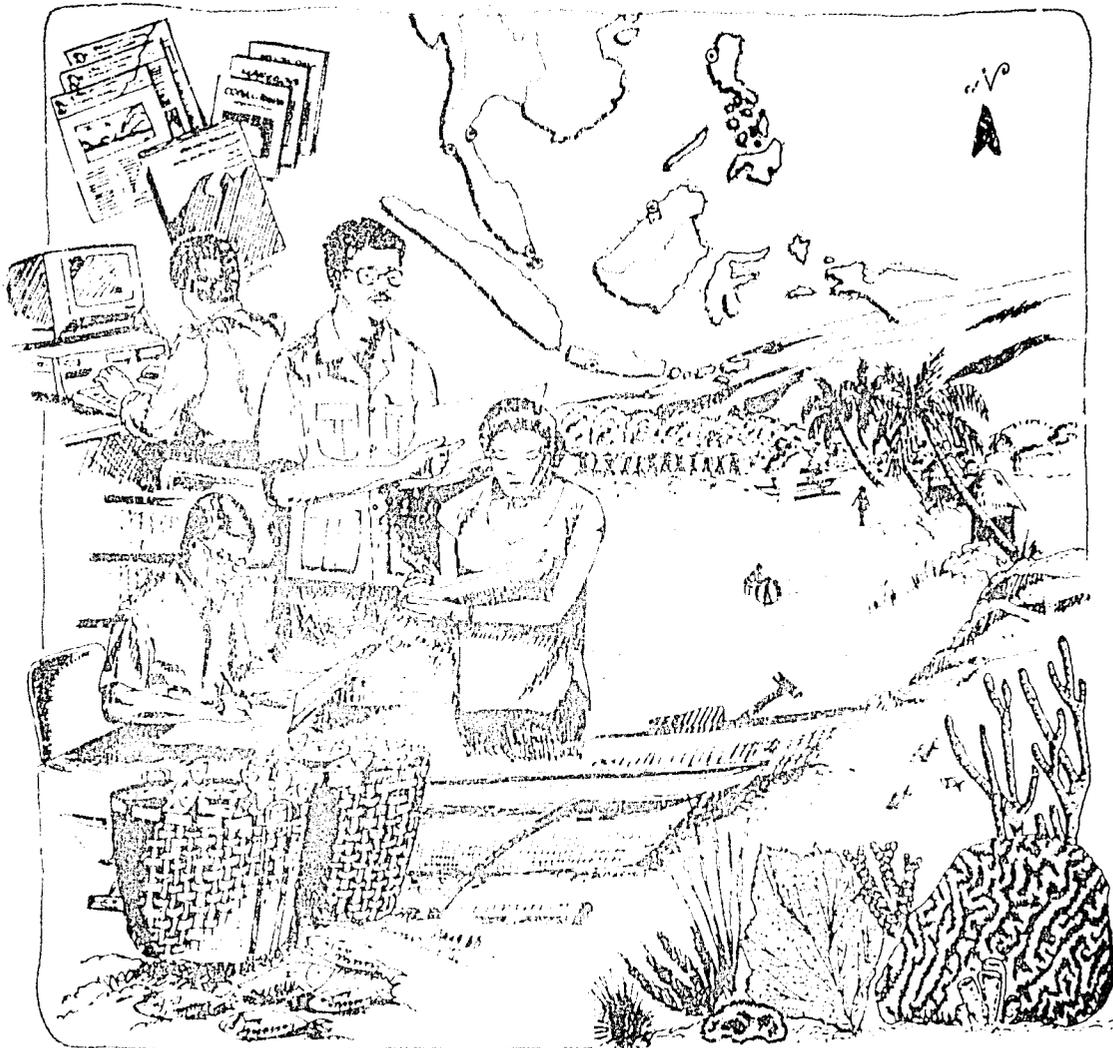


**ASEAN/US Cooperative Program on Marine Sciences:  
Coastal Resources Management Project  
Research, Training and Information  
Programs and Activities  
1986-1989**

**Chua Thia-Eng  
and Ma. Angelina A. Agulto**



Final Report

ASEAN/US CRMP WP R7/13

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Coastal Resources Management Project  
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**1987**



**Association of Southeast Asian Nations  
United States Agency for International Development  
International Center for Living Aquatic Resources Management**

# Contents

<b>Introduction</b>	
Objectives	1
Targets	2
Duration	2
Major Activities	2
Project Organization	3
Institutional Linkages	4
<b>Research Programs</b>	
Objectives and Targets	6
Approach	6
CRM Plan Development	7
Pilot Sites	7
Organization of Research Activities	10
Brunei Darussalam	13
Indonesia	23
Malaysia	36
Philippines	49
Singapore	60
Thailand	65
<b>Training Programs</b>	
Short-term Training Courses	80
Information Research and Management	80
Principles of Coastal Resources Management	80
Methods for Socioeconomic Analysis of Coastal Area Management	81
Remote Sensing Application in Coastal Resource Management	81
Integrative Methods of Coastal Resources Management	82
Policy Seminars and Workshops	82
Medium-term Academic Training	83
On-the-job Training	83
<b>Information Program</b>	
Regional Newsletter	84
Educational Materials	84
Technical Publications	85
Working Paper Series	85
Project Library/Information Services	86
Special Projects	86

## Introduction

Coastal areas play a critical role in the economic development of countries in the Southeast Asian region. The highly productive ecosystems found in these areas help sustain a wide range of diversified economic activities. However, increasing population and rapid economic development make heavy demands on coastal resources, resulting in environmental degradation and resource use conflicts. The latter two are due largely to lack of information on sound utilization and proper management of coastal resources. The rational exploitation must be based, therefore, on sustainable utilization, if present and future development opportunities are to be met.

Recognizing this need, the Association of Southeast Asian Nations (ASEAN) established the Coastal Resources Management Project (CRMP) under the Program of the Working Group on Marine Sciences (WGMS) of its Committee on Science and Technology (COST). The United States Agency for International Development (USAID) provided a US\$5 million grant for its implementation for a period of four years, beginning January 1985. The project is designed to strengthen the capability of ASEAN countries in developing their renewable resources on an environmentally sustainable basis. This is to help ensure the long-term productivity of coastal fisheries, aquaculture, forestry and other forms of primary resource dependent development.

The International Center for Living Aquatic Resources Management (ICLARM), a nonprofit, nongovernmental research center, was chosen to execute the project in close collaboration with the six participating ASEAN countries: Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore and Thailand. The grant also helps to strengthen ICLARM's capability to provide the necessary technical and administrative support through augmentation of its technical and administrative staff.

## Objectives

The immediate objective of the project is to help in the development of improved technical and institutional approaches for managing living coastal resource systems in the ASEAN countries through:

1. Analyzing, documenting and disseminating information on trends in living coastal resources utilization;
2. Focusing attention on the importance of better resource management policies and identifying the critical information and manpower needed to bring about improvements in management for sustainable development;
3. Developing institutional arrangements that link applied environmental and socioeconomic research to coastal resources assessment, planning and management; and
4. Encouraging technical and institutional solutions to resource use conflicts and the loss of coastal development opportunities.

### Targets

The project is expected to produce the following results after four years:

1. Increased awareness among decisionmakers of the trends in renewable coastal resources depletion and greater attention to the importance of sound coastal resources management (CRM) policy;
2. Improved assessments of the capacity of living coastal resource systems to sustain intensive, multiple use forms of development;
3. Promotion of cooperative research on topics relevant to renewable CRM such as improved forecasting techniques for future demands for resources, and the identification and resolution of sociopolitical/legal problems of managing common property resources;
4. Derivation of management concepts and procedures for allocating and developing coastal areas for sustainable use, forms of coastal resource use and the development of site-specific CRM plans;
5. Strengthening of ASEAN regional information dissemination channels on renewable CRM, including the publication of a regional newsletter; and special activities such as the preparation of technical reports, reviews, site-specific coastal resource atlas and the conduct of public awareness and educational activities;
6. Strengthened ASEAN manpower base in renewable coastal resources assessment, research, planning and management through the provision of short- and medium-term (masters level) training; and
7. Strengthened capability of ASEAN national institutions, in association with ICLARM, to facilitate and support the outputs specified in 1 to 6.

### Duration

The project is initially targeted for four years. However, achievement of the overall objectives should be viewed on a longer term. Continued research, extended development and application of comprehensive approaches in CRM and full incorporation of research results into supporting regional and national policies and development strategies will extend beyond four years.

### Major Activities

The project has two components. Component 1 activities cover living resource assessment, planning and research. Activities under Component 2 are training and information dissemination. Activities under Component 1 will be undertaken by participating countries with technical assistance provided by ICLARM complemented with additional expertise recruited from other technical agencies for the said purpose. Activities under Component 2 will essentially be organized through ICLARM and will involve the full participation of all ASEAN nations.

Four, out of the six, ASEAN nations originally participated in Component 1 activities. These are Indonesia, Philippines, Singapore and Thailand. Brunei Darussalam and Malaysia later indicated their desire to participate in Component 2 activities. Hence, the project program was further revised to accommodate full participation of all the ASEAN countries.

### Project Organization

The Project Steering Committee (PSC), composed of representatives from the six participating countries, is mainly responsible for providing project direction and establishing policies and decisions on project implementation. It is also responsible for establishing general operating procedures; providing the means for promoting regional interproject coordination; monitoring, reviewing and evaluating project progress to meet the objectives; and approving ASEAN CRM country programs and annual workplans. Dr. Rafael D. Guerrero III from the Philippines is concurrently Chairman of the Committee and Program Leader of the Philippine Subproject, succeeding the late Dr. Elvira Tan.

The following are the members of the PSC:

*Brunei Darussalam:* Awang Matdanan bin Haji Jaafar (Principal)/Pengiran Sharifuddin bin Pengiran Haji Yusof (Alternate)

*Indonesia:* Dr. Purwito Martosubroto (Principal)/Dr. Kasijan Romimohtarto (Alternate)

*Malaysia:* Dr. Abu Bakar Jaafar (Principal)/Ms. Ch'ng Kim Looi (Alternate)

*Philippines:* Dr. Rafael D. Guerrero III (Principal)/Dr. Edgardo D. Gomez (Alternate)

*Singapore:* Mr. Leslie Cheong (Principal)/Dr. Chou Loke Ming (Alternate)

*Thailand:* Mr. Arthorn Suphapodok (Principal)<sup>1</sup>/Dr. Teerayut Poopetch (Alternate)<sup>2</sup>

At the national level, each participating country has a National Steering Committee (NSC) which establishes country project policy guidelines; prepares and approves annual workplans and project program plans; identifies contractors and collaborative institutions who will be involved in in-country activities; monitors and evaluates in-country project progress; and provides a national focal point for all in-country project activities to interface with the PSC. The composition of the NSCs represents a broad view of CRM issues and national and local institutional capabilities and constraints. At least one of the country's PSC representatives is a member of the NSC.

A coordinating agency and a lead implementing agency in each country are appointed and are responsible for the implementation of in-country project activities. They also administer, disburse and account for funds allocated for in-country project activities. A national coordinator is appointed in each participating country to assist in the day-to-day activities of the project (Fig. 1).

ICLARM, as the executing agency, provides administrative and technical assistance to the participating countries. Project activities are managed and coordinated by the Project Coordinator, Dr. Chua Thia-Eng, with the assistance of the Technical Advisor, Dr. Alan T. White, and other project staff stationed at the ICLARM Headquarters in Manila (Fig. 2).

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<sup>1</sup>Replacing Dr. Pakit Kiravanich

<sup>2</sup>Resigned as of August 1987

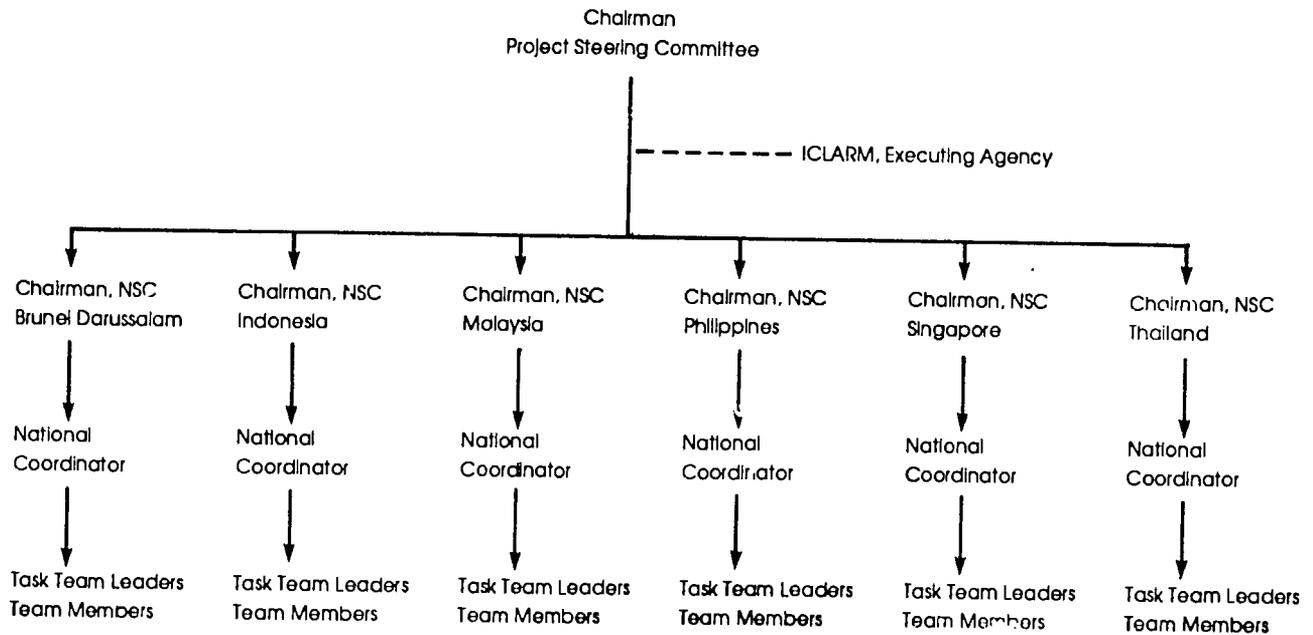


Fig. 1. ASEAN/US Coastal Resources Management Project organizational chart.

### Institutional Linkages

The project establishes linkages with other international agencies involved in CRM, especially with USAID regional/in-country projects to avoid duplication and promote complementarity. The project maintains close contact with international institutions such as the World Bank (WB), Asian Development Bank (ADB), World Wildlife Fund (WWF), International Union for Conservation of Nature and Natural Resources (IUCN), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Environment Program (UNEP) and the United Nations Development Program (UNDP) on areas of mutual interest.

The project also establishes liaison with USAID missions in Thailand, Indonesia and the Philippines to foster closer cooperation between USAID regional and national projects.

The project coordinates closely with training and academic institutions on training programs, curriculum development and on-the-job training in the USA and ASEAN nations as well as with scientists of the region for possible consultancy services and cooperative research.

ASEAN/USAID Coastal Resources Management Project

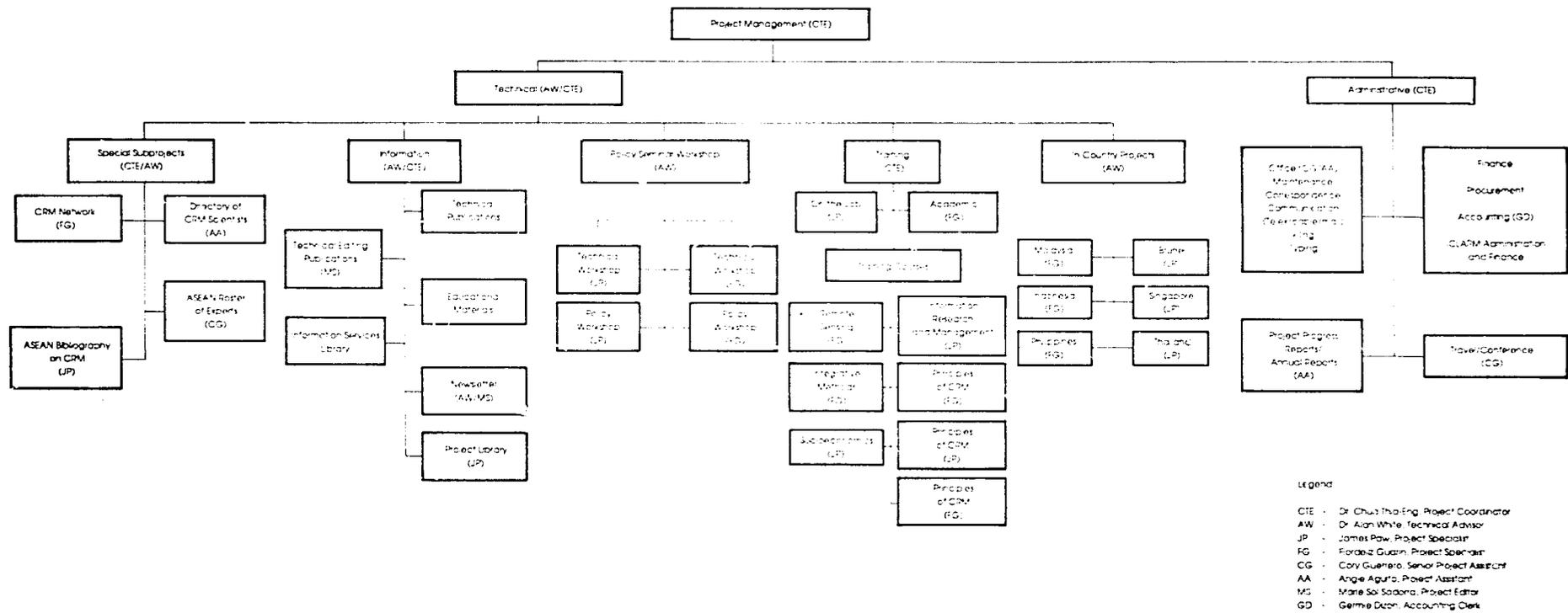


Fig. 2. Organizational chart of the ASEAN/US Coastal Resources Management Project office, ICLARM, Manila, Philippines.

# Research Programs

## Objectives and Targets

The main targets of Component 1 activities are to develop CRM strategies and to formulate a CRM plan that can be implemented at the pilot site and can be used as a model for plan development for other regions in the country.

## Approach

The aims of CRM are to ensure wise use of resources on a sustainable basis and to minimize conflicts in resources use through a set of management options, especially in areas of serious resource use conflicts.

Resource management does not only mean regulating exploitation. It also means establishing ways to restore or rehabilitate destroyed or heavily depleted resources. While past efforts in resources management tended to emphasize conservation measures, technological advancements permit a complementary and parallel approach towards restoration of essential marine communities. This dualistic approach in CRM widens management options towards attaining resources management objectives (Fig. 3).

One of the tasks of resource managers is to develop these options for the formulation of a policy which will benefit the majority of the people. The successful implementation of any management measure requires a multisectoral approach and endorsement by the communities concerned.

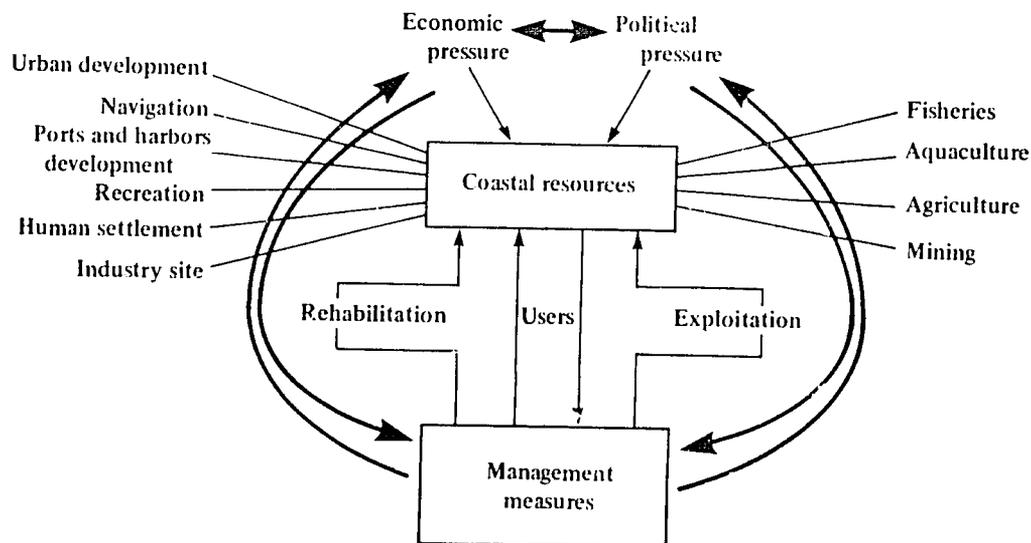


Fig. 3. Coastal resources: utilization, conflicts and management measures.

### CRM Plan Development

The target output under Component 1 of the project is a set of site-specific CRM plans for each participating country. This can be achieved through the following process (Fig. 4):

1. *Coastal environmental profile preparation.* There is a wealth of secondary data on the coastal zones of most sites chosen. However, much of this information is found in annual reports, mission reports, consultant reports, research reports/thesis and departmental documentations. Very few are even published. Some are classified or restricted to specific users only. This information is uncovered through the environmental profile preparation. In nations where baseline information is not available, preliminary on-site surveys were conducted to ensure completion of the profile.
2. *National workshops.* These are useful to flush out relevant information, especially on conflicts on coastal resource use and management. They are organized with the participation of team members, resource planners/managers and community representatives to identify management issues; determine causes; suggest management options; and identify information gaps on which research will be focused.
3. *CRM workplan formulation.* The coastal environmental profiles and the national workshops provide direction for the development of activities on resource assessment, CRM conceptual framework plan formulation and issue-oriented research which form the core research program of Component 1. Multidisciplinary teams are formed to provide relevant information on the biogeography of the selected sites, socioeconomic conditions, existing governance of resource use and the institutional responsibility in resource management (Fig. 5). The program and annual workplan (AWP) are, thus, prepared to demonstrate a concerted, interdisciplinary effort towards providing relevant information for CRM plan formulation.
4. *CRM plan formulation.* This is the final stage of CRM plan development. The analysis and synthesis of data collected provide the basis on which general CRM policy is formulated; management strategies for special areas are developed; and specific management issues are addressed. The planning process requires the integration and coordination of multidisciplinary teams made possible through small planning workshops and seminars.

The above process is the main focus of the present project. Actual implementation of the plan is necessary, and this could only be attained through experimental intervention which works out the means for implementation and provide the opportunity for evaluation before the plan is integrated into the local/regional development plans of the state/province and finally into the National Economic Development Plan (Fig. 4). These activities form part of the Phase II of the project.

### Pilot Sites

The participating countries have selected specific coastal areas as their pilot sites in which to conduct a comprehensive coastal area management study (Fig. 6). This is aimed at providing the necessary information for the formulation of management strategies to ensure sustenance of coastal development. Selection of the pilot sites was based on mutually agreed criteria drawn up by the ASEAN countries. The pilot sites are:

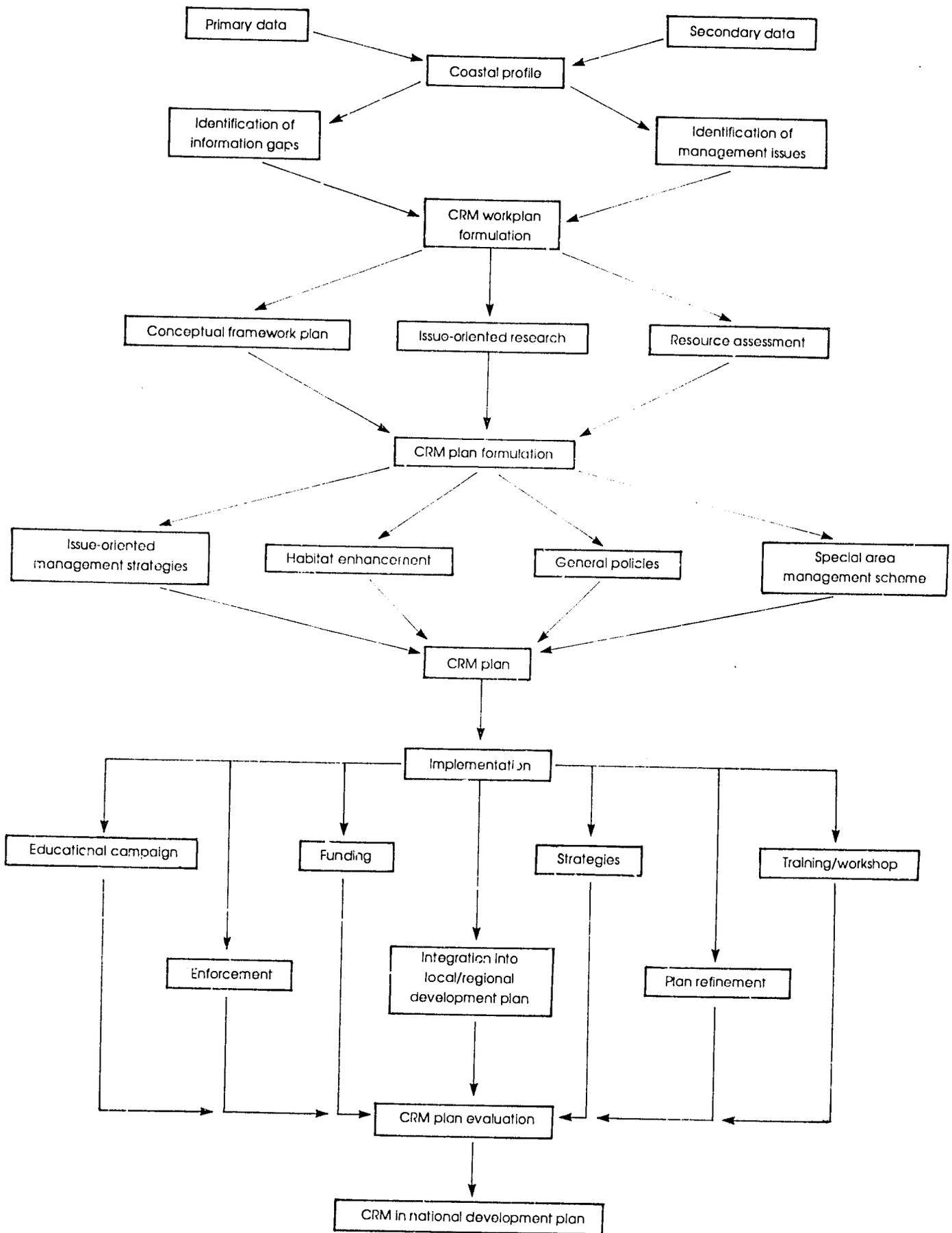


Fig. 4. The process of CRM plan development.

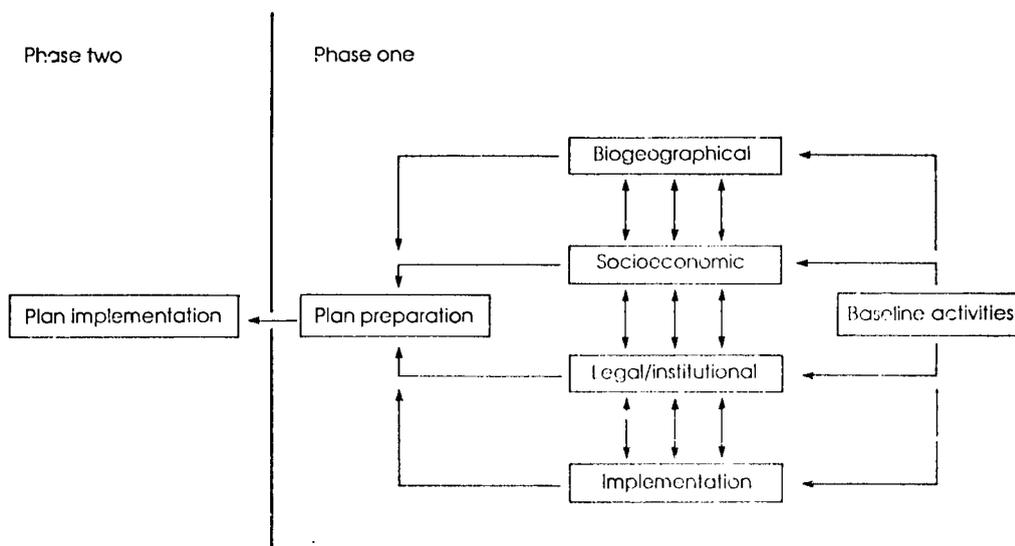


Fig. 5. Conceptual schematic to assist in program preparation.

*Brunei Darussalam:* Brunei Estuarine System and the entire coast

*Indonesia:* Segara Anakan, Cilacap, Java

*Malaysia:* South Johore, Peninsular Malaysia

*Philippines:* Lingayen Gulf, Pangasinan Province

*Singapore:* Straits of Johore, Southern Islands and Singapore River

*Thailand:* Upper South Thailand (Phang-nga and Ban Don Bays)

To facilitate project implementation, each country refined its proposal within the context of an integrated, interdisciplinary and multisectoral CRM concept, breaking down proposed components into specific tasks and activities within an overall program framework. The tasks and activities are then grouped and compiled into an AWP, which also shows the schedule or time frame of each.

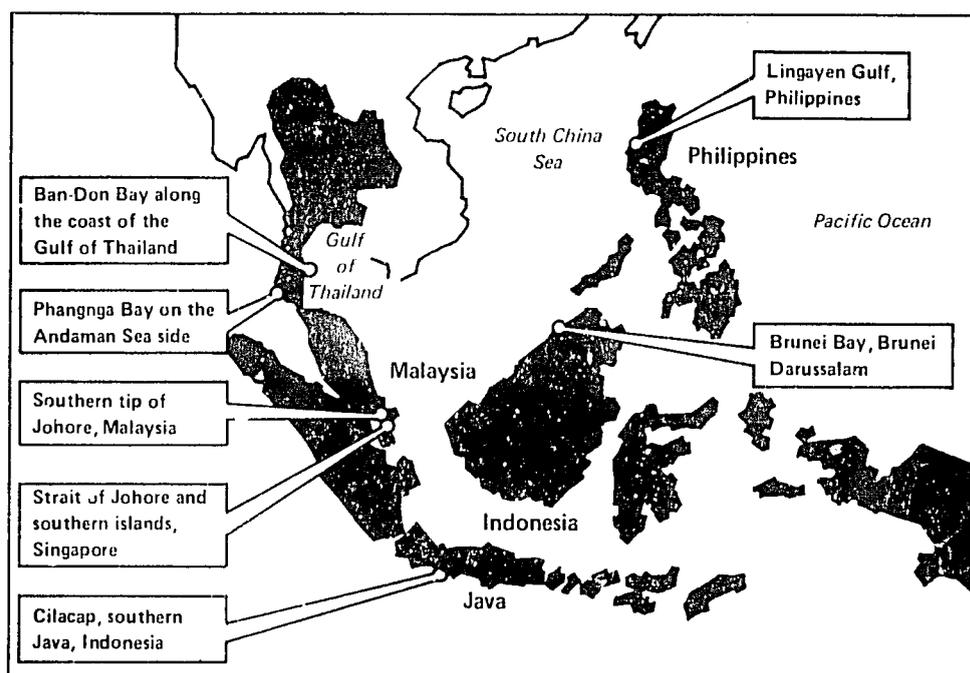


Fig. 6. Proposed sites for in-country research activities of the ABEAN/US Coastal Resources Management Project.

### Organization of Research Activities

In the preparation of the program plan, the total project work was divided into major groups and then subdivided into tasks or subtasks (and specific activities, where relevant) (Fig. 7). A proposed coding system for in-country research projects was formulated and has been in use to standardize divisions and task codes for all in-country subprojects (Fig. 8). The organization of each subproject is shown in Fig. 9.

Fig. 7. ASEAN/US Coastal Resources Management Project task classification and coding.

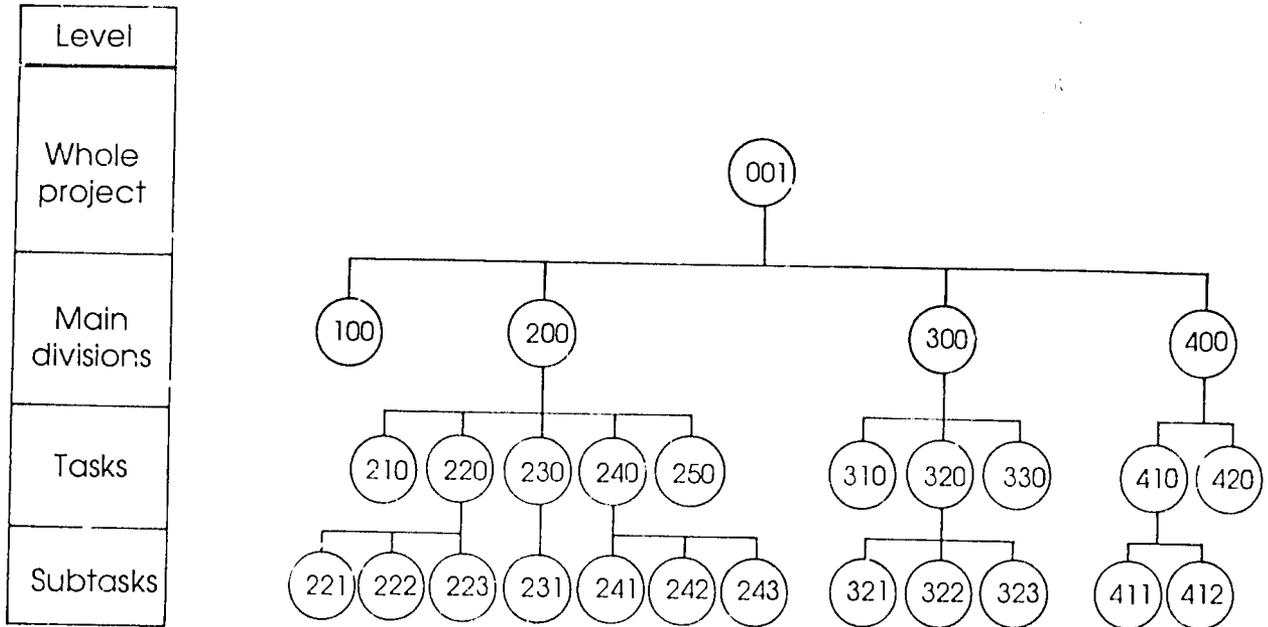


Fig. 8. ASEAN/US Coastal Resources Management Project - In-country research projects coding system.

Division 100 - Baseline Information

The task areas covered are activities related to literature reviews, synthesis of gathered data and environmental profile preparation, including workshops related to the profile.

<i>Brunei Darussalam</i>	<i>Indonesia</i>	<i>Malaysia</i>	<i>Philippines</i>	<i>Singapore</i>	<i>Thailand</i>
Task 110-B	Task 110-I	Task 110-M	Task 110-P	Task 110-S	Task 110-T
Task 120-B	Task 120-I	Task 120-M	Task 120-P	Task 120-S	Task 110-T

Division 200 - Biogeographical Studies

The task areas covered are studies on capture fisheries; aquaculture; ecosystems like coral reefs, mangroves; land use, watershed systems, pollution studies and ecology.

<i>Brunei Darussalam</i>	<i>Indonesia</i>	<i>Malaysia</i>	<i>Philippines</i>	<i>Singapore</i>	<i>Thailand</i>
Task 210-B	Task 210-I	Task 210-M	Task 210-P	Task 210-S	Task 210-T
Task 220-B	Task 220-I	Task 220-M	Task 220-P	Task 220-S	Task 220-T
Task 230-B	Task 230-I	Task 230-M	Task 230-P	Task 230-S	Task 230-T
:	:	:	:	:	:
Task 290-B	Task 290-I	Task 290-M	Task 290-P	Task 290-S	Task 290-T

Continued

Division 300 - Socioeconomic Studies

The task areas covered are sociocultural and economic studies.

<i>Brunei Darussalam</i>	<i>Indonesia</i>	<i>Malaysia</i>	<i>Philippines</i>	<i>Singapore</i>	<i>Thailand</i>
Task 310-B	Task 310-I	Task 310-M	Task 310-P	Task 310-S	Task 310-T
Task 320-B	Task 320-I	Task 320-M	Task 320-P	Task 320-S	Task 320-T
Task 330-B	Task 330-I	Task 330-M	Task 330-P	Task 330-S	Task 330-T
:	:	:	:	:	:
Task 390-B	Task 390-I	Task 390-M	Task 390-P	Task 390-S	Task 390-T

Division 400 - Legal and Institutional Studies

The task areas covered are those related to legal and institutional aspects of CRM, including tourism.

<i>Brunei Darussalam</i>	<i>Indonesia</i>	<i>Malaysia</i>	<i>Philippines</i>	<i>Singapore</i>	<i>Thailand</i>
Task 410-B	Task 410-I	Task 410-M	Task 410-P	Task 410-S	Task 410-T
Task 420-B	Task 420-I	Task 420-M	Task 420-P	Task 420-S	Task 420-T
Task 430-B	Task 430-I	Task 430-M	Task 430-P	Task 430-S	Task 430-T
:	:	:	:	:	:
Task 490-B	Task 490-I	Task 490-M	Task 490-P	Task 490-S	Task 490-T

Division 500 - Rehabilitation and Restoration

The task areas covered are studies on habitat restoration and rehabilitation such as artificial reefs, resource enrichment and similar activities.

<i>Brunei Darussalam</i>	<i>Indonesia</i>	<i>Malaysia</i>	<i>Philippines</i>	<i>Singapore</i>	<i>Thailand</i>
Task 510-B	Task 510-I	Task 510-M	Task 510-P	Task 510-S	Task 510-T
Task 520-B	Task 520-I	Task 520-M	Task 520-P	Task 520-S	Task 520-T
Task 530-B	Task 530-I	Task 530-M	Task 530-P	Task 530-S	Task 530-T
:	:	:	:	:	:
Task 590-B	Task 590-I	Task 590-M	Task 590-P	Task 590-S	Task 590-T

Division 600 - Resource Management Plan Formulation

The task areas covered are workshops/seminars for the formulation, review, refinement and finalization of the management plan.

<i>Brunei Darussalam</i>	<i>Indonesia</i>	<i>Malaysia</i>	<i>Philippines</i>	<i>Singapore</i>	<i>Thailand</i>
Task 610-B	Task 610-I	Task 610-M	Task 610-P	Task 610-S	Task 610-T
Task 620-B	Task 620-I	Task 620-M	Task 620-P	Task 620-S	Task 620-T
Task 630-B	Task 630-I	Task 630-M	Task 630-P	Task 630-S	Task 630-T
:	:	:	:	:	:
Task 690-B	Task 690-I	Task 690-M	Task 690-P	Task 690-S	Task 690-T

Continued

Fig. 8 (continued)

Division 700 - Plan Implementation

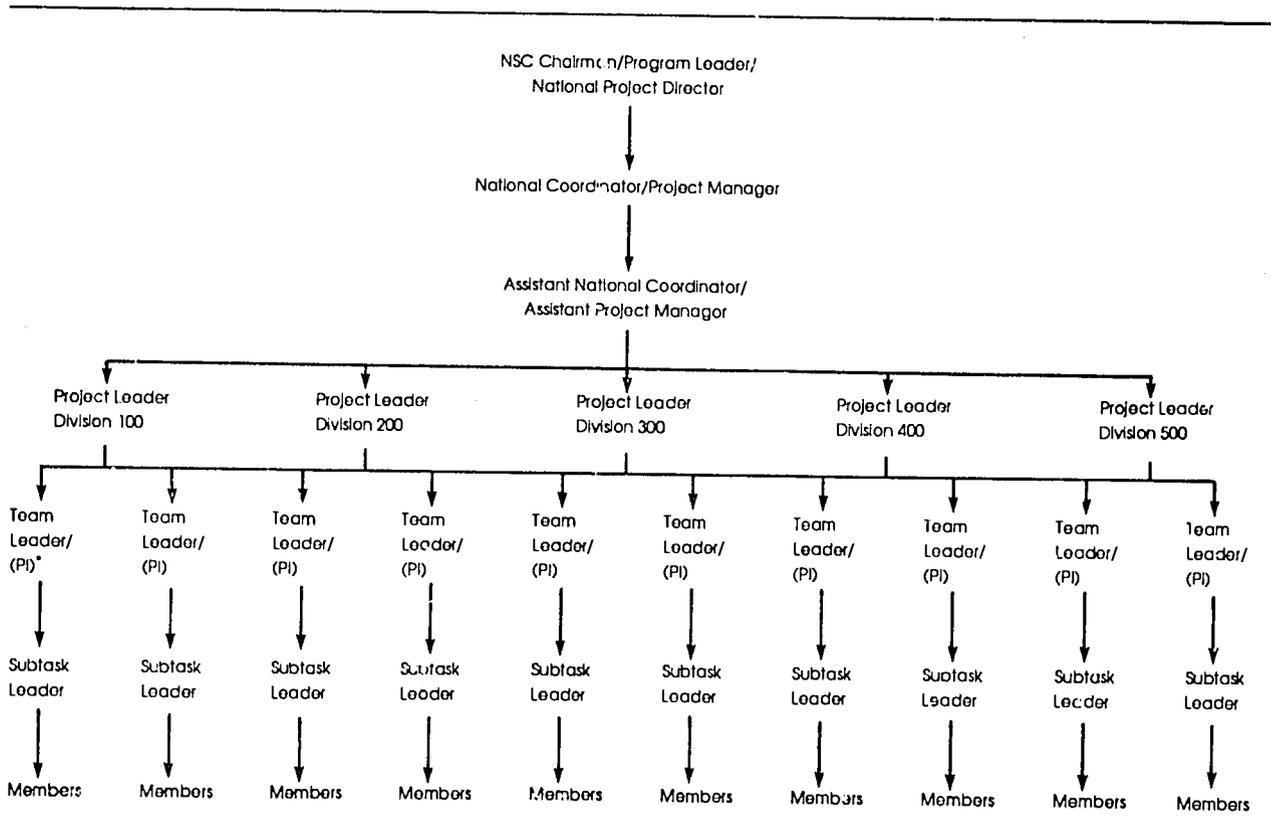
The task areas covered are activities related to pre-implementation of the management plan formulated under Division 600.

<i>Brunei Darussalam</i>	<i>Indonesia</i>	<i>Malaysia</i>	<i>Philippines</i>	<i>Singapore</i>	<i>Thailand</i>
Task 710-B	Task 710-I	Task 710-M	Task 710-P	Task 710-S	Task 710-T
Task 720-B	Task 720-I	Task 720-M	Task 720-P	Task 720-S	Task 720-T
Task 730-B	Task 730-I	Task 730-M	Task 730-P	Task 730-S	Task 730-T
:	:	:	:	:	:
Task 790-b	Task 790-I	Task 790-M	Task 790-P	Task 790-S	Task 790-T

Division 800 - In-country Project Management

The activities under this division are the overall project operation, hiring of consultants, publication of management plan and other reports generated from group and national workshops (excluding the environmental profile) and contingency related to overall project management not covered in any of the previous divisions.

<i>Brunei Darussalam</i>	<i>Indonesia</i>	<i>Malaysia</i>	<i>Philippines</i>	<i>Singapore</i>	<i>Thailand</i>
Task 810-B	Task 810-I	Task 810-M	Task 810-P	Task 810-S	Task 810-T
Task 820-B	Task 820-I	Task 820-M	Task 820-P	Task 820-S	Task 820-T
Task 830-B	Task 830-I	Task 830-M	Task 830-P	Task 830-S	Task 830-T
:	:	:	:	:	:
Task 890-B	Task 890-I	Task 890-M	Task 890-P	Task 890-S	Task 890-T



\*PI - Principal Investigator

Fig. 9. Organization of in-country projects.

The tasks assigned under each division are visualized as complete entities with well-defined beginning and end points. The size of the task or activity is large enough to permit adequate control and visibility without creating an unwieldy administrative burden. Each task may cover one or more activities geared towards attaining certain measurable objectives.

The following in-country research projects of the participating countries for the period 1986-1989 were culled from their respective 1986 and 1987 AWP's.

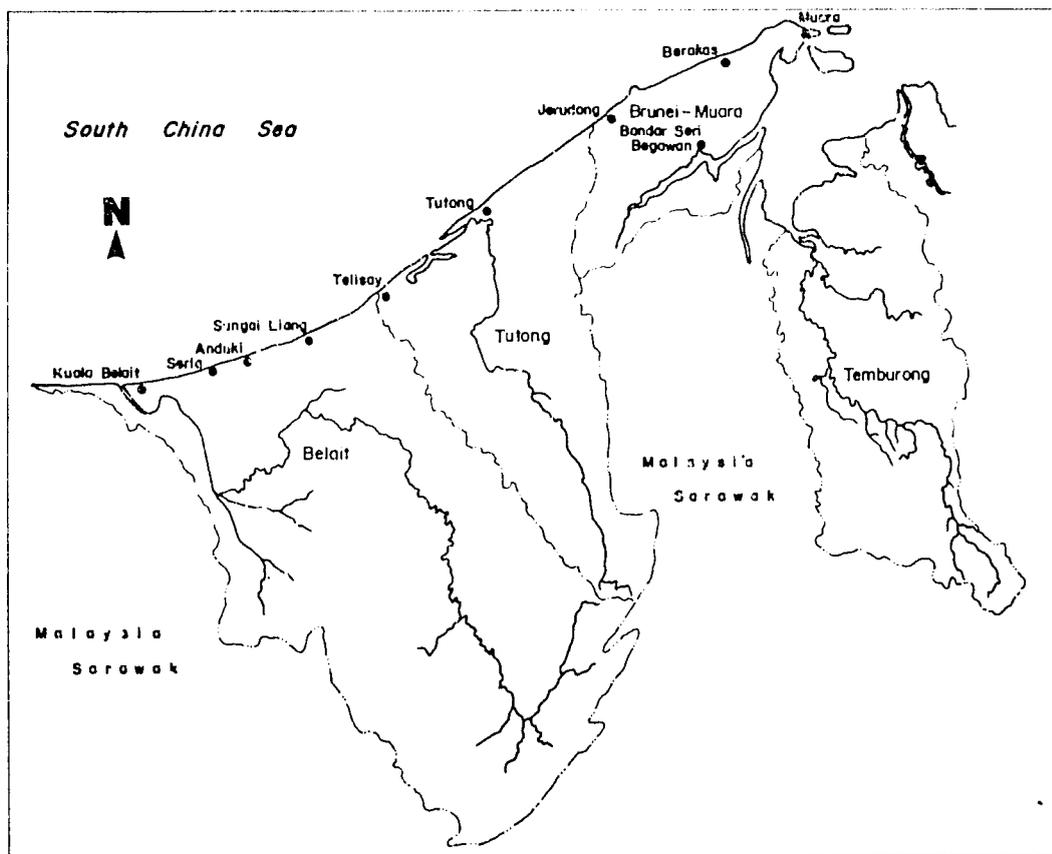


Fig. 10. Brunei Darussalam.

#### BRUNEI DARUSSALAM

Chairman, NSC	: Awang Matdanan bin Haji Jaafar
Vice-Chairman, NSC	: Pg Sharifuddin Pg Haji Yusof
National Coordinator	: Dr. M.W.R.N. de Silva
Coordinating Agency	: Department of Fisheries (DOF), Brunei Darussalam
Cooperating Agencies	: Department of Forestry, Department of Town and Country Planning, Marine Department, Department of Public Works, Brunei Museum and Department of Agriculture
Project Site	: Brunei Estuarine System and the entire coast (Fig. 10)

Brunei Darussalam has an area of 5,765 km<sup>2</sup>, a coastline 130 km long and around 18,400 ha of mangroves. Compared to the other five ASEAN countries,

most of its living coastal resources are relatively underexploited. Today, there is an increasing awareness of the socioeconomic importance of coastal resources, in general, and mangroves, in particular.

Mangroves are known to provide nursery grounds for prawns, mitigate effects of flood and soil erosion and serve as sources of fuelwood, tannin, etc. Although the long-term economic effects of mangrove conversion is not well-documented, there are evidences from other countries which indicate that impacts can be significant as in the reduction of shrimp and finfish production, increased risk of floods and accelerated erosion. The adjoining coastal environment is also subject to a host of external pressures like pollution.

Brunei Darussalam recognizes the need to develop its underexploited coastal resources. The high development potential of these resources and the government's growing interest in economic diversification require the development of a comprehensive and multisectoral natural resources management strategy to promote the sustainable use of coastal areas.

#### General Program Framework

*Objectives.* The main objective of the project is to prepare an integrated management plan which will facilitate the environmentally sustainable economic development of Brunei Darussalam's coastal resources. The plan shall include a zoning scheme, defining areas suitable for dedicated development options. Existing land and sea use activities shall be incorporated into the proposed management plan.

*Broad Tasks.* Research activities under the project will focus on:

1. Collecting and completing secondary sources of information into a coastal environmental profile for use in developing field tasks;
2. Surveying and mapping the country's coastal area, with emphasis on coastal and nearshore habitats;
3. Establishing a baseline data base for water quality in the Brunei Estuarine System and establishing standards of water quality for coastal area management and procedures for water quality monitoring;
4. Identifying and characterizing existing and potential economic uses dependent on the utilization of Brunei Darussalam's coastal resources, applying cost-benefit and other forms of economic analysis to determine optimal and sustainable long-term utilization of the coastal resources;
5. Developing a special area management plan to promote the optimal utilization of the mangrove resources;
6. Conducting an analysis of key institutions responsible for the management of Brunei Darussalam's coastal resources which results in recommended arrangements to facilitate implementation and maximize plan effectiveness; and
7. Developing a CRM plan for Brunei Darussalam's coast, which will outline management strategies promoting the sustainable utilization of the living coastal resources.

*General Approach.* The approach is governed by the objectives of the ASEAN/US CRMP project design document and approaches earlier initiated in the other five ASEAN countries. In broad terms, this approach can be divided into three phases: start-up, which includes the completion of in-country administrative matters and of the coastal environmental profile and one or more national workshops designed to focus on the project's remaining activities (Task 110-B); field activities designed to develop the data required from

which policy options can be supported (Divisions 200-500); and plan preparation and finalization (Division 600).

Several of the tasks described below are interdependent, requiring the completion of one or more tasks prior to the refinement of subsequent task activities. Because of these linkages, the present proposal remains necessarily broad.

Most task activities are closely integrated into the existing planned activities of government agencies. Many of the tasks identified have taken into consideration the existing or future activities or projects of the respective agencies. The project inputs serve to strengthen these activities. The main operational funds for task implementation are derived mainly from the national budgets.

### In-country Research Projects

#### Division 100 - Baseline Information

*Task Code 110-B:* Preparation of coastal environmental profile of Brunei Darussalam

*Target/Product:* A coastal environmental profile of Brunei Darussalam

*Task Description/Methodology:* All secondary sources of information characterizing the nature, significance and management of Brunei Darussalam's coastal resources will be collected, analyzed and synthesized into a single document which will describe the present status and importance of the country's coastal resources base. This profile in turn will serve as a key source document in national workshops and other appropriate fora to refine subsequent project-related field activities.

In the light of Brunei Darussalam's manpower constraints, the profile preparation is expected to be completed by a multidisciplinary team of natural resources scientists from ASEAN.

*Duration:* 3 months, 1987

*Team Leader:* Dr. Chou Loke Ming

*Institutions Involved:* DOF, National University of Singapore, University of the Philippines and ICLARM

#### Division 200 - Biogeographical Studies

*Task Code 210-B:* Natural resources survey

*Target/Product:* A resources inventory of Brunei Darussalam's existing coastal resource base

*Task Description/Methodology:* The field surveys will be structured to complement Task 110-B by addressing key issues and data gaps identified in the profile attributed either to absence of information or data judged to be outdated for the purpose of plan preparation. Once the said gaps and issues have been identified, specific field resource assessments and their respective methodologies can be refined to maximize the utility of field-generated data for incorporation into plan preparation.

*Duration:* 3 months, 1987

*Team Leader:* Dr. Chou Loke Ming

*Institutions Involved:* As in Task 110-B

*Task Code 220-B:* Fish and shrimp stock assessment in the coastal waters of Brunei Darussalam

*Target/Product:* To assess fish and shrimp stocks in the Brunei Estuarine

System and other inshore waters to determine exploitation potential and fisheries management strategies

*Task Description/Methodology:*

1. *Compilation and review of existing information on the fish and shrimp stocks of Brunei Darussalam.* This aspect will summarize available information on resources and their exploitation: (a) oceanography of the area and environment of the resources; (b) magnitude and species composition of catches; (c) biology, population parameters and ecology of the component species; (d) magnitude and (spatio-temporal) distribution of fishing effort; and (e) stock size and potential yield estimates. This aspect will also collate available price/socioeconomic information and undertake a reanalysis of previous trawl survey data for comparative purposes.

2. *Demersal fisheries resources survey.* This is intended to provide more detailed assessments of the fish and shrimp resources in the study area. Points of interest are: (a) catch rates; (b) relative abundance of component species; (c) seasonality; (d) spatial distribution; (e) size composition; (f) population parameters (growth and mortality); (g) exploitation rate; (h) biological parameters (fecundity, maturity, sex ratio, length-weight relationship); (i) recruitment patterns; (j) size selection; (k) faunal assemblages; and (l) yield-per-recruit. The survey is composed of two sampling schemes conducted simultaneously for a period of 12 months: demersal trawl survey and inshore/estuarine beam trawl survey.

*Duration:* 18 months, 1988-1989

*Team Leader:* To be identified

*Team:* 1 Stock Assessment Expert, 1 Senior Stock Assessment Consultant and 1 Research Assistant.

*Institutions Involved:* DOF and ICLARM

*Task Code 230-B: Water Quality Management Scheme*

*Targets/Products:*

1. To establish water quality standards for the management of the coastal waters for fisheries and recreation, i.e., standards particularly for coliform levels, total hydrocarbon, oil aromatics, BOD, heavy metals, Cu, Zn, DO, salinity and temperature;
2. To establish baseline data on sedimentation rate, coliform levels, hydrocarbon, oil aromatics, BOD, heavy metals and pesticides;
3. To identify sources and levels of pollution;
4. To prepare a contingency plan for oil spill control;
5. To prepare a red tide action plan; and
6. To prepare an Environment Impact Assessment (EIA) procedure for specific developments.

*Subtask Code 231-B: Water quality baseline*

*Target/Product:* To develop a data base on water quality of Brunei Darussalam coastal waters as baseline for water pollution monitoring

*Subtask Description/Methodology:* The subtask will collect primary data of major parameters as key pollution indicators, and establish the level of fluctuations with reference to tidal extremes and climatical variations. The existing data base developed by consulting firms or national agencies will be included to provide a general picture of the values and distribution of major hydrological parameters in the coastal waters.

Subtask activities will be implemented under three stages:

Stage I (3 months): (1) formation of team and terms of reference; (2) determination and standardization of methodology and sampling stations; (3) acquisition and field testing of equipment; and (4) compilation of database from secondary sources.

Stage II (4 months): Field sampling of the water at selected sites to cover the following periods: (1) spring tides; (2) neap tides; and (3) wet and dry seasons.

Stage III (3 months): (1) analysis of field data and (2) integration and synthesis of both primary and secondary source database as baseline for computer monitoring.

*Duration:* 12 months, 1988

*Subtask Leader:* Dr. M.W.R.N. De Silva, DOF

*Team Members:* 1 Ecologist (University of Brunei Darussalam); 1 Hydrologist/Hydrographer (Department of Public Works); 1 Research/Technical Assistant (DOF); and 1 Fisheries Biologist (DOF).

*Institutions Involved:* DOF, Department of Public Works and University of Brunei Darussalam

*Subtask Code 232-B:* Baseline for sedimentation rates

*Targets/Products:* To develop a data base on sediment loads in coastal waters and to determine the rate of sedimentation at major coastal locations

*Subtask Description/Methodology:* Sediment traps will be placed in four locations in the coastal waters of Kampong Tungku (area of sand mining); Pelong Rocks (coral area affected by sedimentation as identified by the coastal profile); the Brunei Estuary; and a control site. Ten sediment traps will be set in each location and sediment allowed to accumulate in the traps for two weeks. The sediment will be analyzed for size, type, volume and dry weight. Three experimental runs will be done to cover the wet, dry and intermediate periods.

*Duration:* 18 months, 1988-1989

*Team Leader:* Dr. M.W.R.N. De Silva (DOF)

*Team Members:* 2 Diving Assistants (DOF), 1 Assistant Fisheries Officer and 1 Technical Assistant all from DOF.

*Institution Involved:* DOF

*Subtask Code 233-B:* Development of an oil spill contingency plan

*Targets/Products:* To establish oil spill trajectories in Brunei Darussalam coastal waters and to develop an implementable oil spill contingency plan

*Subtask Description/Methodology:* This task is aimed at: (1) establishing possible oil trajectories based on existing data that might have been collected by Shell Petroleum and expanding the oil trajectories projected by previous studies for the west coast resources of Sabah; and (2) preparing an oil spill contingency action plan for Brunei Darussalam.

The most logical approach to this study is to collaborate with Brunei Shell Petroleum Sdn Bhd, through the Ministry of National Development, Petroleum Unit and the Marine Department.

The task activities will be done in three stages:

Stage I: team formation; finalization with respective agencies with respect to data source; analysis of data to develop trajectories.

Stage II: completion of trajectories; identification of vulnerable resources and estimation of possible impacts; formulation of framework for contingency plan; identification of institutional framework for plan execution.

Stage III: formulation of contingency action plan; review and finalization of plan.

*Duration:* 12 months, 1988

*Team Leader:* To be identified

*Team Members:* Physical Oceanographer (Consultant); Legal Personnel; Ecologist (National Coordinator); and Natural Resource Planner (ICLARM)

*Institutions Involved:* DOF, Brunei Shell Petroleum Sdn. Berhad, Petroleum Unit, Marine Department and ICLARM

*Subtask Code 234-B:* Red tide action plan

*Target/Product:* An action plan for monitoring of red tide occurrence and protection of public health

*Subtask Description/Methodology:* This task is aimed at developing an action plan which consists of:

1. A monitoring mechanism which enables early detection of red tide organisms in any part of the coastal waters of Brunei Darussalam; and
2. A possible health protection mechanism which details a set of activities to be undertaken by various participating agencies ranging from public awareness, warning system and legal procedures to control the sale and procurement of affected fish organisms and other beach-related activities.

*Duration:* 12 months, 1987/88

*Team Leader:* Awang Matdanan bin Haji Jaafar

*Institution Involved:* DOF

*Task Code 240-B:* Mangrove management scheme

*Target/Product:* To develop a special area management scheme for the optimal utilization of the mangrove resources of Brunei Darussalam

*Task Description/Methodology:* The first step for the proper management of Brunei Darussalam's mangrove resources is to develop a national mangrove management scheme (NMMS) to be framed and prepared by an expert multidisciplinary group.

Simultaneous with the development of the NMMS is the establishment of the mangrove data base. Linkages to maintain information flow are essential to ensure incorporation of the latest findings into the NMMS.

The development of the NMMS should consist of three major steps: (1) assessment and (2) management of the mangrove resource; and (3) formulation of the NMMS scheme.

*Duration:* 12 months, 1988/89

*Team Leader:* To be identified

*Team Members:* 1 Mangrove Expert/Consultant (4 m/m); 1 Geologist; 1 Aquaculturist; 1 Forester; and 1 Research Assistant

*Institution Involved:* To be identified

#### Division 300 - Socioeconomic Studies

*Task Code 310-B:* Socioeconomic survey

*Targets/Products:* To develop a data base quantifying the socioeconomic importance of Brunei Darussalam's coastal resources, and to assess present and potential economic significance of these resources

*Task Description/Methodology:* The task will attempt to describe and document the coastal area in terms of its economic resource base for human livelihood and sustenance; human settlement and communities; associated socioeconomic activities; and their impacts on the resource base and quality of life.

The task will focus on the following:

1. Economic valuation of the coastal resources, both living and nonliving, within the coastal zone;
2. Socioeconomic profile of coastal rural settlements and communities, covering demographic characteristics, household employment and income characteristics, social and community structure;
3. Characteristics and quantification of economic activities; and
4. Identification of the external impacts of coastal activities on the resource base and the effects on human settlement and communities, as well as resource use conflicts as a result of socioeconomic activities.

The task will be carried out in three stages:

Stage I: analysis and synthesis of secondary data; formation of team; reconnaissance trip; establishment of sampling sites; questionnaires and other survey methods.

Stage II (5 months): field surveys; gathering of demographic and socioeconomic background data.

Stage III: Data analysis (economic valuation, employment income and others); socioeconomic profile; characteristics and impacts of economic activities; etc.

*Duration:* 12 months, 1988/89

*Team Leader:* To be identified

*Team Members:* 1 Economist, 1 Sociologist, 1 Research Assistant and 1 Ecologist

*Institutions Involved:* DOF and ICLARM

#### Division 400 - Legal and Institutional Studies

*Task Code 410-B:* Legal and institutional analysis

*Target/Product:* A profile of governance arrangements responsible for the management of Brunei Darussalam's natural resources

*Task Description/Methodology:* The main activities of the tasks are:

1. Survey of the existing legal and institutional authorities and the various arrangements pertaining to coastal resource ownership and use rights;
2. Identification of legal and institutional constraints (manpower, coordination, conflicts, etc.) towards effective CRM and recommendation of areas for improvement;
3. Development of administrative procedures for interagency coordination pertaining to the effective enforcement of the CRM plan; and
4. Identification, formulation and development of effective legal, institutional and administrative procedures needed for effective implementation of the CRM plan.

In conducting surveys, special efforts will be made to identify the capability of governmental and nongovernmental organizations in national resource management, especially with reference to manpower capability and facilities (e.g. oil spill combatment equipment), their constraints and potential for improvement. The survey will also identify the relevant institutional structures and organizations, procedures and regulations affecting development in the coastal areas at both local (village, district) and state levels (central government).

The task will recommend institutional functions with respect to public education programs and monitoring and evaluating of plan implementation.

*Duration:* 4 months, 1989

*Team Leader:* To be identified

*Team Members:* 1 Natural Resource Planner (Consultant) and 1 Town and Country Planner (Brunei Darussalam)

*Institution Involved:* To be identified

#### Division 500 - Habitat Enhancement

*Task Code 510-B:* Artificial reef development and monitoring

*Targets/Products:*

1. To assess the biological and economic contribution of the artificial (tire) reefs to coastal fisheries;
2. To assess the contribution of offshore oil rigs to coastal fisheries;
3. To compare the fisheries potential of the artificial (tire) reef area with a bare sand area similar to the one in which the tire reefs have been built;
4. To determine new areas suitable for the building of artificial structures to enhance coastal fisheries; and
5. To develop monitoring mechanism to ensure sustainability of the new habitat resources.

*Task Description/Methodology:* Visual underwater census of both fish diversity, size and abundance will be carried out at four randomly selected oil rigs at intervals of three months over a period of one year. A similar census will be carried out in the artificial tire reefs at Two Fathom Rocks. A comparison will be made of fish caught in five fish traps of a standard size placed in the area of the tire reefs with the fish caught in a similar number of fish traps placed in a sandy area, similar to that where the tire reefs are built. Fish trapping will be carried out for one week, every two months, in one year.

A survey will also be carried out in Abana Rock, Brunei Patches, Victoria Patches and other similar shallow areas (depth less than 20 m) to determine their suitability as sites for artificial reef building.

A valuation will be undertaken to assess the socioeconomic contribution of the artificial habitats to coastal fisheries and their potential impacts on fisheries development in the country.

Regular monitoring of the reefs will be needed. The task will attempt to develop monitoring procedures that can be adopted by the implementing agency to ensure long-term benefits of the artificial habitats to the fishermen and the coastal inhabitants.

*Duration:* 18 months, 1988/89

*Team Leader:* Dr. M.W.R.N. de Silva. DOF

*Team Members:* 1 Coral Reef Expert; 1 Fishery Biologist; 1 Fishery Technician (trained in underwater visual census technique); and 2 Divers

*Institutions Involved:* DOF, Petroleum Unit and Brunei Shell Company, Ltd.

#### Division 600 - Resource Management Plan Formulation

*Task Code 610-B:* Guidelines/policies for CRM in Brunei Darussalam

*Target/Product:* Establishment of guidelines/policies for CRM in Brunei Darussalam

*Task Description/Methodology:* The main focus of this task is to thoroughly review existing policies or guidelines (if any) governing coastal resources exploitation and utilization; to analyze and synthesize information

gathered by various tasks; and finally, to recommend new or revised policies/guidelines for coastal management to strengthen present national efforts in ensuring rational utilization of renewable coastal resources on an environmentally sustainable basis.

The main activities of this task will be:

1. To review existing government policies and guidelines governing coastal resources utilization and exploitation with special reference to policies regulating exploitation and utilization of fisheries resources, mangroves, sand resource, as well as policies on wildlife conservation and marine reserves; and
2. To analyze and synthesize information generated under various tasks to develop appropriate policies (new or revised) for adoption by the government for CRM.

Correlation of the sociopolitical economic framework for management with those of legal and institutional frameworks for specific plan application is essential. The set of policies developed under this task should reflect the political will for the rational management of the renewable resources.

*Duration:* 6 months, 1988

*Team Leader:* To be identified

*Team Members:* 1 Resource Planner (Consultant); 1 Ecologist (National Coordinator); 1 Economist (Department of Town and Country Planning); and 1 Sociologist (University of Brunei Darussalam)

*Institutions Involved:* DOE, Town and Country Planning Department, University of Brunei Darussalam and ICLARM

*Task Code 620-B:* Formulation of action plans for issue areas

*Targets/Products:* A series of action-oriented management plans on: mangrove habitat, water quality maintenance, aquaculture development, sand mining, land use zonation, coastal erosion, inshore fisheries and recreational beaches

*Task Description/Methodology:* The main emphasis of this task is to formulate action plans to address present and potential issues identified by the coastal profile, taking into consideration the integrative multisectoral aspects of various activities. The action plans intend to resolve present and future resource use through appropriate management measures and habitat enhancement procedures.

*Duration:* 24 months, 1988-1989

*Team Leader:* To be identified

*Team:* As in Task 610-B

*Institution Involved:* As in Task 610-B

*Task Code 630-B:* Formulation of management plans for marine protected area (MPA)

*Targets/Products:* MPA management plans

*Task Description/Methodology:* The coastal profile has identified certain marine areas in Brunei Darussalam that should be conserved. These are being investigated by various tasks of Division 200. This task focuses on the final selection of appropriate areas that can be declared marine and to which sound management plans can be developed.

The main activities will include the: (1) selection of appropriate areas as marine reserves; (2) evaluation and improvement of existing or proposed management plans (if any); (3) formulation of MPA management plans; and (4) making suggestions on means for implementing various plans and recommending institutional structures and legal changes, if necessary.

*Duration:* 12 months, 1989  
*Team Leader:* To be identified  
*Team:* As in Tasks 610-B and 620-B  
*Institution Involved:* As in Task 610-B

*Task Code 640-B:* Formulation of coastal area management (CAM) plans  
*Target/Product:* CAM plans for Brunei Darussalam  
*Task Description/Methodology:* This task is aimed at integrating various issue-oriented management schemes, MPA management schemes, other relevant government policies and an institutional/legal framework into a single CAM plan.

The task will require a two-step approach: (1) establishment of a CRM framework and (2) strengthening of this framework to include all specific details into an overall CAM plan.

*Duration:* 12 months, 1989  
*Team Leader:* To be identified  
*Institution Involved:* As in Task 610-B

*Task Code 650-B:* CRM System  
*Target/Product:* To develop a coastal renewable resource management system for coastal area planning in Brunei Darussalam  
*Task Description/Methodology:* The main activity of this task is to integrate various auxiliary data collected by the other tasks with digital remote sensing data (landsat, spot aerial photographs) into a spatially referenced information system made possible through the application of GIS software. The task shall analyze the impact of river basin land use on the coastal environment. Various geographical information systems such as land use, topography, soil, river basin and others are inputs or overlays; and analysis is done on the impact of land use on the coast.

The task will concentrate on applying GIS for coastal resource planning and management which requires modifications and improvement of methodologies originally developed for land-based activities.

*Duration:* 24 months, 1988-1989  
*Team Leader:* To be identified  
*Team Members:* 1 GIS expert and 1 Local Counterpart  
*Institution Involved:* To be identified

#### Division 700 - Implementation

*Task Code 710-B:* Seminars/meetings/policy workshops on CAM plan  
*Target:* Adoption and incorporation of CAM plan into the government's five-year economic development plan

*Task Description/Methodology:* While the proposed CAM plans may be adopted at the NSC level, it is pertinent to ensure that they receive the full support and endorsement of the policymakers. To achieve this objective, the task will: (1) organize two seminars/policy workshops at the levels of department directors and senior government officers; and (2) organize meetings with community leaders affected by plan implementation.

Each meeting/workshop will be of one-day duration.

*Duration:* 12 months, 1989  
*Team Leader:* Dr. M.W.R.N. de Silva, DCF  
*Institution Involved:* DOF

## Division 800 - In-Country Project Management

*Task Code 810-B: Operation and coordination*

*Target/Product:* To provide operational support to task implementation and intertask coordination.

*Task Description/Methodology:* The coordinating agency serves as the focal point for intertask coordination and oversees the implementation of each task activity in accordance to the workplan. National input is in terms of manpower support and office and laboratory facilities. The coordinating agency then appoints one of its staff as the National Coordinator of the in-country project.

*Duration:* 1986-1989

*Team Leader:* Awang Matdanan bin Haji Jaafar

*Team Members:* 1 National Coordinator and 1 Technical Assistant

*Institution Involved:* DOF

## INDONESIA

Chairman, NSC	: Dr. Purwito Martosubroto
National Coordinator	: Mr. Dikdik Sodikin (1986-1987) Mr. Ben B. Abdul Malik (1988-1989)
Coordinating Agency	: Indonesian Institute of Science (LIPI)
Cooperating Agencies	: Directorate General of Fisheries, (main implementing agency), Research Institute for Marine Fisheries, Centre for Oceanological Research and Development, Centre for Agro-Economic Research, University of Indonesia, Bogor Agricultural University, Office of State Ministry of Demography and Life Environment, Indonesian Institute of Sciences (LIPI)
Project Site	: Segara Anakan, Cilacap, Java (Fig. 11)

Segara Anakan, Cilacap is part of the southern plain in the Central Java province, which to the west is bordered by the southern part of West Java Province and to the east by the District of Kebumen of Central Java Province. Cilacap-Segaran Anakan is endowed with abundant natural resources. The mangrove forest covers about 24,000 ha and constitutes the most extensive mangrove area in Java.

The Segara Anakan Lagoon is influenced by various rivers which end in it. The largest river is Citanduy which originates in West Java Province. The lagoon and its tributaries support various fisheries resources upon which many fishermen depend. The surrounding mangrove ecosystem plays an important role in enriching the productivity of the waters and is thus important for the fisheries.

Cilacap also has a natural harbor for ships in the mouth of Donan River and is the only gateway to the south coast of Java. Sand (quartz) mining is also important in Cilacap although this has been declining recently.

However, high rates of sedimentation from the rivers have been noted in the Segara Anakan Lagoon. This has raised the concern of the government on how to proceed with development in the area. Efforts to eliminate flooding that usually occurs during the rainy season and causes problems in the agriculture sector have been largely unsuccessful.

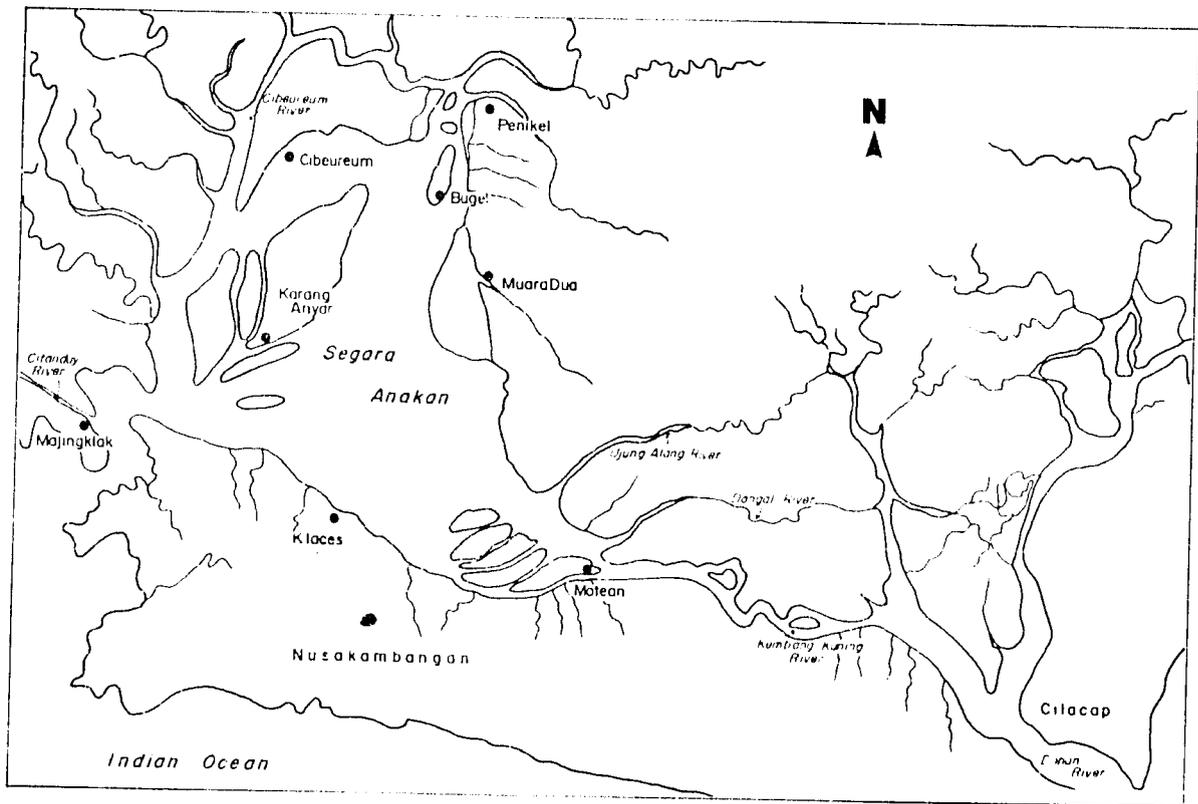


Fig. 11. Segara Anakan, Cilacap, Java, Indonesia.

Land use in the Segara Anakan is also changing. Some mangrove areas have been connected to the paddy fields, especially where silt accretion is occurring. The area of Segara Anakan has invited many studies. The question, however, remains: whether the area should be left as it is or be converted to other uses. The government of Cilacap District needs comprehensive information on the area so that development/conservation questions can be answered.

Management planning for the use of coastal resources (mangroves, fisheries, coastal forest, water, etc.) on a sustainable basis using an interdisciplinary integrated approach is, therefore, very pertinent and urgent for the Cilacap area. The overuse of fisheries and mangroves in combination with plans for alternative uses of the area by the government and private organizations requires the development of a comprehensive and multisectoral CRM strategy to ensure sustainable use.

#### General Program Framework

**Goals.** The goals of the CRM plan are to ensure sustainable development of the resources while upgrading the income of the population.

**Objectives.** The objectives of the plan are:

1. To develop and manage on a sustainable basis underutilized resources;
2. To provide better protection and management of nursery grounds for offshore and inshore fisheries resources; and
3. To improve coordination among national and local institutions involved in management planning and implementation.

## In-country Research Projects

### Division 100 - Baseline Information

*Task Code 110-I:* Preparation of an environmental profile for Cilacap-Segara Anakan

*Targets/Products:*

1. To collect and analyze available secondary sources of information relevant to the CRM of Cilacap;
2. To compile the above information together with supplementary sources into a comprehensive coastal environmental profile of Cilacap-Segara Anakan;
3. To identify information gaps and management issues;
4. To present the results of the profile analysis in a national workshop; and
5. To publish the completed profile documents.

*Task Description/Methodology:* The profile preparation consists of information collection, synthesis and analysis where periodic reviews will be built into the process to ensure data accuracy and objectivity. The profile is expected to provide the current status of the Cilacap coastal area and its resource management aspects.

Information will mainly be collected from published and unpublished sources, interviews with scientists who have conducted research in the area and with managers and officers of institutions engaged in CAM. Governmental and nongovernmental organizations involved in coastal area management are also important sources of information.

*Duration:* 5 months, 1986

*Team Leader:* Mr. Tatang Sujastani (Principal Investigator)

*Institution Involved:* Directorate General of Fisheries

### Division 200 - Biogeographical Studies

*Task Code 210-I:* Assessment of mangrove degradation and zoning for development

*Objective:* Development of a coastal forest/mangrove resources management plan to promote optimal use, proper zonation and protection of the resources

*Targets/Product:*

1. Working maps of the area showing extent, status and uses of the mangroves;
2. Criteria for qualifying mangrove conditions, i.e., undisturbed, disturbed and damaged with specific limitations for determining these conditions;
3. Zonation scheme based on above categories;
4. A review of current forest uses and extent;
5. Recommendations for protection of critical habitat areas;
6. Recommendations for sustainable use of noncritical areas;
7. Evaluation of the direct economic contribution of forest resources in terms of timber uses, ecological nutrient inputs and other contributions; and
8. Proposal of a practical means of implementing the proposed scheme.

*Task Description/Methodology:* The main activity of Task 210-I consists of mapping the mangrove resources of Segara Anakan according to certain categories. Two complementary phases are considered appropriate for the study,

viz., the synthesis of existing information and field observation. In defining the mangrove category, certain criteria are adopted.

The first phase concerns the synthesis of available information which includes, among others, aerial photos, maps, charts, satellite imagery, etc. These are important to the study of the past and present conditions of the resource.

The second phase is primary data collection. Taking into account the large extent of the Segara Anakan mangrove, the mapping process will take place systematically from one locality to the next. For this reason, the study area will be divided into 14 study units. Each study unit will work during the 10-day monthly fieldwork. As such, the fieldwork for the whole Segara Anakan mangrove will spread over a 14-month period.

Three categories of mangrove quality will be applied: undisturbed, disturbed and damaged.

For mangrove land converted to other uses, a different classification system is adopted: agriculture, brackishwater fishpond and human settlement.

Mapping is to be done by using theodolite and plane table. To obtain more detailed information on the flora and fauna of the study area, samples are to be collected by establishing transects at each specific community type.

*Duration:* 24 months, 1987-1988

*Team Leader:* Dr. Subagjo Soemodihardjo (Principal Investigator)

*Institution Involved:* Center for Oceanological Research and Development

*Task Code 220-1:* Analysis of water quality of Segara Anakan

*Objectives:* To provide up-to-date data on water quality and to identify any trend of water quality changes resulting from industrial development with implications for fisheries, mangroves or other management considerations

*Targets/Products:*

1. To establish a monitoring system of important water quality parameters for long-term management;
2. To establish the relative water quality in the lagoon compared to accepted standards;
3. To set acceptable levels of water quality for different uses and areas;
4. To identify the most polluted or high-risk areas on maps;
5. To determine the sources of any pollution source;
6. To design mitigating measures for pollution sites and sources on both a general and a site-by-site base; and
7. To design a comprehensive water quality management plan for the study area.

*Task Description/Methodology:* In this study, water quality is determined by measuring certain chemical and microbiological parameters of the lagoon and some tributaries at 10 stations; 6 stations are located in the lagoon. A fixed station for a 24-hour observation is chosen at one of the stations to study the diurnal fluctuation of sulfate content, dissolved oxygen and pH of the water of the lagoon. For all these purposes, samples of seawater and rainwater are collected periodically every two months (for two years) from the lagoon and the tributaries at the above mentioned stations.

The parameters measured in this study are sulfate, phosphate, salinity, nitrate, silicate, dissolved oxygen, pH, temperature, hydrocarbon, pesticide and heavy metals. Microbial parameters consist of heterotrophic bacteria, halotolerant bacteria and fecal used for different parameters.

*Duration:* 2 years, 1987-1988

*Team Leader:* Dr. Kasijan Romimohtarto (Principal Investigator)

*Institutions Involved:* Centre for Oceanological Research and Development and Indonesian Institute of Sciences

*Task Code 230-I:* Dynamics of water movement and sedimentation patterns

*Objective:* To plot the general water movement and sedimentation patterns of the lagoon area on maps useful for present and future management with relevance for a comprehensive management scheme

*Targets/Products:*

1. Interpretation of all existing data on water movement and sedimentation;
2. Maps showing main water flow patterns, sediment movement and land accretion;
3. Simple models showing water flow budgets in and out of the lagoon;
4. Recommendations on how to minimize detrimental changes resulting from sedimentation and/or pollution; and
5. Predictions on the continued physical changes in the lagoon area and depth.

*Task Description/Methodology:* The study is aimed at providing information on the status and extent of physical processes which characterize the dynamics of the region. This information is needed as baseline for the development of a guideline plan for the resource management of the area and will be useful in evaluating the sources of stress on the coastal ecosystem. Understanding the dynamics of the lagoon is important in the development of aquaculture and capture fisheries; provision of information on the extent of water quality degradation in the lagoon due to the industrial and harbor activities in Cilacap, which will serve as basis for studying sedimentation processes.

The characteristics of the area will be studied by measuring the sea level elevation continuously for 29 days with a self-recording tide gauge. A description of water circulation patterns in the estuarine part of the main rivers connected to the lagoon will be done by making a series of field measurement of current salinity and temperature. Water circulation in the Segara Anakan Lagoon is different from the estuarine part. Accordingly, the location for field measurement will be chosen in such a way that the part of the lagoon close to the opening of the sea will be represented.

*Duration:* 24 months, 1988-1989

*Team Leader:* Dr. Mulia Purba (Principal Investigator)

*Institution Involved:* Bogor Agricultural University

*Task Code 240-I:* Fisheries

*Subtask Code 241-I:* Capture/offshore fisheries assessment

*Objectives:* To assess the fish and shrimp stocks in the offshore waters to determine exploitation potential and fisheries management strategies; and to determine the link between Segara Anakan Lagoon and the offshore stocks.

*Targets/Products:*

1. To assess and to monitor coastal offshore marine and estuarine fish and prawn and shellfish stocks;
2. To gather data on the movement of larvae between offshore and lagoon and vice-versa;
3. To gather data on the catch per unit effort (CPUE) for the different fishing gears;
4. To obtain levels of the maximum sustainable yield (MSY) for important stocks;
5. To set guidelines for management at MSY by gear/effort regulations or other means;

6. To indicate a practical means of implementation; and
7. To isolate critical areas/habitats which support the important stocks in at least part of their life cycle.

*Subtask Description/Methodology:* The study is divided into two main activities:

1. Study of Segara Anakan's role as nursery ground and its surrounding mangrove ecosystem as shrimp nursery ground. This will be done:
  - a. By collecting the incoming larval sample from the east and west entrances during the high tide; and
  - b. By collecting the outcoming juveniles and adolescent shrimp from the chosen stations in the lagoon and mangrove tidal creeks during the ebb tide.
2. Offshore fisheries stock assessment and biological studies. These aim to provide information on:
  - a. The magnitude of the offshore shrimp and fishstock and level of its exploitation by studying the catch-and-effort and length-frequency data;
  - b. The life cycle and spawning season and grounds of some important shrimp and fish species by studying the length-frequency data and gonadal maturity; and
  - c. The important biological parameters: life span, growth rate, mortality rate, recruitment pattern, gear selection/retention by studying length-frequency data and gonadal maturity.

The catch-and-effort data will be collected on board research or commercial fishing vessels and at the fish landings. Length-frequency and gonadal maturity data samples will be collected on a monthly basis for 24 months.

The data on gonadal maturity will be analyzed by using Cummings (1961) and Tuma (1967) methods. Gonadal development is divided into five phases: undeveloped, developing, early maturity/nearly ripe, ripe and spent.

*Duration:* 2 years, 1987-1988

*Subtask Leader:* Dr. Nurzali Naamin (Principal Investigator)

*Institution Involved:* Research Institute for Marine Fisheries

*Subtask Code 242-1:* Lagoon and culture fisheries

*Objective:* To determine the present status of Segara Anakan fisheries for sustainable management as well as the availability of seed, spawners and spat (by time and space), land suitability and soil capability as a basis for sustainable and appropriate aquaculture development.

*Targets/Products:*

1. To assess and to monitor the marine and estuarine fish and shrimp stock of the lagoon;
2. To gather data on the CPUE for different gears;
3. To describe possible impacts of different gears;
4. To obtain levels of MSY for lagoon fish and shrimp stocks;
5. To set guidelines for management regulations based on MSY by gear/effort/area;
6. To indicate a practical means of implementation;
7. To determine critical areas/habitats;
8. To determine feasibility for aquaculture either on land or in the lagoon; and
9. To monitor pilot aquaculture sites.

*Subtask Description/Methodology:* Factors which need to be considered to establish culture fisheries are: location suitability, soil capability, water

quality and characteristics, seed abundance and distribution and biological aspect of species to be cultured.

To obtain information on these, Subtask 242-I will conduct three studies on the:

1. Present status of capture fisheries in the Segara-Anakan lagoon;
2. Seed and spawners availability; and
3. Land and water quality/characteristics.

*Duration:* 2 years, 1987-1988

*Subtask Leader:* Subhat Nurhakim (Principal Investigator)

*Institution Involved:* Research Institute for Marine Fisheries

#### Division 300 - Socioeconomic Studies

Project activities under Division 300 will be carried out in four phases covering Tasks 310-350:

Phase I: A baseline survey will be conducted to identify and make an inventory of the characteristics of the coast's economic potential; human resource asset ownership; traditional fishing right system; types of production systems; aspiration of resource users; kinds, prospects and problems of income-generating opportunities (IGO) for fishing and nonfishing.

Phase II: More surveys based on the results of the baseline survey will be made. The dominant variable will be analyzed such as IGO and its profitability, production system and a comparative study which will include an economic and financial analysis to select models for suggested appropriate/alternative technology.

Phase III: packet models will be developed and test-formulated as hypothetical models to examine relationship patterns between socioeconomic parameters and other components of the coastal resource system.

Phase IV: The adequacy of the packet model developed in Phase III will be monitored.

The study will rely on secondary data and literature study. The multiple regression model analysis will be used to analyze the functional relationship between socioeconomic-biotechnic and environmental parameters.

*Team Leader:* Drs. Budihardjo (Principal Investigator)

*Institutions Involved:* Center for Agro-Economics Research/AARD, Socio-Economic Division and Research Institute for Marine Fisheries

*Task Code 310-1:* Socioeconomic data collection, synthesis and analysis

*Targets/Products:*

1. Compilation of all existing socioeconomic data on the Cilacap-Segara Anakan Lagoon area;
2. New data on traditional income, livelihoods, alternative income, social arrangements demography, aspirations of resource uses and traditional and modern organization in Kampung Laut;
3. Analysis of all data as basis for Tasks 320 and 330 and for social and economic planning as part of CRM

*Task Description/Methodology:* This task has two components: (1) synthesis of existing data and (2) field surveys to update data on socioeconomic status of the Kampung Laut community. The latter will be accomplished by conducting one complete survey using random sample in all villages to undertake the (1) inventory of productive and nonproductive asset ownership pattern and (2) identification of IGO.

The targets and products of these studies are the:

1. Characteristics and economic potential of the Cilacap region's coastal zone and the Segara Anakan Lagoon;
2. Estate, trend and projections of human resources, migration patterns, settlement and others of the coastal zone;
3. State of asset ownership between the fishing and the nonfishing households;
4. Kinds of IGO in the coastal village, especially during off season;
5. IGO for women and children.

*Task Code 320-I:* Identification of and feasibility for alternative income sources

*Targets/Products:*

1. Data on existing alternative income sources;
2. Profitability of all income sources;
3. Suggestions on new alternative sources of income; and
4. Cost-benefit analysis of all possible sources of income in relation to resource base.

*Task Description/Methodology:* This task will determine the feasibility and profitability in a personal and resource-wise sense of different income sources. This will be accomplished by documenting the existing alternative sources of income and analyzing their relative value in contrast to traditional livelihoods. The task will also explore new possibilities and design a scheme to implement these alternatives.

*Task Code 330-I:* Analysis of existing fish production system and traditional fishing rights for application to CRM plan

*Targets/Products:*

1. Data on current fish farming, cage culture and other natural resource-based production systems in terms of productivity and profitability;
2. Recommendation for technical improvements of current production systems;
3. Analysis of traditional fishing rights system in relation to a modern CRM plan for fishing resources;
4. An overall development plan which incorporates improved marine resource-based farming, traditional fishing rights and the social and economic needs of local residents.

*Task Description/Methodology:* This task will focus on existing marine resource-based production systems and possible new alternatives as basis of income. The technical quality of fish ponds, cage culture, seaweed farming, fish trap arrangements and others will be analyzed in relation to benefits to the communities. The traditional fishing rights will also be considered as an integral part of a management plan. The task will examine existing farming and production activities and develop appropriate technology.

Both undertakings will produce these targets and products:

1. Type and current state of production system and level of technology in the coastal zone;
2. Farming system research methodology for the development of appropriate technology; and
3. Selected appropriate technology.

*Task Code 340-I:* Strengthening traditional fishing right system

*Targets/Products:*

1. To present the state of traditional fishing right system in the Segara Anakan Lagoon;

2. To identify the problems arising from common property resources (conflict of interest, friction to commercial fishing, etc.); and
3. To come up with a model regulation and the possibility of its development for Indonesian fisheries management.

*Task Code 350-I:* Aspiration of resource users to find out geographical and occupational mobility and perception

*Targets/Products:*

1. Identification of aspiration and motivation of resource users;
2. Development of a model to encourage fish-based transmigration; and
3. Changing the perceptions of resource users to better appreciate the sustainability of the resources system.

Division 400 - Social, Legal and Institutional Studies

*Task Code 410-I:* Cultural survey on environmental CRM awareness in Cilacap-Segara Anakan

*Objectives:*

1. To quantify the level of resource use/environmental awareness for planning educational programs and to stimulate local participation in planning
2. To obtain description and better insight of:
  - a. the participation of communities (individually or collectively) in environment conservation and development in Segara Anakan-Cilacap, Central Java and
  - b. the role of public officers in conserving and developing Segara Anakan's environment

*Targets/Products:*

1. To establish a baseline on environmental/CRM awareness and knowledge; and
2. To formulate educational programs to increase awareness as necessary for CRM planning and participation.

*Task Description/Methodology:* The study will focus on the identification of public perception and attitudes on environmental conservation and resource utilization; effective mechanisms to create environment awareness among the sectors of communities and the effects of isolation on acceptability to development changes.

*Duration:* 2 years, 1988-1989

*Team Leader:* Prof. Dr. Soerjono Soekanto, SH (Principal Investigator)

*Institution Involved:* University of Indonesia

*Task Code 420-I:* Evaluation of perception and attitudes of public officers pertaining to environmental policy/CRM implementation

*Objective:* To quantify and to qualify the perceptions and attitude of public officials at the local and provincial levels regarding CRM with relevance to improving official performance and cooperation for CRM planning and implementation.

*Targets/Products:*

1. Data from interview of all important or key public officials affecting the CRM planning and implementation;
2. Knowledge, attitudes, awareness and problems as seen by officials;
3. Data on perceptions of officials on how to improve the situation; and
4. Recommendations on how to increase awareness and cooperation among government agencies and officials.

*Task Description/Methodology:* The study will try to identify a CRM plan which will implement strategies and factors which cause communication gaps among the public sector in the execution of an environment plan.

*Duration:* 2 years, 1988-1989

*Team Leader:* Agus Brotosusilo, SH (Principal Investigator)

*Institution Involved:* University of Indonesia

*Task Code 430-I:* Institutional requirements for Cilacap with respect to CRM planning and implementation

*Objective:* To strengthen the legal and institutional capabilities of the governments of Cilacap and Indonesia to develop and implement a CRM plan for sustainable use of local resources and to develop alternative livelihoods

*Targets/Products:*

1. To identify the legal and institutional constraints towards effective CRM and to recommend necessary revisions and necessary regulations and procedures;
2. To formulate and develop administrative procedures for interagency coordinations;
3. To improve and develop interagency programs for effective enforcement;
4. To develop planning guidelines and standards or development project affecting coastal resources;
5. To develop systematic monitoring and evaluation programs;
6. To formulate education programs to create greater public awareness of CRM;
7. To make a summary compilation of the legal and institutional regimes and a report characterizing all the government and nongovernmental entities, their legal mandates and resources available;
8. To form a working committee at the site level to begin project management; and
9. To determine institutional needs to increase livelihood option.

*Task Description/Methodology:* A detailed survey of the existing legal and institutional authorities and the various arrangements (legal or otherwise) pertaining to coastal resource ownership and use rights in the Cilicap-Segara Anakan study area. Photocopies will be made of appropriate legislative acts relevant to the subject for appending to the report. A review of previous studies in the Cilicap-Segara Anakan region will be made and a computerized data base and source reference file will be assembled. Government and nongovernmental institutions and organizations will also be contacted and interviewed.

The second part of the task will be to recommend revisions to institutional and legal structures and procedures; to formulate regulation procedures and guidelines; to develop systematic monitoring and evaluation programs; and to recommend the introduction of education programs into the institutional functions. These will follow after the constraints have been identified.

*Duration:* 2 years, 1988-1989

*Team Leader:* Zen Oemar Purba, SH (Principal Investigator)

*Institution Involved:* University of Indonesia

Division 600 - Resource Management Plan Formulation

*Task Code 610-I:* Guidelines/policies for CRM in Cilacap-Segara Anakan

*Targets/Products:*

1. To form a working committee to review policies and plans;
2. To review recommended policies and guidelines from the coastal resources profile and from primary data of Divisions 200-400;
3. To organize all information relevant for management policies and planning in Cilacap;
4. To complete analysis from the results of other task groups on: (a) fisheries and mangroves; (b) pollution and water quality, in general; (c) watershed management vs. water quality; (d) land use and impacts on coastal resources; (e) cost-benefit analysis for alternative uses of the various coastal resources in relation to sustainable management; (f) correlation of socio-political-economic framework for management with that of legal-institutional for specific plan application; and
5. To conduct regular meetings and small workshops to achieve the above.

*Task Description:* This task will complete a conceptual framework for the management plan to provide a channel for baseline data; and will provide feedback on how appropriate the baseline data are.

*Methodology:*

1. Formation of a planning committee of PIs, NSC and other staff (criteria for selection are knowledge, interest and availability);
2. Conduct of monthly half-day and informal meetings; and
3. Holding of a small workshop in early 1988 to finalize the conceptual framework.

*Duration:* 9 months, 1987/88

*Team Leader:* Dr. Purwito Martosubroto

*Team Members:* NSC Members, PIs and other CRM staff

*Institution Involved:* To be identified

*Subtask Code 611-I:* Formulation of action plans for issue areas and important coastal resources

*Targets/Products:*

1. Series of action-oriented management plans;
2. Coordination of all data from task groups and the profile to achieve action-oriented plans;
3. Coordination with all agencies and individuals of significance to specific plans during the planning process.

*Task Description/Methodology:* As the continuation of Task 610 (conceptual framework formulation) and based on the results of Divisions 100, 200, 300 and 400, an issue-oriented management plan for Segara Anakan-Cilicap will be developed from the following inputs and process:

1. The final conceptual framework for CRM planning;
2. Summaries of all task project findings with relevance to the management plan;
3. Final identification of issues, causes and management strategies to solve the various problems;
4. Overall management objectives and goal;
5. Action plans which include:
  - a. Background of issue (from CRM profile and primary data);
  - b. Background of overall CRMP in relation to specific issues;
  - c. Scope of plan/issue area;
  - d. Institutions involved;
  - e. Detailed description of issue and sub-issues with causes of each;
  - f. List of actions/management strategies necessary to solve each issue or sub-issue;

- g. Means of implementing each solution (e.g., institutions, agencies, laws, personnel budget and time frame, etc.);
- h. Summary of issues and actions; and
- i. References

Periodic meetings, review and consultation with the appropriate national and local agencies and individuals will be used to draft and approve a series of action plans for the project site.

The project will have three stages: formulation, review and finalization of the draft management plans.

*Duration:* 24 months, 1988/89

*Team Leader:* Dr. Purwito Martosubroto

*Team Members:* IRC Members, PIs, Consultants, Resource Persons, Editor, Illustrator and Support Staff

*Institution Involved:* To be identified

*Subtask Code 612-1:* Formulation of management plans for marine protected areas (MPAs)

*Targets/Products:*

1. To select MPAs from recommendations of various tasks and the Department of Forestry;
2. To improve existing MPA management plans;
3. To formulate new MPA management plans; and
4. To recommend means for implementing various plans and to suggest institutional structure and legal changes.

*Subtask Description/Methodology:* To be developed

*Duration:* 12 months, 1988

*Team Leader:* To be identified

*Institution Involved:* To be identified

*Subtask Code 613-1:* Formulation of an integrated CAM scheme for Cilacap-Segara Anakan

*Targets/Products:*

1. Flow charts showing linkages of all agencies and plans to accomplish integrated coordination of smaller area, issue-oriented and MPA plans;
2. Complete maps of Cilacap-Segara Anakan and all site-specific management areas which are consistent in scale and complete with overlays to show important relationships and priorities of management;
3. Document which spells out how the various plans will be coordinated and implemented;
4. Working committee of dedicated persons representing appropriate agencies to coordinate plan finalization; and
5. Series of seminars to communicate the results of the planning process.

*Subtask Description/Methodology:* Fig. 12 shows how Task 610, 611, 612 and 613 will each separately provide specific plans which contribute to an integrated scheme.

*Duration:* 24 months, 1988/89

*Team Leader:* Dr. Purwito Martosubroto

*Institution Involved:* To be identified

Division 700 - Implementation Division

*Task Code 710-I:* Seminars/meetings at decisionmaker level

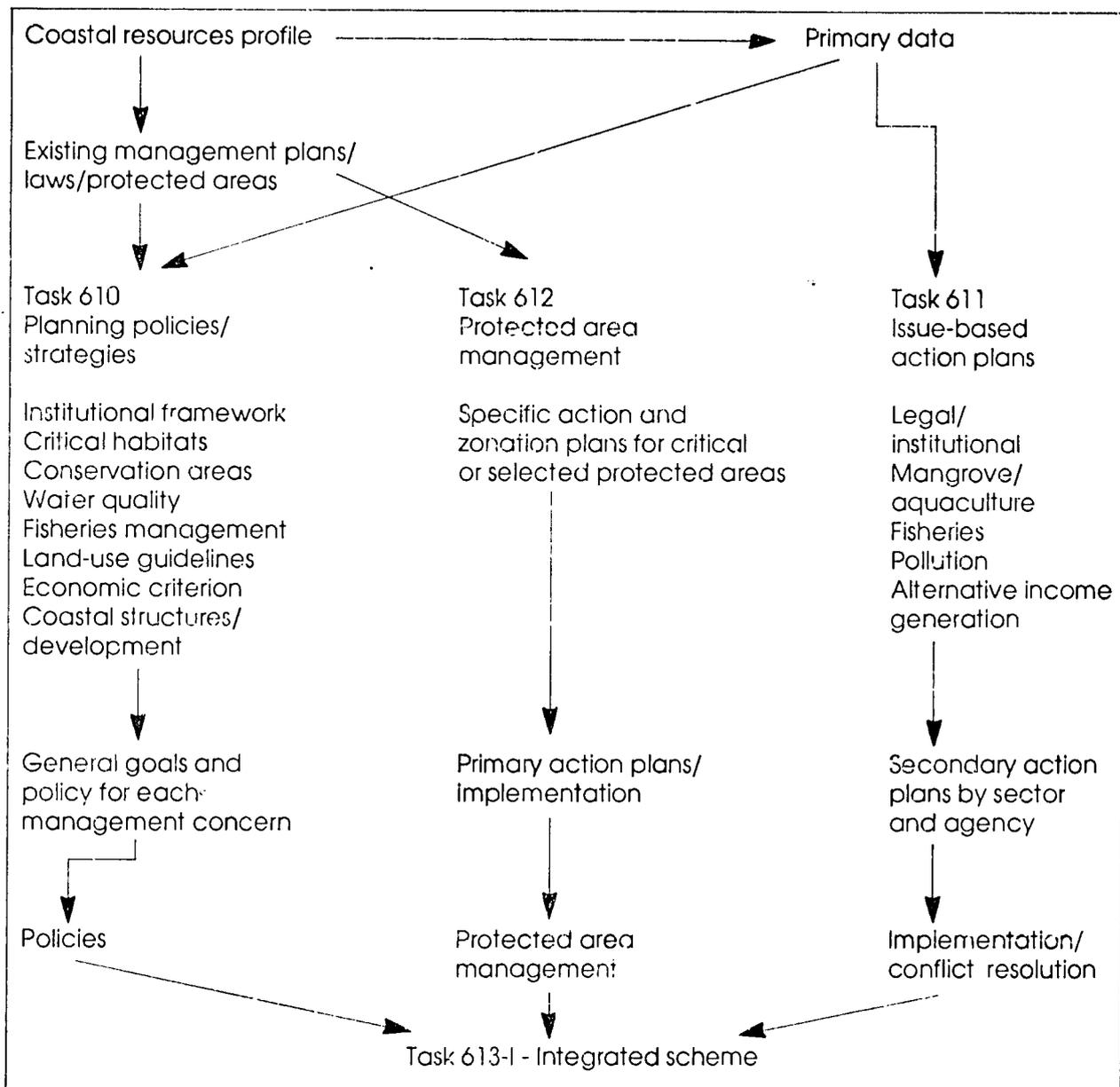


Fig. 12. An integrated CAM scheme.

*Task Description/Methodology:* While the proposed CAM plans may be adopted at the NSC level, it is pertinent to ensure that such plans receive the full support and endorsement of the policymakers. To achieve this objective, seminars/policy workshops and meetings on CAM will be conducted in 1989 to create awareness on the socioeconomic and biological significance of the coastal resources and the need to establish a legal/institutional framework for plan implementation.

The main activities of this task are to : (1) organize two seminars/policy workshops at the levels of department directors and senior government officers; and (2) organize meetings with community leaders affected by plan implementation.

Each meeting/workshop will be of one-day duration.

*Duration:* 3 months

*Team Leader:* Dr. Purwito Martosubroto

*Institutions Involved:* Fisheries Department and Cilacap agencies

#### Division 800 - In-Country Project Management

*Task Code 810-B:* Operation and coordination

*Target:* To provide operational support to task implementation and inter-task coordination

*Task Description/Methodology:* The coordinating agency serves as the focal point for intertask coordination and oversees the implementation of each task activity in accordance to the workplan. National input is in terms of manpower support and office and laboratory facilities. The coordinating agency then appoints one of its staff as the National Coordinator of the in-country project.

*Duration:* 1986-1989

*Team Leader:* Dr. Purwito Martosubroto

*Team Members:* 1 National Coordinator and 1 Technical Assistant

*Institution Involved:* Directorate General of Fisheries

#### MALAYSIA

Chairman, NSC and  
National Coordinator : Ms. Ch'ng Kim Looi  
Coordinating Agency : Ministry of Science, Technology and Environment  
Cooperating Agencies : Department of Fisheries (lead implementing agency); Ministry of Defence (Hydrography Section); Department of Agriculture; Department of Drainage and Irrigation; Department of Town and Country Planning; Coordinating and Implementing Unit of the Prime Minister Department; Department of Geology; Department of Survey and Mapping; Universiti Pertanian Malaysia; Universiti Kebangsaan Malaysia; Universiti Sains Malaysia and Economic Planning Unit of the Johore State Government

Project Site : South Johore, Peninsular Malaysia (Fig. 13)

South Johore is situated in the southern tip of Peninsular Malaysia. It has a unique geographical position, being bounded by the Straits of Malacca in the west, the South China Sea in the east; and the island of Singapore in the south.

The region is subject to resource use conflicts such as clearing of mangrove for aquaculture, human settlement, agriculture, forest harvesting, mining, coastal fisheries and industries. The eastern part of Johore has been earmarked for tourist development, and there are plans to develop the coastal islands into marine parks. The western part of Johore is subject to heavy traffic of ships, including oil tankers, the Straits of Malacca being one of the most heavily used international straits.

Management planning of the use of the coastal resources on a sustainable basis using an interdisciplinary integrated approach is, therefore, very pertinent and urgent for South Johore. The highly competitive use of coastal

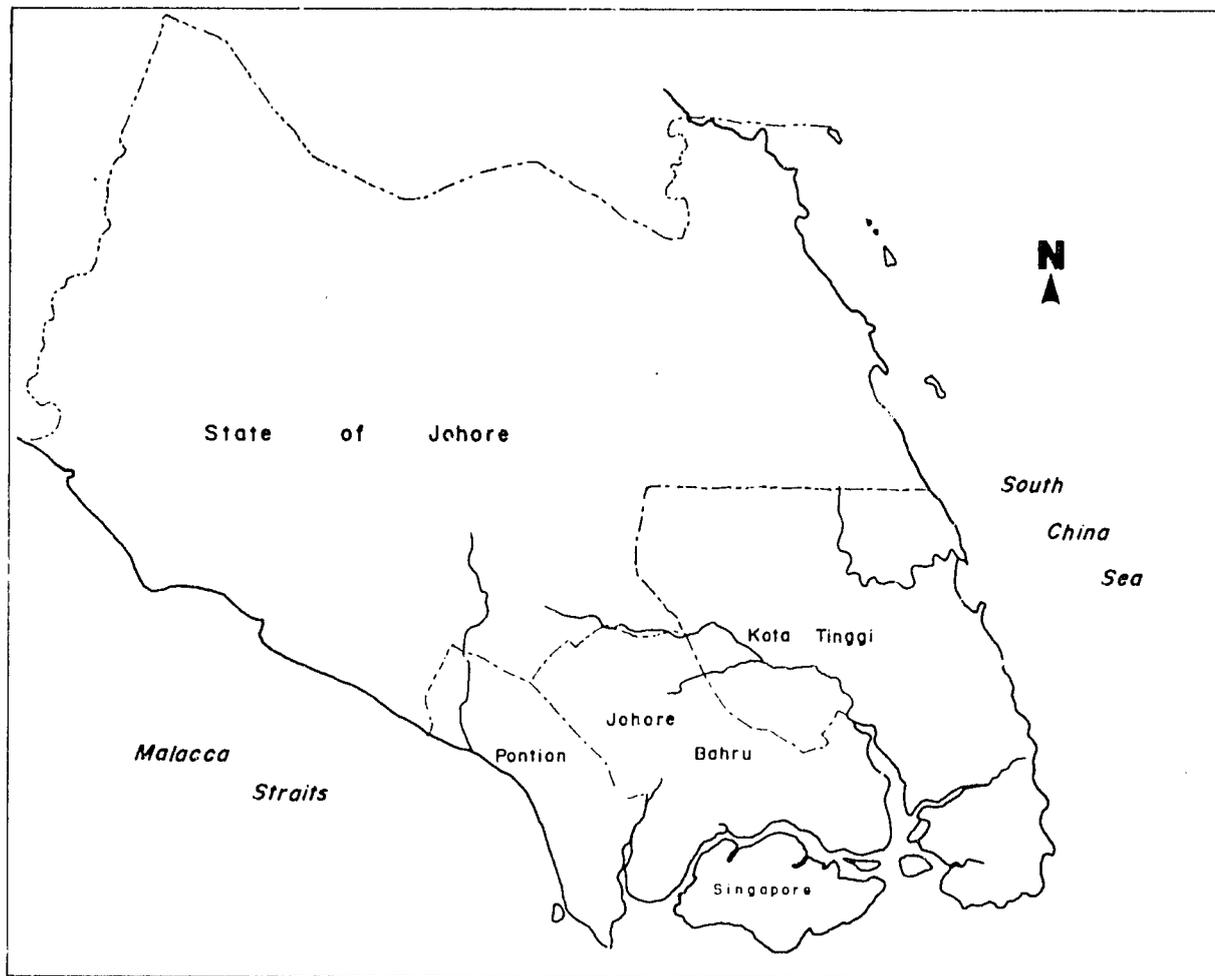


Fig. 13. South Johore, Peninsular Malaysia.

resources in South Johore and the State Government's interest in the development of tourism will require the development of a comprehensive and multisectoral natural resources management strategy to ensure the sustainable use of these coastal resources.

#### General Program Framework

**Goal.** The goal of the project is to develop a management plan, the implementation of which will help ensure that coastal resources of South Johore are utilized and developed on an environmentally sustainable basis.

**General Objectives.** The primary objectives of the project are to develop CRM strategies and to formulate a management plan for the utilization and development, on an economically and ecological sustainable basis, of the coastal resources of South Johore.

#### *Subobjectives:*

1. To document an existing body of information related to the present status of coastal ecosystems; and to define the biophysical characteristics of each system;
2. To assess the status of fisheries, mangrove, land-use, industry, aquaculture, coral reefs, water quality, urbanization and water resource development and coastal recreation and tourism;

3. To exemplify the existing biophysical relationship between economically important coastal fisheries and mangrove systems;
4. To develop viable management strategies which provide for the sustainable development and utilization of the mangrove system and coastal fish stocks;
5. To analyze the impact of present management and development plans for the area on the natural resources, and review and make recommendations;
6. To identify sociopolitical, legal and institutional problems and to develop institutional arrangements and linkages which will facilitate management of coastal resources on a sustained-yield basis;
7. To develop a site-specific comprehensive intersectoral management plan for resources management which embodies the concepts of sustained utilization of the coastal resources along with obtaining the greatest yield from the best multiple uses of the resources within a framework that plans for both long-term and multisectoral use; and
8. To plan for the implementation of the management plan in the pilot site in the Sixth Malaysian Plan starting in 1991.

*Rationale.* Development in Malaysia has been traditionally sectoral, and management is on the basis of economic units. In some cases, institutions have been developed to reinforce productivity and management of economic sectors. Examples of such are the Federal Land Development Authority (FELDA) and the Federal Land Consolidation and Rehabilitation Authority (FELCRA) for the sector, and the economic regions for the Johore Tenggara Development Authority (KEJORA). Management on the basis of economic units involves responsibility for a specific ecological resource and, thus, does not embrace responsibility of the entire ecological unit. For example, responsibility for managing fish resources lies with the Department of Fisheries which, concurrently is not responsible for aquatic ecosystem, nonaquatic pollution or the mangrove systems. Effective management of ecological resources on the basis of economic units thus demand intersectoral communications and cooperation.

The sectoral units of management in the Malaysia coastal zone do not show a high level of interaction for effective CRM on a sound ecological basis. Most interactions appear unidirectional and not reciprocal. For example, the value of reclaimed mangrove swamps for growing coconuts and cocoa has been suggested by the drainage and irrigation sector, which, in the absence of an intersectoral forum, would conflict with forest and fisheries interests with mangrove swamps, thereby, leading to conflicting decisions and suboptimal management and degradation of rational resources. Hence, there is a need for integrated planning for resource development and utilization which embodies the concept of sustained utilization along with obtaining the greatest yield from the best multiple uses of the resources within a framework that plans for both long-term and multisectoral use in Malaysia.

It is hoped that this project will be a model to the Malaysian government, a model that will be extended to other coastal areas. It is also hoped that the implementation and management plan extension will be worked into the Sixth Malaysia Plan which begins in 1991.

#### In-country Research Projects

Division 100 - Baseline Information

*Task Code 110-M:* Preparation of an environmental profile of Johore State, Malaysia

*Targets/Products:*

1. To collect and analyze available secondary sources of information relevant to the coastal area of Johore State and its management;
2. To compile the above information together with the supplementary sources into a comprehensive coastal environmental profile of Johore State;
3. To identify information gaps and critical areas; and
4. To present the results of the profile analysis in a national workshop.

*Task Description/Methodology:* Each section of the profile will be assigned to a Universiti Kebangsaan Malaysia (UKM)-designated investigator selected for his qualifications to write the material. Drafts of the respective sections will be submitted, upon their completion, to the team leader for review and comment. On his judgment, drafts deemed ready for outside review will be forwarded to selected outside resource people for additional review, and, following the workshop, modifications to the profile, if needed, will be incorporated within two weeks of its conclusion. Five copies of the profile will be submitted to the NSC and to ICLARM, two copies and the computer text files.

*Duration:* November 1986-August 1987

*Team Leader:* Dr. Arbain Kadri (Principal Investigator)

*Institutions Involved:* Universiti Kebangsaan Malaysia and Universiti Malaya

## Division 200 - Biogeographical Studies

*Task Code 210-M:* Coastal forest management scheme

*Objectives:* Development of a coastal forest (including mangrove) resource management plan to promote optimal utilization, proper zonation and protection of the resources

*Targets/Products:*

1. To update the type, structure, composition and regeneration status of coastal forests in South Johore;
2. To identify and zone important coastal forest (mangrove, peat swamp and freshwater swamp ecosystems) areas appropriate for wildlife sanctuaries and protected areas;
3. To assess forest productivity in terms of production of logs, fuel-wood and construction materials in designated areas;
4. To review current forest harvesting techniques and to recommend sound silvicultural procedures for sustained yield timber production;
5. To evaluate the direct economic contribution of forest resources in terms of timber production and other forest products;
6. To develop a comprehensive zonation scheme and guidelines governing rational exploitation and utilization of the coastal forest; and
7. To propose practical means of implementing the proposed scheme.

*Task Description/Methodology:* The following approaches/methods will be adopted:

1. Analysis of aerial photographs and spot/landsat imageries to determine location, extent, forest types, stand density and status of coastal forests;
2. Analysis of existing development and management measures of coastal forest through critical analysis of secondary information and review of

existing Forest Development Management Plans of a related scheme of the State Government to identify its strength and weaknesses;

3. Field survey of selected sites in each of the major coastal forest reserves by establishing five random 20 x 20 m plots in each of the forest types in each study site; and

4. Zonation of the coastal forest and preparation of management and implementing guidelines will be prepared based on spot imageries, field surveys and available government development plans. The plan shall include maps of the Johore coast and specific areas with overlays showing all forest areas and relevant information on the current uses, status and potential management regimes.

The task will link up with the information collected on the economic value of alternative forest resources use under Task 310-M.

*Duration:* 10 months. 1988

*Team Leader:* Dr. Chan Hung Tuck (Principal Investigator)

*Team:* 3 scientists and 8 technicians

*Institution Involved:* Forest Research Institute Malaysia

*Task Code 220-M:* Water quality management scheme

*Targets/Products:*

1. To continue water quality monitoring by the Department of Environment;
2. To expand monitoring system;
3. To establish an operating data base on water quality for planning and control;
4. To set acceptable levels of water quality for different uses and areas;
5. To identify the most polluted or high-risk areas on a series of maps;
6. To design mitigating measures for pollution sites and sources on both a general and a site-by-site basis; and
7. To implement at least one pilot case each of pollution control in an industrial, agro-industry waste and oil spill situation

*Task Description/Methodology:*

Phase I. This phase will involve literature search to identify information gaps. Relevant reports and data will be gathered from government departments, research organizations and universities for review. All data of the Department of the Environment will be evaluated before additional data is collected.

Phase II. The sampling activities will consist of two types, land-based and nearshore. Since the Department of the Environment has already initiated the water quality monitoring of the inland rivers and coastal waters since 1978, the sampling activities will be planned in accordance with the findings from Phase I and carried out in coordination with the present monitoring activities undertaken by the Department of the Environment.

Phase III. A refined analysis of all previous and current data from Phases I and II will occur in Phase III. This analysis will include:

1. Review of the Department of Environment's past procedures and monitoring schemes;
2. Critical long-term information gaps which need action;
3. Setting of management guidelines using present information;
4. Mapping of all aquatic areas where pollution is present and setting priorities for management;
5. Formulating a water quality management scheme for at least one site of each important sector (i.e., oil, agro-industrial wastes, etc.) and

6. Following through on implementation at one or more pilot sites to test the management scheme in practice.

*Duration:* 18 months, 1988-1989

*Team Leader:* Dr. Lim Poh Eng (Principal Investigator)

*Institution Involved:* Universiti Sains Malaysia

*Task Code 230-M:* Geographical Information System (GIS) for CRM

*Targets/Products:*

1. To document cause-and-effect linkages which exist between inland uses and the coastal areas and to assess the impact of river basin use of the hinterland on the coastal zone environment;
2. To distinguish between natural and man-induced sources of coastal changes where possible;
3. To define the boundaries of the coastal and nearshore marine areas influenced by catchment processes for each catchment or watershed area on maps;
4. To identify the critical coastal and marine resources in each affected area on maps;
5. To identify the sources and upstream locations of harmful inputs entering the coastal areas;
6. To identify the conservation and management areas of the coastal zone which are both relatively unaffected by human activities in the hinterland and of ecological interest such as marshes, swamps, lagoons, embankments, etc., for the establishment of protected areas;
7. To suggest possible corrective actions and to discuss the potential coastal implication resulting from newly proposed upland basin development activities;
8. To suggest tolerable input levels required to maintain the coastal/marine resources and processes;
9. To establish systematic procedures to evaluate the implications of proposed development activities in the catchment area on the coast;
10. To recommend appropriate modifications to any development proposal which poses a threat to threshold limit of coastal resources; and
11. To produce a series of maps showing the main catchment areas and water flow systems; physical properties (characterization of soils and land forms); environment and biological assemblages; current land use; mineral and energy resources; active processes (including a delineation of zones of erosion and deposition); man-made features and water system; rainfall, stream discharges and surface salinity; and topography and bathymetry.

*Task Description/Methodology:* The study under Task 230-M will be carried out using a GIS approach. The data bases which will be established to meet the objectives of the study will also be useful for the general interpretation of the implication of the river basin use to the CRM planning exercise.

The task will carry out the following activities: (1) review of existing land use information; (2) delineation of river basins; (3) analysis of soil erodibility; (4) identification of point pollution sources; (5) analysis of river basin land use on the coastal environment; (6) identification of environmental geological units; and (7) identification of possible conservation areas.

*Duration:* 16 months, 1988-1989

*Team Leader:* Dr. Kam Suan Pheng (Principal Investigator)

*Institution Involved:* Universiti Sains Malaysia

*Task Code 240-M:* Assessment of coastal erosion

*Task Description/Methodology:* Many areas along the immediate coast of Johore are being developed. Structures are being constructed in some areas without proper consideration of the impact to coastal geomorphologic processes. The result is coastal erosion which affects water quality and the stability of coastal land forms such as beaches, cliffs, mudflats and, in turn, the associated ecosystems. This task will thus:

1. Make a general assessment of the strip of coastline vulnerable to erosional processes;
2. Determine specific causes of erosion in site-specific areas; and
3. Formulate management plans and contingencies on (a) present and future trends; (b) land use zoning so that development is compatible with erosion causes and prevention; (c) initiate a data collection and monitoring program; and (d) identify institutions for implementation of management guidelines and plans.

*Duration:* 12 months, 1988

*Team Leader:* Mr. Sieh Kok Chi (Principal Investigator)

*Institutions Involved:* Drainage and Irrigation Department, Department of Geological Sciences and Universiti Kebangsaan Malaysia

*Subtask Code 241-M*

*Objectives:* To document and update existing data on physiography waves, tides, current, sand wave movement, storm surge, coastal process, coastal formation and other factors influencing coastal areas; and to produce a general coastal environmental assessment in the form of a map showing critical erosion along the coast.

*Targets/Products:* Maps, graphs and charts on

1. Wave roses for Straits of Malacca, Johore Straits (east and west), South China Sea, both annual and seasonal; long term wave distribution and period and height relationship;
2. Mean sea level, mean high water spring, mean high water neap, mean low water spring, mean low water neap, highest astronomical tide, lowest astronomical tide; rise in water level due to storm surge; design of water level for coastal structures;
3. Current intensity and direction;
4. Wind roses;
5. Map of sedimentary substrate and associated soil units displaying grain size, specific gravity, granular shape, cohesive strength, etc.;
6. Descriptive and qualitative information in the form of an environmental ecology map with identification of environmental units;
7. Interpretation of maps and general findings to pinpoint critical sites and their causes of erosion;
8. Mitigating measures to prevent further erosion in critical or chronic areas.

*Subtask Description/Methodology:* Collection of baseline data will be made to provide an adequate knowledge of the nature and distribution of natural forces acting on the coastal area. Land capability in resisting those forces will be assessed and the impact of people's activities to the natural coastal morphological process will be determined.

*Subtask Code 242-M*

*Objectives:* To assess the causes and extent of coastal erosion in the areas identified by the National Coastal Erosion Study and to determine suitable remedial measures.

**Targets/Products:**

1. A general delineation of zones of erosion and deposition in the form of a map; and
2. Recommendation of a setback line, seaward of which no construction is allowed, and of a mangrove belt for coastal protection.

*Subtask Description/Methodology:* The analysis will include: (1) shore-line characteristics of the area; (2) coastal process; (3) sediment budget; (4) causes and extent of erosion; (5) future projection/erosion rate; (6) remedial measures alternatives; (7) economic analysis; (8) effect of the proposed construction on the environment; (9) physical properties of coastal areas (characterization of soils and land forms); and (10) means for implementing management of erosion prone areas.

*Task Code 250-M:* Transport and dispersion of pollutants and dredge residuals

**Targets/Products:**

1. To document, update and compute hydrographic data and flow regimes in Johore Straits under various tidal and meteorological conditions;
2. To document, measure and compute the transport and dispersion of pollutants currently being discharged into the Johore Straits; and to assess the environmental impact due to present and future projected discharge loads; and
3. To assess the likely impact due to dredge residuals arising out of offshore sand mining along the coast from Tanjung Penawar to Tanjung Sepang; and to recommend further study, if deemed necessary.

*Task Description/Methodology:* The task has two phases, each focusing on Johore Straits and offshore sand mining:

Phase I: Johore Straits. Secondary data on hydrography and pollution loading will be collected. Additional primary data to supplement these data will also be collected.

Secondary data required in the assessment of likely environmental impact due to offshore sand mining will be collected. Additional primary data will also be collected for supplement.

Phase II: Johore Straits. Mathematical/computer models of hydrodynamic flow regimes and those which simulate the transport and dispersion of pollutants will be implemented. A tracer dispersion study using Rhodamine B tracer will be designed and implemented. An assessment of environmental impact due to present and projected discharge of pollutants will also be given.

A preliminary assessment of environmental impact due to offshore sand-mining activities and recommendations for further studies will be made.

*Duration:* 12 months

*Team Leader:* Dr. Koh Hock Lye (Principal Investigator)

*Institution Involved:* Universiti Sains Malaysia

*Task Code 260-M:* Shrimp stock assessment in South Johore

**Targets/Products:**

1. To assess coastal shrimp stocks;
2. To obtain data on CPUE for different fishing gear;
3. To note the impact of different gears;
4. To obtain levels of MSY for important stocks;
5. To set guidelines for management at MSY by gear/effect regulation; and
6. To indicate practical means of implementation.

*Task Description/Methodology:*

1. Review and compile existing information on the abundance, potential yields and species/size composition of shrimp stocks in the project area as well as on the status of the fisheries;
2. Plan and conduct a demersal trawl survey to determine the standing biomass, species/size composition and distribution of the demersal shrimp stocks;
3. Monitor and estimate the quantity and composition of shrimp landings monthly in the project area from small-scale fishermen;
4. Determine the percentage of shrimp catch consumed, dried or sold informally outside of normal marketing channels for small-scale fishermen focused on inshore and estuarine areas;
5. Conduct studies on relevant biological parameters on selected commercially important shrimp species important for management;
6. Locate critical breeding areas and fishing sites which require special management; and
7. Compile and analyze all data collected to provide estimates of potential yields from the shrimp stocks within the project area.

*Duration:* 12 months, 1988

*Team Leader:* Dr. Mohd. Zaki Mohd. Said (Principal Investigator)

*Team Members:* 2 Research Assistants, 6 Field Assistants and 1 Data Entry Clerk

*Institution Involved:* Universiti Pertanian Malaysia

*Task Code 270-M:* Present status and economics of aquaculture practices and potential areas for development

*Targets/Products:*

1. Zonation of areas suitable for aquaculture;
2. Socioeconomic analysis of aquaculture systems and level of operation, e.g., extensive, semi-intensive and intensive farming systems;
3. Management strategies which include pollution control of potential sites and guidelines for various culture systems such as cage culture and shrimp production;
4. Plan for sustainable and environmentally viable development of aquaculture in Johore coastal areas; and
5. Determination of problems and constraints in coastal aquaculture development and management and preparation of guidelines for management

*Subtask Code 271-M:* Present status of aquaculture practices and potential areas

*Targets/Products:* A map showing present and potential aquaculture site by zonation and with criteria for selection of sites

*Subtask Description/Methodology:* The study will interpret spot satellites, aerial photographs and truth surveys to identify the current and potential areas for aquaculture. This study would have to link up with the mangrove study, Tasks 210-M and 230-M; and to use a GIS for information interpretation.

*Duration:* 12 months, 1988/89

*Team Leader:* Dr. Ang Kok Jee (Principal Investigator)

*Institution Involved:* Universiti Pertanian Malaysia

*Subtask Code 272-M:* An economic analysis of coastal aquaculture practices

*Targets/Products:*

1. To identify, estimate and evaluate key production parameters for coastal aquaculture, particularly shrimp pond culture;
2. To analyze and estimate the capital structure of coastal aquaculture practices;
3. To analyze and estimate the costs and returns of coastal aquaculture practices;
4. To provide a financial analysis of various culture farms in the area to show their viability; and
5. To make a sensitivity analysis on the effects of farm size and price on the productivity of the coastal aquaculture practices.

*Subtask Description/Methodology:* The study is expected to generate implications for the long-term planning and development of coastal aquaculture in the study area.

The data used in the study will be primarily drawn from a cross-sectional survey of farmers engaged in several and inland aquaculture systems such as marine cage culture, brackishwater pond culture, raft culture and freshwater pond culture. The data on these different types of fish farmers will be gathered using structured survey questionnaires.

For purposes of comparative analysis, the data will be drawn from selected regions within the study area that share a number of production characteristics in common but vary with regard to their economic performances. These regions will be identified in a pre-survey study with the assistance of the Department of Fisheries. The stratified random sampling will be employed for selecting the sample of farmers from the selected regions.

*Duration:* 12 months, 1988/1989

*Team Leader:* Dr. Jahara Yahaya

*Institution Involved:* Universiti Malaya

#### Division 300 - Socioeconomic Studies

*Task Code 310-M:* Socioeconomic Survey

*Targets/Products:*

1. A database quantifying the socioeconomic importance of the coastal resources of South Johore to the state, communities and individuals as required for basic needs and livelihoods;
2. A data base derived from a reasonable economic determination for the alternative uses of various primary coastal resources such as mangroves used on a sustained basis and for the intrinsic value of the preservation of some areas; other coastal resources to be considered are estuaries, beaches, coral reefs and mudflats.

*Task Description/Methodology:* The study will attempt to describe and document the study area in terms of: its economic resource base in terms of human livelihood and sustenance; its human settlements and communities; the socioeconomic activities associated with these settlements; and the impact these activities have on the natural resource base and on the settlement communities.

*Duration:* 8 months, 1988

*Team Leader:* Dr. Wong Poh Kam (Principal Investigator)

*Institution Involved:* Department of Town and Country Planning,  
Socioeconomic Research and Systems Consultants

*Task Code 320-M: Guidelines for CRM for tourism and recreation*

*Targets/Products:*

1. Economic valuation of the overall contribution of tourism to coastal economy;
2. Assessment of the coastal resources important to recreation/tourism ("potential supply" assessment) in the study area;
3. Assessment and projection of the potential recreation/tourism demand;
4. Identification of socioeconomic impacts and potential conflicts with other coastal resource uses and analysis of trade-off; and
5. Recommendations of planning control guidelines for tourism development in the coastal areas.

*Task Description/Methodology:*

1. Review of the existing studies and plans of tourism in Johore by the Tourist Development Corporation and the State Government;
2. Review of the existing applications of tourism projects submitted to the State Government;
3. Analysis of tourist arrival, hotel occupancy and resort visitor statistics;
4. Interview of key TDC officers, tour operators and tourist resort managers;
5. Interview of key informants involved in Singapore tourism; and
6. Sample survey of tourist perception at selected hotel/resort sites.

*Duration:* 6 months, 1988/89

*Team Leader:* To be identified

*Institution Involved:* To be identified

Division 400 - Legal and Institutional Studies

*Task Code 410-M: Legal and institutional studies*

*Objective:* To strengthen the legal and institutional capabilities of the government to develop the renewable coastal resources of South Johore on a sustainable basis

*Targets/Products:*

1. To identify the legal and institutional constraints towards effective CRM and to recommend necessary revisions and regulations and procedures;
2. To formulate and develop administrative procedures for interagency coordinations;
3. To improve and develop interagency programs for effective enforcement;
4. To develop planning guidelines and standards or development project affecting coastal resources;
5. To develop systematic monitoring and evaluation program;
6. To formulate education program to create greater public awareness of CRM;
7. Summary compilation of the legal and institutional regimes and a report characterizing all the governmental and nongovernmental entities, their legal mandates and resources available; and
8. To form a working committee at the state level to begin project management.

*Task Description/Methodology:* A detailed survey will be made of the existing legal and institutional authorities and the various arrangements (legal or otherwise) pertaining to coastal resource ownership and use rights in the South Johore study area. Photocopies will be made of appropriate legislative acts relevant to the subject for appending to the report. A review of

previous studies in the South Johore region will be made and a computerized data base and source reference file will be assembled.

Governmental and nongovernmental institutions and organizations will be contacted; and interviews will be arranged with the appropriate people.

*Duration:* 12 months, 1988/1989

*Team Leader:* Dr. Wan Arifah

*Institution Involved:* Universiti Malaya

#### Division 600 - Resource Management Plan Formulation

*Task Code 610-M:* Resource management plan formulation

*Targets/Products:*

1. A set of guidelines/policies for CRM in Johore;
2. A set of action-oriented plans for issue areas of prime concern for various economic and resource sectors;
3. Plans for marine and estuarine protected area management which are specific to each area; and
4. An integrated CAM plan for Johore which refers to specific action plans and MPA plans and which shows all the linkages for large area management.

*Subtask Code 611-M:* Guidelines/policies for CRM in Johore

*Targets/Products:*

1. To formulate a working committee to review policies and plans;
2. To review recommended policies and guidelines from the coastal resources profile and from primary data of Divisions 200-400;
3. To organize all information relevant for management policies and planning in Johore;
4. To complete analysis from the results of other task groups on: (a) fisheries and mangroves; (b) pollution and water quality in general; (c) watershed management vs. water quality; (d) land use and impacts on coastal resources; (e) cost-benefit analysis for alternative uses of various coastal resources in relation to sustainable management; (f) correlation of socio-political-economic framework for management with that of legal-institutional for specific plan application; and
5. To hold regular meetings and small workshops to achieve the above.

*Subtask Description/Methodology:*

1. Review of present government policies and guidelines governing coastal resources utilization and exploitation; and
2. Analysis and synthesis of information generated under Divisions 200-400 to develop appropriate policies for consideration by the Government of Johore for the management of coastal resources.

The development of the conceptual framework will be initiated in early 1988 by a core group. It is expected to be completed in a year. It will require considerable inputs from the federal and state government bodies and universities and technical inputs within and outside the country.

*Duration:* 24 months, 1988-1989

*Team Leader:* To be identified

*Institution Involved:* To be identified

*Subtask Code 612-M:* Formulation of action plans for issue areas and important coastal resources

*Targets/Products:*

1. Series of action-oriented management plans;

2. Coordination of all data from the task groups and the coastal resources profile to achieve action-oriented plans; and
3. Coordination with all agencies and individuals of importance to specific plans during the planning process.

*Subtask Description/Methodology:* The focus of the task is to formulate action plans on special areas and important resources to address present and potential issues identified by the coastal profile.

*Duration:* 24 months

*Team Leader:* To be identified

*Institution Involved:* To be identified

*Subtask Code 612-M:* Formulation of management plans for marine and estuarines protected areas (MEPA)

*Targets/Products:*

1. To select MEPA from recommendations of various tasks;
2. To evaluate existing MEPA management plans;
3. To improve existing MEPA management plans;
4. To formulate new MEPA management plans;
5. To recommend means for implementing the various plans, and
6. To suggest institutional structure and legal changes.

*Subtask Description/Methodology:* Task 230-M: The GIS will identify certain marine areas in Malaysia that should be conserved. These areas will be investigated by various tasks of Division 200. This task focuses on the final selection of appropriate areas that can be declared as marine as well as the development of management plans.

*Duration:* 12 months, 1988/1989

*Team Leader:* To be identified

*Institution Involved:* To be identified

*Subtask Code 614-M:* Formulation of an integrated coastal area management scheme for Johore

*Targets/Products:*

1. Flow charts showing linkages of all agencies and plans to accomplish integrated coordination of smaller area, issue-oriented and MPA plans;
2. Complete maps of Johore and all site-specific management areas which are consistent in scale and complete with overlays to show important relationships and priorities of management;
3. A document which spells out how the various plans will be coordinated and implemented;
4. A working committee of dedicated persons representing appropriate agencies to coordinate plan finalization; and
5. A series of seminars to communicate the results of the planning process.

*Subtask Description/Methodology:* The task will require a two-pronged approach. The first step is to formulate a CRM framework; the second is to improve on the framework to include all specific details into an overall integrated CAM plan for Johore (see Fig. 12).

*Duration:* 24 months, 1988-1989

*Team Leader:* To be identified

*Institution Involved:* To be identified

*Subtask Code 615-M:* CRM system

*Target/Product:* To develop a CRM system for coastal area planning in Johore

*Subtask Description/Methodology:* One of the major concerns of resource managers is the unisectoral exploitation of renewable coastal resources. It is essential that sound planning and efficient management strategies on resource utilization are developed to ensure long-term economic benefits. Therefore, continuous monitoring of resource status and rate of exploitation are essential for effective long-term resource management and planning. Task 230-M (GIS for CRM) will be expanded to form a resource management system which will continue to provide an inventory of existing resources; an analysis of the change with time; an indication of dynamic processes; trend evaluation; simulation of future development; information of seasonal trends; a picture of zone of conflicts; and an inventory of actual critical areas.

*Duration:* 24 months

*Team Leader:* To be identified

*Institution Involved:* To be identified

#### Division 700 - Implementation Division

*Task Code 710-M:* Seminar/meetings at decisionmaker level

*Target/Product:* To obtain approval from decisionmakers for the implementation of the plan

*Task Description/Methodology:*

1. Seminar and meetings will be conducted at decisionmaker level with relevant agencies/state government of the Johore Prime Minister's Department; and

2. Proposals for implementation in the Sixth Malaysian Plan.

*Duration:* 3 months

*Team Leader:* Ms. Ch'ng Kim Looi

*Institution Involved:* Department of Fisheries

#### Division 800 - In-Country Project Management

*Task Code 810-M:* Operation and integration

*Target:* To provide operational support to task implementation and inter-task coordination

*Task Description/Methodology:* The lead agency serves as the focal point of intertask coordination and oversees the implementation of each task's activities in accordance to the workplan. This agency appoints one of its staff as the National Coordinator of the in-country project. The National Coordinator's terms of reference follow that which are found in the Implementing Guidelines.

*Duration:* 4 years, 1986-1989

*Team Leader:* Ms. Ch'ng Kim Looi

*Institution Involved:* Department of Fisheries

#### PHILIPPINES

Chairman, NSC	: Dr. Rafael D. Guerrero III
National Coordinator	: Dr. Liana T. McManus (1986-1987)
Coordinating Agencies	: National Science and Technology Authority (NSTA) and Philippine Council for Agriculture and Resources Research and Development (PCARRD)

Cooperating Agencies : University of the Philippines (UP): Marine Science Institute (MSI)/College of Social Work and Community (CSWCD)/UP in the Visayas, College of Fisheries (VCF) and the Bureau of Fisheries and Aquatic Resources (BFAR)

Project Site : Lingayen Gulf, Pangasinan Province (Fig. 14)

Lingayen Gulf is a major fishing ground where commercial fishing is being undertaken throughout its breadth. The coastal areas by the Gulf are bordered by brackishwater fishponds which cover a total area of 13,084 ha. A large expanse of reef flats is also found along the western side of the Gulf. Many fishing communities depend on these for food and income.

Lingayen Gulf is an economically important coastal area. Today, however, it is being subjected to a number of unrelated, unplanned and competing human uses. There is no management plan for the rational utilization of the gulf's resources. Because of its importance and the growing sources of stress threatening its stability, Lingayen Gulf is an appropriate study area for the development of a comprehensive management approach.

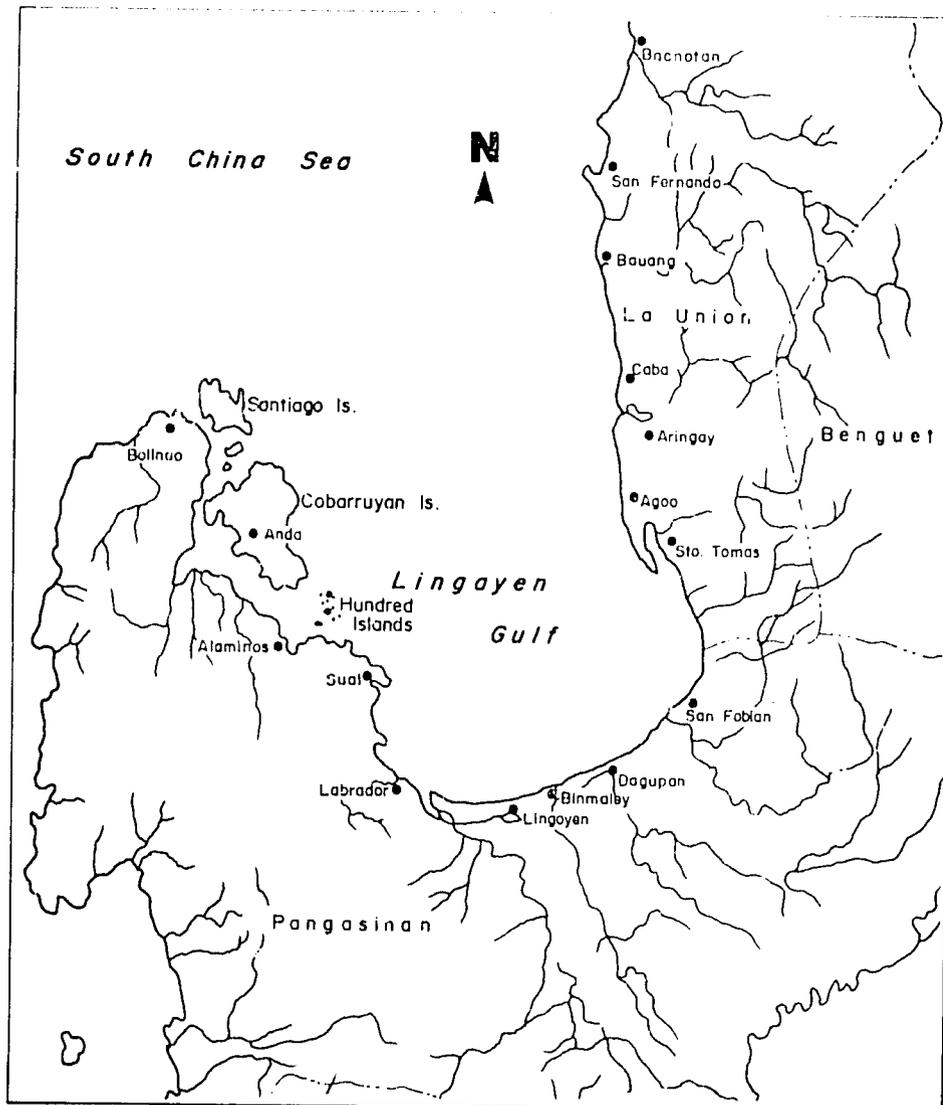


Fig. 14. Lingayen Gulf, Pangasinan Province, Philippines.

## General Program Framework

*Objectives.* The primary concern of the project is to develop community management of renewable coastal resources as one of the means to upgrade the socioeconomic conditions of the population in the coastal communities of Lingayen Gulf. This management will also address critical issues which will reduce stresses on the coastal environment; minimize overutilization of coastal resources; develop a mechanism to facilitate participation and strengthen community organizations in the CRM; identify potential support institutions and strengthen institutional linkages among agencies involved in CRM; develop a mechanism that would make coastal resources accessible to the local population; and develop an education and information system to promote ecologically sound management of resources in the gulf area.

### In-country Research Projects

#### Division 100 - Baseline Information

*Task Code 110-P:* Coastal profile

*Target/Product:* Published coastal profile of Lingayen Gulf

*Task Description/Methodology:* A coastal environmental profile of Lingayen Gulf will be prepared. The management issues, causes and information gaps will be identified at national workshops. The proceedings of the workshops will be distributed for comments and integrated into the coastal profile.

*Duration:* 8 months, 1987

*Team Leader:* Dr. Liana T. McManus

*Institution Involved:* UP-MSI

*Task Code 120-P:* Conceptual framework development

*Target/Product:* A conceptual framework for Lingayen Gulf based on the background studies and coastal profile which will serve as a tentative integrated management plan on which methods of different component studies will be oriented and refined

*Task Description/Methodology:*

1. Design approaches, strategies and methods to be used;
2. Prepare a conceptual framework for management planning and implementation;
3. Hold a workshop to review the draft of the conceptual framework; and
4. Refine the coastal profile.

*Duration:* 3 months, 1987

*Team Leader:* Dr. Liana T. McManus

*Institution Involved:* UP-MSI

#### Division 200 - Biogeographical Studies

*Task Code 210-P:* Natural resources survey of Lingayen Gulf

*SubTask Code 211-P:* Biogeographical analysis of Lingayen Gulf

*Team Leader:* Dr. Liana T. McManus

*Institution Involved:* UP-MSI

*Activity 1:* Site selection, assessment and mapping of coral reef areas

*Targets/Products:*

1. Synoptic view of the entire coralline area of Lingayen Gulf through broad area surveys;
2. Representative areas at barangay/barrio (village) level to be chosen for detailed surveys; and
3. Baseline assessment and broad area survey of coralline areas.

*Activity Description/Methodology:*

1. Collection of topographic and bathymetric maps (scale = 1:25000), landsat and aerial photographs for reference;
2. Reconnaissance survey of all accessible coralline areas in the Gulf; and
3. Selection of study areas at barangay/barrio level.

*Duration:* 3 months

*Activity 2:* Resource inventory survey and natural resource mapping of coral reef areas in Lingayen Gulf

*Targets/Products:*

1. Estimates of production and fishing efforts associated with exploitation of fish, commercially important invertebrates, hard and soft corals, seaweeds and seagrasses; and
2. Coastal resource map based on above data.

*Activity Description/Methodology:*

1. Quarterly habitat surveys in the study sites to determine the abundance of coralline fish and commercially important invertebrates, live cover of hard and soft corals and live cover and biomass of seaweeds and seagrasses;
2. Biweekly fish landing and market surveys and interviews in the study sites to determine actual harvest of fish invertebrates and seaweeds for production estimates, fishing effort based on gear types, including blasting and heavily exploited fishing grounds;
3. Biweekly gleaner-watching to assess activity and harvest from tidal flats; and
4. Mapping to determine major physiographic zones and associated resource stocks by examining existing maps, image processing of satellite data, low altitude aerial photography and ground truthing.

*Duration:* 14 months, 1987-1988

*Activity 3:* Data analysis and integration using GIS

*Target/Product:* Coastal resource map showing available marine and estuarine resources in Lingayen Gulf; levels of nutrient, organic and inorganic loading; and patterns of land use

*Activity Description/Methodology:*

1. Programming of a data base which will accommodate the: data series of production/yield of network resources; time series of concentrations of selected potential pollutants; areas of major physiographic zones of coralline areas; and areas of existing and potential aquaculture sites; and
2. Publication of a technical report which will provide scientific bases for a management plan.

*Duration:* 5 months, 1988

*Subtask Code 213-P:* Fish resource assessment

*Targets:*

1. To provide information on the nature of fish stocks in the study area;

2. To provide estimates on the potential yield of fish resources; and
3. To evaluate the trend of exploitation of fish resources.

*Products:*

1. Technical report on fishing effort and estimates of mortality rates (Year II);
2. Technical report on preliminary assessment of the impact of blast fishing on fish stocks (Year II);
3. Technical report on the growth parameters of important fish (Year II);
4. Paper on fish resource assessment and MSY (Year III); and
5. Paper on fisheries management options in Lingayen Gulf (Year III).

*Subtask Description/Methodology.*

1. Site reconnaissance and survey for the first three months to formulate a sampling scheme;
2. Collection of available basic information, e.g. number and area distribution of fishing villages, inventory of boats by types and sizes, etc.;
3. Time series data collection which will start on the fourth month - systematic sampling on fish and fishing activities of fishermen in the gulf; collection of additional economic data on fishing activities at the pilot site;
4. Problem areas such as ecological impact of blast fishing and gear competition will be addressed;
5. Trawl fishing effort will be addressed in terms of engine horsepower x dragging hours; gillnet in terms of gear area x setting hours; hook fisheries in terms of size and number of hooks x operating hours, etc. Technical description of typical gears used will also be provided.; and
6. Twenty-four-month time-series data which will allow virtual population analysis (VFA); estimation of growth parameters and mortality rates, application of analytical yield and surplus production methods; and variation and seasonality of productivity of fishermen and use of specific gears.

*Duration:* 24 months, 1987-1988

*Team Leader:* Mr. Ricardo R. Federizon

*Institution Involved:* UPVCF

*Task Code 220-P:* Water quality baseline study

*Subtask Code 221-P:* General water quality of Lingayen Gulf

*Targets/Products:* Data on seasonal variation of transparency, temperature, salinity, dissolved oxygen, pH and suspended solids at selected sites

*Subtask Description/Methodology:*

1. Monthly *in situ* measurement of transparency, temperature, salinity and pH; and
2. Collection and analysis of water samples to determine dissolved oxygen and suspended solids concentration.

*Duration:* 12 months, 1987/88

*Team Leader:* Dr. Liana T. McManus

*Institution Involved:* UP-MSI

*Subtask Code 222-P:* Pollution/nutrient studies

*Targets/Products:*

1. Pollution and nutrient index map showing levels of pollutants and nutrient loadings in reef and aquaculture areas; and
2. Map of stressed area based on levels of domestic sewage, pesticides

and fertilizers, industrial effluents and mine tailings, and oil and grease from seacraft.

*Subtask Description/Methodology:*

1. Collection and analysis of water, sediment and biological samples for coral reef areas; and estuaries for the analysis of heavy metal, pesticides, bacterial content and studies for oil and grease; and
2. Use of sediment traps to determine siltation rate and extent of sediment loading.

*Duration:* 6 months, 1987/88

*Team Leader:* Dr. Liana T. McManus

*Institution Involved:* UP-MSI

*Subtask Code 223-P: Pollutants from fishponds*

*Targets/Products:*

1. To determine the types and levels of piscicides used in fishponds;
2. To determine the level of piscicides contained in water discharge from fishponds; and
3. To assess the impact of fishpond discharge containing piscicides on the water quality of nearby coastal waters.

*Subtask Description/Methodology* (activities incorporated in Task 240-P):

1. Reconnaissance survey on probable sampling sites;
2. Linkage with UP-MSI on the establishment of stations and frequency of samplings; and
3. Field collection and analysis of data.

*Institution Involved:* BFAR

*Task Code 230-P: Patterns and level of aquaculture practices in Pangasinan Province and Lingayen Gulf*

*Targets/Products:*

1. Resource map of aquaculture farms;
2. Aquaculture farm survey; and
3. Economic analysis of farm practices.

*Task Description/Methodology:*

1. Aerial and landsat photographs from the National Mapping and Resource Information Authority (formerly the Natural Resources Management Center) and topographic maps will be used to identify existing and potential aquaculture and related areas;
2. Existing productive and abandoned fish pond areas will be inventoried; and
3. Farm distribution, listing of different culture systems and commodities, level of operation (intensive-extensive), farm layout, employment, capital, source of seeds, yields/production, impact on community and farm economics will be identified.

*Duration:* 14 months, 1987-1988

*Team Leader:* Mrs. Leda Handog

*Institution Involved:* BFAR

*Task Code 240-P: Coastal aquaculture potential in Lingayen Gulf*

*Targets/Products:*

1. Ocular survey to identify potential areas;
2. Potential marginal land for aquaculture development to be determined; and
3. Resource mapping and zoning.

*Task Description/Methodology:*

1. Reconnaissance trips will be conducted to prepare and conceptualize zoning;
2. Formulation of sampling methodology, sampling schedule of site suitability survey and selection of sampling sites;
3. Bimonthly collection of samples for nutrient loads and analysis of data;
4. Interview/linkage with UP-MSI and UP-ISWCD on resource assessment;
5. Consultation groups among fisheries officials and representatives of coastal communities will be established; and
6. Final zoning of determined potential areas as alternative resource for aquaculture.

*Duration:* 12 months, 1987-1988

*Team Leader:* Mrs. Leda Handog

*Institution Involved:* BFAR

*Task Code 250-P:* Farm testing of selected appropriate aquaculture technology to increase farm yield

*Targets/Products:*

1. Preparation of a plan of appropriate aquaculture for improving yields of existing resources;
2. Testing of at least two low-cost, high-profit technology like cage culture of low food chain and polyculture techniques; and
3. Introduction of field-tested technology to rural fishfarmers.

*Task Description/Methodology:*

1. Collection of data on species by production unit, production/culture practices, availability of supply/inputs and production constraints;
2. Quarterly analysis of data to come up with a list of priorities of alternative appropriate aquaculture technologies;
3. Identification of pilot site for farm testing; and
4. Test on either polyculture of shrimp/milkfish/siganids, cage culture of siganids and/or oyster and mussel culture.

*Duration:* 19 months, 1987-1988

*Team Leader:* Mrs. Leda Handog

*Institution Involved:* BFAR

#### Division 300 - Socioeconomic Studies

*Task Code 310-P:* Daily record-keeping of the costs and returns and household income and expenditures of municipal fishermen in selected municipalities of Lingayen Gulf

*Targets/Products:*

1. Initial analysis of costs and returns and household income and expenditures of municipal fishermen in Lingayen Gulf; and
2. Investigation of the following data and their relationship as inputs in the formulation of a CRM plan for Lingayen Gulf: costs/earning data; seasonality of fishing activities and volume and value of production; earnings of crew and owners, employees and employers, returns on investments of owners and estimates of pure profits; and distribution of benefits from major fishing activities.

*Task Description/Methodology:*

1. Bimonthly supervision and monitoring of record-keeping activity;
2. Quarterly consultation with resource persons on local, regional and national levels;

3. Quarterly processing of data and initial analysis;
  4. Conducting of mid-year workshop to assess the progress of record-keeping activity and to present the initial findings of the study;
  5. Final analysis and interpretation of a one-year record-keeping;
  6. Write-up;
  7. Conducting of a final workshop to present final findings of study and to formulate policy recommendations for proposed CRM plan
- Duration:* 15 months, 1987-1988  
*Team Leader:* Prof. Elmer Ferrer  
*Institution Involved:* UP-CSWCD

*Task Code 320-P:* Baseline socioeconomic survey and analysis of selected coastal communities of Lingayen Gulf

*Targets/Products:*

1. To gather baseline socioeconomic information on coastal communities bordering Lingayen Gulf;
2. To investigate living conditions of communities involved in major fishing activities and how these affect coastal resource utilization and management;
3. To assess delivery of economic and social services in the coastal communities of Lingayen Gulf to understand its (the delivery's) dynamics and to draw lessons for the proposed CRM plan;
4. To determine and understand conflicts involved in land use in coastal communities; and
5. To formulate policy recommendations for proposed coastal resources communities.

*Task Description/Methodology:*

1. Formulation of a conceptual framework that would govern the direction of activity through consultation with resource persons and survey;
2. Hiring of interviewers;
3. Conducting of one-day training for interviewers;
4. Data analysis and interpretation;
5. Write-up;
6. Conducting of workshops/seminars to selected local leaders and respondents to present the results of survey and formulate possible policy recommendations for the proposed CRM plan.

*Duration:* 10 months, 1987-1988

*Team Leader:* Prof. Elmer Ferrer

*Institution Involved:* UP-CSWCD

*Task Code 330-P:* Market information study of selected commodities generated from the coastal resources of Lingayen Gulf and selected inputs in the production of such commodities

*Targets/Products:*

1. To conceptualize a market information study;
2. To identify existing market structures that prevail in the area and understand how these affect exploitation and conflicts in coastal resource use;
3. To look into factors that lead to reinforcement and reproduction of existing market structures; and
4. To identify alternative market structures that are both sound in terms of efficiency and equity for the proposed management plan.

*Task Description/Methodology:*

1. Survey design conceptualization and construction;

2. Consultation with resource persons on proposed conceptualization;
3. Survey instrument construction;
4. Pretesting;
5. Actual survey;
6. Data analysis and interpretation; and
7. Write-up.

*Duration:* 15 months, 1987-1988

*Team Leader:* Prof. Elmer Ferrer

*Institution Involved:* UP-CSWCD

#### Division 400 - Legal and Institutional Studies

*Task Code 410-P:* Cultural context of CRM in Lingayen Gulf

*Targets/Products:*

1. Ethnography of coastal communities' perception of marine resources and activities related to their exploitation and utilization;
2. Indigenous methods of CRM;
3. Ethnography of village social structure and informal groups and associations which can be harnessed in development programs.

*Task Description/Methodology:*

The study will attempt to present a wholistic view of life in selected communities along the coast of Lingayen Gulf. It should provide a framework to assess the extent and intensity as well as the importance of CRM and utilization activities of the people in the area. Insights and guidelines for a more rational, equitable and humane coastal resource development and management programs should accrue from the study.

Activities under the task are:

1. Inventory of coastal resources, the manner of exploiting and utilizing them;
2. Mapping out norms, institutions, network or relations relevant to (1);
3. Chronicling daily, weekly, monthly, seasonal and annual cycle of activities and events related to CRM as well as alternative occupations; and
4. Identification of local groupings, associations other than village-wide social organizations and their memberships, goals and functions which can be harnessed for development programs.

The study will make use of these approaches: community survey, census and profile; general and key informant interviews; participant-observation for a year; cognitive mapping; time flow studies; and detailed photo documentation. Ideally, the studies will be done on six selected typical communities at the barangay level, two from each sector, based on variables such as ecology, technology, population size, exposure to development programs, etc.

*Duration:* 24 months, 1987-1988

*Team Leader:* Prof. Elmer Ferrer

*Institution Involved:* UP-CSWCD

*Task Code 420-P:* Assessment of contemporary laws, government policies, programs and structures related to coastal zone utilization and management

*Targets/Products:*

1. Annotated compilation of statutes, executive orders, administrative orders and ordinances related to coastal zone resources exploitation and management; and

2. Factual report of local level decisionmaking and policy-implementing dynamics and realities.

*Task Description/Methodology:*

1. Identification of explicit and implicit rationales behind existing laws, government policies, programs and structures for later comparison with traditional beliefs and practices;
2. Identification of existing "operational code" in the area; and
3. Conduct an evaluative research of government and nongovernment development projects in the area to gain insights for future programs.

*Duration:* 13 months, 1987-1988

*Team Leader:* Prof. Elmer Ferrer

*Institution Involved:* UP-CSWCD

*Task Code 430-P:* Values, perceptions and attitudes of people in the gulf area that affect their adherence to laws and their participation in government and nongovernmental development programs relating to CRM

*Targets/Products:*

1. Baseline data on knowledge and opinions of coastal communities on government policies, programs and structures related to CRM;
2. Documentation of people's values, attitudes and perceptions that affect their adherence to laws and participation in government and nongovernment programs; and
3. Case study on the dynamics of law enforcement.

*Task Description/Methodology:*

1. To document values, perceptions and attitudes which animate and sustain these groups and which individuals and community, as a whole, would have in relation to the formulation of an educational plan, in particular and a CRM plan as a whole;
2. To determine and study the level of awareness and adherence of local people to laws and policies in CRM and the reasons for such towards understanding the dynamics of law enforcement;
3. To determine and study opinions of local people regarding formulation, intent and implementation of government laws, policies and programs on CRM; and
4. To document and study people's level of awareness, response and participation/involvement in government and nongovernment programs to gain insight into the dynamics of their evaluative and decisionmaking sets and processes.

The study will make use of social survey, participant observation through community integration and other research methods appropriate in the community.

*Duration:* 24 months, 1987-1988

*Team Leader:* Prof. Elmer Ferrer

*Institution Involved:* UP-CSWCD

#### Division 600 - Resource Management Plan Formulation

*Task Code 610-P:* Formation of a planning group

*Target/Product:* To form a functioning planning group

*Task Description/Methodology:* A management planning team will be formed consisting of representatives from PCARRD (3); UP-CSWCD (2); UP-MSI (2); BFAR (2); UPV-CF (2); ICLARM (2) and the local government agencies and resource user associations with specific terms of reference.

*Duration:* 3 months, 1987/1988  
*Team Leader:* Dr. Rafael D. Guerrero III  
*Institution Involved:* PCARRD

*Task Code 620-P:* Evaluation, assessment and updating of the conceptual framework

*Target/Product:* Updated conceptual framework

*Task Description/Methodology:* All information collected in 1987 by various task forces will be incorporated in the preliminary management plan (conceptual framework).

*Duration:* 6 months, 1987/1988  
*Team Leader:* Dr. Rafael D. Guerrero III  
*Institution Involved:* PCARRD

*Task Code 630-P:* Drafting of an integrated CRM Plan

*Target/Product:* First generation management plan for Lingayen Gulf

*Task Description/Methodology:*

1. Quarterly meeting with planning team;
2. Continual updating and integration of information base from different work groups;
3. Workshop at the beginning of the fourth quarter for refinement of the management framework; and
4. Completion of the management plan draft.

*Duration:* 15 months, 1988-1989  
*Team Leader:* Prof. Elmer Ferrer  
*Institution Involved:* PCARRD

*Task Code 640-P:* Review of management plan

*Targets/Products:*

1. Draft management plan;
2. Public hearings to be conducted by sector groups; and
3. Final review to be done by central policymakers.

*Task Description/Methodology:*

1. Quarterly meeting with planning team;
2. Continual updating and integration of information base from different work groups;
3. Dialogue with user groups and local organizations
4. Dialogue with local representatives and policymakers and
5. Workshop to analyze comments and recommendations.

*Duration:* 3 months, 1989  
*Team Leader:* Dr. Rafael D. Guerrero III  
*Institution Involved:* PCARRD

*Task Code 650-P:* Finalization of a management plan

*Targets/Products:*

1. Incorporation of comments and suggestions from the dialogue/consultation;
2. Finalization of plan for publication; and
3. Incorporation of recommendations for pilot implementation of schemes.

*Task Description/Methodology:*

1. Synthesis of comments/recommendations from dialogue/consultation meetings;
2. Improvement of management plan by incorporating valid recommendations and issues; and

## 3. Finalization and publication of the plan

*Duration:* 6 months, 1989*Team Leader:* Dr. Rafael D. Guerrero III*Institution Involved:* PCARRD

## Division 800 - In-Country Project Management

*Task Code 810-P:* Project monitoring and coordination*Targets/Products:*

1. To coordinate/monitor activities being conducted by the different lead agencies; and
2. To submit quarterly progress and annual reports, annual field evaluation and monitoring; and to conduct seminars/workshops.

*Task Description/Methodology:*

1. Project coordination. The NSC will meet quarterly to assist in establishing policy guidelines; advise on project plan development and implementation; review and endorse annual workplans of the project; and consider other project matters referred by the Program Leader.
2. Project monitoring. The project is subject to review and schedule under the national research system for agriculture and natural resources being managed by PCARRD. Quarterly progress reports and annual field evaluation will be submitted; papers, to be presented in seminars/workshops; and disbursement of project grant, to be monitored.

*Duration:* 3 years, 1987-1989*Team Leader:* Dr. Rafael D. Guerrero III*Institution Involved:* PCARRD

## SINGAPORE

Chairman, NSC and  
National Coordinator : Mr. Leslie Cheong  
Coordinating Agency : Science Council of Singapore  
Cooperating Agencies : Primary Production Department (PPD) and  
National University of Singapore (NUS)  
Project Sites : Johore Straits, Southern Islands and Singapore  
River (Fig.15)

The island-country of Singapore has one of the world's highest population densities. Rapid economic development has resulted in dynamic changes along the urban waterfront and coastal waters. As a "geographically disadvantaged state," Singapore's territorial waters are very limited; and undeveloped natural resources are scarce. Detailed physical planning and rapid urbanization have reduced much of the country's land. The demand for land necessitated the implementation of a coastal reclamation program. Only small patches of mangroves now remain, and these are confined to the Johore Straits. Coral reefs are found in small quantities, and fringing reefs are limited to the Southern Islands.

The proposed project will utilize the country's well-developed research facilities and technical resources to conduct applied research on living resource issues related to coastal development in the ASEAN region.

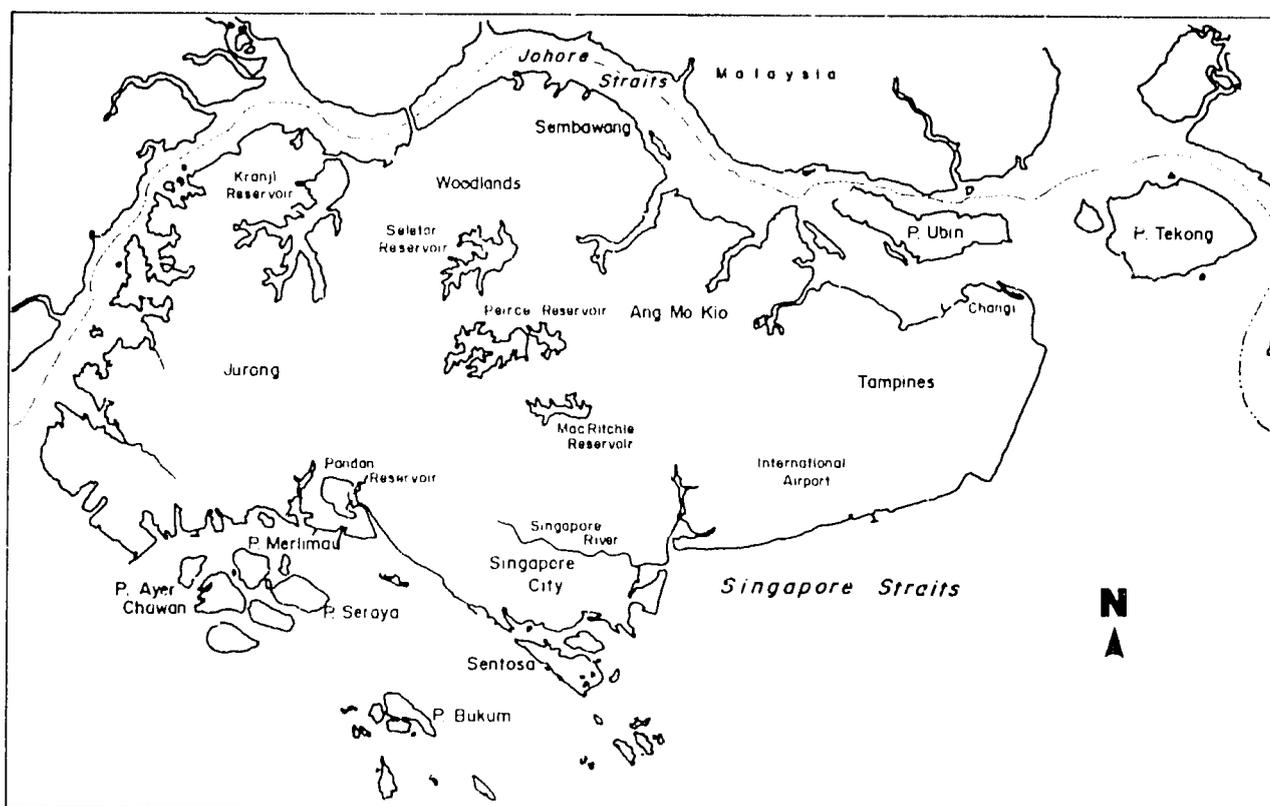


Fig. 15. Johore Straits, Southern Islands and Singapore River, Singapore.

The waters of the Straits of Johore and the Southern Islands and the Singapore River were chosen as pilot areas because of the competing uses for port, industrial and recreational purposes.

#### General Program Framework\*

*Data Base and Guideline Plan.* Data on the biophysical, legal and socio-economic aspects of the entire coastal zone of Singapore will be collected, analyzed and presented on maps. The plan will focus on the description of the current status of the coastal zone and dynamics of change. Case studies of conflicts and coastal development projects will be compiled to illustrate the development process. The information will serve as a framework for the future utilization of marine resources in Singapore.

*Role of Artificial Reefs in Resource Enrichment.* The feasibility of artificial reefs in resource enrichment will be examined. Artificial reefs will be created in seas where depth will make reclamation uneconomical. The product of the investigation will enable proper evaluation of the usefulness of artificial reefs and allow for decisions to be made regarding the role of reefs as an effective alternative to land reclamation.

*Utilization of Waterspace for Netcage Culture.* The role of netcage culture in improving the coastal resources and in increasing fish production in an urbanized environment will be assessed. Long-term benefits over that of mangrove destruction for aquaculture purposes will be ascertained.

*Rehabilitation of Section of Singapore River.* Cleanup of the Singapore River started ten years ago. As part of the rehabilitation program, PPD initiated fish stocking in 1986. More stockings have been planned over a period of

2-3 years. The department also plans to carry out trials on improving water quality through aeration of water with a gas called photozone.

### In-country Research Projects

#### Division 100 - Baseline Information

*Task Code 110-S:* Data base and guideline plan

*Activity 111-S:* Data collection/collation/presentation

*Activity 112-S:* Questionnaire surveys and interviews

*Activity 113-S:* Preparation of guideline plan for utilization of sea-space of Singapore

*Targets/Products:*

1. To collect comprehensive data and information on the biophysical, legal and socioeconomic aspects of Singapore's coastal zone;
2. To conduct socioeconomic survey relating to the existing and perceived use of marine resources and conflicts encountered;
3. To review literature and to identify additional data requirements;
4. To identify problems and issues;
5. To compile data and information and produce maps to provide a basis for a guideline plan for the management of seaspace in Singapore; and
6. To analyze data obtained.

*Task Description/Methodology:* Secondary information from published sources and primary information on the biophysical aspects of the coastal zone; coastal resources and activities; legal and institutional provisions; uses of waterfront land and seaspace; and socioeconomic data-related marine resource utilization, among others, will be gathered from government and statutory bodies and private organizations. Time-series data will also be collected, stored and displayed on maps. Case studies of conflicts and coastal development projects will be compiled to illustrate the development process. To facilitate data gathering, a national workshop will be organized to acquaint concerned parties with the objectives of the project and to enhance their awareness of the need to optimize the use of limited coastal resources.

*Duration:* 30 months

*Team Leader:* Dr. Chia Lin Sien

*Institution Involved:* National University of Singapore

#### Division 200 - Biogeographical Studies

*Task Code 210-S:* Utilization of water space for netcage culture

*Activity 211-S:* Floating netcage

*Targets/Products:*

1. Assessment of the feasibility (technical and economic) of deep netcage and rotational netcage cultures in Singapore waters; and
2. Documentation of the types of fish found around the vicinity of floating farms.

*Activity Description/Methodology:* Literature search of deep nets and rotational nets did not provide much results. EWOS (a Norwegian food company with aquaculture interests) type of cage system may be attempted for trials on deep nets. For rotational nets, simple cylindrical-shaped nets could be attempted. Seabass and groupers will be used. Traps will be set in the vicinity of farmed areas and fish caught will be identified. Catches by fishermen

will also be determined. Water quality parameters and site characteristics will be recorded.

*Duration:* 12 1/4 months, 1987-1988

*Team Leader:* Mr. Leslie Cheong

*Institution Involved:* Primary Production Department

*Activity 212-S:* Submersible netcage

*Targets/Products:*

1. Development of submersible cages suitable for Singapore;
2. Assessment of prototype submersible netcages in Singapore waters; and
3. Documentation of types of fish found around submersible netcages.

*Activity Description/Methodology:* A literature search on submersible netcages used in the world will be carried out. A study tour and identification of suitable sites will follow. One or two sites will be selected for actual testing of netcages. The types of fish suitable for submersible netcage culture and variables (stocking density/depth of submersion of netcage) will be tested. Water quality will also be monitored. Fish species around the submerged netcages will be trapped and identified.

*Duration:* 24 months, 1988/1989

*Team Leader:* Mr. Leslie Cheong

*Institution Involved:* Primary Production Department

#### Division 500 - Rehabilitation and Restoration

*Task Code 510-S:* Role of artificial reefs in living resource enrichment

*Activity 511-S:* Site selection and assessment

*Targets/Products:*

1. To select suitable sites for establishing artificial reefs; and
2. To obtain baseline data on the extent of biological resources in selected sites.

*Task Description/Methodology:* Site selection will be made in conjunction with other agencies. Selected sites will be examined, entailing the study of the physical/hydrographical conditions based on existing information and actual site measurements to confirm and complement existing information. The study includes a survey of the present state of living marine resources within selected sites and their immediate vicinity.

*Duration:* 5 months, 1987

*Team Leader:* Dr. Chou Loke Ming

*Institutions Involved:* National University of Singapore, Primary Production Department, Port of Singapore Authority and Republic of Singapore Navy

*Activity 512-S:* Artificial reef construction

*Targets/Products:*

1. Selection of materials and designs of artificial reef structure suitable for local conditions; and
2. Proper deposition of selected artificial reef materials at site.

*Activity Description/Methodology:* Decision on the materials to be used for artificial reefs will be made based on study visits and existing literature. Rubber tires and hollow concrete blocks will most likely be used. The study involves collection of rubber tires and manufacture of hollow concrete blocks as well as their preparation, transportation and deposition at the

site. Two sites will be used. Each will have 5,000 rubber tires and 80 hollow concrete blocks.

*Duration:* 4 months, 1988

*Team Leader:* Dr. Chou Loke Ming

*Institutions Involved:* National University of Singapore, Primary Production Department, Port of Singapore Authority and Republic of Singapore Authority

*Activity 513-S:* Long-term monitoring of artificial reefs

*Targets/Products:* To obtain data on the effectiveness of artificial reefs in enhancing marine life which will allow proper evaluation of the usefulness of artificial reef as an alternative to land reclamation

*Activity Description/Methodology:* Routine monitoring on a quarterly basis will be carried out using underwater survey techniques, involving transects, permanent quadrants and underwater photography. Assessments will be made on the changes in the diversity and abundance of marine life in and around artificial reefs established in areas with different conditions.

*Duration:* 2 1/4 years, 1988-1989

*Team Leader:* Dr. Chou Loke Ming

*Institution Involved:* National University of Singapore

*Task Code 520-S:* Rehabilitation of section of Singapore River

*Targets/Products:*

1. Stocking of Singapore River; and
2. Assessment, through recapture studies, of the degree of buildup of fish population in the river

*Task Description/Methodology:* As part of the river rehabilitation program, fish stocking effort was initiated by the Primary Production Department in 1986 during which 200,000 banana prawns were stocked. To further improve water quality, the department plans to carry out some trials with the injection of photozone, a gas consisting of ozone and hydroxyl radicals, into the water through aeration tubes. It is hoped that this will work in riverine conditions and that rehabilitation of the water would be accelerated through the injection of photozone.

Two complementary activities will be undertaken: river stocking and recapture studies, and photozone injection and water quality assessment studies.

*Activity 521-S:* River stocking and recapture studies

*Targets/Products:*

1. Stocking of Singapore River; and
2. Assessment, through recapture studies, of the degree of buildup of fish population in the river.

*Activity Description/Methodology:* Fish species which will be stocked in the river include banana prawns, seabass and cherry snapper or red tilapia. The stocking will be carried out periodically at the part of the river called Boat Quay.

Five stockings are tentatively scheduled for 1987: three stockings of banana prawns in February, May and September and two batches of finfish (seabass and cherry snapper) in September and December. Larger prawns and fish fry will be tagged and released into the river for recapture studies. Surveys will be conducted periodically to determine increase in catch.

*Activity 522-S:* River water restoration

*Targets/Products:*

1. To improve river water quality through aeration with photozone; and

2. To determine whether improved water condition could be sustained.

*Activity Description/Methodology:* The treatment will be confined to the section of the bay within Boat Quay. Aeration tubes will be installed on the riverbed to cover the selected area connected to a single tube leading to a photozone generating unit onshore. Various water quality parameters will be monitored. Traps will determine whether there is any enhancement of the fish fauna.

A survey of present water condition will be conducted prior to the photozone treatment. Aeration tubes for photozone injection will then be laid at the selected site. The water condition will be monitored once every three months over the next two-and-a-half years. Progress will be reviewed at the end of the second year. Any modification or input of other water restoration devices may be considered then.

*Duration:* 36 months, 1987-1989

*Team Leader:* Mr. Leslie Cheong

*Institution Involved:* Primary Production Department

#### THAILAND

National Project Director : Mr. Arthorn Suphapodok  
 Assistant National  
 Project Director : Mr. Chalerm Sak Wanichsombat  
 National Project Manager : Dr. Teerayut Poopetch (1986-1987)  
 Assistant National  
 Project Managers : Mrs. Sirikul Bumpapong and Mrs. Orapin Wongchumpit  
 Coordinating and Lead  
 Implementing Agency : Office of the National Environment Board (ONEB),  
 Ministry of Science, Technology and Environment  
 Cooperating Agencies : Department of Fisheries (Brackishwater Fisheries  
 Division and Marine Fisheries Division and Phuket  
 Marine Biological Center); National Institute of  
 Development and Administration; Department of Royal  
 Forestry; Department of Land Development; Faculty  
 of Forestry, Kasetsart University; Department of  
 Marine Science, Chulalongkorn University, and  
 Faculty of Social Sciences and Humanities, Mahidol  
 University  
 Project Site : Upper South Thailand (Phang-nga and Ban Don  
 Bays) (Fig. 16)

The Upper South Region of Thailand is rich in natural resources. These resources, specifically coastal resources, are concentrated in Phang-nga and Ban Don Bays. Extensive mangrove forests and mudflats are found here. These are considered productive nursery grounds rich in commercial marine and brackishwater species. They are also sites for aquaculture development.

Resource use conflicts, however, exist among aquaculture development, mangrove utilization, tin mining, coastal tourism and fishing activities. These will be further intensified by the development projects being considered in the region. The Upper South Thailand has been the focus of many development plans in the past. Careful management planning of coastal resources using a multidisciplinary approach is, therefore, necessary to ensure their sustainable yield and avoid conflicts in the region.

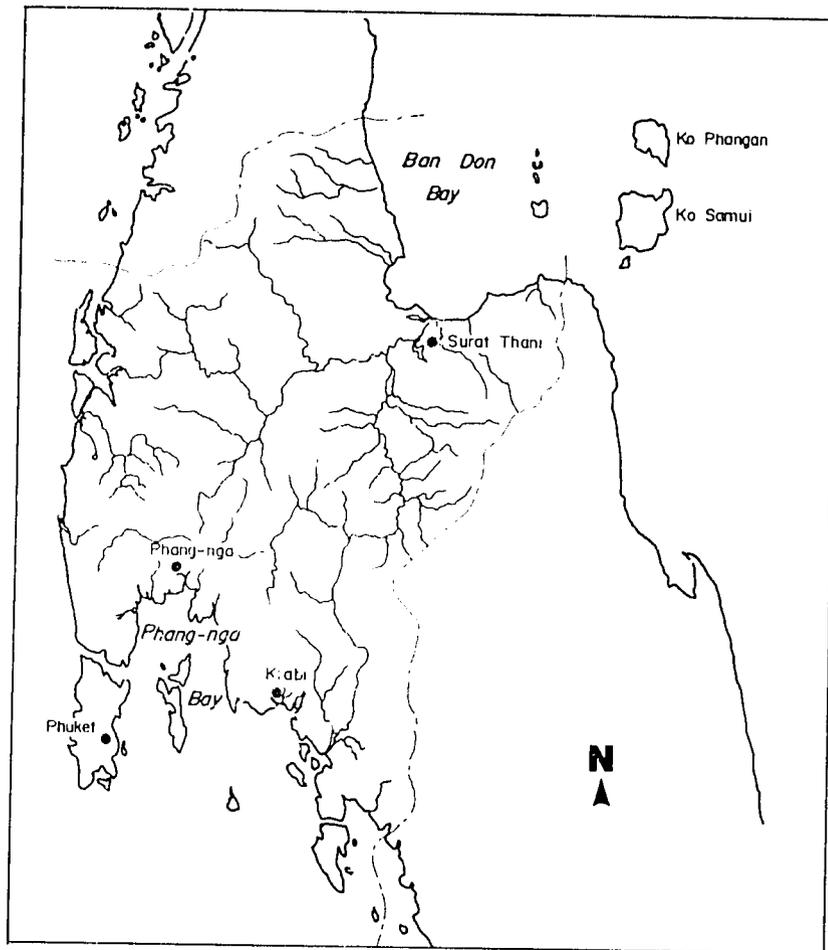


Fig. 16. Phang-nga Bay and Ban Don Bay, Upper South, Thailand.

#### General Program Framework

*Goals.* The project aims to develop CRM strategies and to formulate a management plan which can be implemented at the Upper South region and used as a model development plan for other regions.

*Objectives.* The primary objectives of the project are to develop an effective management plan for the rational utilization of the coastal resources of the Upper South; increase awareness of trends in living coastal resources utilization or exploitation and of impact from development projects; develop institutional arrangements linking applied research to CRM and planning and a model plan that can be applied to other critical zones.

#### *Stages of the Project:*

*Design stage:* this will begin with a preliminary survey to pre-diagnose the area; outline the workplans and prepare the baseline information. It will end with the revision of the workplan and the preparation of the profile.

*Execution stage:* This is of two phases:

*Phase I: resources assessment.* This will involve the diagnosis of the principal needs and problems of the region, its main resources, development potentials and constraints. This plan will end with interim reports which proposes alternative management and development strategies and identifies conflicts and resolutions of CRM.

Phase II: formulation and preparation of action plan. Development strategies will be refined, and an interrelated plan, formulated. The products are final reports which will include formulation of socioeconomic and environmental-cum-economic objectives; policies for sectors; environmental quality standards; and establishment of a regional environmental monitoring program.

Implementation stage: This will involve planning for and supporting the government in the implementation process.

### In-country Research Projects

#### Division 100 - Baseline Information

*Task Code 110-T: Literature review and profile preparation*

*Targets/Products:*

1. To summarize existing information on the biophysical, social and institutional environments of the proposed sites;
2. To determine the nature of the existing data base; and
3. To identify key information gaps and coastal issues which characterize the sites.

*Task Description/Methodology:* A preliminary survey of the proposed site will be conducted to facilitate formulation of the conceptual framework. All existing information relevant to the project will be gathered to serve as bases for the evaluation and synthesis process leading to the development of the draft environmental profile, which will be discussed in a workshop.

*Duration:* 6 months, 1986

*Team Leader:* Dr. Sirikul Bunpapong

*Institution Involved:* ONEB

#### Division 200 - Biogeographical Division

*Task Code 210/220-T: Present status of aquaculture practices and potential areas/economics of aquaculture production*

*Targets:*

1. To promote sustainable and environmentally viable development of aquaculture in Ban-Don and Phang-nga coastal areas;
2. To increase existing aquaculture productivity by limiting nonsustainable production practices and reducing external sources of stress in areas currently under production;
3. To identify the potential economic area of the coastal zone for aquaculture including mudflats; and
4. To determine problems and constraints in coastal aquaculture development, and to prepare guidelines for its development.

*Products:*

1. Maps of existing coastal aquaculture activities and areas suitable for aquaculture development classified by activity and zoned by degree of potential;
2. Recommendations for increased productivity of existing and potential areas for aquaculture development;
3. Means of implementation; and
4. A monitoring plan

*Task Description/Methodology:* A field study will be conducted monthly,

alternating between two study areas: Ban Don Bay on the east coast and Phang-nga Bay on the west coast. This study will be done after conducting a pre-survey to sample reference stations, each a representative of the nearby area. The two types of such stations are: Type A (existing coastal aquaculture areas for shrimp, oyster, cockle and fish culture) and Type B (potential coastal aquaculture areas for shrimp/fish, oyster, mussel and cage/pen culture).

Aerial photographs will be taken of the coastal areas to interpret, map and characterize existing coastal aquaculture areas and activities. Those suitable for aquaculture development will be classified by activity and zoned by degree of potential development. Monthly field trips will be conducted to survey the status of existing aquaculture areas; determine potential areas for aquaculture development, needs for basic information on environmental parameters; and to study the fisheries economics.

Stratified sampling will be used for the study of fisheries economics in shrimp, fish, mussel, cockle and oyster culture. Questionnaires will be developed to gather information on selected species, farm size, operation method, production, cost and benefit, marketing problems and constraints.

*Duration:* 21 months, 1986-1988

*Team Leader:* Mr. Yodchai Karnasuta

*Institution Involved:* Brackishwater Fisheries Division, Department of Fisheries

*Task Code 230-T:* Evaluation of fisheries development potentials

*Targets/Products:*

1. To ensure sustained-yield management of selected commercially important species in Phang-nga and Ban Don Bays;
2. To identify underutilized fish resources and/or inefficient fishing practices;
3. To determine problems and constraints to coastal fisheries development;
4. To recommend coastal fisheries development and fishery management measures

*Task Description/Methodology:* After the reconnaissance survey, four survey trips will be conducted in 12 months both in Ban Don and Phang-nga Bays. Information on catch data and larvae distribution by fishing vessels with baby trawl, push net and larvae net will help classify fisheries production zones and fish ecology in the region. Yield of fisheries will be determined by collecting fisheries information on total marine production, species composition, utilization of catch, fishing effort, number of landing/fishing boats and others from landing places (fisheries ports and rural villages).

The study will focus on fisheries information which include mapping and characterization of high production of fish areas in the study sites, critical habitats and fishing villages; identification and characterization of significant issues/conflicts which affect the sector both internally and externally; and determination of the present status of economically significant fish stocks.

*Duration:* 27 months, 1986-1988

*Team Leader:* Mr. Somporn Losawadikul

*Institution Involved:* Marine Fisheries Division, Department of Fisheries

*Task Code 240-T:* Assessment of coastal environment at Ban Don Bay

*Target:* To assess the environmental conditions of Ban Don Bay based on existing information including aspects of nearshore and intertidal ecology and oceanography

**Products:**

1. Map of natural sources of economically important bivalves;
2. Larvae identification and quantification of contaminants and sources affecting water quality;
3. Development of a model simulating the hydrodynamic circulation in Ban Don Bay;
4. Recommendation designed to reduce harmful coastal impacts associated with previously identified pollution sources;
5. Means of implementation; and
6. A monitoring plan

*Task Description/Methodology:* Physical oceanography: Studies will concentrate on the development of a mathematical model to simulate the hydrodynamic circulation in Ban Don Bay. The model will feature the influence of tide and wind. Data from the Hydrographic Office and the meteorological stations will be utilized in this study. The finite element method will be used in the development of the model.

Chemical and biological studies will concentrate on the actual bay area with some reference stations representing the marine environment. The exact locations will be made after two preliminary surveys and sampling (during dry and wet seasons) are conducted. Chemical parameters to be studied include seawater quality, sediments and marine organisms. Biological studies will focus on bacteria, benthos and plankton. Monitoring of bacteria in oysters will be performed four to six times a year.

The above data will be analyzed to identify contaminants and sources affecting water quality; to describe the water transport regime and assess its relevance to existing/potential CRM issues; to identify and map local natural sources of economically important bivalve larvae; and to characterize the nearshore environment of Ban Don Bay area.

*Duration:* 24 months, 1986-1988

*Team Leader:* Dr. Manuwadi Hungspreugs

*Institution Involved:* To be identified

*Task Code 250-T:* Assessment of the coastal environment at Phang-nga Bay

*Target:* To characterize the nearshore and marine environment of Phang-nga Bay with emphasis on existing and/or potential relevance to coastal resources and development

*Products:* As in Task Code 240-T

*Task Description/Methodology:* The design will focus on water quality and water transport regimes. In the former, physicochemical parameters and pollutants will be qualified and quantified. To achieve this, it is important to work closely with the land-based pollution and fisheries study teams.

The expected outputs of the study are identification and quantification of contaminants and sources affecting water quality; description of water transport regime and assessment of its relevance to existing/potential CRM issues and characterization of the study site's nearshore environment.

*Duration:* 24 months, 1986-1988

*Team Leader:* Mr. Prawin Limsaichol

*Institution Involved:* Phuket Marine Biological Center

*Task Code 260-T:* Land-based pollution study

*Targets/Products:*

1. To evaluate pollution problems due to land-based sources which contribute to coastal resources degradation;

2. To study pollution due to coastal zone development in the Upper South area;
3. To collect, analyze and evaluate baseline data;
4. To propose a management plan and mitigative measures; and
5. To support other project activities with relevant information found.

*Task Description/Methodology:* The major activities of the study are: review of pertinent background information on and preparation of base maps; assessment of the existing condition of inland and coastal water resources by field survey and water sampling; determination of wasteload from major pollution sources by field survey, sampling and use of questionnaires; assessment of the assimilative capacity of receiving waters; recommendations for minimum environmental quality criteria and standards and for a management plan for land-based pollution control; and recommendations to reduce the harmful impact of identified pollution sources.

*Duration:* 18 months, 1986-1987

*Team Leader:* Mrs. Nisakorn Kositratana

*Institution Involved:* ONEB

*Task Code 270-T:* Evaluation of mangrove development potential

*Target:* To ensure optimal sustainable utilization of mangrove resources in Ban Don and Phang-nga Bays

*Products:*

1. Mapping and characterization of the mangrove resources within the project area;
2. Identification and characterization of significant human-based sources which cause mangrove degradation;
3. Identification of suitable areas and approaches leading to the restoration of mangrove habitats; and
4. Identification and characterization of key mangrove environmental parameters which will serve as limiting factors to alternative uses.

*Task Description/Methodology:* The following activities will be undertaken to address the mangrove degradation problem in the Upper South Region. Existing data on the past and present conditions of mangrove resources in the natural and reforested areas will be reviewed. Field data on species composition, zonation, stand density and volume and natural regeneration; environmental condition of the mangrove ecosystems; and impact of development activities on mangroves will be presented.

The following data will also be analyzed: productivity of mangrove communities; their relationship with other environmental factors; EIA of potential development activities; and identification of critical mangrove areas affected by human activities. The current situation of mangrove communities and potential mangrove resources management and conservation programs will also be evaluated. In addition, alternative uses for specific areas guided by sectoral objectives will be studied. Recommendations substantiated by field data will be developed.

*Duration:* 24 months, 1986-1988

*Team Leader:* Dr. Sanit Aksornkoae (Principal Investigator)

*Institutions Involved:* Faculty of Forestry, Kasetsart University and Department of Royal Forestry

*Task Code 280-T:* Evaluation of wildlife resources

*Targets:*

1. To ensure conservation of endangered/rare wildlife and critical habitats; and

2. To promote sustained exploitation of wildlife and habitat resources in the economic development of the Upper South Region.

*Products:*

1. Detailed assessment and mapping of wildlife habitats and protected areas throughout the land bridge and along the coastal areas of Ban Don and Phang-nga Bays;
2. Zoning maps in accordance with assessed resources; and
3. Formulation of recommendations for wildlife exploitation and modifications to existing protected areas which include status, management and zoning requirements.

*Task Description/Methodology:* Data collection and analysis of animal abundance and distribution based on habitats and food sources will be conducted. The environmental impact of potential development activities on wildlife habitats, distribution and migration routes will be analyzed. Tentative zoning maps categorized into three distinct zones (development, conservation and preservation) will be drawn up. Terms of reference for the preparation of the necessary management plans of wildlife sanctuaries, nonhunting areas and others will be drawn up; and a socioeconomic analysis of the existing or proposed wildlife habitat resources and specific study relevant to other study teams will be made.

The study will make use of these methods:

1. Information on wildlife aspects: literature review; and
2. Data collection: habitat inventory and wildlife census methods--direct and indirect count

*Duration:* 21 months, 1986-1988

*Team Leader:* Dr. Chompol Ngampongsa (Wildlife Ecology)

*Institution Involved:* Faculty of Forestry, Kasetsart University

*Task Code 290-T:* Evaluation of land capability use and development potentials

*Targets/Products:*

1. To promote optional sustainable utilization of Upper South land resource within the proposed study site;
2. To provide relevant information in support of other sector activities;
3. To map and characterize existing land use patterns and potentials in project study site;
4. To identify specific areas where appropriate land use resulted in inland/coastal degradation; and
5. To formulate recommendations according to the Japan International Cooperative Agency (JICA) proposed land use plan.

*Task Description/Methodology:* Land capability assessment and present land use survey will be conducted. The data obtained will be considered on the basis of agricultural production and potential uses in the project area. Recommendations aimed at improving the production and reducing further deterioration of land resources for agricultural uses will also be presented. Evaluation of underutilized or overutilized land resources will be assessed to identify areas which have the potentials for development and lands being misused and needing management measures. Recommendations addressing inappropriate land use and potential land use as proposed by the JICA report will be formulated.

*Duration:* 21 months, 1986-1988

*Team Leader:* Dr. Pisoot Vijarnsorn

*Institution Involved:* Department of Land Development - Soil Survey and Classification, Land Use Planning Division and Division of Soil Analysis

## Division 300 - Socioeconomics

*Task Code 310-T: Socioeconomic survey of key development areas*

*Targets:*

1. To integrate socioeconomic considerations into coastal resource planning process for Phang-nga and Ban Don Bays; and
2. To conduct sector-specific socioeconomic assessments of particular issues to provide a basis for sound policy formulation and selection.

*Products:*

1. Characterization of local patterns of natural resource utilization
2. Quantification in both social and economic terms;
3. Significance of these coastal resources dependencies to local communities;
4. Assessment of local perception and receptivity towards environmental management policies; and
5. Identification and characterization of locally perceived, externally driven issues resulting in coastal resources degradation which reflect the "local view" towards CRM.

*Task Description/Methodology:* The study involves a three-stage data collection process with each stage designed to gather sets of socioeconomic information:

Stage I will review previous socioeconomic data on the land bridge and its position within the Upper South economy.

Stage II will lay the groundwork for the development, implementation and analysis of a socioeconomic assessment profile survey. Initial section survey will address social and physical (resource) determinants of economic activities. The second survey will focus on ascertaining personal and individual determinants.

Stage III is solely designed for coordination with the efforts of selected project study teams. A limited number of subsector-specific socioeconomic assessment on particular issues will be conducted based on ongoing researches and identified needs of other subsectors. This assessment will integrate the socioeconomic considerations with the researches of the other study teams.

*Duration:* 30 months, 1986-1988

*Team Leader:* Dr. Subarn Panvisavas

*Institution Involved:* Faculty of Social Sciences and Humanities, Mahidol University

*Task Code 320-T: Anthropological evaluation of the socioeconomic considerations in coastal resources use in Ban Don and Phang-nga Bays, Thailand*

*Target/Product:* Activities and methods will focus on analyzing the socioeconomic considerations which determine indigenous coastal resource uses and compliance with existing or potential future policies concerning conservation and development.

*Task Description/Methodology:* Resource development and management planning issues emphasized in the study will include controlled use and development of mangrove forests, especially in Phang-nga Bay, and aquaculture development, particularly at the small-scale level. Anthropological analysis will be conducted adopting a cultural, ecological approach which qualitatively examines the relationship between specific socioeconomic features and a group's adaptation to its total environment. Research focus will reset on those patterns of activities and social relationships adopted by the groups to exploit their particular ecological niche.

A threefold set of procedures which will guide data collection are the analysis of interaction between the environment and the technology being used in it; analysis of patterns of activities required by exploitation technology used in a given area; and investigation into behaviors involved in exploiting environmental effects and are affected by other aspects of culture. Through this analysis, an effective means to modify activity patterns within existing socioeconomic structures and value system can be recommended.

*Duration:* 30 months, 1986-1988

*Team Leader:* Dr. Subarn Panvisavas

*Institution Involved:* Faculty of Social Sciences and Humanities, Mahidol University

#### Division 400 - Legal and Institutional Division

*Task Code 410-T:* Analysis of institutional arrangement

*Target:* To identify and characterize government entities and their respective roles and responsibilities at the local, regional and national levels which affect/manage the use of coastal resources in the Upper South Region.

*Products:*

1. Summary compilation and analysis of the legal regime supported by copies of the relevant legal acts which affect the Upper South coast;
2. Two reports: one which will characterize all government institutional "actors," their legal mandates and the resources available to carry out these mandates; the other report will be supported by a schematic portraying of all relevant entities at local, regional and national levels.

*Task Description/Methodology:* An assessment of the existing institutional arrangements, policies, processes and constraints affecting the status and utilization of coastal resources in the Upper South Region will be conducted. Identification, characterization and proposed remedies to institutional overlaps, inefficiencies, gaps and others resulting in "significant" coastal resources degradation, mismanagement and/or nonsustainable development will be developed.

Government institutions will be contacted, and interviews arranged with appropriate personnel. The basic information to be gathered will include number and range of professional skills of people employed in offices whose responsibilities affect the Upper South coastal resource systems; trends in recent budgets; and institutional "perspectives" of coastal resources issues in the study area.

*Duration:* 12 months, 1988

*Team Leader:* To be identified

*Institutions Involved:* ONEB in cooperation with the National Institute of Development and Administration

*Task Code 420-T:* Evaluation of existing and potentials for recreation and tourism development and management in the Upper South Region, Thailand

*Targets/Products:*

1. To promote appropriate tourism development of coastal-based resources with regard to socioeconomic-cum-environmental management of these resources; and
2. To identify and characterize linkages between tourism and other development sectors and to recommend measures to reduce negative impacts on tourism development.

*Task Description/Methodology:* To be integrated in the overall coastal

zone plan will be a review of existing and proposed tourism development which will identify any conflict in resource use or means for improved resource development and the preparation of management plans. The following priority issues/questions will be tackled:

1. Ban Don Bay Zone - degree of master plan implementation, especially relating to administrative structure; scale/type of tourism development at Ko Samui in relation to environmental and socioeconomic impacts; development of national parks; most appropriate use and protection of coral resource; and enhancement of the linkage of Surat Thani tourism with Phuket's;
2. Phang-nga Bay Zone - degree of implementation of previous recommendations, especially relating to administrative structure; scale/type of tourism development in Phuket in relation to environmental, socioeconomic and mangrove management impacts; mining and other land uses on tourism in Phang-nga and Krabi; and potentials for increased tourism development in Phang-nga/Krabi to enhance economic inputs from tourism.

*Duration:* 15 months, 1986-1988

*Team Leader:* Mr. Robert J. Dobias

*Institution Involved:* To be identified

#### Division 500 - Habitat Restoration

*Task Code 510-T:* Critical habitat management

*Targets/Products:* To be identified

*Task Description/Methodology:* A classification matrix will be constructed. A field survey of the Upper South Region's major ecosystems will be undertaken, and a report for use by the other team members' will be drawn up. A natural resource team will identify the potentials, constraints and interrelationships of natural components and process of major ecosystems. The impact of various development activities on the availability of the region's natural resources will be determined.

The creation of extensive ecological reserves in the zone where negative impact is severe will be considered after analysis. Management recommendations and development strategies for critical habitat will be drawn up upon detailed study and review of existing development project proposals.

*Duration:* 18 months, 1987-1988

*Team Leader:* To be identified

*Institution Involved:* To be identified

#### Division 600 - Resource Management Plan Formulation

*Task Code 610-T:* Conflict identification and resolution

*Targets/Products:* To be identified

*Task Description/Methodology:* This task will deal with environmental issues as early as possible during planning to avoid unnecessary conflicts in the development process. Interaction within and among ecosystems will be identified to uncover potential resource use conflicts in the Upper South Region for which a matrix arraying development sectors will be constructed.

A report will be generated emphasizing the importance of integrating and coordinating development activities to minimize or control negative development impacts on the ecosystems. Conflicts in resource use will be resolved through project coordination, negotiation and mediation.

*Duration:* 12 months, 1988  
*Team Leader:* To be identified  
*Institution Involved:* To be identified

*Task Code 620-T:* CRM plan formulation and evaluation

*Targets/Products:* To formulate and evaluate a CRM plan that will include sectoral and national economic plans that can be implemented at the Upper South Region and can be used as model development plan for other geographical regions in the country.

*Task Description/Methodology:* National economic planning will involve setting prescriptive goals for each sector of the economy, affecting allocation of labor, investment capital and land use. Plans will be formulated with the assistance of technical advisors specializing in CRM plan development in developed and developing countries. The National Science Council will take action in discussing and approving the plans. The compatibility of the plans with the 7th National Economic and Scientific Development Board (NESDB) plan will be studied at a later stage.

*Duration:* 24 months, 1988-1989  
*Team Leader:* To be identified  
*Institution Involved:* To be identified

*Subtask Code 621-T:* Coastal sectoral planning

*Targets/Products:* To be identified

*Subtask Description/Methodology:* An integrated CRM plan will be designed to interrelate and jointly guide the activities of two or more sectors in planning and development. Sectoral planning will combine forecasting and implementation of capital investment, land use planning and infrastructure needs for specific sectors of the national economy. More emphasis will be placed on issues other than the production of economic goals.

Sectors with the greatest economic relevance to CRM, including port planning, fisheries, tourism, lowland agriculture and industry will be taken into account. Aspects on coastal resource habitats and environmental quality factors will be integrated with the other aspects of sectoral planning to make the effort more successful.

*Duration:* 24 months, 1988-1989  
*Subtask Leader:* To be identified  
*Institution Involved:* To be identified

*Subtask Code 622-T:* National CRM planning

*Targets/Products:* To be identified

*Subtask Description/Methodology:* A long-term plan (four-year period) and setting of production targets in important sectors of the economy will be developed. The plan will create a degree of certainty about coastal frontage and adjacent land needed for development within a particular time frame. One potential strategy is to use national CRM planning for integration of sectors to produce an integrated coastal program for the region. Sectors such as fisheries, ports and tourism will be made mutually supportive.

*Duration:* 24 months, 1988-1989  
*Subtask Leader:* To be identified  
*Institution Involved:* To be identified

*Subtask Code 623-T:* Environmental base maps

*Subtask Description/Methodology:* All available maps of the study area, including aerial photos and satellite imageries, will be collected. Using

these, environmental base maps for the two study areas will be carefully prepared. These maps include those on topography, meteorology, hydrology, land use, forestry, population distribution, industrial location, mineral resources, tourism and infrastructure. A complete set of appropriate aerial photographs will be obtained covering the two study areas. The new photos will be compared to 1966 photos to assess change over the last 20 years.

*Duration:* 18 months, 1987-1988

*Subtask Leader:* To be identified

*Institution Involved:* To be identified

*Subtask Code 624-T:* Mineral resources development potential and planning

*Targets/Products:* To be identified

*Subtask Description/Methodology:* The subtask activities include mapping and characterization of existing and known "economically significant" mines and mineral deposits which will potentially affect other coastal sections. The nature of the major mining and coastal conflicts will be identified and described.

The present technologies employed in mining and their relevance to environmental disturbance will also be described. Existing and potential socioeconomic significance of mineral resources to the region's economy will be characterized. Outputs will cover (1) socioeconomic analysis of coastal conflicts previously identified; (2) formulation of recommendations designed to reduce or minimize coastal impacts associated with land- and sea-based mining activities; (3) means for implementation and (4) a monitoring plan.

*Duration:* To be identified

*Subtask Leader:* To be identified

*Institution Involved:* To be identified

*Task Code 630-T:* Preparation of action plans

*Targets/Products:*

1. Preparation of alternative action plans that identify management/implementation strategies;
2. Formulation of general socioeconomic and environmental-cum-economic objectives;
3. Environmental standards;
4. Management strategies and implementation actions;
5. Regional environmental monitoring system

*Task Description/Methodology:* Alternative action plans will be formulated with different objectives. Necessary actions will be posed to achieve the latter. Alternatives will cover the feasible range of development and environmental protection. The plan will also delineate the various components/sectors and government agencies with responsibilities for and jurisdictions over each component. All significant institutions and the financial constraints involved will be taken into account. An overall realistic program and approach will be recommended.

*Duration:* 12 months, 1989

*Team Leader:* To be identified

*Institution Involved:* To be identified

*Subtask Code 631-T:* Formulation of general socioeconomic and environmental-cum-economic objectives

*Targets/Products:* To be identified

*Subtask Description/Methodology:* An array of objectives that will appear to provide local, provincial and national benefits in the study areas and that

ameliorate the problems or issues will be presented. The objectives will be derived using information developed in previous tasks. The former should be feasible and reflect a full range of options for resource exploitation or preservation. Tentative alternative objectives will be selected and finalized after impact assessment demonstrates compatibility. Objectives will be scoped to ameliorate existing or potential socioeconomic/environmental problems.

*Duration:* 12 months, 1989

*Subtask Leader:* To be identified

*Institution Involved:* To be identified

*Subtask Code* 632-T: Environmental standards

*Targets/Products:* To be identified

*Subtask Description/Methodology:* The task will take into account significant environmental resources/values of the study area and the more sensitive or fragile resources/values in particular. The plan will include preparation of recommended environmental standards to be maintained for each significant natural environmental resource. Standards must be appropriate to and realistic in terms of past practices in Thailand. Trial standards to be identified will be those which appear to be necessary to attain tentative environmental objectives and which reflect available resources of assimilative capacity. After impact assessment is conducted and alternative objectives are finalized, trial standards will be adjusted to environmental standards.

*Duration:* 12 months, 1988

*Subtask Leader:* To be identified

*Institution Involved:* To be identified

*Subtask Code* 633-T: Management strategies and implementation actions

*Targets/Products:* To be identified

*Subtask Description/Methodology:* Strategies of the study will emphasize on the:

1. Future land and other resource uses that should occur, carrying capacity and sustained yields of renewable resources, future demography and future employment opportunities;
2. Types and extent of developments planned;
3. Nonstructured (management) activities needed such as aquaculture species selection and culture techniques, mangrove resource protection, etc.;
4. Institutional arrangements needed;
5. Legal arrangements needed to effect the above;
6. Financial arrangements needed to effect the above;
7. Schedule showing phasing of investments and facilities, management actions and institutional, legal and financial activities during the 20-year horizon;
8. Description of responsibilities and role of local, provincial and national governments and other organizations and entities in the Integrated Coastal Zone Development Plan implementation and plan updating; and
9. Program for continuing evaluation and monitoring of plan implementation to determine effectiveness in meeting objectives and standards.

*Duration:* 24 months, 1988-1989

*Subtask Leader:* To be identified

*Institution Involved:* To be identified

*Subtask Code* 634-T: Regional environmental monitoring system (REMSY)

*Targets/Products:* To be identified

*Subtask Description/Methodology:* A recommended REMSY will be formulated based on Subtasks 621, 622 and 623 and will be carried out under the aegis of ONEB.

The system will include delineation and description of all component tasks and their assignment to participating agencies; estimates of equipment, personnel skills and other resources needed for carrying out the tasks; recommendations on establishing an appropriate Environmental Data Bank/Storage and Retrieval System (EDB/SRS) to be maintained by ONEB.

ONEB will prepare the recommended schedule for implementing and continuing the operation of the proposed REMSY; and the format and content for regular REMSY, including distribution and frequency, recommendations for a REMSY Interagency Committee, estimates of costs and suggestions for cost sharing and financing.

*Duration:* 12 months, 1988

*Subtask Leader:* To be identified

*Institution Involved:* To be identified

*Task Code 640-T:* National guideline for CRM

*Targets/Products:*

1. To suggest and recommend for each type of development ways to improve site selection, project design and/or operational technique; and
2. To present guidelines for the management of coastal development based on CRM plan of the Upper South Region which can be applied to other critical coastal zones.

*Task Description/Methodology:* To be developed

*Duration:* 12 months, 1988

*Team Leader:* To be identified

*Institution Involved:* To be identified

#### Division 700 - Implementation Division

*Task Code 710-T:* Official seminars/meetings

*Targets/Products:*

1. To stimulate the Royal Thai Government (RTG) agencies' interest, sense of participation and ownership of the final product of CRMP;
2. To fit CRMP ideas into existing sectoral plans;
3. To test the feasibility of management strategies for identification of project follow-up activities and implementation structure; and
4. To evaluate the results after seminars/meetings.

*Task Description/Methodology:* Seminars with counterpart agencies will be conducted. Local agencies that will be responsible for the coordination and operation of the project will be approached to obtain ideas. Provincial meetings and dialogues with the beneficiary population will be held. The major role of the task is to discuss with various agencies the technical findings of CRMP and the feasibility of management strategies developed by the project. Follow-up activities and the project implementation structure will be identified with the agreement of RTG agencies.

*Duration:* 4 years, 1986-1989

*Team Leader:* Mr. Arthorn Suphapodok

*Institution Involved:* ONEB

*Task Code 720-T:* Public relation and forums

*Targets:*

1. To use the forum and media contacts to solicit support from a broad political spectrum; and

2. To create public awareness about the project's approach.

*Products:*

1. Four one-day forums to be held during the life of the project;
2. At least one forum to be organized at the project area during the Study Execution Phase I; and
3. Copy of proceedings from each forum for distribution

*Task Description/Methodology:* A one-day public forum will be organized either in Surat Thani or Phang-nga. Local organizations with interests in CRM will be invited to participate. Principal components of the forum will include an overview of the project, characterization of the area, major issues, approaches leading to plan development and projected follow-up activities under the Implementation Division over the project period. Information for public dissemination will be produced to promote CRM awareness.

*Duration:* 30 months, 1986-1989

*Team Leader:* Mr. Arthorn Suphapodok

*Institution Involved:* ONEB

*Task Code 730-T:* Analysis to determine the feasibility of integrating the Upper South CRM plan to the 7th NESDB Plan

*Targets/Products:*

1. To facilitate implementation of multisectoral policy recommendations proposed in the Surat Thani and Phang-nga study sites;
2. To assess viable institutional arrangements required to implement proposed multisectoral policy recommendations arising from plan preparation; and
3. To recommend appropriate institutional arrangements based on well-defined criteria needed to maximize effectiveness of policy recommendations.

*Task Description/Methodology:* To be developed

*Duration:* 6 months, 1989

*Team Leader:* Mr. Arthorn Suphapodok

*Institution Involved:* To be identified

## Division 800 - Project Management Division

*Task Code 810-T:* Project management

*Targets:*

1. To oversee day-to-day management work; and
2. To facilitate coordination in administrative and financial aspects.

*Products:* Quarterly and annual financial reports, and progress reports

*Task Description/Methodology:* The major activities to be undertaken are workplan preparation; monitoring of project progress; providing periodic reports to ICLARM; and drafting terms of reference for contractors. The task will also include coordination between ICLARM and the cooperating and/or implementing agencies in the implementation of research activities and matters on project administration and finance. The ONEB management team will be responsible for in-country project activities. It will allocate, disburse and account project funds; hire consultants; report to the NSC and to the cooperating and/or implementing agencies.

*Duration:* 48 months, 1986-1989

*Team Leader:* Mr. Arthorn Suphapodok

*Institution Involved:* ONEB

## Training Programs

Training activities, which cover short-term training courses, medium-term academic training and technical seminars/workshops, are scheduled throughout the life of the project. These are designed to increase the existing technical capabilities in coastal resources research and management in ASEAN countries and upgrade knowledge on new approaches and concepts on CRM and planning among decisionmakers and planners. Training courses and programs are specially intended for managers, scientists and researchers while seminars/workshops for resource planners and policymakers.

### Short-term Training Courses

#### Information Research and Management

*Course Targets and Approach:* The course is designed to provide the project's technical staff with new knowledge and skills on current approaches and modern applications of information procurement, storage, retrieval and dissemination with special emphasis on CRM and planning. Existing information management systems (DIALOG, AUSTINET, CSIRONET, INFOTERRA), data processing, using and disseminating information are introduced.

*Course Content:* Introduction to information systems (libraries, contents, journals, bibliographies, etc.; use of data bases; on-line searching; information services); using information (in research, training, extensions, avoidance of duplication, etc.); scientific reporting (papers/articles, project report preparation, referencing, etc.); disseminating information (newsletters, press releases, articles, reprints, etc.); word processing; statistics; experimental data storage, communication, etc.

*Duration:* Two weeks

*Number of Participants:* 13

*Schedule:* 29 September-13 October 1986

*Venue:* ICLARM, Philippines

#### Principles of Coastal Resources Management

*Course Targets and Approach:* The course is designed to introduce researchers, resource managers and policymakers to the principles of integrated CRM. It focuses on the synthesis and integration of information on renewable coastal resources use conflicts and formulation of management strategies and planning. The course will create common analytical and philosophical bases for CRM in the participating ASEAN countries.

*Course Content:* Rationale and principles of CRM (interdisciplinary; multiple use management; management information needs; intersectoral coordination; integration of policy; management and research); management tools (set-backs, GISs, zoning, atlases, etc.); conflicts associated with traditional sectoral approaches in the coastal zone; conflict resolution; major resource systems and processes (mangroves, beaches, seagrasses, coral reefs, fish, etc.); role of marine reserves and protected areas; economic systems (fisheries, agriculture, aquaculture, transport and communication, tourism, urbanization, industrialization, mining, forestry); sociocultural characteristics of coastal inhabitants; natural hazards; institutional relationships (traditional resource management, government and quasi-governmental institutions, policies, legal frameworks, regulations and enforcement); economic analysis and CRM (existing economic interactions, modelling, cost-benefit analysis); technology demonstration for research and information management; and case studies.

*Duration:* 2 weeks

*No. of Participants:* 15-20

*Schedule 1:* 2-14 March 1987

*Venue 1:* Bangkok and Phang-nga Bay, Thailand

*Schedule 2:* 10-21 August 1987

*Venue 2:* Johore Bahru, Johore, Malaysia

*Schedule 3:* To be identified

*Venue 3:* Indonesia

*Schedule 4:* To be identified

*Venue 4:* To be identified

#### **Methods for Socioeconomic Analysis of Coastal Area Management**

*Course Targets and Approach:* The course is designed for project personnel involved in socioeconomic studies and who are interested in the socioeconomic aspects, approaches and methods used in the management of coastal zone systems. Participants will be exposed not only to the economic assessment of coastal resources but also to their indirect contribution to coastal systems and social implications to the coastal zone communities.

*Course Contents:* Traditional approaches to economic assessment and their respective strengths and weaknesses; alternative approaches (energy analysis; extended cost-benefit analysis); characteristic human livelihood systems dependent on coastal resources in the ASEAN region; comparative case studies employing traditional vs. alternative economic analysis in the project design.

*Duration:* 2 weeks

*No. of Participants:* 20

*Schedule:* 4-14 November 1987

*Venue:* Singapore

#### **Remote Sensing Application in Coastal Resource Management**

*Course Targets and Approach:* The course is aimed at training project technical staff in the application of remote sensing to CRM including interpretation of satellite imagery and aerial photographs.

*Course Contents:* Basic principles of remote sensing; application of available technology of natural resource assessment (mangroves, coral reefs, seagrass beds, etc.); processes (sand transport, current patterns, bathymetry

modifications); human settlement surveys (land use, patterns of occupancy); pollution monitoring; hazards assessment; management applications (zoning, atlas/graphics preparation); existing data centers; and means available to obtain the data.

*Duration:* 2 weeks

*Schedule:* To be identified

*Venue:* To be identified

### **Integrative Methods of Coastal Resources Management**

*Course Targets and Approach:* The purpose of the course is twofold: (1) to introduce trainees to the various available techniques to assist in interdisciplinary multisectoral natural resources planning; and (2) to provide planners with the means, both training and software, to build site-specific computer simulation models which can be used to predict the status of coastal resources and resource systems given present rates and levels of exploitation within each resource sector and known existing empirical relationships between systems and processes characteristic of the site. The usefulness of this information to the planner will be demonstrated in a management scenario reflecting the situation at one of the project sites. Site selection will depend on the country's level of interest and site applicability to the other participating countries. Direct participatory involvement by the trainees in building a site-specific model together with the supply of appropriate software will equip them with the capabilities to build similar models appropriate to their respective project sites.

*Course Contents:* To be identified

*No. of Participants:* To be identified

*Duration:* 2 weeks

*Schedule:* To be determined

*Venue:* To be identified

### **Policy Seminars and Workshops**

It is considered necessary to expose resource managers, policy- and decisionmakers to new concepts and multisectoral, interdisciplinary and integrated approaches to CRM and to keep them informed of the results of project activities needed for planning and developing management strategies. The seminar will focus on actual situations characterized by resource use conflicts in the participating countries.

In the first two years, the seminars/workshops will put emphasis on the principles and approaches to CRM and planning; while in the last two years, on the actual results of project-funded pilot activities. The course contents of the seminars/workshops will be developed by ICLARM in consultation with policymakers and resource managers.

Two regional technical/planning workshops/seminars will be organized during the middle of the project life and towards its end which will involve national project personnel, resource managers and policymakers of participating countries. This is to provide a forum for further interaction among project personnel and managers, with emphasis on research findings/conclusions which will contribute to the formulation of an implementable CRM plan.

### Medium-term Academic Training

The main objective of this training program is to equip project personnel with the necessary scientific skills and advanced knowledge required to meet the range and extent of issues which characterize the ASEAN region's coastal area. Project personnel who will go on training are expected to perform a considerable part in national project activities upon completion of their training.

Under this training scheme, each participating country nominates one candidate for higher degree training in resource management in US universities and some selected ASEAN academic institutions. The one- or two-year postgraduate (masteral level) training course on marine affairs conducted by some US universities may be appropriate programs for project personnel. Academic training in the US can only be targetted for September 1987 at the earliest.

Some ASEAN academic institutions will be identified to accept ASEAN scholars for postgraduate (masteral level) studies over a two-year period. In most ASEAN universities, course work is generally completed in the first year and a short research project (thesis) is carried out in the second year. Whenever possible, postgraduate research study should be part of the ongoing research studies of the project in the participating countries.

Six postgraduate fellowships (masters degree) for training in the US on coastal zone management or marine affairs have been budgeted for.

### On-the-job Training

Project resources are available for researchers, especially junior scientists, who wish to upgrade his technical skills in one or more aspects of CRM and research through on-the-job training in the US and ASEAN countries. Selected individuals are expected to assist a senior researcher in a specific research project or activity for a period of time during which he acquires the necessary technical skills. At least 3-6 months will be needed if the training involves participation in research work.

The scheme provides opportunities for 48-50 participants. Placements will depend on the needs of the participating countries and the availability of senior scientists and facilities of the host institutions. The project will provide air fares, stipends and nominal training/research expenses as budgeted.

## Information Program

One of the objectives of the ASEAN-US CRMP is to generate new and useful information which can be applied to CRM. The importance of disseminating improved approaches and policies cannot be overemphasized. Many project personnel, scientists, researchers, resource managers and planners at large and the populace of the six participating ASEAN countries will benefit from this dissemination.

Dissemination activities will aim at providing information on trends of living coastal resource exploitation, socioeconomic status of coastal communities and others; promoting the concept of an integrated, multisectoral CRM approach in ASEAN countries; and creating public awareness of the socioeconomic importance of living coastal resources to coastal communities and the rationale for the former's management.

### Regional Newsletter

The project publishes a regional newsletter, *Tropical Coastal Area Management*, which provides up-to-date information on resource distribution; coastal resource utilization; socioeconomic characteristics and interdependency of coastal communities; and coastal zone management and planning. Initially, the newsletter comes out three times a year but frequency will later increase on a quarterly basis.

The newsletter places particular emphasis on, but not limited to, CRM in ASEAN countries. A section of the newsletter is devoted to the progress of project activities including research activities being undertaken by the participating countries. Space is also allocated for project-related activities of other institutions. The newsletter also documents reports from public/national and international agencies on coastal resources degradation.

The newsletter is distributed free of charge to more than 1,500 readers in 92 countries.

### Educational Materials

Educational materials will be prepared for all sectors of the population to create public awareness on the importance or rational exploitation of living coastal resources, environmental conservation and integrated CRM. Existing materials on these will be referred to and considered.

The following have been identified as popular subjects among resource managers, policymakers and educational institutions: mangroves, coral reefs, mudflats, coastal environment, living coastal resources, coastal fisheries, beaches and tourism, tin prospecting, coastal land reclamation, coastal fishing village, nutrition of coastal inhabitants, management of the coastal

environment, coastal aquaculture, coastal human communities, marine mammals, marine parks and reserves, intertidal zone and coastal wildlife. A handbook on coral reefs came off the press in mid-1987 and another on marine parks and reserves is being prepared.

A site-specific Coastal Resources Management Data Atlas will also be prepared. It will present current information on resource distribution, conservation and utilization in the ASEAN region; and incorporate thematic mapping of the attributes and uses of principal resources and management characteristics of each of the pilot areas in the countries. The Atlas is expected to form part of the basis for policy coordination and management strategies in coastal zone planning.

### Technical Publications

The various project activities will generate the following technical publications over the next four years:

1. Technical reports/reviews/monographs on activities of pilot areas: cooperative research of member institutions; country profiles, etc.;
2. Training manuals and lecture series from short-term training courses;
3. Proceedings of seminars/workshops; and
4. Site-specific management plans developed by each country.

### Working Paper Series

The project has also prepared its working paper series. These are documents which are intended mainly for in-house circulation and limited distribution to people and organizations closely associated with the project. This may include technical reports, progress reports, in-country research proposals, etc. There are 21 documents in the series:

- |         |  |
|---------|--|
| WP 86/1 | Suggested Guidelines for Project Implementation and Evaluation   |
| WP 86/2 | ASEAN/US Cooperative Program on Marine Sciences: Coastal Resources Management Project: First Annual Report (30 August 1985-31 August 1986) |
| WP 86/3 | Proposed Evaluation Plan   |
| WP 86/4 | Progress Report of the Project Coordinator (30 August 1985-31 October 1986)  |
| WP 86/5 | Supplement to the Progress Report of the Project Coordinator   |
| WP 86/6 | Proposal for Supplementary Budget  |
| WP 86/7 | Training Course on Information Research and Management, Manila, Philippines  |
| WP 86/8 | Proceedings of the One-day Workshop of Coastal Resources Management Scientists   |
| WP 87/1 | The Coastal Environmental Profile of Brunei Darussalam: Resource Assessment and Management Issues  |
| WP 87/2 | Brunei Darussalam Coastal Resources Management Pilot Project: Annual Work Plan for 1988  |
| WP 87/3 | Resource Assessment, Planning and Research: Malaysia Pilot Project: Annual Work Plan 1988  |
| WP 87/4 | The Coastal Environmental Profile of Singapore   |

- WP 87/5 The Coastal Environmental Profile of Ban Don Bay and Phangnga Bay, Thailand
- WP 87/6 Coastal Resources Profile of Segara Anakan-Cilacap Coastal Region, South Java, Indonesia
- WP 87/7 A Coastal Profile of the Lingayen Gulf
- WP 87/8 Environmental Profile of South Johore
- WP 87/9 Singapore Annual Work Plan 1988
- WP 87/10 Thailand Annual Work Plan 1988
- WP 87/11 Indonesia Annual Work Plan 1988
- WP 87/12 Philippine Annual Work Plan 1988
- WP 87/13 ASEAN/US Cooperative Program on Marine Sciences: Coastal Resources Management Project Research, Training and Information Programs and Activities, 1986-1989

#### Project Library/Information Services

The project has set up a library from which participating countries can gain access to books and other reference materials on CRM and planning. These materials will also be added to the ICLARM library.

The project has also established an information service mechanism which involves:

1. Literature searches for project personnel through collaboration with the ICLARM Information Program and Selective Information System;
2. Providing photocopies of relevant literature requested by participating countries and institutions; and
3. Providing up-to-date information on the contents of current journals/bulletins on CRM.

Active cooperation of participating institutions and individuals will be sought to obtain much of the site-specific literature.

#### Special Projects

The project is producing a directory of ASEAN institutions and experts involved in CRM. Participating countries may seek consultancy services from these on their project activities.

Another project is the publication of a bibliography on CRM in the ASEAN region.