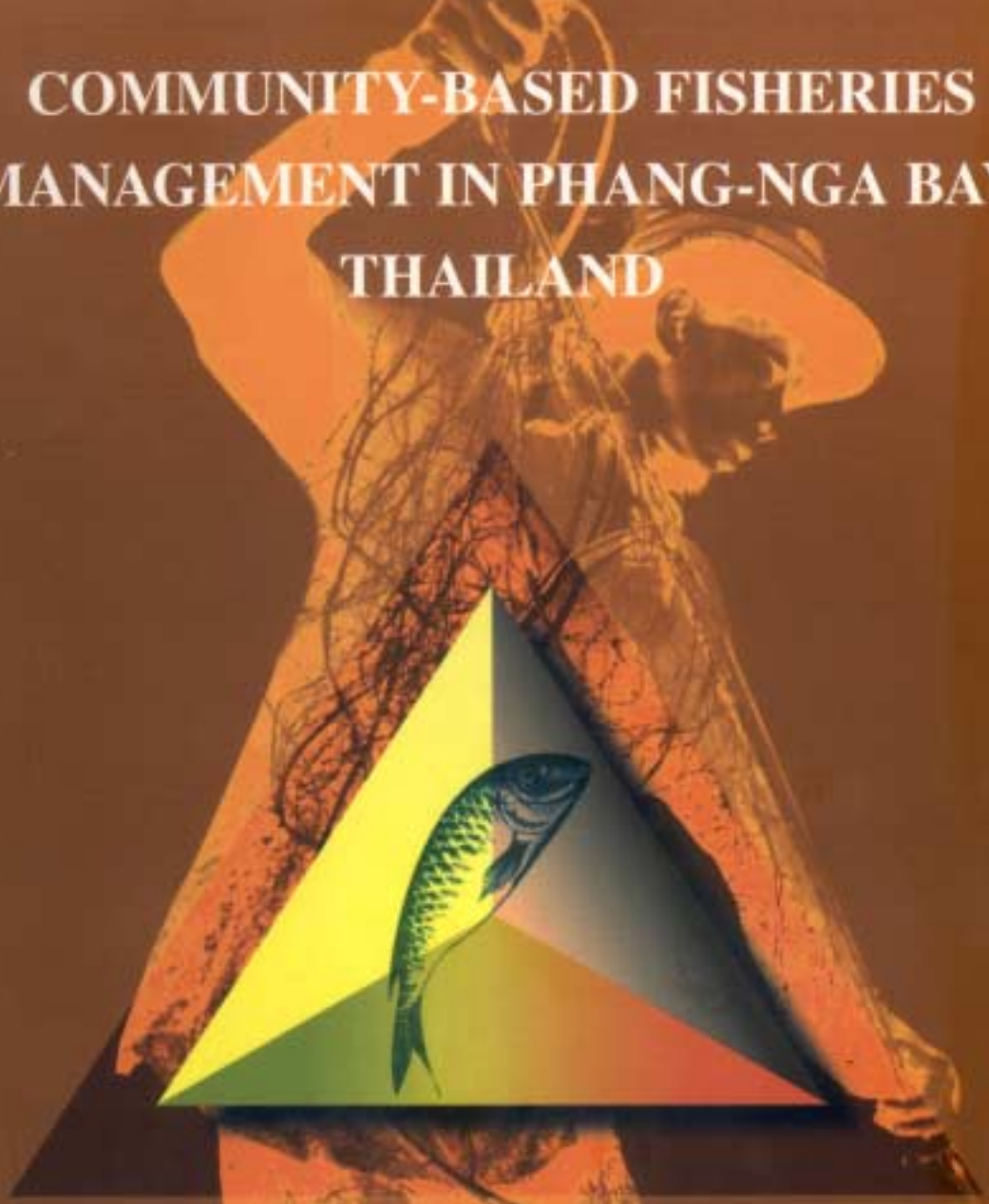
COMMUNITY-BASED FISHERIES MANAGEMENT IN PHANG-NGA BAY, THAILAND



REGIONAL OFFICE FOR ASIA AND THE PACIFIC
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
BANGKOK, THAILAND

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RAP Publication 1998/3
BOBP Report No. 78

COMMUNITY-BASED FISHERIES MANAGEMENT IN PHANG-NGA BAY, THAILAND

Proceedings of the
National Workshop on Community-based Fisheries Management

Phuket, Thailand, 14-16 February 1996

Regional Office for Asia and the Pacific
Food and Agriculture Organization of the United Nations
Bangkok, Thailand

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ISBN 974-86284-8-5

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PREPARATION OF THIS DOCUMENT

This document is the report and proceedings of a National Workshop held jointly by the Thai Department of Fisheries, FAO and the Bay of Bengal Programme of FAO (BOBP) in Phuket, Thailand, 14-16 February 1936. Funds were made available through the GCP/RAS/1 38/JPN Project.

The document comprises the final report of the Workshop, the list of participants and agenda, early results of the Community-based Fisheries Management (CBFM) Project after the Workshop, and the papers presented at the Workshop.

Ms. Donna J. Nickerson, Coastal Management Officer, FAO Regional Office for Asia and the Pacific, prepared the reports on the Workshop and the early results of the CBFM project, and edited the papers contained in this document. Careful reviews of the Workshop Report were provided by Mr. Somsak Chullasorn and Mr. Jate Pimoljindn, Directors of the Phuket Marine Biological Center and Andaman Sea Fisheries Development Center respectively, Department of Fisheries, Thailand. Advice and guidance for the publication was provided by Dr. Veravat Hongskul, Senior Fishery Officer, and Ms. Pornsuda David, Technical Assistant, FAO Regional Office for Asia and the Pacific.

Distribution:

Participants of the Workshop
FAO/BOBP Member Countries
FAO Fisheries Department
Fisheries Officers in FAO Regional Offices

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Nickerson, D.J. (Ed.). 1998.
Community-based Fisheries Management in Phang-nga Bay, Thailand. Proceedings of the National Worskhop on Community-based Fisheries Management organized by the Department of Fisheries of Thailand, FAO and the Bay of Bengal Programme, Phuket, Thailand, 14-16 February 1996. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand. RAP Publication 1998/3 (BOBP Report No. 78), 227p.

ABSTRACT

This document reports the outcome of the Workshop aimed to build a common understanding among the key participants from the Department of Fisheries (DOF) of Thailand, the fishers and village leaders, universities and NGOs, of the importance, benefits and constraints, roles and responsibilities, and needs for flexibility in undertaking the new approach of 'partnership in management' under the DOF/BOBP Community-based Fisheries Management (CBFM) Project in Phang-nga Bay, Thailand. Another objective was to build a consensus among the key participants on the objectives, issues for management and general approach for implementation of the project. Presentations on the status and trends of fishery resources, the ecology, socio-economics, opportunities for women's involvement, as well as fisher's own knowledge of the Bay were presented and are contained in this document. Recommendations of the Workshop include: organization of a CBFM management framework; establishment of a revolving fund managed under the CBFM framework with funding sources from NGOs, Government of Thailand, and fishers' profits; and provision of training and information services for awareness building. It was recommended that the priority issue to be addressed was to develop approaches and measures to effectively execute and enforce the fisher community ban on push nets and trawlers. The early results of the CBFM project after the workshop are also given.

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PREFACE

The National Workshop on Community-based Fisheries Management was the first meeting held together with the Department of Fisheries (DOF), the FAO Regional Office for Asia and the Pacific, the Bay of Bengal Programme (BOBP), the fisherfolk and community leaders to plan the future use of a commonly held resource - the fisheries of Phang-nga Bay. Representatives from all perspectives of management, including the scientific community, universities, government, the private sector, non-governmental organizations, and most important, the coastal fisherfolk communities who have perhaps the closest knowledge of the Bay's coastal resources, participated in the Workshop. To ensure an effective dialogue among these different sectors, a joint DOF/FAO/BOBP Organizing Committee was established for the preparation of the Workshop to create a forum for dialogue on the issues of concern and action required in co-managing the Bay's important resources.

The papers presented in the Proceedings range from technical studies on ecological processes of Phang-nga Bay to the socio-economic and cultural aspects of the coastal fisherfolk communities. Local knowledge of the fisheries and ecosystem was presented by fisherfolk and is contained in the Workshop Report.

A concern for maintaining the high biological productivity of the Bay was shared by all the sectors. What was needed was the unified commitment to a common set of goals, objectives and priorities for management. The Workshop achieved this. It was a successful preliminary step towards a larger purpose - implementation of the Community-based Fisheries Management Project in Phang-nga Bay by the Thai Department of Fisheries with support from FAO and BOBP.

Many contributed to help achieve the objectives of the Workshop. The GCP/RAS/138/JPN (Development of Community-based Coastal Fisheries Management Systems for Asia and the Pacific) Project provided financial support for the Workshop, the Asian Productivity Organization sponsored the participation of a resource person, the FAO Regional Office for Asia and the Pacific and the BOBP provided technical support while the Thai Department of Fisheries provided excellent logistical support for the Workshop. The fisherfolk of Phang-nga Bay took time from their livelihood activities to prepare for and participate in the Workshop, and are continuing to dedicate their time towards an improved and more sustainable management of the fishery resources of the Bay.

It is hoped that this publication would be useful not only to Thailand, but also to other coastal States in their consideration of community-based coastal fisheries management for which all aspects of issues concerned (legal, institutional arrangement, ecology and biology, socio-economic, technology transfer, etc.) must be considered carefully to ensure successful implementation.

The Editor
FAO Regional Office for Asia and the Pacific
Bangkok, February 1998

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PART ONE

REPORT OF THE WORKSHOP

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REPORT OF THE WORKSHOP

OPENING OF THE WORKSHOP

1. The National Workshop on Community-based Fisheries Management (CBFM) was organized by the Department of Fisheries of Thailand (DOF), in collaboration with FAO and the FAO Bay of Bengal Programme (BOBP) at the Phuket Paradise Resort Hotel, 14-16 February 1996. The Workshop was chaired by Mr. Somsak Chullasorn, Director of the Phuket Marine Biological Center (PMBC) of DOF and concurrent BOBP National Coordinator for Thailand. Ms. Donna J. Nickerson served as the Technical Secretary and Dr. Suwanna Panutrakul as Chief Rapporteur. The list of the participants is given in Appendix A and agenda and timetable in Appendix B.

2. The Workshop opened with welcoming addresses by the Chairman; Mr. Sudchit Nimitkul, the Governor of Phuket; Dr. Kee-Chai Chong, Programme Coordinator of BOBP; and the opening address by Dr. Plodprasop Suraswadi, Director-General of the Department of Fisheries, Government of Thailand.

3. The Workshop was organized as a first year activity of the DOF/BOBP Phase III Project in Thailand on "Community-based Fisheries Management in Phang-nga Bay". The Workshop had two major objectives. First, the Workshop aimed to build awareness and a common understanding among the key stakeholders (fisherfolk leaders, village leaders, NGOs, DOF, and BOBP) who will be involved in the DOF/BOBP Community-based Fisheries Management (CBFM) project in Phang-nga Bay about the importance, benefits and constraints, roles and responsibilities, and needs for flexibility in undertaking the new approach of "partnership in management". Secondly, the Workshop provided a forum for discussion with key stakeholders on the objectives and general approach for implementation of the DOF/BOBP coastal fisheries management project in Phang-nga Bay.

4. The Workshop was seen as a timely response to both the Government of Thailand's and fisherfolk's own local initiatives in promoting CBFM as an effective means to manage resources. The Government of Thailand could use the lessons learned from the DOF/BOBP CBFM Project in its planned development and implementation of CBFM nation-wide.

5. The expected outputs of the Workshop were:

a. acceptance and commitment of key stakeholders of the roles and responsibilities they will need to play for effective partnership in management under the community-based fisheries management project;

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b. consensus of participants on the DOF/BOBP Work Plan. The Workplan components include problems, issues and objectives for management, roles and responsibilities for effective partnership in management and a general guideline for activities. This will serve as the platform for future development of management strategies to address problems and issues; and

c. consensus of fisherfolk on the recommended "early actions" for consideration by DOF for implementation.

SESSION 1: PRESENT CONDITIONS IN WANG-NGA BAY FOR COMMUNITY-BASED MANAGEMENT; GOVERNMENT POLICY, GEOGRAPHIC, SOCIO-ECONOMIC, INSTITUTIONAL AND LEGAL CONSIDERATIONS

ITEM 1: POLICY AND PROGRESS TOWARDS CBFM

6. Dr. Plodprasop Suraswadi, Director-General of DOF, outlined the government policy for CBFM in Thailand. The need for CBFM was described as largely originating from a situation of open access to Thailand's marine and coastal waters and resources that has led to a depletion of coastal fisheries resources. Small-scale fisherfolk are the most affected; they not only have competition for resources within their own sector, but also from commercialized fisheries. DOF views CBFM as one means to address the important interrelated issues for the recovery of depleted resources and reducing the conflicts among fisherfolk. DOF would also like to see the fisherfolk develop a sense of ownership of coastal resources, and stressed the importance of building awareness to conserve the resources and environment.

7. Thailand is adopting the CBFM approach to help resolve several national issues of concern. Specifically, CBFM will be used to help Thailand rehabilitate small-scale fisheries; ease conflicts between small and large-scale fishers; create a sense of unity in society, and particularly creating a sense of belonging in the small-scale fisherfolk to the wider community; help transfer the costs of enforcement from government to the beneficiaries; better utilize Thailand's coastal and marine waters; and help ensure sustainable incomes for the coastal communities.

8. The DOF/BOBP Workshop and Project on CBFM was agreed to be a timely response to the needs of Thailand. The continued heavy exploitation of the coastal resources combined with declines in productivity demands a management approach that aims for long-term sustainability. The meeting was informed that the government has recently initiated a plan for introducing a fishery right system to strengthen and continue promoting CBFM as an effective means to manage resources. The Director-General guided the Workshop to: think about how this can be achieved, *i.e.,* by province and also by communities; reach a common

decision; then try it out during the CBFM project as well as improve on it throughout the Project's implementation.

9. The Government of Thailand has recently included CBFM in its Eighth National Economic and Social Development Plan (1997-200 1) under the Coastal Area Management Sub-project of the Rehabilitation of the Thai Seas Project. This National Plan would guide the future fishery policy for Thailand.

10. The Government of Thailand gave its support for CBFM and encouraged the fisherfoolk to come to a common agreement on fishing rights to be adapted in Phang-nga Bay. The lessons learned from this pilot project in Phang-nga Bay would be used by DOF in drafting the revisions to the legislation needed for obtaining coastal fishing rights and enforcement under CBF imperative.

ITEM 2: GEOGRAPHIC CONSIDERATIONS

11. Papers were presented concerning the general **status** of coastal fisheries in Andaman Sea and Phang-nga Bay by Mr. Somsak Chullasorn and Mr. Jate Pimoljinda, and on the general environmental status of Phang-nga Bay by Mr. Prawin Limpasaichol and Dr. Hansa Chansang. The papers noted that, while Phang-nga Bay is an exceptionally diverse and productive ecological system, the increased exploitation of its resources has demonstrated effects including dramatic declines in fishery resources in the last decade that indicate sustainable management of the resources is imperative.

12. Key findings and issues from past studies by the DOF of the coastal fishery resources were raised for discussion. Phang-nga Bay has experienced a steady decline in the abundance of fishery resources over the last 30 years:

a. declines in key target species of the small-scale fisheries, including fish, shrimps, crabs, and other invertebrates; and

b. declines in commercial catch and catch composition. Catch by trawlers in 1969 was 250 kg/hr. Forty-nine percent was the target species, while fifty percent was bycatch, composed of non-target species. Eighteen years later, trawlers were able to catch only 38 kg/hr on the average. Thirty-three percent was the target species, and sixty seven percent was bycatch. In addition, the bycatch was largely composed of juveniles of the target species.

13. Probable causes for the decline in fishery resources were discussed. These included a degradation of environmental conditions in the Bay; continued use, in spite of the community ban, of destructive fishing practices of trawlers and push nets; overfishing; and lack of awareness in conservation measures in fisheries.

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14. The environmental condition of the Bay was summarized. The increasing turbidity of the Bay's water quality was seen as a major concern. Discussion of the water quality issues centered around the local issue of construction of a deep-water harbour planned for the Bay. The potential effect of the harbour on Phang-nga Bay was of concern to the Workshop and the DOF's scientists recommended that the hydrology of the Bay, including residence time, should be taken into consideration in selecting the harbour's location.

15. The diversity of Phang-nga Bay's ecosystem has led to multi-use conflicts. Phang-nga Bay is characterized by valuable living and non-living resources, including seagrass beds, mangroves, corals, tin deposits, and beaches. Each resource brings its own set of uses as issues for management. Uses include small-scale fisheries, tin mining, ecotourism, tourism and resort development, recreational resorts, and coastal aquaculture of shrimp, fish, oyster, cockle and mussel. While some of these uses are compatible, others have impacted each other adversely. Efforts must be initiated to match compatible uses through more coordinated planning. For example, if permit processing for tin mining is not coordinated and approved through the relevant sector agencies, resource use conflicts will arise.

16. To be sustainable, resource management plans and measures developed under the CBFM Project must take into account local considerations including geography, environment, and socio-economic and cultural aspects. Community involvement from the beginning is essential. The issues and key findings of the DOF's scientists raised during this discussion were seen as an opportunity to exchange ideas and obtain feedback on the scientific assessments of Phang-nga Bay's resources with the fisherfolk. This would serve as a platform for future elaboration in subsequent discussion. For example, one potential option for a management measure that has shown success is a seasonal closure of specific fishing grounds, which could be considered by fishing communities under the DOF/BOBP Project.

ITEM 3: SOCIO-ECONOMIC AND GENDER CONSIDERATIONS

17. Papers were presented by Mr. Pongpat Boonchuwong and Dr. Ruangrai Tokrisna. The papers indicated several socio-economic trends, many of which have led to gender issues along the Andaman Sea coast of Thailand and, in particular, in Phang-nga Bay that have implications for the CBFM Project. By 1990, numbers of fishing households and fishing boats were steadily increasing in both the commercial and small-scale fishing sectors. In addition many of the fishing fleets from the Gulf of Thailand moved to the Andaman Sea.

18. Between 1985 and 1990, the number of both commercial and small-scale fishing households decreased by 5.5% and 6.8% respectively. This decrease was due in part to the decline of fishery resources and conflicts between the commercial and small-scale sectors. The largest decrease has been in the small-scale fishing sector, and the general trend in the

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fisheries has been a movement from traditional fisheries towards increasing use of commercialized fishing gears. This has reduced women's participation in fisheries. Women are generally active in the small-scale sector, and have equal roles in small-scale fishing; often the entire family will go fishing together, and children begin participating as early as 8 years old. However, women have taken on tasks that take them away from the family, including work in town, in canneries and large-scale processing plants.

19. From 1990 to 1995, the numbers of commercial and small-scale fishing boats increased. Three main factors were seen to have caused this rising trend: an increase in population of coastal communities; the success of artificial reefs in aggregating fish led to increased catch; and fisherfolk enthusiasm of the idea that communities can look after fishing areas themselves. As community-based management becomes more successful, small-scale fisheries may increase in popularity as a profession, and communities should be prepared for the additional management considerations this may imply.

20. The CBFM Project along the western coast of Phang-nga Bay is one of three CBFM pilot projects to be implemented in Thailand with support from BOBP. The Andaman Sea Fisheries Development Center (AFDEC) has good reason for choosing this site. Besides being of ecological importance, socio-economic conditions of the area indicate a strong need for the Project. Living conditions of coastal small-scale fisherfolk in Phang-nga Bay are the poorest in the country. These fisherfolk have few sources of cash income which can help to supplement their main income from fishing. Therefore, the conditions and health of the fisheries and its habitats were viewed as critical for the long-term welfare of small-scale fishing communities.

21. The Workshop participants agreed that education to generate greater awareness on the long-term benefits of fisheries management is crucial, particularly to the younger generation who will be soon managing the fishery resources themselves.

22. Greater opportunities should also be provided to rural women in Phang-nga Bay to enable them to participate effectively as co-decision-makers in CBFM. Activities recommended to ensure greater equality of community perspectives included allowing women to express themselves, and providing women in the community with information, knowledge and support.

ITEM 4: THE NEW ROLE OF EXTENSION ORGANIZATIONS, EDUCATION INSTITUTIONS AND FISHERFOLK

23. Papers were presented by Dr. Kungwan Juntarashote and Mr. Sakul Supongpan. Approaches for and the importance of coordination both between sectors and within the public and private sectors to provide sufficient information for enabling fisherfolk to participate in CBFM were emphasized.

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24. Government officials, extension workers and fisherfolk were encouraged to undertake consensus-based discussions together to reach solutions. A measure of success will be the establishment of an equal partnership between the community and government.

25. The role of extension workers should be expanded to include a broader set of responsibilities, from the stand point of management approaches, environmental issues, awareness-building, and sharing scientific information available in PMBC and AFDEC. A major role of extension workers would be to exchange ideas and listen to fisherfolk who have gained knowledge from their experiences in working with the local people to organize the push net ban in the Bay. The entire social and fisheries infrastructure needs of the fishing community must be considered in CBFM.

26. The introduction of artificial reefs in Thailand could hold lessons for CBFM. When first introduced, artificial reefs were not accepted by fisherfolk. With improvements in design and once benefits were demonstrated over time, artificial reefs have become largely successful and in many areas are managed by fisherfolk themselves. While CBFM has been accepted in concept, it will also need time to develop and evolve into a design that will meet the needs of Thailand's fishing communities.

ITEM 5: LEGISLATIVE REVIEW AND IMPLICATIONS

27. A paper was presented by Mr. Choomjet Karnjanakesorn on the outcome and progress of the legislative review and requirements for CBFM conducted by DOE Review of the existing fishery legislation has found that additional conditions are required for CBFM implementation. Under the current Fisheries Law, communities do not have the enforcement authority to arrest or detain illegal fishers. This authority lies with the Department of Fisheries. Conditions to enable community enforcement authority can be introduced into legislation through one of three options. First, an additional condition can be added to the existing regulations. Secondly, an amendment can be made to the existing law. Finally, a last option would be to introduce a completely new Fisheries Law. The first two options were preferred in view of the more lengthy procedures involved in the drafting of new legislation which would require an approval by the Parliament.

28. The current Fisheries Act of 1947 empowers the Minister of Agriculture and Cooperatives or the Provincial Governor to regulate and enforce the activities of individuals or associations involved in fisheries by means of administrative power. Thus, the specific legislative power for the purpose of fishing right systems and CBFM could be enacted by adding a new Chapter concerning coastal fishing rights and CBFM into the existing Fisheries Act.

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29. Provisions for resolving environmental issues affecting coastal fisheries should be incorporated into the Fisheries Law when it is revised.

30. DOF has drafted a potential framework for community-based fisheries management in Thailand which consists of a two committee level process. A committee at the national level, the "Central Committee on Coastal Fishing Right System", could be comprised of government representatives, and would coordinate, supervise and approve the operation of the fishing right system. The community level "Local Committee for Coastal Fishing Right System" would be comprised of fisherfolk, and its roles and responsibilities include managing the resources, permitting the fishing and culturing activities, and reporting annually to the Central Committee. However, DOF would assess the outcome of the CBFM pilot project before finalizing this draft framework.

31. It was noted that the organizational structure of DOF is very progressive and optimal for the coordination needed to implement coastal resources management. The jurisdiction and responsibilities for rehabilitation of coastal aquatic resources is under the same umbrella as small-scale fisheries within PMBC and ASFDC.

SESSION 2: STRATEGIES FOR IMPLEMENTATION OF COMMUNITY-BASED MANAGEMENT IN WANG-NGA BAY

Discussion Leader: Mr. Somsak Chullasorn
Rapporteurs: Dr. Suwanna Panutrakul, Mr. Vudhichai Janekarn, and Ms Boonsri Jaruthamsophon

32. A panel discussion comprising Dr. Masamichi Hotta, Dr. Kungwan Juntarashote, Mr. Sakul Supongpan, Dr. Uwe Tietze and Prof. Tadashi Yamamoto brought together experiences from within and outside of Thailand in implementing CBFM. Discussions centered on the key factors that would need to be components of a CBFM strategy.

33. Two factors that would need to be established in Thailand for successful CBFM are strong fisheries management organizations, and a sense of the long-term benefit by fisherfolk of CBFM. CBFM requires commitment and extra effort by fisherfolk and the long-term benefits of the effort must be well understood by all stakeholders. Awareness of such benefits was seen as an important early activity.

34. A number of support services will be necessary to build up the level of organization of the fishing community for successful CBFM. These services include ensuring access to credit for attaining independence from the middlemen, introducing potential changes in occupations as alternatives to capture fisheries, and introducing special income generating projects for women in the community.

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SESSION 3: EXPERIENCE OF NGOs AND EXTENSION WORKERS IN PHANG-NGA BAY IN BUILDING COMMUNITY-BASED FISHERIES MANAGEMENT

Discussion Leader: Dr. Hansa Chansang
Rapporteurs: Dr. Suwanna Panutrakul, Mr. Vudhichai Janekarn, and Ms Boonsri Jaruthamsophon

35. A panel discussion comprised of local NGOs, including Mr. Tanu Nahnien (Wildlife Fund, Thailand) and Mr. Sukit Siripatr (Raindrop Association), as well as Mr. Opas Nuanvilailuk (Fishery Conservation Unit, DOF) and Mr. Kornvit Chantkusol (Extension Officer, DOF) related lessons learned from a grassroots organizational perspective in CBFM efforts in Phang-nga Bay.

36. Although much progress has been made by DOF, NGOs and the communities to provide a foundation for community-based management, CBFM has yet to be established in Phang-nga Bay and should be approached and implemented on a step-by-step basis. This incremental evolving process is necessary because the country does not have the necessary institutional framework to apply a full-scale CBFM at present. Three activities were identified as early necessary steps for the CBFM Project in Phang-nga Bay:

I. clarify and define what is meant by the term “coastal fishing rights”. The following was suggested as an initial set of criteria: a) geographical areas where fisherfolk have usually or historically fished; and b) stock abundance and the potential for stock recovery in the case of overfished stocks;

2. establish a supporting information mechanism and statistical database to transfer management responsibility to the fishing communities; and

3. establish the fishermen’s group as a local level management structure.

37. One option discussed for forming the local level management framework was that fishing communities be mobilized and organized into “cohesive groups” based upon common interests, issues and problems, family relationships, and other criteria that could ensure homogeneity within the group. Further, the elected Village Council was seen as a potential nucleus for a community-based fisheries management committee. In Phang-nga Bay’s fishing villages, most, if not all, of the Council members are fisherfolk. In cases where the elected Village Council’s members are not fisherfolk, other alternatives can be used such as the above criteria.

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SESSION 4: FISHERFOLK PRESENTATIONS ON INITIATIVES UNDER WAY AND NEEDS FOR THE FUTURE IN PHANG-NGA BAY

Discussion Leader: Mr. Pisit Charnsanoh
Rapporteurs: Dr. Suwanna Panutrakul, Mr. Vudhichai Janekarn, and Ms Boonsri Jaruthamsophon

38. A panel comprising representatives of fishing communities focused discussion on issues and future directions for the CBFM Project as seen by fisherfolk. The panel included Mr. Usen Muenthongwari (Trang Province), Mr. Saman Naiyanart (Surattani Province), Mr. Samroeng Rakate (Phang-nga Province), Mr. Din Singtho (Krabi Province), Mr. Samak Ruenchit (Trat Province), and Mr. Mahamasugree Masaning (Pattani Province). The panel identified three of the major initiatives which helped to provide a firm foundation for CBFM in Phang-nga Bay. These include the community ban on push nets, the subsequent expansion of the ban to include trawlers, and ratification of the community ban as a Bay-wide policy and the mangrove reforestation initiative in Phang-nga Province. Environmental issues, artificial reefs, fish marketing, education and awareness, fishery enforcement, and establishment of the local-level management structure based upon existing fishermen's groups were topics of discussion and identified issues for the CBFM Project.

ITEM 1: MAJOR INITIATIVES THAT HELPED TO PROVIDE A FIRM FOUNDATION FOR CBFM IN PHANG-NGA BAY

Environmental concerns as an early motivation for stewardship and action

39. Fisherfolk presentations revealed that, about ten years ago, their catch of the target species, including silver silago, crabs, and shrimp dropped severely. This corresponded with the findings of scientists described in Session 1. Both groups independently came to the conclusion that this was caused by a variety of factors all of which combined to alter the fishery resources to a point from which they have yet to recover. Factors included the use of small-scale fishing gear with small mesh size; increased effort by both small-scale fishers and commercial fishing boats; the intrusion of the push netters and trawlers into inshore areas; and environmental degradation, largely caused by tin mining, shrimp aquaculture and other land-based sources.

40. Environmental concerns are regarded as a priority area among consideration for Phang-nga Bay's communities Fisherfolk recommended issues to be resolved under CBFM. It became apparent that those closest to the resource were the first to see the link between ecosystem health, resource sustainability, and their livelihood. Fisherfolk stated that the costs of environmental problems, particularly development of mangrove areas for shrimp

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ponds, are often borne the local fisherfolk communities but they do not have any share in the benefits. A more equitable distribution of the costs and benefits of environmental services from the resources arose from the discussion as one of the general objectives for the community-based management project.

41. An issue of concern was the steady expansion in shrimp farming operations in Phang-nga Bay, Lanta Islands, and Sikao Bay in particular. Water discharged from the farms is usually not treated prior to disposal into the sea. The discharged water is believed to contain environmentally harmful chemicals that can cause the death of natural organisms. Therefore, to solve the problems, the Department of Fisheries should address the uncontrolled discharge of effluent from shrimp ponds. Any efforts to promote fishery enhancement including the deployment of artificial reefs or release of seeds will not be achieved without a simultaneous resolution of these environmental issues.

42. The community leaders expressed concern about the pollution problems in Phang-nga Bay, and stated that they are aware of the problems and general environmental effects. They experienced the direct effects particularly in Trang Province from shrimp pond effluent, and believe that the water discharged may destroy their environment. Sediments and other pollutants are found in the effluent, and it is felt that it will be more of a serious problem in the future.

The rommunity ban on push nets

43. The ban on push nets in coastal areas was the first fisherfolk initiative in Phang-nga Bay and originated as a response from the fishing communities to environmental changes in the Bay and the subsequent social conflicts arguably arising from the changes:

Environmental changes

1. Fisherfolk stated that the deterioration of marine resources in Phang-nga Bay caused by push nets, discharge from shrimp ponds, industries, oil and grease pollution led to a gradual decline in yields and fisherfolk income.

2. This decline in income has in turn led fishermen to emigrate to other areas and many of the younger members of the community have experienced social problems, including drug abuse.

Social conflcts

1. Before the ban, conflicts existed between fisherfolk using push nets and gill nets. Push nets are a destructive fishing gear and its use leaves visible impact to the

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resources. Fisherfolk using gill nets therefore blamed the use of push nets in coastal areas for their low yields in fisheries.

Creation of the ban

The fishing community responded to the combination of the above conditions by organizing themselves to prevent push nets from being used in the Bay. An assembly was set up by fisherfolk in a number of villages. At present, 35 villages in four districts have been organized into assemblies. Under the assembly system, members from each village gather together once a month for general discussion on fisheries problems. The fisherfolk have found that the monthly meetings enable them to be kept informed of the problems of each village as they arise.

Results of the ban

1. The ban was successful in significantly decreasing the number of push nets. At present, very few push nets are used in the Bay.

2. Resource health and productivity showed improvement after implementation of the ban. This was seen in the noticeable increase in production of shrimp, blue swimming crabs, and the occurrance of mantis shrimp and marine catfish.

3. Success in this initiative has led to other activities of community effort in conservation of living marine resources, for example restoration of mangroves, and establishing the 3 km demarcated boundary to prevent trawling.

44. It was recommended that the ban on destructive fishing practices be continued and further reinforced through a combination of enforcement and awareness. In particular, it was felt that quantifying the benefits of the ban would help to convince the individual "non-compliers" and villagers in the surrounding areas that are not presently a part of the ban, of the importance of the ban and to comply.

Mangrove reforestation in Phang-nga Bay

45. The frsherfolk have long recognized the relationship of the Bay's healthy habitat to their fishery resources, and facing an increasing loss of mangrove areas from aquaculture and other land-use changes, combined with a declining catch and smaller fish caught over the last 10 years, initiated a mangrove reforestation programme in 35 villages of Phang-nga Province. This programme has been at the initiative of many of the communities in the Bay, particularly in Ko Yao-Yai and Ko Yao-Noi Islands of Phang-nga Province.

Ratification of the ban as a buy-wide policy

46. Early success in the pushnet ban and mangrove reforestation initiative helped support the idea of CBFM in the area, and paved the way for a later undertaking that brought the concept even greater influence. In April 1995, the Governors and village leaders from the three provinces of Phuket, Krabi, and Phang-nga signed an agreement to ban push nets and trawlers within the three kilometer zone reserved for small scale fisheries. The fisherfolk voiced their commitment for sustainable resource use and responsible fishing with this fisherfolk-led initiative, and the larger community of Phang-nga Bay responded by supporting the ban and ratifying it as a Bay-wide policy.

ITEM 2: OPPORTUNITIES AND POTENTIAL ROLES AND RESPONSIBILITIES FOR COOPERATIVE MANAGEMENT

Potential fiture government role in the initiatives

47. The fisherfolk asked for greater support from the government agencies, and particularly the Department of Fisheries to help continue implementation of these initiatives in moving towards a more comprehensive community-based management structure. DOF support was needed to enforce the ban on pushnets and trawlers.

48. Discussions revealed that existing penalties were not a strong enough deterrent to the commercial trawl fishers. The Workshop recommended that government impose stricter penalties for violations. The commercial trawl fishery was seen as a primary target for government attention, through a combination of increased enforcement and awareness-building. Management measures to address these enforcement issues were recommended as an area of focus for the CBFM Project.

49. Government sectors have supported the push net ban by helping fisherfolk change their fishing away from the push net to other activities through the provision of funds to support entrance into other activities or businesses. It was recommended that this government support for alternative incomes and other initiatives and activities to cooperate in working together on coastal resources management should be continued and expanded.

Development of management measures

50. CBFM was seen to be an ideal opportunity to use the skills and knowledge of the fisherfolk combined with the ecological science of PMBC and ASFDC and the social science knowledge within local universities in the development of management measures that would make “sound common and scientific sense” and therefore be sustainable. In fact, ftsherfolk voiced the importance of incorporating cultural values in the CBFM measures they would develop.

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51. Discussions also noted that closed fishing seasons have been in effect for more than 10 years with some degree of success. Under careful management practices, it was felt that this could be a potential option for the communities to consider.

Targets for education and awareness

52. The Workshop agreed that enforcement alone is not completely effective in solving their fisheries management problems. Awareness and education targeted to the users of the resource and "non-compliers" of the ban and particularly the trawler operators and owners, is needed as a supplementary approach to enforcement. Participants agreed that the users of the resources must recognize benefits to the resources and to themselves before they are motivated to comply with any fishery legislation or initiative.

53. Fisherfolk stated that an approach to acceptance of a management measure is to demonstrate the impact or benefit to the long-term sustainability of the resources upon which they depend. For example, if resources show an increase over time, encouragement would be provided to continue the measure or impose more stringent measures, if required. Close cooperation between fisherfolk and government in preparation of these outreach materials and information required to better understand problems, and causes and effects will be essential to assist fisherfolk in managing resources under CBFM.

54. A recent co-operative effort between fisherfolk and DOF is the placement of demarcations at strategic points along the 3 km seaward boundary to separate small-scale fishing craft zones from zones allocated for commercial fishing crafts. The demarkation has helped the trawlers more clearly identify the fishing zones and serves as a deterrent to the trawlers for entering the prohibited zone. After implementation of this measure, the fisherfolk have found some indication of improvements and increase of the fishery resources in the Bay. Therefore, education and awareness-building targeted at the trawler fisherfolk and owners was strongly recommended.

55. A continuous exchange of information between the fisherfolk and PMBC/AFDEC was an area of work identified for the CBFM Project. This information would help form the content of awareness building materials, including the quantitative benefits of the ban, artificial reefs, and other potential measures. It was noted that the problem in the past was that DOF did not always know what the fisherfolk needed, but that this would change under CBFM.

56. Awareness of conservation of resources for sustainable use should be targeted at fisherfolk who enter into aquaculture operations, particularly shrimp culture, and also raft mussel culture.

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ITEM 3: EXPERIENCES IN ORGANIZING FISHERFOLK GROUPS

57. Where several villages are located within one enclosed geographic area, a system of co-management by representatives from the villages involved has been proposed.

58. One effective measure that has been discussed and initiated to reduce improper fishing gear, is for the assembly to provide fishing nets of legal mesh size to the fishermen. In addition, marketable sized fish could be sold in a better price through a marketing process held by the assembly.

59. Experience in Surattani Province showed that the driving force in establishing cooperatives is an identified common need and mutual benefit to be shared by the group. The experience of the community leader has found that decisions cannot be left to the community leader, but must involve the entire committee that has been set up under the cooperatives on all the decisions, even though the process will take longer for a decision.

ITEM 4: ARTIFICIAL REEFS

60. Fisherfolk did not initially accept artificial reefs. However, once the fisherfolk found that artificial reefs aggregated more fish in an area, and their incomes rose with less fishing effort, the artificial reefs were accepted and became popular. Therefore, the benefits of any potential action must be demonstrated and should be a large part of the education and awareness-building campaigns if artificial reefs and other potential management measures will continue to be promoted in the future.

61. A growing problem for CBFM management is the placement of surrounding nets around both the artificial reefs and coral reefs by fisherfolk outside the communities. Poisonous powders are used to chase the fish out of corals or artificial reefs. Under this practice, only larger fishes were collected from the nets, while the small and non-valuable fish were discarded.

62. The pros and cons of artificial reef installation were discussed. While the benefit in certain villages in increasing income was fully recognized, a major problem of artificial reefs was the damage caused to purse seines and gill nets. Careful consideration of artificial reef placement and methods of construction should be a part of the CBFM Project. In addition, it was also believed that perhaps the budget expenditure on artificial reefs would be more worthwhile if spent on community effort in restoring marine production by preventing intrusion of trawlers and push nets.

63. The Department of Fisheries was requested to review the benefits and shortcomings of artificial reef construction to improve its future activity.

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SESSION 5: WORKSHOP SUMMATION OF WHAT IS NEEDED TO ENSURE STEWARDSHIP AND AN EFFECTIVE PARTNERSHIP FOR THE FUTURE IN PHANG-NGA BAY

Discussion Leader: Dr. Veravat Hongskul
Rapporteurs: Dr. Suwanna Panutrakul, Mr. Vudhichai Janekarn, and Ms. Boonsri Jaruthamsophon

64. A panel discussion comprising the Discussion Leaders of Sessions 2-4 summarized priorities, roles and responsibilities and needs to be addressed under the CBFM Project in Phang-nga Bay. Panelists included Mr. Somsak Chullasorn, Mr. Pisit Charnsanoh, Mr. Jate Pimoljinda, Dr. Hansa Chansang and Mr. Samroeng Rakate.

65. A priority concern reinforced and summarized from the previous Sessions was the request for DOF to increase enforcement efforts in the nearshore area on the push net and trawler ban. DOF strongly supported this request, and stated that an enforcement officer has been placed at the Project site in Phang-nga Bay to work with fisherfolk in the first year activity of the CBFM Project. DOF gave its commitment to expand enforcement support to the communities in future.

66. It was agreed that under the new approach of partnership in management, government and the communities would each strive to learn from each other to reach consensus on how best to manage the resources for the future. Future consensus decisions under CBFM would include but not be limited to: expenditures of government funds in the communities; research on environment and management; how to completely eliminate the two destructive fishing gear, namely of push nets and trawlers in nearshore fishing; how to establish the fishermen's group as a local-level management structure; and artificial reef management.

67. In addition, the fisherfolk requested the DOF to consider whether or not the entire area of Phang-nga Bay could be included in the DOF/BOBP Community-based Fisheries Management Project. In that way, the communities of the Bay could perhaps better decide on planning the fishing right within the Bay and the allocation of areas to certain uses, fishing gears, and zoning schemes within the Bay.

68. It was recommended that DOF should spearhead closer cooperation among the government organizations as an important part of ensuring smooth implementation of CBFM. It was felt that the enforcement process, in particular, could be more efficient if the various steps with the various agencies in the process could be better understood and coordinated. Agencies mentioned with jurisdictional responsibility in the activities and issue areas identified for the CBFM Project include DOF, the Department of Forestry, Harbour Department, Health Department, and the various authorities and agencies involved

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in enforcement, the Provincial, District, and Village Government Agencies, Police Department, Provincial Court, lawyers, and NGOs for better understanding of the laws.

69. Management of coastal fishery resources and fishing gear should be specific to conditions within each Bay represented at the Workshop. These include Phang-nga Bay, Sikao Bay and Lanta Islands. While exchange of experiences in CBFM was seen as important, each area would need to have a separate CBFM structure and system.

70. The Asian Productivity Organization (APO) was requested to consider possible support to study tours for fisher leaders from villages in the CBFM Project. As the CBFM system of Japan was used as an example in many of the discussions, it was felt that a study tour to Japan to observe this system would be very beneficial to the communities involved in implementing the CBFM Project in Thailand.

71. Fisherfolk requested a regular patrol by DOF to enforce the push net and trawl ban and other management measures developed under CBFM in Phang-nga Bay. Fisherfolk offered to join with DOF's enforcement officers on the surveillance patrols in the Bay.

72. It was agreed that DOF would support the development of the CBFM fisherfolk groups at various levels (i.e., district, provincial, and regional). This support includes information required for CBFM, assistance in research directed towards the identified issues, and funding assistance.

73. Other areas for consensus included setting objectives for multiple use of the Bay's resources and help in identifying sustainable activities and income that would have no harmful or the least harmful effect to the Phang-nga Bay ecosystem.

74. DOF and the NGOs should organize various coastal resources management training courses, covering issues from sea grass conservation to water quality monitoring and fisheries management. These courses could be conducted by mobile teams to reach out to the villages, targeting leaders of the communities, women, children and young people, and local fishery officers. Each course should be conducted for 8-10 fishing villages.

Revolving fund

75. To continue useful programmes of DOF and expand into new related areas, a revolving fund for fisherfolk to both further their fishing occupations and develop alternative sustainable income activities was prioritized as an early activity of CBFM. In addition to alternative incomes, it was determined that both government and non-government sectors should consider a new balanced concept of natural resource use that could balance incomes with ecosystem sustainability. Part of this effort was seen as identifying sustainable occupations for the fisherfolk communities of Phang-nga Bay.

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76. Additional proposed uses of a revolving fund include organizing an in-country study tour for the fisherfolk's group to observe the activities of fishing villages that have established effective revolving funds and are good examples of CBFM; organize training on accounting administration for members of cooperatives; and expanding local participation in the CBFM. The revolving fund would be managed by the fisherfolk's group.

Awareness

77. DOF could help the communities in education on marketing mechanisms targeted towards the fisherfolk and community leaders and to help generate additional family income, by assisting women in finding adaptable occupations. Children were viewed as important targets of awareness building, and fisherfolk felt that training to children in conservation for environmental sustainability should be a part of CBFM.

SESSION 6: DOF/BOBP PROJECT OBJECTIVES AND DRAFT WORK PLAN

Discussion Leaders: Mr. Somsak Chullasorn, Mr. Jate Pimoljinda, Dr. Kee-Chai Chong and Ms. Donna J. Nickerson

Rapporteurs: Dr. Suwanna Panutrakul, Mr. Vudhichai Janekarn and Ms. Boonsri Jaruthamsophon

78. This session helped to narrow the focus of earlier discussions to help summarize priority areas for the DOF/BOBP CBFM Project Work Plan as a starting point for future elaboration and discussion on specific activities:

Establish CBFM management framework

1. Clarify and define what is meant by the term 'coastal fishing rights'.

2. Define geographic area to be included in the Project.

3. Establish a supporting information mechanism and database to transfer management responsibility and authority to the fishing communities.

4. Establish a fisherfolk community management framework and system for coordination between individual groups within the Bay. Assist in establishing an integrated provincial and regional level framework to facilitate CBFM local level efforts and ensure close cooperation among relevant government organizations.

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Priority issue area to be addressed

Development of approaches and measures to effectively execute and enforce the ban on push nets and trawlers. Suggestions included awareness building and increasing regular patrol boat coverage in Phang-nga Bay that would utilize fisherfolk and government manpower.

Revolving find

Establishment of a revolving fund managed by the fisherfolk's group to: further their fishing occupations; develop alternative sustainable income activities; organize a study tour for the fisherfolk's group to observe the activities of fishing villages that have established effective revolving funds and are good examples of CBFM; organize training on accounting administration for the members of cooperatives; and expand local participation in the CBFM.

Training and information services for awareness building

1. DOF and the NGOs will organize various coastal resources management training courses.

2. PMBC and AFDEC will help exchange information with the communities to develop awareness building materials (e.g., benefits of artificial reefs, the pushnet and trawl ban, and other potential measures taken by communities).

3. DOF will provide the information to the communities required for CBFM decision-making, including assistance in research directed towards the identified issues, and funding assistance.

79. With strong direction and consensus on the above recommendations for priority action, the Phang-nga Bay fisherfolk and DOF agreed to meet again in mid-March 1996 to prepare the details and schedules of activities for the Project, and prioritize activities for early action.

CLOSING OF THE WORKSHOP

80. Prior to the closure of the Workshop, Dr. Kee-Chai Chong and Mr. Jate Pimoljinda thanked Dr. Masamichi Hotta, FAO, for helping to organize, sponsor, and participate in the Workshop; Dr. Plodprasop Suraswadi, Director-General, DOF, for his participation, continued interest and support in CBFM; the Government of Thailand representatives; NGOs and the fisherfolk for their active participation. Lastly, the Chairman, Mr. Somsak

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Chullasorn, also thanked the experts for their participation, FAO, the Technical Secretary, Rapporteurs, Organizations involved in the early CBFM efforts, and the Interpreters. He then declared the Workshop closed.

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APPENDIX A

LIST OF PARTICIPANTS

Department of Fisheries, Bangkok

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3. Mr. Udom Bhatiyasevi, Director, Marine Fisheries Division
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62. Ms. Suwimol Piriyatanalai, Pattani
63. Mr. Watchara Tiptong, Phang-nga
64. Mr. Tanu Nabrien, Phuket

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65. Mr. Banchong Nasae, Songkhla
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67. Mr. Sukit Siripat, Raindrop Association, Trang

Universities

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106. Mr. Samarn Naiyanart, Surattani
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110. Ms. Rachada Tharapak, Bangkok Business

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Bay of Bengal Programme, Madras, India
114. Dr. Kee-Chai Chong, Programme Coordinator
115. Ms. Donna J. Nickerson, Coastal Zone Management Adviser

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Mr. Jate Pimoljinda
Dr. Veravat Hongskul
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Ms. Donna J. Nickerson

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APPENDIX B

DOF/FAO/BOBP National Workshop on Community-based Fisheries Management, Phuket, 14 - 16 February 1996

AGENDA AND TIMETABLE

14 Feb.1996 08.15 - 8.45 Registration

08.45 - 9.30 Opening ceremony

09.30 - 10.00 Coffee break

10.00 - 11 .00 The DOF policy regarding CBFM

11 .00 - 11.30 Status of coastal fisheries in the Andaman Sea, with particular reference to Phang-nga Bay

11.30 - 11.45 o pen forum for discussion

11.45 - 12.15 Status of the environment and coastal ecology of the Andaman Sea.

12.00 - 12.30 Open forum for discussion

12.30 - 13.30 Lunch break

13.30 - 14.00 Status of socio-economics and fisheries economics of Thailand

14.00 - 14.15 Open forum for discussion

14.15 - 14.45 Opportunities for women's participation in the proposed CBFM Project in Phang-nga Bay

14.45 - 15.00 op en forum for discussion

15.00 - 15.15 Coffee break

15.15 - 15.45 Legislative review, requirement and enforcement for CBFM

15.45 - 16.00 Op en forum for discussion

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16.00 - 16.30 Implementation of seafarming projects in Surattani based on lessons of DOF/BOBP Phase I Projects

16.30 - 16.45 Open forum for discussion

16.45 - 17.15 New role of extension organizations, education institutions, and fisherfolk for cooperation in CBFM

17.00 - 17.30 o p e n forum for discussion,

15 Feb. 1996 08.15 - 08.30 Considerations for implementation of CBFM

08.30 - .8.45 Op en Forum for Discussion

08.45 - 10.00 Strategies for implementation of CBFM in Phang-nga Bay

10.00 - 10.15 CoffeeBreak

10.15 - 10.45 Experience of NGOs and Extension Workers in Phang-nga Bay in building CBFM

10.45 - 12.00 Open forum for discussion

12.00 - 13.00 Lunch break

13.00 - 17.00 The fisherfolk's initiatives in controlling harmful fishing practices in the fishing grounds: The community ban on trawling and push net in the bays and prohibited area Panel discussion: Fisherfolk community leaders: Trang (l), Phang-Nga (2), Pattani (l), Surattani (l), Trat (1)

16 Feb.1996 08.30 - 09.00 Some key principles and practices of CBFM gleaned from experiences in Japan, Indonesia, and the South Pacific

09.00 - 09.15 Open forum for discussion.

09.15 -09.45 Population issues and access to credit in relation to fisherfolk community development and management

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09.45 - 10.15 BOBP initiatives

10.15 - 10.30 Coffee break

10.30 - 12.00 Workshop summation of what is needed to ensure stewardship of Phang-nga Bay's resources and an effective partnership for CBFM. Agreement on problems, issues and objectives

12.00 - 13.30 Lunch break

13.30 - 14.30 DOF/BOBP project draft work plan and objectives

14.30 - 15.00 Concluding remarks and closing the workshop

15.00 - 15.15 Vote of thanks

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APPENDIX C

ABBREVIATIONS AND ACRONYMS

ADL	Actual Discharged Load
ASEAN	Association of Southeast Asian Nations
ASFDC	Andaman Sea Fisheries Development Centre
BOBP	Bay of Bengal Programme
CBFM	Community-based Fisheries Management
CFMP	Coastal Fisheries Management Plan
CIDA	Canadian International Development Agency
CPU	Catch Per Unit
CPUE	Catch Per Unit Effort
DOF	Department of Fisheries
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
FCA	Fisheries Cooperative Association
FMO	Fish Marketing Organization of Thailand
FRMC	Fishing Rights Management Committee
FS	Fisheries Society
GRT	Gross Registered Tonnage
ICLARM	International Centre for Living Aquatic Resources Management
JIFRS	Japan International Fisheries Research Society
NESDB	National Economic and Social Development Board of Thailand
NGO	Non-government Organization
NSO	National Statistical Office, Office of the Prime Minister of Thailand
OEPP	Office of Environmental Policy and Planning
PMBC	Phuket Marine Biological Center
RFCC	Regional Fisheries Coordination Committee
RFD	Royal Forest Department
SEAFDEC	Southeast Asian Fisheries Development Center
TDRI	Thailand Development Research Institute
TGL	Total Generated Load
TURF	Territorial Use Rights in Fisheries

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PART TWO

AFTER THE WORKSHOP: EARLY RESULTS OF THE CBFM PROJECT

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AFTER THE WORKSHOP: EARLY RESULTS OF THE CBFM PROJECT

1. CBFM WORKSHOP DIRECTION

The CBFM Workshop in Phuket was in many ways a starting point for action on CBFM in Phang-nga Bay. It marked the transition between the design and planning stage of the project to its implementation. The issues were identified at the Workshop by consensus of social and natural scientists, fisherfolk and government - the three major players in CBFM. Equally essential was the clear understanding of a course of action and roles and responsibilities that was had by all players for CBFM implementation.

The focus of the CBFM in Phang-nga Bay is on the fisheries resource and on the fishers who make up the majority of coastal residents in the Bay. However, the CBFM seeks to manage both the problems within the fishery (e.g., overharvesting of living marine resources, use of destructive fishing gear, multiple use conflicts between small- and large-scale fishers), and the environmental factors that affect the health of the fishery resource (e.g., degradation of mangrove areas and seagrass beds which are nursery grounds for the fishery, poor water quality, etc.).

The issues identified for management under CBFM at the Workshop include: overharvesting of living marine resources, use of destructive fishing gear, degradation of coral, sea grass and mangrove resources, increasingly poor water quality, multiple use conflicts between small- and large-scale fisherfolk, all of which have contributed to a decline in fisherfolk income and increase in social problems.

The Workshop established a strong start. Since the Workshop, much has been achieved in addressing the identified issues. Progress has been made on enhancing the management structure for CBFM, implementing solutions to the identified issues, and in building capacity for new management approaches that integrate disciplines and bridge the gap between government and the public.

2. CBFM GOVERNANCE APPROACH

Under the CBFM project, partially funded by FAO/BOBP the Government of Thailand has increasingly delegated certain responsibilities for coastal resource management to the coastal communities of the Bay. The local CBFM management structure was established, composed of village committees whose members include fisherfolk and village leaders. The fishery officers of AFDEC and PMBC serve as advisors to the committees and support implementation of their management initiatives and decisions.

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Monthly meetings are held by the village committees and every two months, several village committees meet together with AFDEC, PMBC, universities, NGOs, FAO and others involved in support of Project implementation. Such close involvement and support establishes and maintains the trust and communication between government and the community that is essential in community-based management. The village committees have grown throughout the life of the Project, not only in number of villages with committees, but in their unity within the committees and their initiative and responsibility towards management decisions.

Continued learning by the communities and government staff involved in CBFM has increased the sense of stewardship for the Bay's resources. Experiences from participating in the new approach of CBFM, and through organized training has helped the participants to direct their sense of stewardship towards meaningful action.

3. TRAINING EXPERIENCES

DOF staff have been trained in consensus-building, interdisciplinary team work, public participation, completion of case studies that identified issues for management, development of objectives, strategies for actions and solutions, and evaluating progress in integrated coastal management (ICM).

Fisherfolk have also been trained in boat engine maintenance and repair. Previously, fisherfolk had to travel far outside their community to find an engine repair shop. The improved skills within the local communities resulting from the training has furthered the livelihoods of the fisherfolk and increased the self-sufficiency of the communities.

Resource conservation and management training was introduced in area schools and was conducted as part of the activities for children's outdoor learning camps in 1996 and 1997. As future fisherfolk, school children will also be trained in monitoring fish catch and habitat conditions in the Bay. They are being prepared for the future, as communities increasingly take on management responsibility in CBFM.

Future training plans include furthering the management skills of the village committee leaders through study tours to neighboring Provinces which have somewhat similar programmes in CBFM. The study tours will enable the participants to exchange experiences and lessons learned among fisherfolk.

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4. IMPLEMENTATION OF CBFM SOLUTIONS

Progress has been made on implementing the solutions or actions to the issues identified at the Workshop.

One of the first successful management initiatives was the ban on push net and trawl fishing in the Bay. The ban was agreed to and supported by the fisherfolk and Governments of the three coastal Provinces of the Bay: Phuket, Phang-nga and Krabi. It marked the first collaborative implementation of a management initiative by government and the communities in the Bay. The fishing communities initiated the ban, the Governors of each Province signed it into force, and DOF, Universities and FAO are providing much of the technical means for its support under the CBFM project.

CBFM is helping to ensure continued compliance of the ban through a combination of enforcement, economic incentives, and education activities. Progress on implementing the push net ban was strong in 1995 and 1996. Before the ban, the destructive push nets were a common gear among some of the 13,000 coastal fisherfolk of Phang-nga Bay. By mid 1996, violators of the push net ban numbered approximately 40, largely because of the combination of an intensive awareness and education campaign conducted under the Project by AFDEC and PMBC, the increased enforcement presence in the Bay of an outposted enforcement officer, and the beginning of an economic incentive programme to replace the push net gear with the less destructive gill nets.

Implementation of actions during the project has also effectively tested and even strengthened the CBFM governance approach. For example, the education and enforcement activities of the project were reduced in 1997. This was followed by a subsequent increase in violations of the push net ban, rising from 40 in 1996, to over 160 in 1997. Tensions between violators and those who comply with the ban consequently increased. At the bi-monthly CBFM meeting in October 1997, village committee leaders requested increased support from DOF to help them address the rising violations of the ban on push-nets. DOF has responded and enforcement and education activities are being increased. Several lessons were derived from the experience. Participants learned that the activities had been effective, and that everyone's role was important in implementation. But most importantly, participants learned that the CBFM process could work. One of the most difficult tests of any management approach is its ability to deal effectively with problems. Concerns were communicated and resolved through the CBFM process.

More difficult has been the implementation of the ban on trawling in the Bay. The problem requires a different approach; its difficult to solve through awareness alone and economic incentives are costly, requiring more involvement from the national level. The communities have asked the DOF to further increase the fishery monitoring, control and

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surveillance (MCS) operations by providing additional enforcement officers and fishery patrol boats to cover the vast expanse of the Bay.

Mangrove and seagrass areas have been rehabilitated in sites throughout the Bay. Conservation areas have been set up and notification boards placed at the sites.

An aggressive education campaign has been conducted throughout the Bay to discourage harvest of gravid female blue crabs. In addition, cages have been established near villages to place gravid female crabs inadvertently caught by fisherfolk. The cages are being used by the fisherfolk and once the crabs release their eggs, the crabs are sold and profits are used for village CBFM activities.

5. MONITORING

Implementation of the solutions or actions are being monitored by the project to be able to provide information on their effectiveness. Knowledge of the effectiveness of current actions will help the village committees and DOF determine how to adjust the actions and develop new ones where needed. DOF and the committees will also use the information to modify the issues initially identified, if needed. CBFM is adaptive and participants are continuously learning as new information arises in the process. The monitoring results are an important source of this new information upon which to base decisions.

Scientific studies previously conducted by PMBC and AFDEC in Phang-nga Bay have provided a baseline for future monitoring efforts. PMBC has observed numbers of juvenile fish, crab and shrimp species in undeveloped mangrove areas and undisturbed seagrasses. Studies indicated that mangrove areas have more variety of species present than do seagrasses in the Bay, and that both are important and productive nursery grounds for the Bay's fisheries. AFDEC has compiled a time series of data on fishery statistics in the Bay.

Standard monitoring forms are being developed by the AFDEC, PMBC and the Mangrove Research Unit, Department of Forestry, in Phuket. This way, data collected throughout the Bay can be designed to measure effectiveness of the actions currently being implemented. Data can also be compared over time. For example, measuring potential change in the fish populations and recruitments resulting from implementation of the ban on push nets requires the long term observance throughout the Bay of species abundance and diversity of juveniles found in the sea grass beds before and after the ban on push nets. Initial results have shown that both biomass and species richness within the seagrass beds have significantly increased following implementation of the ban.

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These and other additional results of the scientific assessments of PMBC and AFDEC have been included in the education activities of the project throughout the Bay. Many of the scientists involved in the studies have taken part in these education activities which has enabled the fishers to continue the discussions and interactions with the scientists that had begun during the CBFM Workshop sessions in February, 1996. The scientists have stated that they have also been able to learn from the fishers, and have been able to use this improved understanding of the Bay in their continued studies on the Bay's problems which in turn, will be used by the CBFM project.

AFDEC is currently assessing the status and trends of the fisheries and habitat conditions in Phang-nga Bay using the data collected under the current monitoring. Findings will be presented to village committees and areas for improvements in data collection, vis-a-vis the objectives of the CBFM actions will be identified as well as additional sampling areas within the Bay which should be included in the monitoring programme. Considerations of potential changes in management measures, action and other CBFM activities can then be discussed at the meetings.

6. CONCLUSIONS

The Project has made significant progress in addressing many of the issues within a relatively short period of time, and has achieved a strong momentum within the communities for implementation of the community-based decisions. Continued success in CBFM will require the vigilance of government and communities to ensure a future for the Bay's small-scale fishers of sustained harvest. The Bay is a valuable resource for Thailand, and its communities are an example for not only Thailand, but for coastal communities around the world that are looking for solutions to the pressing resource management issues of today.

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PART THREE

PAPERS PRESENTED AT THE WORKSHOP

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THE POLICY OF THE DEPARTMENT OF FISHERIES FOR COMMUNITY-BASED COASTAL FISHERIES MANAGEMENT

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1. INTRODUCTION

Marine and coastal resources include all renewable and non-renewable resources situated in marine and coastal areas, such as water, lands, minerals, animal and plant species. The marine and coastal waters, together with bordering coastal lands, support a variety of important economic activities including: shipping and ports, oil and gas development, fisheries, coastal aquaculture, coastal forestry, coastal agriculture, mining industry, tourism, transportation and communication, and coastal community activities (CIDA, 1987; Brahtz, 1972). Many coastal states have increasingly looked to the resources of their coastal areas, territorial seas, archipelagic seas and exclusive economic zones (EEZ) for enhancing economic development and employment opportunities in the future.

The multiplicity of uses in coastal zone areas, coupled with increasing numbers of users, has generated a number of important issues at the local, national, and international levels. These issues have arisen as a result of the many different ways in which coastal resources are used and because so much of the world's population lives, works and plays in or near coastal areas (Schaefer, 1972; Burbridge, 1982). Conflicts have developed over environmental protection, pollution, urban development, and the utilization of resources for the satisfaction of basic human needs, including fisheries. It is widely acknowledged that coastal area management and planning is required for all coastal states as means of ameliorating these conflicts (Burbridge, et *al., 1988).* However, such coastal area management and planning in Thailand has not yet been completely formulated. There has been only sectoral coastal area management and planning by different governmental agencies. Therefore, these governmental agencies usually have their own policies and plans for implementation. For example, the Department of Fisheries has its own policy and planning for managing coastal fishery resources.

This paper reviews the situation of coastal fishery resources in Thailand and addresses the policy of the Department of Fisheries concerning coastal fishery resources, particularly community-based coastal fisheries management.

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2. THAILAND'S COASTAL RESOURCES

2.1 Definition of coastal area

From the biological viewpoint, as from other viewpoints, it is difficult to define the coastal zone precisely. It is roughly described as the sea and land adjacent to the interface, encompassing that region where terrestrial activities importantly impinge on the marine environment, marine resources, and marine activities, and where marine activities importantly impinge on the environment, resources, and activities of the land. Obviously, no precise boundaries can be given, since the intensity of this interaction is greatest at the water's edge and slowly fades out as one moves away from the interface in either direction. This region contains the most intense interaction, from a few kilometers back of the beach to perhaps 10 or 15 kilometers offshore. From a biological viewpoint, one cannot regard this zone as isolated from other regions of either the land or the sea because of the migratory nature of many of its organisms, as well as because of the influences on the biota in this zone of natural processes, and man's activities, both on land and sea (Schaefer, 1972). For example, numerous species of fish that inhabit the coastal zone are highly migratory, just as are many species of land and seabirds that are, in part, dependent on it. Also, some juvenile and early adult stages of marine organisms are inhabitants of the coastal zone. For example, the larval and juvenile stages of tiger prawn live in the open sea for many months before becoming members of the benthic community organisms of the inshore zone. Conversely, some marine species that as adults live well offshore inhabit the inshore zone during their early juvenile stages.

The Department of Fisheries (DOF) views the coastal area as the area affected by tidal variations and climate of the sea. However, the coastal zone is biologically unique and of special importance in several ways. It is a region of very high productivity due to a number of physical processes. Nutrients, such as phosphates, nitrates, and biologically important trace elements reach the inshore margin of the sea from the land by rivers and other forms of runoff. Coastal upwelling is also an important means by which the plant nutrients in the photosynthetic upper layer of the sea are regenerated in the coastal zone, and also to some considerable distance in the open sea beyond. There is the existence of unique habitats in coastal areas as well. These include river estuaries, semi-enclosed embayments, salt marshes, littoral and sublittoral mud flats, and tidal pools. In each of these habitats exist communities of plants and animals that are endemic – in other words which live only in these particular environments. Because of this richness and diversity of habitats, the coastal zone has an extremely varied, and in many respects unique, biota.

For the purpose of discussing coastal resources in Thailand, DOF will define the coastal area as an area starting from the formation of mangrove forest or other landward boundaries to a distance of 5 km upland from the seashore and extending seaward to 3 - 5 km. These boundaries are not fixed, and in fact should be adjusted where resource interactions

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fall outside the described limits. For example, in situations where upland deforestation and consequent soil erosion adversely affect deposition rates along the coast, the landward boundary of the coastal zone could be logically extended further inland to encompass the entire watershed.

2.2 Thailand's Coastal Areas

Thailand has two coasts with a toral coastline of approximately 2,500 miles, covered by sandy beaches, mangrove forests, cliffs, rocky beaches, and salt marshes. The coastline along the Gulf of Thailand has a length of 1,870 km. The western coast of Thailand along the Andaman Sea of the Bay of Bengal has a length of 800 km, extending northward from the Malaysian border to the Burmese border. The Gulf of Thailand, which is typical of the Sunda Shelf, is an integral part of the Asian continent and South China Sea. It is relatively shallow, with a mean depth of approximately 45 meters and a maximum depth of approximately 80 meters (TDRI, 1987). Only few decades ago tropical areas in general were considered to have a very low productivity (Marr, 1976). In fact, the tropical seas can be very productive, Chullasorn and Martosubrato (1986) state that the waters in Southeast Asia constitute one of the most productive areas for commercial fisheries in the world ocean. The total annual catch from this region has increased steadily throughout the years and has reached about 7-8 million tons recently, which accounts for about 10 per cent of the world total marine production (FAO, 1989).

Productivity is high in the continental shelf areas, although low in the surface waters of the deep areas. Generally, enrichment is brought about by vertical mixing in the shelf areas, river discharge, and upwelling. In the Gulf of Thailand, vertical mixing over the continental shelf is the main mechanism for nutrient replenishment in the surface layers, followed by river discharge and upwelling in that order (TDRI, 1987; FAO, 1982).

Thailand's coastal habitats are biologically complex in response to variability of their taxonomic composition, overall community structure, topography, and oceanographic conditions. In gross terms, however, nearshore ecosystems commonly comprise several interdependent habitats: mangrove forests, coral reefs, seagrass meadows, and mud bottoms.

The ecological and economic importance of these habitats to communities of the coast extends beyond the particular exploitable species within them. Coastal habitats provide the foundation for artisanal fisheries, aquaculture, wood production and fuel, village settlements, tourism, urban development, port and harbor, and other numerous activities.

2.3 Ecological Functions of Coastal Resources

The biological complexity and variability of tropical nearshore environments are perhaps only exceeded by tropical rain forests. Taxonomic composition, overall community

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structure and topography conditions vary widely along the coastal zone, even over short distances. Nevertheless, nearshore ecosystems commonly comprise three distinct, but intimately interdependent habitats: mangrove forests, coral reefs, and seagrass meadows and unconsolidated sand or mud bottoms. The ecological and economic importance of these habitats extends beyond the exploitable species that use them and is described below.

Corals

Corals and coral reefs are a dominant shallow-water feature of tropical marine environments that are remote from major upwellings or freshwater inflows. Broadly defined, a coral reef comprises both the physical structure formed from calcareous secretions of corals and other marine organisms. Large coral colonies may contain tens of thousands of individual polyps, and reefs can be hundreds or thousands of years old. It is the carbonate skeletons of these shallow water marine organisms that form the massive reef structures protecting coastlines and creating habitats for the associated biota.

Functions of economic importance of coral reefs are: (1) the creation of complex habitats for a variety of fishes and other important organisms; (2) the role of reefs as a barriers to storm waves and debris; and (3) the aesthetic and recreational values of reefs in attracting coastal tourism.

Mangrove forests

Mangroves are salt-resistant trees with stilt roots or pneumatophores growing in the intertidal range along ocean shores or estuaries. Mangroves are an integral component of coastal ecosystems and fulfill many fundamentally important functions in coastal ecology and the local economy. Mangroves supply wood and other forest products and contribute to the coastal productivity. As prop roots develop and spread, they trap and stabilize terrigenous sediment, building land that helps to protect reefs, bays and lagoons from agriculture and urban pollution. Like coral reefs, mangrove forests protect coasts from storm damage; support an extremely diverse and ecologically important community of marine plants, invertebrates, and seabirds; and provide shelter and nursery for a range of commercially important fish. Mangrove detritus provides an important nutrient base for food webs that include commercially important food fish and invertebrates, and augments the growth of adjacent seagrass and coral reef communities.

If mangrove forests are carefully managed, they can sustain a high fisheries output and a limited forestry production. Mangroves are harvested for fuel and building materials. However, they have been removed in many areas, often to gain access to sites used for aquaculture, tin and sand mining, navigation channels, waste dumping, and the construction of buildings, docks and marinas.

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Seagrass beds

Seagrass and mud bottoms within lagoons and between the shore and reef crest serve many crucial ecological functions of direct and indirect economic importance to coastal communities. Although the seagrass itself is of little intrinsic economic value, the associated sand, coral rubble, fish, and invertebrates are commonly harvested for materials and food throughout coralline areas of Thailand.

The sand and mud bottoms on which seagrass beds form create a habitat for many burrowing and benthic organisms. The leaves and interwoven roots provide extensive shelter for small organisms and grazing surfaces for a variety of species. Many species migrate to and from seagrasses either daily or at fixed stages during their life cycle. For example, although many food fish live and are harvested in the coral reef areas as adults, they pass the crucial larval and juvenile phases in the protection of seagrass beds. Seagrass beds provide additional feeding areas for species on nearby reefs, and the variety of fish species tends to be higher on reefs close to these habitats.

Seagrasses promote settlement and consolidation of sandy sediments, thus helping to prevent coastal erosion. They accumulate sand on which mangroves further consolidate the land. To some extent they can absorb organic wastes and sediment. However, heavy sedimentation can cut off light to bottom communities and eventually smother them. Seagrasses are particularly vulnerable to dredging and to anchor and propeller damage; holes cut in the bed may take years to regenerate. Under natural conditions, it may take decades for a seagrass bed to recover from stress damage once the impact has ceased (McEachern, 1988).

3. ISSUES OF THAILAND'S COASTAL FISHERIES MANAGEMENT

There are numerous issues for coastal fisheries management in Thailand. They can be briefly described as follows:

3.1 Unclear Definition of Coastal Area

As a matter of fact, there is unclear definition of the coastal zone. The Department of Fisheries (DOF), as mentioned earlier, views coastal areas as areas affected by tides and the climate of the sea. The landward area covers mangrove forests and the seaward extends to 3-5 km from the shoreline. This area is characterized by biological diversity of plant species and animal species. In addition, there is a regulation imposed by the power of the Fisheries Act, B.E. 2490 (1947) protecting the area of 3 km from the shoreline throughout the coastal area of the country.

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3.2 Institutional Arrangements

There are many government agencies involved in different activities in coastal areas of Thailand. These government agencies include the Department of Fisheries (DOF), Royal Forestry Department (RFD), Department of Harbour, Office of Environmental Policy and Planning (OEPP), and National Economic and Social Development Board (NESDB), among others. In addition, at the local level, there are various Provincial Offices located along the coastlines and municipal offices in coastal provinces also involved in coastal activities. These government agencies have their own policies, plans and legislation for managing coastal areas pertaining to their disciplines.

The combination of a number of government agencies and an unclear definition of the coastal zone has led to overlapping jurisdictions and frequent conflicts of legislative power and administrative authority in many aspects of management. In response, Thailand has initiated the formulation and integration of a coastal zone management plan at the national level. However, the plan has not yet been completely formulated and integrated. In addition, many pieces of legislation have not yet been amended as well. Still each agency continues to manage coastal areas according to its own policy and planning. Thus, the management of coastal areas in Thailand is quite ineffective.

3.3 Human Settlement

The types of human settlement along the coast in Thailand can be classified into five categories – fishing villages; fishing and farming villages; farming villages; urban and industrial communities; and migratory communities (Adulavidhaya, *et* al, 1982). Fishing villages are the most common along the Thai coasts. Fishing villages are located in estuaries and along the shores. These villages are generally settled in clusters. The size of fishing villages varies from very small *(i.e.,* composed of 20-30 households), to very large villages composed of several hundred households. Panayotou, *et* al. (1985) infers a total number of 90,200 fishing households in the 1,563 fishing villages of the 23 coastal provinces, bringing the fishing-dependent population up to 800,000 -1,000,000. People in fishing villages are usually engaged in small scale fisheries with simple technology. These villages are generally self-sufficient (TDRI, 1986).

Fishing and farming villages are mainly scattered along the east coast and the southern provinces. People in these communities engage in rice farming as a supplementary occupation. The standard living of these people is relatively better than those living on fishing alone (Rientrairut, 1985). But rice production is rarely sufficient for household consumption. Increasing salinity of the soil, population growth which has placed additional pressure on land use, and lack of interest in rice cultivation have resulted in an overall insufficient production of rice to meet the needs of Thailand's rice consumption. In addition to rice farming, coconut plantations also provide supplementary income to fishermen.

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The coastal farming communities are located in the inner part of the Gulf of Thailand. These areas include the estuaries and deltas of four rivers - the Chao Phraya, Mae Klong, Nakhonchaisri, and Bang Prakong. The major occupations of these villages are salt farming, shrimp and fish farming, mariculture, and coconut plantation. This type of settlement is generally in a scattered pattern with each homestead on the farm land.

Most of the coastal urban and industrial communities are located in the vicinity of the inner Gulf of Thailand. Recently these provinces have been industrialized. For example, Chonburi province and neighboring Rayong and Chachoengsao have become the focus of the Eastern Seaboard development plan including a major new port, heavy industry zone, oil refineries, petrochemical industry, marine product industry and numerous housing estates, The rate of urbanization and industrialization in Chonburi and neighboring provinces is increasing rapidly (ONEB, 1986). In addition, many coastal provinces have rapidly developed due to the boom of tourism.

The migratory communities are mainly located in some of the southern provinces on the Bay of Bengal coast. They are an ethnic minority called "Chao Le" (sea dyak or sea gypsy). These people have no permanent settlement, wandering from place to place, from island to island, in order to find fishing locations, It is estimated that the population of sea dyaks in Thailand to be about 2,300 people or 400 households. They live in a small groups with a unique culture (Adulavidhaya, ***et al.,*** 1982).

3.4 Environmental Degradation

There are numerous factors contributing to the environmental degradation and deterioration which have an impact directly and indirectly on the coasts. However, in sum, the following practices or circumstances are major contributors to environmental decline:

- Environmentally destructive practices
- Erosion, upland and coastal
- Sedimentation on coral and seagrass meadows
- Changes to salinity or freshwater regimes
- Water pollution, liquid and solid wastes
- Toxic chemicals from aquaculture run-off
- Mangrove removal, wood products and pond construction
- Over-exploitation of fish stocks
- Tin and sand mining or dredging
- Salt production
- Industry and power generation
- Obliteration of production habitat by unplanned development
- Urbanization

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3.5 Land Use Conflicts

Land use problems in Thailand arise from competing, mutually exclusive uses for the same advantageously located piece of land. Coastal land is a prime example of this category: it is in demand as a desirable place to live, as a recreation resource, as a low-cost site for electrical power plants and industry, as a site for agriculture cultivation and plantation, and as tin mining and salt production area. Coastal land attracts commercial infrastructure as well as marine resources exploitation for mangrove products, aquaculture, mariculture and artisanal fishing. The complex overlap of land uses indicates that an integrated coastal zone management approach is necessary to resolve land use conflicts, and that it can aid in making resource allocation decisions for competing uses (McEachern, 1988).

4. SMALL-SCALE FISHERIES IN THAILAND

Small-scale fisheries are widely practised in the coastal area of Thailand because they can be operated by near-shore fishing, coastal aquaculture, and mariculture. Small-scale fishermen are important participants in the fishing industry of Thailand and account for three-quarters of the total number of fishermen. They provide one quarter of the total fish landings (DOF, 1987, Panayotou and Jetanavanich, 1987). Fishing is also an important source of rural employment and income. It is estimated that 5 percent of the total labour force in Southeast Asia depends on fishing for its livelihood (Panayotou, 1985). Panayotou, *et* al. (1985) also report that there are more than 300,000 small scale fishermen scattered along Thailand's coast.

Although there is no standard definition of small scale fisheries, various classifications of fisheries exist: small-scale versus large-scale; subsistence versus commercial; artisanal versus industrial; and inshore (or municipal) versus offshore. Fisheries may also be classified according to the vessel size; gear type and vessel size; distance from shore; or a combination of the three (Panayotou, 1985). It is not unusual to find that what is considered a small-scale fishery in one country would be classified as a large-scale fishery in another (Emmerson, 1980).

In Thailand, many institutions have attempted to define small scale fisheries. The following definitions used by 3 institutions are taken from Rientrairut (1985):

- Kasetsart University defines small-scale fisheries in terms of current value of fishing asset totaling less than 20,000 baht per fishing household.

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- SEAFDEC defines small-scale in terms of fishing boats ranging from without boat, non-motorized boats, outboard motorized boats to inboard motorized boats less than 8 meters in length.

- DOF defines small-scale in terms of horsepower, length of boat, labour employed and type of fishing gear. All fisheries that are carried out using small traditional fishing gear, operating fishing on a subsistence basis as well as coastal aquaculture using small cultivation area; are defined as small-scale fisheries. Small fishing gear implies that the fishing gear used with the boats is not greater than 10 meters in length, and that the engine is not greater than 30 HP. Traditional fishing gear implies low efficiency and can be employed within the vicinity of a home base, or in the area close to the coast. Subsistence basis implies low income and fishing labour is mainly family members.

Generally, the income of small-scale fishermen in Thailand is composed of fishing income and non-fishing income. Fishing income is derived from three sources: own fishing, fishing labour and fish processing, whereas non-fishing income is derived from farming, hired labour and others (Rientrairut, 1985). Therefore, there is a wide difference in income among small-scale fishermen operating the same type of gear in different fishing grounds or different types of gear in the same fishing ground.

Unlike the commercial fisheries, the exact number of small-scale fishing boats in Thailand is unknown. Although commercial fishermen are required to register the boats and to obtain fishing gear licenses for the purposes of tax collection and inventory, small-scale fishermen are viewed as a poor group in the fishing industry. Their way of life is to fish on a subsistence basis using low-efficiency fishing gears which have a low impact on fishery resources. The government policy is to waive the tax for them, therefore some small-scale fishing gears are not required to obtain licenses (DOF, 1989). In addition, there are always some occupational and geographical migrations in and out of the fishing industry by small-scale fishermen (Panayotou and Panayotou, 1986). These reasons make it difficult to obtain an accurate accounting of small-scale fishing gears in Thailand.

Rientrairut (1985) suggests that there are 24 types of small-scale fishing gear in Thailand, numbering to about 45,000 units. Most of the gear are seasonal. Exceptions include shrimp gillnet, crab gillnet, push net and small beam trawl. The highest number of fishing gear is fish gillnet with about 5,700 units, followed by shrimp gillnet with about 5,200 units. Traditional fishing gear can be classified into four main groups: gillnet, longline, mobile gear and stationary gear (Table 1). Among them, mobile gear catches the highest percentage, approximately 40 percent of the total, whereas longline contributes the lowest at approximately 2 percent. Annual production of small-scale fisheries contributes about 20-30 percent of the total marine production and most of the catch is composed of high-value species.

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Table 1. List of small-scale fishing gear in Thailand.

Gillnet	**Mobile eear**
1. Swimming crab gillnet	17. Ark shell rake
2. Shrimp gillnet	18. Beam trawl
3. Fish gillnet	19. Acetes trawl
4. Seabass encircling gillnet	20. Push net
Stationarvgear	**Long line**
5. Squid trap	23. Hook
6. Fish trap	24. Squid hook line
7. Crab trap	
8. Circular net crab trap	
9. Bamboo mud crab trap	
10. Crab lift net	
11. Bamboo cylinder trap	
12. Small winged set bag	
13. Big block net	
14. Winged set bag	
15. Net for Malaya lift net	
16. Plotorus brush piles	

Source: Rientrairut (1385).

In the past, the socio-economic problems faced by small-scale fishermen in Thailand were largely ignored. This was partly due to a presumption that, sooner or later, small-scale fishermen would be absorbed by the rapidly progressing large-scale fishing sector (either by acquiring advanced technology or by becoming labourers on large trawlers). The thinking was that they would be forced into alternative, more profitable, occupations. Aside from the social problems that such a transformation would have generated, the fact is that the small-scale fishermen, despite their apparently deteriorating standard of living, continue to exist alongside a highly profitable large-scale fishing sector. A number of explanations for this dualistic structure and persisting poverty have been advanced, ranging from the lack of advanced technology to the depletion of fish resources; from a suspected gambling behavior among fishermen to the alleged exploitation by unscrupulous middlemen; and from the lack of alternative employment opportunities to fishermen's occupational and geographical immobility (Panayotou, et al., 1985, Rientrairut 1983).

Panayotou (1985) suggests that the Southeast Asian governments, including Thailand's are facing three distinct, but inter-dependent issues:

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- how to attain a sustainable improvement in the socio-economic conditions of small-scale fishing communities;

- how to manage the resource so as to maximize its productivity (or, more appropriately, the net economic or net social benefit from the resource); and

- how to allocate the country's limited marine fisheries between small-scale fishing communities and commercial fisheries so as to minimize the conflict between them.

In order to solve these problems, many researchers, including Panayotou (1985), ADB (1985), and Rientrairut (1985) conclude that fisheries management can make a dual contribution towards the improvement of income levels of small-scale fishermen:

- by limiting entry into the coastal fishery, which would help consolidate possible gains from fishery development; and

- by effectively prohibiting the operation of the large-scale fishery (particularly trawlers) in the coastal waters, it would enlarge the effective resource base of the small-scale fishery.

5. POLICY OF THE DEPARTMENT OF FISHERIES REGARDING CBFM

In Thailand, the tremendous increase in the number of commercial fishing boats over the past three decades, from approximately 5,000 fishing vessels in the 1960's to approximately 20,000 fishing vessels in the 1980's and the 1990's (Nagalaksana, 1988; Panayotou and Jetanavanich, 1987; DOF, 1995) has **caused** the government fisheries agency to impose fishery regulations in order to minimize the impact of commercial fisheries on small-scale fisheries. This has been done by prohibiting trawl nets used with motorized fishing boats within 3,000 m of the shore (TDRI, 1987). In addition, this area is reserved as a spawning ground, nursery ground and feeding ground for many aquatic species.

There is a search for new management concepts and approaches for fisheries. One of the management concepts which has received much attention recently is the community-based fishery management system. The essence of such systems is that fishermen or fishermen's organizations, rather than the government, should be responsible for management and regulation of the fisheries. It is generally believed that if fishermen or fishermen's organizations were given management responsibilities, they would be more committed and responsive to management and conservation measures.

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Small-scale fishermen in Thailand are increasingly facing the problem of limited fishery resources, which has led to conflicts among resource users. In addition, many small-scale fishermen have improved their traditional fishing gear from simple stationary gear (such as trap, bamboo stake trap, bamboo cylinder trap, etc.) to more effective fishing gears (e.g., push net, small trawl net, etc.). The push net and small trawl net are operated nearshore, usually within an area of 3 km from the shore. Therefore, small-scale fishermen also violate the law and damage the fishery resources.

The Department of Fisheries has initiated and put forward the "Plan for Rehabilitating Thailand's Sea" to be considered at the national level early 1996. Later, the Prime Minister has agreed to adopt this plan as national policy. Under this plan, the sea will be divided into three zones: (i) nearshore within 3-5 km from the shore; (ii) offshore starting from 3-5 km from the shore up to 12 miles; and (iii) deep sea more than 12 miles from the shore. Fig. 1 shows the plan of DOF for zonation of fishery resources allocation in the sea.

The Department of Fisheries will introduce the fishing right system and the community-based coastal fisheries management system in the zone within 3-5 km from the shore. This area will provide an additional area for aquaculture, mariculture, and coastal fisheries for about 15 - 20 million rai based on the calculation of 2,500 miles of coastlines times 3-5 km seaward. A coastal population of up to 1 million live in this zone. In pursuance to this system, there are numerous activities to be initiated and implemented. These activities are briefly described below.

5.1 Law Amendment

The existing fishery laws of Thailand are not comparable to the community based coastal fisheries management system. They do not contain provisions regarding the application of fishing right systems. Such provisions include the clarification of fishing right systems in Thailand; the establishment of fishing right systems by legislative power; the formation of fishermen's organizations (such as fishermen groups, fishermen associations or fishermen cooperatives); the role and duty of coastal communities regarding the management and conservation of coastal fishery resources; etc.

There is a need to amend the law in order that the Department of Fisheries could have a tool to manage coastal fishery resources effectively. The procedures of amending the law can be done either by adding the special chapter concerning community-based coastal fisheries management into the existing fisheries law or by amending the entire Fisheries Act.

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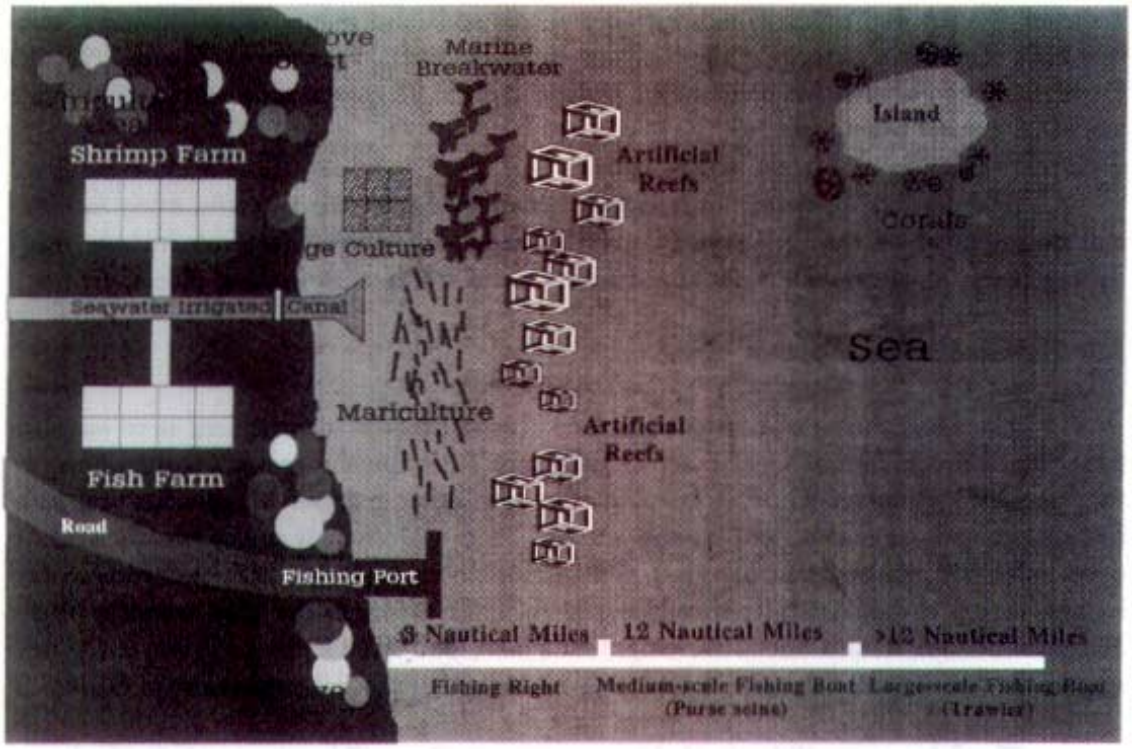

Fig. 1. Zonation of fishery resources allocation in Thailand.

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5.2 Artificial Reefs and Other Facilities

The Department of Fisheries plans to support coastal communities by enhancing fishery resources in coastal areas. One way to do this has been by deploying artificial reefs throughout the coastal areas of the country. It is anticipated that such reefs will be constructed in the sea within a length of more than 1,000 km and a width extending to 2-3 km, Artificial reefs can serve as physical obstacles to trawlers and other commercial fishing boats. As well, artificial reefs help slow wave action, making some coastal areas suitable for aquaculture and mariculture. In addition, within the artificial reefs and vicinity, they provide a shelter for fish and other aquatic animals. These reefs also attract many aquatic species that have resulted in enhancing the productivity of the reefs. Between 1985 and 1995, the Department of Fisheries has constructed artificial reefs in 98 coastal areas within 290 square km of 22 coastal provinces.

In order to support community-based coastal fisheries management, many facilities will be provided by the Department of Fisheries as well. These facilities include small fishing ports, marine brake water constructions, cold storages, processing places, etc.

5.3 Fishermen's Organization

The main theme of community-based coastal fisheries management is to establish fishermen's organizations – whether as fishermen's groups, fishermen's associations or fishermen's cooperatives. DOF in collaboration with other government agencies and local institutions will be responsible for this activity. Since government policy has focused on decentralization, government has given full support to this system. DOF will recommend incorporating the community-based coastal fisheries management plan into the Eight National Economic and Social Development Plan (1997-2001). In addition, DOF will amend the law in order that it contains a provision to form a fishermen's organization.

The fishery tax will be divided into two parts. One will be given to individuals and communities for use in their conservation and management programmes. Another will be returned to the central government as national revenue.

5.4 Training Programme

DOF will provide training courses for coastal fishermen residing along the coasts. These training programs include fishing gear operation and maintenance, fishing boat operation and maintenance, fisheries laws and regulations, coastal fishery resources conservation and management, fishing rights system, and community-based fisheries management, etcetera. In addition, DOF also provides training courses for fishermen's family members such as children and women to be trained in fish processing technology, conservation of coastal resources and environment, among others.

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Apart from providing a training program for coastal fishermen, there also will be the training program for fisheries officers of DOF to acquire the knowledge of fishing right systems and community-based coastal fisheries management. This is due to the fact that only a few of DOF's staff understand the concept and implementation of this system. In addition, many of DOF's staff should participate in international training programmes for community-based coastal fisheries management in countries with experience such as Japan.

5.5 Pilot Project

DOF has recently initiated a plan for introducing a fishing rights system and community-based coastal fisheries management system in Thailand. Under this plan, there will be pilot projects to introduce fishing rights systems in some coastal fishing villages in southern provinces. Although DOF has constructed many artificial reefs and other facilities in many coastal areas, the fishing rights system has not yet been introduced due to lack of knowledge, experience, plan and regulation. DOF anticipates that the pilot project would help coastal communities, DOF's staff, and other people to gain some experiences in managing coastal fishery resources.

6. CONCLUSION AND SUGGESTIONS

The Department of Fisheries views the coastal zone as an area for multiplicity of uses. Conflicts among resource users over environment protection, pollution, urban development and the utilization of other coastal resources including fishery resources have increased over time. In addition, the coastal areas are linked to the sea and affected by tides and the climate of the sea. Therefore, the management of coastal fishery resources should be integrated with marine fishery resources management. The Marine Fisheries Division and the Coastal Aquaculture Division of DOF will jointly plan and work closely in coastal areas of the country in the future, As well, community-based coastal fisheries management will be carried out by these two Divisions.

Regarding the FAO/BOBP project, DOF would suggest that the FAO/BOBP should look at land-based activities in the coastal areas as well, rather than focusing on sea activities. Therefore, FAO/BOBP should plan to increase support for projects involved in coastal area activities and in particular for community-based coastal fisheries management. The Department of Fisheries has recognized that community-based coastal fisheries management would be the right way to manage coastal fishery resources and will be given full support from the Thai government.

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7. REFERENCES

Adulavidhaya, K., S. Akornkoae, S. Arthachinda, S. Rowchai and C. Rongrujipimol. 1982. Thailand: Use and development of mangrove and fisheries resources. In: C. Soysa, L.S. Chia and W.L. Collier (Eds.). Man, land and sea: Coastal resource use and management in Asia and the Pacific. Agricultural Development Council, Bangkok, pp. 273-296.

Armstrong, J.M., and EC. Ryner. 1978. Coastal waters: A management analysis. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, 204p.

Asian Development Bank (ADB). 1985. Thailand F'isheries Sector Study. ADB, Manila, 226p.

Atapattu, A.R. 1987. Territorial Use Rights in Fisheries (TURFS) in Sri Lanka-case study on Jakottu fisheries in the Madu Ganga estuary and Kattudel fishery in the Negombo Lagoon. In Indo-Pacific Fishery Commission. 1987. Papers presented at the Symposium on the Exploitation and Management of Marine Fishery Resources in Southeast Asia held in conjunction with the Indo-Pacific Fishery Commission, Darwin, Australia, 16-26 February 1987. RAPA/REPORT: 1987110 FAO, Bangkok, pp. 370-40 1.

Bailey, C. 1387. Social consequences of excess fishing effort. In: Indo-Pacific Fishery Commission. 1987. Papers presented at the Symposium on the Exploitation and Management of Marine Fishery Resources in Southeast Asia held in conjunction with the Indo-Pacific Fishery Commission, Darwin, Australia, 16-26 February 1987. RAPA/REPORT: 1987/10 FAO, Bangkok, pp. 170-l 8 1.

Becker, T. E. 1986. Fisheries play an important role in a developing nation's economy. In: ADB Quarterly Review, 1986 (Jan-Feb) QR-l-86. Manila, pp. 13-16.

Boonchuwong, P, and A. Lawapong. 1988. Costs and returns analysis of demersal and pelagic fishing gears of Thailand. Asian Fisheries Social Science Research Network, Fisheries Economics Research Sub-Division, Department of Fisheries, Ministry of Agriculture and Cooperatives, Bangkok, 120p.

Brahtz, J.EC.(Ed.). 1972. Coastal zone management: Multiple usewith conservation. John Wiley and Sons, Inc., New York, 325p.

Burbridge, P.R. 1982. Problems and issues ofcoastal zonemanagement. In: C. Soysa, L.S. Chia and W.L. Collier (Eds.). Man, land and sea: Coastal resource use and management in Asia and the Pacific. Agricultural Development Council, Bangkok, pp. 309-320.

Burbridge, P.R., K.H. Dirschl and B. Patton (Eds.). 1988. Coastal zone managetnent in the Straits of Malacca. School for Resource and Environment Studies, Dalhousie University, Halifax, Nova Scotia, Canada, 3 13p.

Burbridge, P.R., N. Dankers and J.R. Clark. 1989. Multiple-use assessment for coastal management. 13p.

Canadian International Development Agency (CIDA). 1986. Canada and Third World Fisheries. CIDA, Hull, Quebec, pp.1 -18.

<<

CIDA. 1988. Action plan for sustainable development of Indonesias marine and coastal resources. Canada! Indoesia Medium-term Planning Support Project, BAPPENAS.

Chantawarangkul S, 1989 **Coastal** area management planning: Thailand experience. **31 p.**

Chikuni S. I 987. Potential yield of marine fishery resources in Southeast Asia. In: Indo—Pacific Fishery Commission. 1987. Papers presented at the Symposium on the Exploitation and Management of Marine Fishery Resources in Southeast Asia held in conjunction with the Indo—Pacific Fishery Commission, Darwin, Australia, 16-26 February 1987. RAPA/REPORT: 1987/10, FAO, Bangkok, pp. 16-27.

Christy, F.T, Jr. 1973. Alternative arrangement **for marine fisheries: An** overview. **RFF/PISFA Paper 1,** Washington DC, 31 **p.**

Christy, FT., Jr. 1982. Territorial use rights in marine **fisheries:** Definitions and conditions. FAO Fish.Tech. Paper. (227): 1 **0p.**

Christy, FT., Jr. I 987a. Measurements of fisheries production in Southeast Asian **countries.** In Judo—Pacific Fishery Commission 1987. Papers presented at the Symposium on the Exploitation and Management **of** Marine **Fishery Resources** in **Southeast Asia held** in conjunction **with the Indo—Pacific Fishery** Commission, Darwin, **Australia, 16-26 February 1987. RAPA/REPORT: 1987/10, FAO, Bangkok,** pp. 109-113.

Christy. Fr., Jr. I 987b. **Experiences** in **dealing** with problems ofexcess fishing effort and conflict. In Indo— **PacifIc Fishery** Commission. 1987. Papers presented at **the** Symposium **on the Exploitation** and Management **of Marine Fishery Resources** in **Southeast Asia held** in **conjunction with the Indo— Pacific Fishery Commission, Darwin, Australia, 16-26 February 1987. RAPA/REPORT: 1987/10, FAQ, Bangkok, pp. 324-330.**

Christy, F.T., Jr. I 987c. **A re—evaluation** of approaches **to fisheries development** : **The special characteristics** of **fisheries** and the need **for** management. In: **Indo—Pacific Fishery Commission. 1987. Papers presented at the** Symposium on the Exploitation and Management of Marine Fishery Resources in **Southeast** Asia held in **conjunction with the Indo—Pacific Fishery** Commis.sion, Darwin, **Australia, 16—26 February 1987. RAPA/REPORT: 1987/10, FAO, Bangkok,** pp. 528-539.

Chullasorn S., and *P* **Martosubroto. 1986. Distribution and important biological features olcoastal fish resources** *in* **Southeast Asia.** FAO **FishTech Paper,** (278) : 84p.

Chua, T—E. 1989. **Developing coastal** area **mangement** plans in Southeast Asian region. JCLARM Contribution No. 482, 10p

DOF. **1985. Annual Report** ofThailand **Fisheries 1984. Department** of Fisheries, **Bangkok.**

DOF. 1987. Fisheries Statistics of Ihailand 1984. Department of Fisheries, Bangkok. (in Thai).

<<

DOF. 1989a. Fisheries Statistics of Thailand 1987. Department of Fisheries, Fishery Staristics Sub—division Publication No. 3/1989 (in Thai).

DOF. 1989b. Thai Fishing Vessels Record 1987. Department of Fisheries, Fisheries Statistics Sub-Division. Publication No. 4/1989 (in Thai).

Emmerson, C. K. 1980. Rethinking artisanal fisheries development: Western concepts Asian experiences. World Bank, Washington, DC, USA. 97p

FAO. 1982. Management and utilization of mangroves in Asia and the Pacific. FAO, Rome, FAO Environment Paper No.3. 160p

FAO. 1984. Report of the FAO World Conference on Fisheries Management and Development. June 26-July 6. FAO, Rome, Italy. 60p

FAO. 1986. Strategy for Fisheries Management and Development FAO, Rome, Italy. 26p.

FAO. 1988. Yearbook of Fishery Statistics 1986. FAO, Rome.

FAO. 1989. Yearbook of Fishery Statistics 1987. FAO, Rome.

Keen, E.A. 1988 Ownership and Productivity of Marine Fishery Resources McDonald and Woodward Publishing Co. Blackshury, Virginia. 122p.

Marr,J.C. 1976. Fishery amid Resource Management in Southeast Asia. RFF/PISFA Paper 7, Washington D.C., USA. 62p.

McEachern, J. 1988. Coastal zone management for sustainable development: Thailand. Contract report for CIDA.

NESDB. 1986. The Sixth National Economic and Social Development Plan (1987-1991). National Economic and Social Development Bard (NESDB). Office of the Prime Minister, Bangkok. pp. III - 146.

OECD. 1984. Experiences in the Management of National Fishing Zones. Organization for Economic Cooperation and Development (OECD), Paris, France. 159p.

ONEB. 1986. Resources Atlas for Eastern Seaboard Region. Office of the National Environment Board (ONEB), Ministry of Science, Tecnology and Energy, Bangkok. 90p.

Panayotou, T. (Ed.). 1985. Small—scale fisheries in Asia: Socio—eeonomic analysis and policy. IDRC—229c. Ottawa, Ontario. 283p.

<<

Panavotou, T., T. Adulavidhaya, S. Artachinda, S. lsvilanonda and T. Jitsaguan 1985. Socio—economnic Conditions of Coastal Fishermen in Thailand: A Cross—Section Profile. In: Panayotou, T. (Ed.) Small Scale Fisheries in Asia. IDRC-229e. Ottawa, Ontario, pp. 55-72.

Panayototm, T.and D Panayotou. 1986. Occupational and geographical in amid out ofThai Fisheries. FAO Fish. Tech. Pap. 271: 77p.

Panayotou, T. and S. Jetanavanich. 1987. The economic and mamiagememit ofThai **marine** fisheries. ICLARM Studies and Reviews 14, Manila, Philippines. 82p.

Petersomi, S. and L.J. Smith l 982. Social and ecomiomic impediments to artisanal fisheries development. In Soysa, C., L.S. Chia and WL. Collier (Eds.). Man, Land and Sea:Coastal Resource Use and Managememit in Asia amid the Pacific. Agricultural Developmnemit Council, Bangkok,Thailand pp. 299-308.

Riemrairut S 1983. Fisheries development and planning system in Thailand. Department of Fisheries, Bangkok.

Rientrairut, S 1985. Small scale fisheries development in Thailand. UNDP/FAO, Manila, SCS/85/WP/1 26. 98 p.

Scaefer, MB. 1972. Conservation on biological resources ofthe coastal zone. In Brahtz.J.F.C (Ed.). Coastal Zotie Management. John Wiley and Sons, Inc., New York, pp. 35-79.

SEAFDEC. 1986. Thailand's marine fishing gear. Southeast Asean Fisheries Development Center (SEAFDEC), Bangkok. 50 p.

Thailand Developmemit Research Institute (TDRI). 1986. The status of coastal and marine resources of Thailand. Bangkok, Thailand. 60p.

TDRI 1987. Thaihamid Natural Resource Profile. Bangkok.Thailand. 304p

Yamamoto, T. l 987. Fishery regulations adopted for coastal and offshore fisheries in Japan. In Indo—Pacific Fishery Commission. l 987. Papers presented at the Symposium omi the Exploitation and Management of Marine Fishery Resources in Southeast Asia held in conjunction with the Indo—Pacific Fishery Commission, Darwin, Australia, 16-26 February 1987. RAPA/REPORT: 1987/10, FAO, Bangkok, pp. 367-378.

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STATUS OF COASTAL FISHERIES IN PHANG-NGA BAY AND CURRENT ISSUES FOR MANAGEMENT

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1. INTRODUCTION

Phang-nga Bay is the largest hay on tile Andaman Coast of Thailand and covers the northeastern shore of Phuket, and the entire shoreline of Phang—nga and Krabi Province (Fig 1) A unique feature of the Bar is the presence of large monolithic limestone islands, particularly in the tipper reach of the Bay. The many islands scattered throughout the bay provide habitat and shelter to a wide diversity of the Bay's wildlife. Most of the bottom bed is mud and muddy sand with a maximum depth of about 35 meters. Extensive mangrove areas of approximately .3000 square kilometers are found along the shore line, and some areas are occupied by sea grasses.

The Bay receives nutrient and freshwater inflow from several rivets and streams. 1 he most significant source of nutrients and freshwater comes from the Phang-nga river, and helps to make Phang-nga Bay a rich spawning ground and nursery ground for an abundance of marine aquatic animals. Important economic species providing sources of income for the livelihood of fishermen are marine shrimp, lobster, swimming crab, blue crab, short-necked clam and many species of fish including chub mackerel, promfet, etc.

2. TRENDS IN THE PHANG-NGA BAY FISHERY

For the last two to three decades, Phang-nga Bay has been a biologically productive area, rich in aquatic resources. Fishing took place mainly in the waters just in front of the villages, and fishermen used artisanal fishing gears such as bamboo stake trap, hook and line and fish ttaps, among others. Gear used depended on geographic conditions and species targeted. Consumer demand for favorite species largely dictated targeted species during different seasons. However, with the development of fisheries and tile increase in Thailands population the demand for marine products for consumption has also increased, causing competition in fishing efficiency. Furthermore, many types of fishing gear and new fishing methods such as trawlers, light luring fishing rechniques and push net, were introduced into the area. As a result, marine prod tticts have decli ned drastically. Competition for fishing grounds and conflicts between fishermen using different fishing methods have finally occurred in the Bay.

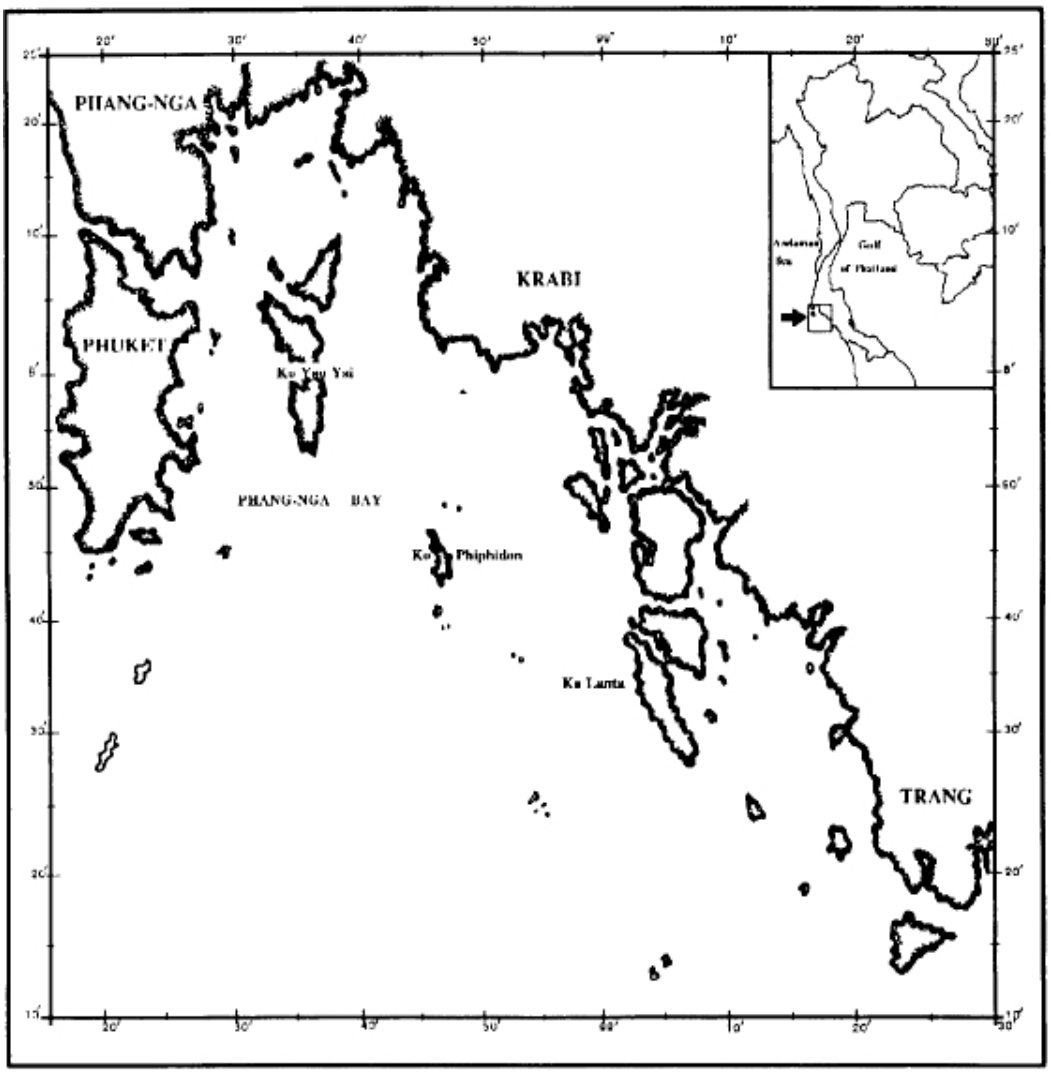

Fig. 1. The map ofPhang-naga Bay.

Furthermore, it was found that fishing activities of each fishing village are based on many factors such as transportation and electricity. For example, in villages with good road connections to towns, each fisherman will use many kinds of fishing gear, as all of the catch can be sold to middlemen who come to buy directly at the landing site. On the contrary, middlemen are less able to come to villages that lack transportation facilities and infrastructure. Consequently, at these villages that lack infrastructure, only some species can be sold because of the long transport time to markets. This constrains the fishermen to catch only the species that enjoy high market demand. Moreover, illegal fishing by commercial fishing boats in prohibited areas of the Bay automatically limits artisanal fishing activities and further increases the hardship of disadvantaged small-scale fishermen.

2.1 Fishing gears used in Phang-nga Bay

Several types of artisanal and commercial fishing gears were used during the last decade in Phang-nga Bay when fishing activities were conducted without limitations and regulations. The gears are described below:

1. Trawler: Single trawlers and twin trawlers were the most common fishing gears operating in Phang-nga Bay. The original target species were economically important demersal species. However, when resources later declined, those fishing boats changed their target species to catch trash fish to sell to fish meal processing plants.

2. Small otter beam trawl: The target species of this kind of fishing gear is shrimp, but other species are also caught with this gear type. These include crab, squid, pelagic fish and economically important demersal species.

3. Light luring purse seiner: This is one kind of commercial fishing boat that is operated in the outer part of Phang-nga Bay by using light to attract schools of fish.

4. Anchovy encircling net: This fishing gear is designed to catch anchovy during the daytime. However, because of the degradation of resources and also the disturbance from light-luring purse seiners, catch from this gear type has decreased to almost zero. These purse seiners attract schools of anchovy and frighten the fish from schooling the following day. As a consequence, these anchovy fishing boats have changed their fishing method to operate during the night by also using light to attract fish schools, much like the light-luring purse seiner. However, this kind of fishery is illegal and creates many problems at present.

5. Trammel net: This fishing gear aims to catch shrimp and is quite commonly used in Phang-nga Bay.

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6. Crab gill net: This is another selective fishing gear that mainly catches crab.

7. Sand whiting gill net: This gill net has been designed to catch sillagid species.

8. Push net: The push net is one of the most destructive fishing gears and also one of the most popular. Since its introduction it has been commonly used in Phang-nga Bay. The target species of this fishing gear includes primarily shrimp; small sizes of other small economic species are also caught.

9. Grouper tray: This fishing gear aims to catch mainly small grouper for selling to fishermen engaged in grouper cage culture to rear up to marketable size which is very high-priced.

Apart from the fishing gears mentioned above, there are some other fishing gears operated in Phang-nga Bay, but most of them are used for subsistence - the catch just feeds the fisher families.

3. CURRENT STATUS OF THE FISHERIES IN PHANG-NGA BAY

Utilization of fisheries resources in Phang-nga Bay has historically been exclusively by small-scale fisherfolk using artisanal fishing gears. One might assume that it is not a serious problem, but because of the rapid expansion of commercial fisheries (large number of fishing boats, new types of fishing gear and technologies), severe pressure has been placed on coastal areas, and commercial boats have begun to enter into the new commercially unexplored fishing grounds of Phang-nga Bay. The Bay is not within the limit of the trawlers and when they enter the Bay, they are fishing illegally. Furthermore, the fishing grounds and fishing habitats have been destroyed by those destructive fishing gears. Most destructive gears found in the bay could be identified as follows:

1. Trawling: Before 1979 every kind of trawler could freely operate in Phang-nga Bay with good catch rates. Ratanachote and Noothong (1969) reported the result of a monitoring survey by the arch Vessel Pramong 3. Results showed the catch in Phang-nga Bay in 1969 was 160 kg/hr, comprising 48.5 % valuable species and 51.5 % trash fish. This catch rate decreased to about 38 kg/hr in 1988, and comprised about 33.3 % valuable species and 66.7 % trash fish. The composition of trash fish was found to be about 30.1 % small economic species and about 36.6 % trash fish (Chantawong, 1993). Finally, these trawlers changed the target species to trash fish just to feed fish meal factories. The consequence of this depletion of resources seems serious.

2. Push net: This is another destructive fishing gear operated along the shore line, particularly in the productive area of shrimp. Over 290 push netters have been recorded

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operating in the bay. Most of them are the long tail boats of 8-10 meters using 5-10 HP engines. Normally, push nets are used in the night after sunset, and at a depth less than 10 meters. Each operation will take 1-1.5 hours and a night's fishing (with a number of operations) can last 3-1 0 hours. However, during neap tide, fishing may last all night long.

Boonragsa and Nootmorn (1990) reported the fishery and resources status of push nets. Average catch was about 67.4 kg/trip, comprising mainly trash fish (about 85.4 %) and 14.6% economically valuable species. Marine shrimp comprised about 10.3 % or about 6.91 kg (Table 1) of the economically valuable species. Moreover, it was found that the trash fish catch was composed of true trash fish 56.10% and small economic species 43.9% (Table 2) which was sold in the form of trash.

The push net is highly efficient in catching trash fish, because the cod end used is just only 2 cm. It has been classified as a heavily destructive fishing gear. The capital for one set of push net was calculated as approximately 1,000-2,500 baht and can last for about one year (Aosomboon, 1988). The average income was about 460 baht while expenses averaged 270-300 baht. A technical analysis by Boonragsa and Nootmorn (1990) found that if shrimp were to grow up for a period of time, the value of the shrimp will register multiple increase, as illustrated in Table 3.

3. Small otter beam trawl: This is another kind of bag net popularly used in Phang-nga Bay and Krabi Bay in the past. About 50 trawlers are still being used in Krabi area at present. This fishing gear can typically operate two times a night with an operation time of 4-5 hour/haul except during high tide. Boonragsa (1988) reported a study of this fishery. The average total catch rate was about 104.86 kg/trip/boat, comprising 32.1% valuable species and 67.9 % trash fish (Table 4). The composition of trash fish was found to be 38.2 % of small economic species and 61.8 % true trash fish. It is therefore believed that this type of fishing gear is one of the more destructive gears.

4. FISHERIES MANAGEMENT INITIATIVES IN PHANG-NGA BAY

Management of fisheries in Thailand commenced more than 10 years ago, but the output was not so satisfactory. This may be because inappropriate methodologies have been used. The fisherfolk are also not so clear about technology transfer and fisheries resources management measures. This is largely due to the fact that fisherfolk are not given the opportunity to provide feedback to government officials on management decision-making. The implementation strategies have therefore been adjusted and improved to meet development targets. The activities that have been performed thereafter are can be divided as follows:

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Table 1 **Catch rate (kg/trip) and species composition of catch by push netting in Phang-nga Bay in 1988-1989.**

Species	1988		1989		Average	
	catch rate	%	catch rate	%	catch rate	%
Large size prawn	5.1	8.5	5.34	7.2	5.23	7.8
Small size prawn	1.47	2.4	1.89	2.6	1.68	2.5
Total prawn	(.58	10.9	7.23	9.8	6.91	10.3
Valuable fish	0.57	0.9	0.90	1.2	0.73	1.1
Crab	1.91	3.2	2.23	3	2.07	3.1
Squid	0.13	0.2	0.07	0.1	0.10	0.1
Trash	51.43	84.8	63.75	85.9	57.59	85.4
Grand total	60.62		74.18		67.40	

Sot trcc: Boo nragsa and N ootmorn (1 990).

Table 2. **Catch rate (kg/trip)** and **species composition of trash by push netting.**

Group of fish	Catch rate (kg/trip)					
	1 988		1 989		Average	
	weight	%	weight	%	weight	%
Invertebrate	10.91	21.2	9.82	15.4	10.37	18
Demersal fish	8.67	16.9	7.03	11	7.85	13.6
Pelagic fish	5.81	11.3	8.36	13.1	7.08	12.3
Trash fish	26.04	50.6	38.54	60.5	32.29	56.1
Total	51.43		63.75		57.59	

Source: Boonragsa and Nootmorn (1990)

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Table 3. Income obtained from banana **prawn** ***(P merguiensis)*** **in various** sizes **1988 - 1989.**

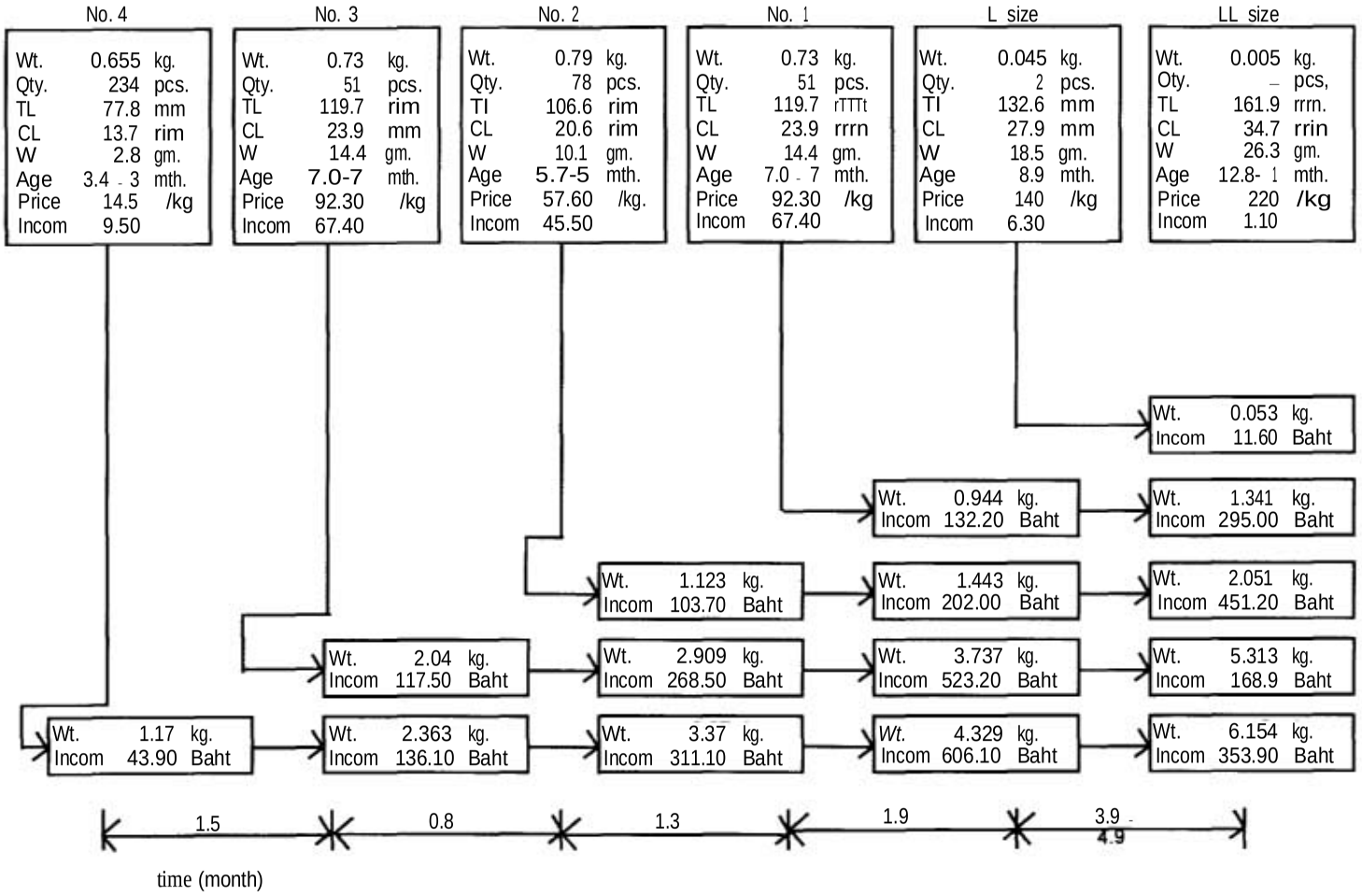

Table 4. Catch rate (kg/trip/boat) and species composition of small otter trawl Phang-nga Bay 1988.

Species	Average all year round	
	catch rate	%
Large size prawn	8.84	8.5
Small size prawn	17.35	16.5
Total prawn	26.19	2.5
Good fish	3.89	3.7
Crab	0.83	0.8
Squid	2.77	2.6
Trash	71.18	67.9
Grand total	104.86	100

Source: Boonragsa and Nootmorn (1390).

Table 5. Total catch rate, valuable species and trash fish (kg/hr) collected by research vessel Pramong 10 **in Phang-Nga Bay in 1986, 1990, 1993 and 1994.**

Year	total catch rate (kg)	valuable fish (kg)	trash fish (kg)	big mackerel (kg)	small mackerel (kg)	operation (time)
1986	34.66	16.42	18.25	0.1471	0.0045	119
1990	39.95	15.36	24.60	0.2904	0.0026	3
1993	49.90	22.53	27.38	0.5353	0.0000	38
1994	55.98	19.68	36.31	0.7745	0.0426	32

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4.1 Legislative approaches

Many Ministerial regulations and fishery issues have been established, but the most important and at present are :

1. Ministerial regulation issued on 1 August 1979 prohibits each type of trawler and bag net with a motorized boat from fishing in Phang-nga Bay (Fig. 2). Since fishery officers cannot cover the whole area, illegal fishing still goes on, particularly in shallow waters near the coast which patrol boats cannot enter.

2. Ministerial regulation issued on 11 April 1985 prohibits each type and size of trawler, and enclosed net gill net with a mesh size less than 4.7 cm, from fishing in Phang-nga Bay and Krabi area during the period 15 April - 15 June every year (Fig. 3). This regulation was initially not so effective because it was not completely understood by fishermen. Enforcement by means of advertising, posters and video films helped clarify the picture. This, coupled with increased surveillance by fisheries patrol boats, has strengthened the effectiveness of the regulation.

Monitoring of the effectiveness of the closed area management measure has been conducted just before, in between and after the closing season every year since 1986. The result can be summarized as follows:

Demersal fisheries: Monitoring surveys of the status of demersal fisheries resources have been conducted by the research vessel Pramong 10 of the Andaman Sea Fisheries Development Center. Phang-nga Bay was divided into 15 stations for monitoring purposes as shown in Fig. 4. It was recorded that the average total catch increased each year. Catch in 1993-1994 showed a particularly significant increase, compared to the catch of 1986 and 1990. However, in 1994, catch decreased slightly in terms of economically valuable species caught, and increased significantly in quantity trash fish. The small size of chub mackerel composed in the trash fish has also significantly increased in 1994 (Table 5). It was also found that the catch rate in the closed area during the closed season showed significant difference from those before and after closed season (Table 6). But right after the end of the closed season, many types of trawlers, particularly pair trawlers immediately entered and began fishing in the area, causing a drastic decrease of fish stock.

Pairoh Sutthakorn, et al. (1995) reported on the follow-up conservation measures in Phang-nga Bay by a pair trawl surveys in 1995 the last day of measurement, about 50 pairs of trawlers were ready to fish. The catch record collected from nine pairs showed an average total catch of 3800 kg/haul operation or 1190 kg/hr - very high indeed. The average composition of catch was about 69.43 % (mostly chub mackerel more than 43%), 10.04 % demersal species and 20.53 % trash fish.

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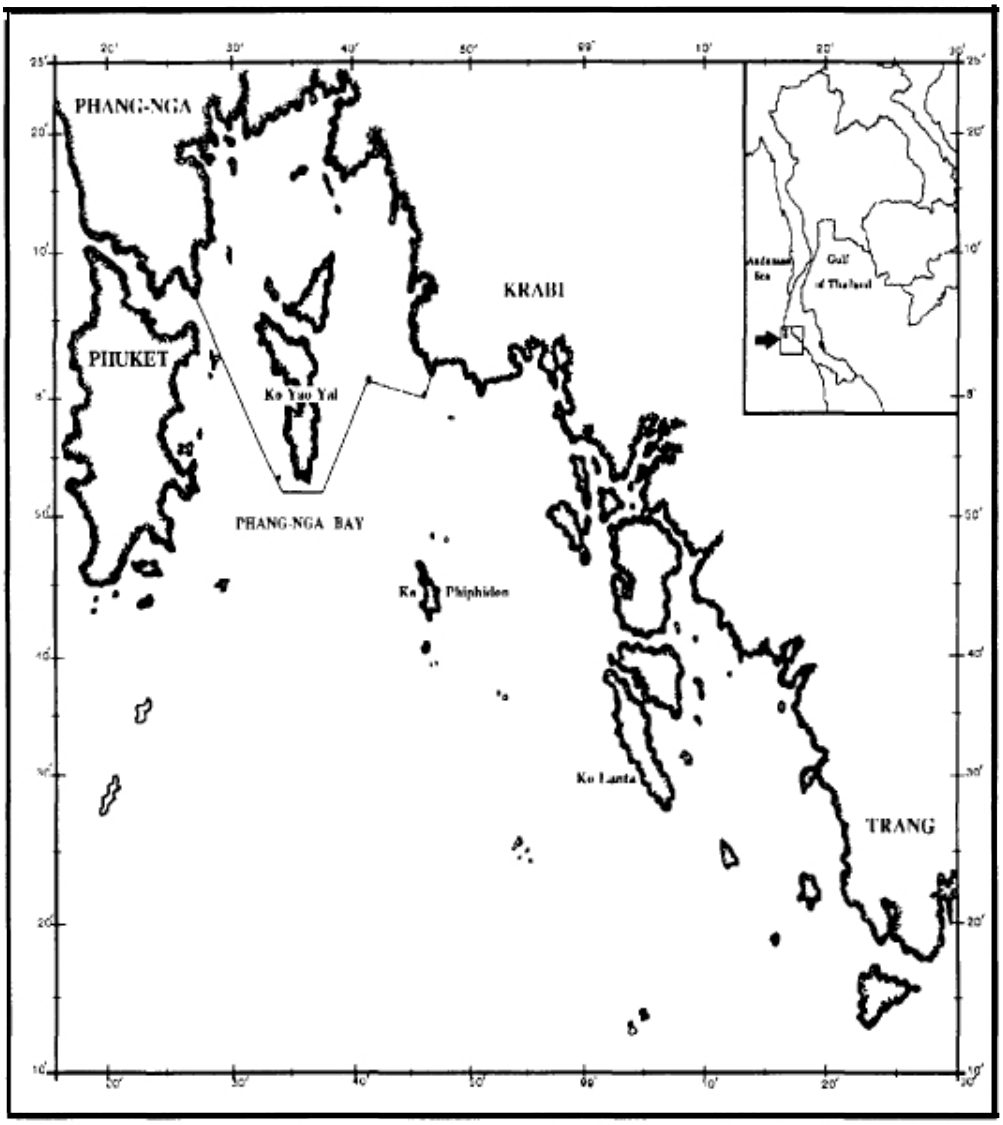

Fig. 2. Illustration of area prohibited of fishing using trawl net, push net and every kind of bag net with motorized boat (Ministerial Regulation issued 1 August 979).

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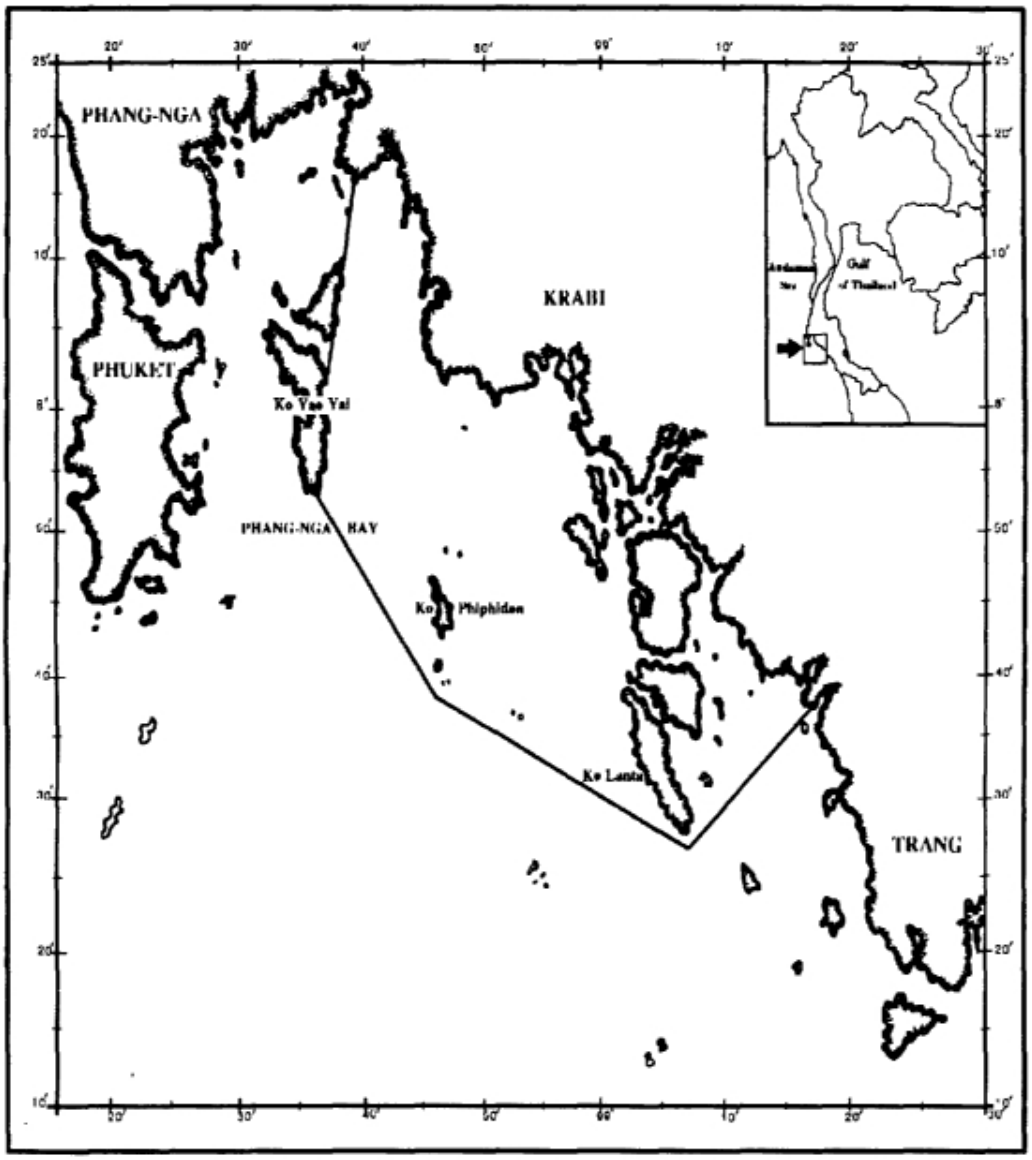

Fig. 3. Illustration of closed area for all kinds of trawlers, purse seiners, gill netters of mesh size less than 4.7 cm. during 15 April to 15 May every year (Ministerial Regulation issued 11 April, 1985).

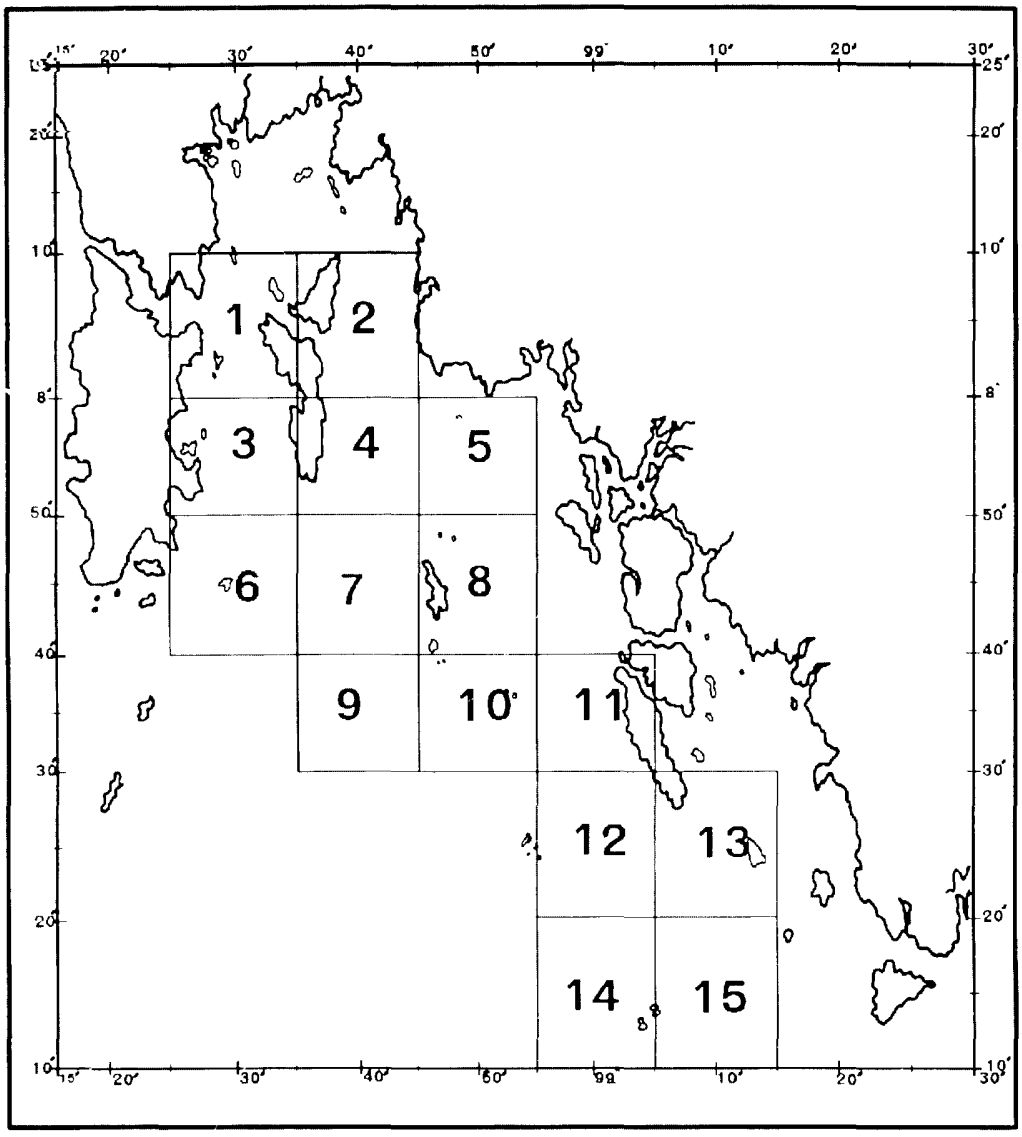

Fig. 4 Illustration ofgrid stations in Phang-nga Bay for demersal resources survey by research vessels Pramong 10

Table 6. Total catch rate, valuable species, trash fish, Mackerel (kg/hr) from inside, outside, and off the closed area during, before, in between and after closing season in 1986, 1990, 1993 and 1994.

Year	Duration	Total			Good fish			Trash fish			Mackerel (L)			Mackerel (S)		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1986	Average	35.84	31.83	–	16.45	16.35	–	19.40	15.48	–	0.15	0.14	–	0.006	0.00	
	Pre	31.12	22.38	–	11.68	10.35	–	19.44	12.03	–	0.09	0.05	–	0.00	0.00	–
	In	33.73	28.53	–	18.42	*15.58*	–	15.32	*12.95*	–	0.15	0.16	–	0.02	0.00	–
	Post	24.75	*12.53*	–	13.30	5.03	–	*11.45*	7.50		0.17	*0.15*	–	0.01	0.00	–
1990	Average	*45.46*	31.14	–	15.76	14.71	–	29.7	16.43	–	0.2163	0.4089	–	0.00	0.007	–
	Pre	28.86	36.55	–	10.00	*15.78*	–	18.86	20.77	–	0.10	0.93	–	000	0.00	–
	In	84.62	*52.26*	–	18.418	22.83	–	66.14	29.43	–	0.07	0.33	–	0.00	0.00	–
	Post	*55.27*	18.50	–	24.02	9.00	–	31.25	9.50	–	14.00	0.10	–	0.00	0.00	–
1993	Average	59.23	30.67	48.01	24.02	17.89	21.95	35.21	12.78	26.05	0.66	0.27	1.16	0.00	0.00	–
	Pre	29.47	35.27	16.27	11.14	17.27	11.26	18.00	18.00	*5.00*	0.12	0.00	*4.75*	0.00	0.00	–
	In	87.92	30.92	50.61	31.91	11.68	32.61	56.01	19.24	18.01	0.73	*0.56*	0.34	0.00	0.00	–
	Post	51.99	28.15	56.41	24.41	23.37	16.64	27.37	4.78	39.78	0.89	0.16	0.64	0.00	0.00	–
1994	Average	72.32	42.12	43.92	22.74	14.59	22.92	49.59	27.53	21.00	1.12	0.48	0:65	0.02	0.00	0.18
	Pre	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	In	87.91	56.95	*55.22*	24.17	14.71	27.04	63.74	42.23	28.18	1.19	0.18	0.70	0.05	0.00	0.32
	Post	58.04	32.24	29.80	21.42	14.51	17.77	36.62	17.73	12.04	1.05	0.68	0.60	0.00	0.00	0.00

** 1. Inside the closed area
2. Outside the closed area
3. Off the closed area

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Pelagic fisheries: Normally, purse seiners for pelagic species will operate in the outer part of Phang-nga Bay and Krabi area. During the closed season, these purse seiners will move to fish off the closed area and come back right after the season ends Data collected during January to May showed that the average total catch will range from 300 to 4800 kg/trip with a high percentage of chub mackerel, Indian mackerel and sardine. The catch rate of chub mackerel appeared to increase from 13 kg/trip in January to 506 kg/trip in February and 1191 kg/trip in March. This might be because of the new recruirment of small chub mackerel. But in April, the catch rate was reduced to 214 kg/trip, perhaps because most of the purse scincrs operated fishing off the closed area.

4.2 Management Measures

Many activities geared towards managing coastal resources have been implemented in fishing communities along the coast. These measures could be classified as follows:

1. Construction of infrastructure for the communities: These include for example, landing site, repair hall, fish processing building, fresh water stocking tanks retaining wall etc. based on the need of each village.

2. Training and grouping: Training courses have been organized for three groups of fisherfolk fisherfolk leaders, fishermen and fisher-women; and students – in order to educate them on resources management and conservation assessment.

3. Extension on coastal aquaculture: Coastal aquaculture has been introduced to the fisherfolk to supplement their income. They have been provided with tools, materials and seeds besides technical assistance. At present, coastal aquaculture has been expanded throughout the coastal area of both the Andaman coast, and the east coast and could yield good benefits to fisherfolk. In the early stage, cage culture was very popular. Species that have been commonly found throughout the coast are sea bass, red snapper and grouper. Fish fingerling will generally be collected from the wild except sea bass fry which can be bought from hatcheries. But as the price of grouper is much higher than those of sea bass and red snapper, most fish cage farmers have changed to culture of this species. Apart from fish cage culture, shrimp culture has now become very intensive and the culture area has now been expanded to cover most parts of Phang-nga Bay. 1992 record reported shrimp production of 3,210 tons valued at 473.5 million Bnht, obtained from shrimp culture ponds of about 2760 rai or 460 ha.

4. Construction of artificial reefs: Artificial reef construction in Phang-nga Bay has been initiated since 1983 by using circle concrete blocks, used tires etc. (Niyom Lohakarn, et al. 1983). Because most of the sea bottom in Phang-nga Bay consists of mud and muddy sand, a part of the module used easier got sunk. Some other modules were destroyed by the trawlers. In 1985 when the Marine Fisheries Conservation Unit was established in Phuket

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and the Ministerial regulation for closing some areas of fishing between 15 April and 15 June was issued, artificial reefs became an important tool for conservation. Two types of artificial reefs were installed. The first type consisted of reefs constructed just in front of fishing villages. The second type is the larger reef, about 50 square km. in area, aimed to prevent trawlers from illegal fishing in the prohibited area within 3 km offshore. It also serves as a big fishing ground for small-scale ftshermcn. At present, quite a number of artificial reefs have already been installed in t-he coastal area as shown in Fig. 5.

5. Awareness-building in fisheries for fisherfolk: This is a most important subject to be included in any management approach that would be applied in Phang-nga Ray. It is needed to create a better understanding within the fisherfolk community of conservation measures, protection of resources and fishing grounds in front of villages from outsiders, use of appropriate fishing gears, knowing how to utilize resources and surveillance of the environment in the area. These could be considered as a basic approach, which would meet the target of long-term development in the future.

6. Community-based ftsheries management: Management of coastal ftsheries resources could never have success without co-operation from fisherfolk. of course, at the beginning they have to be guided by extension workers and gradually increase their responsibilities in resources management until rhey will be considered to be independenr and could be responsible for all activities. This will be one of the indicators to indicate their readiness for pnrticipating in the TURFs project.

5. CONCLUSIONS AND RECOMMENDATIONS

It could be said that fisheries resources management in the past had emphasized infrastructure development more than academic developmnet of the fisherfolk Wit-hour an emphasis on academic development, the fisherfolk could nor absorb what has been introduced. Most of the ftsherfolk still have a strong respect in traditional beliefs and it is therefore rather difficult to change their minds to accept the new technology unless they can prove or try the technologies themselves first-hand. Even though the infrastructure has been successfully implemented, it was found that without a clear explanation of its use, the fishermen seemed to fear to use them. Finally no one became in charge or took responsibility of those constructions.

Therefore, to carry out efficient management of fisheries resources to reach the target of development, the following recommendations should be taken into consideration:

1. Timing: As 7reviously mentioned, most small scale fisherfolk earn rheir living from fishing methods that are based on old rraditional beliefs and irs rather difficult to change their mind. Some activities that rake quite a long time to get the result, like

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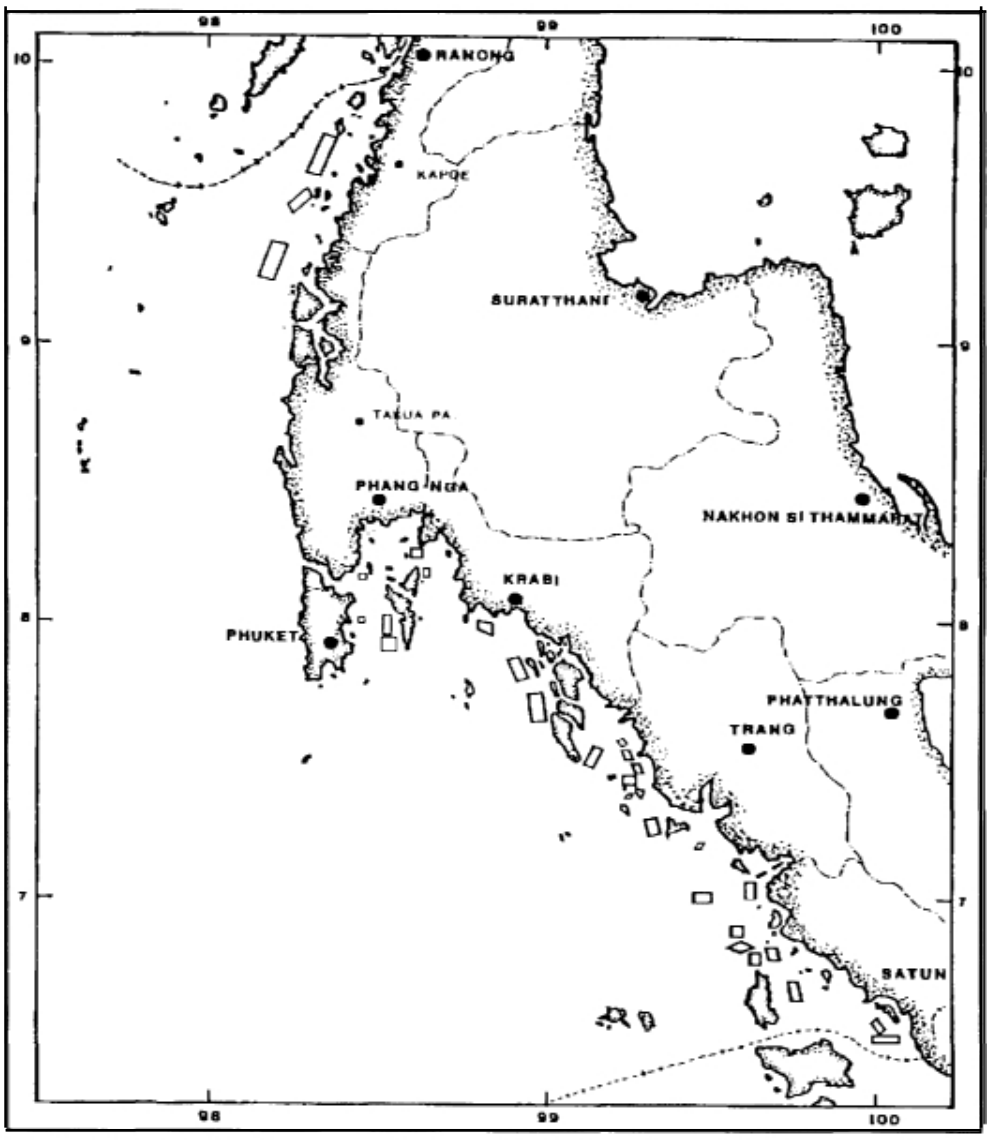

Fig :5 Illustration of artificial reefs construction on the Andaman Coast since 1986 1994

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conservation measures for example, can involve quite complicated procedures and will make the fisherfolk confused without clear explanations. Therefore, to simplify the participator! approach of fisherfolk, confidence must be created among fisherfolk before moving forward to the next step.

2. Education: At present, education in fishing villages has developed slowly. This may be because of poverty or lack of encouragement to children. In addition, some family leaders think that after graduating, their children must come back to be fishermen. Further, in many schools, basic academic tools are in short supply. Threfore, the government should pay more attention to these poor fishing villages and provide opportunities for the young to acquire qualifications. For the older generation, awareness building is essential, and could be done through radio, TV, video, posters, training etc.

3. Infrastructure: To improve the living standard of fishing communities, essential infrastructure such as roads, electricity and water works should be built. At present, a number of fishing villages still have no roads for vechiles nor electricity, and there is a continual shortage of fresh water and drinking water, especially during the dry season. The fishing communities must buy fresh water from the sellers and it is quite expensive. Health care is also essential for fisherfolk. Normally, traditional cures have been popularly used in the fishing villages. Even health stations have been established, but they can only take care of common ailments. In Thailand's coastal communities, many of these activities have been implemented by the DOF Howevcr, it appears that many of the activities have not been utilized, or have lacked management and maintenance, largely because of a lack of clarity in objectives. To attain development targets, activities should be coordinated so that they are carried out together and at the same time.

4. Personnel: Winning the confidence of fisherfolk is not just a matter of giving some introduction to the fisherfolk and leaving them to continue the activity by themselves, for this might make them confused and would not necessarily solve any problem. Therefore, to be close to the fisherfolk, and work together with them on a more practical level, the extension workers should spend full time in the villages. However, those personnel must have a good understanding of the work to be done, have good experience to help the fisherfolk solve the problems and should have good human relations to more efficiently help development.

5. Law and regulation enforcement: To obtain sustainable fisheries resources management, the enforcement should be effective. Many old regulations should be revised and updated. Fisherfolk must follow all regulations issued and furthermore the surveillance of illegal fishing and environment impairments should be performed with close cooperation of fisherfolk and the officers.

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6. REFERENCES

Aosomboon, P 1988. Study on small scale fishing gears in the Phang-nga Bay. Fishing Gear Development Unit, Andaman Sea Fisheries Development Center (AFDEC). Technical Paper No. 6, 32p.

Boonragsa, V. 1988. The status of small otter trawl (with boom) fisheries, Phang-nga Bay. Stock Assessment Unit, AFDEC. Technical Paper No. 5,34p.

Boonragsa, V and P Nootmorn. 1990. Status of push net fishery and resources in Phang-nga Bay. Stock Assessment Unit, AFDEC. Technical Paper No. 6,34p.

Chantawong, T. 1993. Monitoring in Phang-nga Bay. Marine Resources Survey Unit, AFDEC. Technical PaperNo.17, 16p.

Lohakarn, N., P Aosomboon and P Poonyanudach. 1984. Artificial reefs construction in Phang-nga Bay. Phuket Marine Fisheries Station, Phuket, Thailand. 38p.

Sutthakorn, P, B. Jaruthamsophon and Kajarngdara. 1995. Follow up of the conservation measurement in Phang-nga Bay by pair trawl survey. Marine Life History Unit, AFDEC. Technical Paper No. 34, 18p.

Ratanachote, A., and P Noothong. 1969. Report on trawl fishing ground and demersal resources on the Indian Ocean Coast of Thailand. In: Phuket Marine Fisheries Station, Phuket, Thailand. Annual Report 1969, pp. 1 O-78.

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STATUS OF FISHERY RESOURCES IN THE ANDAMAN SEA COAST OF THAILAND

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1. INTRODUCTION

Six provinces of Thailand; Ranong, Phang-nga, Phuket, Krabi, Trang and Satun, face the Andaman Sea (Fig. 1). Their total coastline extends from the Malaysian border 740 km northwards to Mayanmar. The Andaman Sea is a non-enclosed sea with deep oceanic waters. It possesses a rich marine ecosystem which is characterized by vast coastal areas of mangrove forest, seagrass beds and coral reefs. These areas are suitable for nursery grounds of various associated fauna. The sea is influenced by semi-diurnal tides of approximately 3 m during spring tide and 1 m during neap tide. Two monsoon seasons prevail in this area. The south-west monsoon lasts from May to October and the north-east monsoon from November to April.

The Andaman Sea is an important coastal area for a variety of human activities, including the marine capture fisheries, aquaculture, tin mining, recreation, transportation and waste disposal. It is one of the most productive areas for marine resources. Marine capture fisheries along the Andaman Sea's 126,000 km^2 shelf fishing area contributes approximately 20% of the total fishery production of the whole country. In weight, this yielded an annual average of 0.4 million metric tons and an annual value of 4,000 million baht during the years 1980-1992. In 1332, marine fishery production reached 654,824 metric tons which was valued at 7,510 million baht.

However, the sustainability of the fishery resources in the Andaman Sea coast is increasingly constrained due to the heavy utilization of resources as well as rapid growth in industrial, urban and tourism development. Therefore, an appropriate management tool for sustainable use of fishery resources and increasing awareness must be taken into consideration. It should help increase local participation to conserve the natural environment.

The marine capture fisheries in Thailand are primarily commercial scale. Small-scale or artisanal fishing methods, however, still prevail in inshore areas or bays and is most notable in the fishing villages along the Andaman Sea coast of Thailand. Small-scale fishing communities are also often classified as 'backward communities' characterized by a low average income. Thus, within the context of massive rural development programmes and the national policy on fisheries, the Department of Fisheries has given high priority to

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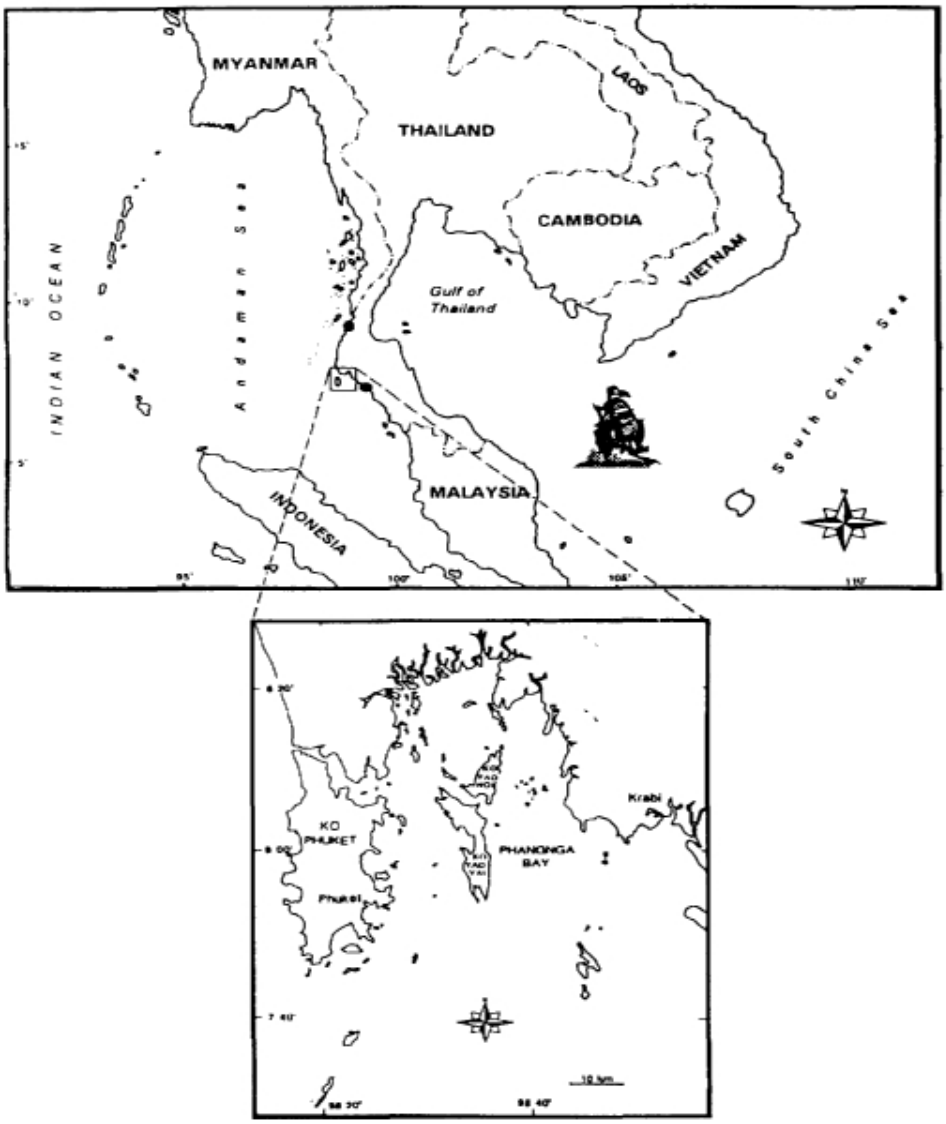

Fig. 1. Andarnan Sea coast and Phang-nga Bay, the upper south of Thailand.

small-scale fishery development and coastal resource management, in order improve the well being of small-scale fishermen throughout the coastal areas.

2. STRUCTURE OF THMARINE FISHERY RESOURCES

The marine fishery resources in the Andaman Sea coast of Thailand can be described according to their habitats into two main groups; pelagic and demersal. Pelagic resources are generally exploited by purse seines, drift gillnets, liftnets and other surrounding nets. There are 17 species and groups of species of pelagic resources that are considered economically important.

The demersal resources include demersal fish, crustaceans, cephalopods and other mollusks and are mainly caught by trawls, push nets, bottom gillnets, traps and hooks and lines. Approximately 30 families comprising more than 300 species have been recorded.

The major fishing grounds of pelagic and demersal resources have been limited to a depth of less than 100 m. The good fishing grounds are generally located in the coastal waters with a water depth range from 10 to 60 m. Therefore, the exploited resources particularly from the trawl catch comprise borh large size of fishery resources and substantial quantities of small-sized fish of no commercial value. The small-sized fish are generally composed of non-edible species and juveniles of young economically important species that are unacceptable in the market. These so-called “trash fish” comprise more than 40% of the total catch.

The marine capture fisheries in Thailand can be broadly divided into two categories; commercial and small-scale fisheries. The commercial fisheries refers to those using inboard powered boats of over 10 gross tonns. They utilize highly efficient fishing gears and have the capacity to fish offshore and spend one or several days offshore during each fishing trip. They utilize fishing ports and usually use ice to preserve their catch. The typical fishing gear employed are medium to large size trawls, purse seines, encircling gillnet and large driftnet.

The small-scale fisheries refers to those using non-powered, outboard powered and inboard powered boat of less than 10 gross tonnes. They use traditional or low efficient fishing gears, operating from fishing villages, rarely spending more than 12 hours at sea. They generally fish in inshore waters within 3 km from shore. They typically employ small trawlers, gillnets, push net, liftnet, set bag net, traps, hooks and lines and other stationary gears operating in estuaries, bays and in nearshore waters.

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2.1 Fishery establishment

The survey from the 1985 Marine Fishery Census (NSO and DOF, 1987) revealed that the total number of fishing villages along the Andaman Sea coast was 720, of which 575 fishing villages are located outside the municipal areas. They are facing many shortcomings because of limitation of facilities and basic infrastructure for their living and fishing occupations. Basic infrastructure lacking in these fishing villages includes transportation, electricity, freshwater and ice supply.

Total fishery establishments were 14,861 in 1985, representing **25.8%** of the whole country and it decreased to 13,960 in 1990 (NSO and DOF, 1992). Of these, 14,368 or 96.7% were engaged exclusively in marine capture fisheries. The number of small-scale fisheries was the largest, contributing 13,523 or 94.1% of total marine fishery establishments. The number of establishments using the fishing boats of 10 gross tonnage and over was only 845.

Besides those mentioned above, there were 493 fishery establishments engaged in coastal aquaculture. It is a known fact that the largest number were those engaged in fish culture in Phang-nga Bay.

2.2 Number of fishermen

The number of fishermen in the Andaman Sea coast in 1990 was 35,488, representing 17 percent of Thailand's total marine fishery population. Ranong had the largest number of fisherfolk, at 7,25 1, while Satun, Trang, Phang-nga, Phuket and Krabi comprised 6,692, 6,410, 5,610 5,006 and 4,519 respectively. The proportion of male fisherfolk was more than 85 percent of the total. It is interesting to note that the proportion of female fisherfolk engaged in coastal fishery and aquaculture was relatively higher in Phang-nga, Ranong and Krabi than in the rest of the country.

2.3 Fishing boats

The total number of fishing boats in the Andaman Sea that had been surveyed from the Marine Fishery Census in 1990 was 14,590 - representing 27.86 percent of the whole country. Outboard powered boats comprised the largest group, with 10,793 or 74 percent. They are found in Satun and Phang-nga, with 2,794 and 2,162 registered boats respectively. Non-powered boats were the second largest group, accounting for 1,944 or 13 percent with the majority found in Phang-nga. Inboard powered boats accounted for 1,853 or 12 percent, and the majority was found in Satun. It is observed that the number of fishing boats increased twofold in comparison with the first census in 1967. The number

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of powered boats had gone up, while non-powered boats had decreased in number. It is clearly seen that the marine capture fishery had been developed from non-powered to powered boats up to the present.

The fishing gear used by outboard and inboard powered boats of less than 10 gross tonnes are mainly shrimp gillnets, crab gillnets and push nets. The fishing gears employed by fishing boats in the range 10-50 gross tonnes were mainly otter board trawls and drift gillnets. Fishing boats of over 50 gross tonnes are employed for operating large trawlers (both otter board and pair trawls) and purse seines.

The number of fishing units categorized by fishing gears registered with the Department of Fisheries is shown in Table 1. It is noted that only inboard powered boats are registered. Among them, trawlers (both otter board and pair trawls) and purse seiners play an important role in the commercial fisheries while gillnets (for shrimps, crabs and others), push nets and squid cast nets are the dominant gears for the small-scale fishery. However, a considerable number of more than 10,000 fishing boats that operated mainly with gillnets, push nets, hooks and lines, traps and others are not registered with the Department of Fisheries. They are non-powered and outboard powered boats.

2.4 Production

The marine fisheries in Thailand has been rapidly developed and expanding due to the use of new fishing gears and technologies, ventures of fishing fleets into new fishing grounds, improvement of fishing vessels, and development of support facilities and infrastructure.

The remarkable developments of the marine fisheries include: (1) the successful introduction of trawl net fishing since 1962; (2) development of the luring purse seine since 1973; (3) development of light luring fishing techniques to catch small pelagic fish and squid since 1978; and (4) development of the coastal tuna purse seine since 1982. These developments resulted in a spectacular increase in both pelagic and demersal resources production. The marine fishery production has exceeded 100,000 metric tons since 1367. In 1991, production reached a peak of 658,000 metric tons and dropped slightly to 655,000 metric tons in the following year.

The production and values of the marine capture fisheries by sub-sector, namely small-scale and commercial fisheries categorized by major fishing gears, are provided in Table 2. It is observed that the small-scale fishery sub-sector comprises on an average about 16.5% of the marine fishery production but is valued at about 26.6% (Table 3). This means that the majority of marine fishery resources available to the small-scale fisheries operating in inshore waters are economically important species.

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Table 1. Number of fishing units registered in the Indian Ocean coast of Thailand, 1980-1992.

Type of Fishing Gear	No. of In-board Powered Boat												
	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980
Otter trawl	1,162	L230	1.425	1,604	769	786	810	860	1,024	947	1,328	736	814
Pairtrawl	215	170	264	248	86	86	24	96	94	86	100	98	138
Beam trawl	–	–	29	5	2	–		–	–		–	–	–
One-boatpurseseine	201	194	200	198	186	170	143	134	106		1	17	12
Chinesepurseseine		24	12	16	16	4	16	17	16	18	13	14	12
Macherelencirclinggillnet	1		1	1	18	4	6	17	78	3	11	1	–
Anchovy purse seine	96	108	130	209	131	70	52	79	102	60	32	19	6
Luringpurseseine	18	23	60	66	71	39	10	18	56	135	139	127	114
Spanishmackereldriftgillnet	62	59	60	66	60	38	32	13	22	30	31	26	24
Push net	184	270	240	641	41	70	85	96	183	*295*	655	333	618
Othergillnets	106	146	119	172	177	123	109	161	46	94	104	240	141
Shrimpgillnet	432	394	390	545	535	653	930	661	394	504	492	530	892
Crabgillnct	88	74	26	60	13	78	68	68	–	8	3	2	3
Other nets	6	9	15	120	76	54	66	97	57	43	35	61	74
Longline	11	14	18	19	27	6	3	11	2	15	1	3	
Squidcastnet	156	121	61	119	69	19	2		15	10			
Pomfretgill net					1			6	9	1		2	

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Table 2. Catch of marine fishery by type of fishing gear and species in the Indian Ocean coast of Thailand, 1980-1992.

TypeofFishingGear	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980
Total	654,824	657.920	406,891	335,570	424,241	424,241	402.253	304,527	318,210	301.993	312,225	238,628	186.211
Large-scale fishery Sub-total	622.146	629,809	407.028	367.942	291.064	358.538	301.239	249,016	279,057	225.637	202,605	183,155	148,292
Otter trawl	404.324	397,994	249,352	230,51	178,257	211.393	209.561	154,094	169,097	148.133	134.452	172.689	139,580
Pair trawl	72.005	60.700	14.790	16,727	17.613	27.083	33,510	29.555	26,076	16.570	10,568	–	–
Purse seine	103,608	153.220	140,533	119.170	93,636	116.868	54,165	53,105	60,439	2,408	1.582	3,399	3.895
Chinese purse seine		–	–	–		–	2,606	11,055	–	590	–	–	–
Anchovy purse seine	36,676	11,849	632	276	223	1.375	134	412	341	194	65	459	657
Spanish mackerel gill net	3,990	2.373	1.721	1,258	1.335	1.695	1,263	795	47	210	687	1.622	575
Mackerel encircling gill net	1,543	3,673	–		–	124	–	–	–	–	–	–	–
Small-scale fishery Sub-total	32,678	28,111	32.027	38,949	44,506	65,703	101,014	55.511	39,153	76,356	109,650	55,437	37,919
Beam trawl	10	–	–	21	–	–		–	23,052	29,208	13,986	4,986	3,591
Push net	3,500	4,695	1.889	2.141	1,600	1.894	4,197	5.345	5,733	6,671	5,916	2.443	2,392
Shrimp gill net	3,226	2.650	2.491	2,722	2.575	2,393	3.03 1	2,544	4,016	2,581	4,004	4,462	4,986
Other gill nets	7.047	8,625	7.977	8,078	7,596	6,507	8,472	6,444	6,952	8.036	6,399	8,280	8.948
Other cast nets	68	41	97	169	249	345	219	296	135	234	390	380	250
Squidlightluring	519	405	237	195	214	236	52	–	–	–	–	–	–
Acetes scoop net	3,205	2,179	2.242	2,959	3.074	2.534	3,261	3,096	2,983	4,854	3,984	2,834	2,775
White board catching shrimp	3	3	7	4	10	36	25	38	34	28	5	40	19
Other nets	760	767	438	266	264	134	361	233	159	658	79	16	28
Other moving gears	20	14	20	36	51	29	18	–		–	–	–	–
Other stationary gears	333	141	88	30	86	34	24	–	5	11	1 2	48	3 1
Long line	859	906	710	432	288	352	659	964	622	587	378	20	116
Hook	1.399	1,533	1,583	1,357	1,665	1,417	926	973	2,076	2,719	2,371	2,987	3,177
Set bag net	2,005	2,665	3,303	3,854	3,695	4,625	4,201	3,759	3,664	3,747	4,925	8,673	9,933
Fish trap	846	572	527	837	1,049	1,195	812	843	900	907	872	750	671
Crab trap	2,242	2,111	1,850	2,066	1,886	1,900	1,508	1,596	1,761	1,147	1,899	1,735	2,387
Squid cast net	—	—	—	—	4	11	—	—	68	453	47	363	406
Others	8,399	180	8,061	13,550	19,901	41.796	73,109	29,380	10,040	43,682	78,389	2,199	1,085
Total (Value in US$ 1,000)	300,384	26343c	146,653	129,410	111,574	112,929	100,731	77,510	96,794	89,178	82,682	74,234	76,880

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Table 3. Fishery production (MT) and value 1980-1992.

Year	Grand Total		Sub total marine fishery		Small-scale Fishery		Large-scale fishery	
	M T	US$ 1000	M T	US$ 1000	M T	US$ 1000	M T	US$ 1000
1980	1,792,948	685.885	1.544,434	467,384	184,637	136,944	1,359,797	330,440
1981	1,989,025	746.24 1	1,756,939	538,512	320.442	171,745	I.436,497	366,767
1982	2,120,133	821.306	1,949,68 1	580.070	471,903	196,832	1,477,778	383,238
1983	2,255,433	834,636	2,055,225	609,514	444.217	178,333	1,61 1,008	431,181
1984	2,134,838	773,982	1,91 1,485	560.394	283,948	149,930	1,627,537	410,464
1985	2,225,204	727,156	1,997,165	517.371	334,316	155,996	I,662,849	361,375
1986	2,536,335	868.406	2,309,480	644,684	381,565	204,480	I,927,9 15	440,204
1987	2,779,07 1	1,071,795	2,540,052	750,566	396,952	181,759	2,143,100	568,807
1988	2,629,754	1,257, 174	2,337,216	768,63 1	365,834	185,583	1,97 1,382	583,048
1989	2,740,037	1,393,00 1	2,370,548	774,187	317,616	198,175	2,052,932	576,012
1990	2,786,370	1,614,497	2,362,2 18	808,830	149,982	178,104	2,2 12,229	630,728
1991	2,967,73 1	2,073,754	2,478,607	1,032,609	306,752	189,573	2,171,855	843,036
1992	3,239,880	2,568,360	2,736,352	1,286,560	372,046	237,566	2,364,306	1,048994

Source : SEAFDEC Fishery Statistical Bulletin, 1982-1 994

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The marine resources caught by the commercial fisheries are divided inro two main groups – demersal and pelagic resources. Demersal resources arc mainly caught by various sizes of otter board and pair trawls, beam trawls, long lines, large push nets, large traps and bottom gillnets. Otter board trawls are the most important gear. More than 300 species of demersal fish have been caught and commercially utilized. More than 40% is trash fish, comprised of non-edible species, edible species of low commercial value and juveniles of commercially important species. The commercial demersal catch in the Andaman Sea coast reached the first peak of 216,000 metric tons in 1973 and has since declined in spite of a substantial increase in the number of trawlers. The catch started increasing again after 1985, when it yielded 174,161 metric tons. In 1992, the catch reached a second peak of 442,285 metric tons (Table 4). It is believed that substantial quantities of demersal resources have been taken from outside Thai waters.

Pelagic resources are mainly exploited by using various types of purse seine nets, drift gillnets, encircling gillnets, lift nets and other surrounding nets. They car; be divided into three groups according to size of pelagic fish *(i.e.,* small, medium and large). Although the pelagic fishery in the Andnman Sea has historically been less intensively developed than in other fishing areas of Thailand, with a gradual mechanization of fishing gear, vessel improvement, and migration of fishermen from the Gulf of Thailand to the Andaman Sea, there has been an increase in pelagic fish production from the Andaman Sea. As shown in Table 3, the catch of mackerels, sardines, round scads, anchovies and neritic tunas have increased considerably after 1385, and the total pelagic catch has subsequently exceeded the level of 100,000 metric tons each year since 1787. The catch peaked at 166,628 metric tons in 1331.

Marine fishery resources caught by the small-scale fishery sector fall into two basic groups; fish and invertebrates. Invertebrates, including shrimps, blue swimming crabs and cephalopods are particularly valuable components of the small-scale fisheries. As for marine fish caught by small-scale fishing gear, they include many species of demersal and small pelagic fish and trash fish. It is noted that rhe percentage of trash fish in the small-scale catch is not as high as in the commercial fishery catch.

3. STATUS OF MARINE FISHERY RESOURCES

The distinct and remarkable development of the marine capture fisheries in Thai waters has resulted not only in the increase of fishery production but also in the decline of resources, particularly in the coastal areas. The drastic reduction of catch rates were surveyed by the DOF research vessel (R.V. Pramong 3). Results of the survey demonstrated the occurrence of overfishing of demersal resources, as described below.

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Table 4. Production (metric tons) by species of marine fisheries resources in Andaman Sea coast of Thailand, 1985-1992.

Species	1985	1986	1987	1988	1989	1990	1991	1992
Total	3 12.568	403,500	426,987	335.570	406,89 l	439.055	657.920	654,824
Sub total fish	243.380	29 1,567	348,578	283.76 1	354,14 1	394.117	588,037	583.176
Sub total pelagic fish	69,219	59,428	104,123	95.450	118,308	136,946	166.628	140,891
Indo Pacific mackerel	13,757	13,868	15,143	12,122	17,570	25.258	38,82 l	32,953
Indian mackerel	1,163	965	2265	5,587	7,127	10.117	14,709	8,547
Sardines	27,545	26,657	41,655	32,69 l	29,504	28265	25,27 1	20.893
Round scad	8,025	2.464	14,298	17,747	22,330	22359	23,982	8,434
Anchovies	413	136	1.413	251	484	782	12.007	36,596
Long tail tuna	2.41 I	1,895	2,034	1297	I.529	1.039	5,620	2,168
Eastern little tuna	3.237	1,497	4,223 l	3,581	3,175	5,844	8,636	9,740
Trevallies	2,657	3,884	9,850	4,453	11,722	13,113	7,550	3,197
King mackerel	l ,95 l	2,303	2,392	1,939	2,503	2,967	2,848	3.912
Hardtail scad	3.196	1,738	4,668	4,872	8,428	8,799	l l ,026	4.517
Bigeye scad	1.244	881	2.982	6,95 1	9,345	11,614	6,857	3,690
Sub total demersal fish	174,161	232,139	244,455	188,307	235,833	257.171	42 l ,409	442,285
Sub total demersal food fish	21,314	27,093	23,609	20,682	24,381	34,452	66,540	63,928
Sub total miscellaneous fish	I 1,953	13,958	15,284	12.991	16,670	19,280	33,392	37,176
Sub total trash fish	140,894	191,088	205,562	154,634	194,782	203,439	32 1,477	341,181
Sub total shrimps	14,661	16,756	15,710	14,263	14,752	13.617	25.530	20,476
Squids	4,919	6,052	7,094	6242	7,108	6.762	12.816	13,565
Cuttle fish	7,036	6,503	4,967	3,961	7,846	6,515	14,952	16.960
octopus	303	1,028	431	476	l ,429	2,704	6,353	5,897
Swimming crab	3,528	6,312	5,307	4,970	5,492	4.366	4,878	4,470
Short necked clam	995	4,802	2,152	8,228	3,411	1.254	130	4,136

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In 1966, DOF conducted a monitoring survey in Phnng-nga Bay and adjacent areas using the research vessel R.V. Pramong 3. The catch per unit effort (CPUE) of demersal resources was 238.9 kg/hr. It decreased to 105.3 kg/hr in 1771, to 64.6 kg/hr in 1778 and to a rather consistent average of 37.5 kg/hr during 1987-1988. It is now undoubtedly recognized that the demersal resources had been fully exploited since 1371 when the catch rate declined to half of the original abundance.

Attempts have been made to assess the state of demersal resource stock. It was found that the maximum sustainable yield (MSY) in coastal areas with depths ranging from 1 0-70 m was 154,000-224,000 metric tons (Isarankurn, 1971; Marr, et. *al.,* 1976; Bhatia and Chullasorn, 1980; Bhatia. et. al., 1983). Hayase (1983) estimated the demersal trawlable stock (biomass) to be about 500,000 metric tons. It is clearly observed that the catch has passed this level since 1986.

The pelagic fishery in the Andaman Sea coast has been intensively developed since 1983. Mackerels, sardines, round scad and coastal tuna have been exploited in substantial quantities to supply the demand of canneries. This is the major factor for the yearly increase in production. It seems that most of the pelagic resources in this area are still not fully exploited. An increase in pelagic fish production may be possible (Bhatia, et. al., 1973; Bhatia and Chullasorn, 1980). However, it is recognized that the catch of sardines and round scads in the latter period did not continue increasing, and may show some signs of having been fully exploited since 1383. Therefore, an increase in fishing effort of these species has to he carefully taken into consideration.

Taking into account the production of fishery resources from the small-scale fishery, a remarkable decrease has occurred since 1986. It is realized that the marine resources exploited by small-scale fishing gears operating in inshore areas using a wery small mesh size net may he in a degraded stage. Therefore, exploitation of nearshore resources should be subjected to conservation principles and management schemes.

4. FISHERY RESOURCES MANAGEMENT

It is anticipated that the decline of marine fishery production and particularly of demersal and nearshore resources, would continue in the future, and that it would cause significant damage to the economy of the country if adequate counter measures for resource conservation and utilization are not implemented.

In order to conserve the marine fishery resources for sustainable utilization, the Department of Fisheries has set up various management measures through the Fishery Act of 1901, The Fisheries Act was subsequently revised in 1947 and is undergoing some

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revision at the present. Many Ministerial Notifications for management and conservation of marine fishery resources have been periodically issued and implemented. These include determination of the size and kinds of fishing implements that are permitted in the fishery; prohibition of the use of certain types of fishing methodology in certain areas, establishment of reserved areas; establishment of a closed spawning and nursery season in certain marine areas which would prohibit the use of certain types of fishing gear during the said season and within the areas; mesh size regulation; limiting of new entry by discontinuing additional trawl licenses; among other possible measures and regulations.

However, such regulations, particularly the restriction of fishing gear and provision of closed areas and seasons, have not been fully enforced. Small-scale fishermen still operate illegal fishing gears, evading the regulation, and complete enforcement of the regulation is difficult.

Taking this problem into account, it is recommended that improvement in fisheries management is urgently needed. Many options are proposed, including but not limited to fishing license and vessel limitation, mesh size regulation for all types of trawlers and push nets, zoning systems for certain size of fishing vessels and fishing methodologies, and installation of artificial reefs for resource conservation.

At present, a *new* concept of fisheries resource management has been introduced – "community-based resource management" which will be carried out in cooperation with local fishery officers. Initiatives in community-based resource management have been established which include self enforcement and protection of fishery resources and the establishment of co-operatives for sharing profit and responsibilities. Phang-nga Bay is the site of the DOF pilot project in community-based resource management and is being implemented in co-operation with BOBP. Public campaigns on community awareness in marine resources and environment conservation through education programmes for the public, as well as direct communication with fishermen, are also steps to be taken by this project.

5. REFERENCES

Bhatia, U., and S. Chullasorn. 1980. Coastal fisheries on the west coast of Thailand. A paper presented at the Consultation on the stock assessment in small-scale fisheries. Chittagong, 16-21 June 1980. 46p.

Bhatia, U., B. Wongchitsue and T. Chantawong. 1983. The status of marine fisheries resources along the west coast of Thailand. Phuket Marine Fisheries Station, Department of Fisheries, Thailand. 23p.

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Hayase, S. 1983. Preliminary assessment of the demersal stocks along the Indian Ocean coast of Thailand. SEAFDEC Technical Paper No. 18, February 1983,20p.

Isarankura, A.P 1971. Assessment of stocks of demersal fish off the west coasts of Thailand and Malaysia. Indian Ocean Fish. Comm., FAO, Rome, IOFC/DEV/71/20,20p.

Marr, J.C. 1976. Fishery and resource management in Southeast Asia. RFF/PISFA Paper 7, Washington, D.C., USA. 62p.

NSO and DOE 1987. The 1985 Marine Fishery Census of Thailand. National Statistical Office, Office of the Prime Minister.

NSO and DOE 1992. The 1990 Report of Intercensal Survey of Marine Fishery of Thailand. National Statistical Office, Office of the Prime Minister.

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ENVIRONMENTAL FACTORS INFLUENCING THE HEALTH AND PRODUCTIVITY OF PHANG-NGA BAY

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ABSTRACT

The Andaman Sea of Thailand borders the west coast ofsouthern Thailand. The Sea venues runoffand offishore upwelling supporting rich fisheries habitats. The richness is further enhanced by environmental regimes both in the northern and southern Andaman Sea. Phang-nga Bay is a rich ecosystem, located in between these regimes of the Andaman Sea. The Bay is one of Southeast Asias most valuable assets, characterized by its extensive estuarine ecosystem and dense mangrove forests. It is blessed with a pleasant tropical climate and high rainfall. The rainfall enriches the Bay's nutrients tbatsupport extensive aquaculture and a wide diversity of marine life, The high potential for economic benefits from these resources has led to hea y exploitation andstresses on the Bay's ecosystem.

This paper reviews the status of Phang-nga Bay's environmental resources and ecosystem processes that help determine its health andproductivity. These include beddepositedsediment, distribution of grain size andsortingin relation to its coexisting trace element and $CaCO_3$ as well as mangrove progradation. Water quality characteristics and their seasonal variations are highlighted together with the application of a two-dimensional, vertically averaged tidal circulation-dispersion model. The mode/simulation showed residual tidal eddies in relation to wind-driven circulation vis-a-vis seasonal change. The residence time of both seawater and runoff water in the Bay were estimated to gain insight into the accumulation anddilution of *wasteloads in the Bay.*

1. INTRODUCTION

The Andaman Sea of Thailand has a coastline of about 700 km (Fig. I), covering a coastal area of approximately 100,000 square km. The sea constitutes a narrow sea shelf, about 108 km wide in the north (Ranong Province), narrowing down to 27 km in the middle (Phuket Province) and widens again to about 130 km in the south (Satun Province). The water characteristics have been summarized by Limpsaichol, et al. (1987). The northern Andaman Sea, from Ranong to Phuket Province, is influenced by an upwelling process that brings in high saline waters. Consequently, salinity of the northern Sea ranges between 32.9-33.4 ppt. The southern Andaman Sea, from Phuket to Satun Province, also experiences strong offshore upwelling (Khokiattiwong and Limpsaichol, 1996), but is mainly influenced

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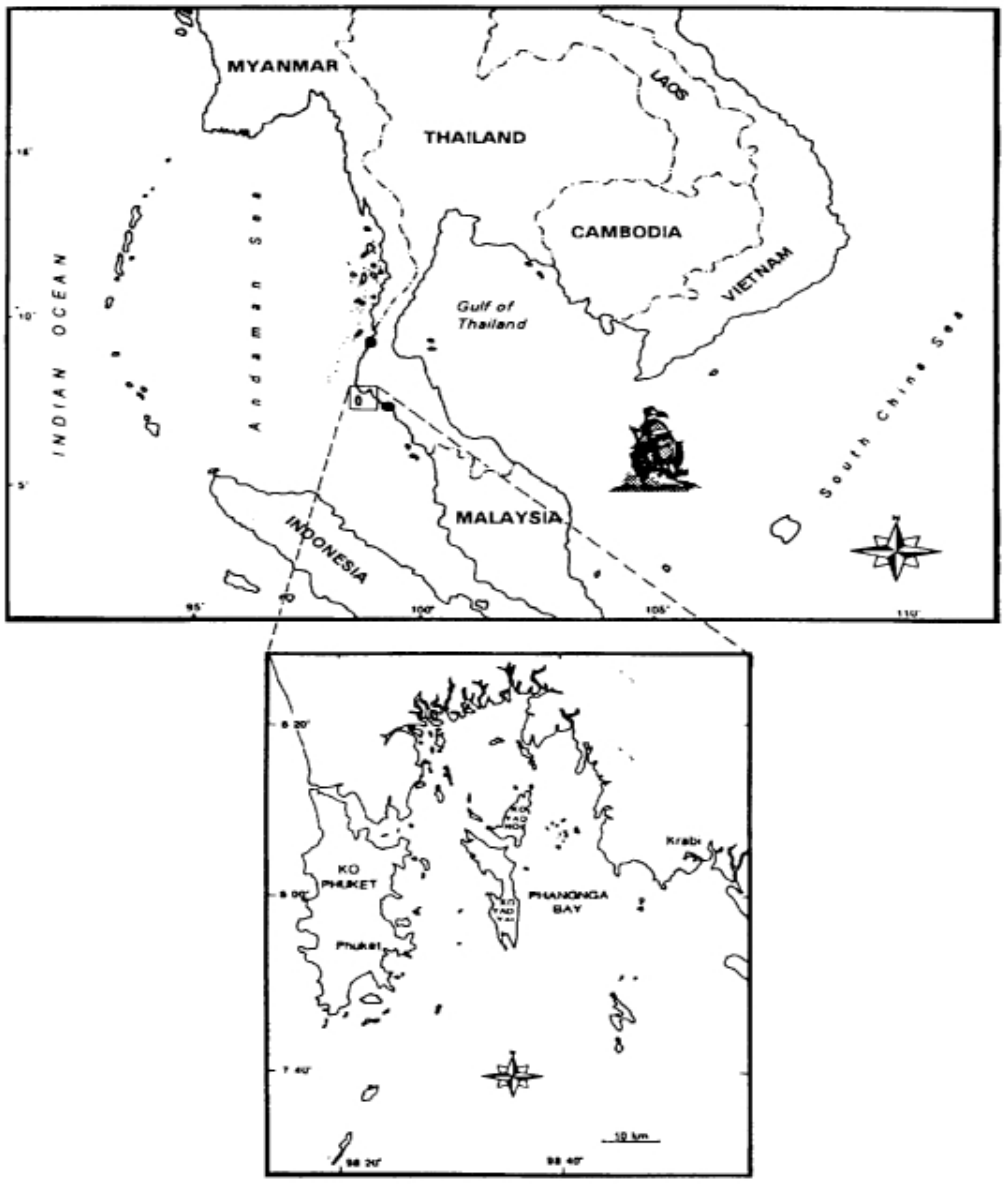

Fig. 1. Andarnan Sea coast and Phang-nga Bay, the upper south of Thailand.

by surface runoff water and water from the Malacca Straits. Consequently, relatively lower salinity of 32.6-32.8 ppt can be found in the southern Sea. The dissolved oxygen, pH and temperature values are fairly uniform along the coast.

The coastlines of Southeast Asia are among the richest in the world in terms of both renewable and non-renewable resources. Phang-nga Bay is not an exception, and is an economically important resource of Thailand. This is one reason it has been chosen as the site for the Department of Fisheries/FAO Bay of Bengal Programme (BOBP) Community-based Fisheries Management (CBFM) project. In previous phases, BOBP initiated a Socio-Economic Development Programme in the area. The current follow up programme on coastal zone management and CBFM builds on other programmes in the area undertaken by local and regional organizations, including the ASEAN/US Coastal Management Project coordinated by ICLARM.

The Bay has a triangular shape covering an area of about 3000 square km, situated at latitude 7" 30' N- 8" 30' N and longitude 98°15°E - 99°15° E.

The Bay is located on the west coast of southern Thailand and is 68 km long, from head to mouth. It is 82 km wide at the mouth in the south which is open to the Andaman Sea. In the northwest, it includes Pak Pra Inlet that separates Phuket Island from the mainland (Fig. 1). Nearshore areas in the north have a water depth generally less than 5 m and cover an area of approximately 700 square km. The northern shores are covered by a fringing mangrove forest with an area approximately 1,900 square km (Aksornkeoa, 1988). Estuarine conditions dominate in the north while marine conditions dominate in the south.

The Bay is under the influence of two tropical monsoonal systems; the northeast monsoon (NE) and southwest monsoon (SW). The NE monsoon is active during November to April, bringing dry weather which originates from the northern continental pressure system. The SW monsoon prevails during May-October and generates wet humid weather and storms which originate from monsoonal regimes in the Indian Ocean. An average annual rainfall of about 290 mm and over 2000 mm characterized the NE and SW monsoon respectively. The hydrodynamics of the Bay is mainly governed by semidiurnal tides with spring tides of up to 2.45 m. and neap tides of about 0.87 m (Khokiattiwong, et al., 1991).

Several environmental factors make Phang-nga Bay a good nursery ground. These include: (1) a great number of islands which provide a variety of coastal habitats used by both juveniles and adults of important marine and estuarine species; (2) nutrient-rich water outflows from the mangrove areas; and (3) favorable hydrodynamic regimes.

The Bay also provides excellent tourism activities that help to generate revenue for the local government and public sectors. Previously, tin mining was the top revenue earner,

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but has declined over the past few decades due to the collapse of the world tin market. Most recently, the coastal Bay has faced a new threat; the rapid expansion of shrimp farms has increased the pond effluent or wasteloads entering the Bay. Industrialization, urbanization and upland activities have worsened the situation. Several rivers are contaminated with sewage discharge organic waste, mine tailings and agricultural runoff. However, the Bay's hydrodynamic regime is like a natural cleansing process that has helped to delay environmental deterioration of the Bay's resources.

2. OBJECTIVES

The purpose of this paper is to review various research activities related to fisheries habitats and environmental status of the Andaman Sea and Phang-nga Bay and integrate the results into a more comprehensive view of the environments that support the rich ecosystem of the Bay. The paper will highlight the factors of the Bay ecosystem, including characteristics of bed sediments, water quality and pollution vis-a-vis seasonal dynamic regimes as well as residence times of runoff water and sea water in the Bay.

3. FINDINGS OF VARIOUS INVESTIGATIONS AND DISCUSSIONS

The Andaman Sea of Thailand has been recognized for its high fisheries and economical potential. The Sea composes the northern and southern Andaman Seas - each having different water characteristics (Limpsaichol and Khokiattiwong, 1991).

In the northern Andaman Sea, the offshore area of Ban Kampuan accommodates a major fishery habitat where the southward flow of mangral runoff from the upper north emerges with the shoreward flow of fertile offshore upwelling water. Shelter from predators is provided by the many islands in the northern Sea. High biological productivity characterizes the northern Sea (Limpsaichol, et al. 1994). Such a highly productive habitat supports a rich dwelling of migratory species. Such a richness of sea life was further enhanced when the Department of Fisheries deployed a large number of artificial reefs in 1983. This fishery habitat enhancement method has mostly benefited the bio-economics of the small-scale fisheries of the northern Andaman Sea region (Yodee, 1994).

In the southern Andaman Sea, regimes of tidal currents are an influencing factor on fishery habitats. The southward flow of water from Lanta Island meets the northward flow from Tarutao Island and leads to a zone of low water movement around Liang Island. These waters emerge into the shoreward flow of subsurface water, creating numerous eddies. It was found that this area is highly productive and fertile.

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The water patterns coincide with a productive mollusk bed of economically important species existing within this area. The area is a spawning and nursery ground for snails; *Chicoreus ramosus* (Khokiattiwong, 1332). This zone is also related to the abundance of chub-mackerel *(Rastrellinger* spp.) and supports their spawning and nursery grounds (Sutthakorn and Snranakomkut, 1386). Furthermore, the nearshore areas support mangrove and seagrass beds, and coral reefs are located around offshore islands within the Bay. Tuna fishing dominates in the offshore areas.

The status of Phang-nga Bay's important environmental features that support the fisheries production is discussed below.

3.1 Bed Sediment Characteristics of Phang-nga Bay

The Bay ties in a rich tin-bearing granite plane that intrudes folded sedimentary rocks along the length of upper Malay Peninsula. These extensive sedimentary limestone rocks form steep hillsides and ridges which influence the topography of the Bay. Lowland areas along the coast and the central basin of the Bay arc composed of alluvial deposits which contain economically important minerals such as tin, rare-earth minerals and quartz. Marine sediments are composed of mud, silt, sand and gravel.

Geological investigations in Phang-nga Bay were conducted by Garson, *et al. (1 975)* and reported that the bed sediment of Phang-nga Bay consists of a considerable thickness of arenaceous sediments. Post-Triassic marine bivalves were found in a thin bed of limestone adjacent to arenaceous beds. The sandstone outcrops have always been confined to Phang-nga, and conglomerate sandstone was found in the mangrove areas of the inner Bay.

3.2 Coastal Deposits

The eroded surface of sedimentary rock is overlain by alluvium which comprises poorly-consolidated and considerable thick mud. Sand and gravel beach deposits around the Bay were less extensive and restricted generally to small Bayhead deposits. The typical sediment was a dark gray mud or silt.

The coast of Ko Boi Yai is comprised of a bed of highly impure limestone about 5 m thick, containing abundant fragments of oysters and thick-shelled modioliform bivalves, overlain by massive calcareous sandstone. In the inner Bay (mangrove areas), the sandstone sediments are overlain unconformably by 1.5 m of steeply dipping calcareous sandstone, followed by 4 m of black shale with thin bands of bituminous shale.

The extent of mangral swamp and creeks are related to the rise in sea level during the geologic evolution of the area, approximately one million years ago. This elevation in base level had resulted in a reduction in the power of rivers to rework material already

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deposited and thus accounted for the extent of river gravel and alluvium which were overlain by estuarine muds. The alluvial deposit included a wide range of unconsolidated river-deposited sediment, ranging from coarse boulders and gravel to fine silt and clay.

Trace minerals including arsenopyrite (Fe, As) and scorodite (Fe, As, AsO4.2H2O) were commonly minor constituents of granitic areas. A Pb content of 830 ppm was observed in hornfels, and 0-10 ppm Cu in drainage samples with higher values (10-20 ppm) in granitic mass and adamellitic rock. However, drainage samples that derived from the coarse-grained biotite-granites contained Cu 20-160 ppm. Relatively lower values of 10-60 ppm Cu and 0-10 ppm were observed in the fine to medium-grained biotite-granites.

In sedimentary areas, values of O-20 ppm Cu were reported on Ko Yao and in similar Mesozoic sandstone in Krabi. Values of more than 30 ppm Cu were recorded on the Ko Tang Li granitic areas. Only 5 ppm Cu was found in Ko Yao sandstone. Zn values in granitic areas were less than 80 ppm while they ranged from 10-130 ppm in the drainage samples.

The trace metal concentrations in the sediments showed large variations because of complexation with varying organic fractions. However, the organogenic process in the sediment plays an important role on the quantity of sorbent as does the solubility of the sorbable element.

Various studies have observed the ratio between heavy metal (mg) and organic compound (kg). Findings revealed that the ratio was fairly constant in the Bay sediment and reflected normal background levels. The contents of sorbents and sorbable substances were linearly related and sorbable substances could be significantly disturbed and deviated in case of pollution (Edgren, 1977). Studies of sorption relations of trace metals in the Bay (Khokiattiwong, et al., 1989) led to valuable interpretation of the potential pollution problem.

Trace metals were at a level expected from data on the geochemical composition of the sediments. The level of Cu, Zn in samples of drainage and fine grained biotite-granite were 0-10, 10-130 and 0-10 mg kg^{-1} dry wt sediment respectively (Garson, *et al.,* 1975). It was noted that higher metal fractions were recorded in the deeper bedrock of main granite mass (adamelitic rock) in the Bay.

A more recent study conducted by Carr, et al. (1991) described the nature, grain size and calcium carbonate distribution of surface sediment in the Bay. Late holocene sediment accumulation and mangrove progradation rate were also estimated. Two major findings were clearly delineated:

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1. Distribution of $CaCO_3$ in surface sediment.

Most of the $CaCO_3$ contribution of the surface sediment originated from whole and fragmented skeletal remains of bivalves, gastropods and other $CaCO_3$ containing shell fragments (Fig. 2). However $CaCO_3$ tended to increase from the inner Bay to the seaward areas. Local variation in $CaCO_3$ was also noted in the inner Bay (<10%->30% $CaCO_3$) hw il e an elevated content of more than 30% of CaCO3 was concentrated in the outer Bay, particularly around beach and reef environments.

2. Grain size characteristics of surface sediment.

The inner Bay is dominated by coarse quartz silts (4-6 phi) while the central and outer Bay are dominated by fine quartz sand (2-4 ph') and coarse quartz sand (2 to -2 phi). The grain size distribution tends to increase from the inner Bay seawards, similar to that of the $CaCO_3$ distribution (Fig.3).

Around the inner Bay, relatively coarser sediment of quartz and occasional feldspar grains were found in channels within the mangrove swamps. It was found that coarse sediments on the northern tip of Ko Yao Noi and other patches of coarse sediments coincided with areas of high $CaCO_3$ (Fig. 3). In th e seaward area, coarse sediments (0 to-2 phi) were related to strong currents.

Poor sorting of sediment occurred in the inner Bay and was rather more complicated than the outer Bay (Fig. 4). However, patches of poorly sorted sediment (> 2.5 phi standard deviation) coincide with areas of coarse sediment and were related to high $CaCO_3$. Nevertheless, in the mangrove channels, coarse grain size and poor sorting did not relate to high

Relationships among mean grain size, srandard deviation and deposition environments, like intertidal zones, mangrove channels and mangrove swamps, were also studied. Results are shown in Fig. 5.

The intertidal sediments ranged from muds typical of sediments found in mangrove swamp environments with fine grain size and generally good sorting, to poorly sorted sand, typical of sediments found in mangrove channel environments (Fig. 5).

The outer Bay sediments are composed of fine and medium sand (0-4 phi) with relatively small variation. Shallow marine sediments can be clustered into two groups, one of coarse poorly sorted sand and the other of better sorted fine sand similar to that of mangrove swamp sediments.

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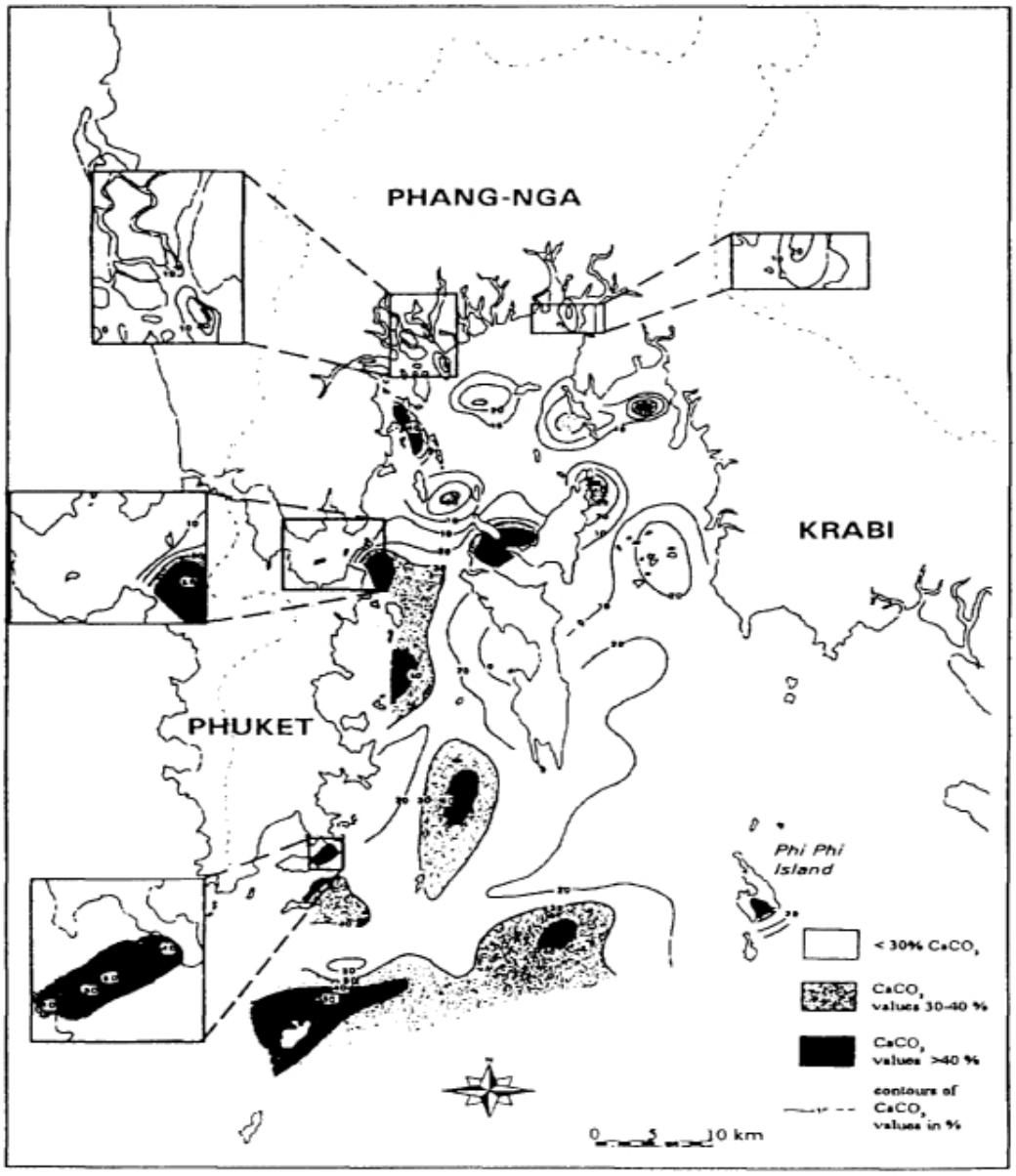

Fig. 2. Distribution of calcium carbonate percent values (after Carr. et. al., 1991).

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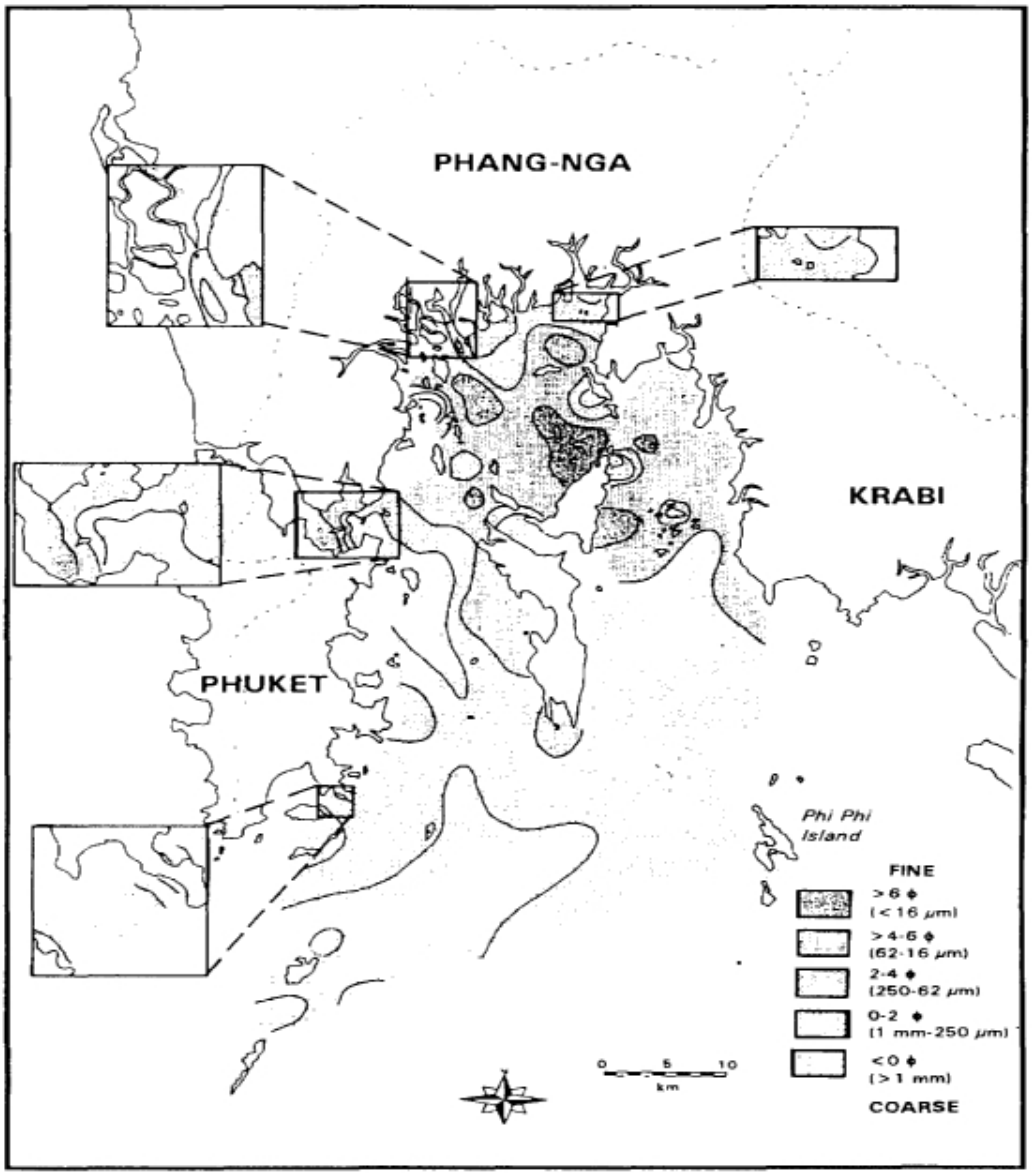

Fig. *3.* Distribution of mean grain size values in phi (ø) units (after Carr. *etal,,* 1991).

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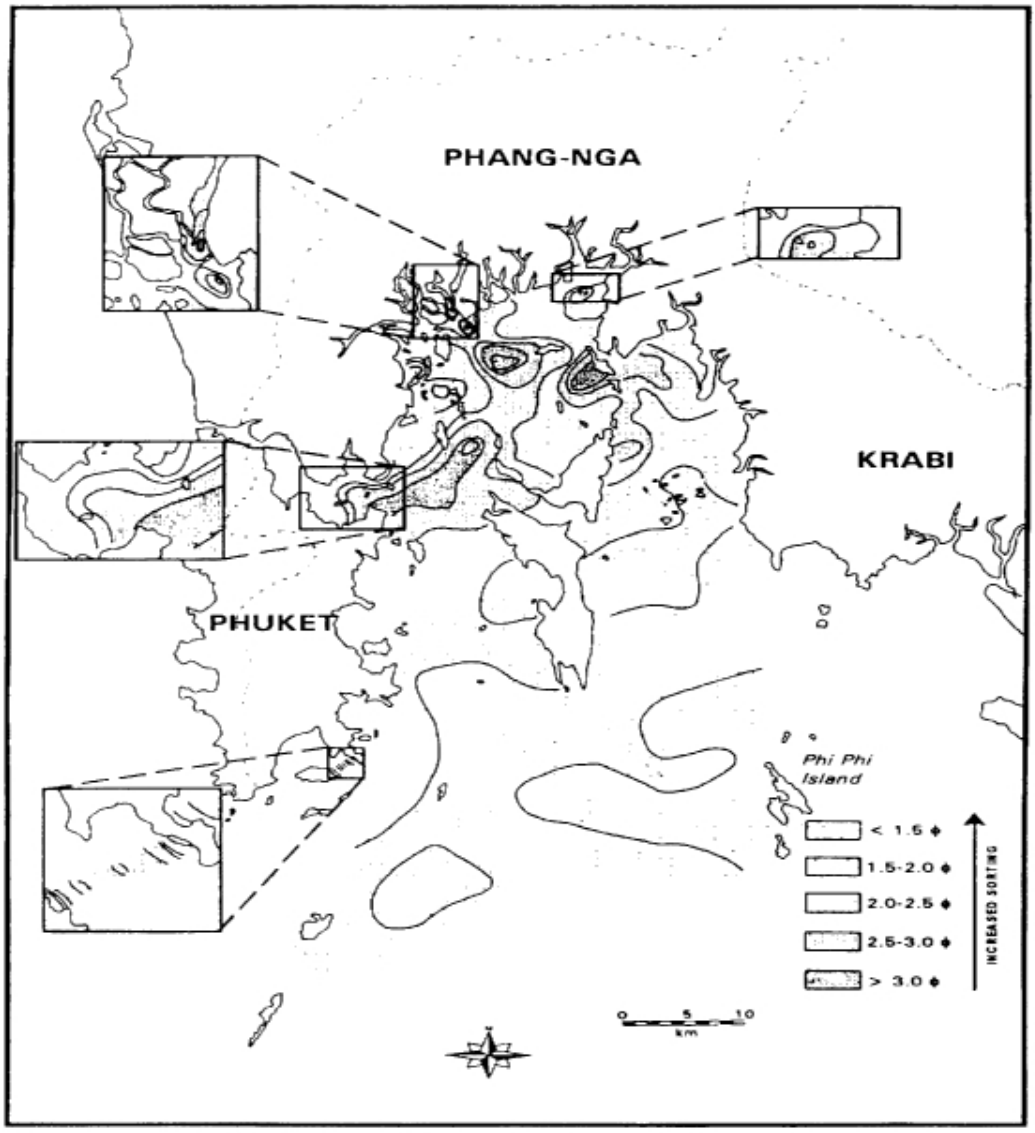

Fig. 4. Distribution of standard deviation (sorting) values in phi(ø) unit (after *Carr, et al.,* 1991).

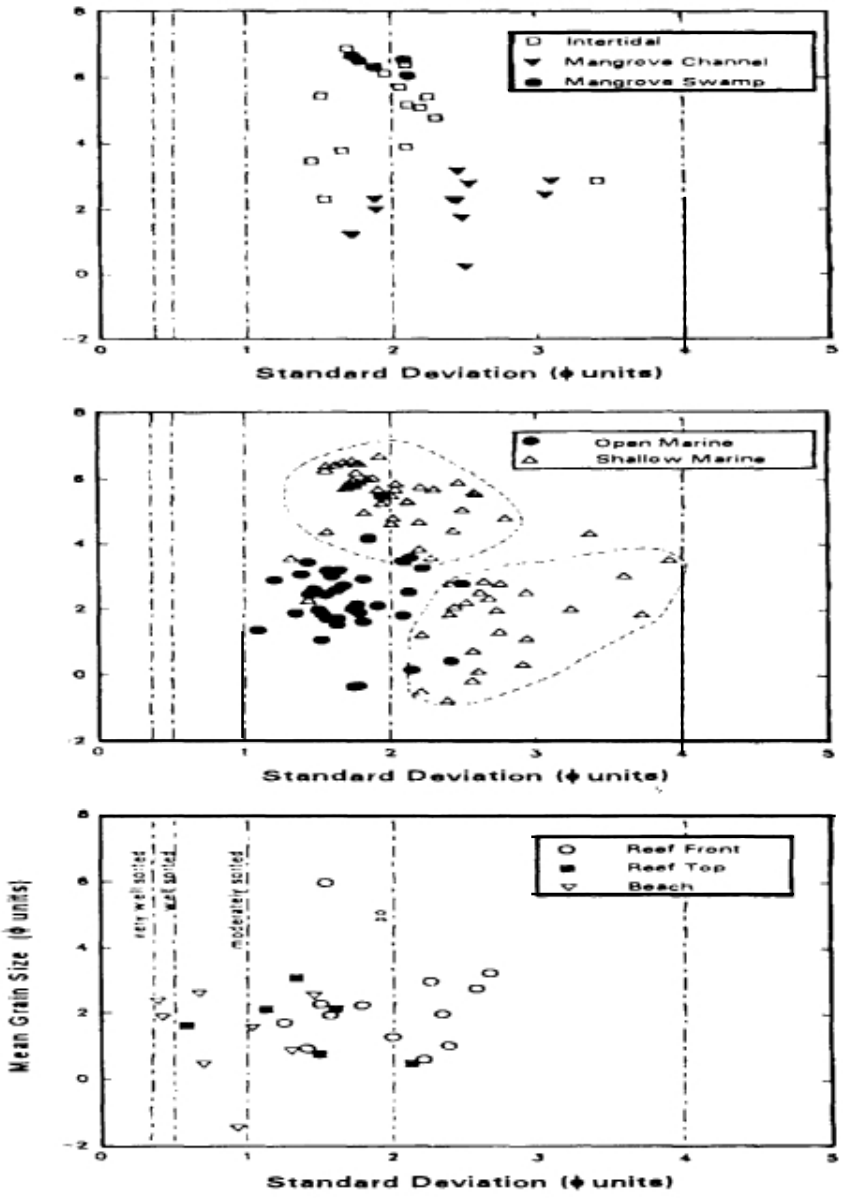

Fig. 5. Graphs of mean **grain** size versus standard deviation for individual depositional environments (after Carr, *etal.,* 1991).

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The beach, reef top and reef front sediments were also studied and showed that they were generally coarse grain by nature. However, comparatively, the best sorted sediments were in the beaches, and the reef top sediments were better sorted than the reef front sediments.

3.3 Accumulation and Progradation Rate of Sediments

In the inner Bay mangrove area, radiocarbon dating was performed on the vertical sediment accumulation and progradation of mangrove swamp. The method observed the bathymetry of sea bed (i.e., present mangrove) and associated vertical sediment accumulation rates. Mangrove progradation was then estimated to be about **1.5** $m.year^{-1}$ (Fig. 6). A second method used in the study applied the Holocene transgression rate during the past **6000** years up to the present sea level. The progradation was estimated similarly at 1.67 m year-'.

Results indicated that the Phang-nga Bay mangrove areas would prograde at a distance of 3 km into the Gay every 2000 years (Fig. 6).

The organic content in the top sediment was subjected to monsoonal influences while the values of the lower sediment were uniform, regardless of monsoons. Organic compounds were deposited by runoff and tidal flow which were believed to be of mangral origin (Rusnak, 1967). Intensive deposition occurred on the west coast during the counter clockwise circulation of northeast monsoon and visa-versa on the east coast during the southwest monsoon.

Schlegel (1987) reported that undissociated H_2S concentrations below 50 mg. l^{-1} corresponds to 2% of free H_2S which is toxic to many aerobic organisms. (Toxicity occurs when H_2S inhibits the normal organogenic process in the breakdown of organic materials.) During the northeast monsoon, free H_2S was noted and a strong smell was observed in newly taken sediment cores. However, the sulfide toxicity reduced when pH level increases to 7.5-8.0 (Kroiss and Plahl-wabnegg, 1988). This indicated that the subsurface water of the Bay was not subject to sulfide toxicity of the sediments.

Adverse effects of H_2S on mussel beds have been observed in Limfjorden, Denmark (Jorgensen, 1980). Jorgensen reported that the anoxic bottom water first appeared in the large and dense mussel beds. Oxygen depletion increased relative to the size of the mussel beds. Bacterial metabolism was then stimulated in the upper few cm and as a result, hydrogen sulfide accumulated in the surrounding sediment.

In relation to anoxic sediments, some benthic infauna which were most markedly seen (such as the deep burrowing polychaete N. virens and C. volutator) bring oxic water

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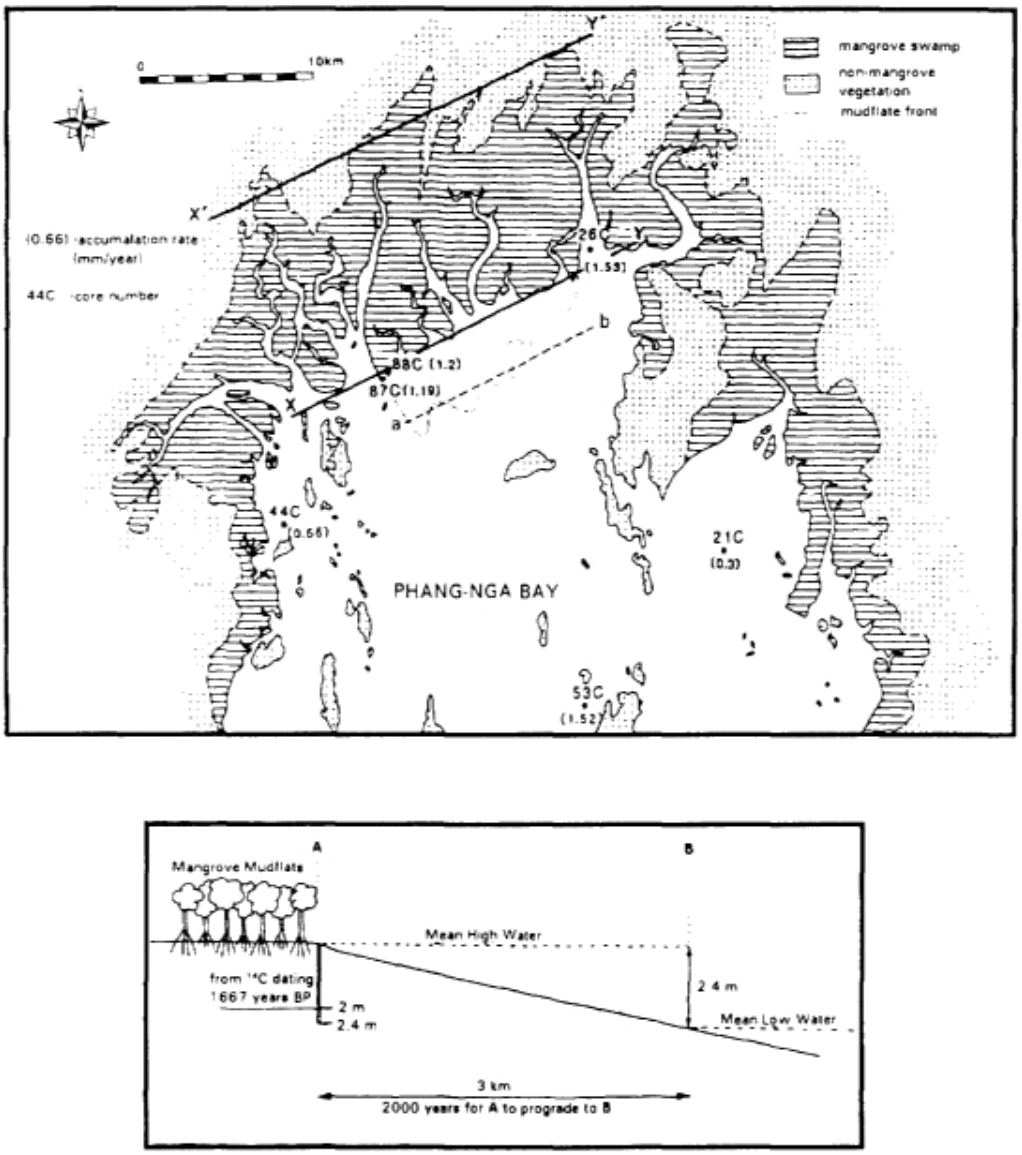

Fig. 6. Location of cores in northern Phang—nga Bay for which radio carbon dates and hence accumulation rates are available. X—Y : present day coastline. X^1—Y^1 postulated coastline 6000 ya. a—h: average position of exposed mufflate extent (above). Model for calculating future progradation of mangrove coastline (after Carr,eta/., 1991) (below).

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into the anoxic sediments and removed toxic products from the sediments (Henriksen, et *al., 1980).* They further showed that benthic infauna and microalgae were factors regulating the exchange of waste products at the sediment-water interface in coastal marine sediments.

3.4 Water Quality Characteristics

An investigation of the coastal environment of Phang-nga Bay was undertaken by Limpsaichol and Bussarawit (1991). They discovered that water quality characteristics showed different regimes in three areas of the Bay: the east coast, the west coast and the inner Bay area (Table l-2).

Table 1 presents the hydrological conditions observed during the northeast and southwest monsoons. Typical salinity variations along the upstream and offshore stretch are shown in Fig. 2. The high variation in coastal water quality characteristics is largely due to meteorological influences. These natural influences, coupled with suspended solids from mining discharges and other pollutants, added stress to the Bay's ecosystem. Siripong, et al. (1 98 1) used remote sensing (LANDSAT MSS data) to investigate the suspended sediment distribution in the inner Bay and the relationship between suspended solids and tidal currents at some outer Bay stations. These MSS data showed that the monsoons induced runoff and circulation in the Bay (Siripong, et *al., 1987).*

The concentration of total suspended solids (TSS) was considered as one of the most significant influencing factors of the Bay. The Bay has a high content of TSS because of its capability of settling and resuspending in accordance with the tidal regimes. The TSS in the 3 areas of the Bay are summarized below.

Total suspended solid (TSS) concentrations were identical (12.8±3.2 ppm) on both coasts while the inner Bay value was higher (18.1±5.0 ppm). The pH values in the inner Bay water, affected by runoff, were lower (pH 8.23±0.09) compared to those (pH 8.35r0.10) on both coasts (Table 1).

The overall Bay-wide averages of salinity, temperature, dissolved oxygen (DO) and total alkalinity were 32.0±0.8 ppt, 28.6±0.4° C, 6.5±0.5 ppm and 134.0±32.0 ppm $CaCO_3$ respectively. Occasionally, identical values of the same parameter were found in rhe three areas. However, the salinity in the inner Bay was generally lower.

Nearshore DO slightly exceeded that of the offshore water (6.3kO.05 ppm), which may indicate a higher primary productivity. In general, the DO of the outer sites of both coasts was that typicial of open sea water (Limpsaichol and Bussarawit, 1991).

Notably, the TSS patterns were closely related to water circulation in the Bay. During the northeast monsoon, the relatively high TSS (14.0±2.0 ppm) of the inner Bay

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water was probably attributed to being transported, partially settling off and being diluted along the counter-clockwise path to the west coast, while a relatively low TSS (10.1±1.3 ppm) was observed along the east coast, where the partial mixing of runoff and seawater occurred.

Similar patterns of TSS were observed in the southwest monsoon. The magnitude was higher due to strong winds, a clockwise circulation and the strong flow of the subsurface water's counter flow. Thus, a very high value of TSS (96.8±13.2 ppm) was recorded in the inner Bay with an intermediate value of *10.8±2.0.* A comparatively low value *(20.8±2.2* ppm) was observed in the west where the partial mixing occurred. The TSS in the inner Bay varied greatly from 615.0 ppm during the southwest monsoon to 41 ppm during the northeast monsoon (Table 1).

TSS in the inner Bay had a low organic content, inferring that the sediment consisted of loosely combined silt **and** clay, most likely derived from mine tailings. The subsurface TSS during ebb tides generally contained a lower organic load than the surface TSS, which indicated a strong re-suspension action.

During the northeast monsoon, the TSS content in the Bay was relatively uniform (14.0±2.0 ppm) throughout ebb and flood tides. In contrast, the strong southwest monsoon's resuspending action occurred typically along a stretch about I km before and behind the coastline (Fig. 7). Thus, a very high TSS content was observed upstream during flood tides and *vice* versa during ebb tides. This showed that the majority of TSS in the Bay was derived mainly from the resuspension of deposited sediment along the shore.

Khokiattiwong, et al. (1991) found that the nearshore circulation was profoundly related to interaction between runoff and saline waters and was superimposed by the monsoonal current regime in the Bay. Significantly low organic fractions of TSS further implied that the depositable and resuspendable sediments consisted of loosely combined silt and clay. These were probably derived from previously discharged TSS from mines. The subsurface TSS during ebb tides generally contained a lower organic fraction than the surface values, which confirmed the above implication.

Similar salinity (31.93±0.27 ppt) was recorded during the northeast monsoon at flood and ebb tides in the Bay, implying uniform circulation. The southwest monsoon subsurface inflow on the west coast resulted in a slightly higher salinity than on the east coast (32.28±0.04 ppt) while relatively low salinity prevailed in the inner Bay water (31.06±0.5 ppt). Quantitative assessment of diurnal salinity variation (4.3 ppt) was considerably higher than the value observed during the northeast monsoon (1.6 ppt). An upstream salinity variation of 11.9 ppt was observed (Table 2 and Fig. 7).

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TabLe 1. Hydrological con ditions Northeast monsoon (January-Febr uary 1988; from Limpsaichol and Bussarawit, 1991).

Parameter	East coast	West coast	**Inner** bay	*KK* site	East coast	West coast	Inner bay	*KK* site
TSS, **ppm**	10.1±1.3	7±1.0	14.0±2.0	5.8-7.3	28.7±5.0	20.8±2.2	96 8±13.2	48.1±55.1
ΔTSS	18.1	18.1	41.0		115.3	48.6	615.0	(75-106)
OF(TSS)	LT 16.4±2.1	3 1.0±4.6	18.2±6.1	3 1.96-63.66	18.8±1.4	10.8±2.0	10.8±2.0	
Salinity, ppt	31.93±0.27	31.39±0.27	31.93±0.27	27.84±30.8	32.28±0.04	32.41±0.02	31.06±0.5	26.9±28.4
Δ Salinity	1.20	1.57	1.56		1.0	1.0	4.3	(14.5156)
DO, ppm	6.84±0.34	6.26±0.31	6.26±0.31	3.80-4.45	Saturated	Saturated	Saturated	
ΔDO	2.05	1.82	2.41		-			
Alkalinity.								
ppm $CaCO_3$	160.0±1.0	160,0±1.0	160.0±1.0	157-158	182±2.1	160,0±4,0	160.0±4,0	158,0-160,0
Δ Alkalinity	3.0	3.5	5.0		27.5	5.0	6.0	(59.0-64,0)
p11	8.27±0.02	0.12±0.04	8.12±0.04	7.53-7.78	8.08±0,03	8,18±0,01	7.97±0,04	7.49-7.72
Δ pH	0.08	0.16	0.36		0.57	0.09	0.62	(7.35-7.41)
Temperature, C	28.62±0,40	28.62±0,40	28.62±0,40	29.6-29.9	32.6±0.5	32.7±05	31.6±0,5	29,5-29,6
Δ Temperature	2	2	3		2	1.2	1.8	
Coliform bacteria								
MPN/100 ml	-	-	23-260	34-2,400	4-350	-	9-170	33-1,400

Notes : KK= Kokekrai cage mariculture; D Variation. Data enclosed

Table 2. Upstream-offshore stretch salinity variation (from Limpasaichol and **Bussarawit, 1991).**

Location		Northeast monsoon	Southwest monsoon	Potential variation
East coast	*Salinity*	1.20 ppt	3.5 ppt	11.90 ppt
	offshore	2 km	5 km	8 km
Inner bay	Salinity	1 ppt	2.5 ppt	3.0 ppt
	offshore	3km	6km	10km

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During the northeast monsoon, the east coast's salinity varied by 1.20 ppt (Table 2). Salinity variation was highest in the nearshore area – within the first two km from shore. Beyond the first two km, the salinity remained uniform and relatively stable at (32.94±0.27 ppt). During the southwest monsoon, salinity showed a higher variation. During the prolonged dry period of the southwest monsoon, a 3.5 ppt variation extended for 5 km offshore while an upstream variation of 12.0 ppt was enhanced during heavy rainfall periods.

The high salinity variations in the Bay had a negative effect on the development of mariculture, particularly for sessile organisms. Cockle (Anadara spp.) mortality was related to the abrupt drop in salinity due to intensive river runoff especially during the wet southwest monsoon (PPFO, 1987). This can be compared with occurrences in other areas of the world. Burrell (1977) reported that high mortalities in oysters and hard clams in the estuary of Santee River, South Carolina (USA), were caused by the drastic change in salinity from heavy runoff. The seaward migration of Penaeid spp. was also reported to be affected by nearshore low salinity stress in Brunei Darussalam Bay (Loo, et al., 1987). Environmental conditions of low total alkalinity favored rapid growth of coliform bacteria, making cultured fish highly vulnerable to disease infection (Dharnchalarnukij, *et al., 1982).*

The buffering property of the coastal Bay waters was relatively high, as indicated by the total alkalinity shown in Table 1.

The northeast monsoonal water temperature (28.62±0.40° C) in January was relatively lower than the southwest monsoonal value (32.3±0.5° C) in June. These values prevailed uniformly in the coastal waters where a 3" C diurnal variation was recorded, regardless of ebb or flood tides.

High nutrient contents (PO, and NO,) were generated in the mangal upstream area during the northeast monsoon. Nutrients were diluted by the downstream water and moved into the Bay during ebb tide. The nutrient-rich stream water was then pushed backwards upstream during flood tide (Fig. 8). Thus, high nutrient contents were again recorded in the upstream water. Fluctuations in nutrient content from runoff of various sources occurred during the southwest monsoon. It was reported by Limpsaichol and Bussarawit (1989) that wasteload from aquaculture activities - mainly cage culture – occurred in Kokekrai (about 3 km upstream of Park Lao River) and affected the water quality in the area. This intensive cage culture site (400 cages) located near human settlements caused very turbid water (TSS 106 $mg.l^{-1}$) that exceeded the threshold value (NTAC, 1972) The TSS consisted of a high organic fraction (OF) of up to 63 ppm, and was mainly derived from the remainder of fishmeal.

The microbial decomposition caused very low DO levels (<3 ppm), which further decreased at night. Thukhvinars, *et* al. (1986) reported the DO content in estuarine waters

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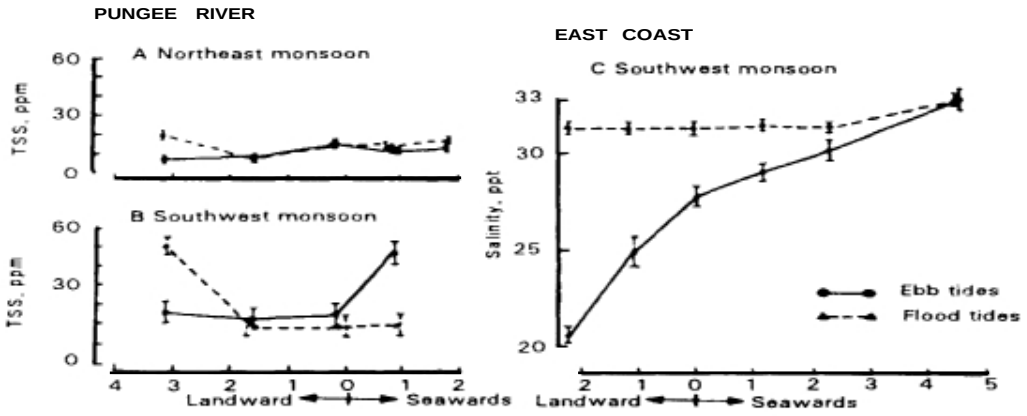

Fig. 7. Typical variation in TSS . Northeast monsoonal—uniform variation (A) Southwest monsoonal-high TSS (B) in upstream and offshore during flood and ebb tides, respectively. Typical salinity variation of 12 ppt (C) located upstream. It can be much larger tinder heavy rainfall (after Carr, et al, 1991).

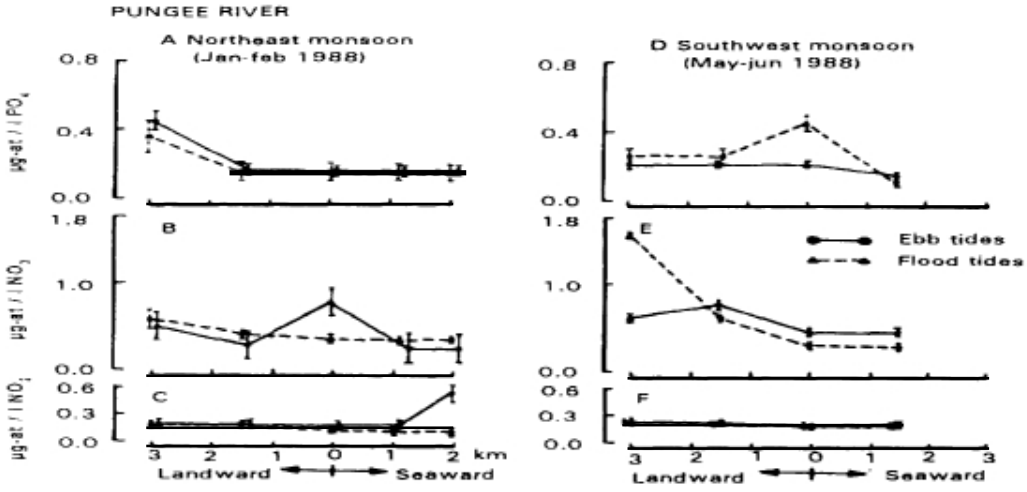

Fig. 8. Nutrients input (A, B, D, and E) during the northwest and southwest monsoons, scawards at ebb tides and seawater flushes upstream during flood tides. High nutrite was generated in the coastal waters (C), otherwise, it was unifotrn (C and F) (after Limpsaichol and Bussarawit, 1991).

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near aquaculture sites to be as low as 1.5 ppm at night, and caused high mortalities due to hypoxia.

High concentrations of cage culture in the Bay have restricted the natural hydrological processes that had previously kept pollutants well dispersed. This has led to a drastic drop in total alkalinity value (<60 ppm $CaCO_3$). Cultured fish become vulnerable to bacterial growths at such low levels of alkalinity (Dharnchalarnukij, et ***al.,*** 1982). A high coliform bacteria (1,700 MPN/100 ml) count, which exceeded the acceptable value of 1,000 MPN/100ml was recorded in the Bay by Unkulvasapaul and Simachaya (1986). High levels of coliform bacteria (1,400 MPN/ 100 ml) were also recorded at sewage discharge sites near the Kokekrai village.

Relatively high primary production was observed in the Bay. Sundstrom, ***et al.*** (1987) found an annual average production rate of about 384 gC m^{-2}year. The high primary production of the area was related to the large area of mangrove swamps and their high productivity (Christensen, 1978). A high chlorophyll- a content was noted in coastal waters (l-5 m depth). However, relatively lower values of both parameters were observed in offshore waters. It was also noted that high densities of zooplankton were recorded during the northeast monsoon in rhe inner Bay (Boonruang, 1985). Abundance and distribution of zooplanton was affected by their feeding patterns and the hydrodynamic regimes of the Bay.

3.5 Land-Based Sources of Pollution

Land-based sources of pollution in Phang-nga Bay were studied by Kositratana and Kajornatiyudh (199 1). The study revealed that pollution sources were scattered throughout the Bay. These included sources that entered into the riverine basins of the Bay as well as those entering directly into the Bay. Pollution sources originated from communities and industries (e.g., oil palm mills and rubber plants). However, the total generated load (TGL) and actual discharged load (ADL) of these sources were relatively small compared with mining activities. In the past, intensive mining activities operated by 14 mines showed a highly significant value of suspended solids at TGL of 280,000kg day' or approximately 50,400 tons year-'. Daily rates averaged 70,000 m^3 day^{-1} of water supply and caused very turbid water (4,000 ppm TSS). Subsequently, sedimentation increased and resulted in shallowness of rivers. The increased sedimentation also affected approximately 280 square km of inner Bay area including corals and mangroves.

Previous TGL of organic waste was calculated at 9,540 kg BOD day-' with a comparatively small ADL of 154 kg BOD day' (approximately 1.6% of the total potential wasteload) (Kositratana and Kajornatiyudh, 1991). However, these values are presently elevated due to the large development of shrimp aquaculture farms in intertidal areas of the Bay. Water quality parameters of DO and BOD in upstream rivers of the Bay (Fig. 9),

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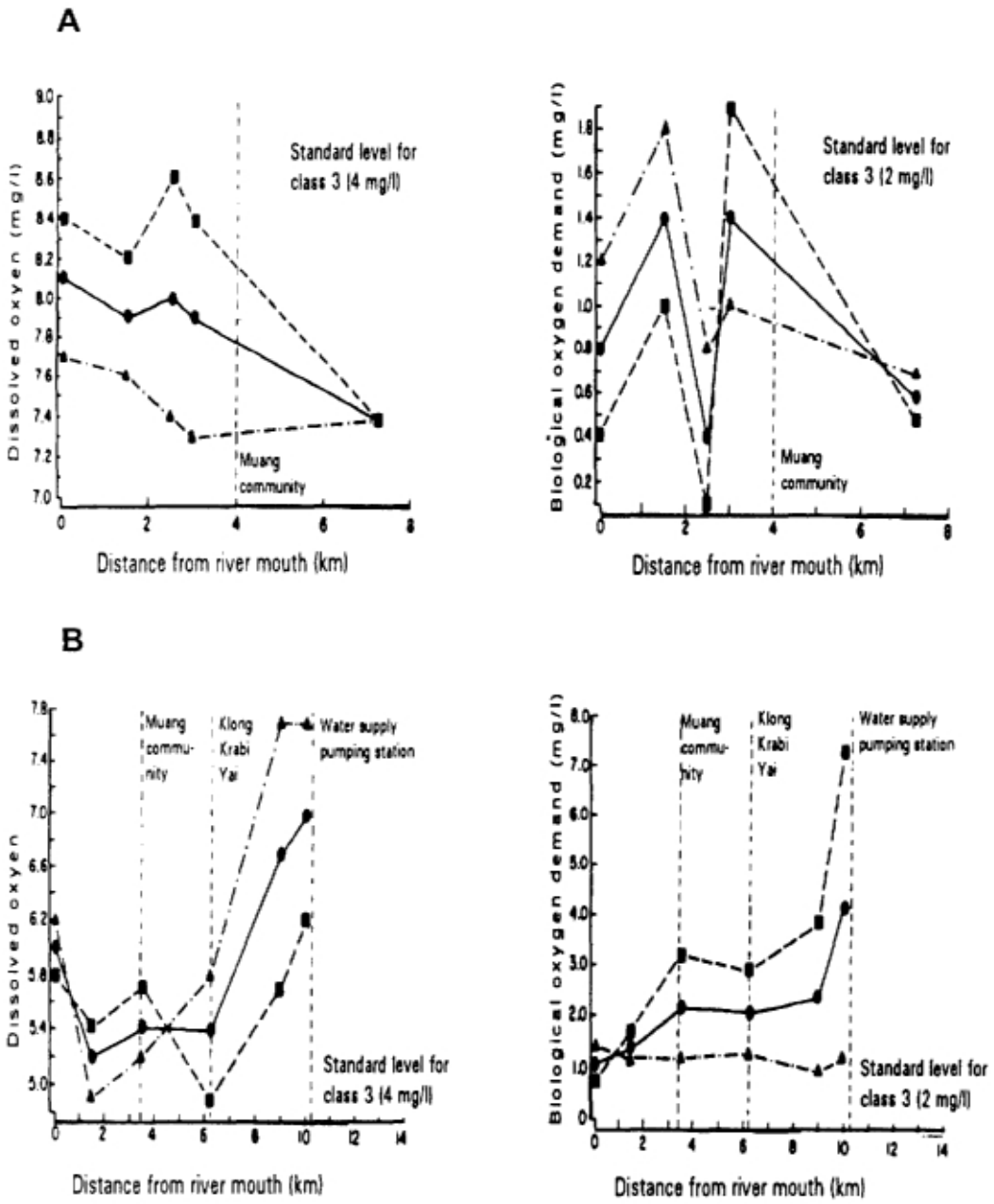

Fig.9. Changes of DO and BOD concentrations in: A) Phang-nga River; and B) Krabi River (after Kositrarana and Kajomatiyudh, 1991).

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indicated that all values were within acceptable ranges of the National Surface Water Quality Standards. However, riverine contamination frequently occurred during times of sewage discharges, particularly along stretches of rivers located near city communities in Phuket, Phang-nga and Krabi Provinces. As a result, high concentrations of total coliform bacteria were reported especially during low tides and wet seasons. Such riverine contamination was comparable to that of bacterial contamination in coastal waters typically found near human settlements. Contamination was attributed to a great amount of extra wasteload **being** flushed out into receiving water during wet seasons.

3.6 Upstream NO, and PO, Distribution

Siripong, ***et al.*** (1987) studied the estuarine ecosystem of the Bay and concluded that high nutrient content distribution of NO_3 and PO_4 (4.333 µM NO_3-N and 0.326 µM PO_4-P) were located in the inner Bay waters. The nutrients largely originated in runoff waters. The data obtained in 1995 during monitoring studies (Khokiattiwong, et ***al.*** **1991)** indicated that the concentrations of NO_3 and PO_4 were 2.454±4.194 µM (NO_3-N) and 0.250±0.134 µM (PO_4-P). The NO_3 level fluctuated. However, the average **content of** NO_3 tended to be generally elevated compared to the previous results 0.25-1.70 µM (NO_3-N) (Fig.8). The increment of NO_3 coincided with the high N-component of feeds given in aquaculture (fish, shrimp, etc.) activities. However the PO_4 levels showed no significant difference compared to previous data (0.20-0.40 µM (PO_4-P). Similarly, total coliform bacterial contamination in general did not show an additional load. Nevertheless, results indicated that the existence of fecal bacteria were generally around 20±4 MPN/100 ml. Elevated values of bacteria were recorded in outflows of sewage waste near coastal communities.

3.7 Tidal Circulation Characteristics

Khokiattiwong, ***et al.*** (1991) investigated the monsoonal effects on circulation of the Bay, focusing on the cross-sectional residual flows of the inner Bay and along the east and west channels. The residual current structures showed that during the southwest monsoon, sea water entered the Bay as surface water through the west channel and Pak Pra Inlet and circulated through the inner Bay and out through the east channel into the Andaman Sea. As a result, relatively high salinity occurred in the northwest area in spite of high runoff and water mixing (Figs. 10 and 11).

However, although highly variated, the bottom residual flow brought sea water into the Bay through both channels (Figs. 15 and 16), then flowed northwards and out of the Bay as surface water (Fig. 14). This pattern would imply the existence of a weak gravitational circulation. The circulation structure during the northeast monsoon reflected the residual surface current outflow through the east and west channels with a relatively stronger current through the west channel and northwards (Figs. 17,18 and 19). This was

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further associated with a weak northward inflow through the west channel and outflow through Pak Pra Inlet. The bottom inflow through both channels is in accordance with the surface flow. Surface residual currents were most variable during the northeast monsoon season. As a result, the salinity was generally low (31.5-32. ppt) during this season, with the lowest value in the northwest area of the Bay (Figs. 12 and 13).

During the pre-northeast monsoon season, the prevailing circulation and salinity characteristic was prolonged but tended to be highly variable. Similarly, the pre-southwest season showed trends of southwest monsoon characteristics. Similar trends occurred during the pre-northwest season.

3.9 Meteorological Characteristics

Meteorological data were taken at three locations around Phang-nga Bay including Phuket Town, Phuket Province, Takua-pa, Phang-nga Province and Lanta Island, Krabi Province (Khokiattiwong, et al, 1991). The time scale of calm periods was calculated from wind roses. It was found that winds were calm approximately 50% of the time, with the exception of the very outer Bay area (Lanta Island) where it was influenced by wind channel. The yearly average vector ranged 0.77-I. 15 m s^{-1} and varied seasonally. The outer Bay (Lanta) was dominated by low wind speed and 6.6% calm, in contrast with the inner Bay (Takua-pa) where winds were calm over 50% of the time. However, winds in Takua-pa could also be the strongest found in the Bay.

The wind regime during the transitional season of pre-southwest monsoons is dominated by weak northwesterly, westerly and southwesterly winds. However, easterly and northeasterly winds were also occasionally recorded. The pre-northeast monsoons are also governed by weak winds of easterly-northerly-northwesterly origin. Frequently, northerly and northeasterly winds were often observed in the far most outer Bay (Lanta Island).

During the northeast monsoon, the prevailing winds were from the northeast and east. However, in the inner Bay (Takua-pa), due to the influence of the landmass, winds frequently prevail from a westerly and northwesterly direction. During the southwest monsoon, the strong winds prevailing in the Bay come from the southwest, west and northwest. However the year-round prevailing winds are westerly.

3.10 Mean Air Temperature, Evaporation and Precipitation

Data accumulated over 35 years at Phuket town, and over five years at two additional locations in the Bay were calculated. It was reported that air temperature was relatively constant with a yearly average temperature of 27.8± 1 .0° C over Phang-nga Bay. The average rainfall was highly seasonal. However, average monthly rainfall during the dry northeast monsoon was

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below 100 mm, while the average monthly rainfall during the wet southwest monsoon was above 300 mm (Khokiartiwong, *et al.* 1991).

It was also reported by Khokiattiwong, *et* al.(1991) that average monthly precipitation of 178.6±136.5mm(rainfall) exceeded evaporation (by pan measurements) of 150.6±23.3 mm. These findings implied that Phang-nga catchment was gaining a freshwater budget. The high freshwater runoff all year round caused seasonal salinity variations in the coastal areas. Lower salinity occurrence in the coastal areas, particularly during the wet season, significantly influenced circulation patterns within the estuarine ecosystem.

3.11 Numerical Model Application of Tidal Circulation in Phang-nga Bay

Sojisuporn, et *al.* (1994) developed a 2-dimensional, vertically averaged tidal circulation-dispersion model and applied it to Phang-nga Bay. The model used oceanographic data in relation to meteorological conditions. The model simulated tidal and wind-driven circulation and dispersions in the Bay. It then utilized two horizontal momentum balance equations and the continuity equation under the assumption of shallow water (Welander, *1957)* and the notation of Blumberg (1977). The principle of depth-average momentum equations of the right-hand Cartesian coordinate system in x and y components are given below:

$$\frac{\partial uH}{\partial t} + \frac{\partial u^2 H}{\partial x} + \frac{\partial uvH}{\partial y} - fvH + gH\frac{\partial \eta}{\partial x} = \tau_x^w - ku(u^2+v^2)^{1/2}$$

$$\frac{\partial vH}{\partial t} + \frac{\partial uvH}{\partial x} + \frac{\partial v^2 H}{\partial y} + fuH + gH\frac{\partial \eta}{\partial y} = \tau_y^w - kv(u^2+v^2)^{1/2}$$

As Phang-nga Bay is considered a shallow Bay where density is not significantly affected by pressure, a vertical average continuity equation can be applied:

$$\frac{\partial \eta}{\partial t} + \frac{\partial uH}{\partial x} + \frac{\partial vH}{\partial y} = 0$$

The momentum equations are nonsteady state, and include nonlinear inertia! terms, the Coriolis effect, pressure terms, surface wind stress and bottom friction (Kjerfve, *et al,* 1990). The values of *u* and *v* are the depth-averaged velocities with respect to x and y coordinates. *H* is the instantaneous water depth given by $H=h+h$ where h = water depth at mean sea level and h is the surface elevation relative to mean sea level, f and g are the Coriolis and gravitational acceleration respectively, τ_x^w and τ_y^w are the x and y components of the 10 m wind stress and *k* is the non-dimensional bottom friction.

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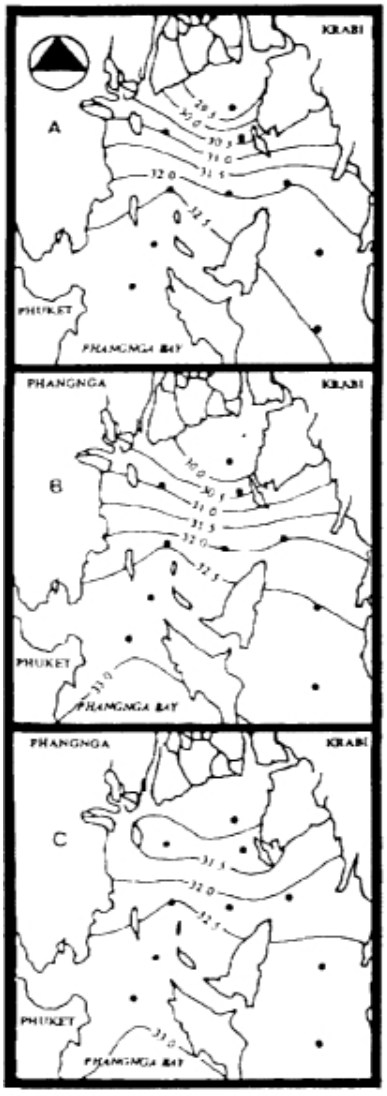

Fig. 10. (a) Surface (b) mid-depth and bottom tidally-averaged salinity distributions Phang-nga Bay: southwest monsoon season. (after Khokiattiwong et al., 1991)

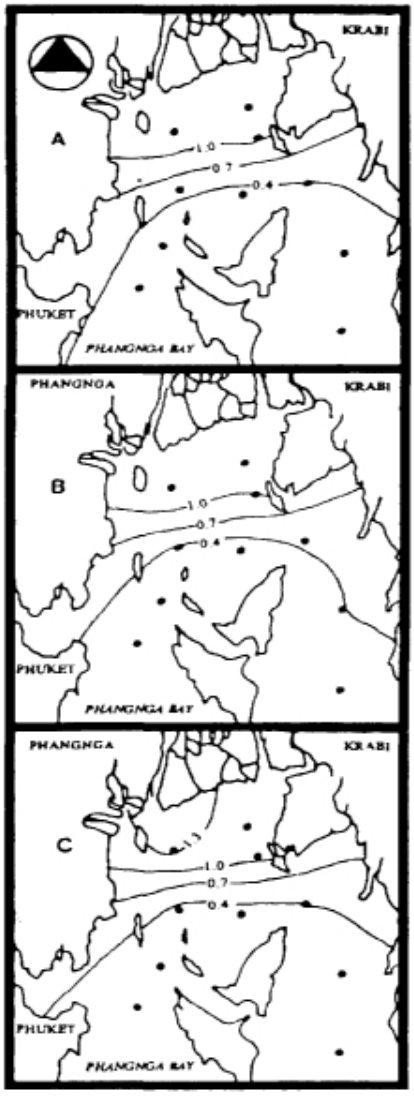

Fig. 11. (a) Surface (F) mid-depth and (c) bottoms (root-mean-square) salinity distribution; southwest monsoon season, 1985 (after Khokiattiwong et al., 1991)

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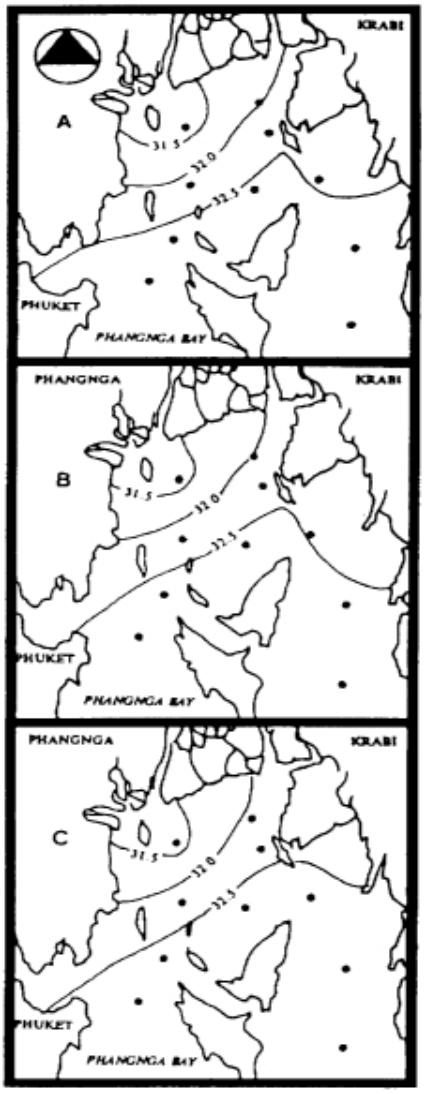

Fig. 12. (a) Surface (b) mid—depth, and (c) bottom tidally—averaged salinity distribution in Phang-nga Bay; northwest monsoon season, 1985 (after Khokiattiwong, *et al.,* 1991).

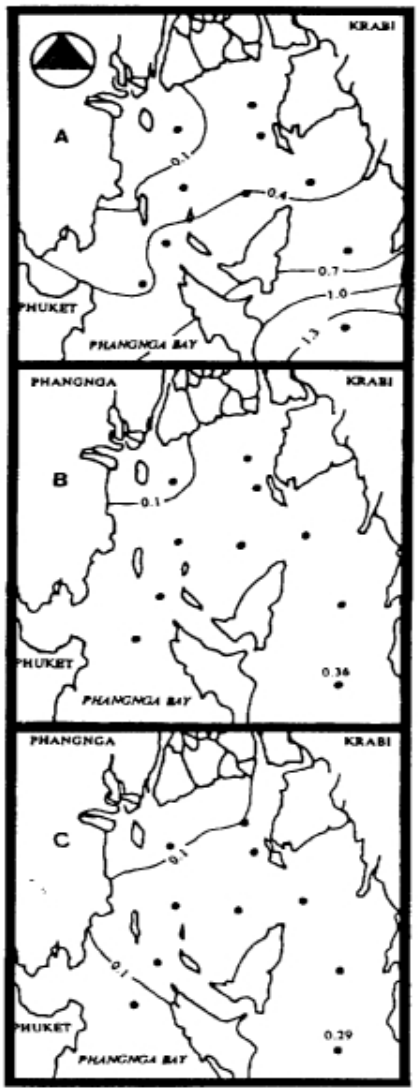

Fig. 13. (a) Surface, (b) mid—depth, and (c) bottom rms distribution; of tidally-averaged salinity in Phang—nga Bay; northwest monsoon, 1985 (a&er Khokiattiwong, *et al.,* 1991).

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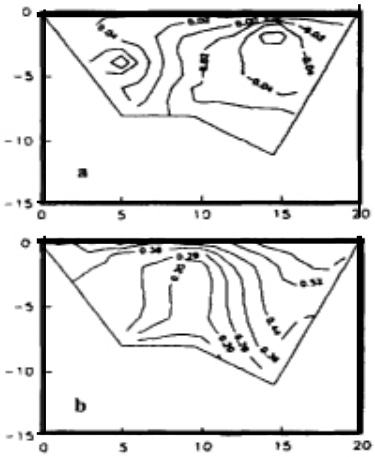

Fig. 14. (a) Cross-section and (b) rms of the residual v—component (N—S) velosity structure in tipper Phang-nga Bay (southwest monSoon season, 1985). Water depth is in meters and channel length is in kilometers (after Khokiettiwong, *etal.*, 1991).

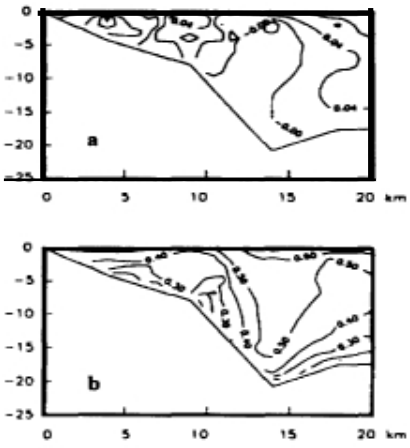

Fig. 15. (a) Logitudinal section and (b) rms ofresidual current structure in the west channel (south—west monsoon season, 1985; after Khokiartiwong, *et al.,* **1991).**

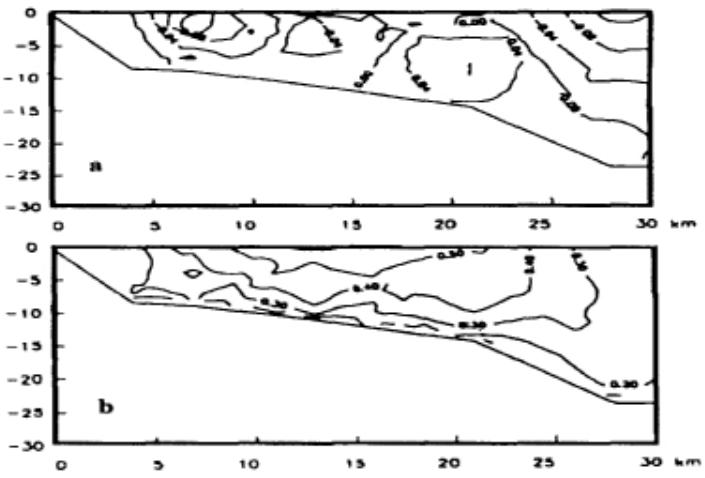

Fig. 16. (a) Logitudinal **section** and (h) rms ofresidual current structure in the east channel (southwest monsoon season, 1985).

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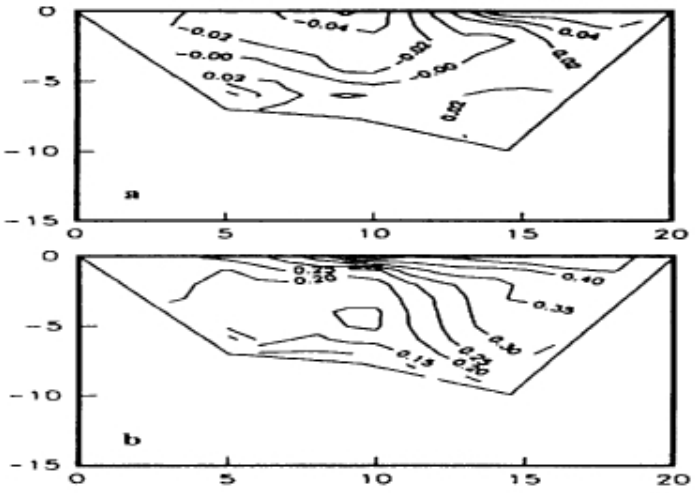

Fig. 17. (a) Cross—section and (b) rms of the v—component residual current structure in upper Phang—nga Bay (northwest monsoon season, 1985).

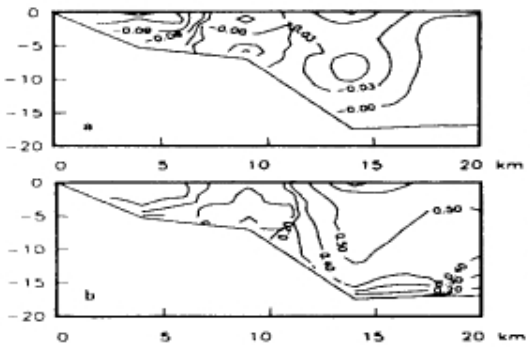

Fig. 18. (a) Longitudinal section and (b) rins of the residual current structure in the west channel (northeast monsoon season, 1985).

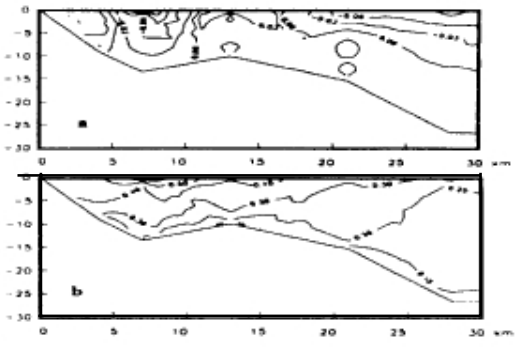

Fig. 19. (a) Longitudinal section and (b) rms of the residual current structure in the east channel (northeast monsoon, 1985).

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The model simulations are forced by tidal elevation at the seaward boundary of the Bay, fresh water input and wind stress on the surface waters. The grid for the Bay consists of a rectangular matrix of 41x34 elements, each of which is 2,000 m wide and long **which** accommodates the eight rivers of the Bay. Each term in the above equations of the model resulted in a similar magnitude. Thus, they can be considered equally significant in the case of Phang-nga Bay. The model runs coupled with a t-test reflected a significant northward flow along the deep channels. The result further indicated a southward flow near land-water boundaries, probably **due to** relatively high bottom friction in shallow water. No patterns emerged in the E-W residual flow. Though the N-S residual flow was weak, it was superimposed by tidal flow-boundary interactions. Thus, residual tidal eddies are the prominent residual flow features in the Bay (Fig. 20).

The model execution also showed that wind-driven circulation was important in the Bay. The easterly and westerly winds created 2 large-scale circulation cells; one across the outer Bay and the other located in the inner Bay at two channels. The easterly wind enhanced anti-clockwise residual circulation (Fig. 21) inducing the maximum residual current ranging 0.15-5.00 $ms^{-1}$of 3% of the wind magnitudes while westerly wind enhanced clockwise residual circulation (Fig. 22) ranging 0.28-0.70 ms^{-1} of 6% of the wind magnitudes.

With wind forcing from the south, due to the orientation and shape of the Bay and islands, an anti-clockwise residual circulation was enhanced on the eastern side of the Bay (Fig. 23). Clockwise residual circulation was enhanced on the western side. Consistent southerly winds are responsible for elevating 0.004 m of water level of the Bay. However, it was highlighted that wind stress changes in the u-component of current speed and phase more than in the v-component current. Further more, the land and sea breeze of 4 m/s blowing from the east and the west alternatively for every 12 hours did not affect the residual circulation in the Bay as they canceled out any effect on wind-driven residual velocity. Consequently, wind-driven circulation was largely responsible for advection and salt transport. However, mixing and dispersion in the Bay are also influenced by tidal oscillations.

3.12 Residence time of water masses retained in Phang-nga Bay

The residence time of water masses was computed by Sojisuporn (1990) with the **use** of the 2-dimensional, vertically averaged circulation dispersion model for Phang-nga Bay. The average residence time of a constituent mass is defined as the average time it takes for the material (after inlet) to reach the outlet of the system (Takeoka, 1984a). With some model modification and justification to take salinity and local depth at various times and locations into account, the age of open sea water and river water in the Bay can be computed. The age is identical to the residence time of water parcels under steady state conditions. To execute the computations for the age of open sea water in the Bay, each model element

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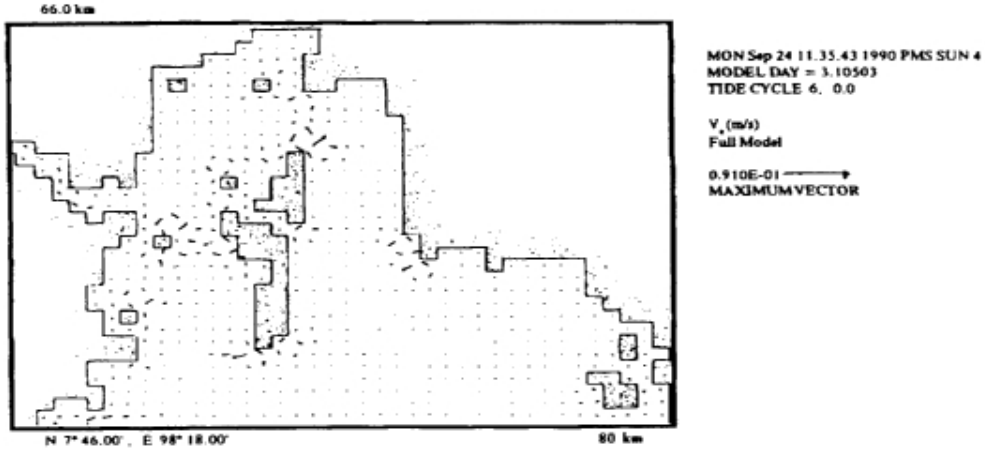

Fig. 20. Eulerian residual circulation for Phang-nga Bay from the full model. The maximum velocity along with its represented current vector is given at the lower right (after Sojisuporn, *etal.*, 1994).

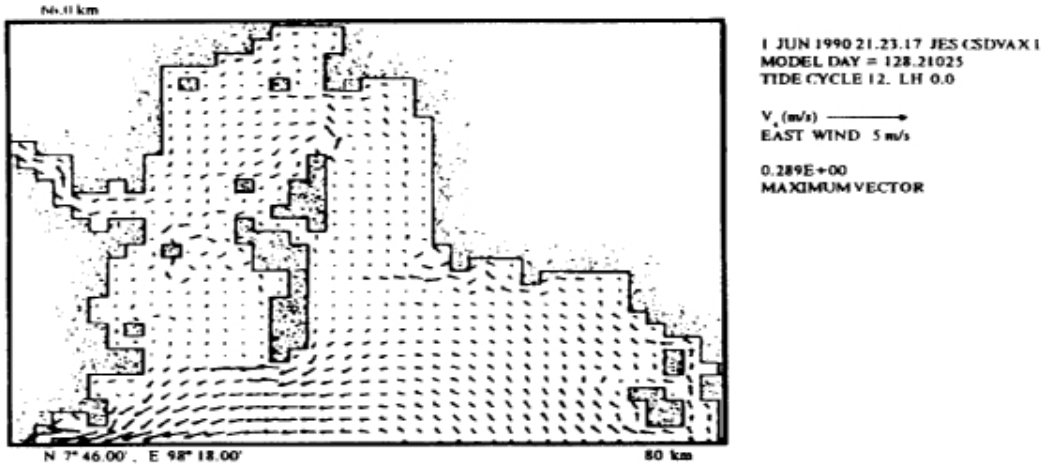

Fig. 21. Eulerian residual circulation for Phang-nga Bay from the numerical model forced by M_2 tide and constant east wind at 5 ms^{-1} The maximum velocity along with its represented current vector is given at the lower right (after Sojisuporri, *etal*, 1994).

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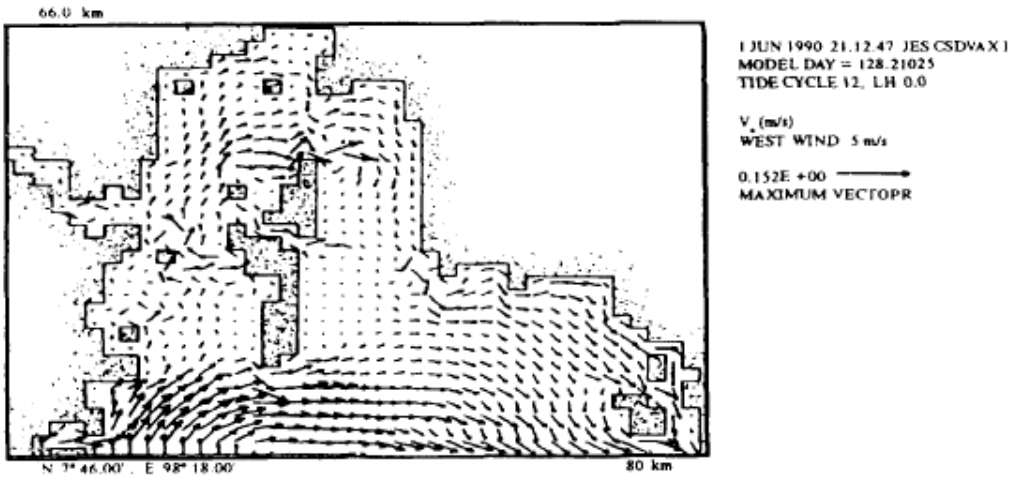

Fig. 22. Eulerian residual circulation for Phang-nga Bay **from** the numerical model forced by M, tide and constant west wind at 5 ms-1. The maximum velocity along with its represented current vector are given at the lower right (after Sojisuporn, *etal.,* 1994).

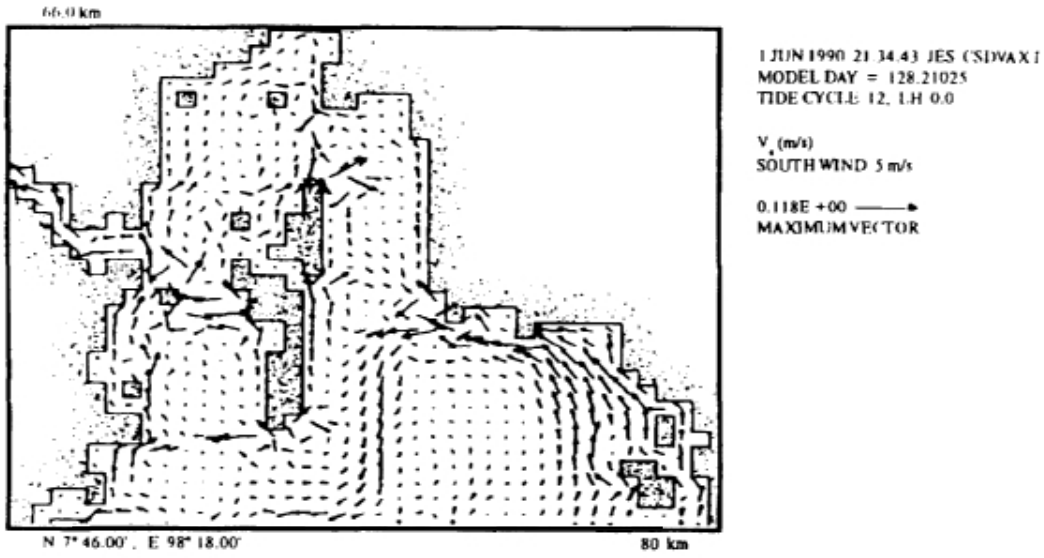

Fig. 23. Eulerian residual circulation for Phang-nga Bay from the numerical model forced by M^2 tide and constant east wind at 5 ins ı The maximum velocity along with its represented current vector is given at the lower right (after Sojisuporn, *etal,* 1994).

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is initially set at zero salinity. Salinity at the open boundary was kept at 34 throughout the model run. Tidal forcing and river inputs were kept the same as the earlier run.

Therefore, given the tidal model computation, the time for average age of sea water in the Bay was 64 days. However, with the presence of easterly wind forcing at 5 m s^{-1}, the average age of sea water was only 25 days.

To compute the age of river water in the Bay, the numerical model was run with salinity of the Bay water initially set at 34. The age of river water was similarly computed to have an average age of 36 days with tidal forcing. However, running the model with the presence of an easterly wind at 5 m $^{-1}$s, the result was only 6 days.

The resulting shorter average age of river water in the Bay than sea water was unexpected. In theory, the river water should spend more time in the Bay than sea water as the river water must travel a longer distance before it reaches the outlet (Takeoka, 1984a). But the conditions in Phang-nga Bay are to the contrary. Large amounts of river water enters the inner Bay. The river water takes a shorter exit route via Pak Pra Inlet, resulting in a shorter average age of river water. The results of model runs demonstrated that the easterly wind would enhance the outflow of the Bay water while the westerly wind would enhance the inflow of sea water into the Bay.

Understanding hydrological patterns of the Bay can help provide insights into changes within the Bay's ecosystem. For example, incidence of green algae bloom, dominated by *Rhizoclonium* and *Enteromopha* were evidenced in early 1995 at the coastal area of outer Phang-nga Bay (Ao Nang, Krabi Province). These green algae originated in the vicinities of fresh water runoff and growth enhanced under conditions of high nutrients associated with sufficient light intensity. They were able to continue growth while drifting in the sea (Chapman, 1973). It was further envisaged that they might have originated from the inner Phang-nga Bay and drifted to land, affecting the coastal areas of the outer Bay when the current pattern shifted.

This coincided with findings of residual currents of the inner Bay directed to the affected site of Ao Nang (Sojisuporn, *et al.,* 1994). High levels of the nutrient parameters NO, and PO, on site were related to the outbreak of the incidence. Phytoplankton composition was 99% dominated by diatoms. The minority was dinoflagellate, including Gonyaulax and Ceratium. Their numbers were considered within normal conditions of coastal seas (Limpsaichol, *et al., 1994).*

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4. CONCLUSION

Investigations into environmental conditions of the Andaman Sea determined that favorable conditions enhance two major offshore fisheries areas located in the northern and southern Andaman Sea. Phang-nga Bay is a rich ecosystem located between these areas and has been well recognized as an important fisheries habitat. The status of environmental conditions of Phang-nga Bay is summarized below:

1. The inner Bay serves as a dominant source of sediment accumulation. The longer mean grain size of sediments can be found in the areas of the Bay closest to the Andaman Sea. A similar trend can be seen in the $CaCO_3$ content.

2. Core samples have been radiocarbon dated. Over the last 6000 years in the inner Bay, vertical accumulation and lateral progradation rates were estimated at 0.3-1.5 mm year-' and **1.5-1.67** m year-' respectively.

3. The coastal areas are governed by seasonal salinity variations. Salinity drops in the northeast of the Bay during the wet monsoon, and drops in northwest of the Bay during dry monsoon.

4. TSS were relatively high in the inner Bay, particularly in wet monsoon. This is caused by the intensive runoff and re-suspension of sediment. Other parameters of water quality were in normal condition except high coliform bacteria and H_2S. However, low DO and alkalinity in coastal fish culture sites occurred in the Kokekrai area due to water movement inhibited by fish cages which have been setup in the Bay.

5. Pollution sources are scattered throughout the Bay. In particular, the total generated loads (TGL) originated mainly from communities and could get up to 9,540 kg BOD day^{-1}. Nevertheless, the actual discharge load (ADL) was only 154 kg BOD day^{-1} which contributed only 1.6% of the total potential wasteload of the Bay.

6. Elevated concentrations of NO_3-N (up to 1 μM) were found in the coastal areas during 1988-1995. This coincided with the expansion of aquaculture on shorelines of the Bay. However, these concentrations of NO_3-N still fell within the normal coastal conditions.

7. During the southwest monsoon, sea water entered the Bay as surface water through the west channel and Pak Pra Inlet and circulated through the inner Bay and out through the east channel into the Andaman Sea. As a result, relatively high salinity occurred in the northwest area in spite of high runoff and water mixing. However, the circulation structure during the northeast monsoon reflected the residual surface current outflow through the east and west channels with a relatively stronger current through the west channel and northwards. This was further associated with a weak northward inflow through the west

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channel and outflow through Pak Pra Inlet. The bottom inflow through both channels is in accordance with the surface flow.

8. Wind-driven circulation is important in the Bay. The easterly and westerly winds create two large-scale circulation cells; one across the outer Bay and the other located in the inner Bay at two channels. The easterly wind enhanced anti-clockwise residual circulation, inducing the maximum residual current ranging 0.15-5.00 m s^{-1} of 3% of the wind magnitudes. Westerly wind enhanced clockwise residual circulation (0.28-0.70 m s^{-1}) of 6% of the wind magnitudes.

9. With wind prevailing from the south, because of the orientation and shape of the Bay and islands, an anti-clockwise residual circulation was enhanced on the eastern side of the Bay. Clockwise residual circulation was enhanced on the western side.

10. Wind-driven circulation is largely responsible for advection and salt transport. However, mixing and dispersion in the Bay are also influenced by tidal oscillations.

11. The average age of sea water in the Bay was 64 days. However, with the presence of easterly winds forcing at 5 m s^{-1}, the average age of sea water can be as low as 25 days. Average age of river water was calculated to be 36 days, and 6 days with easterly wind stress at 5 m s^{-1}. The average age of river water is less than sea water because the river water comes into the Bay as surface water and takes a shorter route to exit the Bay through Pak Pra Inlet.

5. REFERENCES

Aksornkoae, S. and Eiumnoh. 1988. Mangrove forest. In: J.N. Paw, *etal.* (Eds.). The coastal environmental profile of Ban Don Bay and Phang-nga Bay, Thailand. The International Center for Living Aquatic Resources Management on behalf of the Association of Southeast Asian Nations/United States Coastal Resources Management Project, Manila, Philippines, pp 21-26.

Blumberg. A.F. 1977. Numerical tidal model of Chesapeake Bay. Journal of the Hydraulics Division, Proceedings of the ASCE, 103 (HYI):l-10.

Boonruang, I? 1385. The community structure, abundance and distribution of zooplankton at the east coast of Phuket Island, Southern Thailand, Andaman Sea. Phuket Mar. Biol. Cent. Res. Bull. 39:1-13.

Burrell, V.G. 1977. Mortalities ofoysters and hard clams associated with heavy runoff in the Santee River System, South Carolina in Spring of 1975. Proc. Nat. Shelf. Assn. 67:35-43.

Chapman, V.J. 1973. The Algae. The University Press, Glasgow. 497p.

Carr, D.J., S. Khokiattiwong,T.P Scoffin and A.W. Tudhope, 1991. Grain size, calcium carbonate content and accumulation rates of recent sediments in Phang-nga Bay, South Thailand. Phuket Mar. Biol. Cent. Res. Bull. 55:77-36.

<<

Christensen, R. 1978. Biomass and primary production *of Rhizophora apiculata Bl.* in a mangrove in southern Thailand. Aquat. Bot. 4:43-52.

Dharnchalarnukij, V, V. Chuarpohnk, I? Suranoeranart and 0. Manakorn. 1382. Principles and guidelines of techniques for fresh water fish culture. Faculty of Fisheries, Kasetsart University, Bangkok.

Edgren, M. 1977. Sediment as indicator ofpollution. Ambio, Special Report 5:133-l 33.

Garson, M.S., A.H.G. Mitchell, B. Young, and B.A.R. Tait. 1975. The Geology of the Tin Belt in Peninsula Thailand around Phuket. Phang-nga and Takua-Pa. I.G.S. Overseas Memoir No. 1.

Henriken, K., J. Honsen and T.H. Blackburn. 1980.Th e influence ofbenthic in fauna on exchange rates of inorganic mtrogen between sediment and water. Ophelia, Suppl. 1:249-256.

Jorgensen, B.B. 1980. Seasonal oxygen depletion in the bottom waters ofa Danish Fjord and its effect on the benthic community. Oikos. 34:68-76.

Khokiattiwong, S., P. Limpsaichol and I? Rojanavipart. 1989. Distribution of trace metals in offshore mining and non-mining sediments from west coastal of Phuket Island, Thailand. In: Metals and metalloids in the hydrosphere; impact through mining and industry, and prevention technology in tropical environments, pp. 160-172. Proceedings of an IHP workshop held in Phuket, Thailand, 6-10 March 1989. Asian Institute of Technology, Bangkok, Thailand.

Khokiattiwong, S., P. Limpsaichol, S. Petpiroon, I? Sojisuporn and B. Kjerfve. 1931. Oceanographicvariations in Phang-nga Bay, Thailand, under monsoonal effects. Phuket Marine Biological Center Research Bulletin 55:43-76.

Khokiattiwong, S. 1992. Physical and chemical oceanographic aspects in a *Chicoreus ramosus* fishing ground in the Andaman Sea,Thailand. Phuket Mar. Biol. Cent., Spec. Publ. 10:155-167.

Khokiattiwong, S. and P Limpsaichol. 1996. The dynamicvariation ofwatcr circulation in the Andaman Sea, Thailand. Proceeding of the Seminar on Fishery, 18-20 September 1995, Department of Fisheries, Bangkok, Thailand.

Kjerfve, B., K.E. Magill and P. Sojisuporn. 1990. Physical Dynamics. In: R.F. Van Dolah, P.H. Wend and E.L. Wenner (Eds.). A physical and ecological characteristics of the Charleston Harbor Estuarine System. Marine Resources Division, South Carolina Wildlife and Marine Resources Department, South Carolina, USA, pp. 99-120.

Kositratana, N., and S. Kajornatiydh. 1991. Land-based pollution sources in the Upper South, Thailand. In: L.M. Chou,T.E. Chua, H.W Khoo, P.E. Lim, J.N. Paw, G.T. Silvestre, M.J. Valencia, A.T. White and P.K. Wong (Eds.).Towards an integrated management of tropical coastal resources, ICLARM Conference Proceedings, NUS, Singapore, pp. 167-175.

Kroiss, H., and F. Plahi-Wabnegg. 1987. A report on the sulfide toxicity with anaerobicwaste water treatment. 35p. Technische Universitat Wien, Institut fur Wassergute und Landschafts-wasserbau, Austria.

Limpsaichol, I?, S. Khokiattiwong and N. Bussarawit. 1994. Water conditions and nutrient content at the artificial reefsites in **Ranong** Province, Thailand. In: The effect of artificial reef installation on the bio-socioeconomics ofsmall-scale fisheries in Ranong Province, Thailand. BOBP/WP/97, pp. 1 1- 15.

Limpsaichol, P., and S. Khokiattiwong. 1991. Tidal current patterns of the southern Andaman Sea coast of Thailand. Phuket Mar. Biol. Cent. Technical Paper No. 1: l-2 1.

<<

Limpsaichol, I?, and N. Bussarawit. 1991. An assessment of the coastal environment of Phang-nga Bay, Thailand, p,3- 11. In: M. Chou, T.E. Chua, H.W. Khoo, P.E. Lim, J.N. Paw, G.T. Silvestre. M.J. Valencia, A.T White and PK. Wong (Eds.). Towards an integrated management oftropical coastal resources. ICLARM Conference. Proceedings, NUS, Singapore.

Loo, M., L. Hsu and J. Paw. 1987. Physical environment. In: C. Thia-Eng, C.L.Ming and S.M. Sadorra (Eds.). The Coastal Environmental Profile of Brunei Darussalam: Resource Assessment and Management Issues. ICLARM Technical Reports 18, pp. 5-27.

NTAC (National Technical Advisory Committee). 1972. Water quality criteria. United States Environmental Protection Agency, Washington, D.C.

PPFO (Phang-nga Provincial Fishery Office). 1987. A report on seedbed of cockle: *Anadara (tagellarca) nodifera (E. Von martans)* in Phang-nga Province. Phang-nga Provincial Fishery Office, Thailand. Pap. 21187. 22p.

Rusnak, G.A. 1967. Rate ofsediment accumulation in modern estuaries. In: G.H. Lauff (Ed.). Washington Estuary, American Association for the Advancement of science, pp. 194-198.

Schlegel, H.G. 1987. Allgemeine Mikrobiologie, 4 Auflage. Cited by Kroiss and Plahl-Wabnegg (1987). A report on the sulfide toxicity with anaerobic waste water treatment. Technische Universitat Wien. Institut fur Wassergute und Landschafts-wasserbau, Austria. 35p.

Siripong, A., S. Murai, R. Matsuoka, R. Tateishi and T Okuda. 1979. Studying the physiographic feature, the distribution ofsuspended sediment, tin mine and mangrove forest in the Phang-nga area utilizing Landsat MSS CCT data. First National Seminar on Marine Science, May 28-30, 1979. National Research Council of Thailand. 56p.

Siripong, A., N. Paphavasit, V Daorerk and S. Aksornkao. 198 l. The relationship between surface suspended sediment concentration and surface tidal current during the two monsoon seasons in the Phang-nga Bay. Proc. Sem. on the Quality of Water and Living Resources in Thai Waters, NRCT, Bangkok, 26-28 May 1981, pp. 73-78.

Siripong, A., S. Aksornkao and J. Kongsangchai. 1987. Estuarine ecosystems of the Phang-nga Bay. V Chemical & Physical Oceanography, Reports on Soi. Res., Fac. of Science, Chulalongkorn University, Bangkok, 162p.

Sojisuporn, P., B. Kjerfve and S. Khokiattiwong. 1994. Numerical Model of Tidal Circulation in Phang-nga Bay, Thailand. In: Phuket Marine Biological Center Research Bulletin 59: 65-8 1.

Sojisuporn, P 1990. Oceanographic and dynamic characteristics of Phang-nga Bay, Thailand. PhD. Thesis, Marine Science Program, University of South Carolina, USA. 201 p.

Sundstrom. B., V Janekarn, J. Hyllaberg and P Boongruang. 1987. Annual pelagic primary production with notes on physical and chemical variables at Phuket, the Andaman Sea, Thailand. Phuket Mar. Biol. Res. Bull. 47: l-2 l.

Sutthakorn, P, and K. Saranakomkul. 1986. Biological aspects of chub-mackerels *(Rastrellinger spp.)* and round scads *(Decapterus spp.).* The west coast of Thailand. Paper presented at the Third Working Group Meeting on Mackerels in the Malacca Straits, 19-23 August 1986, Phuket, Thailand.

<<

Takeoka, H 1984a, Fundamental concepts ofexchange and transport time scales in coastal seas. Continental Shelf Research, 3: 311-326.

Thukhvinars, S., Y. Douyadon, C. Boontan and P Pirngmarg. 1986. Environmental assessment ofseabass cage culture site. Songkhla outer lake: causative study ofdrastic mortality. Thai Fish. Gaz. 39:255—263.

Unkulvasapaul, M and W Simachava 1986. A report on the coastal water quality in Patong and Karon Bas, Phuket Office ofthe National Environment Board, Bangkok.

Welander P. 1957. Wind action on a shallow sea: some generalizations ofEkman's theory. Tellus 9:45—52.

Yodcc, K. 1994. Bioeconomics of small scale fisheries in the artificial rcefareas in Ranong Province, Thailand. In: The effect ofartificial reefinstallation on the hiosocioeconomics ofsmall—scale fisheries in Ranong Province, Thailand. BOBP/WP/97, pp. 67—86.

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COMMUNITY STRUCTURE AND BIOMASS OF SEAGRASS BEDS IN THE ANDAMAN SEA. I. MANGROVE-ASSOCIATED SEAGRASS BEDS'

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ABSTRACT

The Asean-Australia Marine Science Project "Living Coastal Resources" inctuded studies on Mangrove associated seagrass beds at 10 stations. Two species of seagrasses were found at almost all transects: Enhalus acoroides (33.4% coverage) and Halophila ovalis (18.2% coverage). Five species occurred sparsely: Thalassia hemprichii, Cymodocea rotundata, Halodule uninervis, Halodule pinifolia and Halophila beccarii. The overall grass coverage was 63%. Thtat seagrass biomass ranged fivm 55-1941 g w. w m^2 corresponding to 32-297 g d.w. m^2. Leaf and root-rhizome biomasses of the 7 species were estimated Thalassia hemprichii had the highest above-ground and below-ground biomass.

1. INTRODUCTION

Seagrasses **are common** in shallow marine waters throughout tropical and temperate regions of the world (den Hartog, 1970; McRoy and Helfferich, 1977; Phillips and McRoy, 1980). However, in a recent 840-page treatise on seagrass biology (edited by Larkum, *et at.,* 1989) only 8% of the pages dealt with tropical seagrasses. This indicates how poorly known these tropical resources are. Recently more information has been published on seagrasses of Southeast Asia and Indo-West Pacific region [Alcala, 1991 (Ed.); Chou and Wilkinson, 1992 (Eds.) and Pollard, *et* at., 1993 (Eds.)].

Based on estimated below-ground biomass for many seagrasses, Zieman and Wetzel (1980) and Thayer, *et* at. (1984) suggested that roots and rhizomes contributed substantial amounts of organic matter derived from the production of roots and rhizomes of seagrass.

Biomass values of above-ground and below-ground for seagrasses are summarized by Lewis, *et at.* (1985) and Virnstein and Howard (1987). But limited information is

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available on production and utilization of organic matter originating from roots and rhizomes of seagrass in the Asean region. Similarly, only a few studies on community structure, primary production and biomass of seagrasses have been reported from this region (Estacion and Fortes, 1988; Azkab, 1991; Rollon and Fortes, 1991). Seagrass habitat utilization by groups of animals, such as fishes and crustaceans, was investigated and reviewed by Dolar (1991), Sudara, et al. (1991), and Vergara and Fortes (1991).

Investigations of grass beds of the Andaman Sea were conducted under the ASEAN-Australia cooperative programme on marine science. Three types of seagrass beds have been identified along the Andaman Sea coast of Thailand (Chansang and Poovachiranon, 1994): 1) mangrove-associated seagrass beds; 2) seagrass beds on shallow sandy bottom; and 3) seagrass beds associated with coral reefs. This study provides information on seagrass species composition, biomass and zonation of mangrove-associated seagrass in the Andaman Sea. The aim is to increase the knowledge of seagrass contributions to coastal ecosystems in Thailand.

2. MATERIALS AND METHODS

2.1 Site description

The Andaman Sea west coast of Thailand is approximately 740 km long. The shoreline is characterised by mangroves, river mouths and sandy beaches. Fringing reefs are commonly present around islands or rocky outcrops. The climate of the area is under monsoonal influence. There are two dominant seasons, viz., a rainy season dominated by southwest monsoon (May-October) and a dry season when Northeast Monsoon predominates (November to April). The tide is semidiurnal with a range from 1.1-3.2 m. Tide was measured at mean low water (MLW) and mean high water (MHW) at various stations along the Andaman Sea from 1988-1992. Mean sea level is about 2.2 m (calculated from Tide Table of the Hydrographic Department, Royal Thai Navy).

Ten mangrove-associated seagrass beds were studied (Fig. 1). Four sites were in Phuket province: Banthayai (station 2), Banlaemphappha (station 3); Ao-Chalong (station 4) and Thachatchai (station 8); two study sites in Krabi province at Ao-Thalane (station 5) and Ao-Nang (station 6); three sites in Phang-nga province at Banpakklongyid (station 7), Yaoyai-1 Island (station 9) and Ao-Tonong (station 10). One site was in Trang provice at Talibong-1 Island (station 1). The grass beds in Phang-nga province represent the greatest area of mangrove-associated seagrass beds among the 10 stations.

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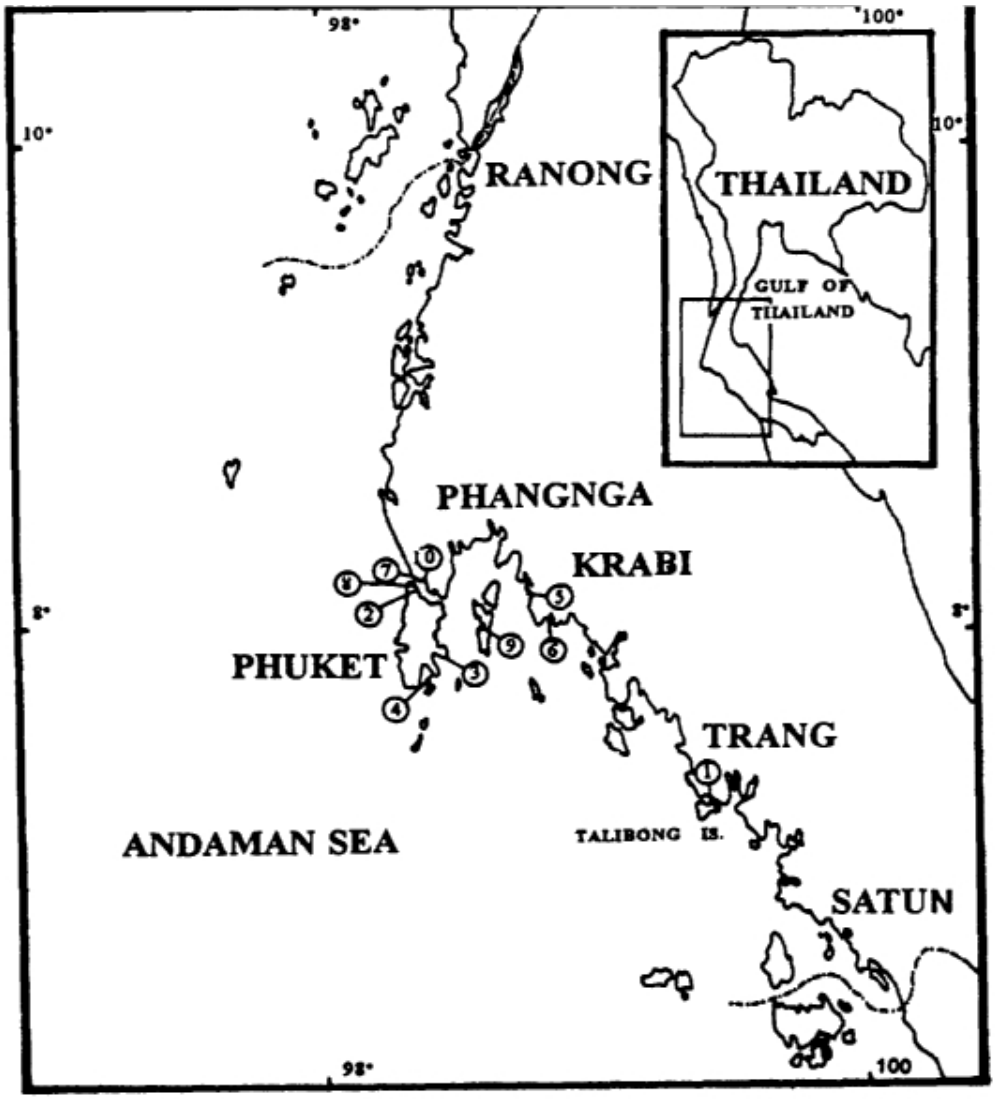

Fig. 1. Mangrove-associated seagrass beds along the Andarnan coast of Thailand. Numbered circles show 10 stations of this study.

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2.2 Transect profile and biomass study

The line tansect method of Dartnall and Jones (1986) was used for transect profile, percentage seagrass species coverage, and seagrass biomass. Most grass beds were exposed during low ride. Transects started at mangrove edges and ran perpendicular to the shoreline. Transect depth profiles were measured at maximum high tide at 50 m intervals using small buoys placed on the transect during low tide. Mean water depth for each species was obtained by averaging the range of depth distribution at each site. The shore profile was calculated in relation to MHW using time of day and tidal data for the Andamnn Sea.

Four quadrats (50 x 50cm) were sampled at random along the transects (unless otherwise indicated). Leaves, roots and rhizomes were collected by hand inside each quadrat. The samples were rinsed, cleaned of adhering debris and sorted to species. The shoots of each species were weighed and material of the same species combined from the four samples. Fifty shoots from each species were seperated into leaves, rhizomes and roots for biomass study. Each portion was blotted, weighed wet (w.w.), and dried at 30°C to constant weight (d.w.). The above and below ground biomasses were weighed for each station and species. Finally, percentage species coverge and species composition were estimated along transect lines. Intervals for these estimates were selected after visual inspection of the grass bed.

3. RESULTS

3.1 The individual transects

Mangrove-associated grass beds are characteriscd by relatively narrow bands of grass bed adjacent to mangroves fringing bays or sheltered shorelines. The upper part of a grass bed is intertidal. Sediments are either homogenously composed of very fine to medium sand, or non-homogenous changing along the transect in the offshore direction from very fine sand to fine sand or mud, or from fine sand to coarse sand.

Fig. 2 shows characterstic shore profiles and species composition expressed as the percentage seagrass cover of beds associated with mangrove communities. Each grass bed profile stretched 250-650 m and had different topogaphy (slope) and substratum.

Station 1: 250 m transect. The grass bed started 50 m from the mangrove at 1.5 m depth. The edge of the bed reached a depth of 2.3 m at MHW. The bed was dominated by Enhalus *acoroides* occurring continously to the end of the seagrass bed. E. *acoroides* had 70% coverage in the area between 100 and 150 m. Sparse patches of *Halophila ovalis* mixed with *E. acorides* occurred at 50 and 200 m. The substrata were fine to very fine sand.

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Station 2: 260 m transect. Seagrass covered approximately 60% of the area. The depth varied from 1.8 to 2.0 m in the upper part of the transect (50- 100 m). From 100 m and seawards, the depth increased from 2-4.65 m at the end of transect. The vegetation was composed of mixed stands of *Cymodocea rotundata, Thalassia hemprichii and Halophila ovalis* in the 50-100 m interval. In the area between 100 and 260 m, the beds comprised *Enhalus acoroides, Cymodocea rotundata, Tbalassia bempricbii and Halopbila ovalis.* These species had coverage of 18.6, 17.9, 15 and 8.5% respectively. Homogeneous, medium sand substratum dominated this grass bed.

Stations 3 and 4: 260-270 m transects. Seagrass beds of these stations were similar in terms of length, slope and species composition. Only one species, *Enbalus acoroides,* had a patchy occurrence in the upper and lower tidal zones at a maximum depth of 2.8 m (station 3). It was infrequent at station 4, where patches occurred at a maximum depth of 2.1 m. Seagrass coverage was 47.4% on very fine sand substratum in the area between 100 and 260 m at station 3. The coverage was 4% on very fine sand to muddy substratum in the area between 130 and 270 m at station 4.

Station 5: 350 m transect. A pure stand of *Halopbila ovalis* stretched across the total transect from shallow water to the maximum depth of 2.3 m. Coverage ranged from 50-90% (mean 79.17%.). The substratum was fine sand.

Station 6: 400 m transect. Seagrass beds extended from the mangrove line and 200 m seawards to a water depth of 2.4 m. Depth increased to 2.5 m in the area between 200 and 400 m. Cymodocea *rotundata* was the most common species (56% coverage) followed **by** *Halophilo ovalis (25%), Thalassia bempricbii* (7%), and *Halodule pinifolia (7%).* The substratum was fine sand.

Station 7: 470 m transect. *Tbalassia bempricbii* was common in the upper part. Coverage was 20 to 50%. Water depth increased from 1.3 m to 1.8 m in the area between 50 and 200 m. *Tbafassia bempricbii, Halopbila ovalis, Cymodocea rotundata* and *Enbalus acoroides* were found in this area. Depth increased progressively to 4.8 m at MHW over the stretch from 200 m to the end of the transect. Seagrass occurred to the maximum depth of *4.8* **m.** *Halophih ovalis* grew in a mixed community with *Enhalus acoroides* and *Tbalassia bempricbii.* The coverage of *Halopbila ovalis* ranged from 1 to 40%. The coverage of *Cymodocea rotundata* ranged from 5-l 0% in the area between 70 and 170 m. *Enhalus acoroides* occurred in two areas: one zone between 100 and 120 m; the other one between 270 and 390 m. Coverage ranged from 15-67%. The substratum type changed from medium sand to coarse sand offshore.

Station 8: 500 m transect. Seagrasses were moderately abundant. Depth increased from 1.5-2.4 m in the area between 50 and 200 m, but decreased again to 1.8 m at 250 m, after which it increased to 2.8 m at 400 m. The depth decreased again at the outer edge of

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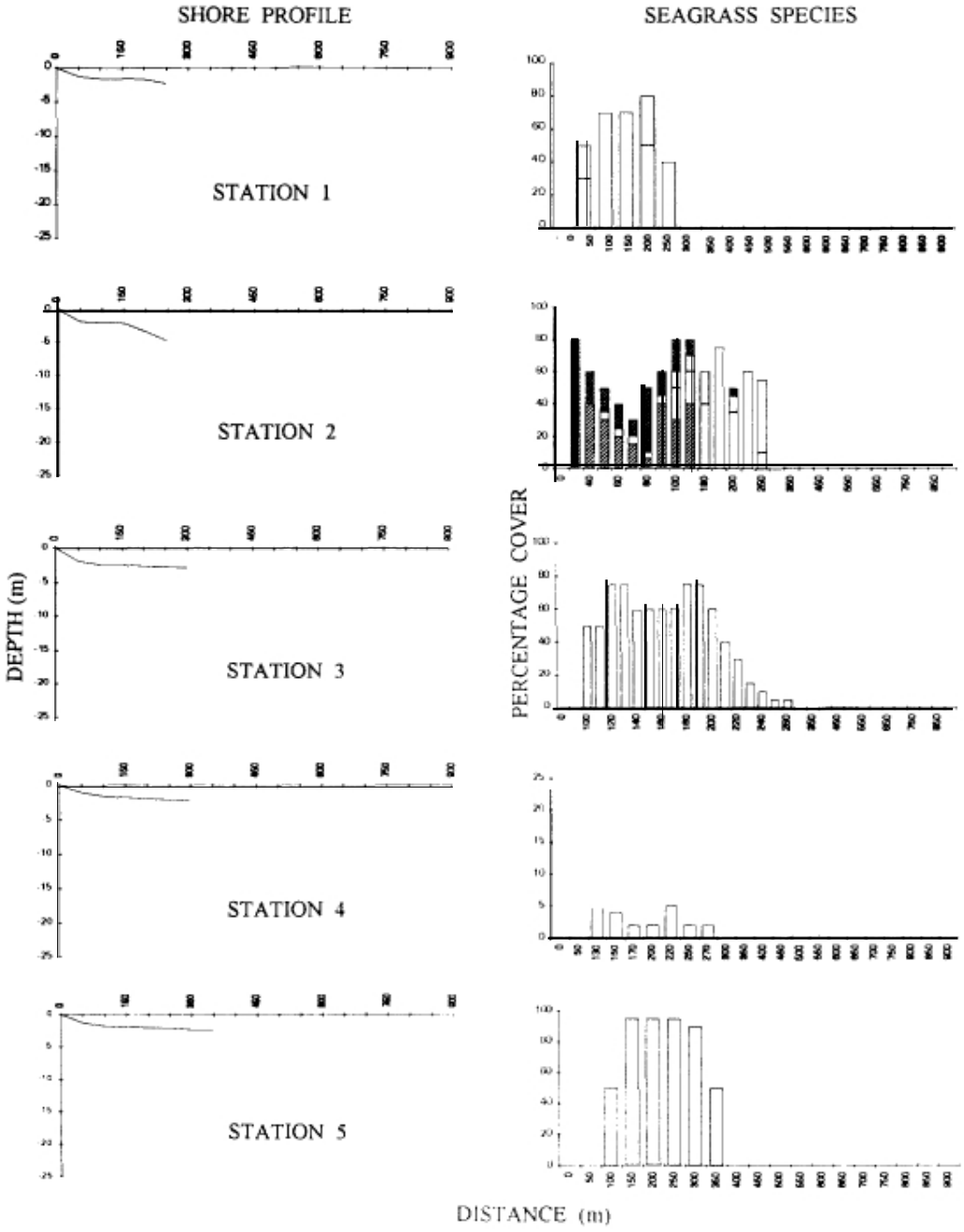
SHORE PROFILE
SEAGRASS SPECIES
STATION 1
STATION 2
STATION 3
STATION 4
STATION 5
DEPTH (m)
PERCENTAGE COVER
DISTANCE (m)

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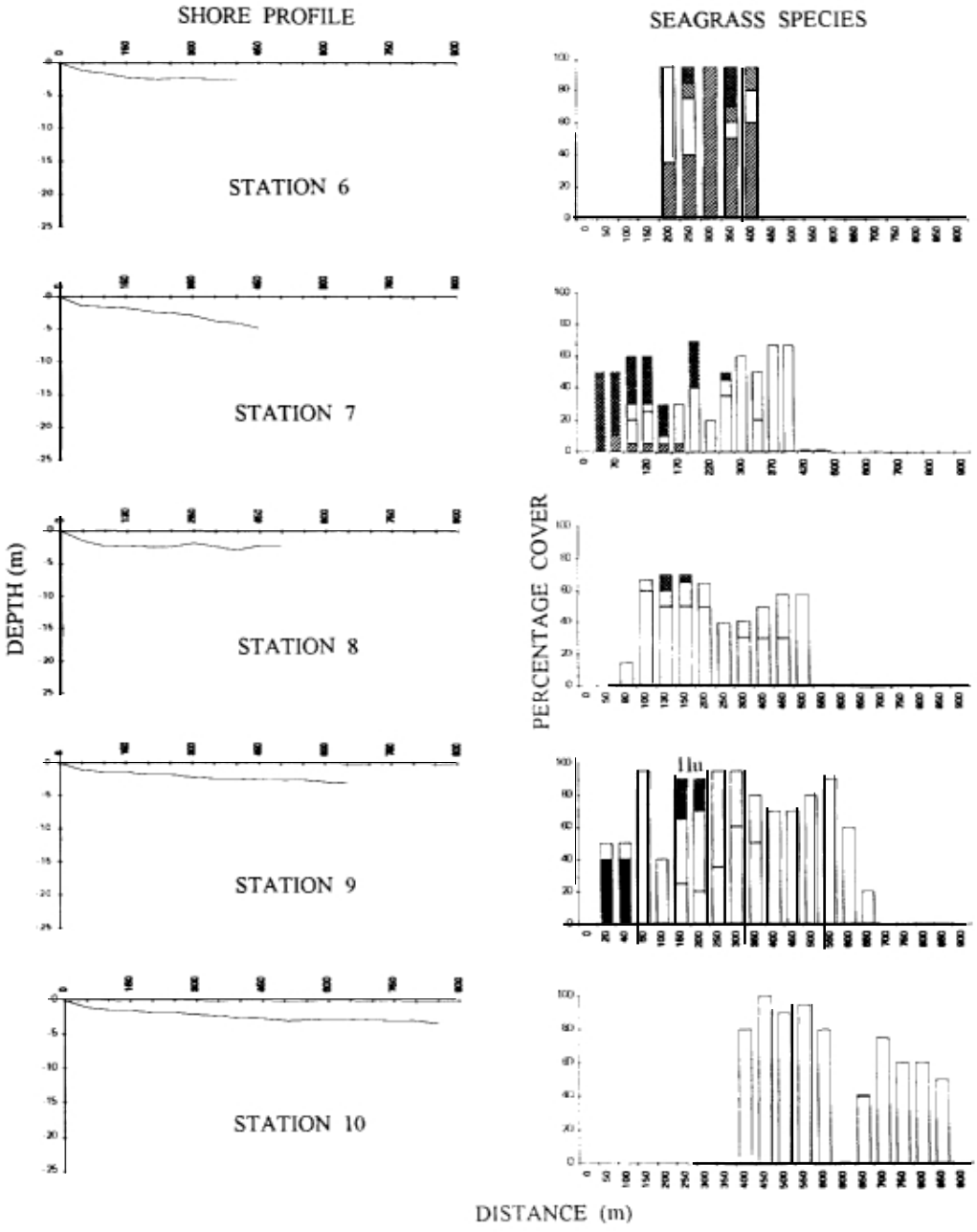

Figure 2. Mangrove-associated seagrass beds along the Andaman Sea coastShore profiles of 10 seagrass beds (left) and percentage cover (right). The following ahbrivations has been used to show the percentage cover of individual species: = *Cymodocea rotundata,* = *Enhalus acoroides,* = *Halophila beccarii,* *Halophila ovalis,* : *Halodule pinifolia,* Hu = *Halodule uninervis,* and = *Thalassia hemprichii.*

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the seagrass bed. Patches of *Enhalus acoroia'es* and *Halophila ovalis* were distributed throughout the area. Patches of *Thalassia hemprichii* occurred in areas between 130 m and 150 m. The coverage varied accordingly: *Enhalus acoroides (15-60%), Halophila ovalis* **(10-**40%), and *Thalassia hemprichii* (5-10%). Substratum was hornogenous, medium sand.

Station 9: 640 m transect. Water depth increased gradually from 1.0 m to 3.0 m along the stretch from 50 m to the edge of the seagrass bed. In the upper tidal zone, approximately at 20-50 m, *Holophila beccarii* (40% coverage) occurred together with *Halophila ovalis.* Otherwise, the bed comprked abundant *Halophila ovalis* (10-95% coverage) until 350 m. *Halophila ovalis Thalassia hemprichii, Enhalus acoroia'es* and *Halodule uninervis* were found in the area between 150 and 200 in. Further seawards, Enhalus acoroides became more abundant (20-90% coverage). Infrequent patches of *Enhalus acoroides* were noted further seawards from the outer edge of this seagrass bed. Substratum was a mixture of fine sand and very fine sand.

Station **10:** 850 in transect. Depth increased from 1.5 **in** (at 50 in) to 3.3 in at the outer edge of the bed. A monospecific stand of *Enhalus acoroides (73%* coverage) began at 400 m and stretched to the end of the grass bed. However, a sparse stand of *Halophila ovalis* (1% coverage) occurred in the area between 600 and 650 in. Substratum was coarse sand in the upper intertidal and changed to medium sand in the upper subtidal zone.

3.2 Species coverage

The overall seagrass coverage was 62%, leaving 38% of the area without vegetation. *Enhalus acoroides* was most abundant (34% coverage). *Halophila ovalis* covered 17% of the total area of grass beds while *Cymodocea rotundata* and *Thalassia hemprichii* covered 4 and 6%, respectively. The 3 species *Halophila beccarii, Halodulepinifoloa,* and *Halodule uninervis* were rare in the mangrove-associated seagrass beds and covered 0.8, 0.7, and 0.2%, respectively.

3.3 Distribution of seagrasses and water depth

Chansang and Poovachiranon (1994) showed that depth distribution of seagrass species was correlated with secchi-depth for all types of grass beds in the Andaman Sea. *Halophila beccarii* was oniy found close to the mangrove edge *in* the upper tidal zone at a depth of 1 m (Fig. **3).** The following 7 species occurred to the end of individual transects: *Halophila ovalis* and *Enhalus acoroides* from the intertidal zone to >4.0 **in** depth (sparse stands of Halophila ovalis at a maximum depth of 4.8 m). E. acoroides formed dense meadows in deeper water (maximum depth 4.7 m) but patches occurred in the intertidal zone. Patchy stands of *Halodule uninervis* occurred in the lower tidal zone (1.9 **in).** This **species** was **not** found deeper than 2.1 in. *Halodule pinifolia* occurred in shallow water at 2.4 m

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water depth. It was only found at one site (station 6). Cy*modocea rotundata and Thalassia hemprichii were* abundant in shallow water (maximum depth 3.3 m).

3.4 Mean total biomass

The lowest mean total biomass was 557 g w.w. m^{-2} (Station5), and the highest one was 1941 g w.w. m^{-2} (Station 10) corresponding to 31.6 and 296.7 g d.w. m^{-2}, respectively (Fig. 4A). The mean biomass at station 4 was 247.3 g d.w. m^{-2}, while stations 7, 3, 9 and 2 had 105, 109.9, 132.1 and 172.3 g d.w. m^{-2} respectively. The remaining sites had mean biomasses less than 100 g d.w. m^{-2}, *viz.*, station 5, 1, 6 and 8 with 31.6, 77.4, 97 and 97.3 g d.w. m^{-2}, respectively. Grass beds with high biomass were dominated by *Enhalus acoroides* which occurred in abundance at station 10 (Fig. 2). *E. acoroides* is the largest seagrass species recorded in the Indo-Pacific. Low biomass was found when small *Halophila ovalis* occurred in a pure stand, e.g., at station 5.

3.5 Comparison of above-ground and below-ground biomass

Fig. 4 B and C show the mean total biomass per unit area of above-ground and below-ground biomass. Individual species of seagrass are listed in Table 1 which shows the mean biomass per unit area of leaves (above-ground biomass), roots, and rhizomes (below-ground biomass). The relative proportions of leaves, roots and rhizomes were calculated for individual species and grouped into the following three categories:

1. Relatively high above-ground, and low below-ground biomass

Halophila ovafis (total biomass 25.08gd.w. m^{-2}). A relatively high above-ground biomass (56%). Rhizomes comprised 28%.

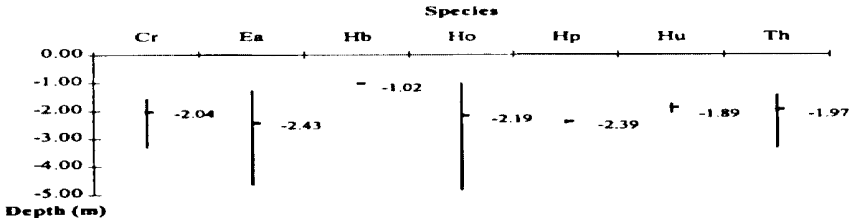

Fig. 3. Mangrove-associatedet scagrass beds along the Andaman Sea coast. Encountered species of seagrass as a function of mean depth. Bars indicate depth range. Cr = *Cymoducen* rotundata, Ea = Enhalus acoroides, Hh = *Halophila beccarii,* Ho = *Halophila ovalis,* Hp = *Halodule pinifolia,* Hu = *Halodule uninervis,* and Th = *Thalassia hemprichii.*

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2. Relatively low above-ground, and high below-ground biomass

Halodule pinifolia (total biomass 26.03 g d.w. m^{-2}) 22% above-ground biomass. Rhizomes dominated the below-ground biomass (48%). *Enhalus acoroides* (total biomass 136.62 g d.w. m^{2}) 29% above-ground biomass. This species had the highest rhizome biomass (64%). Halodule *uninervis* (total biomass 2.97 g d.w. m^{-2}) 36% above-ground biomass. Rhizomes dominated the below-ground biomass *(39%). Halophila beccarii* (total biomass 13.67 g d.w. m^{-2}) 40% above-ground biomass. Rhizomes comprised 44 % of the total biomass.

3. Above-ground biomass relatively similar to below-ground biomass

Thahssia hemprichii (total biomass 239.77 g d.w m^{-2}) 46% above-ground biomass. Below-ground biomass was dominated by roots (39%). This was in contrast to the other seagrasses where root biomass was low, relative to the biomass of rhizomes. *Cymodocea roturdata* (total biomass 94.2 g d.w. m^{-2}) 47% above-ground biomass. Rhizomes comprised 37%.

3.6 Shoot number

Fig. 4D shows the mean shoot number estimated per unit area for individual species of seagrass. The pure stand of *Halophila oval is* at station 5 had a very high mean shoot number. Very low shoot densities were found at stations 3, 4, and 10 which comprised pure stands of *Enhalus acoroides.*

Table 1. Biomass(g d.w. m^{-2}) and ratio of leaf, root and rhizome of the species.

Species	Biomass (g d.w. m^{-2})			Ratio Leaf: Root: Rhizome
	Leaf	Root	Rhizome	
Cymodocea ro tundata	44.00	15.55	34.65	3:1:2
Enhalus acorodies	56.75	13.97	125.90	4:1:3
Halophila becrarii	5.44	2.16	6.07	3:1:3
Halophila ovalis	13.91	4.06	7.11	3: 1:2
Halodule pinifolia	5.72	7.8 1	12.50	1:1:2
Halodule uninervis	1.07	0.73	1.17	1: 1
Thalassia hemprichii	105.8	94.49	40.00	3:2:1

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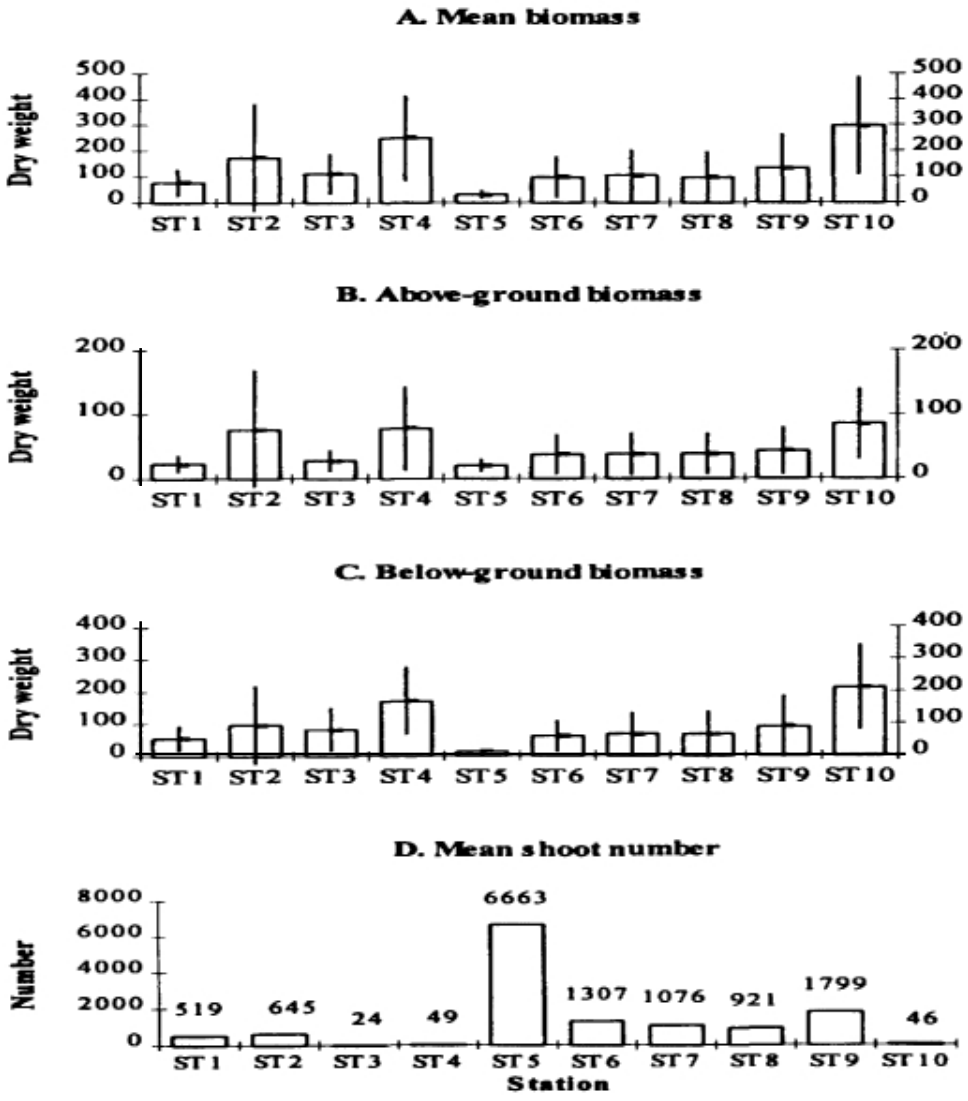

Fig. 4. Mangrove-associated seagrassbeds along the Andaman Sea coast. Estimates at station 1-10 (A) Mean total biomass ±SD (gd.w. m^{-2}). (B) Mean above-ground biomass ±SD (gd.w. m^2). (C) Mean below-ground biomass ±SD (g d.w. m^2). (D) Mean shoot number m2.

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4. DISCUSSION

Depth distribution of seagrass species is limited by light availability (Fig. 3). Seagrass was only found in shallow (usually turbid) water adjacent to mangroves in the Andaman Sea. In comparison, beds were found at water depths >10 m along the north east Australian coast between Cape York and Hervey Bay (Lee Long, et *al.,* 1993). This discrepancy is presumably due to differences in water transparency.

The present study showed sediment conditions ranging from mud to coarse sand. However, the muddy substratum at station 4 may reflect environmental disturbance since the site was located in a bay which was dredged for tin ore in 1980- 198 1. The coverage and biomass of seagrasses were also very low at this station. Pethpiroon (pers. comm.) visited the site during 1974-1975 and found luxurious growth of seagrass in that area. Apart from this station, most seagrasses were found in fine to medium sand substrata despite being adjacent to mangrove areas. *Enhalus acoroides* was the most common species in mangrove associated grass beds (Fig. 2). It occurred in 8 of 10 stations and had the highest coverage (34%). *Halophila ovalis* ranked second. It was found in 7 of 10 stations (16.5% coverage). These two species also had the widest range of depth distribution (Fig. 3) which implies that they can tolerate exposure at low tide.

The temperate seagrass *Zostera marina* displays considerable variation in above-ground (l-100 g d.w. m^{-2}) and below-ground (5-1600 g d.w. m^{-2}) biomasses. This wide range is caused by variation in environmental parameters as well as different sampling methods and design (Thayer, *et al.,* 1984; Kenworthy and Thayer, 1984). Total biomass of seagrass ranged from 31.6 to 296.7 g d.w. m^{-2} in this study. The maximum biomass was low compared to Indonesia, where biomass ranged from 236.8 to 676 g d.w. m^{-2} (Azkab, 1991), and other parts of Asia with 2.1 to 862.7 g d.w. m^{-2} (Kiswara, 1992).

Above-ground mean biomass of *Enhalus acoroides* ranged from 23 to 86 g d.w. m^{-2} in this study (stations 3 and 10), which was similar to other studies in the region. Fortes (1992) found leaf biomass to be 10.60-85.23 g d.w. m^{-2} in *Enhalus acoroides,* and 0.18-25.41 g d.w.m^{-2} in *Tbalassia hemprichii.* Coles, et al. (1989) reported maximum above-ground biomass of 158.3 g d.w. m^{-2} in the Gulf of Carpentaria, and 99.6 g d.w. m^{-2} between Cape York and Cairns.

With the exception of *Tbalassia bempricbii,* below-ground portion weighed more than the above than above-ground portion. It was especially pronounced in *Enhalus acoroides* and *Halodule spp.* which were the most common species. Thus the below-ground biomass constitutes a significant pool of organic matter which can contribute to nutrient cycles in the sediment.

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In most of our surveys, variability was higher with leaf standing crop than with roots and rhizomes. We speculate that this is related to grazing, physical damage, non-lethal human disturbance, and that leaves have faster turnover rate than roots and rhizomes.

Thalassia hemprichii communities showed an epiphyte contribution of about 37% of the total annual mean net production (seagrass plus epiphyte) at one site, and 19% at another one in Papua New Guinea (Heijis, 1984). In comparison, only small amounts of macroalgae and epiphytes were observed at seagrass beds in the Andaman Sea. We are unable to explain this difference. Further studies are needed on environmental parameters and ecological factors, such as the presence of grazers.

5. ACKNOWLEDGEMENTS

Staff of PMBC is thanked for assistance during field surveys and in laboratory. This work was supported by the ASEAN-Australia Economic Cooperative Programme in Marine Science, Project II: Living Resources in Coastal Areas. Excellent cooperation with the National Environmental Board of Thailand is gratefully acknowledged. We appreciate the assistance and comments by Dr. Mark S. Fonseca, Dr. D.W. Klumpp, Dr. D.M. Dexter, and Professor Jorgen Hylleberg.

6. REFERENCES

AIcala, A.(Ed). 133 1. Proceedings of the Regional Symposium on Living Resources in Coastal Areas. Marine Science Institute, Universiryofthe Philippines, Quezon City, Philippines. pp. 333-385.

Azkab, M.H. 199 1. Study on seagrass community structure and biomass in the southern part of Seribu Islands. In: A.C. Alcala (Ed.). Proceedings of the Regional Symposium on Living Resources in Coastal Areas, 30 January- 1Februaty 1989, Manila, Philippines. Marine Science Institute, Universityofthe Philippines, Quezon City, Philippines. pp. 353-362.

Chansang, H. and S. Poovachiranon. 1994. The distribution and species composition ofseagrass bed along the Andaman Sea coast of Thailand. Phuket Marine Biological Center Research Bulletin 59: 43-52.

Chou, L.M. and CR. Wilkinson (Eds.). 1992. Third ASEAN Sctence and Technology Week Conference Proceedings. Marine Science: Living Coastal Resources. Department of Zoology, National University of Singapore and National Science and Technology Board, Singapore. Vol. 6: 223-3 17.

Coles, R.G., I.R. Poiner, and H. Kirkman. 1989. Regional studies - Seagrasses of North-Eastern Australia. In: Larkum, A.W.D., A.J. McComb and S.A. Shepherd (Eds.). Biology of Seagrasses. A treatise on the biology ofseagrass with special reference to the Australian region, pp. 261-278.

<<

Dartnall, A.J. and M. Jones (Eds.). 1986. A manual of survey methods: living resources in coastal areas. ASEAN-Australia Cooperative Program on Marine Science Handbook. Australian Institute of Marine Science Townsville. 167p.

den Hartog, C. 1970. The seagrasses of the world. North-Holland Publishing Amsterdam. 275p.

Dolar, M.L.L. 199 1. A survey on the fish and crustacean fauna of the seagrass bed in north Bais Bay, Negros Oriental, Philippines. In: A.C. Alcala (Ed.). Proceedings of the Regional Symposium on Living Resources in Coastal Areas, 30 January-l February 1989, Manila, Philippines. Marine Science Institute, University of the Philippines, Quezon City, Philippines. pp. 367-377.

Estacion, J.S. and M.D. Fortes. 1988. Growth rates and primary production *of Enhalusacoroides* (L.F.) Royle from Lag-it, North Bais Bay, Philippines. Aquatic Botany 29:347-356.

Fortes, M.D. 1992. Comparative study ofstructure and productivity ofseagrass communities in the ASEAN region. In: Chou, L.M. and C.R. Wilkinson (Eds.). Third ASEAN Science and Technology Week Conference Proceedings. Marine Science: Living Coastal Resources. Department of Zoology, National University of Singapore and National Science and Technology Board, Singapore 6: 223-228.

Heijs, F.M.L. 1984. Annual biomass and production of epiphytes in three monospecific seagrass communities of *Thahsia hemprichii* (Ehrenb.) Aschers. Aquatic Botany29: 195-218.

Kenworthy, W.J. and G.W. Thayer. 1984. Production and decomposition of the roots and rhizomes of seagrass, *Zostera marina* and *Thalassia testudinum,* in temperate and subtropical marine ecosystems. Bulletin of Marine Science 35(3): 364-379.

Kiswara, W. 1992. Community structure and biomass distribution of seagrasses at Banten Bay, West Java-Indonesia. In: Chou, L.M. and C.R. Wilkinson (Eds.).Third ASEAN Science and Technology Week Conference Proceedings. Marine Science: Living Coastal Resources. Department of Zoology, National University of Singapore and National Science and Technology Board, Singapore 6: 24 1- 250.

Larkum, A.W.D., A.J. McComb, and S.A. Shepherd (Eds.). 1989. Biology of Seagrasses. A Treatise on the Biology of seagrasses with Special Reference to the Australian Region. Elsevier, Amsterdam. 840

Lee Long,WJ., J.E. Mellors and RG. Coles. 1993. Seagrasses between Cape York and Hervey Bay, Queensland, Australia. Australian Journal of Marine and Freshwater Research 44: 19-31.

Lewis Ill, R.R., M.J. Durako, M.D. Moffler, and R.C. Phillips. 1985. Seagrass meadows of Tampa Bay: A Review. In: S.F.Treat, J.L. Simon, R.R. Lewis III and R.L. Whitman (Eds.). Proceedings Tampa Bay area Scientific Information Symposium. Florida Sea Grant College., Report No. 65, pp. 21 O-246.

McRoy, C.P. and C. Helfferich. 1977. Seagrass ecosystems, a scientific perspective. Marcel Dekker, New York. *314* p.

<<

Philips, R.C. and C.P. McRoy. 1980. Handbook of seagrass biology, an ecosystem perspective. Garland STPM Press, New York. 353 p.

Pollard, PC., I. Kioke; H. Mukai and A. Robertson (Eds.). 1993. Tropical Seagrass Ecosystems; Structure and Dynamics in the Indo-West Pacific. Australian Journal of Marine and Freshwater Research 44: 233 p.

Rollon, R.N. and M.D. Fortes. 1991. Structural affinities ofseagrass communities in the Philippines. In: A.C. Alcala (Ed.). Proceedings of the Regional Symposium on Living Resources in Coastal Areas, 30 January-l February 1989, Manila, Philippines. Marine Science Institute, University of the Philippines, Quezon City, Philippines. pp. 333-346.

Sudara, S., S. Nateekanjanalarp, T. Tamrongnawasawat, S. Satumanatpan and W. Chindonnirat. 1991. Survey offauna associated with the seagrass community in Aow Krabane, Chanthaburi, Thailand. In:-A.C . Alcala (Ed.). Proceedings of the Regional Symposium on Living Resources in Coastal Areas, 30 January-l February 1989, Manila, Philippines. Marine Science Institute, University of the Philippines, Quezon City, Philippines. pp.347-352.

Thayer, G.W., W.J. Kenworthy and MS. Fonseca. 1984. The ecology of eelgrass meadows along the Atlantic coastal of North America: A community profile. U.S. Fish wildlife Serv., Biol. Serv. Program FMS/ OBS. 147 p.

Vergara, S.G. and M.D. Fortes. 199 1. A survey ofichthyofauna from five seagrass sites in the Philippines. In: A.C. Alcala (Ed.). Proceedings of the Regional Symposium on Living Resources in Coastal Areas, 30 January-l February 1989, Manila, Philippines. Marine Science Institute, Universityofthe Philippines, Quezon Citv, Philippines. pp. 385-396.

Virnstein, R. W. and R. K. Howard. 1987. Motile epifauna of marine macrophytes in the Indian River Lagoon, Florida. II. Comparisons between drift algae and three species of seagrass. Bulletin of Marine Science 41(l): 13-26.

Zieman, J.C. and R. G. Wetzel. 1980. Methods and rates of productivity in seagrasses. In: R C Phillips and C.P. Mcroy, (Eds). Handbook of seagrass biology, an ecosystem perspective. Garland STPM Press, New York, pp. 87-116.

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SOCIO-ECONOMIC CONDITIONS OF SMALL-SCALE FISHING COMMUNITIES AND THE IMPLICATIONS FOR COMMUNITY-BASED FISHERIES MANAGEMENT IN PHANG-NGA BAY

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1. INTRODUCTION

Thailand has a total population of 58 million, with Gross Domestic Products (GDP) of **3,161** million baht and per capita income of 53,357 baht in 1394. Fisheries accounts for 1.5 percent of Thailand's GDP and 14.9 percent of the agricultural sector's GDP. However, fisheries in Thailand has rapidly developed during the last few years. It also contributes to economic development of the country in various aspects. Fisheries products are a major source of protein for Thai people. Annual average consumption is approximately 27 kg per person.

Development of the marine fishery has led to several interlinked industries. The marine product processing industry in Thailand, for example, was developed before any other countries in the Asian region. The industry expanded so rapidly that domestic raw materials became inadequate and had to be imported from abroad. As a result, Thailand has become the world's largest exporter of fisheries products. Thailand accounted for 10 percent of the total world fish export (110,283 million baht) in **1993.**

However, fisheries development in Thailand has largely focused on commercial fisheries as small-scale fishermen play less of a role in both socio-economics and politics. Consequently, most benefit generated from the development process or government policy has gone to commercial-scale fishermen rather than small-scale fishermen. This is in spite of the fact that the latter is four times greater than the former. Therefore, it is necessary to develop a system of management that provides opportunities to small-scale marine fishing communities to manage fishing resources by themselves so that they can survive in current circumstances.

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2. STRUCTURE OF COASTAL FISHERIES IN THAILAND

2.1 Households and fishing boats

The coastline of Thailand is 2,614 kilometers in length. Twenty three provinces are situated along the coast. The Department of Fisheries has divided the provinces into five coastal fishing regions. Phang-nga Bay is in Region 5, which covers the coastal areas of the Andaman Sea. Regions l-4 cover the Gulf of Thailand and the fishing gears of these regions are given in Fig. 1.

According to a Preliminary Report on Marine Fishery Census in 1995 NSO (1996), there are 80,701 marine fishing households which can be classified into three types. Households that engage exclusively in fisheries account for 62.3 percent. Households engaged in coastal aquaculture account for 35 percent. Households engaged in both fisheries and aquaculture account for 3.7 percent. In 1995, 53,313 fishing households were engaged in marine fisheries, of which 88 percent can be classified as small-scale fishing households' and 12 percent can be classified as commercial-scale fishing households (Table 1).

A structural change in Thailand's fisheries has taken place during the last 10 years. From 1985-1990, the number of fishing households and fishing boats decreased by 5.5 percent and 2 percent respectively. (Tables 1 and 2) Small-scale fishing households and small-scale fishing boats decreased by 6.8 and 3.4 percent respectively whereas commercial-scale fishing households and commercial-scale fishing boats increased by 5.5 percent and 7 percent respectively. The decrease in the number of small-scale fishing boats was largely due to the decrease in coastal fishing resources on the one hand and the conflicts between small-scale and the commercial-scale fishermen on the other.

During 1990-1995, the number of fishing households and fishing boats in Thailand increased by 10.1 percent and 4.5 percent respectively (Tables 1 and 2). The increase in fishing households has largely been in commercial fisheries. Commercial scale fishing households account for 15.3 percent of the total increase. Small-scale fishing households account for 9.5 percent of the total increase.

Conversely, the increase in fishing boats has been in the small-scale sector. Small-scale fishing boats account for 6.6 percent of the total increase, while commercial boats have actually decreased in number by 7.5 percent. One reason for the change in commercial boats has been the creation of a boat-tenure system within the commercial fishing sector, which results in a decrease of the number of boats per household.

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l Small-scale fishing households are defined as those who use non-power boats or outhoard-powered boars or inboard-powered boats with less than 10 gross ton engines in fishing operations.

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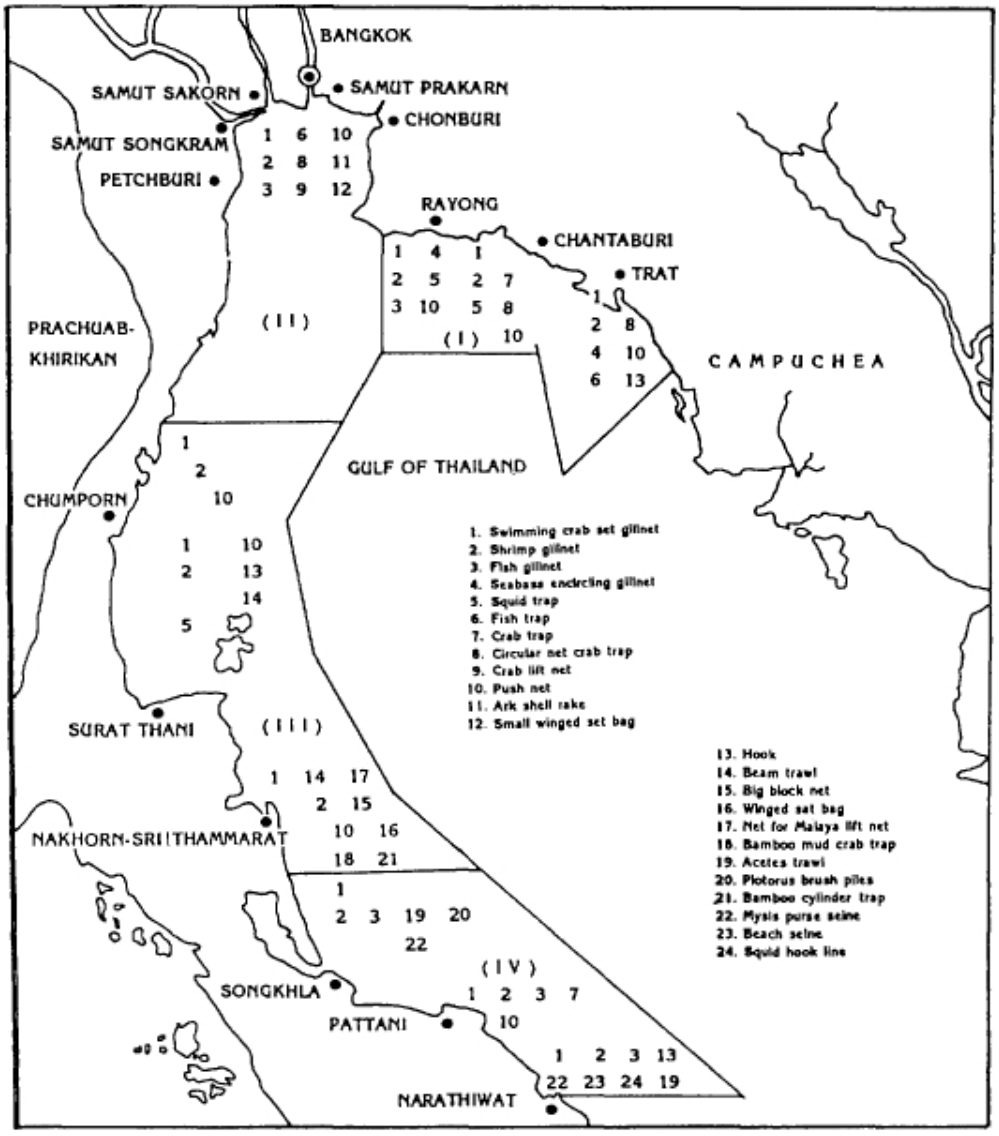

Fig. 1. Map illustrating small-scale fishing gear by Region.

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Table 1. Change in fishing households in Thailand, 1985-1995.

	Small-Scale			Commercial Scale			Total		
Year	Number	%	% of change	Number	%	% of change	Number	%	% of change
1985(1)	46.005	89.8		5240	10.2		51.245	100.0	
1990(2)	42.880	88.6	-6.8	5,528	11.4	5.5	48,408	100.0	-5.5
1995(3)	46,940	88.0	9.5	*6.373*	12.0	15.3	*53,313*	100.0	10.1

Source: (1) NSO and DOF (1987); (2) NSO and DOF (1992); (3) NSO (1996).

Table 2. Number of fishing boats in Thailand classified by type of fishing operations, 1985, 1990 and 1995.

	Small-Scale			**Commercial Scale**			**Total**		
Year	**Number**	*%*	*% of change*	**Number**	*%*	*% of change*	**Number**	*%*	*% of change*
1985(1)	46,053	**862**		7,374	13.8		53,427	100.0	
1990 (2)	44,487	84.9	-3.4	7,887	15.1	7.0	52,374	100.0	-2.0
1995 (3)	47,423	86.7	6.6	7,292	13.3	-7.5	54,715	100.0	4.5

Source: (1) NSO and DOF (1987); (2) NSO and DOF (1992); (3) NSO (1996).

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Three major factors have led to the increase in small-scale fishing households and small-scale fishing boats during the last five vears. First, the population in coastal fishing communities has increased. Second, coastal fishery resources have partly, recovered bacause of artificial reefs. The reefs have become additional fishing areas that have also been able to inhibit coastal trawl fishing. Third, fishing communities are enthusiastic about looking after fishing areas by themselves.

2.2 Production of small-scale fisheries

According to DOF marine fishing communities production statistics (1995), production of small-scale fisheries in 1993 was 154,467 tonnes per year. This accounts for 5.6 percent of the total catch from marine fisheries in 190.3. The catch has increased since 1984 and reached the highest amount of 159,825 tonnes in 1989 and decreased thereafter, with some yearly fluctuations.

The species composition of the small-scale fisheries catch has been changing considerably throughout Thailand. T he number of squids and crabs have increased, often in substitution for other marine animals. Moreover, the number of shrimps and prawns caught decreases. This is probably due to the expansion of the shrimp culture areas since 1986, especially in areas where pipelines are used to bring in sea water for shrimp culture, and contaminated water is discharged hack to the sea. As a result, the natural production potential of shrimps and prawns resources on the coast of the Gulf of Thailand has decreased. However, the same problem has not yet arisen on the Andaman Sea coast because the area is less intensively used for shrimp culture (Table 3).

Most small-scale fisheries production comes from fishing regions on the coast of the Gulf of Thailand which account for 84.7 percent of the total catch of the small-scale fisheries. The remaining 15.3 percent comes from the Andaman Sea coast. Production of small-scale fisheries from the Andaman Sea coast varies between 20,786 to 24,020 tonnes. It has a tendency to increase during the last five years and reached the highest level in 1392.

3. SOCIO-ECONOMIC CONDITIONS OF SMALL-SCALE FISHING COMMUNITIES

Most small-scale fishing communities are located in the coastal areas of Thailand. In 1995, there were 2,562 fishing communities in Thailand (NSO and DOF, 1995). Of these, 76 percent are situated on the coast of the Gulf of Thailand and 24 percent are on the Andaman Sea coast. In Phang-nga province alone, there are 132 fishing communities which account for 21 percent of the total fishing communities on the Andaman Sea coast.

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Table 3. Production of small-scale fisheries by Region, 1954-1963.

Year	Total catch of Marine Fisheries (MT)	Total Catch of Small-Scale Fisheries		Fishing Ground							
				Gulf of Thailand						Andarnan *Sea*	
		(MT)	% of Total Catch	Region 1 (MT)	Region 2 (MT)	Region 3 (MT)	Region 4 (MT)	Sub-total (MT)	% of Small-Scale Fisheries Production	Region 5 (MT)	% of Small-Scale Fisheries Production
1984	*1.973,000*	138.369	7.0	n.a.	n.a.	na.	na.	na.	na.	n.a.	na.
1985	1,997.200	*141,390*	7.1	16,925	53.721	25,525	24,433	120.604	85.3	20.786	14.7
1986	2,309.500	146,773	6.4	*17,334*	52,155	28,429	25,147	*123.065*	83.8	23,708	16.2
1987	2,540.000	155.316	6.1	14.916	59.999	30,181	28,207	*133.303*	85.8	22.013	14.2
1988	2,337,200	159,353	6.8	18,632	57,708	*29,903*	30,105	136.588	85.6	*23,005*	14.4
1989	2,370,500	159,825	6.7	18,695	57,591	*30.460*	29,842	136.588	85.5	*23237*	14.5
1990	2,362,200	149,989	6.3	20,760	53,762	27,844	25,546	127,912	85.3	22.077	14.7
1991	2,478.600	154,145	6.2	20.808	54.326	29.673	26.102	130.909	84.9	23236	15.1
1992	2,736.400	153,074	5.6	21.426	53,852	28,502	25,544	129,324	84.5	24,020	15.7
1993	2,752,500	154,467	5.6	21,908	52,445	29.933	26,594	130.880	84.7	23,587	15.3

source DOF (1955).

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Moreover, 61.7 percent of the small-scale fishing households in the coastal fishing communities are Buddhists whereas 38.3 percent are Muslims (Panayotou, 1985).

3.1 Structure of the small-scale fishing households

According to the 1990 survey, the average size of the small-scale fishing households is 5.5 persons per household. Fishing households in Region 4 have the largest average size with 7 persons per household. In Region 5, Region 2, Region 1 and Region 3, the average sizes are 5.5, 5.3, 5.1 and 5.1 persons per household respectively. It was found that custom and religion have effects on the size of fishing households. For instance, in Region 4 (consisting of Nakorn Sri Thammarat, Songkhla, Pattani and Narathiwns Provinces) and in Region 5 (Ranong, Phang-nga, Phuket, Krabi, Trang and Satun) where most of the fishing households are Muslim, the average household size is larger. In Phang-nga province alone, where 97 percent of the household; are Muslim, the average size of the small-scale fishing households is 5.5 persons per household (Adulavidhnya, 1980).

3.2 Occupational structure of small-scale fishing households

Apart from their main occupation as marine fishermen, some members of the fishing households may earn additional income from non-fisheries activities. Additional income sources vary and depend on the location of village or fishing community. Examples include activities in fishery sectors such as marine animal culture, marine animal processing and hired labour (fishing boat crew, processing factory labour, shrimp culture labour), activities in agriculture such as rice growing, horticulture, field crop growing and animal raising, other activities such as technician, merchant and small-scale business (shop owner and middlemen). Reasons for supplementary occupation ate;

- low income from fisheries
- instability in fisheries
- unemployed labour in households, especially women
- off-season unemployment

3.3 Income structure of fishing households

Incomes of small-scale fishing households come from various sources. However, the main income is generated from fisheries. According to a recent income and expenditure survey (NW, 1992b), the annual national average income is 58,776 baht. Fisheries income accounts for 80.2 percent of the total. For small-scale fishing households on the Andaman Sea coast and those in Phang-nga province, fisheries income accounts for 77.4 percent and 78.0 percent respectively of the total income (Table 4). Therefore, it can be concluded that the condition of coastal resources is a major factor which determines the income and living conditions of small-scale fishing households.

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Table 4. Average annual income of small-scale fishing household by source, 1990.

Income and Source	National Average		Andaman Sea Coast		Phang-nga	
	Baht/Year	%	Baht/Year	%	Baht/Year	%
Total Income	58,776	100.0	54.098	100.0	50,166	100.0
Cash Income	43,333	73.7	42.257	78.1	39.288	78.3
Fisheries Income :						
- Fishing Income	37,501	63.8	33,765	62.4	29,924	59.6
- Related Fishing Income	1,706	2.9	1,425	2.6	1,952	3.9
- Fish Culture	139	0.2	417	0.8	356	0.7
- Fish Processing	1,567	2.7	1,008	1.9	1,596	32
Non-fisheries Income:						
- Salary and Wage	3,749	6.4	3,051	5.6	2,31 I	4.6
- Farming Income	1,656	2.8	2,279	4.2	4,006	8.0
- Small-scale Business and Services	1,301	2.2	1,577	2.9	960	1.9
- Others	420	0.7	160	0.3	135	0.3
Non-cash Income	12,443	212	11,841	21.9	10,878	21.7
Fishing Income	6216	10.6	5,484	10.1	5,340	10.6
Goods and Services	1,764	3.0	2,227	4.1	2,245	4.5
Housing Rent	4,463	7.6	4,130	7.6	3,293	6.6
Family Size (persons)	5.5		5.5		5.5	
Income per Capita (baht/year)	10,687		9,836		9,121	

Source : NSO (1992b).

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Table 5. Annual expenditures of small-scale fishing households, 1990.

Type of Expenditure	National Average		Andaman Sea Coast		Phang-nga	
	Baht/Year	%	Baht/Year	%	Baht/Year	%
Total	49,474	**100.0**	44,768	100.0	42,219	**100.0**
Cash Expenditure	43,333	73.7	42,257	78.1	39,288	78.3
Fisheries Income :						
Food	37,031	74.8	32,957	73.6	29,314	72.9
Drink, etc.	23,696	47.9	20,553	45.9	17,480	43.5
Cigarette and other	2,418	4.9	2,436	5.4	2,560	6.4
Clothing	1,695	3.4	1,761	3.9	1,427	3.5
Housing Rent	3,648	7.4	3,137	7.0	3,448	8.6
Medical Care	818	1.7	758	1.7	768	1.9
Utilities	1,188	2.4	1,138	2.5	1,229	3.1
Transportation and Communication	1,237	2.5	1,438	3.2	1,023	2.5
Other	2,322	4.7	1,289	2.9	1,099	2.7
Non-cash Expense	12,443	2.52	11,841	26.4	10,878	27.0
Fish for Household Consumption	6216	12.6	5,484	12.2	5,340	13.3
Goods and Services	1,764	3.6	2,227	5.0	2,245	5.6
Housing Rent	4,463	9.0	4,130	9.2	3,293	8.2

Source : NSO (1992b).

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3.4 Living standard of small-scale fishermen

The living standard of small-scale fishing households can be calculated using two approaches. The first is comparison of the per capita income. The second is estimation of Engel's coefficient (ratio of the household's food expenditure to the total expenditure). A ratio greater than 50 percent indicates that food expenditure is a major expenditure and that such households have a low living standard. This is based on the principle that household income will be spent on food as a first priority and that any remaining surplus will be spent for other purposes.

In 1990, the annual national average per capita income of small-scale fishermen was 10,687 baht. Average per capita income for the Andaman Sea coast was 9,836 baht, and 9,121 baht for Phang-nga province (NSO, 1992). Meanwhile, annual national per capita income of all sectors was 16,463 baht and 14,054 baht in southern Thailand (NSO, I992a). This implies that the per capita income of small-scale coastal fishermen is less than the national average. Furthermore, the per capita income of small-scale fishermen on the Andaman Sea coast is not only less than the national and the southern per capita income but also less than that of small-scale fishermen nationwide. Finally, small-scale fishermen in Phang-nga province have the lowest per capita income compared to small-scale fishermen nationwide, and people living in the southern region.

In 1990, Engel's coefficients of the small-scale fishing households would be 60.5 for the whole country, 58.1 for the Andaman Sea coast and 56.8 for Phang-nga province. Comparing these figures with the national coefficient of 36.2 and the southern coefficient of 39.5, the living standard of small-scale coastal fishermen is lower than the national average and that of southern Thailand. Furthermore, the living standard of small-scale coastal fishermen on the Andaman Sea coast is not only lower than the national and the regional average in southern Thailand, but also lower than that of the nationwide average of small-scale fishermen. Finally, under both methods for calculating living standards, the small-scale fisherfolk of Phang-nga Bay have the lowest living standard compared to the national and regional average of fisherfolk and the general population.

4. TYPE OF FISHING OPERATIONS AND FISHING INCOME OF SMALL-SCALE FISHERMEN

4.1 Type of fishing operations

The fishing boats of small-scale fishermen can be classified into three types. These include non-power boats; outboard-powered boats; and inboard-powered boats. Usage of the boats accounts for 6.6 percent, 77.2 percent and 16.2 percent respectively. The percentage

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Table 6 : Annual income and expenditure of households in Thailand, 1990.

Items	National Average		Southern Region	
	Baht/Year	%	Baht/Year	%
1. Household Income	67,500		61,836	
2. Household Expense	65,244	100.0	61,920	100.0
2.1 Food	23,628	36.2	24,456	39.5
2.2 Drink, etc.	1,956	3.0	1,812	2.9
2.3 Clothing	3,816	5.8	3,768	6.1
2.4 Housing Rent	14,628	22.4	11,616	18.8
2.5 Medical Care	2,220	3.4	2,100	3.4
2.6 Others	18.996	29.1	18,168	29.3
Family Size (persons)	4.1		4.4	
Income per Capita (baht/year)	16,463		14,054	

Source : NSO (1992a).

Table 7. Number and types of small-scale fishing boat in Thailand, 1990.

Type of Boat	Total		Gulf of Thailand		Andaman		Phang Nga	
	Number	%	Number	%	Number	%	Number	%
Non-power Boat	3,116	6.6	1,872	6.0	1,244	7.7	348	8.7
Outboard-powered Boat	36,634	77.2	21,188	74.0	13,446	83.7	3,474	87.3
Inboard-powered Boat	7,673	16.2	6,291	20.1	1,382	8.6	159	4.0
Total	47,423	100.0	31,351	100.0	16,072	100.0	3,981	100.0

Source: NSO 1996

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use of inboard-powered boats in the Gulf of Thailand is much greater than that of the Andaman Sea. This indicates more development of fishing boats in the Gulf of Thailand.

In Phang-nga province, the total number of small-scale fishing boats is 3,981. This consists of 87.3 percent of outboard-powered boats, 8.7 percent of non-power boats and 4 percent of inboard-powered boats (Table 7).

Small-scale fishermen in Thailand usually employ specific fishing gear with respect to fishing seasons. However, most fishermen tend to employ one major fishing gear which can be utilized for a longer period, thus generating a higher yearly income. Major fishing gears for the small-scale fisheries in Phang-nga province include shrimp gill net, crabs gill net, fish trap, anchovy purse seines and other moving gears.

4.2 Costs and revenues of small-scale fishing operations

Fishing revenues

In 1990, the gross national average of fishing revenues per small-scale fishing household was 71 ,1 66 baht, 60,630 baht for the Andaman Sea coast and 49,767 baht for Phang-nga province (NSO, 1992). Unlike small-scale agricultural households who keep most of the output for household consumption, small-scale fishermen sell 90 percent of their production in response to high prices. Average annual cash revenue of the small-scale fishermen is 64,950 baht for the whole country, 55,146 baht for the Andaman Sea coast and 44,427 baht for Phang-nga province.

Costs *of fishing operations*

For small-scale fishing operations, the main fishing costs are fuel cost, labour cost and equipment cost which accounts for 35.8 percent, 20.5 percent and 13.5 percent of the total cost respectively. For fishing operations on the Andaman Sea coast, the cost components are 33.7 percent, 19.5 percent and 15.2 percent respectively. It is noted that the labour cost of small-scale fishing operations in Phang-nga province (3.5 percent of total cost) is the lowest, compared to that of the whole country and that of the Andaman Sea coast. This indicates that the small-scale fishing operations in that area employ traditional fishing gears and utilize household labour. Fishing costs of the small-scale fishing operations is 3 1,773 baht per household for the national average, and 24,653 baht per household for the Andaman Sea coast. The lowest fishing costs are in Phang-nga province, at 17,151 baht per household.

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Table 8. Annual costs and revenues of small-scale fishing operation in Thailand, 1990.

Items	National Average		Andaman Sea Coast		Phang-nga	
	Baht/Year	%	Baht/Year	%	Baht/Year	%
1. Gross Fishing Revenues	71,166	100.0	60,630	100.0	49,767	100.0
1.1 Cash:						
Fishing Income	64,950	91.3	55,146	91.0	44,427	8927
1.2 Non-cash:						
Value of Fish for Household Consumption	6,126	8.6	5,484	9.0	5,340	10.73
2. Fishing Expenditures	3 1,773	100.0	24,653	100.0	17,151	100.0
2. I Cash :						
Crew	6,526	20.5	4,797	19.5	600	3.50
Fuel	11,363	35.8	8,296	33.7	6,207	36.19
Equipment	4,305	13.5	3,758	15.2	4281	24.96
Ice	776	2.4	678	2.8	246	1.43
Material	669	2.1	735	3.0	701	4.09
Boat Repair and Maintenance	1,520	4.8	1,164	4.7	824	4.80
Engine repair and Maintenance	1,497	4.7	1234	5.0	1,163	6.78
Interest	554	1.7	452	1.8	381	222
Others	239	0.8	267	1.1	100	0.58
2.2 Non-cash :						
Depreciation cost	4234	13.3	3272	13.3	2,648	15.44
Net Revenue (1) - (2)	39,393		35,977		32,616	
NetCashRevenue(l.l)-(2.1)	37,50 1		33,765		29,924	

Source : NSO (1992b).

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Net *revenue of small-scale fishing operations*

Net revenue is the difference between gross fishing revenues and fishing costs including depreciation cost. High net revenue would justify long-term fishing operations. Net revenue represents returns on factors of production such as capital, household labour, management and rent (including resource rent and rent of ability). According to the 1990 survey, the annual net revenue of small-scale fishing operations in Phang-nga province is 32,616 baht per household, which is the lowest, compared to that of the whole country (39,393) and that of the Andaman Sea coast (35,977).

Furthermore, net cash revenue represents the immediate maximum cash income that can be used to finance fishing operations and household consumption expenditures. It is the difference between cash revenue and cash costs excluding depreciation costs. In 1990, the small-scale fishermen in Phang-nga province had an annual net cash revenue of 29,924 baht per household which is less than that of the national average (37,501) and that of the Andaman Sea coast (33,765). It is noted that the net cash revenue of small-scale fishermen in Phang-nga province is far different from the net cash revenue of the whole country and that of the Andaman Sea coast. More fish are consumed per household in Phang-nga province.

5. SOCIO-ECONOMIC POSSIBILITY OF CBFM

In order to develop a system in which fishing communities have opportunities to participate in resource management, three socio-economic principles have to be taken into consideration to ensure that the communities would benefit from the system. First, net returns must be increased. Net returns in this sense are from resource rent or surplus benefit. Second, the pattern of distribution of income or benefit must be improved. Third, conflicts among fishermen of various scales must be reduced.

5.1 Increase in net returns

The increase in net returns is the result of higher fishing revenue or lower fishing costs or both. In the case of coastal resource development where artificial reefs have been constructed to enhance marine flora and fauna habitat or small-scale fishing operation areas, such initiatives have been successful so far in terms of generating fishing revenue and cooperation, as well as in improving resource conservation by fishing communities. Such artificial reefs can not only increase resource productivity, but also decrease fishing costs. However, successful systems depend on three major factors. First, fisheries management must be appropriate, conforming to regulations and based on resource conditions. Second, fishing communities must be self-reliant and have the right to take care of themselves. Third, regulations issued by the communities must be effectively enforced.

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5.2 Improved pattern of distribution of income or benefit

In well-managed systems, fishing areas and types of fishing operations must be specified. Fishermen in the communities who have the right to operate fisheries activities will benefit directly from the system. Nevertheless, other people in the communities will also benefit through the 'Multiplier Effect'. That is, fishing crews will be positively affected by higher income from shared revenues. However, in communities where resources have deteriorated because of overfishing, such operations would have to be restrained. This would give rise to problems of income distribution. In principle, CBFM should be managed in such a way that income and size of fishing operations are not very different among members of the communities.

Equal income distribution is also a matter of value judgment. Wherever benefits are concerned, problems will often arise. In the case of Phang-nga Bay, the government and fishermen in the communities must set up a mechanism which helps achieve a compromise between the losers and the gainers.

5.3 To lessen conflicts between fishermen

Any conflicts, if they occur, imply a social loss in implementing a management system. A conflict can be violent if there are socio-economic and cultural differences between the confronting groups who exploit the resources. Therefore, it is necessary to take socio-economic and culcural conditions into consideration when selecting fishing communities for management at the beginning stage. It is expected that if fishermen have similar economic purposes, the integration and harmonization of the members in the communities will be easy. On the contrary, conflicts between fishermen within the managed communities and those between the managed communities and outside communities may increase, especially when resources outside the managed areas are limited. Outsiders will have a tendency to want to fish in the fishing grounds of the managed area where fish may be more abundant because of better management practices.

The degree of violence experienced in conflicts depends on several factors. For example, the conflicts can be violent if the intruding outside communities have socio-economic and political power and the regulated communities are strict about the right to utilize fishing areas.

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6. CONCLUSIONS AND SUGGESTIONS

From the socioeconomic conditions of small-scale fishing communities on the Andaman Sea coast, and especially those in Phang-nga province who have lower incomes and living standards than small-scale fishermen nationwide and those in the south, the household income is determined mainly by the output from fishing operations. Incomes from other sources are limited. Therefore, fishing operations and fishing resource management should be organized by the fishing communities themselves.

CBFM is a system of small-scale fisheries management for purposes of efficient resource use, impartiality and optimal resource use over time. This system is one of the strategies currently used in several countries and is based on the principles of compromise, respect and trust among various participants of the management system. The usefulness of the operational system is worth considering because successful development of such a system is not easy and cannot be achieved instantly.

In implementing this policy, the relationship between the fishing communities and the government's role has to be adjusted. Explicit identification of agents who will have the right to manage fisheries resources and who will benefit from the policy is needed. Finally, more data and information are needed to help specify conditions for the success of the system.

7. REFERENCES

Adulavidhaya, T. 1780. Socio-economic conditions ofcoastal fishermen in Phang-nga. South China Sea Fisheries Development and Coordinating Programme, Manila, Philippines.

DOE 1775. Production of coastal Fishing Communities Survey 1773. Department of Fisheries, Ministry of Agriculture and Cooperatives, Thailand.

NSO and DOE 1787. The 1785 Marine Fishery Census of Thailand. National Statistical Office, Office of the Prime Minister, Thailand.

NSO and DOE 1772. The 1770 Report of Intercensal Survey of Marine Fishery of Thailand. National Statistical Office, Office of the Prime Minister. Thailand.

NSO. 1992a. The 1770 Report of Socio-economics Survey of Households in Thailand. National Statistical Office, Office of the Prime Minister,Thailand.

<<

NSO. 1992b. The 1990 Report of Incomes and Expenditures Survey of Small Scale Fishing Households of Thailand. National Statistical Office, Office of the Prime Minister, Thailand.

NSO. 1996. The 1995 Preliminary Report of Marine Fishery Census of Thailand. National Statistical Office, Office of the Prime Minister, Thailand.

Panayotou, T. 1985. Socio-economic conditions of small scale fishermen: A conceptual framework. In: T. Panayotou (Ed). Small Scale Fisheries in Asia: Socioeconomic Analysis and Policy, pp. 31-35. International Development Research Centre, Ottawa, Canada.

Pomeroy, R.S., and M.J. Williams. 1994. Fisheries co-management and small scale fisheries: A policy brief. International Center for Living Aquatic Resources Management, Manila, Philippines.

Piumsombun, S. 1994. Socio-economic feasibility of introduction of fishing rights system in the coastal waters of Thailand. In: Indo-Pacific Fishery Commission. Proceedings of the Symposium on Socio-economic Issues in Coastal Fisheries Management. Bangkok, Thailand, 23-26 November 1993. RAPA Publication 1994/8, 442p.

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OPPORTUNITIES FOR WOMEN'S PARTICIPATION IN THE PHANG-NGA BAY COMMUNITY-BASED FISHERIES MANAGEMENT PROJECT

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1. INTRODUCTION

Women's participation in community-based fisheries management as outlined by the organizing committee are in fish processing, marketing, fishery management and environmental protection. Participation in the aspects listed is recognized by various agencies involving women development in rural areas. The focus of this paper is thus on the understanding of women's status in the coastal areas of Phang-nga Bay, and especially their capacity and their existing roles and functions in those communities.

From the Preliminary Report on the 1995 Fishery Census of Thailand, data by gender has not been made available. The Census reveals that from about 6,000 marine and coastal fishing and aquaculture households, a little more than 3,000 engage only in marine capture, nearly 1,000 are coastal aquaculture households, while about a thousand are employed as labor in the fishing sector. Most of these households practise both marine capture and coastal aquaculture. The number of fish processing households is 352 while there are only two commercial fish processors. Preparation of shrimp paste is the main form of fish processing in these areas. In terms of fish marketing; 170 households are fish dealers, mainly middlemen and retailers.

The only data by gender made available from the previous Fishery Census is the number of "female" fishery households. About 20 percent of the fishery households are listed as "female households" while the number is a little higher for fishery employees' households. Information by gender is limited and seems to be inadequate to plan for effective women's participation in community-based fisheries management.

2. CONSTRAINTS ON WOMEN'S PARTICIPATION

In this section, we look at the existing constraints to effective women's participation in fisheries management.

I. Lack of information on fisherwomen Lack of information and data on fisherwomen is an important problem. Rarely has data on women has been disaggregated by agencies in

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the compilation of field data. Women's responsibility on family and child care is by no means less important than the income earnings of men. While men's responsibility has focused on income generation, women's is on maintaining and improving the family's well-being.

Successful community development cannot be pursued by increasing income alone, but by also improving the quality of life. Often, women have been both earning the income and contributing to the family's well-being. Women's work should not be under-estimated but properly quantified in order to determine their participation in community-based fisheries management.

2. Lack of policy on women's participation Policy on women's participation in fisheries management has never been clearly identified. Traditionally, men have been considered as heads of households and as decision-makers, while women have played subordinate roles. There is a lack of official recognition of fisherwomen. Women have not been welcome in decision-making at the community level and at higher levels of management planning. Extension services on fishery and aquaculture development have been designed for men, not women, while women are capable of effectively dealing with these issues of rural life. Technology training programmes should be geared towards women in order to increase women's participation in fisheries management.

3. Limited education. Because of their traditional role, women usually have fewer opportunities than men to gain knowledge and experience. While they are aware of community problems, they participate less than men in community development. This can be explained by the lack of knowledge and information as well as lack of self-confidence in participation. Limited education limits their job opportunities and participatory roles at all levels of fisheries management.

4. ***Social norms.*** Not being well-informed, women often do lack confidence in expressing their ideas. Traditionally, women look after the families households and serve family members rather than take part in community activities. Men usually do not listen to women in public. In many cases, women do not express themselves in community meetings.

3. GOVERNMENT PROGRAMMES IN WOMEN'S DEVELOPMENT

In 1977, the Royal Thai Government initiated a number of women's development programmes. They emphasized improving the quality of rural women's life and promoting women's participation in community development. The programmes have been mainly conducted by four government agencies: Department of Agricultural Extension, Department

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of Community Development, Department of Non-formal Education, and Department of Public Health.

The Department of Agricultural Extension encourages women's group organization, and introduces home economics programmes to improve family income and well-being. The Department of Community Development works on strengthening women's participation in community development via training and education on group organization skills. The Department of Non-formal Education organizes job training programmes. The Department of Public Health aims at better health care for pregnant women and children as well as family planning.

The activities mentioned above have been designed specifically to promote women's participation, there is no agenda for co-operation among women and men, because of the consensus that the work described above is confined to "women's tasks".

The Royal Thai Government has prepared a Long-term Programme (1992-20 1 1) for Women with an objective to increase women's participation in development at all levels. Nevertheless, the plans on Social Participation Development and Improving Mechanisms for Women's Development are not prioritized. The allocated budget has been considered as limited for such an extensive programme, indicating a low priority at the national level (Thailand Development Research Institute Foundation, 1995).

There are also a number of NGOs working on women's development in rural areas. A review of these existing programmes can be useful for effective planning on women's participation in community-based fisheries management.

4. OPPORTUNITIES FOR WOMEN'S PARTICIPATION

In traditional fisheries, women work with men in various activities concerning harvesting, processing and marketing. Women can engage in fishing within limits imposed by their domestic responsibilities. They can make and repair fishing equipment, undertake post-harvest activites, including fish processing and marketing. Where aquaculture has been practiced, women can work on pond management. Such active involvement allows them to take part in decision-making at the household level. They can take part in financial control or even control household income.

Industrialization or commercialization of the fishery reduces women's participation in fisheries. Commercial fisheries depends more on modern equipment and ways of life which are not condusive to women's involvement. Market development and better transportation involve work beyond the limits imposed by women's domestic work. Only

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women enjoy some economic status can participate in fisheries development. Women, and other family laborers, have been replaced by hired labor, most of whom are men.

Women's participation in fisheries can be enhanced in community-based mangement regimes. Community-based fisheries management allows women's participation in fisheries activities, fisheries management, and environmental monitoring. When non-traditional economic activities are introduced, they should allow an opportunity for women's participation in such development.

Opportunities for women's participation in community-based fisheries management can be increased by providing the following:

- Information on gender division of labor, women's active role, and women's status in the community.
- Encouraging women's participation in community-based fisheries management at every possible stage, from the early stages of planning and decision-making through implementation and monitoring.
- Support on women's group organization to increase women's participation.
- Training for women as well as men.

Women can benefit most from activities in the following technical areas (FAO1788):

- economic activities
- social services and community activities
- organizational, technical, and financial support
- household food security

The status of women in the fisheries community should be assessed. Information concerning existing roles of women in domestic work, income generation, involvement in community organization in various aspects, and constraints on women's participation should be sought in order to design an effective plan for women's participation in community-based fisheries management.

While modernization of the commercial fishery has forced women out of the fisheries, community-based fisheries management regimes focus on small-scale fisheries and maintaining traditional practices within the fisheries. This regime will therefore avail of greater women's participation by working within traditional fisheries. Women can participate in various traditional fisheries activities, including harvesting, post-harvest handling,

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processing, and marketing, as well as non-fisheries activities. Those can help augment local food supply and generate income.

In fisheries, women can fish (e.g., as crew, owners of the vessel, manual collection, etc.) and engage in aquaculture. In artisanal fisheries, women can help fishing gears. They can participate in processing and marketing. These activities are either for domestic food supply or income generation or both. The greater the participation, the more significant the fisheries are among local women. Thus, the greater is the concern for fisheries management.

Involvement in non-fisheries activities as allowed by availability of input supplies and access to market can be useful as alternatives where fishing effort has to be controlled.

Community-based fisheries management schemes should take into account women's social status, their community activities and perceptions of their social needs. Opportunities should be given to women to participate in community decision-making, providing training for women's decision-making and leadership skills. At an early stage, women's groups can be organized to serve as a forum for exchanging ideas and increasing women's social awareness to develop collective action and involvement in fisheries management.

To enhance women's participation, support on organization, technical know-how, and finance should be considered where necessary. Women can be involved in various stages including fisheries management, monitoring, data collection, adoption of appropriate technology, maintenance of fishing gears and equipment, post-harvest handling, processing, marketing, as well as other non-fisheries activities. Nevertheless, they may need organizational, technical and financial assistance at the beginning.

Household food security is the main responsibility of women. Not only are women responsible for ensuring an adequate daily food intake for family members, through harvesting or other means of producing food, but they can also generate income to buy food for the family. Women can engage in processing, marketing or other non-fisheries activities. Community-based fisheries management should consider women's roles in these ways. Design of the management schemes should accommodate women's responsibilty in food security.

5. WOMEN'S PARTICIPATION AT THE COMMUNITY LEVEL

Opportunities for women's participation in community-based fisheries management are still limited at this early stage, but nonetheless, there are many possibilities to increase women's participation. Women as well as men should be invited to participate in the forum. They should be encouraged to make their voice heard in meetings. Women's views can be

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different from men's as they have the responsibility to provide food for their family members. Women tend to give priority to quality of life rather than income earning. At the same time, if fish products are the main source of food, and as it is dependent on the health of the fishery resources, women should be aware of it's sustainability and be willing to co-operate in sustainable fisheries management schemes.

Lack of access to information, training and education, and existing social norms may constrain women's self-confidence and their active participation. Special programmes tailored for women may be required at the early stages of community-based management projects. Organizational support can help in developing collective women's groups, thus allowing them to take part in project development and implementation. Working groups composed of women members can help enhance their participation. Understanding women's social status, their responsibilities, capabilities, and their perceptions is necessary for effective planning in enhancing opportunities for women's participation in community-based fisheries management. Providing that an improvement in the quality of life in coastal communities is an objective of community-based fisheries management projects, women's participation cannot be neglected.

6. REFERENCES

Asian Productivity Organization. 1995. Women in farming and improving quality of life in rural areas in Asia and the Pacific. Report of an APO Seminar, 27/9-7/10 1994, Japan.

Canadian International Development Agency. 1993. Women and fisheries development. Communication Branch, Quebec, Canada.

FAO. 1988. Women in fishing communities. Rome, Italy

National Statistics Office and Department of Fisheries. 1996. A Preliminary Report on 1995 Fishery Census. Bangkok, Thailand (in Thai).

Thailand Development Research Institute Foundation. 1995. Women in development: Enhancing the status of rural women in northern Thailand. Natural Resources and Environment Programme., Bangkok, Thailand.

Phothiyong, Thongdee. 1995. Mae ying pattana. 21 th Komol Keemthong Foundation Lecture, 22 Feb. 1995. Thammasat University, Bangkok, Thailand (in Thai).

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REVISION TO THAI FISHERIES LAW AND OPPORTUNITIES FOR COMMUNITY-BASED MANAGEMENT

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1. INTRODUCTION

Coastal fisheries in many Southeast Asian countries have faced serious problems arising from over-exploitation of fishery resources. In Thailand's case, it has been estimated that over-exploitation in the Gulf of Thailand probably occurred during the late 1970's or early 1980's. However, the total marine landings in Thailand continues to increase every year. This is because Thai landings include the catch from outside of Thai waters. In addition, the composition of catch has been changed to low value fish such as trash fish.

The problems of the Thai coastal fisheries include deteriorating socio-economic conditions of fishing communities; increasing conflicts between commercial fisheries and small-scale fisheries and among small-scale fishermen; over-capitalization in fishing capabilities resulting in significant economic waste; and environmental and resources degradation.

In order to solve these problems, the Thai government is considering delegating management responsibility to the local level including fishing communities and fishermen's organization. This application is commonly known as "community based fisheries management". However, there are a wide range of issues that might need co be clarified before such system could be implemented. These issues include legal and institutional aspects, fishery biological aspects, technical aspects, economic and socio-economic aspects, as well as social and political aspects.

This paper reviews legal aspects particularly the existing fishery laws and regulations concerning community based fisheries management, the regulations applied for the pilot project of community based fisheries management, and the opportunities for introducing this system in coastal areas of Thailand.

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2. AN OVERVIEW OF THAILAND'S FISHERIES LAW

There are five pieces of legislation concerning fisheries in Thailand. They include:

- Fisheries Act, B.E. 2490 (1947)
- Act Governing the Right to Fish in Thai Fisheries Waters, B.E. 2482 (1939)
- Thai Vessels Act, B.E. 2481 (1938)
- Fish Marketing Act, B.E. 2496 (1953)
- Wildlife Reservation and Protection Act, B.E. 2535 (1992)

However, the main legislation is the Fisheries Act, B.E. 2490 (1947).

The first fisheries law in Thailand was enacted in B.E. 2444 (1901). At that time, both inland and marine fishery resources in Thailand were abundant because the Thai people used simple traditional fishing gear and caught mainly freshwater fish. The marine fisheries had not been developed. The main purpose of the Fisheries Act, B.E. 2444 (1901) was to collect tax from fishermen. However, it also included fisheries conservation measures by prohibiting fishing during the spawning season of freshwater fishes. This Act was used for 46 years, and it was repealed and replaced by three pieces of legislation namely the Fisheries Act, B.E. 2490 (1947); the Act Governing the Right to Fish in Thai Fisheries Waters, B.E. 2482 (1939); and the Thai Vessels Act, B.E. 2481 (1938).

These Acts are now dated, and it appears necessary to make changes in them so that the Department of Fisheries (DOF) and other government agencies could have the instruments required to effectively regulate fisheries. Several commentators, notably FAO (ADB, 1985), have suggested that rewriting the Acts would be preferable to piecemeal amendments, mainly due to very significant changes in fishing activities which have occurred during the past 49 years since the present Fisheries Act was enacted. Neighboring countries have already updated their fisheries laws. For example, Malaysia enacted a new Fisheries Act in 1985 (Act 317: Fisheries Act, 1985) and Japan revised its fisheries law in 1975 (Law No. 63: the Fisheries Law, 1975).

So far, the Acts have not been rewritten, but some provisions have been revised from time to time. As a matter of fact, rewriting the Act could take a lengthy process because making a new law in Thailand means going through the procedure of drafting by the committee and presenting to the parliament for approval which takes many years to be completed. In addition, the present Fisheries Act, B.E. 2490 (1947) empowers the Provincial Governor or the Minister of Agriculture and Cooperatives to regulate and enforce the activities of individuals or companies involved in fisheries by means of administrative power (i.e., proclaim the Ministerial Regulations, the Departmental Regulations, the Royal Decrees, etc.) which to some extent are believed adequate to cope with the present fisheries situation in Thailand. However, there are loopholes in many aspects. For example, the Act

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does not cover environmental issues, registration of fishing vessels, fishing right systems, and fishermen's organization.

Fisheries Act, B.E. 2490 was drawn up in 1947 before the development of marine fisheries. The Act is drafted primarily with inland fisheries in mind and has been amended twice, in 1953 and 1984. The Act is composed of six chapters or 73 sections which include fisheries management and conservation, aquaculture, registration and application for permission, collection and fixation of fisheries tax, fisheries statistics as well as the provision of penalties. Some important provisions of fisheries management and conservation are summarized below.

Provision of legislative power

These provisions are articulately coded in the Act and can be repealed or amended only by the parliamentary process which is quite difficult and time consuming. Examples of these provisions include: no person shall use poisonous substance, or do any act that stupefies the aquatic animals (section 19); no person shall use an electric current in fisheries, or use explosives in fisheries in any other way (section 20); no person shall have in his possession for commercial purpose aquatic animals which he knows has been taken in contravention of the section 19 or section 20 (section 20 bis.); etc.

Provision of administrative power

The Minister of Agriculture and Cooperatives or the Provincial Governor is empowered by the provision of the Act to impose some fisheries regulations by proclaiming the Ministerial Notification. These regulations are relatively easy to amend and have been revised from time to time. The power given to the Minister is coded in section 32 below.

"The minister or provincial governor in his jurisdiction and with the approval of the minister, is empowered to make notifications determining:

(1) the size of mesh and dimension of every kind of fishing implement, and size, kind, number and parts of fishing implements, which is permitted in fisheries;
(2) any kind of fishing implement which is absolutely forbidden to be used in fisheries;
(3) the distance between each stationary gear;
(4) the methods of using every kind of fishing implement;
(5) the spawning and breeding seasons, fishing implement; and methods of fishing in any fisheries during the given seasons;
(6) the species, size and maximum number of aquatic animals the fishing of which is permissible; and

(7) certain species of aquatic animals the fishing of which is absolutelv forbidden."

Since 1947, there have been many regulations imposed by the provision of section 32 such as: prohibiting of fishing any kind of turtles, tortoises and their eggs (14 April 1947); prohibiting the use of trawl nets of various types (such as trawler, push net, shrimp push net) used with motorized fishing boats within 3,000 meters from the shore line and within a radius of 400 meters from stationary gears licensed by DOF (20 July 1972); prohibiting of clam dredges used with motorized vessels within 3,000 meters from the shore line (18 February 1374); closed areas for three months every year during spawning and nurturing seasons of Indian mackerel in three southern provinces (28 November 1984); etc.

Regarding provision of fishing gear, section 4 states that :

"To fish" means to catch, to trap, to injure, to kill, or to take aquatic animals in fishery waters with any fishing implement of by any method.

"Fishing implement" means machinery, instrument, accessories, component parts, arms, stakes, or vessels which are used in fishing operations.

"Vessel" means a water craft of every description.

"License" means license issued by a competent official to a licensee to use a fishing implement.

"Licensee" means a person who holds concession, permit or license, or a person who obtains permission to do any thing according to this Act.

"Stationary gear" means fishing implement which is used in the manner of pegging down, tying, stretching, pulling, sinking or by any other means which will make the fishing implement stationary during the time of fishing.

"License fishing implement" means fishing implement the name, description and method of operation of which are specified in the ministerial Regulation.

"Non-licensed fishing implement" means fishing implement which is not specified in the Ministerial Regulation.

Under Thailand's fisheries law, all kinds of fishing gear falls into two categories, (i) license fishing implement and (ii) non-license fishing implement. Licensed fishing implements are specified in Ministerial Regulation No.1 (1947) and were revised and

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added to by Ministerial Regulation No. 17 (1978). These categories (Table 1) are used to determine annual fees.

Table 1. **Rate of fishery tax on license fishing implements**

Name of Fishing Implements	Rate of Fishery Tax (Annual Fee)
Simple lift net (4 types)	20 baht/unit
Stownet (Set bag net)	20 baht/unit
Bag of barm	15 baht/unit
White board catching	10 baht/unit
Cast net more than 4 m. in length	10 baht/unit
Scoop net more than 3.5 m. in width	10 baht/unit
Long line more than 40 m. in length	5 bahtlunit
Barrage	1 baht/unit
Push net	150 baht/unit
Net, Gill net, Purse seine and Trawler	
(i) gill net/purse seine mesh size more than 7 cm.	1 baht/unit
(ii) gill net/purse seine mesh size less than 7 cm.	2 baht/unit
(iii) trawl net	5 baht/unit
(iv) other nets	
- the width from 1 to 4 meters	0.5 baht/unit
- the width from 4 to 8 meters	1 baht/unit
- the width from 8 to 24 meters	2 baht/unit
- the width more than 24 meters	3 baht/unit

Source: DOF (1989).

License fishing implements can be used only by the entitled person. Section 28 states "any person is entitled to use licensed fishing implement only when the license specifying his name has been issued and the fishery tax under the Act has been paid."

Non-licensed fishing implements (such as hook, line, trap, spear, etc.) is not specified in the Ministerial Regulation listed in Table 1. Therefore, for employing non-license fishing implement to is not required to obtain license and pay the tax.

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Stationary gear (such as lift net, stow net, stake trap net, bag of barm, barrage, etc.) can be set only in the concession fisheries or reserved fisheries (not in public fisheries). Section 31 states that "no person shall erect, peg down or build a stationary gear in public fisheries, nor shall he do so in other fisheries without permission from the competent official".

Section **61** states "whoever violates section 31 shall be punished with a fine not exceeding 2,000 or with imprisonment notexceeding one month, or both."

The Act covers both inland and marine fisheries. Generally, fisheries are divided into four categories. Each Provincial Council is empowered to proclaim any fisheries within the province as Preservation Fisheries, Concession Fisheries, or Reserved Fisheries, subject to the Minister's approval. Preserved fisheries include areas in or near monasteries, in navigation locks, weirs, dams or other places suitable for the conservation of aquatic animals. Fishing in such areas is prohibited without the permission of the Director-General. Fishing in concession or reserved fisheries is reserved for individual licensees and is subject to compliance with conditions imposed by the Director-General or other competent officials. Any fisheries not proclaimed as preservation, concession or reserved fisheries are public fisheries. In public fisheries every person has the right to fish or to cultivate aquatic animals, subject to compliance with any conditions imposed by the Minister of Agriculture and published in the Government Gazette. Permission is also required to construct cultivation ponds, although no restrictions are placed on fishing in cultivated ponds once these have been established.

3. PROBLEMS OF FISHERIES LAW

It can be concluded that the existing Fisheries Act, B.E. 2490, is not comparable to the fishing right system. It does not contain provisions regarding fishing rights for community-based fisheries management. The right in this Act is granted only to persons who have obtained the right to fish in concession and reserved fisheries which is viewed as individual fishing right. This Act does not recognize the right of fishermen as a group or the right of fishing communities which is basic to community-based fisheries management. Therefore, there is a need to amend the law to establish such a fishing right system in Thailand. In addition, fishermen's organizations, their roles and duties should figure in the law.

In accordance with the Constitutional Law of Thailand revised in 1995 (No.5), section 48 (penta) it can be concluded that the government shall maintain the fairness and protect the right of people for their occupation. Section 48 (para. 2) states that the limitation of such right shall be allowed only by the specific legislative power for the purposes of

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national security, national economy, the protection of public infrastructure, arranging people's professions, environment and natural resources conservation, etc.

As mentioned earlier in the discussion, the Fisheries Act, B.E. 2490 has been enacted for the purposes of collecting a fisheries tax, controlling the use of fishing gears and managing mainly freshwater fisheries. It has not been drafted for the purpose of establishing a fishing right system and community-based fisheries management. Therefore, specific legislative power should be enacted for the purposes of fishing right system and community-based fisheries management. Such laws could be enacted either by adding a new chapter concerning a fishing rights system and community based fisheries management into the existing Fisheries Act, B.E. 2490 or by enacting a new fisheries law which incorporates a right system and CBFM.

Recently, the DOF set up the drafting committee to carry out this work. However, many issues need to be clarified. In addition, DOF would like to assess pilot projects for community-based fisheries management before finalizing the draft. Such pilot projects would be useful especially in gaining an insight into the opinions of coastal fishermen towards a fishing right system and CBFM.

4. OPPORTUNITIES FOR CBFM

As mentioned, the Fisheries Act, B.E. 2490 does not contain any provisions concerning the implementation of a fishing rights system or community-based coastal fisheries management systems. However, DOF has planned to establish a pilot project for a fishing rights system and for CBFM in some coastal areas in the near future. It can use a provision that applies temporarily to this system during the pilot projects.

Section 16 of the Fisheries Act, B.E. 2490 states

"Public fisheries are fisheries in which every person has the right to fish and cultivate aquatic animals.

Any person fishing or cultivating aquatic animals in public fisheries must comply with the conditions imposed by the Minister and published in Government Gazette."

The provision of Section 16 (para. 2) empowers the Minister of Agriculture and Cooperatives to impose any conditions for a person fishing in public fisheries. This provision is viewed as administrative power, therefore the Department of Fisheries (DOF) can use this provision to proclaim any conditions relevant to its plan for pilot projects in relation to CBFM. DOF has attempted to draft such conditions which will be proclaimed by the Ministerial Notification in the future.

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The content of such Ministerial Notification is summarized as follows:

"By the power of Section 16 (para. 2) of the Fisheries Act, B. E. 2490, the Minister of Agriculture and Cooperatives has laid down the conditions for fishing right system as follows:

1. The fishing right system means the decentralized system given tbepower to local communities. They will be authorized to manage fishery resources in the given areas specified by the government based on scientific information and socio-economic information, and subject to the approval ofjsbing communities.

2. The Department of Fisheries and the Provinces are empowered to control, supervise, advise or suggest and approve to carry out tbe fishing right system.

3. The Department of Fisheries shall set up the "Central Committee for Fishing Right System" with appropriate members. This Committee is authorized to supervise and approve the operation of fishing right system in any coastal communities; and to set up the working group to study the necessary scientific research presenting to the Central Committee.

4. The Head of Provincial Fisheries Office shall put forward the fishing right system to be notified by the Provincial Council for seeking cooperation.

5. Specify the areas for introducing fishing right system.

6. Within the areas ofjsbing right system spec.ified in 5, coastal aquaculture and fishing are permitted except using trawl net and push net.

7. The Provincial Governor shall set up the "Local Committee for Fishing Right System" which is selected from fishermen as their representatives no Less than 15 people.

8. Such Local Committee in 7 is authorized to:
   8.1 manage the fishery resources
   8.2 grant the permit for fishermen
   8.3 list the name offishermen who are permitted
   8.4 make annual report presenting the to Central Committee

9. Before carrying out any activities in the areas of fishing right system, the fishermen shall notify to Local Committee.

10. DOF shall p roc la in fi sh eries tax exemption for the fishermen who are permitted to fish in the fishing right areas temporary.

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11. Violation to this Ministerial Notification shall be penalized by the penalty setforth in the Fisheries Act.

12. This condition is valid for 5 years

13. This Ministerial Notification shall come into force after 30 days being published in the Government Gazette. "

Therefore, there is an opportunity to implement the fishing right system and community-based fisheries management in Thailand by selecting some coastal areas for pilot projects where the Ministerial Notification can be applied temporarily for the pilot project only. The full scale of fishing right system and community-based fisheries management requires the government to enact the law to legalize all activities related to this system. The accomplishment of such pilot projects could convince the government to speed up the procedure of law amendment.

5. CONCLUSION

Community-based fisheries management has been perceived as an appropriate alternative for coastal fisheries management among Southeast Asian countries including Thailand. The Department of Fisheries, Government of Thailand has planned to prevail the fishing right system and community based fisheries management by initiating the pilot project in some coastal areas of the country. However, under Thailand's existing fisheries law, there are insufficient provisions to implement the full scale of fishing right system and community based fisheries management in Thailand. There is only one provision under the Fisheries Act, B.E. 2490 (1947) which can be applied temporarily for the implementation of the pilot project only. There is a need to enact the law to cover many aspects regarding fishing right system and community based fisheries management such as legalize the fishing right granted to fishing communities, define the type of fishing tight, legalize the fishermen's organizations, etc. In addition, it is also necessary for DOF to obtain scientific information, socio-economics information, and other related information in order that DOF and the communities could manage coastal fishery resources effectively.

6. REFERENCES

Asian Development Bank (ADB). 1985. Thailand Fisheries Sector Study. ADB, Manila, 226p.

Christy, F.T, Jr. 1973. Alternative arrangement for marine fisheries: An overview. RFF/PISFA Paper 1, Washington, DC., USA. 31p.

<<

Christy, ET. Jr. 1982. Territorial use rights in marine fisheries: definitions and conditions. FAO Fish. Tech. Paper (227), 1 Op.

Christy, ET. Jr. 1987. Experiences in dealing with problems of excess fishing eEffort and conflict. In: RAPA/ REPORT: 1987/l 0, FAO, Bangkok, pp. 528-539.

Department of Fisheries (DOF). 1989. Thai Fishing Vessels Record 1987. No. 4/1 989, Fisheries Statistics Sub-Division, DOF, Bangkok (in Thai).

Panayotou, T. and S. Jetanavanich. 1987. The economics and management of Thai marine fisheries. ICLARM Studies and Reviews 14. Manila, 82p.

Thailand Development Research Institute (TDRI). 1987. Thailand Natural Resources Profile. Bangkok, 60p.

Yamamoto, T. 1987. Fisheries regulations adopted for coastal and offshore fisheries in Japan. In: RAPA/ REPORT: 1987/10, FAO, Bangkok, pp. 367-378.

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FISHERMEN INCOME AND COMMUNITY-BASED FISHERY MANAGEMENT: OPTIONS FOR IMPROVING INCOMES OF FISHING COMMUNITIES IN PHANG-NGA BAY

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1. INTRODUCTION

The fisheries resources in Phang-nga Bay are mainly exploited by small-scale fishermen who employ small and low efficiency fishing gears. The majority of the fishing boats have outboard engines. The main fishing gear operated in Phang-nga Bay are traps and gillnets. The catches comprise fish, prawns, squid and crabs that are sold to the local middlemen at a price determined by middlemen. In the past, the total catch of each fishing household was plentiful, **but** the price per unit was rather low owing to the lack of fishermen's bargaining power. Hence, the income of the small-scale fishermen in this area was comparatively low. While the price of fish today has increased owing to the rising demand by tourists, supplies are limited due to the depletion of fisheries resources. The income of fishing households therefore remains at a low level.

In order to improve the income and living conditions of small-scale fishing households in Phang-nga Bay, the DOF has established several development projects for the Bay. Community-based fishery management is one of the development programmes that are being implemented in close collaboration with the FAO Bay of Bengal Programme.

2. PROBLEMS AND CONSTRAINTS OF SMALL-SCALE FISHING HOUSEHOLDS

The problems and constraints of small-scale fishing households are social, economic and sometimes political. However, the most severe problem is poverty.

Juntarashote and Daosukho (1986) have described the major problems and constraints of small-scale fishery households as follows.

1. Limitation of coastal fisheries resources

Overfishing, by the large-scale fishery and illegal fishing by the small-scale fishery through the use of dynamite, electric shock and poison, has an adverse effect on the coastal

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fisheries resources utilized by the small-scale fishery. In addition, the degradation of the coastal environment is another factor that has led to the depletion of the resources.

2. Lack of investment capital

The depletion of coastal fisheries resources has been the cause of minimal production and low income, and has ultimately resulted in a lack of funds for further investment. Most of the fishery households normally rely on non-institutional credit because they are unable to offer collateral to the value required for obtaining loans from credit institutions.

3. Inefficiency of fishing boats and fishing gear

Owing to the lack of investment funds, the fishing boats and gear employed by the fishermen are small and inefficient. The average size of a fishing boat is less than 8 metres **and** are either without an engine, or equipped with a small engine. The fishing gear is simple; hook and line, traps, beach seine and gill net. These imply a low catch.

4. Lack of bargaining power at the market

This problem results from the low catch of each fisherman, low quality of fish due to improper handling at sea, limited means of transportation from the village to town and the relationship between the fishermen and fishmongers in terms of indebtedness.

5. Lack of infrastructure and public utilities

The fact that small-scale fishing households are located in remote areas and are far from the government's basic infrastructures and public utilities results in a higher fishing cost, and lower prices for fish sold.

6. Lack of alternative sources of income

Job opportunities for small-scale fishermen are rather limited. In general, fishing is their only source of income because they cannot take up other occupations on account of their low level of education and lack of skills.

Hongskul (1981) has pointed out that these problems are interrelated and, that, generally, they need both short-term and long-term solutions.

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Short-term

1. Placing limits on fishing effort appropriate to available resources.
2. Improvement of fish processing techniques.
3. Extension of services for production and marketing.
4. Improvement of public utilities, education and health care.
5. Development of other sources of income.

Long-term

1. Enrichment of fishing grounds.
2. Improvement of the marketing system.
3. Improvement of fishing boats and fishing methods.
4. Coastal aquaculture management.
5: Promotion of fishermen's groups and fisheries cooperatives.

3. COMMUNITY-BASED FISHERY MANAGEMENT AND INCOME OF FISHERMEN

The income of small-scale fishermen in Phang-nga Bay derives mainly from the fisheries resources, with very small earnings from other sources such as selling their labour and services to amateur fishermen and tourists. Therefore, fisheries resources are the mainstay of small-scale fishing households in Phang-nga Bay.

The income of small-scale fishermen is in general rather low compared with that of commercial fishermen; however it is above the poverty line in Thailand. The DOF wants to improve the socio-economic conditions of the small-scale fishing households in the country. Main reasons:

1. The small-scale fishery is the main supplier of fish for the local populace; its quality is much higher than that from commercial fishery catches;

2. The small-scale fishery employs a high proportion of the labour force. Past marine fishery censuses of Thailand, show that this sector absorbed more than 100,000 persons. This figure would increase if assistants to fishermen on the shore were included; and

3. Small-scale fishermen constitute the majority in the fishery sector, but their earnings are limited.

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The DOF has realized that, in order to improve the income of fishermen, the Department should:

1. Enrich coastal fisheries resources;

2. Reorganize the fishery by establishing new fishery management measures, such as co-management, community-based fishery management, etc.;

3. Strengthen fishermen's institutional activities in order to improve their bargaining power and enhance the capability of fishermen's institutions in the fishery management programme;

4. Create more competition in the local market and seek new markets for fish and fishery products; and

5. Advise fishermen about fish processing so that they meet quality standards demanded by the consumers.

Enrich coastal fisheries resources through community-based firhery management

So far, fisheries resources have been treated as a common property and the management of these resources is the responsibility of the government. The DOF has implemented many management programmes on the basis of a "top-down" management policy. However, as mentioned in several papers, fishery management measures that have been practiced for many decades have failed for several reasons. But the main reason is that the DOF could not ensure the co-operation of fishermen, who always believe that fisheries resources belong to the fishermen. They have therefore exploited the resources to the utmost without the "wise use" concept. Thus, fisheries resources in Thai waters face severe depletion, resulting in low catch and low incomes for fishermen.

Therefore, the community-based fishery management programme has reversed the concept of exploiting the fisheries resources as common property, It is now regarded as the property of the community. The resources of the sea area where the DOF grant a fishing right to community(ies) are no longer a common property, They are the property of the community; only the fishermen in that community or from other "approved" communities can fish in that sea area. The community has to establish a fishery management committee by general election that can have responsibility for establishing any management programme for the benefit of fishermen as a whole. These management programmes differ from past programmes. They will operate on the basis of a "bottom-up" policy. In general, it is believed that the fishermen will collaborate closely in implementing the management programme as they realize that they will benefit from it.

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In order to assist fishermen in enriching the fisheries resources, the DOF allocates a considerable budget for the construction of artificial reefs along the coastal area. The two main purposes of installing artificial reefs. First, to create more habitats for aquatic animals and at the same time a device to attract big fish. Small-scale fishermen are allowed to operate on selective gears. Secondly, artificial reefs restrict fishing by trawls and push nets in the coastal area.

Supongpan (1995) conducted an assessment of the impact of artificial reefs in Phetchaburi Province and concluded that the artificial reefs installed in 50 sq. km of the near-coastal area could enrich several fisheries resources. The average catch per trip of every type of fishing gear has increased from 12.31 kg in 1990 to 22.4 and 37.9 kg in 1992 and 1994 respectively. However, the study did not mention the operation of trawls and push nets in that area.

Increase in fishermen's income through community-based fishery management

Under community-based fishery management, the fisheries resources have been enriched and have resulted in an increase in fishermen's catches. In addition, with proper fishery management programmes, the size of fish caught is larger than in the past and this has led to a higher price per unit. It should be noted, however that the community-based fishery management programme cannot make small-scale fishermen rich – it could, however generate higher income and prevent conflicts. The socio-economic conditions of fishermen would improve.

The Ban Lam Makham fishing community in Trang Province is a good example. Under the small-scale fishery development of the DOF and with the guidance of the Yard Fon (Rain Drop) Association, this community has practiced partial community-based fishery management on the basis that coastal fisheries resources in their traditional fishing grounds belonged to them. At the initial stage, the main objective was to conserve seagrass and protect the dugong in that area by restricting the operation of trawls and push nets in the coastal area. The push net is the target gear to ban but law enforcement had not been entirely successful in doing so. Fishermen in the community have therefore introduced a new approach. Instead of law enforcement, they convinced fishermen who operate push nets to quit and offered them a fishing ground for gill net and traps.

Finally, all push netters in the community had exchanged their destructive fishing gears for a selective gear that catches only fish of marketable size. Consequently, the income of fishermen in this community has increased dramatically; for instance, squid trap fishermen now earn 400-600 baht a day compared with 100-200 baht a day in the past; hook and line fishermen earn 800-1,000 baht a day from artificial reef fishery. In addition, the fishermen spend less time on fishing because they need not to go to more distant fishing grounds. Squid trap fishermen leave their homes at 6 a.m. and return to the shore at 9 a.m.

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They complete their fishing activities, including marketing, during the morning. Hence, they have free time for participating in community activities or seeking additional income from other occupations in the afternoon. However, there are still trawlers from other areas which try to operate in this fishing ground. The fishermen of this community complained that when trawlers fish on a single day, small-scale fishermen's catches drop sharply for the next **15** days. If the trawlers can be banned, the income of fishermen in Ban Lam Makham will greatly increase substantially.

Therefore, community-based fishery management is another option for improving the incomes of fishery households in Phang-nga Bay. Their higher incomes will derive from the following;

1. Increase in total catch. As mentioned above, through the community-based fishery management programme, coastal fisheries resources have been able to increase. The stock size of fish is larger, resulting in better catches for fishermen. Furthermore, owing to management measures on gear selectivity, the size of fish caught is bigger than in the past. With the increase in catches and higher prices, fishermen's earnings have improved.

2. Decrease in fishing costs. Since coastal fisheries resources have been enriched, fishermen need not go to more distant fishing grounds as in the past. Therefore, fishermen can save at least the fuel and maintenance costs of fishing boat and engine. The fact that total sales are increasing and fishing costs are decreasing, would indicate that the income of fishery households under the community-based fishery management programme are increasing.

3. Decrease in fishing time. In the past, fishermen in Phang-nga Bay had to spend a long time to reach the fishing grounds. Owing to overfishing during the last two decades, coastal resources available for exploitation remain only in distant fishing grounds. If the fisheries resources are enriched, fishermen will be able to reach the fishing grounds in a short time. They may finish their fishing activities in the morning, and spend the remaining time to carry out other activities to rest.

4. CONCLUSION

Fishermen in Phang-nga Bay are entering a new era of fishery management. It is hoped that they can earn more money than in the past through to the coastal fisheries resources enrichment programme. It is assumed that the total catches will increase and also fetch higher prices. However, this will not happen in the short term as it takes some time for resources to recover. Thus, at the beginning of the programme, an appropriate source of income has to be provided for them. In addition, the success of the programme depends to a great extent on cooperation from fishermen in various respects. As for the fishery officials, they should keep in mind that this programme is a very challenging one and needs dedicated

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persons that can work closely with the fishermen. The past relationship between officials and fishermen has to change. They must work together in partnership and as friends. Then the success of the project is ensured.

However, an increase in fishermen's income is not the ultimate objective of the programme. Increasing their income is not a difficult task. The more difficult task is for the fishermen to learn how to manage their increased incomes for the benefit of fisheries development. They may fritten away their increased income on luxury goods and services, and have nothing left for their families improving their fisheries, and lapse into poverty.

Lastly, it should be stressed that small-scale fishermen in Phang-nga Bay must experience real development and not just economic growth. The Thai economy, one may observe in this context, has experienced growth without development.

5. REFERENCES

Hongskul, V. 198 1. Fisheries administration ofThailand: Small-scale fishery development. Fishery News, Vol. 8(1). Bangkok, Thailand.

Juntarashote, K., and S. Daosukho. 1986. Handbook for fishery extension workers in Southeast Asia. Southeast Asian Fisheries Development Center, Bangkok, Thailand, 103 p.

Supongpan, S. 1995. The assessment of the impact of artificial reefs in Phetchaburi Province. Technical Paper No. l/1995. Marine Fishery Division, Department of Fisheries, Bangkok, Thailand, 28 p.

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THE NEW ROLE OF EXTENSION WORKERS UNDER A COMMUNITY-BASED MANAGEMENT REGIME: EXCHANGING SCIENTIFIC INFORMATION FOR BETTER COMMUNITY DECISION MAKING

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1. INTRODUCTION

During the past three decades, the demand for fish has increased rapidly both from developing and developed countries, owing to increase in population, change of consumer tastes and economic growth. Therefore, fish producing countries, including Thailand have expanded their exports and earned huge amounts of foreign exchange. In 1994, Thailand was the world's leading fish exporter earning nearly US$ 4,000 million, of which around 40 percent was from frozen prawns.

In the developing world, 14-20 million people are directly involved in fisheries and aquaculture. The figure increases to 50 million if post-harvest handling and marketing are included. In addition, there are 1 billion people who rely on protein from aquatic products as their main source of animal protein (Pomeroy and Williams, 1995). The supply of fish comes mainly from the natural fish population and only a small portion come from aquaculture. Therefore, the fisheries resources have been heavily exploited in the last three decades resulting in resource depletion. At present, most coastal states face this problem and are trying to solve it by introducing various fisheries management measures, such as area and seasonal closures, gear restriction and limited entry. However, it has not been possible to solve this problem.

Thailand is one of the coastal states in which the fishery industry has been developed since 1960. In the 196Os, the trawl fishery was developed and demersal fish became acceptable to Thai consumers. Fishing technology developed rapidly and the number of fishing boats increased. This resulted in over-exploitation of the fisheries resources in Thai waters during the 1970s (Juntarashote, 1994).

The fisheries resources of Thailand are treated as common property. That is, anyone can benefit from these resources. They are, therefore, heavily exploited by fishermen who employ various types of fishing gear. Arising from the development of the Thai marine fishery during the last three decades, the two most severe problems are, fisheries resources depletion and conflicts among fishermen. If these two problems cannot be solved in the next decade, the fishery industry of Thailand may reach a stage where it is no longer viable.

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DOF has recognized these problems. Hence, many fishery management measures have been implemented for the recovery of the country's fisheries resources. Although these measures have been implemented for more than a decade, the fisheries resources have been unable to reach a satisfactory level for the following reasons:

1. The number of staff and boats for law enforcement is inadequate for patrolling the coastline of 2,614 km, given the large number of fishing boats that use various types of fishing gear.

2. The fishermen do not co-operate fully.

3. The law enforcement cost is very high.

4. The DOF is not the sole agency for fishery management.

5. The fishery management policy is a "top-down" policy. Thus fishermen are not involved at any stage in establishing and implementing a fishery management programme.

Therefore, in order to solve the problems of the fishery industry, the DOF must seek other alternatives of fishery management. Community-based fishery management, which is a "bottom-up" policy, may be the answer.

In implementing a community-based fishery management programme, officials from various agencies must work closely with fishermen. The extension workers are seen to be the most important persons working with the fishermen. Their role in the past was principally technology transfer, but in a community-based fishery management programme, their role would be expanded to include other aspects such as exchanging scientific information with fishing communities for better community decision making.

2. COMMUNITY-BASED FISHERY MANAGEMENT IN THAILAND

Towards the end of 1992, the DOF, in collaboration with the Fishery Association of Thailand, organized a seminar in Surat Thani province. One of the recommendations made by the small-scale fishery group was that the DOF should establish a fishing rights system for Thai small-scale fishermen who are the poorest in the fishery sector. It is generally believed that if the fishermen were given management responsibilities, they would feel more committed and be more responsive to managing the resources. In addition, the fishing rights system would, firstly, solve the problem of conflicts among fishermen; secondly,

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reduce law enforcement costs; and, thirdly, enable coastal fisheries resources to recover (Juntarashote, 1994).

In 1993, the DOF in collaboration with the Department of Fishery Management (DFM), Faculty of Fisheries, Kasetsart University, set up a development plan for a community-based fishery management programme for Thai fishermen. Fishing rights would be granted to all small-scale fishermen. They would be given exclusive rights to fish in their own fishing ground and, at the same time, they would have responsibilities in connection with the fishery management programme in that area.

However, in granting fishing rights to small-scaIe fishermen, the following have to be considered:

- Whether the DOF is ready to grant fishing rights to fishermen's institutions.
- Whether fishermen are willing to accept a fishing rights system.
- Whether the fishing rights system is in accord with the present fishery law.
- Whether the fishing rights system is in accord with the present fishermen's institutional law.
- Whether the persons concerned with the fishing rights system have a common understanding of the concept of fishing rights (Juntarashote, 1994).

In 1994, the DOF formally set up several committees for the establishment of community-based fishery management for small-scale fishery. The urgent tasks are (a) drafting a new fishery law to incorporate the fishing rights system, and (b) preparing a pilot project.

2.1 Pilot Project

Since the community-based fishery management concept is new to Thailand, it is essential to have a pilot project in order to study' the problems that may occur and seek solutions. The DOF and DFM agreed to start the pilot project by October 1995.

The principal criteria for selecting a pilot project area for improving the management of coastal fishery will include the following (Juntarashote, 1995):

Economic

Sustainable capture fisheries is capable of becoming the principal source of livelihood of the communities selected.

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Competition from commercial trawlers is minimal or there is a strong possibility of minimization through project implementation.

DOF is able to provide legal and practical assistance to protect fisheries.

Social

Previous participation by the communities in DOF or NGO programmes should have been demonstrated.

Willingness on the part of fishermen to cooperate in managing and protecting fisheries resources should be shown to exist.

Ability and willingness of fishermen to work with the neighboring villages in a community approach to resource management.

Ecological

Potential exists for adequate and sustainable fish catch from coastal fishery. In addition, the following criteria should apply to areas for the implementation of a package to improve management of coastal zone resources in relation to small-scale fishery:

- Potential for sustainable small-scale coastal fishery based on more than one stock within a three-kilometer limit.
- A significant number of small-scale fishermen to form a viable self-supporting organization.
- Sufficient depth of water for installing artificial reefs.
- Demonstrable relationship between groups which might form a community.
- The existence of at least a rudimentary organization among fishermen or experience of participating in previous department programmes.
- Fishermen views are consistent with the active management of fishery.
- Some potential exists for mangrove or sea grass rehabilitation (MIDAS, 1995).

Based on the above criteria, there are many areas that show a potential for the implementation of CBFM. But, owing to budget constraints and the limited number of competent staff, only three provinces have been selected as pilot project areas. These are:

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1. Trat Province, on the eastern coast of the Gulf of Thailand.

2. Nakhon Si Thammarat Province, on the western coast of the Gulf of Thailand.

3. Trang Province, on the Andaman Sea.

In addition, under the Bay of Bengal Programme (BOBP), Phang-nga Bay has been chosen as a pilot project area that is being implemented by the Andaman Marine Fishery Center of DOE

In order to avoid future difficulties and problems of project implementation, the following research aspects will be looked into as they relate to the pilot project areas:

1. The socio-economic conditions of fishery households and their attitudes towards CBFM.

2. The establishment of fishermen's institutions and their functions as well as performances in the past.

3. The abundance of coastal fisheries resources, in particular of sedentary species and their utilization.

4. The activities and performances of the NGOs that work in the pilot project areas.

5. Changes that would occur in fishery households and communities on account of the introduction of CBFM.

Components of the programme

1. Identification of a potential fishing community as a coherent mix of a number of settlements or groups. Individual fishing communities or settlements are not usually large enough to constitute a management unit for a sustainable fishery area over which they can be given rights. Identification will be carried out through close consultation and co-operation with the communities.

2. Identification of relevant fishing grounds in which the community will have fishing rights. Community surveys to determine usual or traditional fishing grounds and the interest of other communities in those grounds.

3. Ensuring that neighboring communities will respect fishing rights. This may prove difficult as the adjacent community will not necessarily be included in CBFM in the short term, and may therefore be excluded from some fishing grounds without

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being given rights to others. There may be a need to reach an agreement on some fisheries resources or some fishing grounds being common property resources.

4. Granting of legal rights to the community to identify fishing grounds and protect their resources. At present, a new fishery law is being drafted to provide for community fishing rights.

5. Establishment of a community fisheries management committee. This will be decided by the community, with advice and training on what is involved in committee work.

6. Management training/awareness raising of the community and committee. This includes:

   - basic principles of fishery management and coastal environmental issues;
   - business management principles;
   - legal aspects of community-based fishery management; and
   - moreover, government personnel will be made aware of the principles and methodology and of their roles of in CBFM.

3. ROLES OF EXTENSION WORKERS

So far, the main objective of fishery industry development is to increase fishery production both in terms of quantity and value. In order to increase fisheries production continuously, a major change in the attitude, knowledge and skills of fishermen is required. The fishermen must break away from traditional attitudes and methods in favor of more objective attitudes and scientific methods. An extension education service must play a fundamental role in this respect.

Principles of extension work

The ultimate goal of extension work is to raise the standard of living of small-scale fishermen. Therefore, extension workers should encourage fishermen to make the necessary efforts to improve their technical knowledge, in order to raise their income and standard of living.

There are a number of principles which will contribute to the efficieiency of extension programmes and lead to greater success. These are as follows:

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1. Helv veovle to helv themselves

In developing countries, extension work has appeared to be on the borderline of charity. In fact, this type of work differs from the charitable assistance given to fishermen. Extension workers should not turn people into beggars.

The extension workers should have a clear understanding of the basic principle for which an extension service is designed: to help people to help themselves. The most difficult task for extension workers is to correct the misunderstanding that extension is charity. The real purpose of extension work is to motivate and convince fishermen to improve their living conditions themselves.

2. Work at the village level

Previous experience has proved that the fishermen are not likely to change significantly if the basic extension programme is introduced from outside. Therefore, the fishery extension workers can achieve their objectives if they work closely with the target group and become acquainted with the fishermen's problems, make friends with them and gain their confidence.

3. Encourage learning bv doing

To learn something by doing it is much more educative than to learn it merely through verbal communication of ideas.

4. Create an imbalance

It has been found that extension creates an imbalance in the level of knowledge in a specific area. Thus, differences emerge in the technological know-how of the target groups. In terms of the flow of technology, it is obvious that there is a shifting of technology from place to place and that people select an appropriate technology according to what is readily available to them, and by the amount of information channeled from higher technology sources to groups with lower technological know-how (Juntarashote and Daosukho, 1986).

Some specific roles that an extension education service performs include:

- Providing direct technical assistance to fishermen.
- Providing educational materials.
- Assisting in marketing and market development.
- Presenting training and educational programmes.

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- Conducting field trial research.
- Assisting fishermen in formal and informal activities.
- Assisting in government decision-making, policy planning and programming in all aspects of fisheries development.

4. THE NEW ROLES OF FISHERY EXTENSION WORKERS UNDER A COMMUNITY-BASED MANAGEMENT REGIME

At present, fisheries management in Thailand is government-based management, or government-centralized management. It has been found that the success of fishery management is rather limited for the reasons mentioned above. The DOF, therefore, realized that it is essential to change the concept of fishery management from government centralized management to community self-governance and self-management. However, it is impossible to suddenly change from government-based management to community-based management owing to several problems. These primarily include the fact that fishermen's institutions are not well developed, and that the present legal framework is inappropriate. Therefore, at an early stage, co-management should be introduced to fishermen. Co-management is defined as the sharing of responsibility and/or authority between the government and local fisheries resources users/community to manage the fishery or resource (e.g., coral reef, mangrove shoreline habitat) (Pomeroy, 1994).

Co-management is the first step in developing community-based fishery management. This should be followed by (Berkes, 1994):

1. Information dissemination. The DOF must inform the fishermen of the new concept of fishery management. This will be done by the fishery extension workers. It is time- consuming since the extension workers must visit each fishing community and explain to the fishermen the concepts of co-management and community-based fishery management. In addition, extension workers have to explain these concepts to local fishery officials and other local offtcers who are concerned with this project.

2. Consultation. For the development of community-based fishery management, close consultation has to be maintained between fishermen and extension workers.

3. Co-operation among fishermen and between fishermen and extension workers.

4. Communication between the DOF and the fishermen. Two-way communication between the DOF and the fishermen is essential.

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5. Information exchange. Exchange of data and information between fishermen and extension workers should be done regularly.

6. Advisory role. The fishery extension workers play a very important role as advisors to fishermen. Advice may relate in particular to fishery biology, aquaculture, fish processing, fish marketing, group development and leadership improvement.

7. Joint action. In co-management and community-based management, the government and the community will work together from the beginning. They will act together in implementing the programme and solve the problems that arise.

8. Partnership. The relationship between fishermen and DOF officials must change to one of a close partnership. The success or failure of the project will be shared by both parties and not be attributed to officials only as has been the case in the past.

9. Community control. This will come into effect when the management regime evolves into CBFM. The community will have full authority to manage the fishery whereas the government will act as advisor to the community. Fishery management measures will be established by the community.

10. Inter-area coordination. Once community-based management has been well developed, each fishing community will have its own fishing grounds and apply its own fishery management measures. Thus, the close inter-area coordination of fishing communities will create better fishery management and increase their bargaining power.

The key conditions for successful fishery co-management

Ostrom (1990 and 1992) and Pinkerton (1989) described the key conditions for successful fishery co-management as follows;

- Clearly defined boundaries.
- Clearly defined membership.
- Group cohesion.
- Existing organization.
- Benefits exceeding costs.
- Participation by those affected.
- Enforcement of management rules.
- Legal rights to organize.
- Co-operation and leadership at community level.

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- Decentralization and delegation of authority.
- Coordination between government and community.

Roles of fishery extension workers in scientific information exchanges

The abundance of the coastal fisheries resource is the key factor for developing a CBFM programme. As mentioned in various papers, the coastal fisheries resources of Thailand are heavily exploited by fishermen. Trawls and push nets are the major gear exploiting the resources. At the same time they destroy coral reefs and the sea bed which are the habitat of aquatic animals. In addition, pollutants from agriculture, industry and households are discharged into the sea. Therefore, the coastal fisheries resource of Thailand faces the problem of depletion, which applies also to Phang-nga Bay.

Geographically, Phang-nga Bay is one of the most biologically productive bays because many rivers and canals flow into it. Nutrients from the land accumulate in the Bay and enrich the fisheries resources. However, owing to overfishing and the failure of fishery management measures, the fisheries resource in Phang-nga Bay has been depleted.

In order to enrich the fisheries resource in Phang-nga Bay, important data and information on fishery biology needs to be collected and analyzed. These are as follows:

1. Water quality. The quality of water in Phang-nga Bay has to be monitored regularly. Water quality is one of the key factors that indicate the health and abundance of fisheries resources.

2. Species composition. It is essential to know the species composition of the fisheries resource in the Bay. These data may be obtained from the fishermen's catch and from researchers' own data. From these, extension workers may be able to give advice to the fishing community on establishing fishery management measures.

3. Catch data. Data and information on fish catch by type of fishing gear and fishing grounds are essential for estimating total allowable catch. Collecting such data require the co-operation of fishermen, otherwise the reliability of the data will be limited. Fishery extension workers must therefore make the fishermen understand the importance of these data and instruct them on keeping proper records.

4. Data on number of fishing boats by size and type, and number of fishing gears. These data are collected in the course of a fishery household enumeration. They should be collected yearly if possible. These data will be used for establishing the fishery management programme.

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5. Data and information for artificial reef establishment. Artificial reefs are one of the means of enriching the coastal fishery resources. They create a habitat for aquatic resources and at the same time act as an obstacle to trawls and push nets that operate in coastal areas.

The collected data and information will be analyzed by researchers. The results of the analysis should be made available to the fishery management committee for decision-making purposes.

As mentioned above, in CBFM, the fishermen are responsible for managing their fishery themselves. However, the fishermen have experience only in fishing and some basic knowledge of their fisheries resource. They therefore require additional information on fishery biology as well as on fishery management concepts. It will be the duty of extension workers to simplify the scientific data supplied by DOF for transfer to fishermen and summarize fishery management concepts for them. However, at the initial stage, the fishermen will have to provide the essential data and information on their fishing activities to researchers or extension workers for analysis.

In sum, the further duties and roles of fishery extension workers in scientific information exchange for Phang-nga Bay, under the community-based management regime, should include the following:

Educate and point out the importance of fishery data and information to fishermen through group activities and the mass media.

1. Collect from fishermen in Phang-nga Bay, data and information on their fishing activities.

2. Assist fishermen in establishing a fishery data collection system for fishery management purposes.

3. Transmit to researchers for analysis the data and information that is collected from the fishermen.

5. Simplify and transfer research results to fishermen, These should include total allowable catch at Phang-nga Bay, catch per unit of effort, spawning ground, nursery ground, first capture size of fish to be caught, the optimum mesh size of each type of fishing gear and the optimum size and type of fishing boat to be used.

6. Advise the fishery management committee about fishery management measures such as limited entry, catch quota, area and seasonal closures. However, any measures have to be designed by the fishermen, not by fishery extension workers.

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7. Establish a monitoring system based on catch records drawn up by fishermen. This will minimize the enforcement costs that will have to be borne by the fishermen.

8. Choose locations for installing artificial reefs for use by local fishermen. The locations should be selected on the basis of scientific criteria to avoid conflicts of interest among fisherman,

5. CONCLUSION

CBFM is a new concept of fishery management not only for fishermen in Phang-nga Bay but also for many fishery offrcials and local officials involved in this programme. In addition, under this programme some commercial fishing vessels may lose some benefits and may be against the programme. Therefore, fishery extension workers have to work harder than in the past: They also need more knowledge of fishery biology and management. In future, any debate among fishermen will need strong scientific evidence and the extension workers will be responsible for providing such information. Fishery extension workers should therefore have higher qualifications to meet the requirements of the programme. In the success or failure of the programme, fishery extension workers constitute a key factor. Finally, it should be kept in mind that science and technology may answer every question but cannot solve every problem. To solve problems, other than scientific and technical, tolerant and responsive personnel with a good intellect are needed.

6. REFERENCES

Berkes, F. 1994. Co-management: Bridging the two solitudes. North. Perspect. 22(2-3): 18-20.

Juntarashote, K. 1994. Possible development ofcommunity-based fishery management inThailandwith the advent of the fishing rights system. Presented in the 7th International Conference of IIFET. Taipei, Taiwan, 18-21 July 1994.6 p.

Juntarashote, K. 1995. Thailand's fishing rights programme. Presented in the Fisheries Co-Management Workshop on Research Strategy, Methodologies, Field Experience of Partners and Exchange of Information. The North Sea Center, Hirtshals, Denmark, 29-31 May 1995.6 p.

Juntarashote, K., and S. Daosukho. 1986. Handbook for fishery extension workers in Southeast Asia. Southeast Asian Fisheries Development Center, Bangkok. 103 p.

MIDAS. 1995. Pre-investment study for a coastal resources management program in Thailand, Vol. 1. Report submitted to the World Bank and the Office ofAgricultural Economics, Ministry of Agricukure and Cooperatives, Royal Thai Government, Bangkok. 274 p,

<<

Ostrom, E. 1990. Governing the commons: the evolution of institutions for collective action. Cambridge University Press, Cambridge.

Ostrom, E. 1992. Crafting institutions for self-governing irrigation systems. Institute for Contemporary Studies Press, San Francisco.

Pomeroy, R.S., and M.J. Williams. 1994. Fisheries co-management and small-scale fisheries: A policy brief. International Center for Living Aquatic Resources Management, Manila, Philippines. 15p.

MEETING THE INFRASTRUCTURE NEEDS OF FISHING COMMUNITIES IN PHANG-NGA BAY

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1. INTRODUCTION

Phang-nga Bay is located in the south of Thailand along the Andaman Sea coast. The Bay's landward perimeter is made up of the three provinces of Phuket, Phang-nga and Krabi (Fig. 1).

Phuket, the longest island in Thailand's waters of the Andaman Sea, is the only island having provincial status. It is also a regional headquarters. Phuket island's long shape runs from north to south. Its general geographic characteristics are rolling hills alternating with basins and some 32 small outlying islands. Phuket is the smallest southern province of Thailand; occupying 543 square kilometers. It is administratively divided into three districts; Muang, Thalang and Krathu.

Phang-nga Province covers a land area of 4,170.9 square kilometers, 57% of which is mangrove and evergreen forest. The majority of the area is mountainous, with few low-lying basin areas. It is administratively divided into eight districts; Muang, Kapong, Khura Buri, Takua Pa, Takua Thung, Thai Muang, Thap Put and Ko Yao.

Krabi is the southernmost province, and is the most open to the Andaman Sea. It occupies an area of 4,708 square kilometers that is administratively divided into seven districts and 1 sub-district; Muang, Ao Luk, Khao Phanom, Khlong Thorn, Ko Lanta, Plai Phraya, Lam Thap and sub-district Nua Khlong. General geographic characteristics include mountains, hills, plains and more than 30 small islands off the coast.

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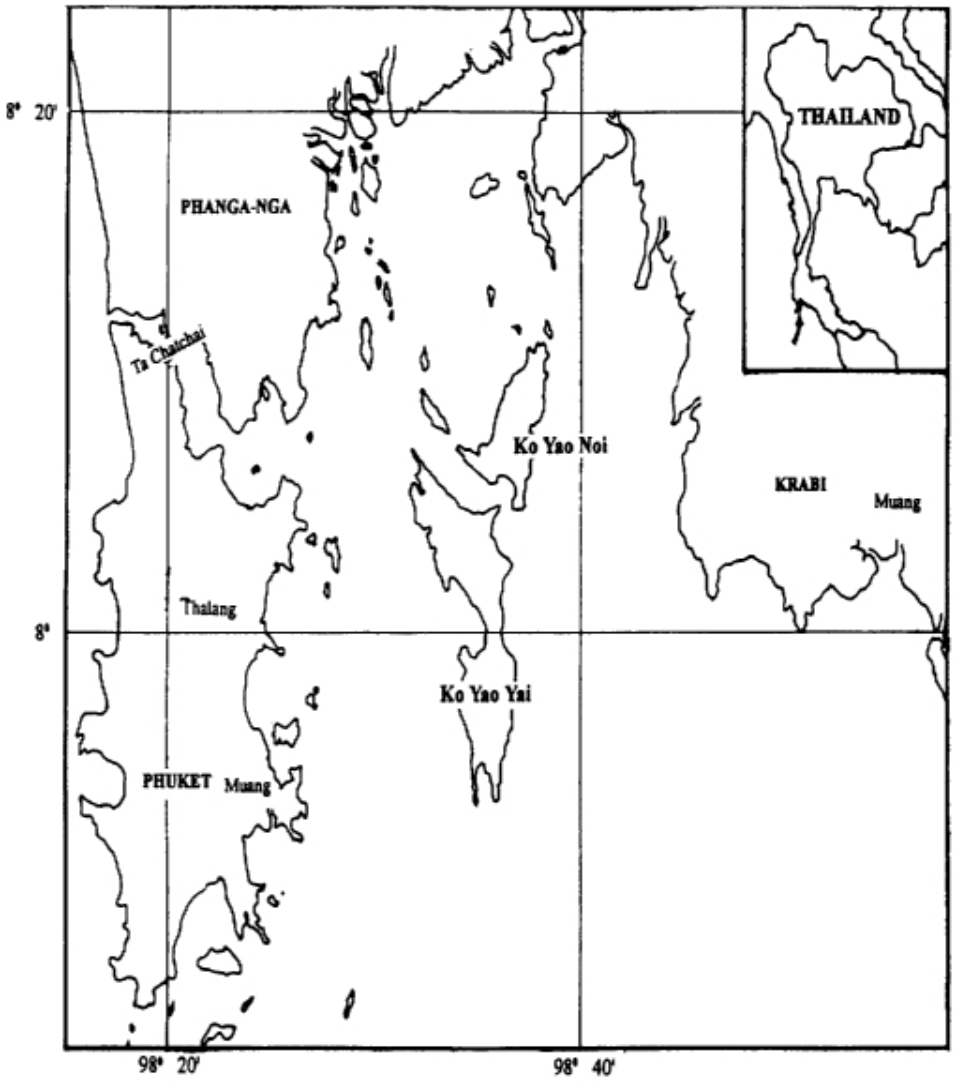

Fig. 1. Phang-nga Bay is bordered by 3 provinces (Phuket, Phang-nga and Krabi).

2. IDENTIFYING INFRASTRUCTURE NEEDS IN WANG-NGA BAY FOR SUSTAINABLE DEVELOPMENT OF COASTAL FISHERIES

The DOF has implemented fisheries activities under the 6th (1987-1991) and 7th (1992-1996) National Economic and Social Development Plans. These Plans have targeted small-scale fisheries concerns in 22 provinces along the Gulf of Thailand and Andaman Sea Coasts.

One of the DOF activities has been small-scale fisheries development of Phang-nga Bay. The activity used a "bottom-up" approach to identify villages in need of infrastructure facilities, and specific facilities that were needed by the villages. Fishermen from fishing villages of Phang-nga Bay approached the local DOF officers and governors of provinces to request infrastructure facilities.

3. INFRASTRUCTURE NEEDS PROVIDED BY DOF

Once these infrastructure needs of Phang-nga Bay for sustainable development of coastal fisheries were identified, DOF allocated technological and financial support to establish the facilities during the years 1990-1996. The infrastructure needs supplied by the Department of Fisheries in Phang-nga Bay are listed in Table 1.

Table 1. Infrastructure needs in Phang-nga Bay supported by the Department of Fisheries from 1990-1996.

Name of Province	Krabi	Phang-nga	Phuket
Total Numbers of Fishing Villages Requested	7	10	8
Infrastructure and activities			
1. Fishing Pier Construction	5	7	3
2. Retaining Wall (or Water Breaker)	3	5	2
3. Fishing Equipment Repair and Storage	2	2	-
4. Rainwater Tank	1		.
5. Fish Processing, Nutrition and Storage	1	1	1

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3.1 Infrastructure facilities of Phang-nga Bay's three provinces

Eight fishing villages of Phuket Province, in districts of Muang and Thalang, requested two types of infrastructure facilities which include a retaining wall and fishing pier. Among these, the fishing pier construction and retaining wall are high priority requirements.

Table 2. DOF infrastructure facilities established in Phuket province.

Plot #	Village	Town	District	Activities	Year
4	Para	Pa Klog	Thalang	1. Fishing pier construction	199 1
				2. Retaining wall	1991
7	Yamu	Pa Klog	Thalang	1. Fishing pier construction	1990
				2. Retaining wall	1990
5	Ta	Mai	Thalang	1. Fishing pier construction	1995

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Ten fishing villages of Phang-nga Province, in the districts of Muang, Thap Put, Takua Thung and Ko Yao, requested five items of infrastructure. These items, except for the rainwater tank, are similar to those requested in Krabi Province.

Table 3. DOF Infrastructure facilities established in Phang-nga province.

Plot No	Village	Town	District	Activities	Year
1	Kok Sai	Ma Rui	Thap Put	1. Fishing pier construction	1990
4	Kuan	Bo Saen	Thap Put	1. Fishing pier construction	
				2. Retaining wall	1991
6	Tai	Bang Tei	Muang	1. Fishing pier construction	1992
2	Hin Rom	Klong Kian	Takua Thung	1. Fishing pier construction	1993
				2. Retaining wall	1993
				3. Fishing equipment repair and storage	1994
				4. Retaining wall (Coastline)	1996
8	Sam Chong Tai	Kalai	Takua Thung	1. Fishing pier construction	1996
4	Takao	Ko Yaonoi	Ko Yoa	1. Fishing pier construction	1993
				2. Retaining wall	1993
				3. Fishing equipment repair and storage	1996
7	Lo Parade	Prunai	Ko Yao	1. Demonstration of Fishing Gears and Supplying	1995
				2. Fishing pier construction	1996
				3. Retaining wall	1996

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Seven fishing villages of Krabi Province, in the districts of Muang and Ao Luk, requested eight items of infrastructure. Thgese include retaining wall, fishing equipment repairing and storage, rain water tank, fishing pier construction and green mussel culture.

Table 4. DOF infrastructure facilities established in Krabi province.

Plot	# Village	Town	District	Activities	Year
3	Ta Lane	Kao Thong	Muang	1. Retaining wall	1993
				2. Fishing equipment repair and storage	1993
				3. Rain water tank	1993
1	Ko Klang	Klong Prasong	Muang	1. Fishing pier construction	1995
				2. Retaining wall	1995
2	Klong Muong	Nuong Talay	Muang	1. Fishing pier construction	1996
1	Hin Rao	Lam Sak	Ao Luk	1. Fishing pier construction	1992
				2. Retaining wall	1992
				3. Fishing equipment repair and storage	1992
3	Lam Sak	Lam Sak	Ao Luk	1. Fishing pier construction	1990
				2. Fishing equipment repair and storage	1990
2	Ba Kan	Ao Luk Noi	Ao Luk	1. Fishing pier construction	1994

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4. FUTURE NEED FOR INFRASTRUCTURE

Further development supported under the 8 th National Economic and Social Development Plan (1997-200 1) will be considered later by request. The plan for infrastructure facilities and activities under the 8th National Economic and Social Development Plan in 22 provinces is listed below in Table 5.

Table 5. Plan for infrastructure facilities and activities under the 8th National Economic and Social Development Plan in 22 provinces.

		Year			
Activities	**Unit**	**1997**	**1998**	**1999**	**2000**
1. Fishing Pier Construction	sites	25	25	25	25
2. Retaining Wall (or Water Breaker)	sites	25	25	25	25
3. Fishing Equipment Repair and Storage	units	5	5	5	5
4. Rain Water Tank	units	5	5	5	5
5. Fish Processing, Nutrition and Storage	units	12	12	12	12

Many of the items were allocated and completed by the Department of Fisheries during the period 1990-1995 (Fig. 1). The remaining items are expected to be completed by 1996. These items still under construction include three fishing piers, two retaining walls, fishing gear demonstration unit and one fishing equipment and storage unit.

5. CONCLUSION

While an evaluation of each activity has not been made, the facilities are widely used by fishermen communities in Phang-nga Bay.

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CURRENT PROBLEMS IN FISHERIES COOPERATIVES IN WANG-NGA BAY: PRIVATE OPTIONS FOR STRENGTHENING COOPERATIVES FOR IMPLEMENTING COMMUNITY-BASED FISHERIES MANAGEMENT

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1. INTRODUCTION

The DOF conducts a number of activities throughout Thailand that support a community-based approach to fisheries management. In Phang-nga Bay, DOF activities support three fisheries cooperatives; the Fishing Gear Group, Mariculture Group and Fish Processing Group.

These ongoing pilot activities were introduced in 1990. Members of each group are full-time fishermen, and membership in each group includes more than 20 families. Community-based management of each group is set up and organized by a selected representative of the members in meeting fishermen's needs, which include for example, fishing gears, seedlings, marketing, public health, education of children, and loans.

2. PROBLEMS OF FISHERIES CO-OPERATIVES IN PHANG-NGA BAY

Community-based management of each group is still loose because of the following weaknesses:

- The fishermen are poor and ill-educated and lack market power. Fish prices are in the hands of local and powerful middlemen.

- The fishermen are full-time fishers. Gillnets (targeting fish, shrimp and crab) are the dominant fishing gears, while other traditional gear types (targeting fish trap, handline, hook, etc) are still in use. Fishermen used these gears to catch target-specific fish species during particular seasons of the year. Changes in fishing gear types are also due to season. Fishermen have no free time to devote to taking part in the community-based organization.

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- The organizers do not know how to organize accounts. Loans have not been repaid.
- Cold storage and ice producing factories are not available. Fish is landed at a local fishing pier or village with no ice preservation. Transportation is also simple; no truck or car transports fish directly to the market.

The fishermen and housewives do not know how to minimize fish wastage and post harvest losses. There has been no adaptation for better technologies to find ways and means for alternative utilization of fish discards for human consumption or for other use.

3. CONCLUSION

Options for strengthening the co-operatives must be addressed by the community-based fisheries management initiatives in Phang-nga Bay. These options should consider the above weaknesses and needs of the Bay communities.

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COMMUNITY-BASED COASTAL FISHERIES MANAGEMENT IN ASIA AND THE PACIFIC

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1. INTRODUCTION

The IPFC Symposium on Socio-economic Issues in Coastal Fisheries Management held in Bangkok in November 1993 revealed that fisheries management programmes implemented in the region had rarely helped to improve fishermen's incomes. It was noted that the problem of low fishermen's incomes would not immediately disappear with the removal of open access which had been considered one of the major reasons for the poor state of fishermen's households.

Lack of alternative employment opportunities is another reason for low fishermen income, since it is highly probable that the low incomes of many fishermen result from low-opportunity incomes. In this context, the Symposium recommended that governments should promote economic diversification and enterprise development among rural fishing communities to generate opportunities for alternative employment in the coastal fisheries sector.

"Top-down" centrally-controlled management regimes are not effective if they fail to reflect fishermen's needs on management planning. The shortcomings of "top-down" approaches could be overcome by involving fishermen in the process of planning, designing and implementation of fishery management schemes. This recognition has prompted governments to consider new means of managing fisheries which integrate participatory approaches in fishery management strategies. The fishery management under the authority of the central government emphasizes mainly the biological, conservation and economic areas of fishery management, whereas participatory approaches stress the importance of social and cultural aspects of fishing communities in addition to the economic gains that fishermen seek.

Successful experiments in CBFM have shown that if fishermen play decisive roles in management decisions (e.g., determination of sustainable harvest levels and allocations to fishermen), there is a high rate of adherence to fishery regulations. Such management decisions are usually made to bring forth increase of incomes. Provision of economic incentives and assurance of resource availability through appropriate management (e.g., combining marketing with management measures) would enhance the degree of fishermen's compliance with regulatory measures.

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2. SUCCESSFUL EXAMPLES OF COMMUNITY-BASED FISHERY MANAGEMENT

CBFM offers potential as a way to improve the conservation of fish resources in coastal areas. The government does not have the resources required to manage a great many fishermen and enforce resource conservation for long coastlines. Inshore community fisheries management could be supported in selected locations where topographic conditions are suitable. Past experience shows that community management works best where a tradition of local knowledge exists on the state of fish resources, traditional conservation methods are practised, there is respect for community leaders, and viable organizations in fishing communities exisr.

2.1 Examples from Asia

Japan has a very effective system of community fisheries management which is operated by fisheries co-operatives. These co-operatives are given exclusive fishing rights to control fisheries resources adjacent to villages. The legal status of fishing rights in Japan is equal to that of land ownership. Coastal areas under the jurisdiction of fisheries co-operarives are, in effect, the private property of the fisheries co-operatives concerned. The area covered by fishing rights stretches some 10 km from the shore at the most and averages 2 to 3 km. Unless fishermen are members of the co-operatives, they are not allowed to fish in these areas. This legel set-up obliges inshore fishermen to join co-operatives. In fact, the great majority of coastal fishermen in Japan are members of co-operatives; this ensures strong solidarity.

Because coastal waters belong to fishermen, they are interested in the conservation and management of coastal fisheries resources. Regulations are enforced by each co-operative to prevent reckless fishing. In order to enhance fishery resources, each co-operative tries to improve its fishing ground by stocking seedlings of fish, shellfish and seaweed. Research institutes provide necessary information combined with extension services offered by prefectural government. Because the network of co-operatives is firmly established through three tier systems (i.e., national, prefectural, village), policies on the use of the nation's fishery resources filter down effectively to individual fishermen from the central government through prefectural government and fishermen's co-operatives.

The traditional sasi system in Maluk of Indonesia contains a variety of legal and institutional arrangements which promote effective micro-environmental management, economic distributive justice (fairness or equity), effective law enforcement, and secure economic benefits to the local community (Zerner, 1992). Local fishermen have devised a variety of regulations which affect (a) timing of fishing seasons (b) permitted and unpermitted gear (c) permitted and prohibited fishing behaviors or techniques (d) species or stock specific regulations (e) establishment of specific fishing seasons within the community waters (f)

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boundary concepts and physical markets. The regulations are enforced by the communities concerned and a variety of sanctions are imposed on violators which include fines, public shaming, temporary confiscation of fishing gear, permanent confiscation and sale of the gear, and corporal punishment.

Although these customary rights and practices are recognized as extremely effective to sustain local fishery resources, they are not formally integrated into the national legal framework for protection, implementation or litigation.

This has led to changes in the allocation of rights and the management of inshore marine environments, which include appropriation of the sasi system by government officials. Also, private sector control of the flow of credit to local fishers and control of the flow of benefits from community-managed reef resources may affect equity and *de facto* rights. Community-based legal systems and institutions for fisheries management are no panacea; problems in national fisheries law and administration remain and must be worked out at both the central and provincial level.

2.2 South Pacific examples

Village-based marine conservation has experienced a remarkable upsurge in Vanuatu since 1990 (Johannes, 1994). Vanuatu's shallow water marine resources are legally owned and controlled by villagers. While traditional fishing taboos mainly on trochus and green snails had existed for many years, their controls have since 1990 been diversified to cover other marine resources such as crabs, Beche-de-mer, turtles, clams, octopus, parrotfish, rudderfish and rock lobsters. Restrictive measures have been implemented in respect of fishing areas, fishing seasons, size limitations, gears (e.g., gillnets and night spearing using underwater torches are banned). Educational efforts of the Fisheries Department have played a major role in strengthening management measures in inshore waters.

Fishermen generally have a good knowledge of local resources such as the seasonal movements and spawning aggregations of fishes in inshore waters. There is no single body of custom in relation to the marine tenure in Vanuatu; there are over 100 different language groups with differing resource tenure customs. In many places, land and sea tenure rights are inherited through men, but in some it passes down through women.

Ownership of marine resources created opportunities not only for resource management but also for dispute resolution. There are six levels of dispute-resolution available for fishing rights owners within a clan, In the event that such a dispute-solving process still proves unsatisfactory, a dispute can be taken to an island court which is staffed by justices who are knowledgeable about custom.

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The Department of Fisheries has provided advice and motivation in the development of management strategies. Strengthening extension in fishery management is considered important to increase the impact of management measures.

3. REQUIREMENTS FOR DEVELOPMENT OF CBFM

A number of issues must be taken into account when CBFM is planned and promoted. These are described below:

(a) **Cohesive community organizations:** The existence of voluntary community organizations (e.g. co-operatives, associations, community councils etc.) with strong solidarity is essential.

(b) Territorial use rights in fisheries (TURF): Establishment of demarcated areas in which the right to harvest a particular stock might facilitate community-based approaches in fishery management.

(c) Initiatives by communities: It is important that initiatives to establish management plans should come from communities.

(d) **Modifiable:** It is necessary that management regulations should be easily modified to accommodate changing circumstances with a minimum degree of cumbersome legislative procedures for revision.

(e) Enforcement: Fishermen should be involved in the enforcement of fishery management measures.

(f) **Economic benefits:** Controlling access to fishery resources by outsiders may guarantee economic benefits to local coastal communities.

(g) Respect for community authority: This is essential to maintain the solidarity of the community.

4. PARTICIPATORY APPROACHES IN FISHERY MANAGEMENT AND FISHERMEN'S ORGANIZATIONS

There is a need for strengthening fisheries co-operatives to enhance the effective participation of fishermen in the management process. In many countries, fishermen have had a bitter experience with co-operatives because of their lack of viability, A satisfactory level of economic performance needs to be achieved to win fishermen's trust in co-operatives.

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Besides economic viability, the following checkpoints may he considered to determine whether fisheries co-operatives could undertake management tasks.

(a) Social viability: the great majority of fishermen should he members of a co-operative; a high rate of homogeneity is likewise an important factor.

(b) Equitable distribution of benefits and prevention of possible misuse of power by co-operative leaders.

(c) Availability of government assistance in terms of legal backup. information on the state of fishery resources, extension and research.

5. CONCLUSION

Management measures are not permanent, and need to be revised in accordance with the state of fish resources which changes constantly. Awareness-building and education on the long-term benefits of fishery management in terms of higher economic returns are important among fishermen. For example, mesh size limitation might give fishermen opportunities to increase incomes since larger-sized fish fetch higher prices than small ones.

A high management cost constrains fishery management. One of CBFM's advantages is its cost effectiveness. Enforcement of fisheries regulations is greatly facilitated when fishermen understand the purpose of the regulation and support it. Fisheries enforcement can be assisted by decentralizing the management authority that deals with the fishing communities.

6. REFERENCES

Indo—Pacific Fishery Commission. 1994. Proceedings of the Symposium on Socio—Economic Issues in Coastal Fisheries Management. Bangkok, Thailand. 23-26 November *1993.* RAPA Publication 1994/8, 442p.

Johannes. RE. 1994. Government—supported village-based management of marine resources in Vanuatu. FFA Report No. 94/2.

Zemer, C. 1992. Community management of marine resources in the Maluku Islands, Report of Kobe Expert Consultation on Community—based Fisheries Management Systems for Asia and the Pacific, FAO, 1992.

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PCPULATION ISSUES AND ACCESS TO INSTITUTIONAL CREDIT IN RELATION TO COMMUNITY-BASED FISHERIES MANAGEMENT AND DEVELOPMENT

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ABSTRACT

This paper discusses two important issues that need to be considered when introducing CBFM measures. The first issue concerns demographic and population characteristics offishing communities and their implications for sustainable we ofaquatic resources. The secondissue relates to the access of fisherfolk to institutional credit for the purpose of investment in fisheries management related economic activities.

In its first part, the paper attempts to identify some of the problems concerning demographic trends and population characteristics of fishing communities in relation to thesustainable exploitation ofaquatic resources as observedin most countries of South and Southeast Asia. It then suggests how population and demographic concerns can be incorporated intofisheries related research, fisheries management and development programmes.

In its second part, the paper identifies some of the problems of fisherfolk in accessing institutional credit and its potentially negative effects on fisheries managementprogrammes ingeneraland CBFM programmes in particular It then proposes measures to improve the access of fisherfolk to institutional credit for fisheries management related investments with reference to experiences in other countries of South and Southeast Asia.

1. INTRODUCTION

In many countries of Asia and the Pacific as well as in other parts of the world, fisheries management measures are presently being introduced, in many cases with the active involvement and participation of fisherfolk and their associations. This is being done to promote sustainable use of aquatic resources and to put an end to the degradation of the coastal environment and overexploitation of fisheries resources and the marine habitat.

The growing awareness of the need to introduce fisheries management measures was also expressed at the 21st Session of the FAO Committee on Fisheries, which was held in Rome in March 1995. FAO member countries, includingThailand, adopted a declaration which highlighted the problems and dangers of over-exploitation of aquatic resources and of the degradation of the coastal environment. They urged restructuring of fishing fleets, diversification of fishing effort and better utilization of scarce aquatic products including

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presently discarded by-products and waste through improved processing and marketing and through the development and promotion of new value-added fish products.

2. POPULATION ISSUES

2.1 Problems

In most Asian countries, a rapid growth has been observed in the number of fishermen. This has two major causes:

- high birth rates of fisherfolk families coupled with reduced child mortality as a result of better health services and improved socio-economic living conditions;
- in-migration of labour from other sectors of the rural economy.

The rapidly growing number of fishermen, which is reflected in a growing density of the fishermen population per kilometre of coastline, has a direct impact on fishing effort and thereby on the level of exploitation of aquatic resources. As a part of overall population growth, population growth in fishing communities also increases the demand for aquatic products and thereby exerts further pressure on aquatic resources.

While excessive growth of the fisherfolk population and the number of fishermen has in many cases contributed to over-exploitation of in-shore aquatic resources and destruction and degradation of the coastal habitat and environment, it also is an obstacle to the introduction of fisheries management measures that aim to limit access to fisheries resources.

Moreover, fishing communities that do not understand the need for a sustainable population growth will also not understand and adhere to concepts of sustainable use of natural resources. They will even less be able and motivated to actively participate in the design of fisheries management measures and their implementation and monitoring.

In addition to having a negative impact on the use of natural resources and being a constraint to the introduction of CBFM measures, excessive population growth in fishing communities also hampers the improvement of living conditions and quickly dilutes and absorbs economic benefits from development programmes undertaken for fishing communities rather than making use of these benefits for productive investments.

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2.2 Possible Solutions

In order to address the above problems and achieve the objective of bringing about sustainable population development in fishing communities, it is proposed to carry out the following actions and related activities, based on experiences and approaches followed in other Asian countries.

First of all, the carrying capacity of aquatic resources for sustainable fisherfolk populations in various regions of the country needs to be defined in a flexible manner. In order to do this, the following activities need to be carried out:

- collection of data on the population dynamics of fisherfolk and its relation to the level of exploitation of aquatic resources;
- incorporation of demographic elements in the fisheries research and the collection of statistics:
- review of national population strategies; and
- identification of appropriate population management strategies and adaptation of the same to the needs of fishing communities.

Secondly, population education, family planning programmes, disaster preparedness, health promotion and environmental care in fishing communities need to be strengthened. In order to do this, the following activities could be undertaken:

- identification of currently on-going programmes;
- linking appropriate programmes with on-going fisheries extension and training programmes; and
- incorporation of education into community-based livelihood, income generation and self-employment programmes.

3. ACCESS TO INSTITUTIONAL CREDIT

3.1 Problems

In the context of CBFM programmes, a number of changes occur with regard to economic activities undertaken by fisherfolk. The more important ones, as observed in other Asian countries and other parts of the world, are:

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- diversification of fishing effort from over-exploited and heavily exploited species to under-exploited species. In addition to vocational training and fisheries extension services, this usually requires the acquisition of new types of fishing gear and/or fishing craft;

- occupational changes from employment in capture fisheries to employment in brackishwater aquaculture or other types of coastal aquaculture. In addition to vocational training and fisheries extension services, this usually requires the acquisition of fish ponds and various production inputs;

- full-time or part-time occupational changes from employment in capture fisheries to employment outside the fisheries sector. In the case of self-employment, in addition to vocational training, this usually requires the acquisition of required capital and working capital inputs;

- introduction of improved fish marketing and processing methods in order to make better use of available aquatic resources and to add more value to available raw material and thereby compensate for financial losses as a result of reduced levels of exploitation of aquatic resources; and

- introduction of special income-generating projects for women to increase family income, make better use of so far under-utilized economic resources and to enhance women's socio-economic role and participation in fisheries management programmes.

All these changes require considerable investments, many of which are medium-term and it is very unlikely that many of these investments can be made from fisherfolk's own financial resources because of their weak economic status, low levels of savings and because of the fact that fisherfolk only have a rather limited access to institutional credit.

Fisherfolk's credit needs have so far been met in most countries of the region by the informal sector, which consists largely of fish traders cum moneylenders. Informal credit, however, has a number of limitations and disadvantages including the disadvantage of being linked to unfavourable terms of trade, of high interest rates, the limitation of being short-term and being mainly available for traditional investments with expected high short-term returns rather than for innovative investments with medium- and long-term benefits such as the ones related to fisheries management.

A number of factors are responsible for the limited access of fisherfolk to institutional credit. The more important ones are:

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- lack of familiarity of banks with the fisheries sector;
- lack of collateral and the unimpressive credit record of fisherfolk;
- high transaction costs of lending institutions; and
- poor performance of many past fisheries credit programmes because of absence of appropriate lending policies and procedures, **lack** of monitoring of loan use and loan recovery, lack of trained bank personnel staff and the perception of credit programmes as exercises in social welfare rather than credit.

Experiences in other countries show that fisherfolk participate in CBFM efforts much more actively if occupational changes and related investments are supported by institutional credit facilities.

3.2 Possible solutions

In order to improve fisherfolk's access to institutional credit for management related investments as listed above, technical assistance, training and financial support to financial institutions in the form of credit guarantee schemes **and** possibly interest- rate subsidies need to be provided by Governments in co-operation with foreign donors and development banks.

Appropriate institutional arrangements and lines of credit for the above investments need to be established and, among others, the following main activities are to be carried out:

- identification of suitable financial institutions;
- in close cooperation with fisherfolk, identification of credit needs related to fisheries management;
- design of credit guarantee arrangement;
- design of co-operation mechanism between financial institutions, fisheries administrations and fisherfolk associations;
- design of lending policies and procedures;

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- design and implementation of savings mobilization campaigns;
- implementation of pilot credit schemes; and
- on successful completion of pilot credit schemes, institutionalization of fisheries credit programmes.

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COMMUNITY-BASED FISHERIES MANAGEMENT

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ABSTRACT

Over the past 250years,Japanese fisheries regimes have developed with three fishery laws in sequence, in which a fishing right system has been commonly used.

During the feudal era until 1867, the fishing right was used mainly as a tool for the collection of fishery tax. The fishing right system established by an old fishery law (1901- 1947) was used mainly as a tool to reduce conflicts among different groups of coastal fishermen and disputes between coastaland trawl fisheries.

The current fishery law, enacted in 1949, refers to "Territorial Use Rights in Fisheries". It limits coverage to sedentary resources and non mobile gears. At the same time, the current law has rreateda system whereby a coastal fisheries management plan may be established with the participation of fishermen These innovations bavegiven fishermen a great motive to create a community-based coastal fisheries management system.

As a result, since the inception of the current fishery law in 1949, the number of fisheries management organizations created under the initiative of fish ermen has increasedyear after year and reached 1,524 in 1993.

1. INTRODUCTION

Japan has both marine and inland fisheries, the latter being insignificant in quantity and value.

The marine fishery is administratively classified into coastal, offshore and distant water fisheries, and the coastal fishery is further classified into coastal capture fishery and coastal aquaculture (Fig. 1 and Table 1). The coastal and offshore fisheries are those which operate in Japan's waters, i.e., her territorial waters and her 200 mile Exclusive Economic Zone (EEZ). The distant water fishery operates in the high seas and the EEZ of foreign countries. (For the definition of these fisheries, see the footnote of Table 1).

Table 1 sets out the economic structure of Japanese marine fishery, on the basis of 1991 data. The coastal fishery is the mainstay of Japanese marine fishery, accounting for 94% of the total number of fishing establishments. All of them are fishing households. In

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terms of quantity, coastal and offshore fisheries produce 30% and 56% of the total respectively. In terms of value, the coastal fishery produces 55% of the total.

There is no internationally agreed definition for "Community-based fisheries management (CBFM)". However, in Japan it is understood that CBFM is a system of fisheries management run under the initiative of fishermen. Its activities cover the management of fisheries resources, fishing effort and fishing grounds. Management covers not only conservation of fisheries resources such as setting catch limits but also propagation of fisheries resources through marine ranching.

CBFM in Japan has been developed mainly for the coastal fishery and partly for the offshore fishery. Owing to the complexity of Japan's coastal and offshore fishery the quantity of fish caught and fishing gears employed, a variety of CBFMs are in operation.

2. CHANGE IN FISHERIES MANAGEMENT REGIME

Over the past 250 years, the Japanese fishery has been administered by regulative regimes, such as the "Ura" Law (1743-1867), Old Fishery Law (1901-l 948) and Current Fishery Law (1949) (Fig. 1). These three laws have used the concept of fishing right for different purposes.

2.1 "Ura" Law (1743- 1867)

Decreed by the feudal government in 1743, "Ura" Law was the first fishery law in Japan. Its objective was to ensure tax collection from villages by granting them fishing rights. A similar tradition existed before the "Ura" Law was enacted.

Under the "Ura" Law, all villages along the coast were classified as either fishing or farm villages. The fishing villages were granted an "Osumi-tsuki", a fishing right, that allowed villagers to fish in their sea area. Those living in farm villages were allowed to collect only seaweeds for use as fertilizer.

An Osumi-tsuki was sometimes awarded to an individual when he made a special contribution to a samurai lord. Such occasions, however, were the exception.

2.2 The "Blank Period" (1868-1900)

The feudal era ended in 1867, and the Ura law became invalid. The policy of the new government was to modernize every aspect of Japanese administration. A special fishery mission sent to Europe took note of fishery laws in France, Germany and England, but none of them suited conditions in Japan.

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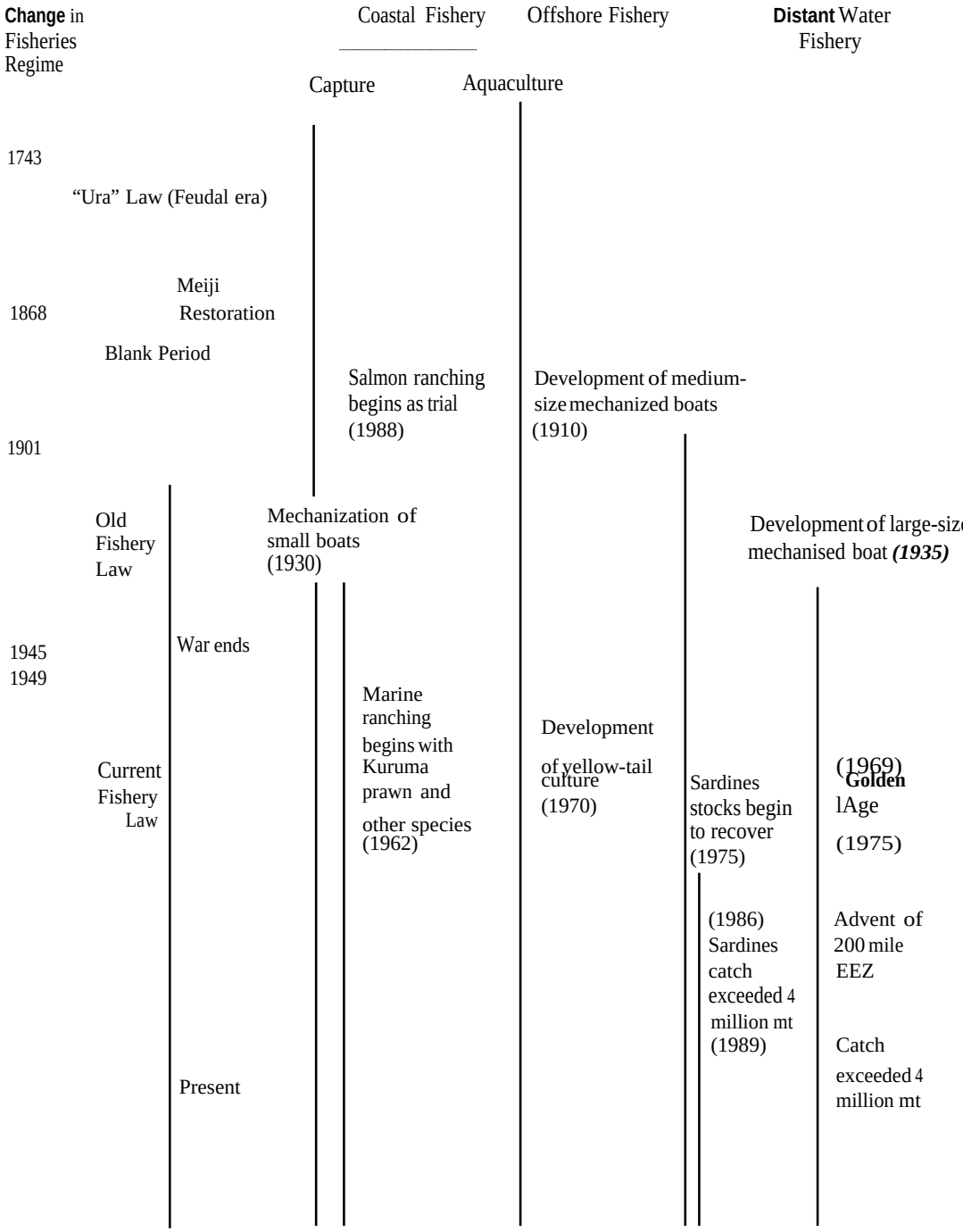
Fig. 1. Development of marine fisheries and regulatory **regimes.**



It took 32 years to get a new law in place. This period was one characterized by resource disputes between fishermen. Certain intermediate measures were taken without success.

2.3 Old Fishery Law (1901-1948)

This "Old Law" was formulated by the new government and approved by parliament in 1901. The "Old Law" was Japan's first own modern day legislation, as all other laws were modifications of European laws. According to the Old Law, fishing rights were classified into (i) exclusive fishing right (ii) set net fishing right (iii) specific fishing right and (iv) aquaculture right. It stipulated that exclusive fishing rights were to be granted only to a Fishery Society (FS). As a result, all fishermen in a fishing village had to organize their own FS. Otherwise, they were not allowed to fish (Fig. 2).

While the Old Law was being drafted, fishermen made it known that they wanted traditions and rights established by the samurai lords to continue. As a result, all Osumi-tsuki granted by feudal lords were converted into a coastal fishing right known as an Exclusive Fishing Right (traditional). However, the Old Law also created a category covering resources not covered by any of the exclusive fishing right (traditional). It was known as an Exclusive Fishing Right (new).

Owing to their importance, the central government was responsible for issuing both exclusive fishing rights. They were valid for 20 years and could be renewed. When the traditional right was renewed, its geographic area of coverage could not be expanded. Conversely, when the new right was renewed, in response to a request from a FS, the geographic area of the right was expanded seaward so as to cover migratory resources such as sardine, mackerel, squid, etc. Such an expansion of the new right took place in accordance with the progress of small boat mechanization. The new right had no restriction in terms of type of species and fishing gear to be covered.

The prefectural governments took charge of granting: (i) set net fishing right; (ii) specific fishing right for beach and boat seines; and (iii) aquaculture right valid for five years. These rights were granted to individuals who were capable of carrying out fisheries or aquaculture, and the fishermen's society was not.

With the introduction of medium-size mechanized boats, fishing gears such as otter trawl, pair trawl and Danish seine began to operate in near-shore waters, resulting in severe conflicts with coastal fishermen. This was an occasion when offshore fishery appeared in Japan. In response, the government introduced a restricted fishing license system within the framework of the Old Law. Closed areas for the trawl fishery were also established. Enforcing the new regulations required large expenditures by both the central and prefectural governments on patrol boats and inspectors.

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Table 1. **Economic structure of Japanese marine fishery** (1991).

		Total	Coastal Fishery		Offshore Fishery	Distant Water Fishery
			Capture	Aquaculture		
No. of Fishing Establishments		175.444 (100)	128,903 (73)	36,95 I (21)	9,298 (5)	212 (0.1)
No. of Fishing Boats		277,949 (100)	253,149 (91)		22,235 (8)	2,565 (1)
No. of Fishermen		370,300 (100)	300,300 (81)		70.3 (19)	
Productior	1000 MT	10,843 (100)	1,992 (18)	1,273 (12)	6,081 (56)	1,496 (14)
	Billion Yen	2,562 (100)	805 (31)	609 (24)	704 (27)_	444 (17)

Source : Japanese Ministry of Agriculture, Forestry and Fishery.

Definition:

The coastal fishery comprises capture fishery or aquaculture operations which operate in coastal waters adjacent to fishing communities, using powered or non-powered fishing boats of less than 10 GRT. The coastal fishery is run by fishing households with their family members for the purpose of maintaining their livelihoods.

The offshore fishery is any capture fishery which operates in waters outside the coastal waters but within Japan's 200 mile EEZ, using powered boats of more than 10 GRT with many hired fishermen. This fishery is run by fishing enterprises, who pursue a profit.

The distant water fishery is also a capture fishery which operates in the high seas or the EEZ of foreign countries, using powered boats of mostly 100 GRT or above, with many hired fishermen.

A fishing establishment is any type and any size of economic unit, which engages in capture or aquaculture of aquatic animals and plants. However, 95% of fishing establishments are fishing households who engage in the coastal fishery.

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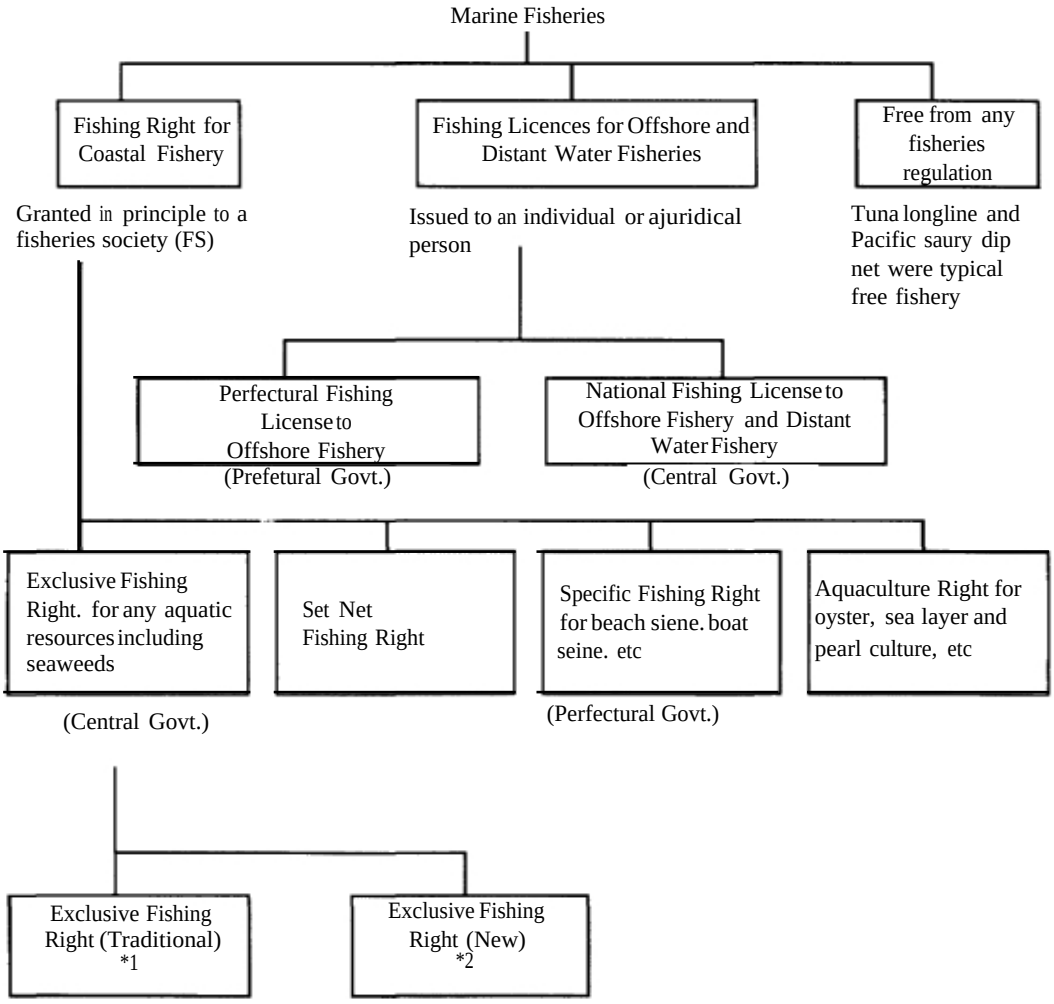
Fig 2. Fishery regime based on Old Fishery Law (1901-1948).



*1 This was a right based on Osumi-tsuki' granted by a Samurai lord.
*2 : This was a right newly granted by the Old Fishery law.
Granting or issuing organization.

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Japan is located in a temperate zone. A variety of resources is therefore being exploited by different groups of fishermen using different gears. Therefore, even among coastal fishermen there were many struggles for resources use. The trawl fishery brought about another type of conflict. The Old Law was more significant for reducing such struggles and conflicts among fishermen than for resources conservation. Nevertheless, granting the fishing right to the FS gave fishermen a perception that resources available in the sea area right off their own village were their own.

Around 1933, the country encountered a great recession. To help fishermen improve their incomes and living conditions, the government began to strengthen the fishery infrastructure and make available to FS facilities such as a fishing port, fish marketing hall, ice making factory, cold storage, etc. This gave an opportunity for many FSs to be involved in fish marketing, and change their status from guardian of fishing rights to a fishery cooperative association (FCA).

In the past, fishermen used to sell their catches directly to middlemen. This practice led to the exploitation of fishermen. Consignment sale of catch to FCA conferred many advantages on both FCA and fishermen. The financial status of FCA was stabilized, and the mutual reliance and solidarity of fishermen in a FCA was strengthened. These institutions were taken over by FCA which were newly reorganized after World War II. This may be one reason why CBFM under the initiative of fishermen developed smoothly in the postwar period.

2.4 Current fishery law (1949 Present)

After its military surrender during World War II, Japan was occupied by the Allied Forces for seven years, from **1945** to 1952. The Allied Forces sought to reform every aspect of Japan's administration and democratize it. A nation-wide land reform programme, implemented with a great success was a typical example. As a result, all landless farmers were able to own land.

In pursuance of such a policy, the Old Fishery Law was abolished and all fishing rights established by it were nullified. The government compensated those who lost fishing rights held under the Old Law with bonds that were redeemable in five years.

In 1948, all FSs and FCAs established by the Old Fishery Law were replaced by a Fisheries Cooperative Association (FCA) as required by passage of the Fisheries Cooperative Law. This law called for FCAs to be established in a democratic manner, for each coastal municipaliry. In 1949, the Current Fishery Law (Current Law) was promulgated, with fishing rights reformed. Then, within the new legal framework, fishing rights were granted to the newly organized FCAs.

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Responsibility for granting rights was totally handed over from the central government to prefectural governments. The procedures established by the Current Law for granting fishing rights were so democratic that fishermen themselves began to feel that the resources covered by rights were their own. A community-based coastal fisheries management system was created. Further detail on this issue is discussed under Section 3 below.

3. THE CURRENT FISHERIES MANAGEMENT SYSTEM

A community-based coastal fisheries management system in Japan has been successful for two reasons. First, fishing rights reformed under the Current Law really conform to the principle of 'Territorial Use Right in Fishery' (TURF). Secondly, allocation of fisheries resources to FCA or fishermen is based on the Coastal Fisheries Management Plan (CFMP), which has been funded by a regional fisheries coordination committee in a very democratic manner (see Section 3.2).

3.1 Tools for fisheries management

For the management of Japanese coastal fisheries, there are two tools in use; fishing rights for coastal fisheries and prefectural fishing licenses for offshore fisheries (Fig.3). In terms of international management methods, both fishing rights and licenses fall under the category of 'Limited entry'.

Fishing right (coastal fishery)

Under the Current Law, the fishing right is classified into: (i) Common Fishing Right (CFR); (ii) Large-Scale Set Net Fishing Right; and (iii) Coastal Aquaculture Right. Of these rights, the CFR corresponds to the exclusive fishing right under the Old Law, as it covers the entire sea area adjacent to the respective fishing village.

In comparison with the previous exclusive fishing right, however, resources covered by CFR Type 1 are confined to sedentary resources. Similarly, gears covered by CFR Type 2 and 3 are also confined to non-mobile gears. This was due to a policy that any migratory fish and mobile gears should be excluded from the CFR. In this way, the nature of CFR has been a TURF in a strict sense. As a result, the exclusive nature of the CFR lends a sense of proprietorship over the resources (Yamamoto, 1983). On the other hand, mobile gears which formerly figured under exclusive fishing rights have come under the management of the prefectural fishing license.

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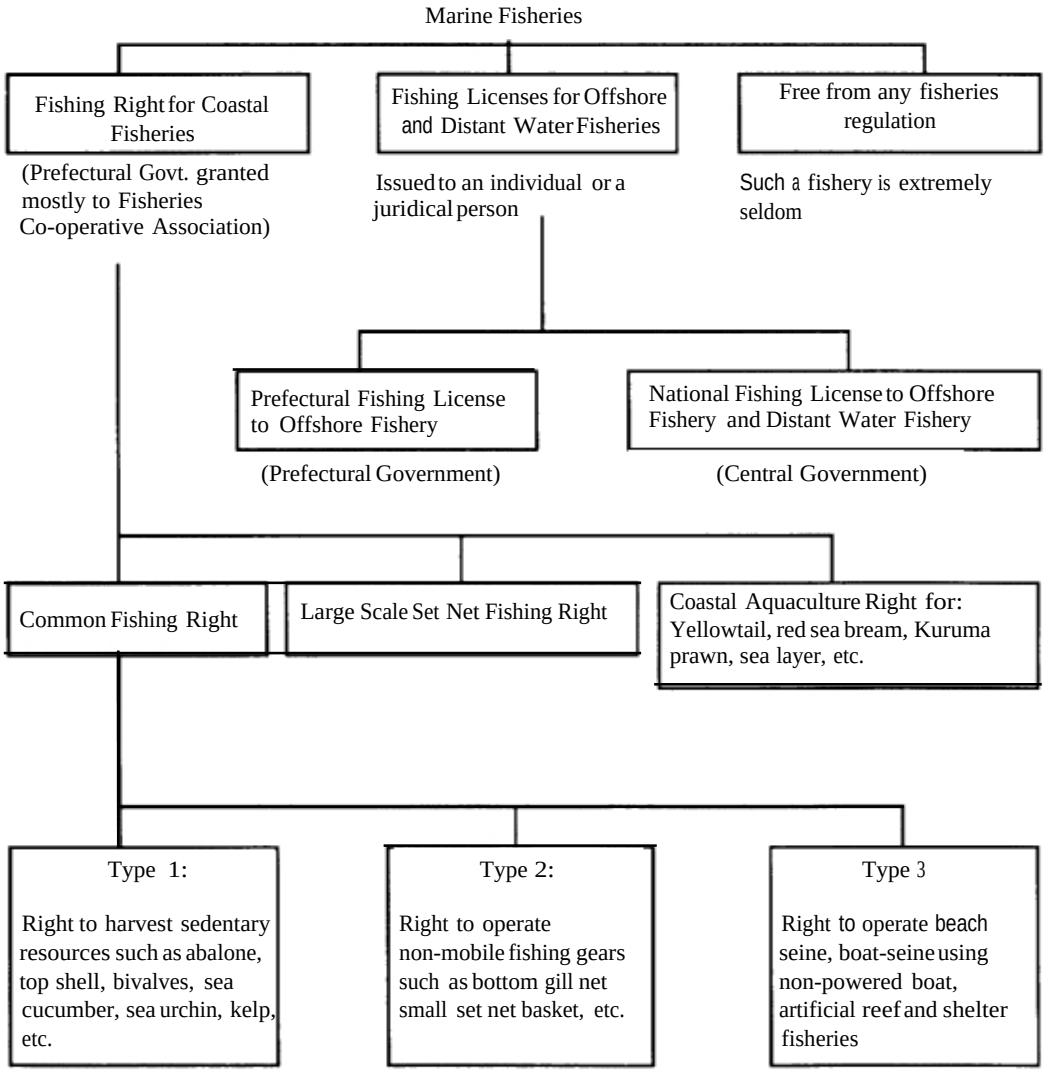
Fig. 3. Fishery regime based on Current Fishery Law (1949 - Present).



():Granting or issuing organization.

As for the large-scale set net fishing right and coastal aquaculture right, there has been no change in nature as compared with those under the Old Law. The validity of the right is ten years for the CFR and five years for the remaining two. As for the large set net and coastal aquaculture, changes in fish stock and the sea environment will sometimes necessitate a change in the location of these activities within a shorter period.

All three rights are granted to FCAs. However, the rights for large set net and coastal pearl aquaculture are sometimes given to individuals wherever the local FCA lacks the resources to utilize it. As was done in the Old Law, the Current Law regards these rights as property rights that cannot be sold or rented. It is also important to note that fishing rights in Japan are effectively area based (Christy, **1992).**

Fishing license(offshorefishery)

The system of fishing license under the Current Law is exactly the same as those established by the Old Law, having national and prefectural fishing licenses (Fig. 3).

The CBFM system in Japan has been developed, to a certain extent, by including some offshore fisheries which are regulated by prefectural fishing license. This is because offshore fishery operators are, in many instances, the members of a local FCA, who also think of a need to conserve resources exploited by them and establish their own fisheries management systems. Fisheries covered by such fisheries management systems are mobile gears such as baby trawl, boat seine, small purse seine, etc. which are not covered by any fishing right.

For gears under a fishing license, the fishing effort is regulated by the number of licenses issued, limits on vessel size and gear and through the opening and closing of season and area. A fishing license is normally valid for five years with a renewal. The license is transferable with certain conditions established for respective license.

3.2 Coastal fisheries management plan

Regional fisheries coordination committee and its role

The Coastal Fisheries Management Plan (CFMP) is a plan by which a prefectural governor grants fishing rights or issues fishing licenses. For the formation of the CFMP, FCA is requested to establish a Fishing Right Management Committee **(FRMC)** for drafting the contents of fishing rights. At the same time, the prefectural government is requested to establish a Regional Fisheries Coordination Committee (RFCC) to formulate the CFMP referring to the draft proposal on fishing rights from FCAs and other reference materials provided by the prefectural government (Fig. 4).

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Fig. 4. Formation of Coastal Fisheries Management Plan.

(1) Draft Management Plan at FCA

i. Establish a fishing right management committee (FRMC) at FCA.
ii. Form FCA draft management plan indicating fishing rights FCA members wish, and submit it to the prefectural government (PG).

(2) Preparatory works by prefectural government

i. Form a Regional Fisheries Coordination Committee (RFCC) at a prefectural evel.
ii. Synthesize all FCA draft management plans at prefectural level.
iii. Collects materials needed for justification of the FCA draft management plans, and forwards the above materials, together with the original FCA draft management plans to the RFCC.

(3) Preparation of draft coastal fisheries management plan (CFMP) at RFCC

i. Prepares draft coastal fisheries management plan for the prefecture by referring to materials provided by the PG.
ii. Forwards the draft coastal fisheries management plan to the PG.

(4) Public hearing by the prefectural government

i. Announces of the public hearing on the draft coastal fisheries management plan through government gazette and any other means, and holds the public hearing.
ii. Obtain consent from RFCC if any change arose in the draft coastal fisheries management plan.

(5) Granting fishing rights

i. Official announcement of a final CFMP indicating the location of fishing area, species or type of gear and fishing season of all fishing rights.
ii. Granting fishing right by the prefectural government to the applicants in response to the application.

Note: This figure is drawn based on a manual prepared for the implementation of the Current Fishery Law.

a) The figure illustrares how the FRMC at FCA level and the RFCC are involved in the information of the CFMP relating to fishing rights.

b) The RFCC also acts as a consulting organization to the prefectural government in the formation of the CFMP relating to prefectural fishing license.

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The RFCC comprises 16 members. Nine are elected from among fishermen, and seven nominated by the prefectural government. The seven nominees are people well acquainted with fisheries in the prefecture or who represent the broad public interest. Each member has a four-year term of office, and the chairman is elected from among the members.

Coastal fisheries management plan (CFMP)

To assist a clear understanding of fisheries management in Japan, the fisheries management plan in the Shizuoka Prefecture is discussed below. A map and two tables are used to illustrate the number, location and types of fishing rights and licenses (Fig. 5 and Table 2.1 and 2.2).

Shizuoka is one of the 47 prefectures in Japan that face the Pacific Ocean. Spread out along its 200 kilometres of coastline are 36 Fisheries Cooperative Associations (FCAs) with approximately 27,500 full time and associate members. In 1392, they harvested 289,000 metric tones (mt) from marine fisheries (the fresh water harvest was 10,000 mt). The offshore fisheries accounted for the largest part of the catch, about 175,000 mt. The distant water catch was 75,000 mt, and the coastal fishery provided another 33,000 mt. Coastal aquaculture produced 5,000 mt.

The Shizuoka fishing fleet in 1992 numbered over 7,300 boats. Most (94%) were under 10 Gross Registered Tonne (GRT). In other words, the fleet was made up for the most part of small boats appropriate to the coastal and offshore fisheries.

Of the four components of Shizuoka's marine fishery, only the distant water fishery is regulated by the central government. The coastal and offshore fisheries and coastal aquacul ture operations are under the jurisdiction of Shizuoka Prefecture and its Coastal Fisheries Management Plan. The CFMP is divided into two parts. One part deals with coastal fisheries **and** aquaculture under the fishing right system, the other with fisheries under the prefectural fishing license system.

Common fishing rights

For the Shizuoka Prefecture as a whole, 20 common fishing rights have been established and assigned to 35 FCAs. For ease of illustration, a map of the western half of the prefecture is provided (Fig.5). The map shows that right C16, for example, was awarded to the Shizuoka City FCA only, while rights C 17, 18 and 19 were each divided among several neighbouring FCAs (Fig.5 and 2.2).

The seaward extent of common fishing rights ranges from 1 to 8 kilometres off the shore in the Shizuoka Prefecture. On occasion, a right is established in an area not contiguous to the shore (see C 19 in Fig. 5). This usually occurs when sedentary resources are found

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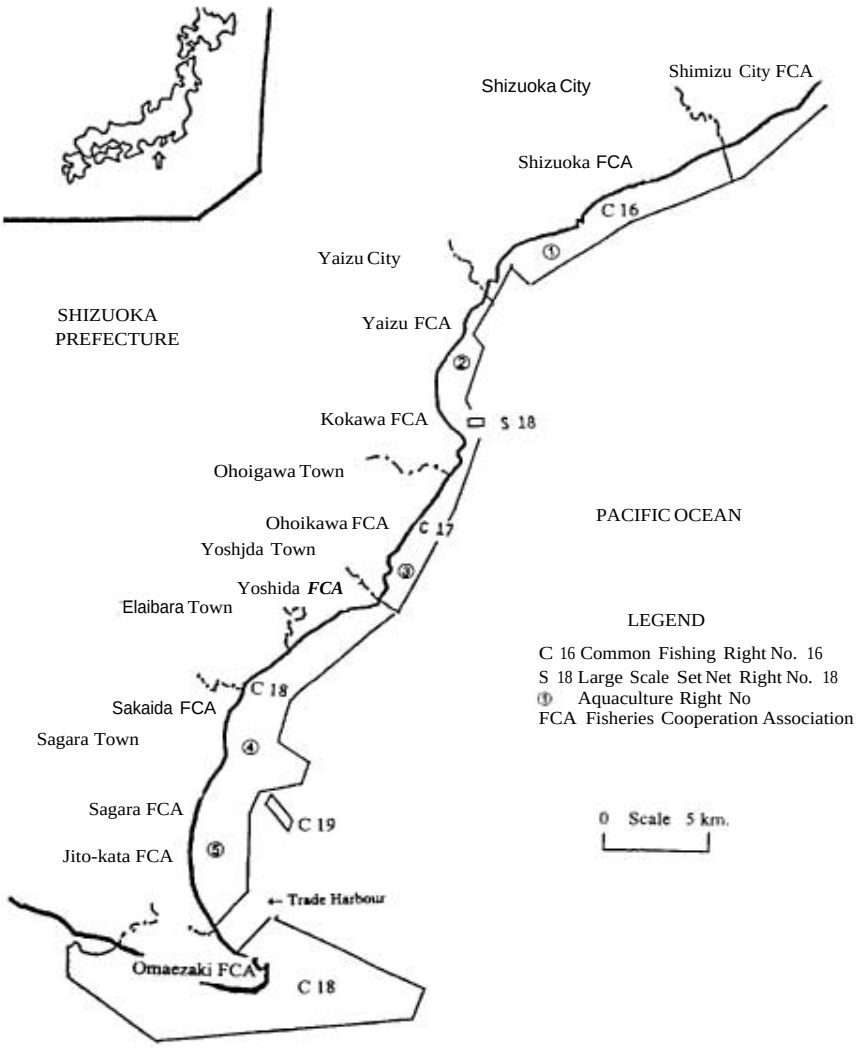

Fig. 5. Coastal Fisheries Management Plan (Fishing Right Allocation).

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Table 2. Coastal Fisheries Management Plan, Shizuoka Prefecture (1993).

(1) **Fisheries under Fishing Rights**

	No. of Rights
Total	139
Common Fishing Right	20
Large Scale Set Net Fishing Right	18
Aquaculture Right	101

(2) Fisheries under Prefectural Fishing License

(These are boats operating in Shizuoka prefectural water)

	No. of Licenses
Total	2,937
Medium size purse seine	25
Small size purse seine	28
Baby trawl	123
Boat seine for anchovy, halfbeak, etc	1,351
Danish seine for sea bream	10
Mackerel scoop net	32
Stow net	216
Deep sea bottom gillnet	501
Small set net	87
Drive-in net	18
Other gears	546

(For Reference only)

(3) Fisheries under National Fishing License

(These are fishing boats based at Shizuoka Prefecture but operate in sea area far away from Shizuoka Prefecture with licenses issued by the central government)

	No. of Licenses
Total	136
Distant water tuna & skipjack fishery	69
Offshore tuna & skipjack fishery	25
Large scale purse seine	22
Saury pike lift net	9
Large scale squid angling	4
Overseas squid angling	6

Data source: Report of Fisheries Shizuoka Prefecture (1993)

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near an offshore reef. There are also coastal areas, where no rights are granted. The map shows that right C 18 is divided by a trade harbor, an area that is unassigned.

In **(1)** of Table 2.2, it would be interesting to see exactly what species or gears are covered under each type of common fishing right. Not all assigned areas have the same harvesting rights. For example, Type 1 and 2 rights are always available, while Type 3 rights are not.

Large-scale set fishing right

In the western half of Shizuoka Prefecture, there is only one such right, number S 18. It has been granted to a private citizen (Fig. 5 and Table 2).

Coastal aquaculture right

There are five aquaculture rights in place on Shizuoka's western coast, located in a protected area near the shore. All of these rights have been awarded to FCAs (Fig.5 and Table 2.2).

Prefectural fishing licenses

The Shizuoka Prefecture has a fishing license system for 33 different gear types used in the offshore fishery. The number of licenses to be issued for each gear type is established in consultation with the Regional Fisheries Coordination Committee. Decisions are based upon data provided by the Shizouka Fisheries Experimental Station and fishermen themselves. Applicants for the license are usually members of an FCA and need FCA approval before submitting a license request to the prefectural govenor. This system makes it possible to harmonize the effort and harvests of fishermen operating under a fishing right with those who hold licenses. In 1993 there were more than 2,900 licenses issued (Table 2.1).

3.3 FCA fishing right management committee and its role

The FCA Fishing Right Management Committee (FRMC) has two roles. The first is to propose a FCA draft management plan to the prefectural government (see 1 of Fig. 4). The second is to establish a plan to make best use of resources or fishing grounds allocated by the fishing rights and granted by the prefectural government.

This FRMC itself may propose CBFM at the FCA level. There may be a case that a group of fishermen who were allowed to collect abalone may establish their own CBFM. It should be mentioned that in Japan the government has never guided fishermen/FCA to create their CBFM system, although there were campaigns guided by fisheries economists

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and the National Federation of Fisheries Cooperative Association (ZENGYOREN), which took place in the latter half of the 1970s and early 1980.

The Current Law has fostered a community-based management approach, with fishermen participating through the fishing right management committee and any other organization.

4. DEVELOPMENT OF CBFM IN JAPAN

Until 1987, CBFM had been known only on a case by case basis. The 1988 fishery census, for the first time, succeeded in enumerating all fisheries management organizations in operation as of November 1, 1988 (Hasegawa Miyazawa and Yamamoto, 1992). The 1993 fishery census again did the same.

The census defined CBFM as having three basic components, i.e., management of fishery resources, fishing effort and fishing grounds. Fishermen's groups involved in any elements of those three components with or without written rule were, for the purpose of the census, defined as Fisheries Management Organizations (FMO).

4.1 Findings from the 1988 Fishery Census

The 1988 Fishery Census identified 1,339 FMOs throughout the country. The census tried to count the number of FMOs by year when organized. As a result, there were 30 by the end of 1948, right before the Current Law was enacted and 871 FMOs between 1949 and 1976. Another 394 appeared between 1977 and 1988. There were 44 FMOs, for which the year of their establishment was not known.

Of 1,339 FMOs, 1,004 FMOs (75 %)were established on the basis of fishing rights, and 294 FMOs (22%) were established with reference to prefectural fishing license. Surprisingly, another 17 FMOs (2.8%), were established without reference to either fishing rights or fishing license.

Of 1,339 FMOs, 1,017 FMOs (76%) were concerned with the management of sedentary resources such as abalone, top shell, spiny lobster, sea urchin and clam. In addition, 229 FMOs (17%) were involved with migratory species such as Kuruma prawn, mantis shrimp, red sea bream and flat fish. Thus, it can be said that for the moment, most FMOs have been involved with sedentary resources.

About 70% of the FMOs are involved with managing fisheries resources, and over 90% help manage both fishing grounds and fishing effort.

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For the management of fisheries resources, prefectural government, FCA and even FMO have established their own fisheries regulations or rules. In many instances, FMO rules are more stringent. For example, the FMO minimum size for abalone is much larger than required by either prefectural or FCA regulations. Many FMOs are involved in monitoring fishing grounds and have the authority to fine or suspend violators. They assess stocks and set catch limits and monitor pollution.

Over 60% of FMOs are engaged in marine ranching and about haIf that many in fishing ground enhancement (e.g., artificial reef, man-made spawning grounds).

They share in the costs and are subsidized by the central and prefectural governments through the FCAs. Both governments also subsidize pollution monitoring efforts.

The 1988 census found that a large majority of FMO members think that community-based management has been successful in reducing both competition for resources and conflict among fishermen. Most thought that catches had stabilized due to FMO management in general and its reduction of fishing effort in particular. This sense of co-operation extends to a system of catch pooling in 11% of FMOs, and, after predetermined costs are deducted, the proceeds are distributed equally among fishermen.

4.2 Findings from the 1993 Fishery Census

For the period from 1988 to 1993, the number of FMOs increased by 185 (14%), and rose from 1,339 to 1,524. The total number of fishing households that participated in any FMO in 1993 was 69,985, or 43% of the total. This means that nearly a half of fishing households are involved in CBFM.

Of 1,524 FMOs, 452 (30%) were FCA, 598 (39%) were fishermen's groups, which have already been established for each different gear within the FCA, and 314 (21%) were fishermen's groups, which were newly established for the purpose of fisheries management.

Number of FMOs counted by target species were 121 for Bastard halibut, 122 for flat fish, 103 for red sea bream, 359 for prawn, 352 for sea urchin, 547 for abalone, 35 for top shell. Thus, in comparison with the results of the 1988 fishery census, the number of FMOs targeting migratory species is likely to have followed an increasing trend. On the other hand, the number of FMOs counted by type of gear employed were 216 for baby trawl, 312 for gillnet, 587 for the collection of clams and seaweeds and 252 for other gears.

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5. CONCLUSION

For the success of CBFM, fishermen must regard the resources as their own. The 1983 FAO Expert Consultation on the Regulation of Fishing Effort has suggested that property rights can take many forms including individual catch quota, "TURFs", etc. When fishermen consider the fish stocks as their property, they will adopt a more positive attitude to conservation and management measures (1983, FAO). The 1949 revision of Japanese fishery law has led to alteration of the characterization of Japanese fishing rights and brought it close to TURFs by limiting its coverage to sedentary resources and non-mobile gears. This has led fishermen to a more positive involvement with CBFM.

In many FCAs, marine ranching is being intensified at the cost of FA or by sharing the cost among fishermen. Marine ranching also gives fishermen a perception that fish released are their own, and this will increase the chances to create a CBFM system.

For the creation of CBFM, both (i) a fishery law which is the legal framework for the award of fishing rights and issue of licenses and (ii) fishermen's organizations are indispensable. While new fishing rights were being granted by the Current Law, new FCAs were already in existence with good solidarity among fishermen. This has facilitated the creation of a community-based coastal fisheries management system.

For the creation of a new CBFM system, a mutual agreement among fishermen is indispensable. Such an opportunity may best occur at the fish market hall of the FCA, where daily sale of the catch of fishermen takes place. This will enhance the chance of fishermen to create an idea of CBFM. Such a fish marketing system with auction will strengthen the financial stability of the FCA, as commission charged to each catch sale will be the constant income of FCA (Hirasawa, 1992).

It may, however, be argued that the absence in the size of sustainable yield in many FMOs is a weak point in Japan's CBFM system. In recent years, however, fishermen are trying to have MSY/TAC with the help of the prefectural fisheries experimental station.

Some people attribute the success of CBFM development in Japan to a long history of fishing rights. In a country without such a history, fishermen may not accept a fishing rights system, and hence there will be no chance to develop CBFM. However, during my recent visit to Thailand in December 1993, it has been assured that fishermen do believe in the concept of ownership of resources although the fishing rights are not legally endorsed. There is, therefore, a possibility of developing a CBFM system for Thailand.

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6. REFERENCES

Christy, ET., Jr. 1992. Territorial use rights in fisheries: Suggestions for government measures. FAO Fisheries Report No. 474 Suppl. Vol. 2: 378-385.

FAO. 1984. Report ofconsultation on the regulation of fishing effort (fishing mortality). FAO Fisheries Report No. 289, Rome, 1993.

Hasegawa A., H. Miyazawa and T. Yamamoto. 1992. An overview of Japanese fisheries management systems developed under the initiative of fishermen (The Results of the 1988 Fishery Census), Japan International Fisheries Research Society (JIFRS), pp. 103 - 126.

Hirasawa Yutaka, S. Masaaki and T. Yamamoto. 1992. Fisheries cooperative as the core for development of coastal fisheries management system: International perspectives on fisheries management. Japan International Fisheries Research Society (JIFRS): pp. 127- 158.

Japanese Ministry of Agriculture, Forestry and Fisheries. 1994. A Preliminary Report of the 1993 Fishery Census. August 1994, pp. 6-187.

Yamamoto, T. 1983. Fishery regulations adopted for coastal and offshore fisheries in Japan. FAO Fisheries Report No. 289 Supplement 3: 299-306.

Yamamoto, T. 1984. Fisheries institutions needed for the management of tropical living aquatic resources. Economic Research Journal, College of Economics, Nihon University (Keizai-shusi). Vol. 54(3): pp. 509-522.

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