

1. To build understanding and awareness of the relationships between conditions in the small coastal watersheds of the ZEM and the economic and social well-being of coastal residents in terms of environmental productivity and attractiveness for tourism

2. To protect remaining primary forest, initiate reforestation, retain and better utilize fresh water supplies, and use sound erosion control practices in deforested and degraded uplands

3. To test integrated watershed planning and implementation techniques in a specific watershed

4. To expand sustainable agricultural activities as an alternative to coastal resource exploitation as well as to supplement family incomes

E. Management Policies and Plan of Action

The undesirable results of exploitive logging, land clearing, and farming practices can be seen

throughout the ZEM watersheds. But these results are not so severe that they justify pessimism about improving productivity, reclaiming degraded areas, and preserving tropical forests and the best agricultural soils that still exist in the ZEM.

During the initial ZEM planning process, less attention had been given to understanding the issues, economic potential, and most useful techniques for watershed management. The need for greater emphasis now in these areas is twofold: First, continued degradation in the watersheds will place even more stress on coastal environments, which are already experiencing considerable degradation and lost productivity. Second, a lack of expansion of economic activity in the coastal resource sector in the face of rapidly increasing population means that the ZEM will have to look more carefully at agricultural development as a source of both food and employment in the near future.

The management of river basins in the ZEM still does not have a sufficient information base to enable the designing of plans that will encompass the entire inland extent of the watersheds. The immediate strategy—which includes protection of the humid tropical forest, evaluation of the real agricultural potential in order to design projects, development of appropriate norms and techniques for a sustainable forest and agricultural use—comprises only the first step towards the management of river basins.

Policy 3.6.1
Existing stands of native humid tropical forest in the upper watershed, which have retained their native genetic material and not sustained damage from cutting, must be fully protected. Reforestation should occur along the floodplain of the rivers and major roads for erosion control and landscape attractiveness.

Specific actions to implement this policy include the following:

3.6.1(51)
Reforestation in the basins

Expand forest areas, especially where there are steep slopes and marginal cattle raising (Tonsupa, Salina, Súa, surrounding the lagoon of Same, Galera, Tonchigue).

3.6.1(52)
Protection of upper basin forests

Identify and develop norms to protect the forested areas of the upper basins; establish forested corridors along the basins out to the main roads of the ZEM.

3.6.1(53)
Reduction of soil erosion.

Identify and promote the use of forest harvesting techniques that will reduce soil erosion and prevent the establishment of pastures in critical eroding areas.

Policy 3.6.2
The potential for sustainable agriculture will be analyzed in every watershed in terms of consumption and commercial marketing. The types of assistance needed to promote, and improve the productivity of, family gardens and small- and large-scale agriculture will be assessed, including techniques to reduce the impact of farming on soils and water quality.

3.6.2(54)
Pilot Management Plan for a small watershed basin

Develop a management plan for a small basin in the ZEM. In order to prepare the pilot plan, it will be necessary to develop maps, a detailed land use zoning scheme and principal ordinances, and organize the business side of groups involved in farming and logging.

3.6.2(55)
Agricultural potential and technical assistance

Form a technical team composed of agricultural and forestry local and national experts. The team will prepare a preliminary analysis of the basins' main resources, patterns of ground use, and problems concerning family gardens, farms, and permanent plantations. The perspectives of farmers, land owners, and local families will be taken into consideration in the design of projects such as forest harvesting, reforestation, and agricultural development. ZEM areas will be selected to carry out test projects of new techniques on these topics.

3.6.2(56)
Production of food in the ZEM

Develop pilot programs for the production of farm products for local use. This will involve the following areas:

- Horticulture and fruit trees in La Unión, Salima, and Cumba in the basin of River Atacames
- Horticulture and fruit trees in Guachul in the basin of River Súa
- Fruit trees in the basin of River San Francisco
- Fruit trees, mainly for commerce, in Puerto Nuevo, El Sucio, La Colorada, and Tortuguita in the estuary of River Muisne

Policy 3.6.3
A long-term extension program should be created to test, demonstrate, promote, and evaluate appropriate agriculture and logging techniques in the ZEM watersheds.

3.6.3(57)
Public education campaigns and user agreements

Educational campaigns will be organized to support programs such as family orchards, agricultural development, logging, reforestation, erosion control practices, etc.

Agreements will be established among resource users (wood concessionaires, peasants, authorities) to protect areas of primary forest that act as genetic reserves for the ecosystems. Only traditional low-impact harvesting practices will be permitted.

In order to implement the agreements, the IERAC will have to modify the regulation that

requires deforestation for property distribution. The UCV will have to actively participate in the control of forest destruction in the ZEM.

3.6.3(58)
Expansion program for the watersheds

Design and carry out an extension program for increasing public awareness, interest, and community participation in supporting the management plans.

F. Expected Results

1. Intervention in critical primary forest areas to control timber harvest

2. Initiation of reforestation and planting of permanent orchards as well as family gardens in river floodplains and coastal settlements

3. Design of basic system for agricultural and family gardening extension

4. Development of a model small watershed planning and management program that can be used elsewhere in the Atacames-Súa-Muisne ZEM and elsewhere in the coast

Chapter 4

INSTITUTIONAL DEVELOPMENT OF THE CRMP AND THE ATACAMES-SUA-MUISNE ZEM

4.1 Present Situation

The current structure of the Coastal Resources Management Program was established in Executive Decree 3399, published on June 1, 1992, by President Rodrigo Borja.

Between 1989 and 1992, the structure of the coastal program was adequate for carrying out its principal mission, which was creating the special area management plans and preparing for their implementation.

For successful undertaking of a new phase of the coastal program, the CRMP implementation was attached to the president's office and administratively decentralized with a permanent office in Guayaquil.

At the ZEM level, the advisory and executive committees were combined into a single unit called the Zone Committee. At present, the responsibility for implementing and administering the coastal program is assigned to the executive director, nominated by the National Coastal Resources Management Commission, as well as the Executive office in Guayaquil and the ZEM coordination offices.

The ZEM offices play a key role working with the Zone Committee, the Ranger Corps (UCV), the technical team, consultants of the CRMP government agencies, and the various contractors who implement parts of the plan.

The National Coastal Resources Management Commission is responsible for directing the coastal resources management program. The president of the commission is the general secretary of public administration.

4.2 Roles and Responsibilities of the Key Implementing Units of the CRMP

A. National Coastal Resources Management Commission

- Recommend policies for coastal resources management to the president of the republic and monitor their implementation
- Approve the special area management plan of each ZEM
- Approve the annual CRMP work plan and budget, and evaluate the work plan's accomplishments
- 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
- Designate the CRMP executive director from a list of three candidates presented by the president of the National Commission of Coastal Resource Management; terminate the executive director when necessary
- Determine the responsibilities and operating rules for contracting committees
- Establish administrative means to enable public officials to coordinate management actions

B. President of the National Commission

- Periodically inform the president of the republic of the principal activities of the program
- Convene and chair the meetings of the national commission
- Promulgate internal rules, agreements, instructions, and other measures to implement the Executive Decree

C. Executive Director

- 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
- Submit an Annual Work Plan for the program and Special Area Management Zones for review by the national commission
- Submit an annual budget for national commission review
- Authorize spending to carry out the program and provide reports on expenditures
- Recommend and justify the creation or termination of Special Area Management Zones to the national commission
- Approve the annual operating plans for the Special Area Management Zones

- Assign and remove program personnel according to personnel procedures
- Act as the secretary to the national commission

D. Ranger Corps

- Promote awareness and compliance with the various laws, rules, administrative requirements, and methods for protection, conservation, and proper use of coastal resources
- Enforce coastal resource policies of the special area management plans
- Advise resource users on the conservation and protection policies
- Distribute information on legal rules and judicial procedures related to coastal resources
- Apply sanctions as they pertain to the internal rules and procedures of the Ranger Corps
- Develop and implement projects recommended by the Zone Committee
- Coordinate actions with local authorities and members of the Zone Committee to achieve compliance with conservation and management rules

E. Zone Committee

- Promote cooperation and coordination among public and private institutions, user groups, and communities to establish priorities in the ZEM; implement the management plan; and develop annual operating plans
- Promote citizen participation to assure that management actions will be sustained through local awareness, interest, and capacity. This base of knowledge and support will enable the committee to find satisfactory solutions for resource use conflicts
- Encourage public authorities who serve on the committee to adopt the necessary measures and initiatives to solve use conflicts, and serve generally as a mechanism for solving resource use conflicts in the ZEM
- Sponsor and recommend the adoption of interinstitutional agreements, municipal and provincial decisions, and resolutions of the national commission to assure the follow-through on management actions, including planning and zoning
- Prepare amendments and improvements to the Special Area Management plans
- Support the organization and participation of communities and user groups on the Zone Committee, and promote implementation of the annual operating plans
- Oversee public education program activities, and keep the local community and country informed of progress being made by organizations and individuals in sustainable management of resources
- Monitor and evaluate plan implementation
- Inform the Ranger Corps and the national commission on the status of support and

collaboration for plan implementation by public and private entities

F. Composition of the Zone Committee

- Representative of the national forest agency
- Representative of the land reform agency
- Representative of the General Directorate of Fisheries
- Representative of the national tourism agency
- Representative of the public sanitary works agency
- Port captain of Esmeraldas
- President of Atacames town council
- President of Muisne town council
- Prefect of Esmeraldas province
- Representative for each legally organized ZEM community
- Representative for each legally constituted coastal resource user group organization
- Delegate from each environmental organization of the ZEM
- Delegate for primary education teachers
- Delegate for secondary education teachers

G. Role of the President of the Zone Committee

- Represent the Zone Committee and sign all authorized decisions and agreements
- Convene and preside over committee meetings
- Set the agenda and provide leadership for carrying out the responsibilities of the Zone Committee
- Monitor the execution of committee decisions
- Participate in Ranger Corps meetings

H. Operating Rules for the Zone Committee

a) The committee will develop and carry out planning procedures, provide reports, and assure the credibility and strength of institutional mechanisms for carrying out the ZEM plans.

b) The committee can create task forces or permanent subcommittees on special issues, such as preparing the annual work plan, public education, management themes, implementing projects or other activities in the work plan.

c) The president and vice-president of the committee, along with coordinators of working groups, will serve as a coordinator and follow-up group to oversee ZEM plan activities. This group does not have authority to make decisions, and must make reports to the Zone Committee in its regular meeting.

d) With the exception in Article 5 of the Zone Committee regulations, all members of the committee have voice and vote. (Members must belong to a legally constituted organization.)

e) All user groups have the right to be represented on the committee, along with community associations. These groups could represent a community, parish, or canton. The base of the group must be from within the ZEM.

f) When assigning tasks, the committee will identify the responsible person and the deadline for accomplishment. If the task is assigned to an institution, the ZEM committee member representing the organization will be responsible.

g) An open file will be maintained containing copies of agreements made at full committee meetings, as well as the work of the groups and subgroups.

h) When there is a conflict among user groups, the Zone Committee will use the following procedures:

i) When necessary, the committee will request the technical assistance of CRMP and will make a quick analysis of the nature of the conflicts, key actors, and alternative solutions. A commission or working group may also be formed to carry out this study.

j) The report of the CRMP or the working group will be analyzed by the committee, along with the actors involved in the conflict. A consensus process will be used to reach the required agreements to solve the problem.

Once it is convened, the Zone Committee will determine the designation of new members.

No project can be included in the ZEM plan if it is not first brought to the attention of the Zone Committee.

The CRMP will only implement or finance projects that the Zone Committee has approved.

I. Relationship with the Ranger Corps

The Zone Committee will establish a relationship with the Ranger Corps in order to carry out its responsibilities and to coordinate the activities of the Corps that pertain to ZEM plan implementation, as well as the enforcement of laws, rules, and regulations governing the use of coastal resources in the ZEM, including:

a) Establishing agreements among coastal resource user groups

b) Resolving coastal resource use conflicts

c) Helping in patrols and control activities carried out in the ZEM by the Corps

d) Monitoring legal actions resulting from violations of coastal resources laws

e) Preparing joint reports to promote awareness and compliance with conservation, protection, and use regulations

J. Relationship to the ZEM office

The ZEM office is a part of the permanent structure of the CRMP, and its mission is to carry out the daily operations of the program in the ZEM. The Zone Committee will receive the help of the office primarily for:

a) Preparing and implementing the annual operating plan

b) Contacting and coordination with communities, user groups, and institutions related to the committee and Ranger Corps

c) Providing administrative and technical support to the committee and Ranger Corps

d) Relations with other parts of the CRMP; and

e) Carrying out the assigned functions of the committee

K. ZEM Coordinator

a) Prepare the annual operating plan and budget for the ZEM

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 in the ZEM

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 of the CRMP

h) Provide assistance to the executive director and ZEM 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 meetings and Ranger Corps meetings and advise on public education activities

k) Represent the executive director of the CRMP in the ZEM

l) Participate in CRMP 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

o) Carry out any additional assignments given by the executive director in order to carry out the resolutions of the national commission.

L. Office of the Coordinator

The focus of future planning, technical assistance, and monitoring of ZEM plans and Zone Committee implementation is in the ZEM office, under the supervision of the CRMP Executive Director.

The ZEM coordinator will make available the resources necessary to for the successful functioning of the Zone Committee and expert and technical teams, and will assist with committee meetings, conferences, and training and education programs carried out within the ZEM

The ZEM office needs to include support staff for secretarial and accounting service, as well as a local technical team.

The office personnel will be trained by the CRMC and will help in field projects and in the communities involved in ZEM plan implementation.

4.3 ZEM Annual Work Plan

The drafting and implementation of the special area management plans must be carried out with public participation through the Zone Committee or subcommittees. The aim of the special area management plan is to achieve sustainable use of coastal resources and improve the quality of life of the ZEM population.

Preparation and approval of the annual operating plan for the ZEM will be accomplished as follows:

a) The executive director of the CRMP will notify the Zone Committee of the procedures for preparing the work plan in accordance with the approach and schedule in the CRMP budget as approved by the national commission

b) The chief of the ZEM office and the working group which the Zone Committee assigns to prepare the work plan will examine the prior year's work in light of the available budget and schedule

c) A national workshop will be held, including the Zone Committee president, to evaluate CRMP progress, set guidelines and priorities for the next year's work, and ensure a regional perspective in the work plan

d) With the help of the CRMP technical team, the chief of the ZEM office and the designated operating plan committee will prepare a draft of the annual plan in light of national priorities and annual review results

e) The chief of the ZEM office, the working group, and the staff of the CRMP will assess

the first draft and make adjustments, considering available funds, the ZEM plan, technical feasibility, and so on

f) The Zone Committee will analyze and approve the operating plan

g) The executive director will submit the draft operating plan for consideration by the national commission

h) The executive director of the CRMP will provide the operating plan and associated budget to the Zone Committee and the ZEM office for implementation once the national commission has completed its review

The operating plan must include:

a) An evaluation of the previous progress of the CRMP and spending priorities

b) Goals for the new year

c) Identification of priorities in the ZEM plan

d) Description of the tasks to be carried out, the products to be produced, and the schedule for implementation

e) Include an inventory of available human and financial resources for carrying out the work plan

f) Assign roles and responsibilities for CRMP personnel, technical consultants, Zone Committee members, and executing and collaborating institutions

g) The schedule of initial activities that will be revised quarterly by the Zone Committee

The executive director of the CRMP is responsible for implementing the ZEM plan. The executive director may contract directly with government institutions and municipalities in the ZEM, the Provincial Council, and legally constituted community organizations and user groups in accordance with the annual work plan. In addition, contracts can be made with foundations, consultants, independent contractors, and other nongovernmental organizations.

4.4 Community Work Plans

Many of the specific actions of the ZEM plan are directed towards strengthening capabilities of each coastal community to plan and manage the resources upon which it depends for food, income, and quality of life. Each community will be strongly urged to participate in the Zone Committee to select priorities and carry out local projects with the technical support of the ZEM and CRMP Coordinator.

An essential topic for discussion at the ZEM and community level should be how to focus on the tasks that can be accomplished successfully with local resources. Additionally, communities should actively explore new ways to increase enthusiasm, effort, and local capacity for managing coastal resources. The experience of the ZEM practical exercises in communities between 1990 and 1991 shows the importance of careful design, technical support, and follow-up for project success.

Each community should identify the activities of the ZEM plan to be carried out in its locality as well as other agreements which have been made through the ZEM process. Communities should take steps to prepare themselves to participate in ZEM plan implementation.

The community work plan will include the following:

a) Presentation of community goals for the entire year

b) List of activities to be directly accomplished with the community

c) List of activities in the ZEM program that benefit the community and where local community participation is expected

d) The work plan of each project will include: identification of financial, technical and other resource needs and their sources; major steps, completion dates and designation of people or groups responsible for the implementation and follow-up of the projects.

4.5 The Execution of the ZEM Plan

The Executive Directorate will manage the implementation of the ZEM plan. According to legal regulations, the directorate will contract the work, studies, and other planned activities.

To strengthen local capacity, the executive director can contract directly with government institutions, ZEM municipalities, provincial council, and community and legally formed user organizations. It can also contract with foundations, consultants, independent contractors, and other nongovernmental organizations.

Small projects, which, due to cost and technology, do not require specialists, will be carried out by organizations or people from the community.

The establishment of coastal resource management based in the communities requires that these groups be able to:

1. Implement these ZEM plan policies and actions which will benefit their community or user group

2. Present the Zone Committee with project ideas related to coastal resource management

3. Undertake contracts to carry out some of the ZEM plan actions

4. Participate in Zone Committee meetings and bring issues to the attention of the national commission, through its representative (the president of the community organization)

5. Nominate delegates to follow up implementation of ZEM projects in their communities or for sectors that use coastal resources

In general, the Executive Directorate will perform the evaluation, follow-up, and control of the plan and perform the inspection and technical supervision of tasks and equipment.

ANNEX 1 LIST OF ACTIVITIES TO IMPLEMENT THE SPECIAL AREA MANAGEMENT PLAN

ACTION		LOCATION
3.1	**Shore Management**	
1 (1)	Zoning and designation of uses along the coast	Atacames, Súa, Muisne
1 (2)	Guidelines for coastal construction	ZEM
1 (3)	Protection of the coastline	ZEM
1 (4)	Protection of special recreation areas	ZEM
1 (5)	Coastal road Same-Tonchigue-Galera-Bunche-El Relleno de Muisne	Same-Tonchigue-Galera-Bunche-El Relleno
2 (6)	Control of mangrove area uses for the Ranger Corps	Estuaries of Muisne and Atacames
2 (7)	Restoration of mangroves in Atacames, Súa and Tonchigue	Atacames, Súa, Tonchigue
2 (8)	Recreational use of mangroves in Atacames	Atacames
2 (9)	Public awareness and education for mangrove conservation	ZEM
2 (10)	Reforestation of mangroves in Muisne River	River Muisne Estuary
2 (11)	Protection of mangroves in the Muisne River	River Muisne Estuary
2 (12)	Charcoal production	Muisne
3 (13)	Public access along the shore	ZEM
3 (14)	Public access points to the shore	ZEM
3.2	**Management of the Natural Resources Base for Tourism Development**	
1 (15)	Tourist resources inventory	ZEM
1 (16)	Tourist guides to the ZEM	ZEM
1 (17)	Tourism public awareness campaign	ZEM
2 (18)	Tourist signs for the ZEM	ZEM
2 (19)	Information booths for tourists	ZEM
2 (20)	Improving tourist services	ZEM
2 (21)	Multi-purpose tourist facility in Atacames	Atacames
2 (22)	Basic tourist services for Súa	Súa
2 (23)	Basic visitors' services for Muisne	Muisne
3 (24)	Land use planning in the ZEM	ZEM
3 (25)	New tourism offices in the ZEM	ZEM

3.3 Environmental Sanitation and Coastal Water Quality

1 (26)	Design, construction and maintenance of water supply systems	Muisne, Bunche, Atacames Súa, Tonchigue, Galera-San Francisco
1 (27)	Public education campaign on sanitation practices	ZEM
1 (28)	Training on operation of water supply systems	ZEM
2 (29)	Protecting coastal water quality in Atacames	Atacames
3 (30)	Sanitary facility installations along the coast	Súa, Tonchigue, Galera, Bunche-Muisne
3 (31)	Centralized treatment of sewage	ZEM
3 (32)	Collection and disposal of solid waste in Atacames, Súa, Tonchigue, and Muisne	Atacames, Súa, Tonchigue, Muisne, and small communities
4 (33)	Monitoring water quality and sanitary conditions	ZEM

3.4 Management of Fisheries Resources

1 (34)	Fishery areas	ZEM
1 (35)	Basic data collection on fisheries	ZEM
1 (36)	Managing important estuary and coastal resources	ZEM Quingue-Galera
1 (37)	Control of black coral exploitation	ZEM
2 (38)	Protection of fisheries' habitat	ZEM
2 (39)	Study and control of oil contamination	ZEM
2 (40)	Impact of sewage discharge on fisheries	ZEM
3 (41)	Services and infrastructure for artisanal fisheries	
	a) Supply depot for fishing gear	
	b) Fuel and lubricant depot and motor repair shop	Tonchigue, Galera Tonchigue
	c) Fish handling facilities	Galera-San Francisco
	d) Communication network for fisheries	ZEM
	e) Credit system for artisanal fishermen	ZEM
3 (42)	Training for artisanal fishermen	ZEM

3.5 Management of Mariculture

1 (43)	Reducing the mortality of captured shrimp post-larvae	ZEM

1 (44)	Study the distribution and abundance of shrimp	ZEM
1 (45)	Strengthen fisheries' rules and improve law enforcement	ZEM
2 (46)	Control the issuance of concessions for shrimp pond construction	ZEM
2 (47)	Mangrove buffer zones around shrimp ponds	Atacames, Tonchigue, Muisne
2 (48)	Fish aquaculture in the Muisne River	Muisne
2 (49)	Fish aquaculture in the Muisne River	Muisne
3 (50)	Technical assistance to shrimp farm owners and laboratories	ZEM

3.6 Management of Small Watersheds

1 (51)	Reforest coastal watersheds	ZEM
1 (52)	Protecting the forest in the upper watershed	ZEM
1 (53)	Controlling soil erosion	ZEM
2 (54)	Pilot project on integrated management of a small watershed	ZEM
2 (55)	Developing aquaculture potential and technical assistance	ZEM
2 (56)	Producing food for local consumption in the ZEM	ZEM
2 (57)	Public education campaigns and user group agreements	ZEM
2 (58)	Extension for watershed management	ZEM

ANNEX 2 DESCRIPTION AND USE OF THE WATERSHEDS IN THE ZEM

Rio Atacames watershed

The 300 km^2 watershed is drained by the main branch of the Rio Atacames and two other streams that join together in the town of Atacames. This zone of confluence had 578 hectares of mangrove in 1969, but the construction of shrimp ponds along the rivers reduced this to 52 hectares by 1987. The narrow floodplains of the river system have high quality soils, but rainfall in the watershed is only about 900 mm annually, making the Rio Súa watershed the driest in the ZEM. The upper portion of the Rio Atacames is cultivated in a variety of fruit trees, while the lower portion is pasture, with various short-cycle crops as well. Shrimp ponds occupy much of the good soils in the lowest part of the riverbed. The other branches of the river areas are also pasture mixed with crops, such as corn and yucca.

Rio Súa watershed

This is one of the smallest (47 km^2) and driest watersheds in the ZEM, receiving an estimated 700 mm of rainfall per year. Population density is high for the ZEM, 37 persons per km^2, but concentrated in the coastal village of Súa, which depends on tourism and fishing. Some mangrove loss has been experienced here in the tidal portion of the river behind the beach. Like the Rio Atacames, the narrow floodplain has very good soils, but the hills of the lower watershed are suitable only for pasture, and the upper half of the watershed has the poorest quality agricultural soils. The lower one-third of the river is used for a mixture of pasture and short-cycle crops, while the upper two-thirds in various fruit trees.

Rio Tonchigue

This watershed is among the smallest in the ZEM, 57 km^2, but has by far the highest population density, (61 persons per km^2 in 1980). The road from Tonchigue to Muisne, constructed in 1980, follows the course of the Rio Tonchigue through the narrow band of very high quality agricultural soil, which is associated with the floodplain of the river and its small tributaries. In the coastal part of the watershed, the fishing village of Tonchigue and shrimp ponds are occupying the best soils. In the middle and upper portions of the watershed, agricultural land is used to produce fruits, cocoa, coffee and corn.

Small settlements follow the road, which has a slope of less than one percent. Most of the rest of the watershed has relatively little agricultural potential. The lower watershed is used for pasture-

land and some agriculture. Cattle ranching is low density, about one animal per hectare. There are no good pasture management systems in use. The high quality river floodplain is planted with a variety of fruit trees, corn, and vegetables. The soils on the hillsides of the upper watershed are of relatively low suitability for farming, among the poorest in the entire ZEM. A small forested area remains at the top of the watershed.

The watershed receives about one meter of rainfall annually, which produces a usable discharge of .9 m^3 per second. However, the river is not a good source for potable water, since the flow is low during the dry period.

Rio San Francisco

This complex watershed has three branches, the Estero Chipa, the Estero El Partidera, and the upper Rio San Francisco, which drain the forested 110 km^2 watershed. Rainfall in this zone is estimated at 1500 mm per year, and river flow on average is 2.3 m^3 per second. Land suitable for agriculture is found only in the coastal portion of the Rio San Francisco, and this is utilized primarily for settlements and shrimp ponds. This watershed has the highest elevations and roughest terrain in the ZEM. There are small areas of humid tropical forest remaining in the higher sections of the watershed. Much of the forest cover has been cut, and some permanent plantations of banana, platano, and coffee have been created. Deforestation in this zone is estimated to be 50 percent. In areas adjacent to rivers and tidal inlets, there are small family gardens that produce fruits, yucca, and corn, mainly for local production. Use of the poorer agricultural land in the highest elevations is primarily for pasture where cattle are raised at low densities, less than one head per hectare.

Population density is relatively high for the ZEM, 23.4 persons per km^2 in 1980. Nearly all of this is concentrated in the coastal village of San Francisco, where fishing is the predominant occupation.

Rio Bunche

This watershed is about 80 km^2 and receives 1500 mm of rainfall per year. Is is very sparsely populated (2.6 persons per km^2 in 1980) and has no major road access.

There is a road, usable in summer between Bunche and Muisne, that goes along the shore.

The Rio Bunche has a very shallow slope, less than .5 percent, and has an average flow of 1.5 m^3 per second. The coastal portion of the watershed is occupied by the fishing village of

Bunche, shrimp larvae ponds, and small shrimp ponds. There are no major pollution problems in this area. The slopes of the watershed are still covered by origina- growth trees mixed with some plantations. Above this forest cover on the hills of the watershed is soil that is relatively poorly suited to agriculture. This area is characterized by steep slopes and irregular topography, and there is little interest in agriculture or cattle ranching.

Rio Vilsa watershed

This is one of the larger watersheds in the ZEM, nearly 200 km^2, and possesses the greatest expanse of excellent and good agricultural soil, as well as an annual rainfall of 1700 mm. As in the other watersheds of the ZEM, the land has a mix of uses, including pasture, a variety of short-cycle crops, and forest, with some permanent plantations. The population density of the watershed is the lowest in the ZEM, less than two people per km^2 in 1980. The Rio Vilsa empties to a formerly extensive mangrove, which was very productive and heavily harvested for shellfish and finfish. This mangrove forest has been largely converted to shrimp ponds, as well as the rapidly developing village of El Relleno. The recently paved road from Tonchigue to El Relleno, which is the transfer point to the island city of Muisne, runs along the northern edge of the watershed.

Rio Muisne watershed

This 470 km^2 watershed is drained by the Rio Canuto, Rio Skucio, and Rio Repartidero, which all flow northward to join the Rio Muisne. The Rio Muisne in turn empties westward into a mangrove forest of about 500 ha behind the Isla Muisne, which in its natural state had covered 1,700 ha as recently as 1969. Conversion to 1,200 hectares of shrimp ponds occurred primarily in the late 1980s. Access to formerly productive fishing and shellfishing grounds in the rivers and mangroves has been greatly reduced. Annual rainfall is about 2,200 mm per year, which, combined with expanses of high quality agricultural land along the floodplain of the rivers (the largest in the ZEM), gives this region a good potential for agricultural development. However, most of this area is being utilized for low-density cattle pasture land. The forests in the upper slopes continue to be cut. The population density of the watershed is low—2,600 people, or 5.6 persons per km^2, in 1980, not including the city of Muisne, with a population of 6,600.

ANNEX 3 PARTICIPANTS IN PREPARING AND APPROVING THE PLAN

1. User Groups

- Hotel Owners Assocation of Esmeraldas
- Atacames Bartenders Association
- Association of Atacames Shrimp Farmers
- Association of Restaurant Owners at Atacames
- Youth Association for Tourism
- Shrimp Larvae Cooperative of Bunche
- Shellfish Collectors Cooperatives of Bunche
- Charcoal Makers Association of Muisne
- Committee for the Defense of the Rights of Muisne
- Fishermen's Cooperative of Tonchigue

2. Government Entities

- Provincial Governor's Office
- Port Captain of Esmeraldas
- Provincial Director, National Forestry Agency
- Provincial Director, National Tourism Agency
- Provincial Director, Fisheries
- Provincial Director, Land Reform Agency
- Provincial Director, Public Education
- Political Chief of Atacames

3. Members of the National Commission who approved the plan on April 2, 1992

- Dr. Antonio Iglesias Caamaño, Vice President of the Commission
- GPFG-EM-Napoleón Villacís, Representative of the Ministry of Defense
- Ing. Lino Delgado, Representative of the Ministry of Agriculture and Livestock
- Lcdo. Fabián Yánez, Representative of the Ministry of Energy and Mines
- Ec. Rubén Moreno, Representative of the Ministry of Industry, Commerce, Integration and Fisheries