

# THE COASTAL ENVIRONMENTAL PROFILE OF REKAWA LAGOON, SRI LANKA

To support Special Area Management Planning  
for the Rekawa Lagoon and surrounding area

Edited by

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K. Haywood

**1995**

Coast Conservation Department

National Aquatic Resources Agency

Department of Fisheries and Aquatic Resources Development

Divisional Secretariat, Tangalle

Coastal Resources Management Project of  
The University of Rhode Island

United States Agency for International Development

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Front Cover      Rekawa lagoon with a fisherman

Back Cover      upper left, Rekawa lagoon fisherman near mangroves

upper right, Children of Rekawa lagoon fisher families

lower left, Rekawa beach - an important resource

lower right, Leather back sea turtle resting on Rekawa beach (P. Richardson)

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## **List of Acronyms and Abbreviations**

AGA	Assistant Government Agent
AREMCO	Aquatic Resources Management Consultants
CCD	Coast Conservation Department
CEA	Central Environmental Authority
cm	centimeter
CRMP	Coastal Resources Management Project
CZMP	Coastal Zone Management Plan
DAC	District Agricultural Committee
DAS	Department of Agrarian Services
DEA	District Environmental Authority
DEARD	Department of Fisheries and Aquatic Resources Development
DFEO	District Fisheries Extension Officer
DS	Divisional Secretary
DWLC	Department of Wildlife Conservation
EIA	Environmental Impact Assessment
GA	Government Agent
GCE (AL)	General Certificate of Education (Advanced Level)
GCE (OL)	General Certificate of Education (Ordinary Level)
GN	Gramaseva Nilhadari Division
ha	hectare
HIRDEP	Hambantota Integrated Rural Development Project
IE	Irrigation engineer
ID	Irrigation Department
JSP	Janasaviya Welfare Program
km	kilometer
KV	Kanista Vidyalaya (Junior School)
mc	million cubic meters
MFARD	Ministry of Fisheries and Aquatic Resources Development
MOH	Medical Officer of Health
MP	Member of Parliament
NARA	National Aquatic Resources Agency
NAREPP	Natural Resources and Environment Policy Project
NGO	Non-Governmental Organization
NORAD	Norwegian Agency for International Development
PV	Prathamika Vidyalaya (Primary School)
ppt	parts per thousand
RDA	Road Development Authority
RLFA	Rekawa Lagoon Fishermen's Association

Rs.	Rupees
SAM	Special Area Management
sp	species
TEAMS	Technology Evaluation And Management Services
URI	University of Rhode Island
USAID	United States Agency for International Development

### **Sinhala and Other Terms Used**

Chena	Slash and burn agriculture
Maha	Northeast monsoon season, high cultivation season in Rekawa
Ja-kotu	Wooded barriers placed in water to guide fish into traps
Oya	Small river, not perennial
Paddy	Rice
Velyaya	Tract of paddy fields
Vewa	Irrigation reservoir
Yala	Southwest monsoon season, low cultivation season in Rekawa
Yaya	Tract
Vasama	Area of authority for a village

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## Foreword

The Coastal Environmental Profile of Rekawa Lagoon, Sri Lanka provides an excellent summary of all the background information on the Lagoon and surrounding area required to proceed with management planning and implementation for the area. As part of the Special Area Management (SAM) approach to planning, the completed profile concludes the first phase of information gathering and synthesis before longer term management can begin. The profile has evolved from a simple compilation of secondary information to its present inclusion of primary research findings and observations. It is the first publication on the environmental and management status of Rekawa Lagoon.

This profile is a collaborative effort among all the agencies concerned with the management of the Rekawa area. It summarizes the research findings of the National Aquatic Resources Agency (NARA) which began in 1991 and concluded in 1994 on the natural lagoon shrimp fishery. The results and conclusions of studies conducted in 1994 by several contracted research groups are also summarized. These include: the hydrology of the lagoon and surrounding area; the techno-economic feasibility of aquaculture development; the socioeconomic status of residents in the management area; detailed mapping of land use from aerial photographs and a lagoon fisheries study. The results of these studies all have significant implications for the long-term management of the lagoon and its environs.

The Coast Conservation Department is strongly supportive of the management efforts commencing in the Rekawa area. The Department realizes that without Special Area Management for important resource-rich areas, such as Rekawa, the potential for sustainable use and development of the resources is limited. It is becoming apparent, that to achieve improved coastal resources and zone management in Sri Lanka, we must as national agencies, collaborate with local government officials and local communities in the process of resources conservation. The burden would be too great for one Department to implement management plans without significant responsibilities at the local level. We are therefore embarking on this collaborative approach with the Tangalla Divisional Secretariat, other local officials and communities of the Rekawa area.

It is hoped that this coastal profile will provide guidance for improved management of the coastal resources of the Rekawa and Tangalla area and stimulate a long-term process which can be replicated in other coastal areas of Sri Lanka.

B.S. Kahawita  
Director  
Coast Conservation Department

## Preface

The coastal areas of Sri Lanka hold high potential for environmentally sensitive economic development. If development continues to degrade the environment, however, all benefits to society will be lost. This prognosis is the same the world over and although this lesson is recognized by some in Sri Lanka, it is not yet being heeded by all. The Rekawa, Tangalla coastal area is relatively undeveloped. If ecologically appropriate planning can prevail, the area can avoid some of the pitfalls already affecting other coastal areas in Sri Lanka.

The Rekawa lagoon and its surrounding areas have natural fisheries, beaches, mangroves and aesthetic qualities which are in unusually good condition. The unfortunate decision which threatens much of the natural resource and lagoon system is that most of the fresh water which historically drained into and through the lagoon, is now being diverted for upland and lowland agriculture. The dynamics of the lagoon system are changing and need immediate attention. For this reason the area was selected for management.

Rekawa is the site of an experiment called Special Area Management (SAM) which will facilitate the realization of sustainable resources use and management. It is helpful to understand the SAM approach to coastal management because this environmental profile is part of the SAM process and is a fundamental step towards development of a dynamic management plan for the area. The unique feature of SAM is that although we are talking about a 'profile' and a 'SAM Plan', implementation of management measures have already begun. The Special Area Management (SAM) process started when the first meeting was held in early 1993 to identify a list of management problems regarding the lagoon. A key feature of the SAM approach is that it is participatory for all the individuals, community groups, agencies or businesses who have a stake in the resources to be managed. The SAM approach facilitates decision making by consensus which encourages participation in management by all levels of government, the local community and the private sector.

Because the Rekawa lagoon and surrounding area is not under the jurisdiction of any one national or local government agency, management will only occur when a majority of users and stakeholders of the area are part of the management scheme. And, although the lagoon is a management problem with bounded dimensions for a small water body, the larger coastal and surrounding area is much more complicated. Thus, the only possible hope for improving the environment of this larger coastal area of Rekawa which impacts on the lagoon, is a management model which is highly participatory, at least partially voluntary and not too dependent on regulations.

Thus, the SAM approach, of which this profile is part, is a means to support integrated and participatory management of the Rekawa SAM area. It will build on

existing laws and regulations but will not be totally dependent on them. Rather, it will depend on the dynamic actions of community groups in collaboration with local and national government agencies responsible for managing the site. The SAM approach has proven successful in other Asian countries and is being adapted to the situation in Sri Lanka at two sites, the other being the Hikkaduwa town and the Marine Sanctuary. Its potential for success is promising as long as all concerned are open to the process and collaborate to make it work. Let us proceed!

Alan T. White  
Manager  
Coastal Resources Management Project

## MAJOR ISSUES AND CONFLICTS IN REKAWA



*Causeway impeding free flow of lagoon water to the sea*



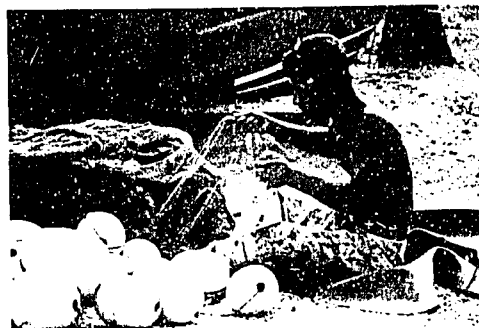
*Lime kiln operation*



*Dependence on coral processing indicates a lack of alternative livelihoods*



*Beach erosion at marine fishing boat landing*



*Fishing only provides a partial income to people*



*Firewood for lime kilns*

## **Chapter 1**

### **INTRODUCTION AND HISTORY**

#### **The Site and its Problems**

Rekawa lagoon and its surrounding area is about 200 km south of Colombo in the Tangalla Secretariat Division, Hambantota District in the Southern Province of Sri Lanka. The 250 ha lagoon with its wide basin and narrow, meandering channel, is the dominant feature of the area. Mangrove and scrub forest (about 200 ha) surround the lagoon which is bounded on the seaward side by a broad, sandy beach, approximately 10 km long. Landward of the lagoon is a large tract (about 500 ha) of paddy (rice) fields, most of which has been abandoned due to high salinity. The Rekawa lagoon site has nearly 5400 people comprising almost 1200 families. About half the population is engaged in sea and lagoon fishing and the other half in agriculture. Their incomes are low by national standards.

In its entirety, the lagoon, together with its water supply and flow, the fisheries, the mangroves and other forest with its wildlife, the agricultural land, the dynamic beach environment and the humans that depend on and coexist with these resources, comprise a large and complex ecosystem. The area and its parts are all interconnected and each part has its requirements for survival and limits of use. Unfortunately, the trend towards abuse is increasing in Rekawa and the natural potential of the lagoon area to sustain itself will decline if immediate actions are not taken.

This environmental profile attempts to highlight the most serious management issues of the Rekawa lagoon area and to provide sound information for management of the site. It is important to understand what major issues affect the area so that consistent actions can be taken to solve them. The issues described below are critical, but can also be viewed as opportunities to improve the situation, the environment and the quality of life for the people of Rekawa.

The most crucial issues which have caused the lagoon to decline in natural productivity, reduced the useable paddy land, disturbed the overall ecological balance of the system and contributed to poverty of people are:

- ***Impediments to freshwater flow into the Rekawa lagoon***

Freshwater flow into the lagoon has been impeded through numerous irrigation structures built to irrigate agricultural land along the three main rivers flowing into the Rekawa area. About 400 ha of the Tangalu Veliyaya (paddy land) on the western fringe of the lagoon is now abandoned because of salinization caused by changes in freshwater inflow from these river sources.

- *Impediments to seawater flow into the Rekawa lagoon*

Several causeways near the lagoon mouth impede the flow of seawater, and shrimp and fish recruitment to the lagoon. These changes have affected the natural lagoon fish and shrimp fishery consistency, overall productivity, and also water quality and lagoon volume.

- *Unsustainable fishing methods and effort in the lagoon*

Fishing with small mesh nets overharvest juvenile and adult fish in the lagoon and Jakkotu fishing, which uses wooden fence, constructed of Palmyra wood to make a barrier in the water leading fish and shrimp into traps, are reducing the natural recruitment of shrimp and movement of fish. Exploitation is generally not controlled, so large quantities of immature fish are being caught. Overall, the productivity of the lagoon fishery has been declining.

- *Proposed aquaculture development near the lagoon*

The potential for shrimp aquaculture in the area is considered good by developers who are buying land and obtaining funding. The local community is concerned about removal of mangroves, further degradation of the lagoon water supply and fishery, and potential social conflicts.

- *Rekawa beach and tourism development*

Tourism development is beginning near the broad, sandy beaches fringing the sea. Although the potential for development is good if planned and considerate of the local environment and local values, the problems associated with tourist developments elsewhere in Sri Lanka are causing concern to the local populace.

- *Coral mining and lime production*

The limited coral reefs off Rekawa beach near Oruwellogoda village have been destroyed by coral mining. Now, although coral mining continues, the supply of coral limestone for the numerous lime kilns in Rekawa is mostly from other coastal sites outside of Tangalla. Some lime kilns also use mangrove wood as fuel.

- *Sand mining*

Sand mining occurs along the Rekawa East and West beaches, further accelerating beach erosion. A system of permits is currently used to monitor this activity, but it needs to be regulated more carefully so this problem does not increase.

- *Sea turtle nesting and poaching*

Rekawa beach is a prime sea turtle nesting area. Local residents remove all the eggs after laying for either consumption or sale and occasionally the animals are killed for their meat and shells. Thus, these rare species are being further depleted and a potential tourism resource lost.

- *Poverty in the Rekawa community*

Low income of people in the area is both a cause of environmental degradation and an effect of changes in the Rekawa lagoonal system and its environs. Coral mining, cutting of mangroves, collection of sea turtle eggs are all related to poverty among the people. Also, the dependence of about 80 percent of the local population on some form of welfare indicates both a need for assistance and a cause of their weak development and slow progress.

The ecosystems and resources of Rekawa are the inheritance of the local communities. It is these communities which need to become the stewards of the resources to insure their own and future generations' survival. If these communities can take more responsibility for their own development through proper management of their natural resources, they can improve their quality of life both materially and spiritually. Along with such responsibility comes the need to address such basic problems as family planning, health and community organization. These are all integral to successful development of human communities in balance with their natural environment.

## **History and the Present Situation**

The management issues described above and how they evolved can be better understood in relation to a few historical events which have shaped the current status of the area. These are highlighted in Figure 1.1.

The region of Sri Lanka surrounding Tangalla had a rich historical background leading up to the period of colonialism beginning in the year 1505. Stories of the great king Dutugemunu (161-139 B.C.), and his royal elephant of the mangroves (Kandula) provide popular stories that have provided a cultural foundation for people (Prematilleke, 1989). Ruins indicate that by 200 B.C., a sizeable and well established civilization existed in the Rekawa area. And even as recent as several hundred years ago, the Buddhist organization and structures were more firmly established and elaborate than they are today (Prematilleke, 1989). The colonial era of the Dutch (1650-1796) and British (1797-1948) has had more immediate impacts along with the post independence period after 1948 which affect the environment and people even today.

### The Portuguese (1505-1650) and Dutch Periods (1650-1796)

These periods of influence contributed much in irrigation structures and architecture (Prematilleke, 1989). The Dutch repaired many of the irrigation works previously damaged and attempted to reestablish the agricultural prosperity of the region. One of the most significant Dutch projects was the building of a dam across the Urubokka Oya (River) (Samaranayake, 1983). The Dutch also introduced the beach-seine fishing technique which has contributed to the evolution of the hierarchical social stratification within the fishing community today.

### The British Period (1797 to 1948)

Administrative Districts were established under the British to include an administrative structure, infrastructure, irrigation, agriculture practices and education, health and social welfare services, many of which are still in operation today. The 'Kachcheri' system under which a Government Agent represented the Governor at the District level commenced during British times. Under the Government Agent were the Assistant Government Agents (AGAs), and Village Headmen (presently designated 'Gramaseva Niladharis' (GNs)) for each village.

The British also made concerted efforts to develop irrigation and agriculture in the district. The Kirama Tank, in close proximity to the Rekawa lagoon, was one of the first irrigation reservoirs to be constructed by the British in the early 1800's (TEAMS, 1994).



### After Independence in 1948

Until 1950, the Rekawa area was inhabited by a predominantly agricultural community that cultivated rice using water from the Pattiapola irrigation reservoir and a few weirs (small dams) on the Kirama Oya. A small lagoon and sea fishing community coexisted in the villages of Godigamuwa, Kapuhenwala, Marakolliya and Rekawa. In 1950 about 100 lagoon fishermen, displaced from the Koggala lagoon during World War II, were settled in the area around the Rekawa lagoon. The well established farming community considered the Koggala Lagoon fishermen as intruders and outsiders. There was very little social interaction between the communities and occasionally violent conflicts ensued over the different methods of fishing practised by the "outsiders". After a major dispute in 1980, a Commissioner was appointed to inquire about and settle the dispute. The report of the Commissioner was published in March 1981 (Gov. Gazette, 1981). Several excerpts from the Gazette describe the conflicts:

"From earlier times, the people in this area were engaged in three methods of fishing: cast net fishing, fishing by rod and line and fishing by setting traps in the shallow parts of the lagoon which are called 'Ja-kotu'. These modes of fishing were carried on till the year 1950 when people who migrated from Koggala, having settled down near the lagoon, started another type of fishing called 'drift net' fishing..."

"In 1965 there was a dispute between the drift net fishermen and cast net fishermen... The Ja-kotu fishermen did not take part in this dispute." (Gov. Gazette, 1981).

There were major disputes among the fishermen, requiring government intervention in 1965, 1977 and in 1980. The Gazette report also quoted from a longtime resident fisherman, who indicated the number of people engaged in the different methods of fishing.

"...there are about 80 people engaged in drift net fishing during the prawn season. There are about 65-75 cast net fishermen during the prawn season, and there are also about 40 people engaged in Ja-kotu fishing during the prawn season. ...The cast net fishermen and Ja-kotu fishermen are opposed to the drift net fishermen fishing in the lagoon. Their objection to the drift net fishermen is that the drift net fishermen are able to catch a larger number of prawns and as a result of their laying nets in the lagoon, the cast net fishermen and the Ja-kotu fishermen are badly affected with regard to their financial condition..." (Gov. Gazette, 1981).

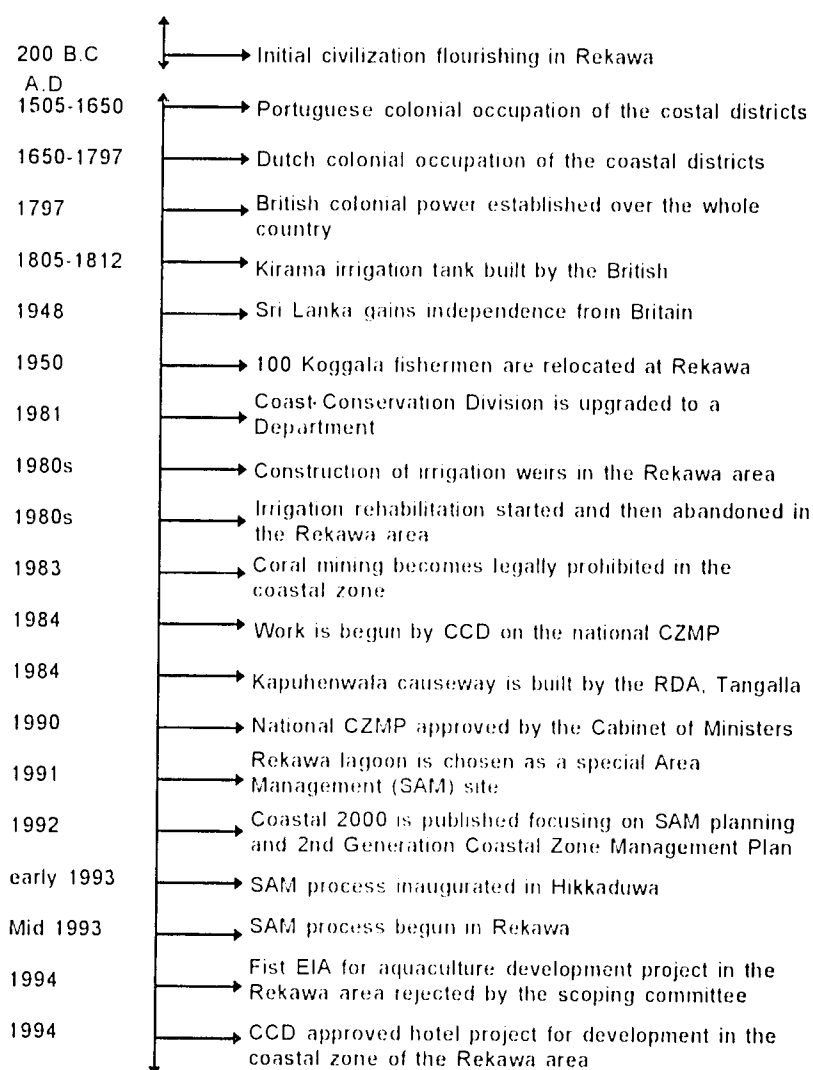
Animosity between drift net fishermen, cast net fishermen and Ja-kotu fishermen still exists today and is a major concern of the newly formed Rekawa Lagoon Fisherman's Association.

### Era of the Hambantota Integrated Rural Development Project

Since independence, although social welfare and development projects were conducted in the Hambantota District, noteworthy progress has been made only recently

with the implementation of the Hambantota Integrated Rural Development Project (HIRDEP). This project was begun in 1979 with support from the Norwegian Agency for International Development (NORAD). The purpose of HIRDEP was to increase income, employment and production and to improve social conditions and living standards of the people in the Hambantota District with a focus on the poorest groups (Smith, 1986).

HIRDEP has made a major contribution to the development of the Hambantota District in the areas of irrigation, agriculture, infrastructure and social welfare. While these developments resulted in higher income levels from agriculture, the primary issue of water flow to the Rekawa lagoon has been aggravated. The rehabilitation of the Kirama Oya and Urubokka irrigation systems through the construction of 18 weirs and the



*Figure 1.1 Major events affecting natural resource use in the Rekawa area*

construction of roads, bridges and culverts such as the Kapuhenwala causeway bridge in the lagoon channel near the sea have all had repercussions on the ecosystem of the Rekawa lagoon (TEAMS, 1994). In particular, the movement of fish and shrimp to and from the sea have been disturbed (Jayakody, 1994).

HIRDEP is now reducing its operation but will continue to provide funding to Divisional Secretariats for development and social welfare activities. During the period 1979 to 1989 HIRDEP spent about Rs. 500 million, most of this on infrastructure. Although many benefits have resulted from HIRDEP, much damage also occurred because the overall implications of the irrigation systems constructed on the water flow to the Rekawa lagoon and ecosystem were not adequately studied. It is now realized that development actions must consider the balance between agriculture development and its effects on natural coastal systems.

### **Special Area Management for Rekawa**

The Coast Conservation Department (CCD), the Divisional Secretariat of Tangalla, the Department of Fisheries and Aquatic Resources Development (DFARD) with the assistance of the National Aquatic Resources Agency (NARA), HIRDEP and the Coastal Resources Management Project (CRMP) of the Natural Resources and Environmental Policy Project (NAREPP) are initiating a Special Area Management (SAM) program at Rekawa. The overall objective is to develop and implement a local-level, coastal resource management plan by facilitating the participation of government agencies and community groups, using a community-based and multi-sectoral strategy, in which the local community is encouraged to assume a primary role in planning and implementation. The second volume of *Coastal 2000: Recommendations for a Resource Management Strategy for Sri Lanka's Coastal Region* (Olsen et al., 1992) produced by CCD and the CRMP (Sri Lanka), strongly recommends a policy of "participatory resource management" at the local level using the SAM approach. The Coastal Zone Management Plan (CCD, 1990), approved for implementation by the Cabinet of Ministers in 1990, also points out the need for community participation in the planning and implementation of management strategies. The sense of community ownership of activities, whereby the community assumes a role as the custodian of the resources, is the key to this approach (Wickremaratne and White, 1992). The SAM approach to coastal resources management can now begin to provide a model for implementation of the National Environmental Action Plan of Sri Lanka.

The basic premise of the SAM process is that it is possible to organize local communities to manage their natural resources and that they will continue to do so if they perceive tangible benefits to them from better management (White and Samarakoon, 1994). The planning agency plays the role of the facilitator or catalyst by providing technical inputs for better understanding of the nature, scope and potential of the resources available to the community. The key to the process is that the community and local government in a collaborative relationship take responsibility for management of their resources. Sustainable management can only be possible with the active involvement and participation of the community while outside planners facilitate the process (Wickremaratne and White, 1992).

Pertinent aspects and outcomes of the SAM process in Rekawa are expected to be:

- Resolution of competing demands on resources through a participatory and consensus building planning process for determining and achieving sustainable use;

- An approach which builds community and local-level responsibility for implementation of management plans with technical support and collaboration of government agencies; and
- A process which promotes the formation and strengthening of democratically constituted community or resources-oriented organizations for sustainable development.

The overall Rekawa SAM site of concern is shown in Figure 1.2 and includes 7 Grama Niladhari (GN) divisions which either border the sea near the lagoon or are important to the lagoon systems because of agricultural influences. In September 1992, a workshop in Tangalla attended by representatives of HIRDEP, the Irrigation Department (ID), DFARD, CCD, the Tangalla Divisional Secretary and the CRMP decided that the boundaries of the Rekawa SAM site should be the Rekawa lagoon, its environs and its immediate catchment area. The site encompasses a total of 2127 hectares (Mervyn and Kannangara, 1994). Reasons for selection of the management site are:

- Of the 15 lagoons in the Hambantota District, Rekawa lagoon was the most productive in 1984, but its productivity has since declined. It was therefore reasoned that the potential for rehabilitation of such a dynamic system would provide a good opportunity for improving incomes by enhancing the once rich fish and shrimp fishery;
- The planning area is relatively small and manageable with 7 GN divisions and about 1200 families;
- The hydrology of the area and the lagoon and the problems associated with water flow are typical of many such lagoon systems in Sri Lanka. The lessons learned from improved management of the Rekawa lagoon would be relevant for and applicable to other areas in the country; and
- The Divisional Secretariat and HIRDEP endorsed the participatory SAM process as a useful approach to test natural resources management in the area.

### **The Rekawa Environmental Profile**

The compilation of this environmental profile is a major step in the formulation of a management plan. The profile serves as a source of background information and baseline data on the project area, providing a broad perspective on the physical, biological and socioeconomic characteristics, the institutional and legal framework, and the issues and opportunities for management. Its objectives are to:

- Identify major resource management issues to be addressed by the SAM plan;
- Identify the constraints, opportunities and objectives for management and development of the coastal resources associated with the Rekawa management area;
- Summarize and assess information on ecosystems and resources, social and economic conditions, and legal and institutional regimes for management;
- Provide a source of information to be used by communities, local and national government personnel, planners, researchers, and other individuals in the planning and education process;

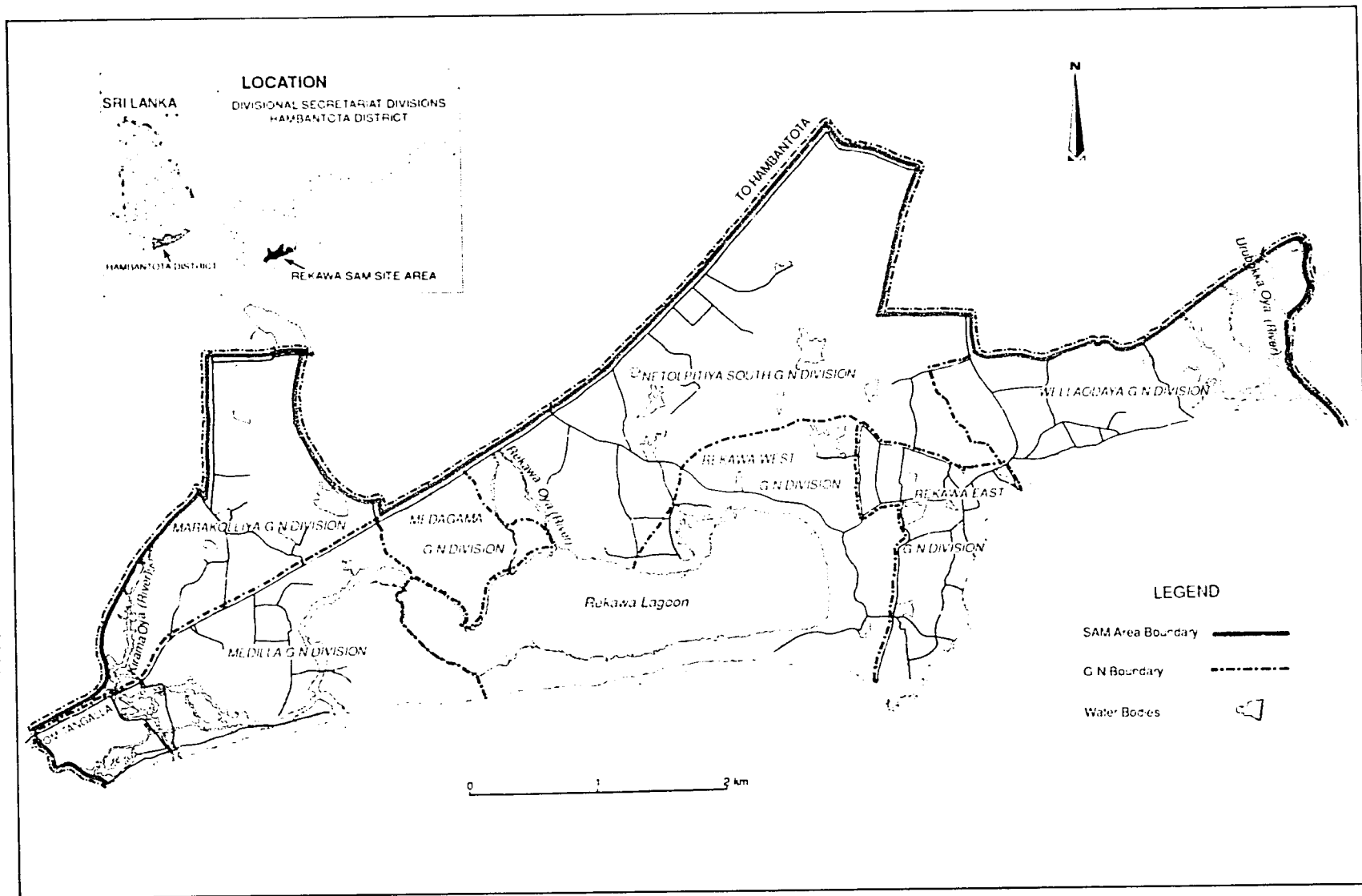


Figure 1.2 The Rekawa SAM site and Grama Niladhari Divisions

- Synthesize mapped information which will constitute a visual database;
- Compile baseline information for monitoring and assessing trends in environmental changes resulting from the SAM process; and
- Provide a source of information for environmental impact assessments of development projects within the SAM implementation area

Information for this profile was collected from secondary sources consisting of published and unpublished documents, maps, government files, gazette notifications and aerial photographs. Primary sources include short-term investigations, interviews with local residents, government officials and specialists, and group discussions at the community level.

## **Summary**

Rekawa lagoon and its environs was selected as a Special Area Management site because its dynamic hydrological and lagoonal system offers an opportunity to assess a new technique in coastal lagoon management which has not been tested in Sri Lanka. Communities, local government and key national agencies will collaborate in the development of an integrated management plan for the resources of the area. The planning process will include pilot projects in which community groups and local government are the main participants and beneficiaries. This coastal environmental profile is a first major step in identifying the management issues to be addressed in the plan and ongoing projects implemented by local community organizations and government. It also provides the information base for monitoring changes in the area, conducting education programs and for planning appropriate actions.

## **Chapter 2**

### **CLIMATE, HYDROLOGY AND GEOGRAPHICAL SETTING**

The Rekawa area is in a transitional climate zone in southern Sri Lanka making rainfall patterns unpredictable. The yearly variations in precipitation poses problems for farmers who require water. In response, numerous irrigation schemes have been implemented to provide water for farms upland far from and within the Rekawa Special Area Management (SAM) site. These interventions have, over the years, reduced water flow into the Rekawa lagoon with broad ecological consequences. This chapter provides the background information on the climate, hydrology and physical geography of the area, all of which affect the present and future condition of the lagoon and the associated coastal resources of concern.

#### **Climate**

Located near the southernmost tip of Sri Lanka, the Rekawa site is tropical. Average temperatures range between 26.6 and 27.2 degrees Celsius. The area receives nearly 7 hours of unobstructed sunlight on average per day with March averaging the highest sun exposure of all the months (Samaranayake, 1983).

The Rekawa lagoon area lies on the border of the climatic wet zone and dry zone of southern Sri Lanka. This border is known as the intermediate zone. The wet zone receives an average of 191 cm of rainfall per year and the dry zone has approximately 127 cm of rainfall per year. Climatic characteristics of the Rekawa lagoon area include periods of "low rainfall, severe sunlight, and seasonally strong winds" (McCall, 1990).

The two monsoon seasons dictate the weather and the rainfall in and around Rekawa. From May to October, the Southwest monsoon predominates and is the 'Yala' or low cultivation season for the Rekawa area. From November to April the Northeast monsoon influences weather patterns and is the 'Maha' or high cultivation season in Rekawa. Of these two, the Northeast monsoon tends to bring the most rain to the area.

However, because the Rekawa site lies in the intermediate climatic zone, rainfall can occur throughout the year. Heavy rains can occur during both the wet and dry monsoon seasons over a period of twelve months. The period from mid 1993 to mid 1994 had exceptionally heavy rainfall and the pattern of precipitation shows that large amounts of rain can fall during both monsoon seasons (Figure 2.1). The Rekawa area has received, on average, a total of 204 cm of rain per year over the past fifteen years (Jayakody, 1994; TEAMS, 1994). While this figure conforms to averages typical of the wet zone, the long term pattern of rainfall is punctuated by years of very little rain, which have averages typical of the dry zone (Figure 2.2). Rain falling inland of the project area provides the water for the main watershed and rivers flowing into the immediate Rekawa surroundings

and the Rekawa lagoon itself. It is important to note that the hydrodynamics of this area play a critical role in the natural resources of the Rekawa area and in the lives of the residents.

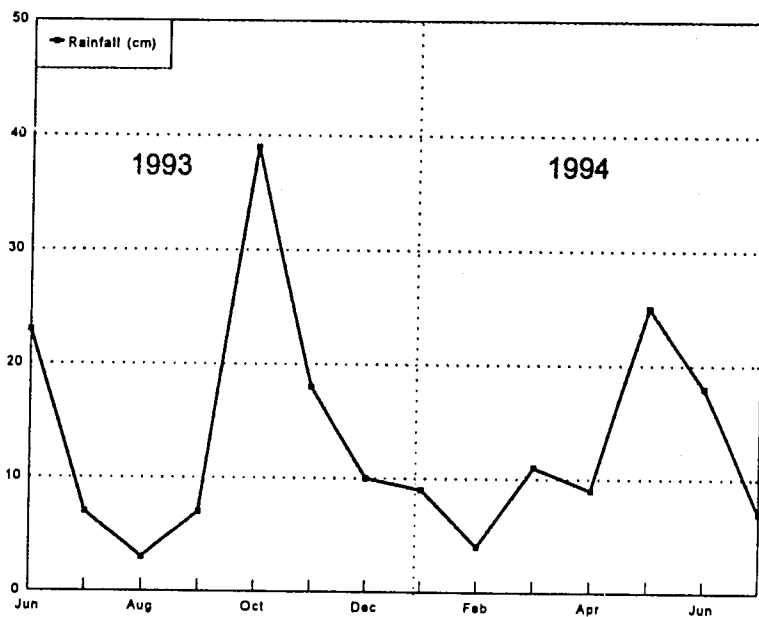


Figure 2.1 Rainfall in the Rekawa lagoon area, June 1993-July 1994 (Jayakody, 1994)

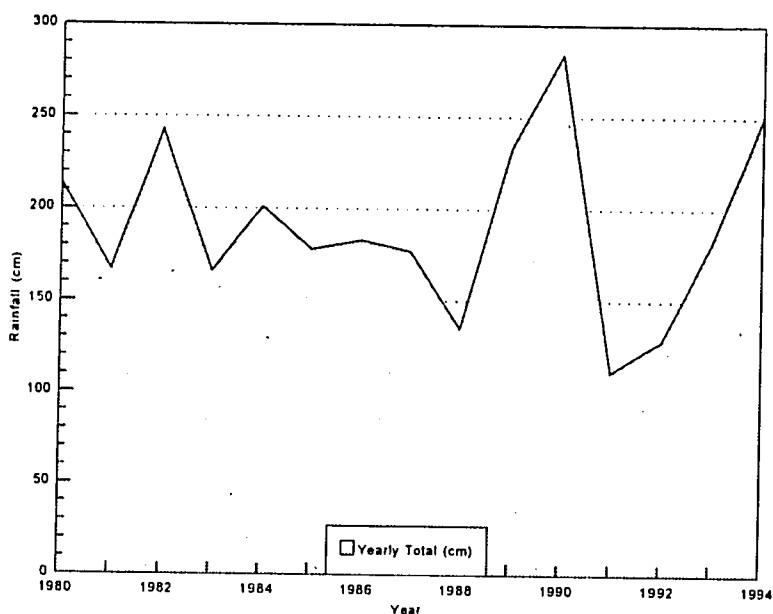
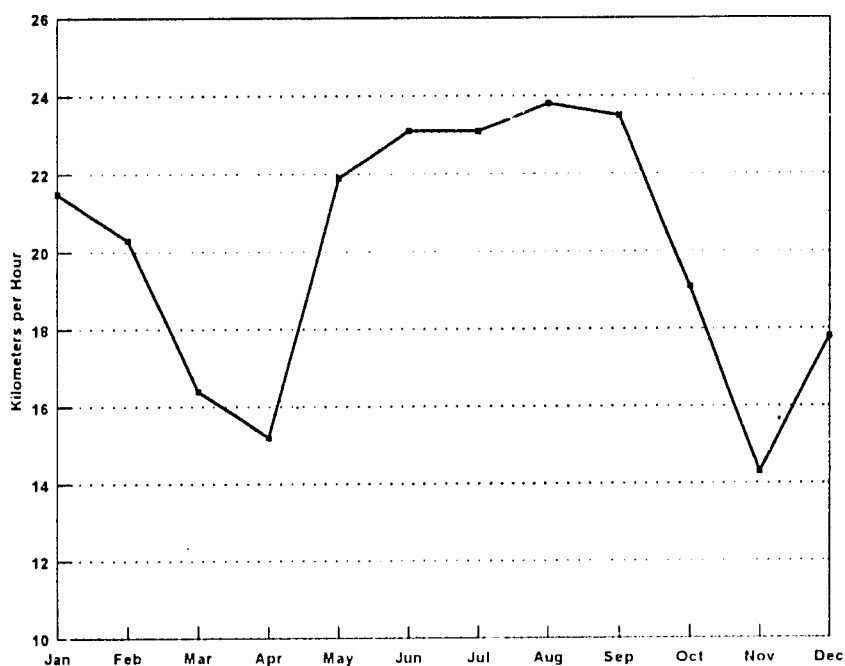


Figure 2.2 Total yearly rainfall in the Kirama River basin, 1980 - 1994 (Jayakody, 1994; TEAMS, 1994)





*Figure 2.3 Average monthly wind speed in Hambantota, 1931-1960  
(Meteorology Department, Hambantota Station)*

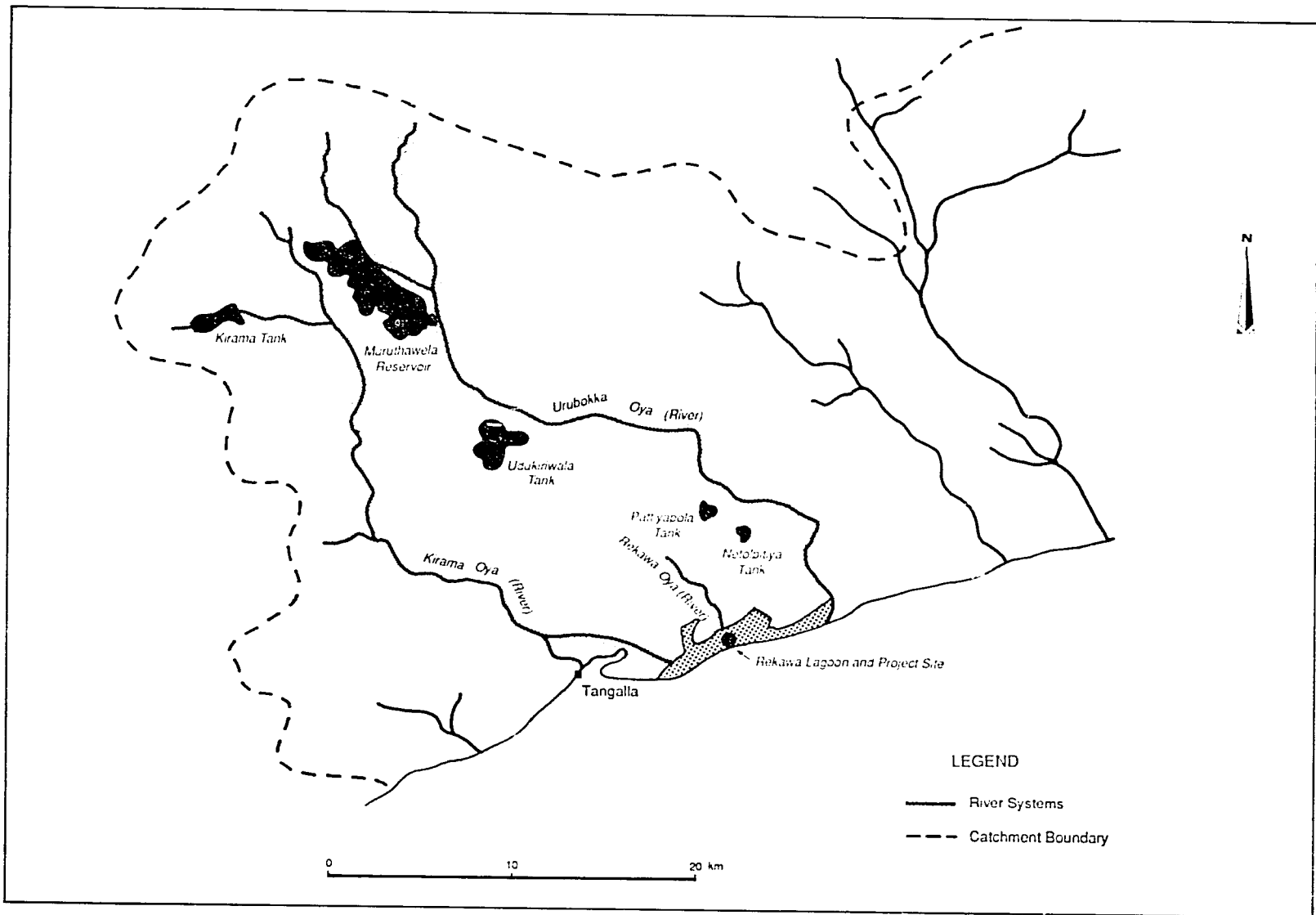
The area is subject to strong and consistent winds, especially along the coast. These high winds are most prevalent from June to September, when the average wind speed is 23 km/hr (Samaranayake, 1983). An average wind speed of 18 km/hr occurs during the rest of the year (Figure 2.3). The wind speeds are measured at the meteorology station in Hambantota and are indicative of the wind pattern found at the Rekawa site which is located nearby. These winds cause depositional sand formations (sand dunes) all along the coast and help to fill the natural lagoon mouth that connects the Rekawa lagoon with the sea.

### Hydrology

Rekawa lagoon receives most of its water from inland watersheds draining into two main rivers, the 32 km long Kirama Oya (River) and the 42 km long Urubokka Oya (Figure 2.4). The Kirama Oya is the principal water source for the Rekawa area, with a catchment basin of approximately 225 sq. km, which receives an annual average of approximately 11.5 million cubic meters (mcm) of water into its 14 sq. km. drainage area. The Kirama Oya ultimately flows into the Rekawa lagoon, controlling many of the hydrological processes of the lagoon and its channels (TEAMS, 1994).

Much of the water flowing through the Kirama Oya is diverted and used for agricultural purposes before it finally reaches the Rekawa lagoon. The 162 ha Kirama tank, constructed by the British between 1805 and 1812, was the first major diversion of water from the Kirama Oya and irrigates about 200 ha of agricultural fields. Eighteen weirs have since been built by the Irrigation Department along the river's path further diverting water into an additional 2000 ha (approximately) of adjacent agricultural lands (TEAMS, 1994).

Figure 2.4 River systems affecting the Rekawa lagoon area



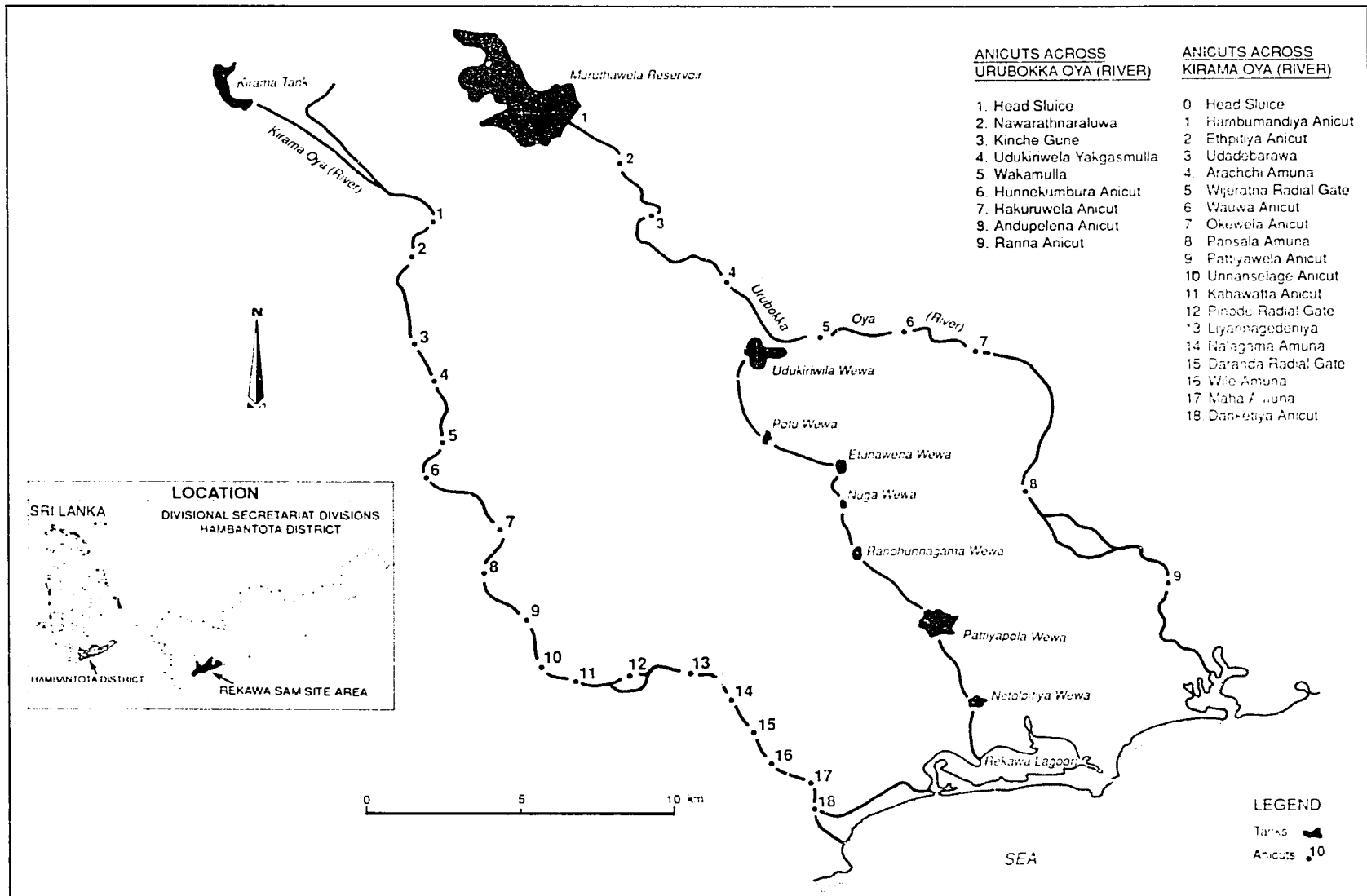


Figure 2.5 Major irrigation tanks and weirs along the Kirama and Urubokka rivers

The Urubokka Oya, having a catchment basin of approximately 352 sq km and flowing from the northeast, is used in the Rekawa SAM site to a lesser extent (TEAMS, 1994). Irrigation tanks have also been constructed along this river. The two main ones, the Murutawela and the Udukiriwila, retain the most water for agriculture. These two reservoirs have holding capacities of approximately 48 mem and 4 mem respectively. Additional smaller tanks hold still more Urubokka Oya runoff, further reducing the amount of water reaching Rekawa lagoon and its surroundings.

A third and smaller river, the Rekawa Oya, has a catchment basin of approximately 78 sq. km, and also provides some water to the area. It has two major tanks, the Pattiapola and the Netolpitiya, which store 700,000 and 180,000 cubic meters of water respectively (TEAMS, 1994). Four minor tanks have also been constructed along the Rekawa Oya. The location of these rivers, the main water tanks and the weirs can be seen in Figure 2.5.

Freshwater reaching the Rekawa lagoon enters into the main body of the lagoon. A study by NARA researchers (Jayakody and Jayasinghe, 1992) found nearly 250 ha of water surface, while the Hambantota District Profile completed in 1983 indicated 339 ha of water surface (Samaranayake, 1983). This is evidence of gradual shrinkage of the lagoon area due to sedimentation and mangrove encroachment.

There is speculation that runoff into the lagoon may contain high levels of pesticide and fertilizer from agricultural use. This could cause slow eutrophication of the lagoon creating blooms of filamentous green algae, which block sunlight to benthic organisms and deplete oxygen levels in the lagoon. However, levels of chemicals in the lagoon have not been measured.

Water from the lagoon ultimately reaches the sea by breaching a narrow sand barrier located at the natural lagoon mouth on the southwestern coastal side of the lagoon. Breaching of this barrier can occur naturally during the rainy Northeast monsoon season, when water levels in the lagoon increase. In addition, local residents manually open this inlet to relieve water threatening to flood inland paddy fields. Flooding is especially acute when both the lagoon and the Kirama, Urubokka and Rekawa river catchment areas receive large amounts of rain. In addition, when the inlet is open to the sea, in-flowing saltwater recruits shrimp larvae into the lagoon, helping to enhance the lagoon's shrimp fishery as described in chapter 3 (Figure 2.6).

However, the Kapuhenwala causeway, constructed by the Road Development Authority (RDA) of Tangalla in 1984, has restricted the flow of seawater into and out of the lagoon (Figure 2.6). Water passes under the causeway through twenty-three 30 cm diameter pipes and greatly reduces the amount of shrimp larvae and fish entering the lagoon system from the ocean (Jayakody and Jayasinghe, 1992). This causeway also affects the salinity of the lagoon by not allowing strong mixing of marine and freshwater (Jayakody, 1994).

The flow of fresh and seawater into the lagoon has a direct impact on its salinity creating a mostly brackish water environment. At times of heavy rainfall, an influx of freshwater from the Kirama and Rekawa rivers, and drainage of agricultural land into the lagoon will cause salinity to drop, especially when the natural lagoon mouth is not open. When rainfall is sparse, and the mouth to the sea open, salinity may rise significantly in the lagoon. Variation in salinity is therefore seasonal with corresponding periods of high salinity during the dry Southwest monsoon season and low salinity during the wet Northeast monsoon season. In addition, when the lagoon mouth is open to the sea, salinity can also increase in the lagoon, especially during high tides (Jayakody, 1994). Variations

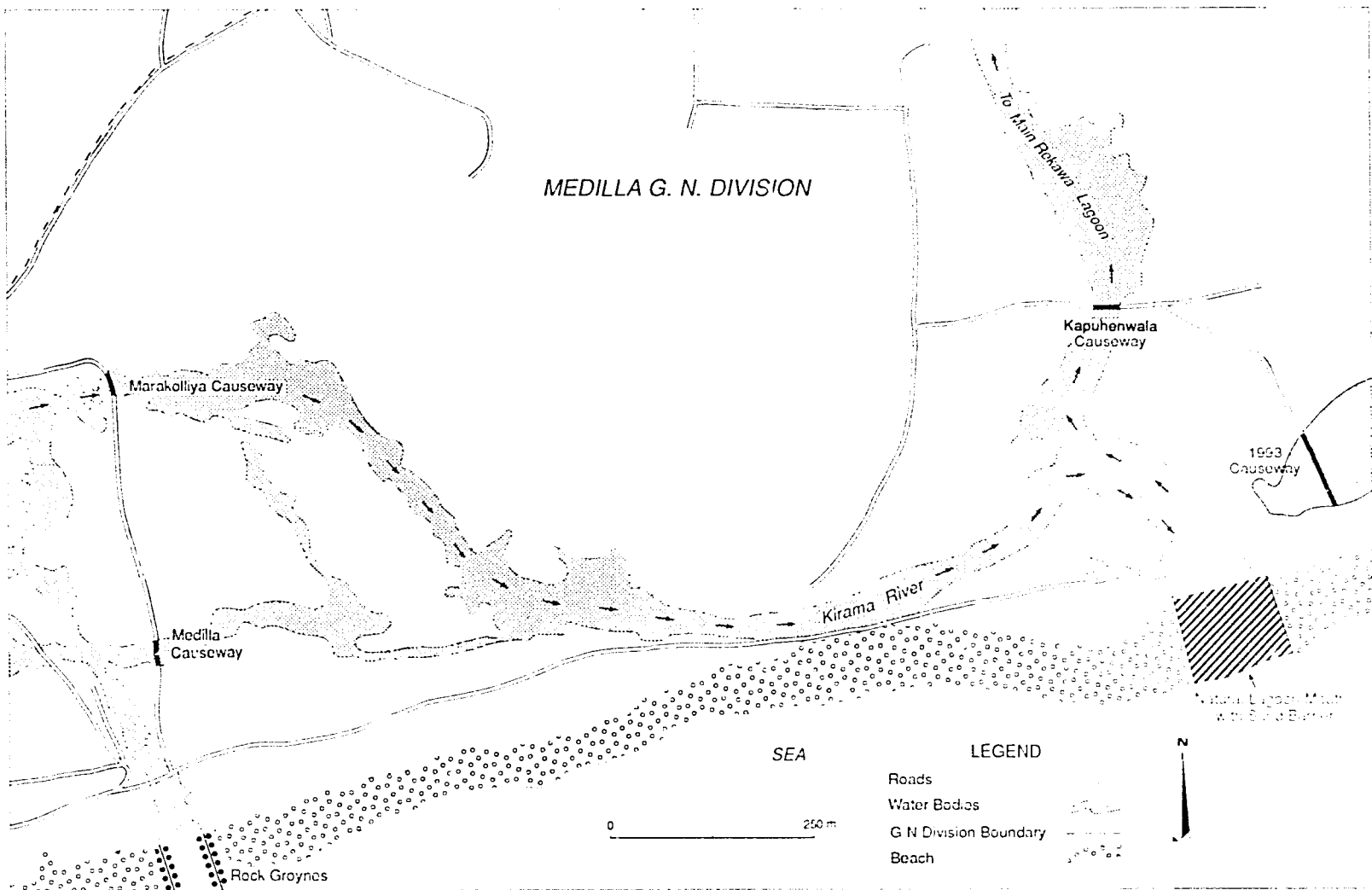


Figure 2.6 Rekawa lagoon natural mouth and causeways affecting water exchange

in salinity at different testing stations are shown in Figure 2.7 as sampled by Jayakody in 1994. The testing station locations in the lagoon are shown in Figure 2.8. The Kapchenwala causeway is also a factor in salinity fluctuation as reported by Jayakody (1994):

“During high tide, sea water enters into the lagoon canal portion and spreads towards the lagoon proper increasing the salinity levels in Stations 1,2,3,4,5 and 6. The Kapchenwala causeway constructed across the channel end of the lagoon acts as a major impediment and reduces the speed of the water considerably. High density lagoon water moves fast up to the causeway (Station No. 4) and enters the other side (Station No. 5) slowly through the causeway culverts. After this point, high density saline water moves slowly towards Panakapitiya (Station No. 6). By this time, as a result of the mixing process, salinity levels tend to decline. Beyond this point (Station No. 6), the lagoon becomes wider and the sea water is diluted, resulting in low salinity values (8-12 ppt) in the lagoon proper (eg: Station Nos. 7-12).”

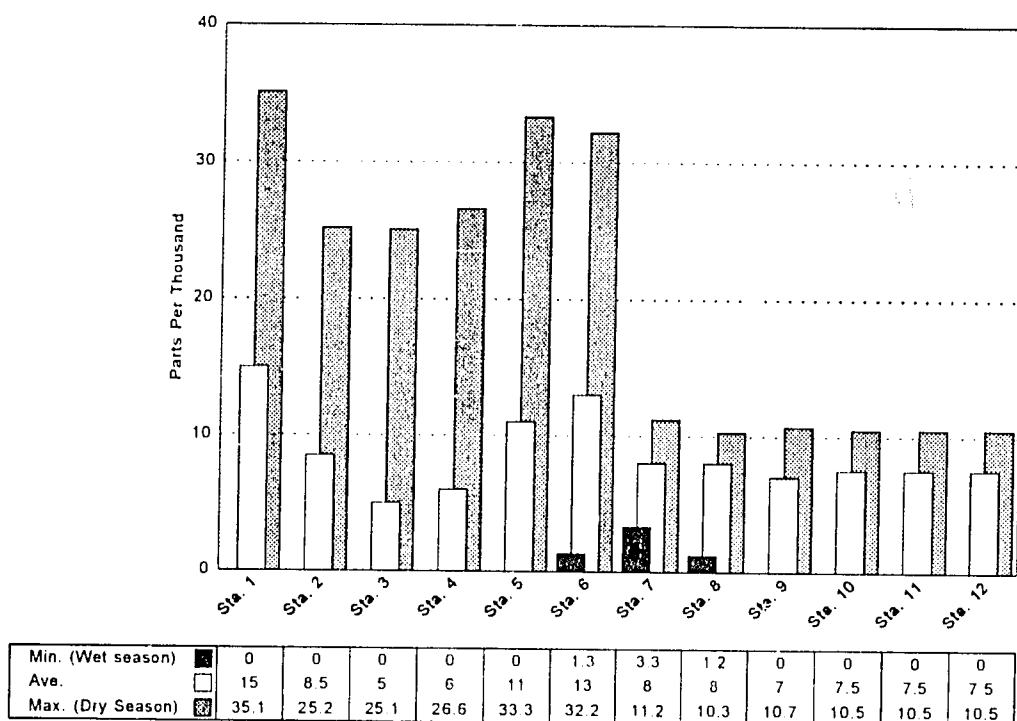
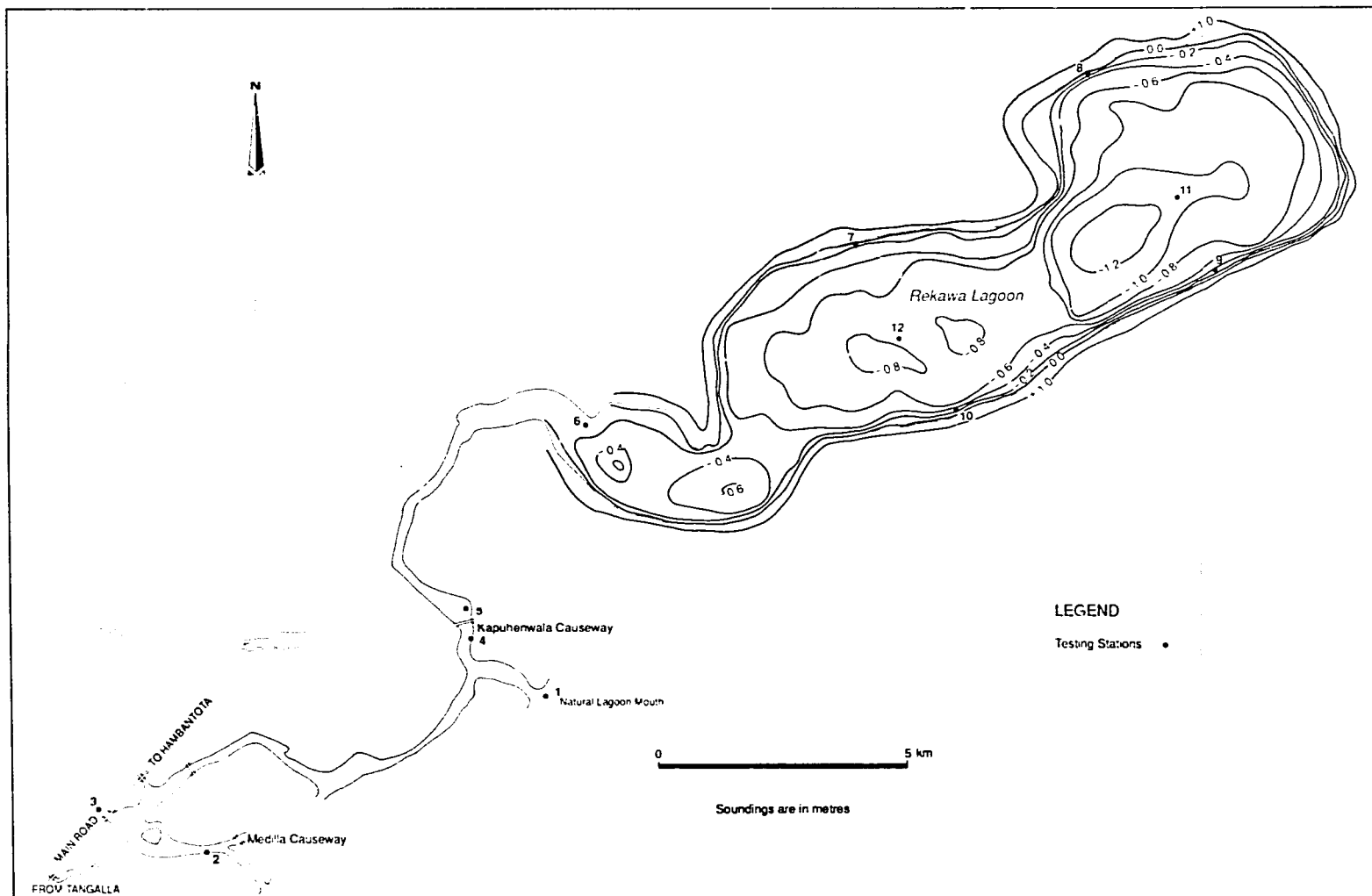


Figure 2.7 Salinity at testing stations (shown in Figure 2.8) in the Rekawa lagoon (Jayakody, 1994)

The pH of the lagoon varies between 6.13 and 8.60, with the readings in the 8.6 range occurring in March 1994, when the lagoon mouth happened to be closed to the sea (Jayakody, 1994). However, due to its narrow range, pH has not been shown to be a factor greatly affecting the lagoon ecosystem (Jayakody, 1994).

Figure 2.8 Bathymetry of the Rekawa lagoon and salinity testing station locations



## Physical Geography

Lying in the coastal plain, the Rekawa lagoon area was under water some 6,000 years ago (TEAMS, 1994). Today, it is located on the lowest peneplain in Sri Lanka, gently sloping from an inland elevation of 300 meters to sea level. Rekawa lagoon itself is shallow with the water depth averaging 1.4 meters. Its widest point is approximately 2.5 km. (Figure 2.8) (Jayakody and Jayasinghe, 1992). The surrounding area is physically defined by hills, ridges, and outcroppings none rising more than 50 meters above sea level. Scattered among this coastal area are granite outcroppings, but most of the land forms comprise an undulating coastal plain.

The metamorphic rock in the Rekawa area has proven to be Pre-Cambrian in age (more than 570 million years) and areas near the rivers are Miocene limestone (between 6 and 24 million years) with alluvial soil beds (Samaranayake, 1983). The coastal plain has been formed primarily through the erosion of crystalline rock and extensive recent sedimentary deposits.

Coarse sand beaches form dunes along the coast of Rekawa. Most of the sand that accumulates on the shoreline comes from constant wave action on the shoreline. Very little sand is supplied by river deposits. Beach erosion which occurs in Rekawa can mostly be attributed to longshore currents and wave action.

The coral reef system, found offshore at the southeast corner of the Rekawa site, is poorly formed. It has been mined for coral limestone and degraded. This activity contributes to coastal erosion in this area (Rajasuriya, 1994).

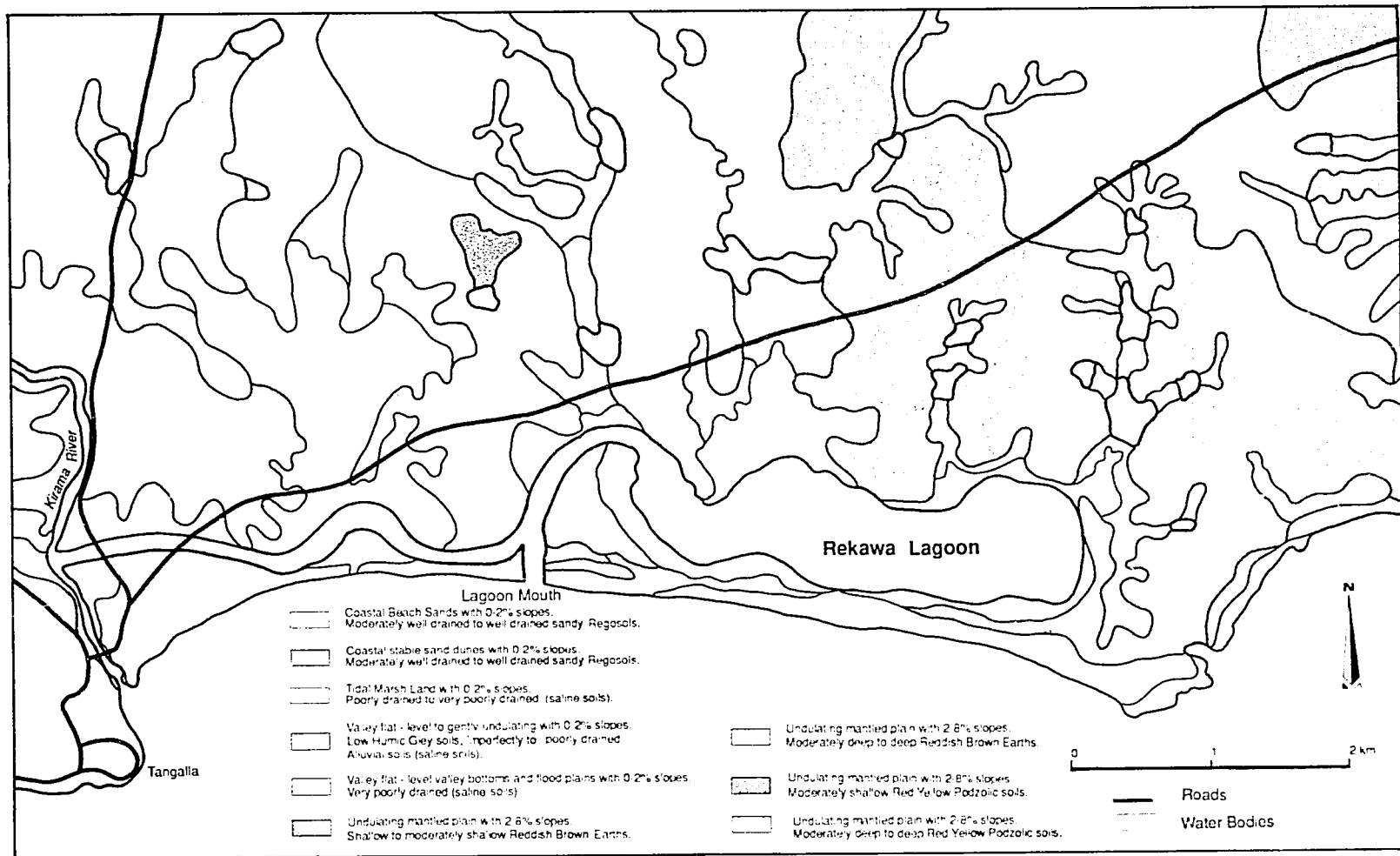
The underlying geology, and its processes provide the foundation for the eight soil types that are found in the Rekawa area, which include (TEAMS, 1994) (Figure 2.9):

- Regosols (coastal beach sands and sand dunes);
- Low humic gley soils (poorly drained and saline);
- Alluvial soils (poorly drained and saline);
- Solonchaks soils (poorly drained and saline);
- Solodized Solonetz soils (poorly drained and saline);
- Reddish brown soils;
- Red yellow Podzolic soils; and
- Tidal marsh soils (poorly drained and saline).

The tides and currents affecting the coastal areas of the Rekawa site are very strong. The currents have been known to reach speeds up to 1 m/sec and average about 0.25 m/sec (Swan, 1983). These currents influence beach geology, offshore water depth, shelf morphology, and the direction and incidence of waves offshore of the Rekawa lagoon area. Tidal range reaches a maximum of about 70 cm and tidal currents tend to move eastward along the coast away from the Rekawa site and then northward once they flow around the southeast tip of the island.



Figure 2.9 Major soil types of the Rekawa lagoon area



## Summary

The Rekawa SAM site is greatly affected by the movement and supply of water because it is located in a relatively dry climatic region. The water resources require careful management since they are limited and/or restricted due to the construction of irrigation tanks, weirs, and causeways. The lagoon water surface area appears to be decreasing because of sedimentation, encroachment of mangroves and possible overloading of nutrients from agricultural runoff.

The water supply and its movement, both from the watershed and the sea, is important to local communities and the integrated ecosystem as a whole. The limited water resources are the key to the productivity of this area. The fresh water flow from the rivers is essential to maintain the productivity of the agricultural areas while the flow of sea water into the lagoon is crucial for the maintenance of the Rekawa lagoon shrimp fishery. Managed properly, these water resources can help sustain these activities which are major components of the socio-economic framework of the Rekawa lagoon area.

## **Chapter 3**

### **NATURAL RESOURCES**

The Rekawa lagoon and its surrounding areas support many of the coastal resources and ecosystems typical of Sri Lanka's southern coasts. The coastal resource systems are diverse and rich in both ecological and economic terms. A viable mangrove and lagoon system support both lagoon, nearshore and offshore fisheries for shrimp and a variety of fish. The mangroves provide habitat for resident and migratory birds, stabilize sediments and produce organic matter for lagoon fisheries. Some of the surrounding land supports productive agriculture while other areas have become too saline for most commercial crops. The extensive beaches are nesting grounds for several species of rare sea turtles and are beginning to provide an outlet for beach tourists. Even limited areas of coral reef occur. Although this large ecosystem and all its resources are threatened by changes in water movement through the lagoon as discussed in chapter 2, sustainable use of the existing resources is still possible with careful planning and management. The important natural resources of the Rekawa management area and their condition are described below.

#### **Paddy Land (Tangalu Velyaya)**

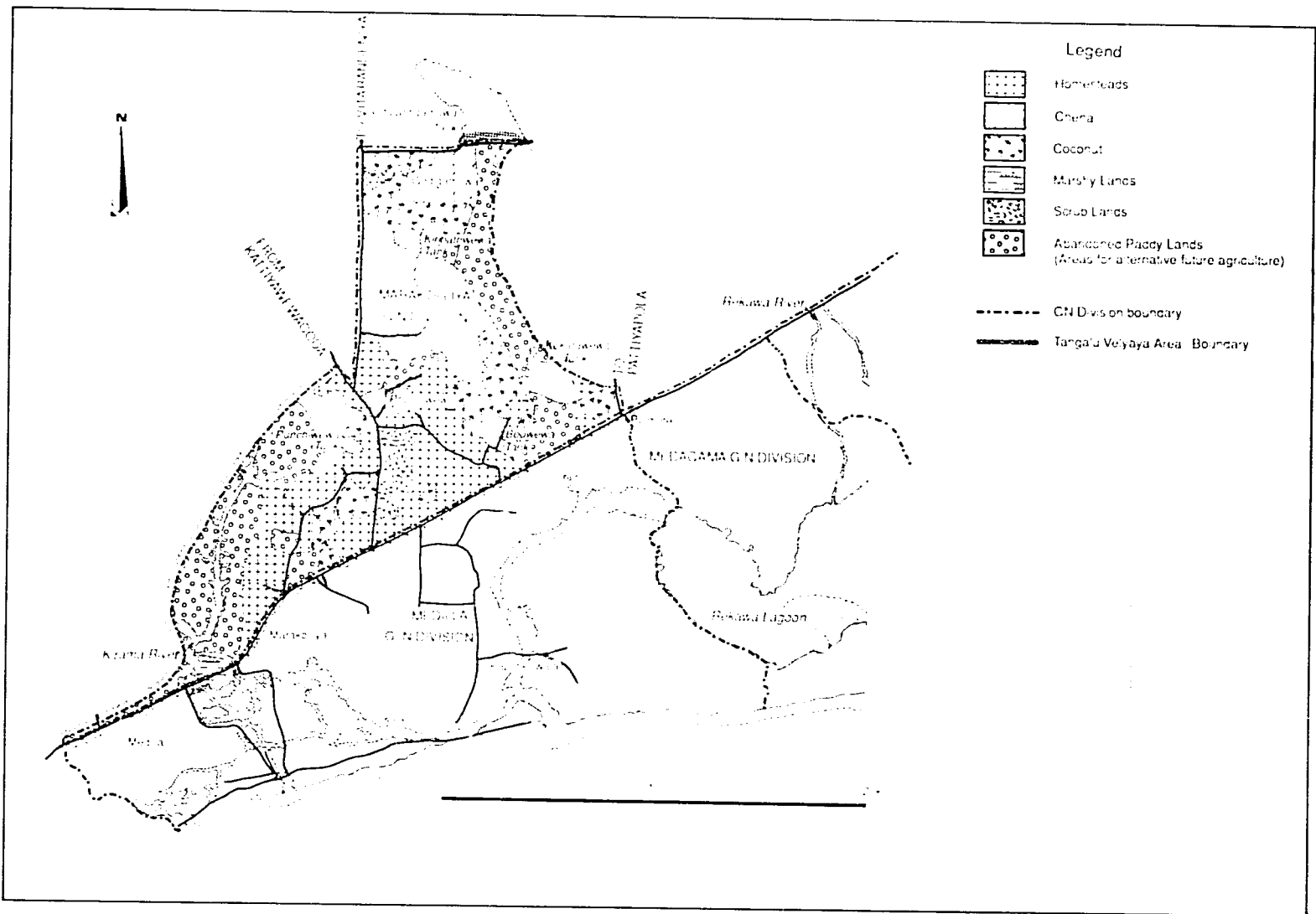
Inland from the Rekawa lagoon lie about 500 ha of paddy land and another 250 ha of land adjacent to the lagoon. This area is known as the Tangalu Velyaya or 'Yaya' (Figure 3.1). About two thirds of the land closest to the lagoon is currently not used because of its high salt content and regular flooding. Drainage of the Tangalu Velyaya is not good and flooding is a problem during the North East monsoon season. An efficient drainage system for this area could increase its agricultural potential and help lessen the extent of this seasonal problem.

There is interest in developing this unused land for hardy agricultural species such as cashew, salt tolerant varieties of paddy or reed (pan) and seasonal vegetables (TEAMS, 1994). The potential of the area for aquaculture, a development issue being considered by local communities and government, is discussed in chapter 5.

#### **The Rekawa Lagoon and Mangroves**

The quantity and quality of water reaching the Rekawa lagoon has critical impacts on this ecosystem. The influx of seawater when the lagoon mouth is open and freshwater from the mouth of the Kirama Oya and the Tangalu Velyaya, especially during the rainy Northeast monsoon season, keep this brackish environment dynamic. These fluctuations cause salinity to vary significantly within the lagoon area as shown in chapter 2. This diverse and productive brackish environment must be maintained in ecological balance.

*Figure 3.1 The extent of the Tangadu Veliya and surrounding area*



Along the shoreline of both the channel and the main basin of the lagoon are mangroves. Due to low tidal patterns in Sri Lanka, mangroves are restricted to very narrow areas along the coast and are easily subject to degradation (Baldwin, 1991). Growing to several meters in height, mangroves have a dense root system, which enables them to live in these coastal brackish water areas. Fringing mangroves such as *Rhizophora mucronata* and *Bruguiera gymnorhiza* make up only a small portion of the mangrove forest system in Rekawa and only form a narrow band around the shoreline. Less dominate mangrove species mixed with other vegetation grow inland from the fringing mangroves and form an additional band around the lagoon (Figure 3.2). These mangroves are interspersed with other vegetation such as *Sonneratia acidia* or "Kerala" which is used to make cork (Samaranayake, 1983). This mixed mangrove scrub environment is common in the Medilla, Rekawa West and Medagama GN divisions of the Rekawa site. A total of over 200 ha of mangrove and mixed mangrove vegetation is found in the Rekawa area (Mervyn and Kannangara, 1994). A list of common mangrove and other plant species is found in Table 3.1.

**Table 3.1 Mangrove and scrub vegetation species found in the Rekawa lagoon area (Karunaratne, pers. comm., 1994; CCD, 1991)**

Scientific Name	Local Sinhala Name
<i>Acanthus ilicifolius</i>	Mulli, Katu ikkili
<i>Acrostichum aureum</i>	Karen Koku
<i>Aegiceras corniculatum</i>	Heenkadol
<i>Avicennia marina</i>	Manda, Madagas
<i>Avicennia officinalis</i>	---
<i>Bruguiera gymnorhiza</i>	Malkadol, Sirikanda
<i>Bruguiera sexangula</i>	---
<i>Ceriops tagal</i>	Punkanda, Rathungas
<i>Clerodendrum inerme</i>	---
<i>Dolichandrone spathacea</i>	Diya danga
<i>Excoccaria aggalochu</i>	Thela
<i>Heritiera littoralis</i>	Etuna
<i>Lumnitzera racemosa</i>	Bariya
<i>Rhizophora mucronata</i>	Kadol
<i>Sonneratia acidia</i>	Kerala
<i>Sonneratia caseolaris</i>	Kirilla
<i>Typha angustifolia</i>	---

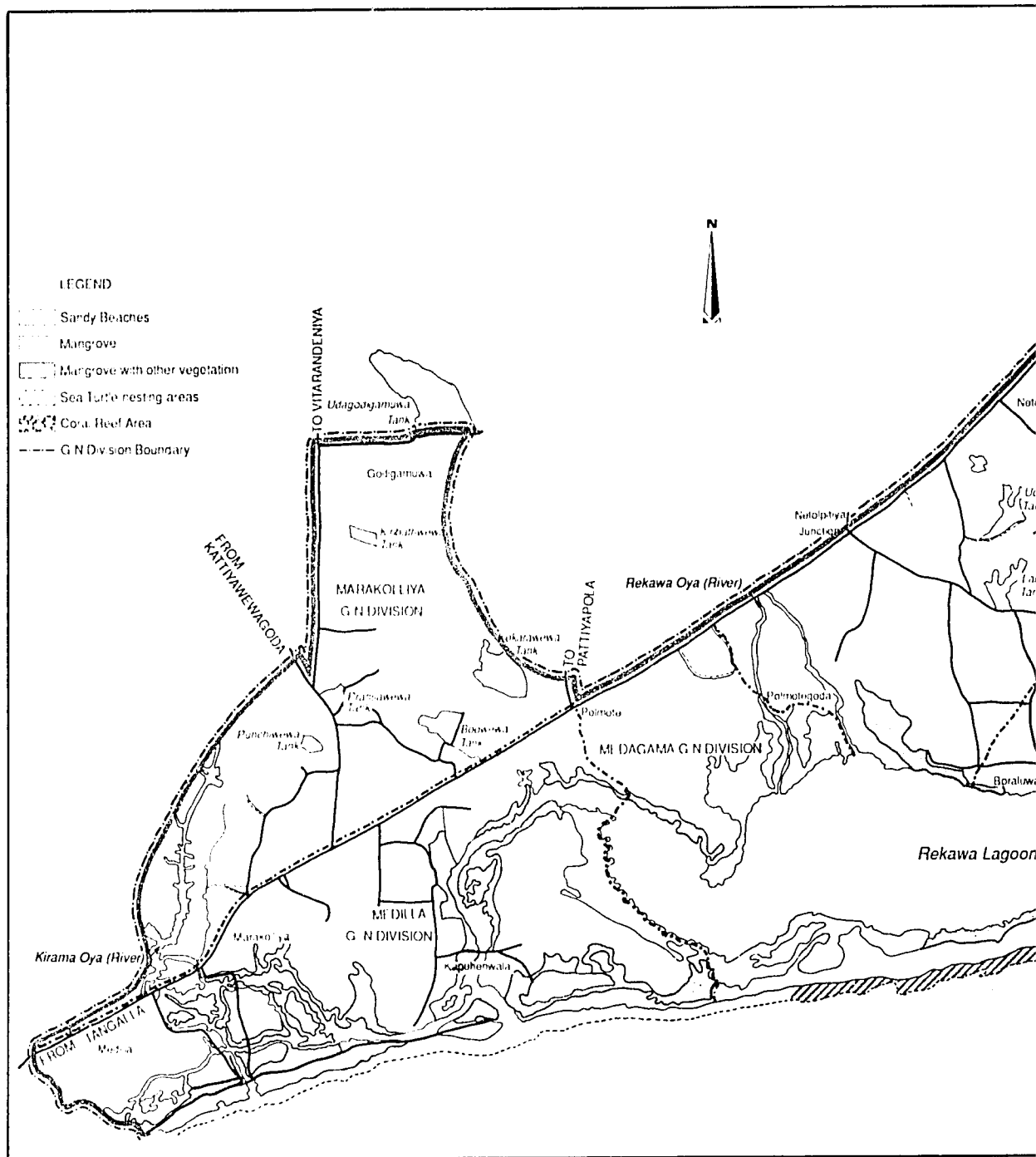
This coastal mangrove forest system provides an important environment for larval and juvenile stages of fish and crustaceans, including the economically important penaeid shrimp species (Table 3.2). This fauna finds safe haven and food within the complex root systems of these plants. The Rekawa mangroves also provide extensive areas for local and migratory birds to roost and nest on seasonal movements from colder climates (Table 3.3). Some bird species are dependent on these mangroves for breeding and rearing of young. Various species of mammals and reptiles are also found in the Rekawa mangroves (Table 3.4).

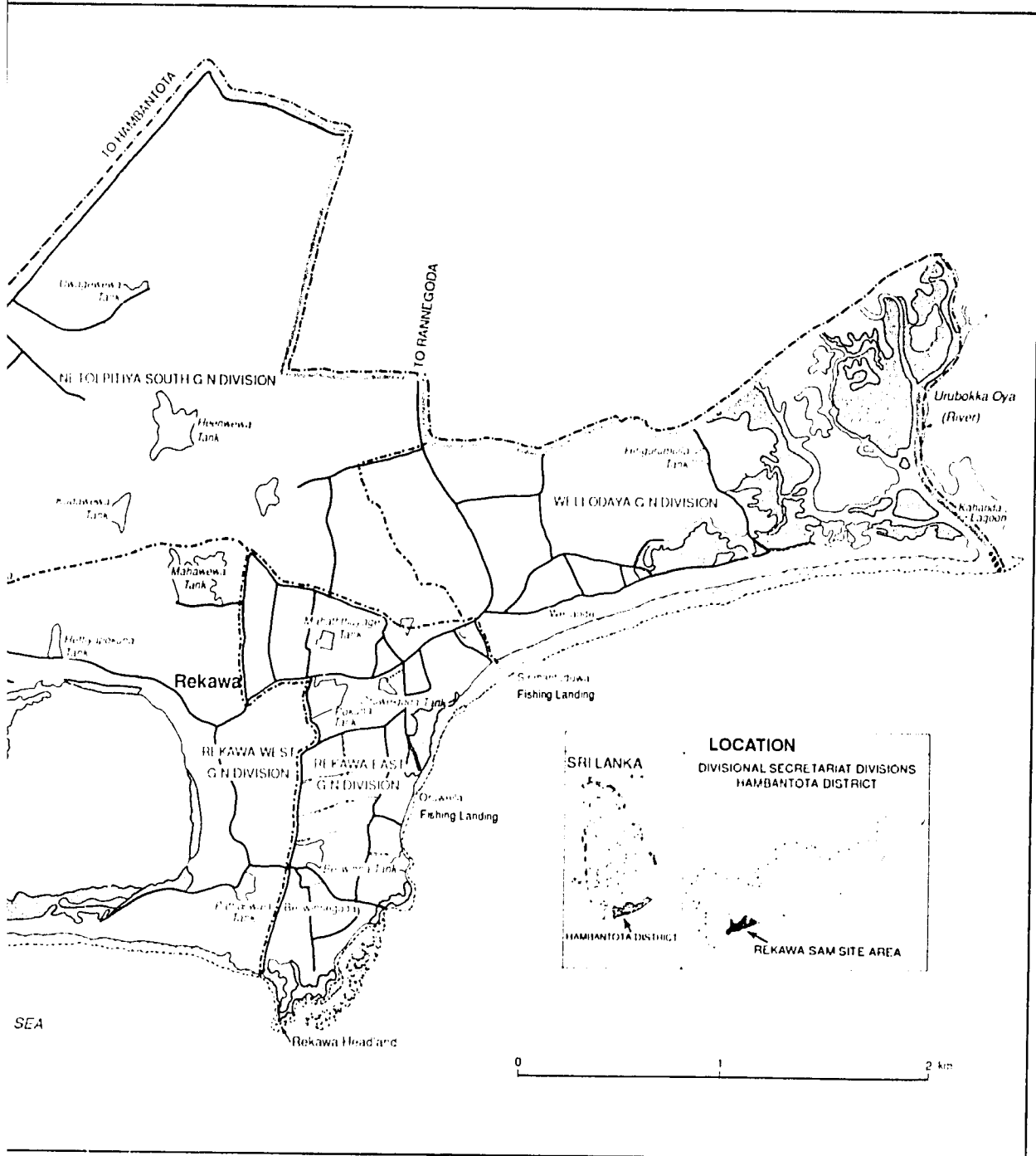
Local residents use mangroves as a source of wood as fuel for lime kilns, cooking and house construction, agricultural and medicinal purposes. A few hectares of mangroves around the lagoon have been cut for these uses. Since the beginning of 1994, the Forest Department in Hambantota is responsible for overseeing the protection of this resource and people are beginning to realize the ecological importance of mangroves as well.

**Table 3.2 Common fish and crustacean species found in the Rekawa lagoon (Jayakody, 1994)**

Scientific Name	Common Name	Present in	
		1986	1994(*)
<i>Anguilla sp.</i>	Eel	N	Y(.10)
<i>Arius sp.</i>	Catfish	N	Y(.45)
<i>Carangoides malabarius</i>	Malabar trevally	Y	Y(.55)
<i>Chanos chanos</i>	Milkfish	N	Y(.22)
<i>Elops sp.</i>	Tenpounder	N	Y(.15)
<i>Ephinephelus tauvina</i>	Greasy grouper	Y	Y(.10)
<i>Etroplus maculatus</i>	Spotted etroplus	Y	Y(.15)
<i>Eutheraon sp.</i>	Large-scale banned grunt	Y	N
<i>Gazza sp.</i>	Toothpony	N	Y(.10)
<i>Gerreomorpha sp.</i>	Biddy	N	Y(.23)
<i>Gerres sp.</i>	Silver biddy	Y	Y(.21)
<i>Gerres setifer</i>	Black-tipped silver biddy	Y	Y(.73)
<i>Gobius sp.</i>	Goby	N	Y(.27)
<i>Gobius tentacularis</i>	Tentacled goby	Y	Y(.61)
<i>Hyporhamus sp.</i>	Halfbeak	N	Y(.20)
<i>Ilisha elongata</i>	Slender shad	Y	N
<i>Leiognathus sp.</i>	Ponyfish	Y	Y(.24)
<i>Leiognathus equius</i>	Greater ponyfish	Y	Y(.11)
<i>Macromus vittatus</i>	Striped-dwarf catfish	Y	N
<i>Monodactylus argenteus</i>	Ceylon angelfish	N	Y(.37)
<i>Megalops sp.</i>	Tarpon	N	Y(.22)
<i>Mugil cephalus</i>	Flathead mullet	N	Y(.12)
<i>Muraenox cinereus</i>	Daggertooth pike conger	Y	N
<i>Nematalosa nasus</i>	Bloch's gizzard shad	Y	Y(.21)
<i>Ophisthopterus tardoore</i>	Tardoore	N	Y(.30)
<i>Oreochromis mossambicus</i>	Mozambique tilapia	Y	Y(.43)
<i>Oreochromis niloticus</i>	Nile tilapia	N	Y(.20)
<i>Puntius vittatus</i>	Striped barb	Y	N
<i>Sardinella sp.</i>	Sardine	N	Y(.10)
<i>Siganus javus</i>	Streaked spinefoot	Y	Y(.21)
<i>Sillago sihama</i>	Silver sillago	N	Y(.33)
<i>Tachysurus sp.</i>	Catfish	N	Y(.44)
<i>Tetradon sp.</i>	---	Y	Y(.28)
<i>Therapon jarbuva</i>	Jabua terapon	N	Y(.30)
<i>Thryssa sp.</i>	Anchovy	N	Y(.22)
<i>Tilapia sp.</i>	Tilapia	N	Y(.41)
<i>Tricanthus brevirostris</i>	Tripod fish	Y	Y(.11)
<b>Crustaceans</b>			
<i>Brachirus orientalis</i>	---	Y	N
<i>Macrobrachium javanicus</i>	Giant freshwater shrimp	Y	N
<i>Metapenaeus dobsoni</i>	Peneaid shrimp	Y	N
<i>Metapenaeus monoceros</i>	Peneaid shrimp	Y	Y(.10)
<i>Penaeus indicus</i>	White shrimp	Y	Y(.50)
<i>Penaeus latissulcatus</i>	Milk shrimp	Y	N
<i>Penaeus monodon</i>	Tiger shrimp	Y	Y(.22)
<i>Penaeus semisulcatus</i>	Green tiger shrimp	Y	Y(.10)
<i>Scylla serrata</i>	Swamp crab	Y	Y(.15)

\* relative frequency





*beaches and sea turtle nesting sites found in the Rekawa area*



**Table 3.3 Non-migratory and migratory bird species found in the Rekawa lagoon area (Karumaratie, pers. comm.; Jayawardena, pers. comm.)**

Scientific Name	Common Name	Scientific Name	Common Name
<b>Non-migratory Birds</b>			
<i>Acrodothores tristis</i>	Common mynah	<i>Pelecanus philippensis</i>	Brown pelican
<i>Aegithina tiphia</i>	Ceylon iora	<i>Phalacrocorax niger</i>	Little cormorant
<i>Alcedo althis</i>	Common kingfisher	<i>Phalaenoptilus fuscicollis</i>	Indian shag
<i>Amaronis phoenicurus</i>	White-breasted waterhen	<i>Porphyrio porphyrio</i>	Purple coot
<i>Anastomus oscitans</i>	Open bill	<i>Prinia hodgsonii</i>	Ashy prinia
<i>Anhinga melanogaster</i>	Darter	<i>Prinia inornata</i>	White-browed prinia
<i>Aratus fuscus</i>	Ashy swallow shrike	<i>Prostratula benghalensis</i>	
<i>Ardea purpurea</i>	Eastern purple heron	<i>benghalensis</i>	Painted snipe
<i>Ardea cinerea</i>	Eastern gray heron	<i>Psittacula krameri</i>	Rose ringed parakeet
<i>Ardeola grayii</i>	Pong heron	<i>Pycnonotus catenatus</i>	Red vented bulbul
<i>Bubulcus ibis</i>	Cattle egret	<i>Pycnonotus luteolus</i>	White-browed bulbul
<i>Butorides striatus</i>	Little green heron	<i>Scolecophagus japonicus</i>	Black robin
<i>Capsicus squamatus</i>	Southern magpie robin	<i>Spilornis holospilus</i>	Serpent eagle
<i>Casimodius alba</i>	Large egret	<i>Sterna albobrunnea</i>	Little tern
<i>Centropus viridis</i>	Common coucal	<i>Streptopelia chinensis</i>	Spotted dove
<i>Ceyx nalis</i>	Indian pied kingfisher	<i>Tachybaptus ruficollis</i>	Little grebe
<i>Charadrius dubius</i>	Little ringed plover	<i>Tersiphone paradisi</i>	Sri Lankan paradise flycatcher,
<i>Chlidonias hybridus</i>	Indian whiskered tern		
<i>Coracias benghalensis</i>	Indian roller	<i>Threskionius</i>	
<i>Corvus macrorhynchos</i>	Black crow	<i>melanocephala</i>	White ibis
<i>Dendrocygna javanica</i>	Lesser whistling teal	<i>Tringa totanus</i>	Eastern red shank
<i>Dicaeum erithrorhynchos</i>	Sri Lank in small	<i>Turdoides affinis</i>	Common babbler
<i>colaptes</i>	flowerpecker	<i>Trochiloides bichenovii</i>	Yellow biter
<i>Egretta alba</i>	Large heron	<i>Vanellus indicus</i>	Red wattled lapwing
<i>Egretta garzetta</i>	Little egret	<i>Vanellus malabaricus</i>	Yellow wattled lapwing
<i>Eremophila alpestris</i>	Finch lark		
<i>Esacus recurvirostris</i>	Great stone plover	<b>Migratory Birds</b>	
<i>Gallus latifrons</i>	Jungle fowl (endemic)	<i>Charadrius dubius</i>	Little ringed plover
<i>Halcyon smyrenensis</i>	White-crested kingfisher,	<i>Chlidonias hybridus</i>	Indian-whiskered tern
<i>Haliaeetus leucogaster</i>	White-bellied sea eagle	<i>Hirundo rustica</i>	East asian swallow
<i>Haliastur intermedius</i>	Brahminy kite	<i>Merops philippinus</i>	Blue tailed bee eater
<i>Hemiprocera coromandala</i>	Indian crested swift	<i>Motacilla cinerea</i>	
<i>Himantopus himantopus</i>	Black-winged stilt	<i>melanope</i>	Gray wagtail
<i>Hydrophasianus chirurgus</i>	Peasant tailed jacana	<i>Motacilla flava thunbergi</i>	Gray-headed yellow wagtail,
<i>Lonchura punctulata</i>	Spotted munia		
<i>Megalaima zeylanicus</i>	Brown-headed barbet	<i>Numenius arquata</i>	Eastern curlew
<i>Merops orientalis</i>	Green bee eater	<i>Pitta brachyura</i>	Indian pitta
<i>Mesophobax intermedia</i>	Median egret	<i>Plegadis falcinellus</i>	Glossy ibis
<i>Mitrasia assamica</i>	Bush lark	<i>Pluvialis fulva</i>	Golden asiatic plover
<i>Mycteria leucocephala</i>	Painted stork	<i>Pluvialis squatarola</i>	Gray plover
<i>Nectarinia asiatica</i>	Purple sunbird	<i>Sterna nilotica</i>	Gull-billed tern
<i>Nectarinia luteola</i>	Loten's sunbird	<i>Tringa hypoleucos</i>	Common sandpiper
<i>Oriolus chinensis</i>	Black-headed oriole	<i>Tringa stagnatilis</i>	Marsh sandpiper
<i>Oriolus chinensis</i>	Tailor bird	<i>Tringa totanus</i>	Red shank
<i>Pelargopsis capensis</i>	Short billed kingfisher		

**Table 3.4 Common mammals and reptiles found in the Rekawa lagoon area (Karunaratne, pers. comm.; Jayawardena, pers. comm.)**

Scientific Name	Common Name
<b>Mammals</b>	
<i>Felis rubiginosa</i>	Sri Lankan rusty spotted cat
<i>Funambulus palmarum</i>	Palm squirrel
<i>Herpestes smithii ceylanicus</i>	Ruddy mongoose
<i>Lepus nigricollis</i>	Black-naped hare
<i>Presbytis entellus</i>	Grey langur
<i>Tragulus melinna</i>	Mouse deer
<b>Reptiles</b>	
<i>Calotes calotes</i>	---
<i>Python molurus</i>	Python snake
<i>Sitana ponticeriana</i>	---
<i>Varanus bengalensis</i>	Iguana lizard
<i>Varanus monitor</i>	Water monitor lizard
<i>Testudo elegans</i>	Milk tortoise

### Seagrass Beds

Seagrass beds thrive in the main body of the lagoon. They need clear water, free from sedimentation and turbidity, to flourish. Like the mangroves, seagrass beds provide sediment stability and a nursery ground for aquatic fauna, which in turn serves as stock for lagoon and ocean fisheries.

### Marine Resources

Within the lagoon and just offshore of the Rekawa area, a productive penaeid shrimp fishery exists. The species most common is *Penaeus indicus* (Jayakody, 1994). Its life cycle includes time in both the open sea and brackish lagoon environments (Figure 3.3).

The late mysis and early post-larval stages of this shrimp have been found to enter into the lagoon system in June/July and October/December when the sand barrier has been breached (Jayakody, 1994). Juveniles are then caught in lagoonal waters beginning in September. By October, these juveniles begin to move back into the sea and continue to do so through April when the sand inlet is open to the sea. Mature, gravid females are present just outside the lagoon mouth in 5-8 m of water in June/July and October/November (Jayakody, 1994).

Lagoon fishermen use cast nets, drift gill nets, and Ja-kotu to catch these shrimp 10-14 cm in size. Figure 3.4 shows the amount of shrimp harvested by the three major types of fishing methods in Rekawa lagoon and the total shrimp fishery yield for one year. It is evident from this data that Ja-kotu yields are substantially higher, and should be monitored so that this method of fishing does not overexploit the fishery. Just opposite the lagoon mouth in the ocean, trammel nets are used to exploit the same species (Jayakody, 1994).

Many local fishermen fish the inshore waters off Rekawa using gill nets and beach seines to catch sardines, anchovies and mackerel. This fishery is exploited using small

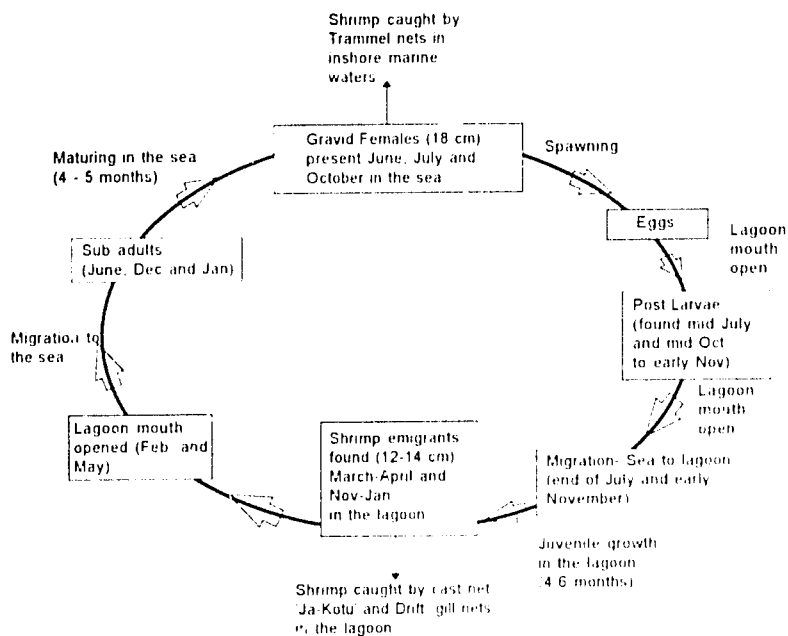


Figure 3.3 Life cycle of *Penaeus indicus* in the Rekawa lagoon and inshore marine waters

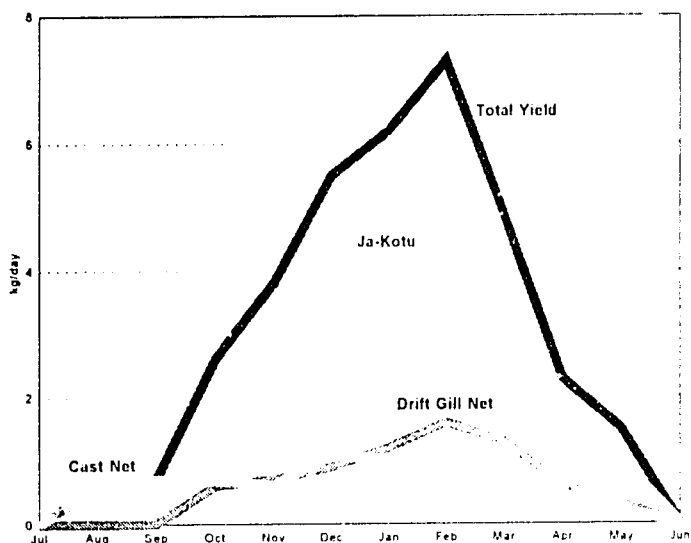


Figure 3.4 Shrimp fishery yields in Rekawa lagoon from July 1993 through June 1994 (Jayakody, 1994)

open craft which use outboard motors to fish these inshore waters. These fish caught in this inshore fishery are packed in ice and transported by truck to local markets.

The beach along the Rekawa East GN division is a main landing site for many of these inshore fishermen. However, the beach here is dynamic and naturally eroding due to its exposure to heavy wave action. This erosion creates a steep sand gradient which makes the landing of fishing craft difficult, especially in rough weather. Coral mining in the limited reef area just offshore of this beach and the collection of sea coral rubble from the beach for lime production also contributes to the erosion problem in this area.

Additionally, local inshore fishermen set nets along reef areas just offshore of the Rekawa lagoon beaches to catch spiny lobsters and reef fish. Reef fish and lobster are economically valuable, but bottom set nets are damaging to the corals, gorgonians, and sponges which make up the coral reef causing degradation of this habitat. Moxy nets, which are placed over coral heads, are commonly used by aquarium fish collectors. Some collectors will pry and break the coral to chase the fish into these nets, resulting in physical damage to the reef (Rajasuriya, 1994).

Further offshore of the Rekawa site, the Hambantota Bank supports one of the most productive deep-water fisheries in Sri Lanka (Baldwin, 1991). The bank stretches from Dondra Head, the southernmost tip of Sri Lanka, in the west to Little Basses Reef in the east and is between 13 and 31 km wide. Migratory tuna, shark, and billfish are caught in addition to bottom dwelling (demersal) and semi-demersal fish species such as snapper, grouper and breams. Estimates from a 1978-80 study showed that the offshore fisheries of pelagic species could yield as much as 15,000 tons and demersal fish catches could yield up to 9,000 tons. Currently, only about 7,000 tons and 1,500 tons are produced respectively per year within the whole Hambantota district (DEARD, 1989).

This same study estimated that the total mean biomass of both pelagic and demersal fish on the Hambantota Bank is about 105,000 tons. The main limiting factor for increasing deep-water fisheries is the cost of purchasing and operating boats and associated equipment for exploiting this resource more effectively.

## **Coral Reefs**

Located on the northeastern side of the Rekawa headland, a fringing reef 100 to 150 m. wide and 300 m. long (approximately) lies in 2-3 m of water (Figure 3.2). Reefs in the Rekawa area are geologically relatively young (Swan, 1983). Therefore, these reefs are not well defined and the southern coast area is subject to heavy wave action, especially during the Southwest monsoon (Rajasuriya, 1994). The reefs present are usually found at the base of rocky headlands, such as the one off the Rekawa site (Rajasuriya, 1994). A preliminary survey showed that this reef is not well developed and that the corals grow intermittently on sandstone and crystalline rock substrate (Rajasuriya, 1994).

Coral cover near the channel close to the Rekawa headland, used by local inshore fishing boats, is less than 1-2 percent, while the rest of the reef area, east of the boat channel, has as much as 25 percent coral cover (Rajasuriya, 1994). Overall diversity of both corals and fish is low with only 21 species of stony corals (Table 3.5) and 38 species of fish found in the preliminary survey (Table 3.6).

Noticeable reef damage has occurred from coral mining. The survey by Rajasuriya (1994) noted the effects of erosion of the coastal area and beaches in the area. Dead coral rubble was found in mined patches of the reef and on the lagoon side of the reef. This reef debris accumulates from the reef crest where increased wave action due to coral mining has accelerated reef and beach damage.

**Table 3.5 Coral species found on the Rekawa reef during visual survey in March 1994 (Rajasuriya, 1994)**

<b>Family: Acroporidae</b>	<b>Family: Merulinidae</b>
<i>Acropora formosa</i>	<i>Hydnophora microconos</i>
<i>Acropora aculeus</i>	<b>Family: Milleporidae</b>
<i>Acropora robusta</i>	<i>Millepora platysphyllia</i>
<i>Montipora acutituberculata</i>	<b>Family: Oculinidae</b>
<b>Family: Astrocoeniidae</b>	<i>Galaxea fascicularis</i>
<i>Stylocoeniella guentheri</i>	<b>Family: Pocilloporidae</b>
<b>Family: Faviidae</b>	<i>Pocillopora damicornis</i>
<i>Favia speciosa</i>	<i>Pocillopora verrucosa</i>
<i>Favites chinensis</i>	<b>Family: Poritidae</b>
<i>Favites flexuosa</i>	<i>Porites</i> sp.
<i>Favites abdita</i>	<b>Family: Siderastreidae</b>
<i>Favites pentagona</i>	<i>Pavona varians</i>
<i>Platygyra lamellina</i>	<b>Family: Thamnasteridae</b>
<i>Platygyra sinensis</i>	<i>Psammacora contigua</i>
<i>Platygyra pini</i>	

**Table 3.6 Fish species found on the Rekawa reef during visual survey in March 1994 (Rajasuriya, 1994)**

Scientific Name	Common Name	Scientific Name	Common Name
<b>Family: Acanthuridae</b>		<b>Family: Monacanthidae</b>	
<i>Acanthurus leucosternon</i>	Powder blue surgeonfish	<i>Amanes scopas</i>	Broom filefish
<i>Acanthurus lineatus</i>	Striped surgeonfish	<b>Family: Mullidae</b>	
<i>Acanthurus triostegus</i>	Convict surgeonfish	<i>Paripeneus barberinus</i>	Dash-dot goatfish
<i>Ctenochaetus striatus</i>	Striped bristletooth	<i>Paripeneus indicus</i>	Indian goatfish
<i>Naso lituratus</i>	Orange unicornfish	<b>Family: Pempheridae</b>	
<b>Family: Canthigasteridae</b>		<i>Pempheris ovalensis</i>	Silver sweeper
<i>Centrigaster solandri</i>	Solander's toby	<b>Family: Pomacentridae</b>	
<b>Family: Carangidae</b>		<i>Abudefduf septemfasciatus</i>	Seven bar sergeant major
<i>Caranx melampygus</i>	Blue fin trevally	<i>Abudefduf sordidus</i>	Black spot sergeant major
<b>Family: Chaetodontidae</b>		<i>Abudefduf vaigiensis</i>	Indo pacific sergeant major
<i>Chaetodon citrinellus</i>	Citron butterflyfish	<i>Chrysiptera leucopoma</i>	Surge damselfish
<i>Chaetodon decussatus</i>	Black finned butterflyfish	<i>Chrysiptera</i> sp.	Damselfish
<i>Chaetodon lunula</i>	Raccoon butterflyfish	<i>Neoglyphidodon bonang</i>	Ocellated damselfish
<i>Chaetodon vagabundus</i>	Vagabond butterflyfish	<i>Neopomacentrus azysron</i>	Yellowtail damselfish
<b>Family: Labridae</b>		<i>Plectroglyphidodon dickii</i>	Dick's damselfish
<i>Anampses lineatus</i>	Lined wrasse	<i>Plectroglyphidodon lacrymatus</i>	Jewel damselfish
<i>Gomphosus varius</i>	Bird wrasse	<i>Pomacentrus chrysurus</i>	White-tail damselfish
<i>Halichoeres nebulosus</i>	Nebulose wrasse	<i>Stegastes nigricans</i>	Dusky gregory
<i>Halichoeres marginatus</i>	Dusky wrasse	<i>Stegastes</i> sp.	Damselfish
<i>Halichoeres centripunctatus</i>	Checker-board wrasse	<b>Family: Zanclusidae</b>	
<i>Stethojulis trilineata</i>	Three-lined wrasse	<i>Zanclus canescens</i>	Moorish idol
<i>Thalassoma quinquavittata</i>	Five-stripe wrasse		
<i>Thalassoma lunare</i>	Moon wrasse		
<b>Family: Lutjanidae</b>			
<i>Lutjanus fulvus</i>	Yellow-margined sea perch		
<i>Lutjanus lunulatus</i>	Crescent snapper		

## Beaches and Sea Turtles

The long, broad beaches located along the ocean side of the Rekawa lagoon provide an ideal environment for the nesting of several species of sea turtles, which come ashore to lay their eggs every year (Figure 3.2). Turtles favor dark, well defined beaches for nesting. The Rekawa beaches provide ideal nesting grounds for sea turtles, and approximately 1900 turtles nest there each year (Ranger, pers. comm., 1994).

Sea turtles use the continuous beach found approximately 8 km east of Tangalla as nesting areas. The most common nesting beach extends west of the Rekawa headland for about 3 km. Turtles reportedly also commonly nest on the Wellaodaya beach east of the headland extending for about 5 km. (Richardson pers. comm.).

Of the five species of sea turtles nesting on Rekawa beaches, the Green turtle (*Chelonia mydas*) is the most common. This species nests all year round. During a 22 day period in May and June 1994, 112 nests were recorded. Between May and July 1994, 10 Loggerhead turtle (*Caretta caretta*) nests and between 10 and 15 Leatherback turtle (*Dermochelys coriacea*) nests were also recorded. Only one Hawksbill turtle (*Eretmochelys imbricata*) nest was recorded on Rekawa beach in 1994, but local reports claim that this species was once more common. The Olive Ridley turtle (*Lepidochelys olivacea*) is also reported to nest on Rekawa beaches, but there are no reports of this species nesting in 1994, suggesting that its population in this region may be precariously low (Cooray, in press).

The sea turtles mate and feed offshore and the females come ashore to lay their eggs. Turtles nest throughout the year, with May and July being the peak nesting periods for most species (Richardson, pers. comm.). The average clutch size is between 100 to 150 eggs and a single female may lay up to five nests in one season. The eggs are incubated in the sand and hatch after approximately 60 days. The juvenile turtles (hatchlings) make their way directly to the surf and begin their lives in the ocean. Local people collect all the turtle eggs laid on Rekawa beach for personal consumption or sale at local markets and occasionally turtles are slaughtered. Egg collectors report that female turtle populations are declining in the Rekawa area primarily due to egg collection and incidental by-catch of turtles in fishing gear. There is potential to protect this living resource through community based, sustainable conservation strategies (e.g. limited eco-tourism) and careful environmental management in Rekawa.

## Mineral Resources

Mineral resources of the Rekawa area have not been extensively researched for their potential. They however, make up a portion of the natural resources and add to the richness of the Rekawa lagoon site.

One of the more common minerals is limestone containing calcium carbonate, which exists in the form of skeletons created by living polyps of stony, reef-building corals. The coral is mined for lime production and used in the construction industry. Coral mining has been providing many people in the coastal areas of Sri Lanka with a lucrative income. Some coral comes from relic inland deposits. However, the mining of sea coral, which is superior in quality, is not sustainable and has caused significant coastal erosion and degraded a biologically rich ecosystem. Other mineral resources exist inland for less harmful exploitation.

Preliminary surveys show that the whole Hambantota District, including the Rekawa area, holds potential for minerals such as almandites, chromium, garnet, granulite, mica and nickel. Gneiss, granite, graphite, sand and sea salt are also abundant and could prove to be valuable natural resources as well (Samaranayake, 1983). Clay deposits near Netolpitiya in the northern part of the Rekawa area are exploited for tile and brick making (HIRDEP, 1990).

### **Summary**

The resources of the Rekawa lagoon and the surrounding areas are rich and diverse. The lagoon and nearshore marine fisheries have potential to improve the livelihoods of local fishermen if managed for maximum sustainable yields. The mangrove forests, beaches, agricultural land and potential aquaculture sites all can play important roles in upgrading the livelihoods of the Rekawa communities. Each resource system has its limits of endurance and must be managed with care so that the ecosystems are disturbed as little as possible. The fisheries should not be over-fished nor the fish habitats destroyed. This includes the mangrove forest, which plays an important role in maintaining a healthy lagoon system. Sea turtle nests and nesting sites need protection so that they can enhance the Rekawa beach as a potential tourist site. Sustainable development of the Rekawa resources will not endanger their integrity if the larger ecosystem, including humans and its linkages are given due consideration in management actions for the area.

## **Chapter 4**

### **POPULATION AND INFRASTRUCTURE**

The people of the Rekawa area and their social infrastructure comprise a rural community closely connected with the natural resources and processes analyzed in earlier chapters. Their quality of life is not high, but the natural resources and environment provide some income to most people.

Occupations depend on natural resources but unemployment is significant. Coral mining is one of the more lucrative occupations along with the lagoon shrimp fishing. Coral mining is environmentally unsustainable, but the shrimp fishery has potential for sustainable use. Agriculture, the most common livelihood of the residents is inhibited by infertile coastal land with low productivity. Most local families are supported to some extent with supplemental income by government social welfare.

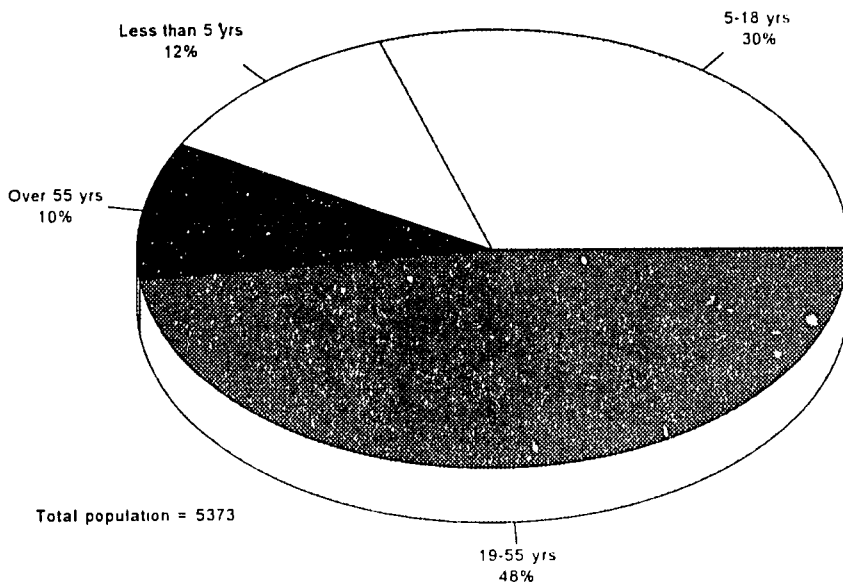
The level of formal education in the community is low and there is poor understanding of the various rural diseases and sanitation problems. The social condition of the people in the Rekawa area needs to be improved through education and sustainable development.

#### **Population**

There are 20 villages within the 7 Grama Niladhari Divisions of the Rekawa site. In 1994, 1184 families comprising 5373 people lived in the Rekawa area. The average household size was 4.5 people (Ranaweera Banda et al., 1994). Overall, the Hambantota District, which includes the Rekawa area, has experienced a decrease in birth and death rates since 1952. Between 1952 and 1988, the birth rate went down from 5.8 percent to 1.8 percent, the death rate from 12 to 3.7 per 1000 and infant mortality rate from 61 to 7.25 per 1000 (McCall, 1990). These problems have become less acute as health care and social infrastructure have improved.

Females comprise 51 percent of the population (HIRDEP, 1990). Overall, the population of the Rekawa area is young with over 40 percent 18 years old or less. Nearly 90 percent of the people are under 55 years of age, while nearly one third of the total are between 5 and 18 years old. The youngest age group, (less than 5 years old) makes up about 12 percent of the population and the oldest age group (55 years and over) each makes up about 10 percent. The age group between 19 and 55 is the most productive and represents nearly half of the population (Figure 4.1) (Ranaweera Banda et al., 1994).





*Figure 4.1 Percent of population by age in the Rekawa area*

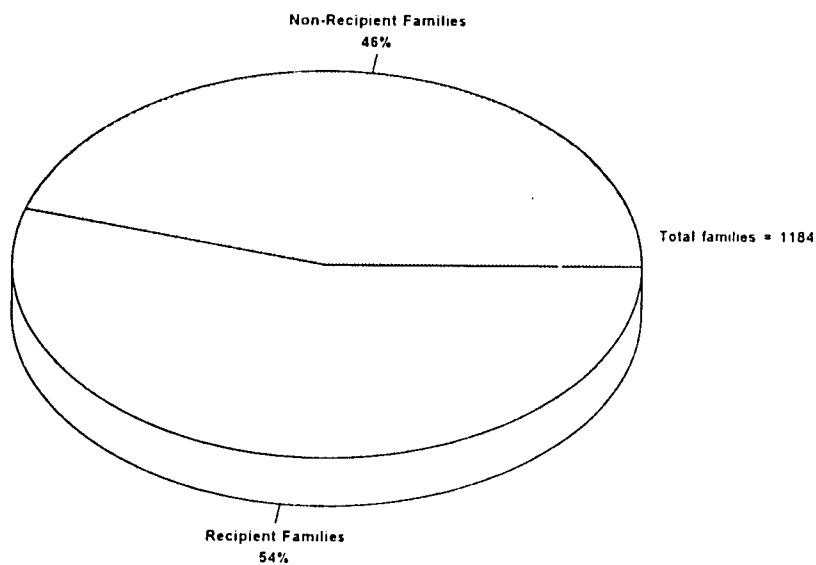
### Religion and Ethnic Groups

The majority ethnic group is Sinhala (about 98 percent). Most of them practise Buddhism as their religion. Muslim and Hindu religious groups comprise only 1.6 and 0.4 percent of the population respectively (IHRDEP, 1990).

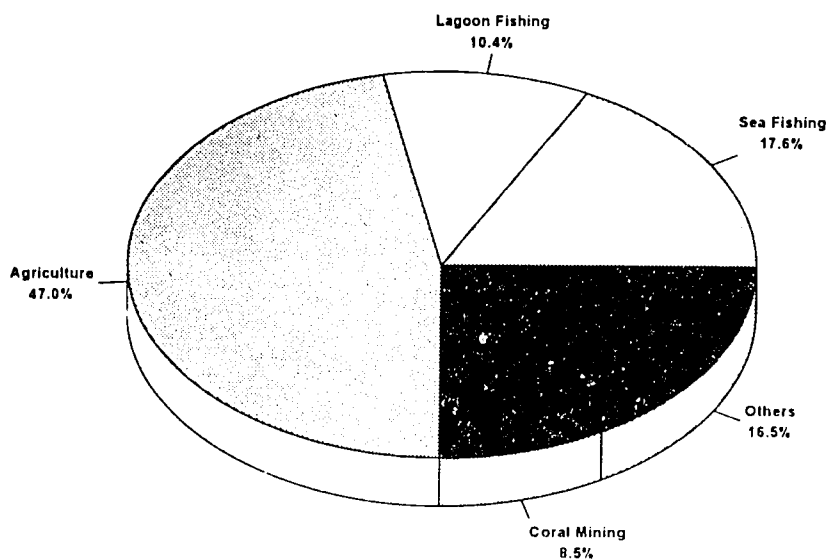
### Occupations

Four main types of occupation provide employment for the working population of the Rekawa area. These include sea and lagoon fishing (18 and 10 percent respectively), agriculture (47 percent) and coral mining (9 percent) (Ranaweera Banda et al., 1994). Other occupations include carpentry, masonry, labor and local government service. As many people in the Rekawa area are engaged in more than one occupation it is difficult to get accurate employment data for each individual occupation.

The work force of three GN divisions, Netolpitiya, Medagama and Wellaodaya, is predominantly involved with agriculture including livestock, paddy and chena (slash and burn) farming. These three divisions have 94, 80, and 55 percent of the total working population respectively engaged in agriculture. Rekawa West, Rekawa East and Wellaodaya GN divisions have the largest fishing populations comprising 72, 36, and 22 percent of the total work force respectively engaged in fishing. Although these occupations provide some income to the people of the Rekawa area, many of them are still on government social welfare (Ranaweera Banda et al., 1994). Figure 4.2 gives the breakdown of employment by major occupations.



*Figure 4.2 Major occupations and percent employed in the Rekawa area (Ranaweera Banda et.al., 1994)*



*Figure 4.3 Total Janasaviya Program and public assistance recipients in the Rekawa area (Ranaweera Banda et. al., 1994)*

## Janasaviya and Other Public Assistance Programs

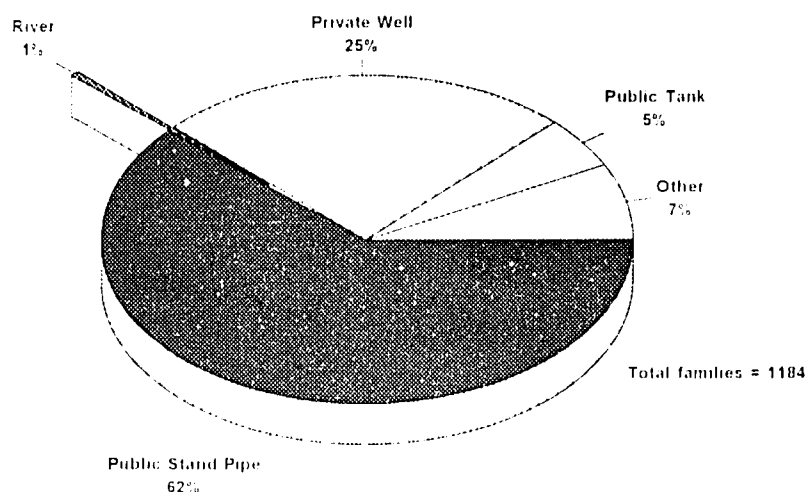
The Rekawa area is located in Hambantota, the least developed district in Sri Lanka. Over 70 percent of the population was receiving Rs. 700 per month in food stamps from 1980 until 1990 (Balachandra, pers. comm.).

In 1991, the central government started the Janasaviya (Community Strengthening) Program (JSP) to replace the food stamp scheme. A monthly income of less than Rs. 1,458 per month is a necessary qualification to become a beneficiary of this program. Recipients are entitled to a capital certificate with a face value of Rs. 25,000 on the date of issue. This certificate can be used as collateral to obtain a bank loan for self-employment projects. In addition, certificate recipients are also ensured a monthly interest of Rs. 250 from the National Savings Bank.

Public assistance programs are provided for people in the Rekawa area who are old, chronically ill and infirm. These people have little or no income or social support and represent the neediest of the community. Recipients of both the JSP and public assistance programs in the Rekawa area are shown in Figure 4.3. The people on public assistance are also usually in need of medical support which they cannot get on their own.

## Health, Sanitation and Medical Care

Health problems prevalent in the Rekawa area include malaria, bowel diseases, helminthic infestations, typhoid, malnutrition, and complications from poisonous snake bites. These problems are aggravated by a lack of adequate drinking water and sanitation facilities, medical care and adequate nutrition.



*Figure 4.4 Percent of families having access to fresh water in the Rekawa area (Ranaweera Banda et. al., 1994)*

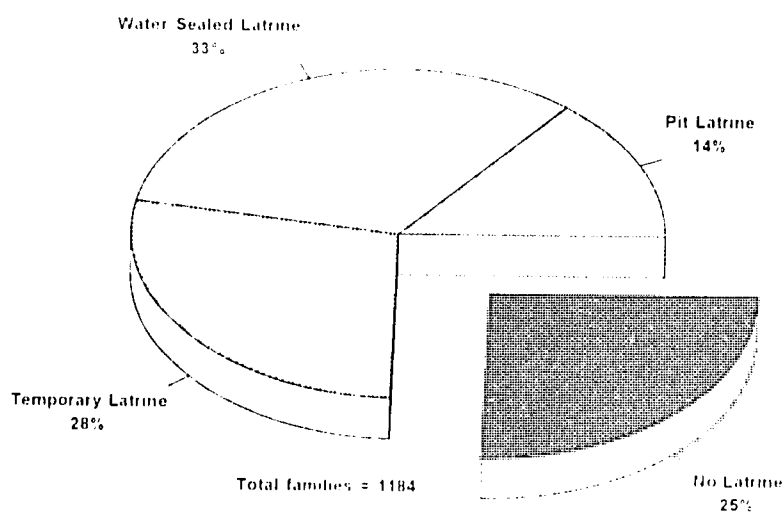
Malaria is not common near Rekawa lagoon, but is more prevalent inland, where standing freshwater pools provide ideal breeding sites for mosquitoes. The brackish water nearer the lagoon prevents mosquitoes from breeding and malaria becomes less of a problem.

Drinking water is a primary concern in the Rekawa area. It is scarce and supplied mostly from wells, pipes, tanks and waterways. By prior arrangement, villages have their cement water tanks filled on certain stipulated days. This service is provided by the Ranna Water Supply Scheme but the water is not adequately treated and the quantity is limited. Approximately 62 percent of the Rekawa population receive water in this fashion, while 25 percent get their water from wells which are mostly unprotected and improperly constructed (MOH, 1993) (Figure 4.4).

Lack of safe drinking water coupled with the lack of adequate sanitation has led to bowel diseases and worm infestations. The Health Department therefore undertook an intensive latrine construction project in 1990 along with a latrine subsidy scheme, funded by HRDEP (McCall, 1990). Despite this effort, the sanitation problem still continues. Many people use unsanitary temporary latrines or pit latrines. These provide breeding grounds for flies and mosquitoes. The water seal latrine, an adequate sanitary system, is used by about one third of the people in the Rekawa site (MOH, 1993). About half of the Rekawa families do not have sanitary latrines (Figure 4.5).

Malnutrition in the Rekawa area is acute in children under the age of five. Nutrition surveys carried out during 1975-76 and 1980-82 found that:

- Acute malnutrition occurs among 6.3 percent and chronic malnutrition in 29.7 percent of preschool children and is widespread throughout the whole population;
- Anaemia occurs in 50-60 percent in preschool children and pregnant women and 35 percent of all adults; and
- Vitamin A deficiency was widely prevalent (McCall, 1990).



*Figure 4.5 Percent of families with sanitation facilities in the Rekawa area (MOH, 1993)*

Although these figures are applicable to the whole Hambantota District, it reflects what can be expected in the Rekawa area. Lack of nourishing food and poor medical care make these nutritional problems widespread.

The Department of Health provides medical services through district and rural hospitals and dispensaries for people in the Rekawa area. In addition, the Tangalla Medical Officer of Health provides public health services through Public Health Inspectors and Public Health Midwives. Assisting with these services in the field are local health volunteers which help with organizing and conducting health education activities. These programs cover immunization, maternal and child health, nutrition and health education.

## Education

There are 3213 children and 183 teachers in the Rekawa SAM site (Table 4.1). All the schools are primary and junior schools, with the exception of one each in the Medilla and Netolpitiya GN divisions, which offer secondary education. If students wish to receive a higher education (GCE Advanced Level) they have to move to a Maha Vidyalaya school. The nearby town of Tangalla has three such schools. Families that can afford to do so send their children to schools outside the Rekawa area (Director of Education, pers. comm.).

Table 4.1 Numbers of teachers and students in the Rekawa area (Director of Education, pers. comm.)

GN Division with schools	Students			Teachers
	Primary	Secondary	Junior	
Medagama	0	0	436	26
Medilla	91	870	0	52
Netolpitiya South	360	515	0	49
Rekawa East	0	0	369	19
Wellaodaya	180	0	392	37
Total	631	1385	1197	183

## Summary

The people of Rekawa face a multitude of economic, social and health problems. Unemployment is high with low occupational diversity and income. Many people manage to get by on welfare but ultimately, the community cannot hope to depend on such outside assistance. Education and health problems add to the low standard of living. Poor sanitation and limited safe drinking water are other major issues. These problems, if addressed, can be eliminated or significantly reduced with community supported programs. Their negative impact on the people of Rekawa area are such that any improvements will have an immediate beneficial impact and help catalyze further improvements in the sustainable development of the Rekawa area.

## **Chapter 5**

### **ECONOMIC SECTORS**

The economy of the Rekawa area is not strong or diversified and incomes are low even for the Hambantota District. Reliance on the land and sea make any changes in the natural resources immediately apparent in family incomes. Economically, agriculture and fisheries are the main industries, along with coral mining. Smaller industries such as brick making and coir manufacturing are limited but supplement incomes and provide some diversity to the economy. Tourism and aquaculture have potential, but the local communities have so far resisted any substantial development of these industries through fears of potential negative environmental, social and cultural effects.

Coral reef mining, though banned by law is still practised with damaging environmental consequences. It is one of the biggest income generating activities in the Rekawa area. While most people in the SAM site know this is an unsustainable livelihood, they still practise it for want of an alternative. The short term economic benefits of coral reef mining are great. Unless attractive alternative avenues of employment are found and current national coral mining laws enforced, coral mining will continue (Hale and Kumin, 1992).

#### **Agriculture**

Agriculture is a major source of income for residents of half of the GN divisions. The people living in the GN divisions of Marakolliya, Medagama, Netolpitiya and part of Wellaodaya all engage in paddy, coconut, citronella, subsidiary food crop production, and raise livestock (Mervyn and Kannangara, 1994). Most of this land is inland off the main road that cuts through the Rekawa area heading west from Tangalla to Tissamaharama. The major land use patterns for the Rekawa site, including agriculture, can be seen in Figure 5.1.

Water for these activities comes from the major irrigation works of the Muruthawela Project (Weeraketiya), the Urubokka Oya Project (Netolpitiya) and the Kirama Oya Project. These three irrigation schemes, except part of the Urubokka Oya project, are all within the Rekawa site (see chapter 2). Paddy cultivation is widely practiced in the northern part of the Rekawa SAM site, while vegetable cultivation is the most lucrative occupation in Netolpitiya, complemented by inland coconut, citronella, vegetables and subsidiary food crop cultivation.

Most land in the Rekawa area cannot be used for paddy cultivation because of the high salinity of the soil. Only about 54 ha of the Tangalu Veliyaya and the surrounding land are currently used for rice cultivation (Mervyn and Kannangara, 1994). Rice cultivation is lucrative since a metric ton of rice will fetch Rs. 10,000 and an average

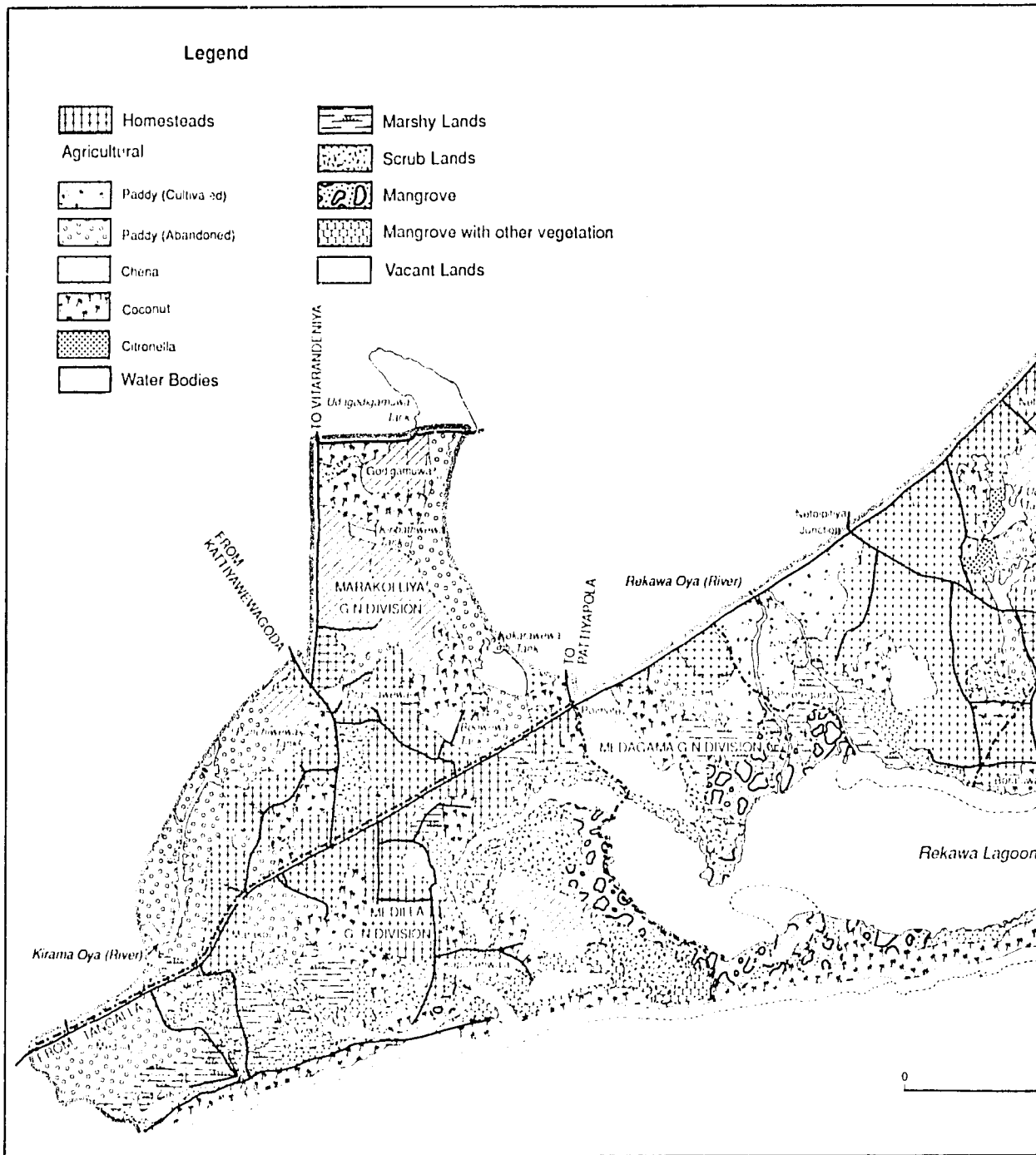


Figure 5.1 Land use patterns in the





hectare of paddy land yields 3.5 metric tons per season (DAS, pers. comm.). The distribution of irrigated paddy land, average yield and estimated returns on investment are shown in Figure 5.2. The percentage of agricultural land used for the main crops such as paddy, coconut, citronella and chena cultivated vegetables are shown in Figure 5.3.

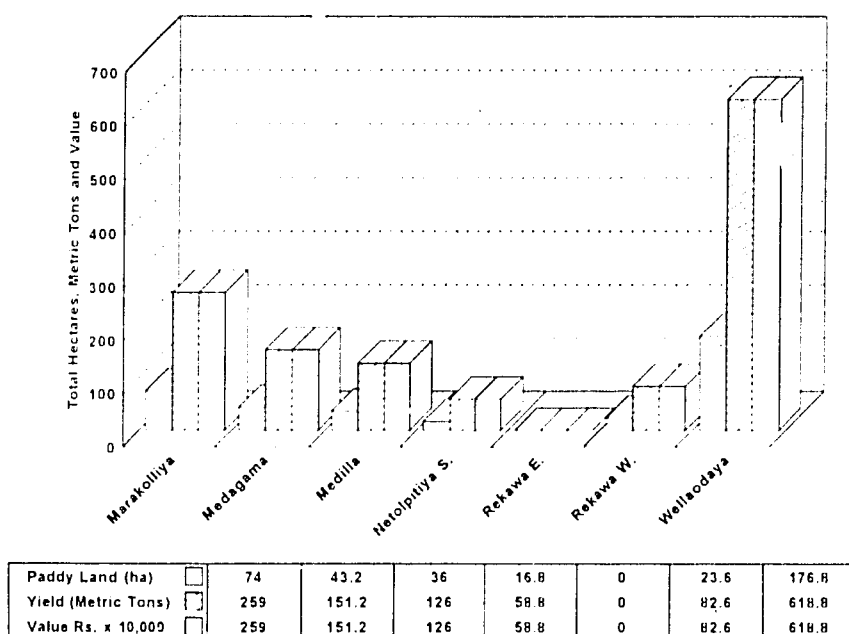


Figure 5.2 Extent of paddy land under cultivation in the Rekawa area  
(Divisional Agricultural Officer, pers comm.)

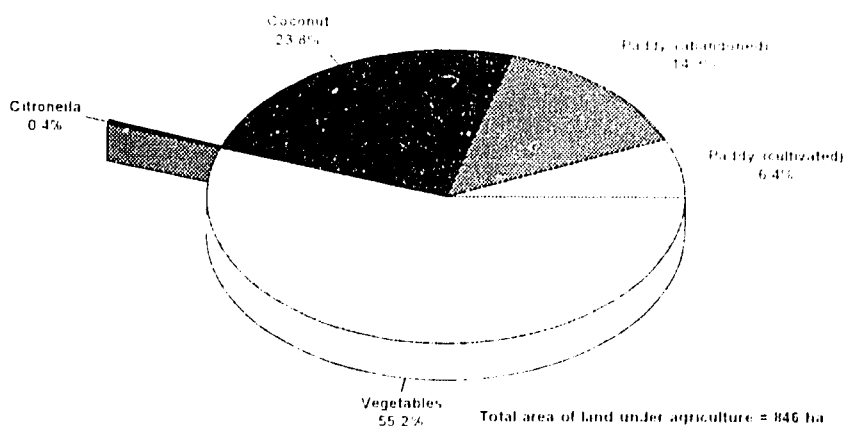


Figure 5.3 Major agricultural land use categories by percent in the Rekawa SAM site  
(Mervyn and Kannangara, 1994)

There are 200 ha of land under coconut in the Rekawa area (Mervyn and Kannagara, 1994). A prolonged drought in 1989 seriously damaged this crop, but in 1991 and 1992 IIRDEP provided subsidies in two stages to help farmers start more coconut plantations. In 1991, Rs. 1.2 million were allocated by IIRDEP for this purpose and an additional Rs. 200,000 was given in 1992 (this money was provided for the whole Hambantota District, not only Rekawa).

Citronella oil is distilled in two stills in the Rekawa area. One is in Marakolliya and the other is in Wadiya. Several producers cultivate up to 10 ha of this crop. This long grass is harvested in a manner similar to paddy and the oil is then extracted through a steaming process.

Maize, green gram and vegetables such as snake gourd, luffa and pumpkin are grown extensively in the Wellalodaya GN Division with smaller crops in Netolpitiya South and Rekawa West. Over 476 ha of these crops are grown in chenas in the Rekawa site during the 'Maha' cultivation season of the Northeast monsoon (Mervyn and Kannagara, 1994). This produce is sold at village markets and roadside stalls, bringing some farmers over Rs. 2000 per month (DAS, pers. comm.).

Cattle, water buffalo, goats and poultry also are raised and graze freely within the site. Livestock provide a lucrative income for those who raise these animals, but this activity is not actively pursued by the Rekawa fishing communities, who object to artificial insemination programs to increase herd sizes.

## **Fisheries**

The lagoon and the sea supplements agriculture in the Rekawa area. Fishing is the main form of income of communities living near the lagoon and the beach. Lagoon fishing practices are mostly traditional and fishermen use small non-mechanized open outrigger boats to fish the lagoon. About 250 families are totally or partially engaged in lagoon fishing with 60 percent using cast nets and 30 percent using gill nets (Jayakody and Jayasinghe, 1992).

Annual production of fish and shrimp from the lagoon has been estimated at 36 metric tons with a value of Rs. 1.8 million (Jayakody and Jayasinghe, 1992). In 1984 and 1985, the average income of the fishermen ranged from Rs. 17,000 to Rs. 19,500, with about 66 percent of the catch coming from shrimp. In the early 1990's this income rose to between Rs. 24,000 and Rs. 26,000, but 70 percent of the catch is now fin fish, which reflects a decline in the lagoon shrimp fishery (Jayakody and Jayasinghe, 1992).

The sea fishermen use both mechanized traditional outriggers and more modern fiberglass boats to reach the inshore fishing areas and offshore banks where they harvest both pelagic and demersal species. As stated in chapter 3, it has been estimated that the Hambantota Banks could sustainably yield as much as 23,500 tons per year. However the current average take is only about 10,000 tons per year for the whole Hambantota District (Figure 5.4). Motorized fishing boats landed approximately 25.3 kg/trip in 1985 and 21.7 kg/trip in 1986. Non-motorized boats landed only 10.8 kg/trip and 11.5 kg/trip in 1985 and 1986 respectively (Jayakody and Jayasinghe, 1992). Lack of more modern equipment and techniques have prevented this industry from being more productive.

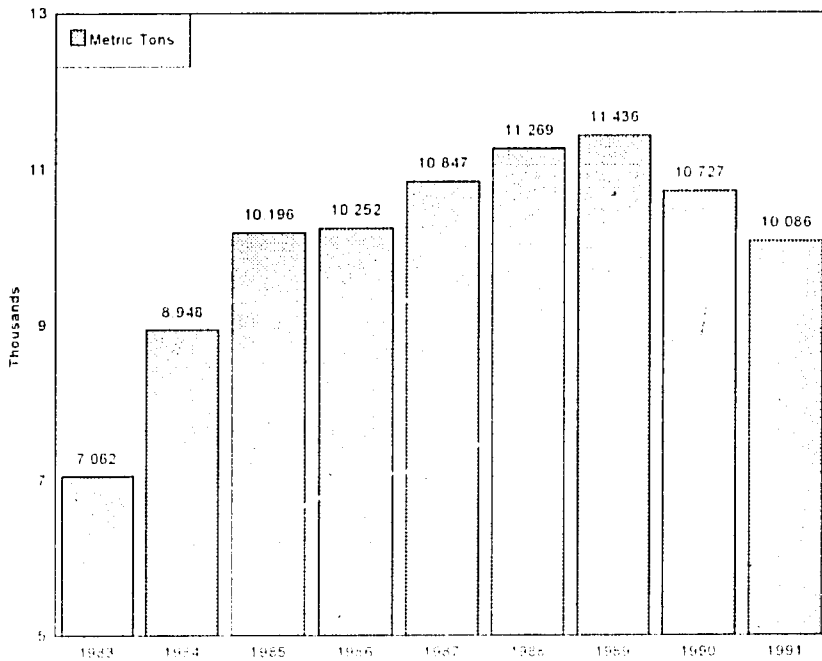


Figure 5.4 Coastal sector fish production in the Tangalla Division including Rekawa (Karadeniya, pers. comm.)

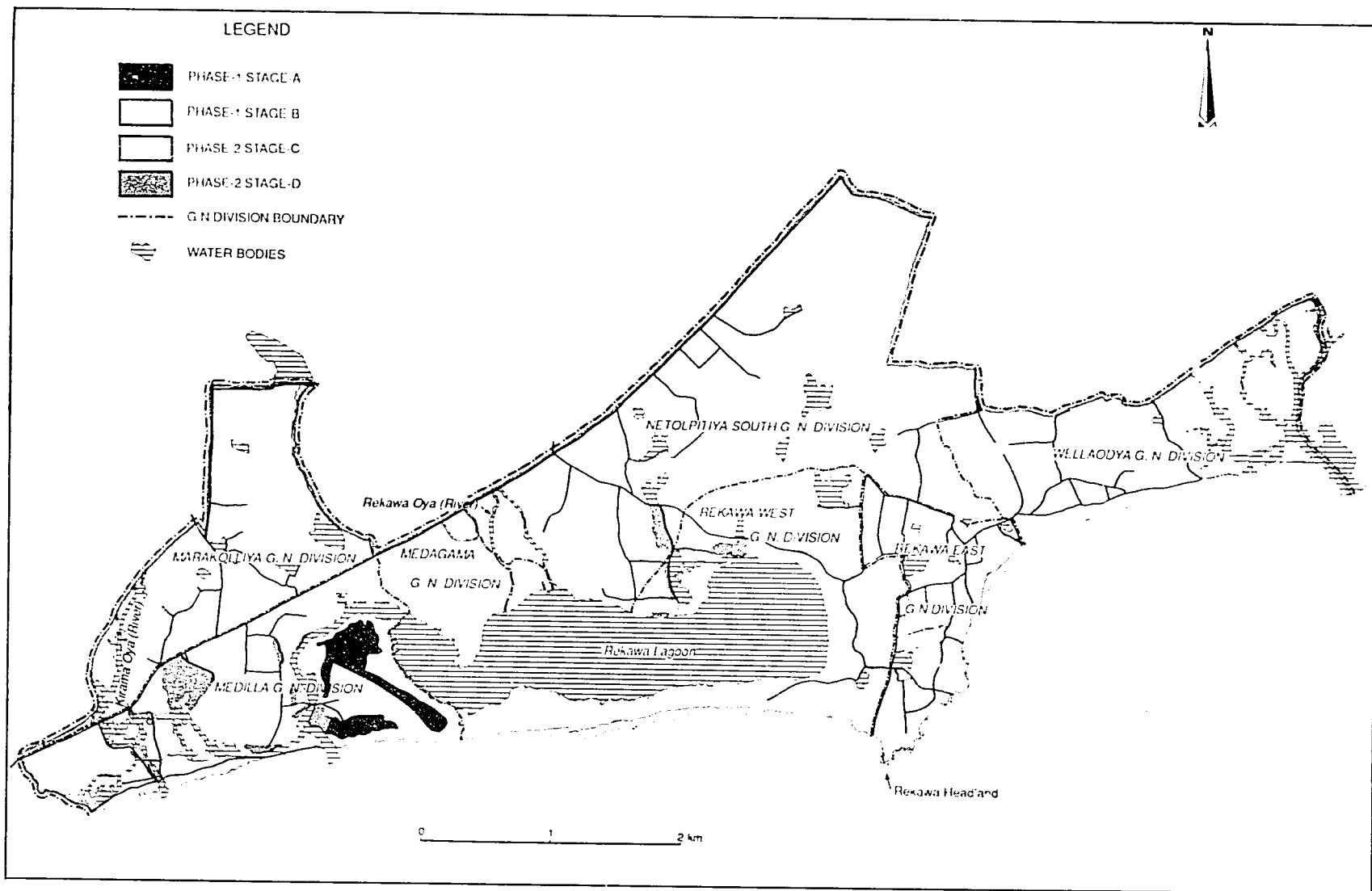
### Fishery Management

With the overall decline in shrimp catches in the Rekawa lagoon in recent years, there is a need to manage this fishery to make it more economically productive for the local community (Jayakody, 1994). It has been estimated that between 65 and 75 percent of the shrimp and certain fish species are recruited into the lagoon when the lagoon mouth is opened to the sea by the breaching of the sandbar as mentioned in chapter 2 and 3. Access to the sea is critical for maintaining the lagoon fishery and needs to be ensured. Such management can come through the opening of the lagoon mouth when shrimp larvae are abundant along the beach areas. This can be achieved by educating the local fishermen about the shrimp life cycle. Such management can help enhance incomes from this potentially sustainable resource. Additional hindrances to the proper management of this industry are the Medilla and Kapuhenwala causeways and irrigation impediments which are detailed in chapter 2.

### Aquaculture Development

Aquaculture has a limited potential for development in the Rekawa area. Careful planning and management of this industry can help provide additional employment and income to the local community. Small scale commercial and subsistence aquaculture could be done on approximately 97 ha of land divided into lots and developed in phases around the Rekawa lagoon. Of this amount of land suitable for aquaculture, approximately 59 ha could be used for actual pond construction. These potential sites for aquaculture development around the lagoon are shown in Figure 5.5 (AR!EMCO, 1994).

Figure 5.5 Sites suitable for potential aquaculture development and their environmental impacts



In the project area, the Medilla GN division has the most suitable land for pond construction. The soil types and water characteristics in the entire area are adequate for shrimp aquaculture, but not ideal. Because of this and the relatively small size of the lagoon (about 250 ha), the feasibility of large-scale aquaculture is poor. However, a community based industry could provide additional employment and income, therefore improving the local economy.

Economically, aquaculture could provide a comparatively substantial income and employment for the Rekawa lagoon community, yielding as much as Rs. 45,000 Rs/ha/month. Such profits could go into a local aquaculture society providing income for local beneficiaries and direct local employment. If aquaculture is to be developed, it should be done in stages, to enable development to be made sustainable and to see what works on a smaller scale before enlarging any projects (Table 5.1). It has been recommended that *Peneaus monodon* be selected as the species for culture since it has the best market value and the water quality of the lagoon is acceptable for this species (AREMCO, 1994).

Environmental and social considerations should be taken into account in developing this industry. An Environmental Impact Assessment (EIA) was done for one proposed aquaculture project in the Medilla GN division. The outcome of this assessment is shown in Table 5.2. It should be noted that this project was turned down by the scoping committee. Unless well managed and properly planned, aquaculture can be environmentally damaging. However, if planned and managed properly, aquaculture can be made feasible without harmful results.

**Table 5.1 Proposed aquaculture development phases, pond area, potential beneficiaries and employment potential (AREMCO, 1994)**

*Phase 1(a)* To be developed as a community based project, should be carefully planned to determine its feasibility.

Total area (ha)	:	21.7
Total pond area (ha)	:	14
Total locally employed	:	60
Potential beneficiaries	:	300

*Phase 1(b)* May be undertaken by an investor or group of investors who will provide engineering expertise for the irrigation and road construction needed.

Total area (ha)	:	34.7
Total pond area (ha)	:	24
Total locally employed	:	100
Potential beneficiaries	:	100

*Phase 2(a)* To be undertaken as a subsequent community based development program after assessing the impact of the initial developments

Total area (ha)	:	19.2
Total pond area (ha)	:	30
Total locally employed	:	30
Potential beneficiaries	:	150

*Phase 2(b)* This phase is technically feasible, but may be vulnerable to unsustainable development and therefore careful regulation may be needed.

Total area (ha)	:	21.1
Total pond area (ha)	:	14
Total locally employed	:	60
Potential beneficiaries	:	300

**Table 5.2 An environmental impact assessment for the proposed aquaculture development in the Medilla GN Division (Engineering Consultants, Ltd., 1993)**

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**Problems:**

- Development site is presently covered with mangroves
- Low elevation of development site
- Lagoon water is not suitable for project use due to:
  - a) Sedimentation of the lagoon and encroachment of mangroves into the lagoon;
  - b) Extreme variation of salinity within the lagoon;
  - c) Lagoon habitat supports a productive ecosystem; and
  - d) Possible contamination of lagoon water from inland agricultural runoff containing pesticides and fertilizers.
- Local Community presently utilizes the natural shrimp fishery of the lagoon
- Community is not favorable to aquaculture development
- No major development projects have yet to be done in the area
- The local communities are rural and rely heavily on JSP welfare support

**Benefits:**

- Project can be designed so that it does not harm the environment
- Project water is taken and discharged from the sea
- Product is in heavy demand and has strong international markets
- Developed at the community level with the input of the local people
- Local employment and community participation will be used
- Lagoon will be seeded with post larvae to improve shrimp fishery
- Assistance in restoring lagoon and reversing sedimentation
- Use of alternative energy sources such as solar and wind power
- Helping the local community with sustainable use of the mangroves
- Project is designed from the perspective of sustainability
- Direct economic benefits for the local community
- Indirect benefits such as provisions for a hatchery and shrimp feed production, research and transfer of alternative energy sources to the local community

**Mitigatory Factors:** The proposed aquaculture development project would make the following provisions:

- Avoid use of the lagoon water as a source of water for ponds
  - Avoid using the lagoon for discharging pond effluent
  - Provide intake and discharge of project water to the sea
  - Avoid excavation of pond beds, which could have harmful effects
  - Provide sedimentation tanks and aeration lagoons for treating effluent
  - Provide storm-water drains to prevent flooding of project area
  - Replace any mangroves that are destroyed and start mangrove nurseries and replantation projects outside of development area
  - Project will occur in phases to control development
  - Awareness programs will be conducted for the local communities
- 

**Environmental factors to be considered include:**

- Mangrove forests, which if removed, can disturb the lagoon ecosystem, resulting in habitat loss and erosion;
- Water quality, which can also adversely affect coastal ecosystems with heavy nutrient loading into shallow water bodies with little water exchange;
- Lagoon Water Volume, which can be depleted if water for aquaculture ponds is taken from the lagoon and discharged to the sea and could have serious consequences for the lagoon ecosystem and its natural shrimp fishery; and
- Salt intrusion, which may occur in agricultural land and fresh water sources as a result of the construction of ponds and the pumping of saline water to ponds (AREMCO, 1994).

Careful attention must be given to the intake and drainage systems used for aquaculture projects in the Rekawa lagoon area because of the potentially heavy nutrient loading and high water volumes needed (Table 5.3) (AREMCO, 1994).

Another limiting factor to aquaculture development is the supply (for the ponds) of seed stock, which is in short supply in Sri Lanka. For any aquaculture development to take place in the Rekawa area, a hatchery would have to be built. Such an operation requires trained aquaculturists, technicians and scientific equipment. This could be provided to the local community in the form of training and equipment supplied by a capable aquaculture company that could invest in the Rekawa area and the local community. This approach would be the "mother farm" concept, whereby a well established company can provide equipment and supplies to the local community, helping with pond and facility construction, water quality monitoring, animal growth parameters and developing a contract grower system which would enable the product reach international markets (AREMCO, 1994).

**Table 5.3 Four water intake and disposal options for aquaculture projects in the Rekawa lagoon vicinity (AREMCO, 1994)**

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#### **Option A**

Intake water from Rekawa lagoon and discharge water into Rekawa lagoon

- |                       |   |
|-----------------------|---|
| <i>Advantages:</i>    | <ul style="list-style-type: none"> <li>· Convenient</li> <li>· Inexpensive</li> <li>· Will not greatly affect lagoon water volume</li> <li>· Utilize brackish water for better shrimp growth</li> </ul> |
| <i>Disadvantages:</i> | <ul style="list-style-type: none"> <li>· Wastewater is discharged into the lagoon</li> <li>· Lagoon water volume limited</li> </ul>   |

#### **Option B**

Intake water from Rekawa lagoon and discharge water into the sea

- |                       |   |
|-----------------------|---|
| <i>Advantages:</i>    | <ul style="list-style-type: none"> <li>· Wastewater will not be discharged into the lagoon</li> <li>· Utilize brackish water for better shrimp growth</li> </ul>  |
| <i>Disadvantages:</i> | <ul style="list-style-type: none"> <li>· Possible reduction of lagoon water volume</li> <li>· Disposal of water comparatively expensive</li> <li>· Need to keep lagoon mouth open more often</li> </ul> |

#### **Option C**

Intake water from the sea and discharge water into the lagoon

- |                       |   |
|-----------------------|---|
| <i>Advantages:</i>    | <ul style="list-style-type: none"> <li>· Lagoon water volume will not be reduced</li> </ul>   |
| <i>Disadvantages:</i> | <ul style="list-style-type: none"> <li>· Could raise lagoon water level</li> <li>· Could increase lagoon water salinity</li> <li>· Could lead to salt intrusion into paddy land</li> <li>· Intake of water comparatively expensive</li> <li>· Wastewater is discharged into the lagoon</li> </ul> |

#### **Option D**

Intake water from the sea and discharge water into the sea

- |                       |  |
|-----------------------|--|
| <i>Advantages:</i>    | <ul style="list-style-type: none"> <li>· Least impact on the lagoon ecosystem</li> </ul>   |
| <i>Disadvantages:</i> | <ul style="list-style-type: none"> <li>· Limits area for development in Rekawa lagoon</li> <li>· Water intake and disposal both expensive</li> </ul> |
-

An equally important consideration is the social impact of such development since local people might be excluded from employment and profits might not stay locally within the area. The people of the Rekawa area have such concerns and presently have not been receptive to the idea of aquaculture development despite proposals addressing community-based developments on a very small scale. For such development to be considered, the local community must be involved in both the planning and the operation so that they benefit from such development and help ensure that projects are environmentally and economically sustainable.

### **Coral Mining and Lime Production**

The lucrative but illegal coral mining and lime production industries provide substantial income for those involved. A survey in August of 1994 revealed that there are 51 lime kilns in operation in the Rekawa area. Of these, over 20 are operating within the coastal zone where they are prohibited by the Coast Conservation Act (see Chapter 6). The remainder fall outside the jurisdiction of the CCD and operate legally if permitted.

Most of the kilns will produce ten tons of lime a month using an average of 24 cart loads of coral. Generally, lime is produced 4 times a month in the kilns. The lime is sold to distributors for Rs. 12,000 per 2.5 tons of lime. A profit of about Rs. 2,000 goes to the producers and between Rs. 500-700 to the distributor (Ranaweera Banda, 1990). Based on an average of 6 cart loads of coral the kiln operation costs are approximately:

- a) Rs. 5,700 for sea/land coral (raw material);
- b) Rs. 800 for transportation costs;
- c) Rs. 1,500 for fuel wood; and
- d) Rs. 800 for labor.

The lime is sold in 20 kg. bags at about Rs. 40 per bag. Women and children, who are the main transporters of coral, are generally paid Rs. 15 per basket of coral (Ranaweera Banda, 1990). The best quality lime comes from sea corals; however, there is also some use of inland corals. As sea coral is depleted in the Rekawa area, outside regions such as Matara, Unawatuna and Habaraduwa supplement the supply. Approximately 75 percent of the kilns in the Rekawa area use sea coral in their mining operation (Ranaweera Banda, 1990).

It is estimated that about 500 people are employed, directly and indirectly, in all aspects of the coral mining industry in Rekawa which includes supplying coral, transportation of the coral to the kilns, the collection and transportation of kiln fire wood and the actual lime processing (burning) of the coral (Ranaweera Banda, 1990). Nearly 50 percent of the work force in Rekawa East and over 15 percent in Rekawa West are engaged in this industry (Ranaweera Banda et al, 1994). The main coral mining villages in these areas are Kanattegodu, Beliwinnegoda, Oruwellegoda and Pokunagoda.

### **Tourism**

The natural beauty and the cultural heritage of the Rekawa area makes it attractive for tourism, which is currently not a major industry, but has the potential to grow. An application for a small hotel (less than 100 rooms) near the beach in the Rekawa West GN division has been approved by the CCD. Several small guest houses also exist in the



**Table 5.4 Considerations and mitigating measures for tourism development (De Silva et al., 1994)**

---

**Solid, liquid and sewage waste disposal**

- Construction of an on-site sewage treatment system required
- Appropriate waste disposal options required to manage potential problem
- Landfill versus incineration alternatives and waste minimization considered
- Liquid waste not discharged onto beaches, coral reefs, or other sensitive areas
- Verify local capacity to monitor and enforce pollution regulations

**Construction of facilities**

- Control of construction contractor
- Submission of plans in accordance with local ordinances with respect to sand mining and other natural resource materials
- Observe CCD setbacks and permitting procedures for Coastal Zone development

**Destruction of habitat (wetlands, mangroves, cultural sites and other sensitive areas) and "free" environmental services provided by ecosystem functions**

- Baseline information on resources
- Areas considered for development should have zoning plans to account for natural geographic and socioeconomic conditions
- Carrying capacity defined so that tourism can be sustained without overburdening existing infrastructure and resources
- Include improvements in project design

**Erosion**

- Develop erosion and sediment control plans
- Observe CCD setbacks and permitting procedures for development within the Coastal Zone.

**Access conflicts**

- Access for local people to necessary areas maintained by integrated planning to reduce traffic and pedestrian congestion, noise and potential conflicts

**Sea turtle nesting**

- Beach monitoring for turtle protection coupled with beach zoning and development guidelines to preserve the natural beach environment
- Restrict night activities on nesting beaches during egg-laying and incubation periods
- Restrict artificial lighting in areas near nesting beaches

**Displacement of human population**

- Plan and implement program of compensation and resettlement
- Offer guidance for people in their newly resettled area

**Conflicts with natural resource use (fishing, agriculture)**

- Conceive tourism development in framework of national, regional and local socioeconomic development plans to integrate new objectives into development strategies
- Identify zones most suitable for tourism

**Multiplier effect on other industries or natural resources**

- Adequate infrastructure and services support to meet physical, social and economic needs of the region
  - Recognize that "overbuilding" will be an eventual problem
-

Medilla GN division. Given the attractive natural surroundings of the Rekawa lagoon, carefully planned and managed tourism could be developed on a limited scale. Nature-based tourism which focuses on observation of birds, plants or sea turtles could be explored further. Potential tourist sites are indicated in Figure 7.1.

However, tourism is being developed slowly as social, cultural and environmental problems can be introduced if tourism is not adequately planned and managed. The local communities are very cautious about this industry just as they are about aquaculture development. Some social and environmental considerations for tourism development are shown in Table 5.4.

### **Alternative Industries**

Several smaller scale industries are also found in the Rekawa area and provide additional employment and income for the community. These include limited forestry, shell mining, pottery, brick making, handloom textiles and the coir industry.

As mentioned in chapter 3, the Rekawa area has over 250 ha of mangrove forest, which represents an important ecosystem and resource. In the past, mangroves have been extensively cut for fuel in the lime kilns, but this activity has abated somewhat due to better community education about the importance of keeping mangrove forests intact. In addition, the Forest Department regulations prohibit the cutting and transport of mangroves. The Hambantota District has experienced the second highest district loss of forest cover in the country. Nearly 7 percent of the district's forest cover was lost due to illegal harvesting between 1981 and 1983 (McCall, 1990).

Small scale mining of shells from the lagoon bottom is done at Kapuhenwala. These shells are sold, unprocessed, to the Ceylon Ceramics Corporation in Hungama. In addition, the clay soil of the Medilla and Netolpitiya GN divisions is used for brick and pottery manufacture. Pottery is a traditional activity in several Rekawa area villages and has potential for more developed growth. Netolpitiya, in the Rekawa area, is a major exporter of bricks to the Hambantota district. Seasonal droughts are one of the few impediments to these two industries.

Coir manufacturing from coconut husks is done both mechanically and manually in the Rekawa area. Two sites within the project area produce white coir using diesel powered machines. Brown coir is made manually using aged husks retted in lagoon water. Coir made in this fashion can be environmentally damaging since large amounts of acidic chemicals are released into the water from the naturally decomposing husks. This can lower water quality, especially in water bodies which receive little water exchange. Raw husks for this industry are in short supply and transportation costs from inland sources are costly (HIRDEP, 1990). These factors have inhibited the development of this industry. If the coir industry expands, the extraction of brown coir should be carefully monitored so that it is environmentally sustainable.

Handloom textiles have been made in the Rekawa area and was a large industry in the Tangalla AGA division prior to 1977 (HIRDEP, 1990). However, this industry is now almost nonexistent in the Rekawa area. The reintroduction of the textile manufacturing could be a viable economic alternative to more natural resource dependent activities and could provide incomes for local communities.

For the Rekawa area to grow economically and to sustain its ecosystems, industries which are not heavily dependent on the area's natural resources should be encouraged. Manufacturing, handicrafts and service related industries have potential in the Rekawa area and need to be further explored.

## Summary

Agriculture, lagoon and sea fisheries, coral mining and lime production are the main economic activities in the Rekawa area. Some of these industries such as coral mining and lime production are lucrative, but contribute to the destruction of resources such as sea coral and mangroves which are used to operate the lime kilns. Other industries such as agriculture and fisheries are very dependent on the environmental quality of the area and are directly affected by any impacts such as impediments to water flow. Alternatives include hardier crops, limited aquaculture and tourism, and expansion of some of the smaller 'cottage' industries. In addition, the potential exists, if planned and managed, for some of these to give the Rekawa area a diversified economy providing more jobs and better incomes. However, much of this development rests with the local community and their decisions and desires to pursue different avenues of employment, which could be provided in a carefully designed and integrated development management plan.

## **Chapter 6**

### **INSTITUTIONAL AND LEGAL FRAMEWORK**

The use and management of natural resources in the Rekawa area are affected by various national and local institutions and laws. Traditionally, there has been a top-down approach to government in Sri Lanka, which has had limited success in managing natural resources in relation to the needs of the people at the local level. Rekawa is no exception in that national actions have not been well coordinated or focused on the problems of the communities in the area.

A national law of overriding importance for the management of the Rekawa coastal resources is the Coast Conservation Act of 1981 which mandates the Coastal Zone Management Plan implemented by the Coast Conservation Department (CCD, 1990). In addition, The Special Area Management approach was first proposed in *Coastal 2000: A Resource Management Strategy for Sri Lanka's Coastal Region*. This document was endorsed in 1994 by the Cabinet of Ministers with significant implications for locally-based coastal management.

For effective management to occur in Rekawa, close cooperation and participation by all the concerned institutions, local and national, are crucial. The Special Area Management (SAM) approach which decentralizes important decisions to a coordinating committee with most institutions and community organizations represented will provide a means for more efficient and responsive management of the Rekawa coastal resources.

#### **Institutional Framework for National Coastal Zone Management**

The management of coastal resources involves many government institutions, as in the case of other natural resources in Sri Lanka. Responsibilities are sometimes overlapping and/or conflicting, and in other instances responsibilities are unclear. The primary management responsibility, however, rests with the Coast Conservation Department (CCD) presently placed within the Ministry of Fisheries and Aquatic Resources Development (MFARD). CCD is responsible for:

- Formulating and implementing coastal protection and management activities;
- Regulating development within the prescribed "coastal zone" (see below) through permits;
- Evaluating development project impacts through discretionary environmental impact assessments;
- Preparing and implementing the Coastal Zone Management Plan; and
- Conducting surveys in cooperation with other agencies.

To assist with management decisions and recommendations, the Coast Conservation Advisory Council advises the Director of Coast Conservation on all development activities in the coastal zone. This council reviews the Coastal Zone Management Plan (CZMP), environmental impact assessments (EIAs) and requests for variances on permits. The CZMP, which was approved by the Cabinet of Ministers in 1990, provides the framework to manage resources in the coastal zone.

One main constraint faced by the CCD is its limited legal jurisdiction. CCD's jurisdiction is restricted to the "coastal zone", which is defined as the area 2 km out to sea, 300 m inland, and 2 km inland for rivers, lagoons and estuaries. CCD and other agencies also face the more common problems of lack of financial resources, equipment and trained personnel.

Unlike other Government agencies, CCD's mandate is more farsighted in that it was designed to help coordinate the sectoral management authority of other agencies. Thus far, CCD's coordinating role has been on a more informal basis. There is a need for CCD to place greater emphasis on interagency coordination. To help accomplish this, more formal interagency coordinating mechanisms, such as Memoranda of Understanding, may be needed.

In the case of Rekawa, CCD plays a leading role in coordinating management activities within the SAM area. This situation is a test of CCD's broad interest in coastal zone management, as envisaged in *Coastal 2000* (Olsen et al., 1992). Central to this process is the concept of Special Area Management.

### Special Area Management Planning

*Coastal 2000*, in its recommendations for a second generation coastal zone management plan, set a precedent for using special area management (SAM) to deal with the issues faced within specific geographical areas of the coastal zone. SAM planning has evolved through several international projects. This concept seeks to work with people and organizations having a direct link to the natural resources at the local and national levels. The SAM philosophy applies a "bottom-up" participatory approach to management by giving local people the responsibility for managing their resources, using central government institutions only to provide additional support and guidance.

This approach has been applied to two pilot sites in Sri Lanka, the Rekawa lagoon and the Hikkaduwa Marine Sanctuary. The Hikkaduwa site was the initial site for SAM and represents a very different set of circumstances outlined in *The Coastal Environmental Profile of Hikkaduwa* (Nakatani et al., 1994). However, the SAM approach remains the same for the Rekawa lagoon and exemplifies the flexibility of this type of management.

CCD has taken an active role in SAM by implementing the SAM process in Hikkaduwa and Rekawa. CCD has stationed an officer in the Rekawa area to oversee SAM activities and ensure that management progresses. In addition, they will assist to coordinate the different agencies and organizations that have a part in the SAM process.

Other government bodies, which have primary responsibilities within the coastal zone area, with a potential role in the Rekawa lagoon SAM include:

- The Central Environmental Authority (CEA): Formulates and coordinates environmental policy of various agencies in long-range planning and management. Recommends land use schemes and basic management policies for natural resources with an emphasis on fisheries, wildlife, forestry and soil; specifies standards, norms and

criteria for environmental management, monitoring of environmental conditions, and initiates research and the dissemination of information; coordinates environmental impact assessments of development projects and the licensing of pollution discharges, primarily of industries; mandated to assist Divisional Secretaries to set up "Environmental Councils" to address problems of water pollution, waste disposal and other environmental issues at the Divisional level<sup>1</sup>.

- The Ceylon Tourist Board (CTB): Implements coastal tourist development projects; recommends and enforces tourism policies and guidelines affecting the coastal zone; provides information on development plans, proposed and adopted tourism policies and guidelines affecting the coastal zone.

- The Forest Department: Oversees the use and management of forest resources; has responsibility for the management and conservation of mangrove forests larger than 50 sq. ha in area.

- The Irrigation Department: Responsible for irrigation system engineering, design, construction, operation and maintenance.

- The Ministry of Fisheries and Aquatic Resources Development (MFARD): Coordinates and monitors all activities relevant to fisheries and other aquatic resources; formulates policy guidelines and recommends management plans; implements development projects for fisheries and organizes cooperative societies.

- The National Aquatic Resources Agency (NARA): Conducts research and development, monitoring, and research coordination functions, disseminates information, and provides advisory and consultant services concerned with marine and inland aquatic resources management.

- The Department of Wildlife Conservation (DWLC): Responsible for protecting wildlife through the enforcement of the Fauna and Flora Protection Ordinance and the management of protected areas. All the endangered species of sea turtles which nest on Rekawa beaches and some of the migratory and local birds which live and nest in the Rekawa lagoon mangroves are protected under the Ordinance and protective enforcement is the responsibility of the DWLC.

- Other government bodies with secondary responsibilities within the coastal zone include the Ceylon Fisheries Association; the Ceylon Fisheries Harbor Corporation; the Board of Investment; the National Water Supply and Drainage Board; the Water Resources Board; the Geological Survey Department; the Low-lying Areas Reclamation Board; the Urban Development Authority and the Sri Lanka Land Reclamation and Development Corporation.

## **District Government and Institutional Framework for Tangalla**

The Kachecheri System of public administration, a British colonial legacy, was used in Sri Lanka prior to 1970. This system was a classic top-down bureaucratic approach to government which assigned a Government Agent (GA) as chief executive of each district.

Under this Agent, the Districts were divided into Divisions with an Assistant Government Agent (AGA) as the executive head of each Division. The Divisions were further subdivided into villages represented by a Village Headman (Gramaseva Niladhari), who was responsible to the AGA. A Village Committee system was also used and consisted of elected members and a chairman.

This system has been changed over the past two decades. The national government has now introduced Provincial Councils (Palath Sabha), which are made up of elected representatives under a Chief Minister of the Province. A senior administrative official serves as the Chief Secretary and Executive of the Province. The former AGA Division is administered by the Divisional Council (Pradeshiya Sabha) consisting of elected representatives. The holder of the former position of Assistant Government Agent, is now designated Divisional Secretary (DS) and serves as the chief executive of the Division.

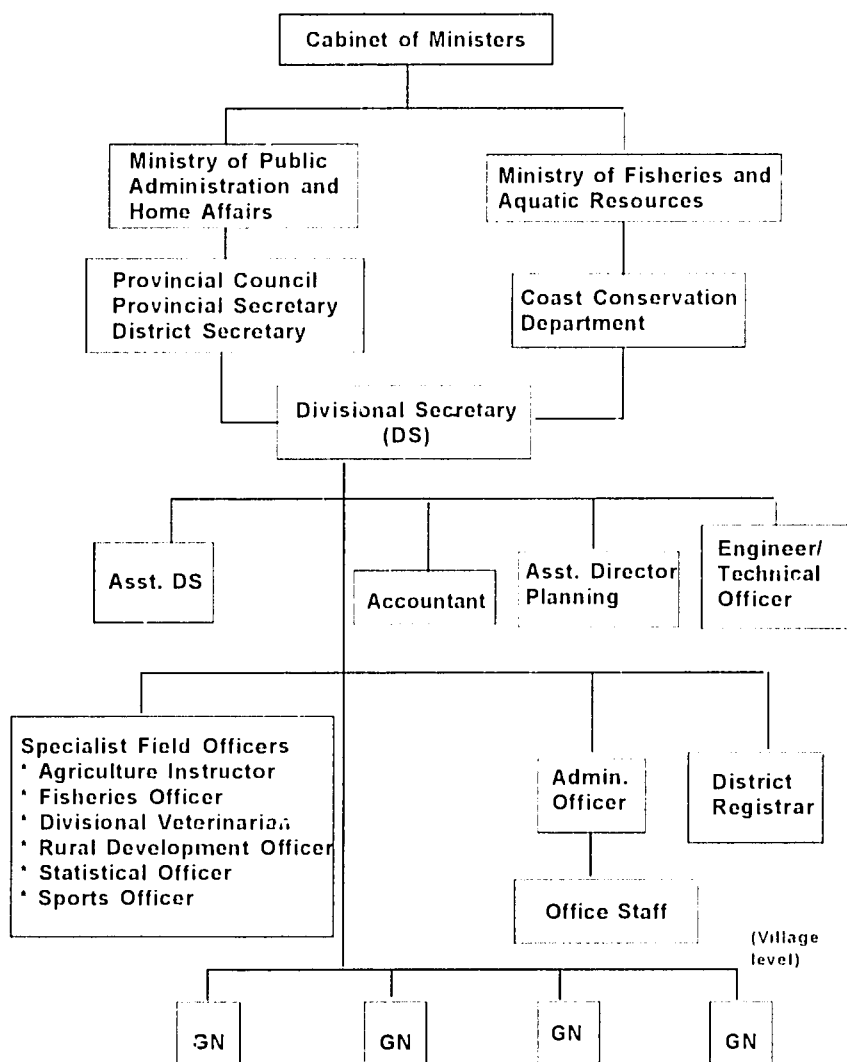


Figure 6.1 The Government structure of the Rekawa area at the district level

The former Village Committee system was replaced by the Gramodaya Mandala system including the Gramaseva Niladhari (GN) as the chief executive. This system consisted of all the registered voluntary organizations in each GN division, but is no longer in operation in most divisions.

A general government policy is to devolve responsibility to local authorities. In the present administrative framework, the Divisional Secretariat is the unit of government best suited for this role in the activities of the Rekawa SAM site. The DS implements the development projects of the Division and provides basic services to the inhabitants. Figure 6.1 outlines the administrative structure at the divisional level.

There are three Hambantota District Committees and the District Environmental Agency (DEA) that have direct relevance to the resources and activities within the Rekawa Project area. The committees include Agricultural, Land Use and the Hambantota Integrated Rural Development Project (HIRDEP) Coordinating Committees.

The District Agricultural Committee (DAC) is an important and powerful coordinating agency. Its membership includes members of Parliament, the Provincial Council and District heads of all government departments with the Secretary of the Provincial Council serving as the Chairman. The DAC has been very active and vocal about environmental issues in the Rekawa area.

HIRDEP has a District Coordinating Committee which reviews progress and discusses problems and issues in the implementation of the HIRDEP projects. Meetings are held quarterly and include all members of HIRDEP, District heads of departments and leading voluntary organizations. Like the DAC, the Provincial Secretary is the Chairman of this committee as well.

Land use falls under the scrutiny of the District Land Use Committee also known as the District Action Plan Committee for Land and Land Development. Members of this committee are the Secretary of Land and Land Development, District Land Officers, and District representatives of the Survey, Irrigation and Forest Departments. This is a strong technical body which makes important decisions such as planning reforestation projects in the Hambantota District.

Finally, the District Environmental Agency (DEA) is made up of government departments and agencies such as senior representatives of the Forest Department, District Medical and Public Health officers, Education officers and the Central Environmental Authority. The main responsibilities of the Agency include creating awareness about environmental issues such as pollution, soil management, and the discharge of toxic waste from paper and sugar factories. The DEA has legal support from the CEA and many of its projects are funded by HIRDEP. Unfortunately, the DEA has to depend on other government agencies to implement its decisions.

## **Governmental Social Organizations**

HIRDEP has Social Mobilizers who serve as catalysts for community participation projects in and around the Rekawa area. This group was formed by HIRDEP in 1986. Social Mobilizers are educated youth who work on a voluntary basis with a Rs. 1000 monthly honorarium. They work at the village level and are mostly well educated women who set up small homogenous groups through identifying members, helping define their problems, provide advice and put the people in contact with resources (McCall, 1990).

The Janasaviya social welfare and Public Assistance programs function in the Rekawa area. Most of the community receives some income from these programs due to the impoverished social condition of the area (see chapter 4).



## **Non-Governmental Organizations (NGOs)**

Sarvodaya is the largest NGO in Sri Lanka and focuses its activities at the village level. This NGO is active in about 12 percent of the nation's villages including those in the Rekawa area. The main goal of Sarvodaya is:

"To develop, stimulate and encourage self sufficiency of the entire community by promoting sharing of labor, welfare and developing economic activities. It is mainly funded through overseas donors." (McCall, 1990)

Sarvodaya concentrates on promoting the "10 Basic Needs" of people including basic health care, safe drinking water, a balanced diet, a well-rounded education and a clean, beautiful environment. There is a Field Director for the Province and a District Coordinator in Hambantota who help with activities in the Rekawa area. Almost all the Sarvodaya workers are volunteers and receive only a small allowance for basic needs.

A strong women's organization, the Women's Development Society, was begun in Hambantota during 1990 by a group of dedicated women workers. The Society proposes to establish organizations in every village and a Women's Development Federation at the District level. These societies have been formed in the Medilla, Marakolliya, Medagama and Netolpitiya GN divisions of the Rekawa project site.

The Women's Development Society publishes a newsletter, "Janashakthi", and has adopted a holistic approach to help alleviate poverty using women as catalysts. The Society works mainly on improving nutrition, strengthening infrastructures in rural locations, and promoting bank savings and credit. This includes the establishment of the Janashakthi Bank concept which allows a minimum of five women to progressively invest in a savings account against which they can take out bank loans for small, sustainable, self-employment projects.

## **Community-Based Organizations (CBOs)**

There are a number of community based cooperatives and organizations which exist only in name in the Rekawa area and adjacent communities. Two notable exceptions are the fisheries cooperatives and farmer organizations.

The Fisheries Cooperative Societies are established at the level of the GN Divisions. The membership of these societies is presently confined to sea fishermen. The Rekawa lagoon fishermen have formed their own organization, which is registered also under the Cooperative Ordinance. The primary objective of the Rekawa Lagoon Fishermen's Association (RLFA) is to take responsibility for the management of the lagoon.

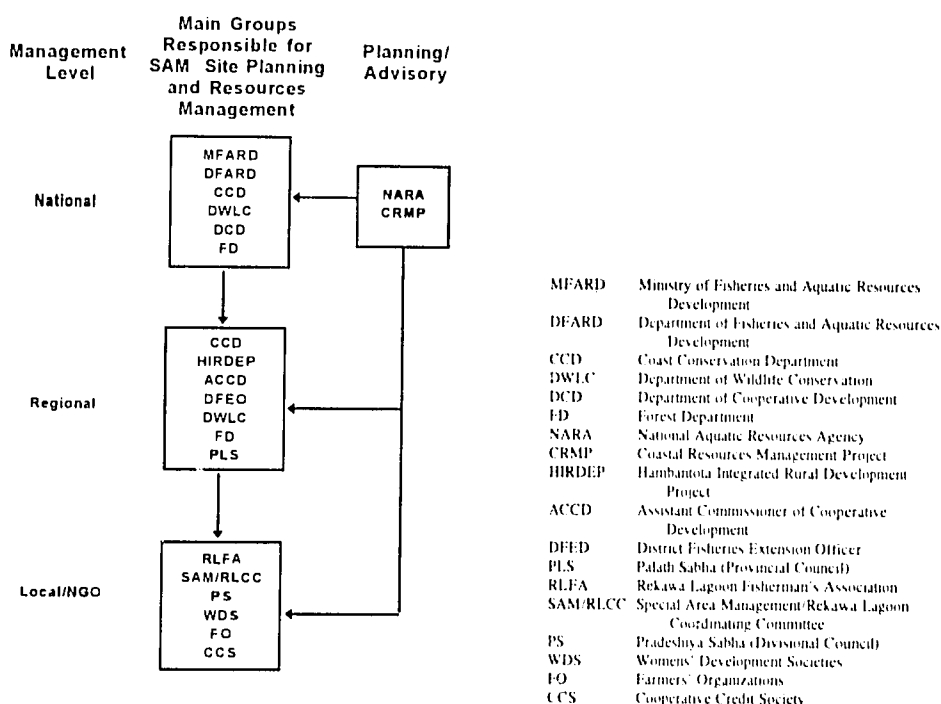
In recent years, the central government has promoted farmer organizations with the objective of bringing farmers together to discuss and solve their problems such as irrigation, agricultural input procurement and distribution, marketing produce and banking credit. Farmer organizations are registered by the Commissioner of Agrarian Services, who grants legal recognition and status. Three farmers organizations exist in the Rekawa project area.

## **The Rekawa Lagoon SAM Coordinating Committee**

To ensure that all the different user groups, organizations and institutions participate in managing the resources of the Rekawa lagoon, a coordinating committee has been formed to discuss issues and make recommendations for management action. The composition of this diverse group is shown in Table 6.1.

**Table 6.1 Members of the Rekawa Lagoon SAM Coordinating Committee**

1. Divisional Secretary, Tangalla
2. Assistant Directors of Planning, Tangalla Divisional Secretariat
3. CCD Project Officer, Rekawa
4. Deputy Director of HIRDEP
5. Central Environmental Authority representative
6. Research Officer, NARA
7. CCD Deputy Manager
8. Divisional Forest Officer, Forestry Department
9. Entrepreneur Development Officer, NORAD/HIRDEP
10. Irrigation Engineer
11. CRMP Consultant, technical advisor
12. Project Officer, CRMP
13. Representatives from Volunteer Organizations including:
  - Lagoon Fishermen's Organization;
  - Sea Fishermen's Organization;
  - Farmer's Organization; and
  - Women's Development Society
14. Representative from Pradeshiya Sabha, Marakolliya
15. Divisional Officer, Fisheries Department
16. Assistant Superintendent of Police
17. Director of Education, Tangalla
18. Turtle Conservation Project (TCP) Representative, Rekawa

**Figure 6.2 Levels of government and institutions important for Special Area Management in Rekawa**

This committee meets once a month and is chaired by the Divisional Secretary. The committee remains flexible as to its membership so new user groups can be incorporated into this framework, ensuring that all groups participate in the Rekawa project decision making process. The institutional roles for the coordinating committee and other associated bodies in the Rekawa area are shown in Figure 6.2.

## Legal Framework

The Sri Lanka government has a number of laws regarding the use and protection of natural resources. The ones with particular relevance to the Rekawa Lagoon SAM site and its resources include:

- The Seashore Protection Ordinance, Gazette No. 7710 (1929), banning the removal of coral, sand and other substances;
- The Fauna and Flora Protection Ordinance, Gazette No. 8675 (1940), protects threatened and endangered wildlife including sea turtles nesting on the Rekawa beaches;
- The Fisheries Ordinance, Gazette No. 12304 (1951) bans the use of destructive fishing gear and supports sustainable fishing activities;
- The Tourist Development Act No. 14 (1968) authorized the CTB to regulate services and prevent indiscriminate and unplanned development in resort areas. The Act has implications for tourism development in the Rekawa area;
- The Natural Heritage and Wilderness Act (1980) was amended in 1988 to require Environmental Impact Assessments and licenses for industries potentially producing air, water and/or land pollution;
- The National Environmental Act No. 47 (1980) and Amendment No. 56 (1988) (a) established the CEA and made provisions regarding its powers, functions and duties, and (b) made provision for the protection, management and enhancement of the environment, and for the prevention, abatement and control of pollution. The Amendment calls for tighter environmental quality control, the establishment of a CEA Fund, CEA officers and an Environmental Council made up of senior officers from relevant Ministries with environmental responsibilities;
- The National Aquatic Resources (Research and Development) Agency Act No. 54 (1981) established the NARA to ensure the application of science and technology to the conservation of aquatic resources in the inland water, coastal wetlands and offshore areas, disseminate information, and provide advisory and consultant services;
- The Coast Conservation Act No. 57 (1981) (a) requires CCD to develop a Coastal Zone Management Plan, regulate and control activities within the coastal zone, and formulate and execute coast conservation projects, (b) defines coastal zones to include some portion of the water areas of lagoons, estuaries and rivers, (c) established uniform procedures for permit applications without distinction between development activities undertaken by private and state sectors, (d) encouraged collaboration among various government agencies involved in research and development activities within the coastal zone, (e) specified penalties for violation of the law, (f) authorized the Director of CCD to demolish unauthorized structures, and (g) established horizontal links between the law and other parallel legislation;

- The 1988 Amendment to the Coast Conservation Act No. 57 of 1981 (a) authorized the Director of CCD to delegate powers, duties and functions to government agents or public officers of any administrative district which contains a portion of the coastal zone, (b) banned the mining, collecting, possessing, storing, burning and transporting of coral, and the possessing of limestone kilns, (c) authorized the demolition of kilns and the seizure of boats engaged in illegal activities within the coastal zone, and (d) granted the public the right to use any beach;
- The Forest Ordinance No. 3 (1945) Amendment No. 13 (1966) and Act No. 13 (1988) makes illegal the harvesting, possession, sale and transport of timber without a permit and provides legal authority to prosecute offenders. This law has particular relevance to the mangrove forests and their illicit harvesting in the Rekawa area;
- The Marine Pollution Prevention Act No. 59 (1981) authorized the Marine Pollution Prevention Authority to prevent, reduce, and control pollution in Sri Lankan waters;
- The Specified Tourist Services Code (1984) provides for the classification, registration and licensing of all tourism-related establishments.

These laws provide some legal framework for protecting resources in the Rekawa area, however, enforcement of these laws is sometimes difficult. Adding to enforcement problems is the “top-down” bureaucratic approach to legally based natural resource management. A “bottom-up” enforcement strategy could help make enforcement of these laws easier and more effective.

## Summary

The Rekawa Lagoon Special Area Management (SAM) Coordinating Committee is a body representing all national agencies and community organizations involved in the management of the SAM site. This coordinating committee has been established with the assistance of the CRMP, to review and guide the development of the management plan and its implementation. Presently, there is no “bottom up” approach to management at government levels, but the coordinating committee can be a beginning to this type of local, community based decision making and management plan formulation.

Key agencies in the plan’s implementation are the CCD, Department of Fisheries and the Divisional Secretariat of Tangalla. These agencies will work closely with the most affected community organizations such as the Lagoon Fishermen’s Society. Critical legislation for management of the area are the Coast Conservation Act of 1981 which mandated the development of the Coastal Zone Management Plan. The Plan revision of 1995 includes Special Area Management as an approach to localized coastal management. Community and collaborative management of the coastal resources of the Rekawa area being encouraged by the current institutional arrangements being developed. This theme is also supported by the policies highlighted in *Coastal 2000* which encourage SAM planning and implementation with local participation.

## **Chapter 7**

### **MANAGEMENT ISSUES AND OPPORTUNITIES**

Rekawa lagoon with its surrounding environment and human communities comprises a large and productive natural ecosystem. Considerate management of this system will yield substantial returns to the people in the area. But, as is the case in most coastal areas in Sri Lanka, the natural resources are not presently being used in a sustainable manner and are limited in supply. This leads to short term economic gains at the cost of long term ecological use and benefits of the natural resources.

The main issues in Rekawa revolve around the lagoon fishery, the flow of water through Rekawa lagoon and the low productivity of agriculture in the area. Future development such as tourism and aquaculture have potential as community-based industries, but careful management is needed so that social and environmental degradation does not occur. Other industries such as vegetable and fruit processing also present opportunities for growth and diversification in the Rekawa area.

The short term priority of management is to increase the productivity of the lagoon. This can yield substantial and immediate benefits at a relatively small cost. Once this objective is realized, it can provide the basis for addressing some of the more complex environmental and socioeconomic problems of the area. The long-term management objective will be to have sustainable economic growth, while also maintaining ecosystem functions. This involves a gradual change towards less natural resource dependent industries, but which are economically viable. The main issues and concerns of the Rekawa area are summarized in Table 7.1. A possible future integrated land use perspective for the Rekawa site is presented in Figure 7.1. Given the main management and development issues of the area, this projection provides one integrated view of how the site may be sustainably developed.

#### **Special Area Management (SAM) for Rekawa Lagoon**

The overall goal of SAM in Rekawa is to develop and implement an effective community based coastal resource management plan to conserve the coastal and lagoon resources in an ecologically and economically sustainable manner. The Rekawa SAM process is designed to build a community based development strategy with the people of Rekawa, the non-governmental organizations and government institutions working together. The Rekawa community has to play a major role in the development of the management plan, its implementation, monitoring and finally in its evaluation. The government bodies working in Rekawa (CCD, Department of Fisheries and Aquatic Resources Development (DFARD), Forest Department, and the Tangalla Divisional Secretariat) need to continue to actively support this management process.

Table 7.1 Management issues and potential causes in the Rekawa SAM Site

Issues	Potential Causes
<b>Environmental</b>	
Erosion of sea beach	Exacerbated by coral mining
Reduced fresh water flow and pollution of lagoon and/or coastal ecosystem	Diversion of river water for irrigation; agrochemical runoff
Sedimentation of lagoon	Poor flushing due to Kapuhenwala causeway and decreasing freshwater flow
Cutting of mangroves	Use of mangrove wood in house construction, fishing kraals and as fuel for kilns; aquaculture development
Poaching of turtle eggs and slaughter of turtles	Lack of awareness about this resource, poverty, no management
Salinity of Tangalu Veliyaya	Poor design, construction of irrigation drainage systems
<b>Socioeconomic</b>	
Inadequate fish stocks in the lagoon	Open access and over fishing in the lagoon, interruption of government stocking program; unsustainable methods of fishing
Low shrimp and fish productivity	Infrequent opening of lagoon and mouth during shrimp recruitment obstruction at Kapuhenwala causeway; harmful fishing methods
Declining reef fish population	Destruction of reef for coral limestone, possible overfishing for the ornamental fish trade
Post harvest losses in vegetables	Poor packing and transport of vegetables
Low income, poverty	Over dependence on social welfare programs, declining natural resource base, lack of alternative income sources
<b>Institutional</b>	
Weakness of Fisheries Cooperatives	Poor management and leadership
Inadequate involvement of NGOs	Weak organization and poor leadership
Poor coordination among agencies at the Divisional level	Lack of understanding among government agencies regarding responsibilities and functions
<b>Legal</b>	
Inadequate enforcement of regulations	Difficult to detect violations; political interference
Ignorance of laws and ordinance by enforcement personnel	Lack of awareness about degradation of environmental resources and its consequences

## Management Issues

### *Environmental*

Coral mining: Coral mining in the sea off the Rekawa West GN Division has continued unabated for nearly two decades. At present 51 lime kilns in Oruwellogoda village produce lime from both inland and sea corals, obtained both locally and from towns in the Matarara District. Despite police action, there has been no major reduction in the number of kilns operating. Coral mining has helped accelerate beach erosion even depriving fishermen of a place to berth their fishing boats. Nevertheless, coral mining and lime production provides direct and indirect income to about 500 people. It cannot be stopped without alternative livelihood options (Ranaweera Banda et.al., 1990).

The use of unsustainable fishing methods and the opening of the sand bar at the lagoon mouth: Ja-kotu and small mesh drift nets overharvest fish and shrimp in the lagoon and continued or increased use of these methods will overfish these resources. The opening and closing of the sand bar at the lagoon mouth directly affects the lagoon water salinity and the fish and shrimp recruitment into the lagoon. The opening of this barrier needs to be strategic with regards to shrimp larvae recruitment from inshore marine waters and as use as a flood control mechanism.

Reduced flow of fresh water to the lagoon and pollution: Fresh water to the lagoon comes from the Kirama Oya (River), seepage from Urubokka Oya through Pattiapola Wewa (irrigation tank) and rain water. There are 18 weirs across the Kirama Oya and maximum use is made of the water for irrigation. As a result very little fresh water flows into the lagoon, especially during periods of reduced rainfall. This alters the dynamics of the lagoon ecosystem.

Some of the fresh water flowing into the lagoon is suspected to be polluted with fertilizer and agrochemical run-off. A study to assess the level of these pollutants in the water flowing into the lagoon is required.

Sedimentation of lagoon: Surveys by HRDEP in the early 1980s indicated that the surface area of the Rekawa lagoon was 350 hectares whereas a study by Jayakody in 1994 measured the surface area at about 250 hectares. This reduced area of the lagoon is probably due to sedimentation and the expansion of mangroves into the main water body of the lagoon. The shallow lagoon depth of about 0.5 m to 2.0 m (Jayakody and Jayasinghe, 1992) makes it vulnerable to changes in water quantity and sedimentation.

Deforestation of mangroves: There are about 200 hectares of mangroves surrounding the lagoon. Although mangrove wood is used for fences, house construction and as fuel for the lime kilns, a growing ethic of mangrove conservation appears to be reducing mangrove cutting.

Potential impacts from the proposed hotel project: CCD has approved a 99 room hotel complex on the Rekawa coast, which is expected to be operational by the end of 1995. CCD will be responsible for ensuring the investor carries out effective treatment and disposal of sewage, solid waste and "gray" water. Fishermen complain that the road leading to the beach is obstructed by the hotel. The Divisional Secretary through the SAM process can solve these problem before construction begins.

Poaching of turtle eggs: The Rekawa beach area serves as a nesting area for several species of endangered sea turtles. Though sea turtles are species protected by law, their eggs are illegally taken by local residents and sold in Hambantota and Ratnapura towns. Sea turtles are also occasionally slaughtered for their meat. Robbing of eggs continues unabated and threatens the survival of the sea turtles. Their conservation presents a substantial opportunity for nature tourism.

Salinity of the Tangalu Veliyaya: About 300 hectares of paddy land have been abandoned, mostly in the Tangalu tract, due to soil salinization. Further salinization of the areas now being cultivated could threaten the livelihood of a segment of the agricultural community in the Rekawa area. A study done by TEAMS (1994) shows that salinization is caused partly by irrigation interventions.

Alternatives to present rice cultivation include the cultivating of salt resistant varieties of rice and the growing of reeds for making mats and baskets. Aquaculture ponds could also be developed on land that is no longer suitable for agriculture.

### *Socioeconomic*

Declining fish and shrimp stocks: The fish resources of the lagoon are being depleted partly because of the suspension of the government fish stocking program and overfishing. Harmful fishing methods such as Ja-Kotu and the use of fine mesh nets restrict the movement of fish and shrimp through the lagoon and result in the capture of large numbers of both juveniles and adults. This can lead to declining fish populations.

Shrimp and fish larvae recruitment into the lagoon is further hampered by the Kapuhenwala causeway. Authorities admit that the causeway, built by the Tangalla Road Development Authority in 1984, impedes the movement of water and shrimp from the sea.

Shrimp productivity in the lagoon has dropped in recent years. In 1992, only 30 percent of the lagoon fishermen's income came from shrimp as against 65 percent in 1984-85 (Jayakody, 1994).

A 1992 report by Jayakody and Jayasinghe stated that:

"It was revealed that, the fish-shrimp production of the lagoon is highly dependent on its connection with the sea. The maintenance of lagoonal stocks of fin-fish and shrimp depend critically on the connection to the sea and the fresh water discharge which dilutes sea water adequately...

The bridge constructed at Kapuhenwala impedes shrimp recruitment. The holes constructed under the bridge are partially blocked and water movement is adversely affected."

Jayakody's study during July 1993 - June 1994 has indicated that shrimp productivity of the lagoon has increased considerably because the sand barrier between the lagoon and the sea breached 8 times during the year. In his view, if a span bridge is constructed at the deep end of the Kapuhenwala causeway and if regular opening of the lagoon mouth is maintained in sequence with the shrimp migration from the sea, shrimp productivity would increase.



Under utilization of inshore and offshore fisheries: The potential catch of demersal (nearshore) fish resources in the Tangalla DFEO area estimated by the Department of Fisheries (1986) at 8500 to 9000 tons. The present annual production of 1500 tons leaves a potential surplus of 7000 to 7500 tons. The potential for pelagic (offshore) fish production is estimated at 15,000 tons while the annual harvest in 1991 was only 10,000 tons (DFARD, 1989).

Although both the demersal and the pelagic fisheries appear to be under utilized at the present in the inshore and offshore waters from Tangalla and Rekawa, the experience of the fisheries all over the world indicates there are only a few years left before almost all fisheries will be overfished. Thus, even though the Rekawa fishermen still have access to a strong fishery, recommendations to expand capacity through more modern gear and larger boats should be resisted in light of the ultimate limits on the fishery.

Aquaculture development: Several developers have proposed establishing shrimp farms on land adjoining to the Rekawa lagoon. These proposals have been evaluated in relation to their potential impact on the lagoon water quality, the lagoon fishery, the mangroves and the human communities and their expectations. The consensus has been that aquaculture is not favored by the local communities because of its potential negative environmental impacts. The evaluation study on aquaculture by ARIEMCO (1994) as highlighted in Chapter 5, that although the potential for aquaculture in the area is limited because of space and water constraints, if it is carefully planned and integrated with the human communities, aquaculture could substantially augment the local economy and could alleviate unemployment.

Reef fish depletion due to coral mining and aquarium fish collecting: Many species of coral reef fish are found on the coral and rock reef in the Rekawa area. Coral mining degrades the habitat supporting this fish resource and adds to the beach erosion process, thus contributing to two major threats to coastal resource depletion. Reef fish are also caught by commercial operators for sale in the marine aquarium industry. Such capture without management results in the depletion of fish populations.

Post harvest vegetable losses: The cultivation of vegetables in Netolpitiya South is a major economic activity. Although the farmers are well organized and earn a substantial income from this activity, they suffer from heavy post harvest losses due to poor storing, packing and transportation methods.

Low incomes, poverty: The people of Rekawa have become dependent on public assistance programs for a portion of their income. This is both a result of the few livelihood options and a factor in contributing to their lack of self sufficiency. Viable options for livelihood are essential to make the community more productive and less dependent on government.

### ***Institutional***

Lagoon fishermen's association: About 250 families, mostly from Rekawa West, Marakolliya and Medilla Grama Niladhari areas, depend on the lagoon fishery for their livelihood (Jayakody and Jayasinghe, 1992). Since the productivity of the lagoon is declining as a result of poor management, the fishermen believe a strong Lagoon Fishermen's Association should be organized to improve the management of the lagoon shrimp fishery.

Ineffectual fishermen's cooperatives societies: Fishermen's cooperative societies exist in six of the seven Grama Niladhari Divisions of the Rekawa SAM site. The primary objectives for their existence include providing loans and subsidies for the purchase of fishing craft and supplies rather than conservation and management of fisheries. Men and women have joined these societies to receive benefits. These societies, however, are often limited in scope and are often ineffective.

Lack of coordination: Several government departments, agencies and NGO's operate in the Rekawa SAM area. The activities of these institutions need to be integrated and decentralized at the local level so better management coordination can be accomplished.

All the government institutions are centrally controlled with delegated authority. Very little horizontal coordination occurs between these state agencies. Efforts are often duplicated resulting in wasted resources. The SAM activities require an effective coordinating mechanism so management goals can be reached faster and more easily.

Few non-governmental organizations: Few NGO's besides the Funeral Aid Societies and the newly formed Women Development Societies, are effectively working in the Rekawa area. The leadership positions in these organizations are monopolized by a few traditional leaders and by government officials such as teachers and other field level officers. It is necessary for local people to take on responsibility and leadership in these voluntary organizations.

Another problem associated with these voluntary organizations is lack of coordination. The "Gramodaya Mandala" system initiated by the government to effect this coordination has collapsed. Therefore, it is necessary to evolve a mechanism to bring about effective coordination at the Rekawa area level.

## ***Legal***

There are many Ordinances, Enactments and Laws which regulate offenses such as coral mining, transport of coral, storing of coral, cutting mangroves, poaching of sea turtle eggs, killing of turtles, pollution of the lagoon, and degradation of the environment. Unfortunately, the existence of laws does not solve these problems. In most cases, the underlying causes contributing to these offenses are poverty, lack of awareness, poor motivation, weak institutional coordination and inadequate community participation.

**Table 7.2 Studies completed and proposed for the Rekawa SAM site**

### **Completed:**

#### **Lime Kilns Located in the Coastal Zone from Ambalangoda to Hambantota (Ranaweera Banda, 1990):**

- The number, location and ownership of kilns in the Rekawa area identified
- Raw material used, employment, income and costs of lime production examined
- Feasibility of relocating kilns and owners views on relocating kilns examined
- Attitudes of lime kiln owners to the CCD Act surveyed
- Socioeconomic, political and environmental factors associated with coral lime production examined

#### **Socioeconomic Study (Ranaweera Banda et al., 1994):**

- Examined factors influencing existing social, economic and environmental issues and potential constraints with new and existing programs
- Distribution of assets within the community described
- Social and economic disparities caused by resource utilization patterns surveyed

*(Table 7.2 continued)*

**Hydrology and Irrigation: A Study of the Tangalu Velyaya and Rekawa Lagoon (TEAMS, 1994):**

- Status and impact of engineering interventions and natural causes
- Reasons for abandoning Tangalu Velyaya paddy fields
- Alternative management approaches to problems of the Rekawa area
- Agency roles and community participation

**Aquaculture Site Evaluation and Development Design for the Rekawa Lagoon Area (Aquatic Resources Management Consultants (ARE/MCO), 1994):**

- Site evaluation and environmental factors for shrimp culture
- Proposed technology and hatchery for shrimp culture
- Design, and operation of shrimp ponds in Rekawa lagoon
- Shrimp farm management concepts and strategies
- Community-based approaches to aquaculture management

**Shrimp Recruitment Study of the Rekawa Lagoon (Jayakody, 1994):**

- Salinity distribution pattern and changes in the Rekawa Lagoon
- Discovering the optimal time for shrimp larval recruitment
- Relative abundance of major species of shrimp
- Types of lagoon fishing gear, catch rates and production
- Migrations and local movements of shrimp

**Turtle Conservation Project (TCP) monitoring of sea turtle nesting and poaching (Ranger, pers. comm.)**

- Income survey conducted
- Socioeconomic survey conducted
- Scientific sea turtle research will be started
- Environmental education program begun
- Preliminary reports on the status of sea turtles and mangroves completed
- Possibilities for sustainable sea turtle conservation programs are being examined

**Health and sanitation survey** – carried out by the Medical Officer of Health, Tangalle.

- Surveyed the sanitation of the Rekawa area and types of latrines being used
- Surveyed the health of the Rekawa population and main health concerns

**Flora and Fauna Survey of the Rekawa Lagoon Area (Karunaratne, pers. comm.)**

- Surveyed the Rekawa lagoon and surrounding area for reptile, mammal, migratory and non-migratory bird species
- Surveyed the mangrove forest for mangrove and associated vegetation species

**Proposed Studies for SAM Planning:**

- **Study on Agrochemical levels in Agricultural Runoff** to determine if levels of chemical pollutants and their adverse affects on water quality
  - **Feasibility of nature tourism including sea turtle conservation** to assess costs and benefits of this type of tourism in the Rekawa area
  - **Survey of the attitudes and perceptions of the local community regarding hotel development** in the local community once the approved hotel is completed and operating
  - **Trends in population increase/decrease in the Rekawa area** and assessment of its potential impact on the resources
  - **Monitoring of lagoon shrimp population and sedimentation** to monitor changes reflecting better management of the lagoon
  - **Crop feasibility study** to determine what crops could be grown in saline soils and accessibility of viable markets for these agricultural products
  - **Survey of women's status** in the Rekawa area including their roles, decision making, self employment, and leadership trends
  - **Survey of volunteer organizations** to assess their composition, leadership abilities, activities, problems and future trends
  - **Follow-up survey of lime kilns** to assess if lime production is expanding or contracting
-

**Table 7.3 Summary of management recommendations for the Rekawa area\*****Lagoon and Shrimp Fishery:**

- Open the mouth of the lagoon for extended periods of time from June-July and October-December to enable more efficient shrimp recruitment;
- Remove or change the Kapuhenwala Causeway to allow more seawater exchange;
- Monitor salinity and water quality within the lagoon with respect to shrimp productivity;
- Explore brackish water finfish cage and shrimp aquaculture possibilities within the lagoon and surrounding areas;
- Monitor water quality of the Kirama Oya, Rekawa Lagoon and nearby water sources for salinity fluctuations and agrochemical pollution levels;
- Organize a Lagoon Fishermen's Society including members of all the lagoon fishing groups to monitor and manage the lagoon fishery; and
- Control mangrove harvesting to help maintain lagoon ecosystem.

**Shorefront:**

- Use community inputs in approving hotel and tourism developments;
- Develop tourism slowly and insure social compatibility through monitoring;
- Insure tourism developments have sound sewage and solid waste disposal;
- See that any shorefront development complies with CCD regulations;
- Explore possible nature tourism activities to help sea turtle conservation; and
- Maintain existing access for local community to areas such as lagoon fishing, cemetery grounds and beaches.

**Coral Mining:**

- See how inland coral supplies can be better utilized to supplement current sea coral mining;
- Develop awareness programs in local schools about the effects of coral mining on coastal erosion;
- Develop alternative employment for coral mining women such as native handicraft work;
- More law enforcement; and
- Integrate laws at the national level to include broader jurisdiction for enforcement.

**Watershed and Irrigation (TEAMS, 1994):**

- Remove the Kapuhenwala and Medilla causeways to allow more fresh water to flow into the lagoon and surrounding agricultural lands;
- Examine aquaculture as a possible alternative industry on salinized land;
- Remove all or a portion of the Kapuhenwala causeway to improve lagoon waterflow;
- Monitor trends in water flow, availability and salinization;
- Explore possible crop diversification to include salt tolerant plant species;
- Improve crop marketing, and packaging to improve product; and
- Use farmer's organizations to discuss problems, issues and how to deal with them at the local level.

**Aquaculture Development (AREMICO, 1994):**

- Develop aquaculture in phases;
- Develop less than 50 ha for sustainable management;
- Employ local people in the industry;
- Start an aquaculture ownership society;
- Develop a community-based "cluster farm" approach for aquaculture;
- Use a "Mother Farm" to help finance a hatchery, feed and equipment;
- Require aquaculture projects to be reviewed by local community prior to development;
- Avoid deforesting mangrove areas leaving at least a 50 meter band around the lagoon periphery;
- Avoid taking excessive amounts of water from the lagoon and avoid discharging effluent into the lagoon; and
- Subject all aquaculture projects to initial community approval before beginning any developments.

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\* The recommendations will be considered for management

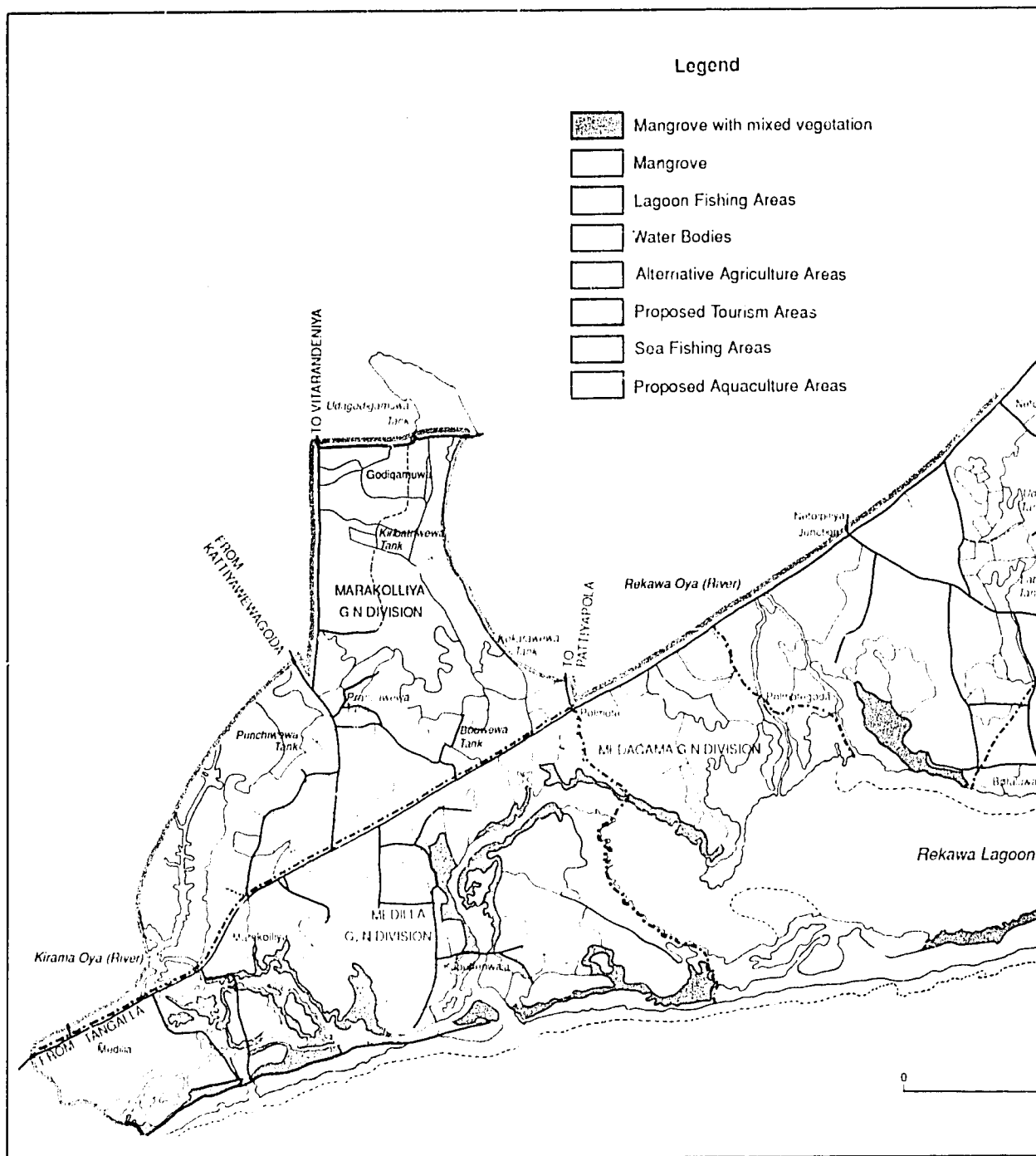
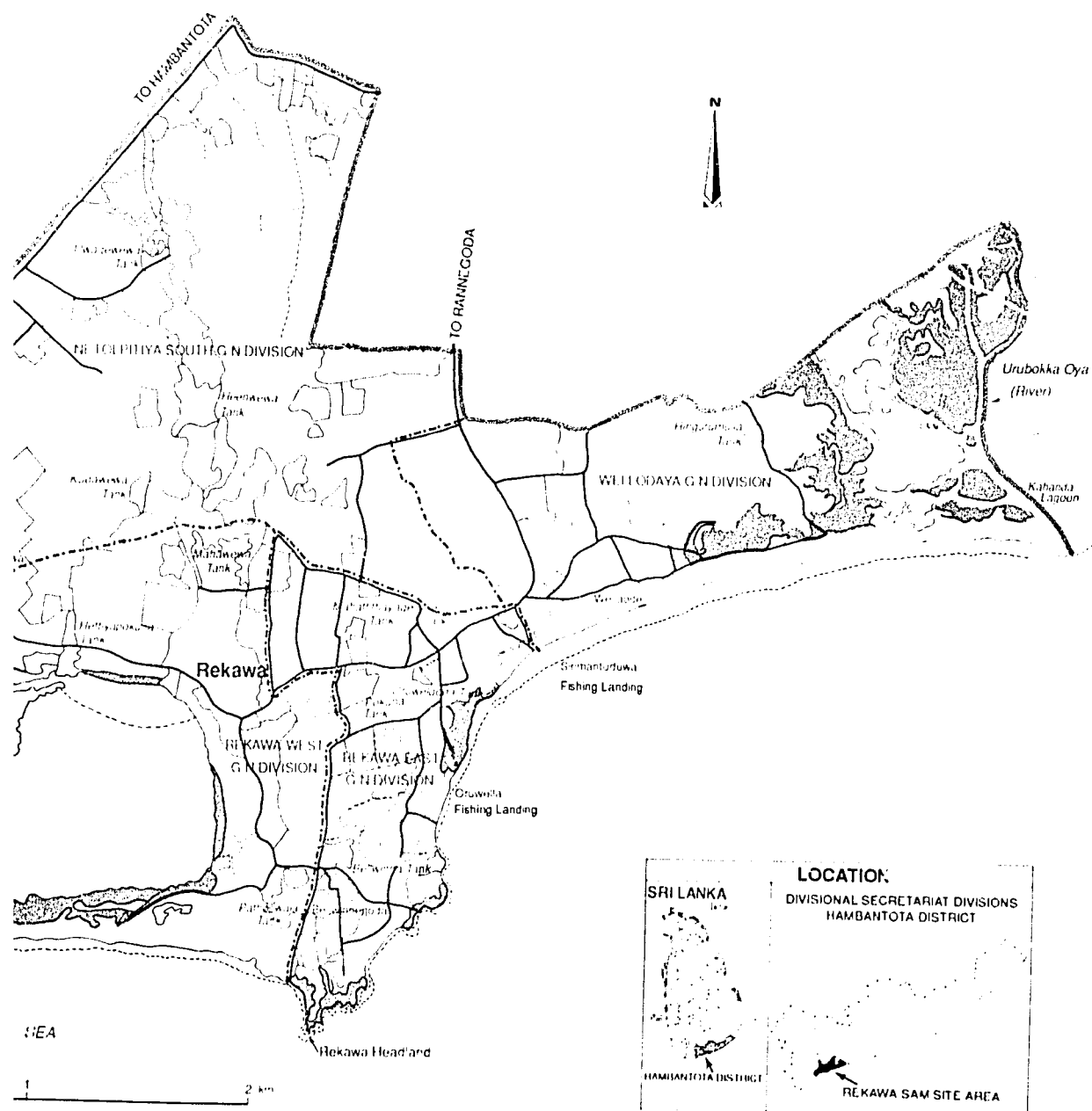


Figure 7.1 Potential future multiple



### *land uses of the Rekawa lagoon area*

## Studies Undertaken for Management of the Rekawa Area

Secondary information has provided some of the data in this profile and in addition, primary studies have been required as summarized in Table 7.2. Studies deemed important for future management and still pending are also listed in Table 7.2. They include improved data on water quality and feasibility studies on economic alternatives.

## Management Recommendations and Actions Taken

Recommendations from consultants and government agencies have helped to gain a clearer perspective on how to deal with the various management issues. The SAM process takes an integrated holistic approach in order to view the area and its problems in an integrated manner. Some of the recommendations for the management of the area and key strategies for the SAM plan are given in Table 7.3.

Actions completed in the Rekawa SAM site since 1991 include:

- Meetings with the Provincial Director of the Road Development Authority (RDA), the Chief Engineer of RDA, Tangalla and the an engineer with HIRDEP in 1994 to agree on redesigning the Kapuhenwala causeway so that a bridge can be built, replacing part of the causeway.
- Placement of a CCD field officer for the Rekawa SAM site in the end of 1994;
- Establishment of a field office and placement of a field officer field officer in 1993 on site to facilitate management processes, organize the coordinating committee, provide educational information and act as a liaison between the community and government groups;
- Formation of the Rekawa Lagoon Fishermen's Association in 1994 with the assistance of Assistant Commissioner of Cooperative Development in Galle, which will take responsibility of the management of the lagoon;
- Organization of the SAM Coordinating Committee in 1994, comprised of representatives from the user groups and holds formal meetings;
- Formation of a committee of all the voluntary organizations in Rekawa in 1994 to improve coordination and avoid duplication of efforts; this committee has a representative present at the Coordinating Committee meetings;
- Several educational workshops and awareness programs on the SAM planning process and coastal resources management conducted for GN's and other local government officials;
- An aquaculture feasibility study completed in 1994 (AREMCO);
- An irrigation and watershed study completed in 1994 (TEAMS);
- Shrimp recruitment and lagoon ecosystem study ongoing from July 1993 through July of 1995 (NARA);
- Baseline socioeconomic study completed in 1994 (Ranaweera Banda);
- Most target community groups contacted and identified;
- Social mobilizers selected to act as catalysts and trained by HIRDEP, for GN divisions of the Rekawa area in 1994;
- Rekawa Lagoon Environmental Profile completed with land use maps of the Rekawa area;

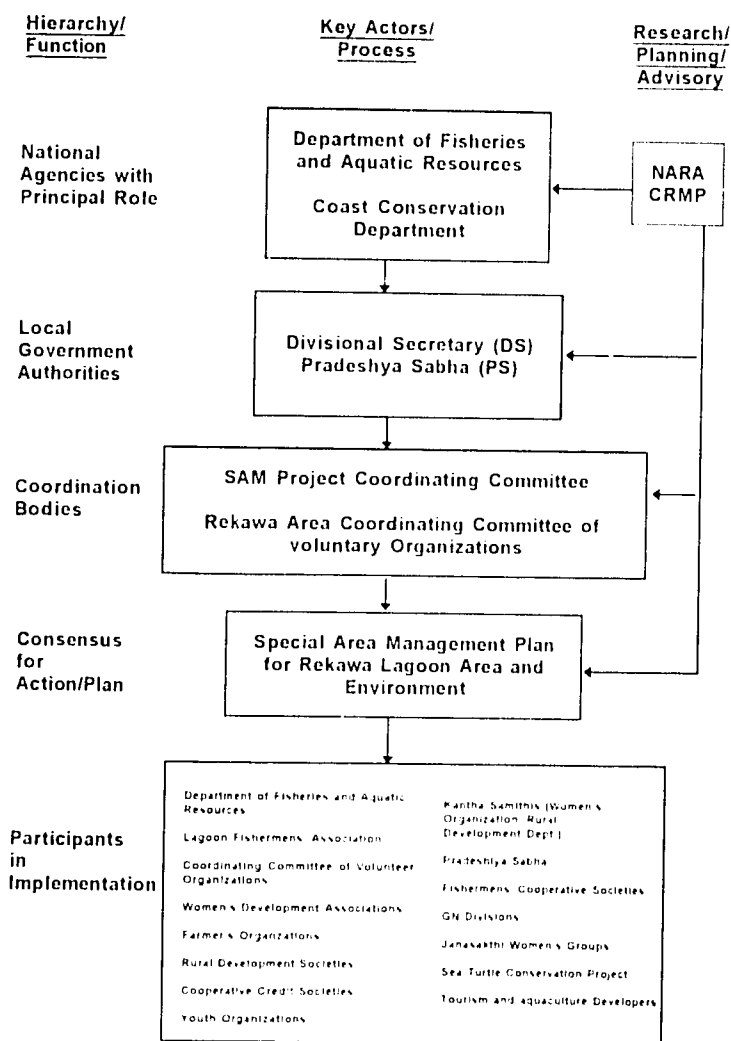


Figure 7.2 Institutional framework necessary for planning and implementing the Rekawa SAM Plan

- Management plan being formulated in cooperation with the government and local community through the SAM process; and
- The Divisional Secretariat and other central government representatives active in SAM activities.

### SAM Plan Development and Implementation

The baseline information in the *Coastal Environmental Profile of the Rekawa Lagoon* area provides the foundation for SAM plan formulation. The SAM planning process is designed to integrate all the user groups and government agencies so that



comprehensive management can be successfully carried out with full representation and cooperation from the Rekawa community. By taking this approach, the fishermen can manage the lagoon, the agricultural community can diversify and strengthen its resources, aquaculture and tourism can be considered for sustainable development, alternatives to coral mining can be found, and the conservation of living resources such as the sea turtles and mangrove forests can be accomplished. New economic activities which are not natural resource dependent will need to be found so that development can diversify. The coordinating committee is central to this task and will play a major role in the management decision making process.

The planning and implementation framework for the SAM process is outlined in Figure 7.2. The SAM plans are meant to be flexible and open to change with management needs and as new user groups are incorporated into the process. With the SAM process and planning in place, it should be possible for the Rekawa Lagoon community to sustainably manage their resources and improve their quality of life.

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