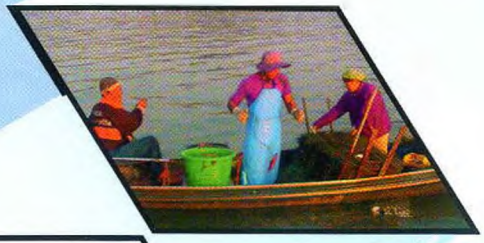
Proceedings of the

REGIONAL SEMINAR ON

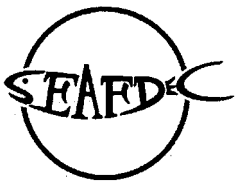
INTEGRATED COASTAL RESOURCES MANAGEMENT IN SOUTHEAST ASIA



Southeast Asian Fisheries Development Center

Department of Fisheries, Thailand

TD/RP/108 LBCFM-PD No. 49 September 2007



What is SEAFDEC?

The Southeast Asian Fisheries Development Center (SEAFDEC) is an autonomous intergovernmental body established as a regional treaty organization in 1967 to promote sustainable fisheries development in Southeast Asia.

Objectives

SEAFDEC aims specifically to develop fishery potential in the region through training, research and information services in order to improve the food supply through rational utilization of fisheries resources in the region.

Functions

To achieve its objectives the Center has the following functions:

1. To offer training courses, and to organize workshops and seminars, in fishing technology, marine engineering, extension methodology, post-harvest technology, and aquaculture.

2. To conduct research and development in fishing gear technology, fishing ground survey, post-harvest technology and aquaculture, to examine problems related to the handling of fish at sea and quality control, and to undertake studies on the fisheries resources in the region; and

3. To arrange for the transfer of technology to the countries in the region and to make available the printed and non-printed media, which include the publication of statistical bulletins for the exchange and dissemination related to fisheries and aquaculture development.

Membership

SEAFDEC members are the ASEAN Member Countries (Brunei Darussalam, Cambodia, Indonesia, Lao PDR., Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam) and Japan.

Proceedings of the

INTEGRATED COASTAL RESOURCES MANAGEMENT IN SOUTHEAST ASIA: LESSONS LEARNED THROUGH INTEGRATED COASTAL RESOURCES MANAGEMENT IN PATHEW DISTRICT, CHUMPHON PROVINCE (ICRM-PD)

10-12 July 2007
At Chumphon Marine Fisheries Research and Development Center
Chumphon Province, Thailand

Training Department
Southeast Asian Fisheries Development Center

Department of Fisheries
Thailand

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ISBN : 978-974-8075-55-6

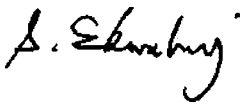
FOREWORD

The Integrated Coastal Resources Management in Pathew District (ICRM-PD) Project, Thailand, is a collaborative project between SEAFDEC/Training Department (TD) and the Department of Fisheries (DOF), Thailand. The ICRM-PD project initial component of the Coastal Resource Management Program, which base on the adoption of ASEAN-SEAFDEC Fisheries Consultative Group (FCG) Scheme. ICRM-PD is financially support by the Japanese Trust Funds, while DOF support by Royal Project Funds.

SEAFDEC/TD and DOF/Thailand agree to arrange the Regional Seminar on Integrated Coastal Resources Management in Southeast Asia. The seminar had four main objectives . The first, to report the achievement and outcome of the project during its 5-year implementation and review its progress in line with the original project concept. The second, to verify the impacts of the concept to the beneficiaries, from the project's activities in terms of quantity as well as quality considering both facets of community development as well as sustainable fishery resources management. The third, to discuss its resultant rationale and implication in the dissemination of the project concept to other SEAFDEC member countries. And the last, to identify the necessary follow-up actions to be undertaken by DOF Thailand and other collaborating local agencies.

The ICRM-PD places a great emphasis on practical lessons and experiences through the project implementation in order to transfer knowledge and technology to any other pilot projects. According to this initial purpose, the seminar was designed to reported project activities. Those member country, local people and project's staff having participated in the ICRM-PD welcomed all recommendation and comment from all participants in the seminar. These may be useful to steer and adjust the direction of the other project and project implementation for next by member countries.

SEAFDEC/TD strongly desires that this proceedings would offer more detailed information on the ICRM-PD activities with successful and bitter lessons obtained. The project's staff will be very glad that all basic and informative document would be useful to policy makers and planners who are responsible for implementing and formulating coastal resource management projects in order to achieve sustainable use of coastal resources in the Southeast Asian region.



Siri Ekmaharaj, Ph.D
Secretary-General

PREFACE

SEAFDEC/Training Department (TD) and the Chumphon Marine Fisheries Research and Development Center (CMDEC), Department of Fisheries (DOF) cordially collaborate to formulate action plan of the ICRM-PD project. The Integrated Coastal Resources Management in Pathew District (ICRM-PD) project was initially named "Locally Based Coastal Resources Management in Pathew District (LBCRM-PD)".The two parties involved in the phase of the ICRM-PD during the period from October 2001 to December 2006. The parties coordinated with local people in Pakklong Sub-district (the project's site)'s participation to handle the initial stage of the project implementation. Active local people's participation is supportive mechanism to help pushing organization-driven strategy toward the decentralization of authority in coastal resource. The organization is core and leading entry to integrate all disciplines, factors and conditions that exist in local community.

SEAFDEC/TD and CMDEC/DOF have gained practical lessons and experiences that are learning-by-doing from the project implementation and substantial information of the project. It was reported through 'the Regional Seminar on Integrated Coastal Resources Management in Southeast Asia. Recommendation and comments come from the seminar attendances are valuable for the two parties to re-consider proper and feasible direction of the other projects action plan.

SEAFDEC/TD and CMDEC/DOF

CONTENT

REPORT OF THE REGIONAL SEMINAR ON INTEGRATED COASTAL RESOURCES MANAGEMENT IN SOUTHEAST ASIA: LESSONS LEARNED THROUGH INTEGRATED COASTAL RESOURCES MANAGEMENT IN PATHEW DISTRICT, CHUMPHON PROVINCE, (ICRM-PD)THAILAND

10-12 JULY 2007

I. INTRODUCTION

1. The Regional Seminar on Integrated Coastal Resources Management in Southeast Asia was jointly organized by SEAFDEC Training Department (TD) and the Department of Fisheries, Thailand from 10 to 12 July 2007 at Chumphon Marine Fisheries Research and Development Center (CMDEC), Thailand. The Seminar was held as part of the project on Integrated Coastal Resources Management in Southeast Asia (ICRM) implemented by SEAFDEC/TD with funding support from the Japanese Trust Fund.

2. The Seminar was attended by participants from Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Vietnam as well as officials from SEAFDEC Secretariat and TD. The Seminar was also attended by observers from the Department of Fisheries, Thailand. The list of participants appears as Annex 1.

3. The Seminar was held with the objectives as follows:

- To report the achievement and outcome of the project during its 5-year implementation and review its progress in line with the original project concept;
- To verify the impacts of the concept to the beneficiaries, from the project's activities in terms of quantity as well as quality considering both facets of community development as well as sustainable fishery resources management;
- To discuss its resultant rationale and implication in the dissemination of the project concept to other SEAFDEC member countries under component 2; and
- To identify the necessary follow-up actions to be undertaken by DOF Thailand and other collaborating local agencies.

II. OPENING OF THE REGIONAL SEMINAR

4. Mr. Pirochana Saikliang, Acting Director, Chumphon Marine Fisheries Research and Development Center (CMDEC) welcomed the participants to the Regional Seminar. He outlined the fisheries profile and its importance in Chumphon Province, Thailand. He introduced the ICRM-PD project and the site in Pakklong Sub-district started since October 2001. He stressed on the role of Pakklong Fishermen's Group, which form the important component of coastal fisheries management and has contributed to the development of coastal fisheries management in the project site. His Welcoming Remark appears as Annex 2-A.

5. Dr. Siri Ekmaharaj, SEAFDEC Secretary-General, explained the fisheries situation in Southeast Asia, which has been encountering with severe resource degradation and conflicts. This has led to the formulation of the ICRM project by SEAFDEC in 2000. He highlighted the importance of project activities in building capacity of Pakklong Fishermen's Group (PFG) to gradually take up responsibility in the management of coastal fisheries. He expressed his hope that the Seminar would be able to discuss the achievements and develop conclusion and recommendations for future promotion of ICRM in Southeast Asia. His Statement appears as Annex 2-B.

6. Dr. Poonsap Virulhakul, Senior Expert on Fisheries Management, Department of Fisheries, Thailand expressed her appreciation to the organizer for extending kind invitation to attend this important Seminar. She commended SEAFDEC technical support to the project implementation in Pathew District.

The experience and lessons learned from the implementation would therefore provide a basis for the project to progressively work towards better coastal fisheries management and also to exchange experience with other countries in the region. Her Opening Remarks appears as Annex 2-C.

III. Adoption of Agenda and Timetable of the Seminar

7. The Agenda and timetable of the Seminar appear as Annex 3, was adopted.

IV. Background of Deployment of the ICRM Projects in Southeast Asian Countries and the Regional Seminar

8. Mr. Sei Etoh, Japanese Expert, SEAFDEC/TD explained the development initiatives on CBRM in Southeast Asia particularly in Thailand since 1989. Supplementing at the regional level, SEAFDEC initiated the regionalization process to the Code of Conduct for Responsible Fisheries (CCRF) since 1998. This has led to the formulation of the project on "Locally Based Coastal Resources Management in Pathew District (LBCRM-PD) in October 2001 with the main objectives of establishing sustainable coastal resources management at the local level, rehabilitating the coastal fishery resources, and alleviating poverty in coastal fishing communities. In August 2003, the project initiated component II to be implemented in Pulau Langkawi (LBCRM-PL), Malaysia. The two project components were reformulated to a new program on "Capacity Building of Human Resources and Participation in Integrated Coastal Resources Management (ICRM), which places more emphasis on human resources development in the project activities. In addition to ICRM-PD and ICRM-PL, the project initiated a new component in November 2005 in Sihanoukville (ICRM-SV), Cambodia.

9. Mr. Etoh introduced the objectives and expected outcome of the seminar. He underlined the importance of reviewing the project experience and achievement as a basis for sharing among countries in the region, particularly in the other project sites in Pulau Langkawi, Malaysia and Sihanoukville, Cambodia. The Seminar therefore serves as the mid-term review of the project. His working paper appears as WP01.

V. Integrated Coastal Resources Management in Pathew District, Chumphon Province, Thailand (ICRM-PD)

10. ICRM-PD was implemented in two Phases – Phase I from 2001 to 2004 and phase II from 2005 to 2006. The project site was Pakklong Sub-district. The project has been implemented in collaboration with Chumphon Marine Fisheries Research and Development Center(CMDEC), Department of fisheries in association with other key local agencies particularly Pakklong Fishermen's Group (PFG). The project activities comprised 6 components, namely

- Base line survey;
- Encouraging community-based resource management (CBRM);
- Promoting local business development;
- Enhancing human resource capability and participation;
- Developing extension methodologies and extension systems;
- Rehabilitating and Enhancing coastal resources.

11. Although, the project development process was initiated by SEAFDEC in collaboration with DOF, Thailand, the project has been gradually taken over the DOF, Thailand and subsequently by the PFG through the implementation. It was envisaged that with the assessment of progress and achievement made during the project implementation from 2001 to 2006, future course of actions would be identified in order to sustain the ICRM in the project site.

Base Line and Monitoring Survey

Socio-economic Survey

12. Ms. Thanyalak Suasi, Socio-economic Officer, SEAFDEC/TD introduced the socio-economic survey conducted as part of the project as bench-mark for understanding socio-economic situation and fisheries profile of the project site and monitoring achievement made by the project. The first base line survey was conducted in January 2002 and the monitoring survey was conducted in December 2006. The socio-economic survey comprises 4 parts, namely general information, fisheries sector, people's participation in fishermen's groups, and attitude of fishers towards ICRM project.

13. According to the survey, Ms. Thanyalak pointed out that 76% of respondents indicated that the project helped in fisheries resources management and 71% was felt that community was better developed. 42% of the respondents indicated no change in household income, while 32% believed a little increase. For future activities, 36% of the respondents indicated to have more artificial reefs installed, 11% indicated the need to continue the project activities, and 10% for increased installation of Fish Enhancing Devices (FEDs) and fish releasing activities. Her working paper appears as WP02.

In the discussion, there was a suggestion on the use of indicators in base line and monitoring surveys. Ms. Jessica C. Munoz questioned to the presenter whether there any indicators that were used for the comparison of data of the year 2002 and 2006. Socio-economic indicator for example: Opinion and attitude to fishers on income level, contribution of project to fisheries in the region, and landing data which is used for obtaining average fish size and calculating CPUE.

In addition, it was suggested that the marital status could also be considered collecting number of members per household and utilization of resources, which indicated how much money they had and spent.

Status of Marine Environment in Pathew District

14. Ms. Sumana Kajonwattanakul, Marine Biologist, Marine and Coastal Resources Research Center (MCR), the Central Gulf of Thailand presented the results of marine environment monitoring at the project site from 2002 to 2006. The conclusion was that the water quality in the study area was suitable for coastal aquaculture. Her working paper appears as WP03/1.

In the discussion, Brunei commented good or poor is now indicated as healthy or unhealthy. Regarding the occurrence of red tide is mostly contributed by aquaculture activities. The development of aquaculture activities should be carefully planned and assessed to avoid environmental impacts to the coastal ecosystem.

The Condition and Community Structure of Coral Reefs in Pathew District

15. Ms. Anchalee Chankong, Marine Biologist, Eastern Marine and Coastal Resources Research Center (MCR) presented the investigation of condition of coral reefs and coral community structure which the results showed that the condition was varied. The reef condition was very poor and still similar to the results in 2000-2001. Her working paper appears as WP03/2.

Fisheries Status of Pakklong Sub-district

16. Ms. Sansanee Srichanngam, Fishery Biologist, Chumphon Marine Fisheries Research and Development Center (CMDEC), introduced biological landing survey as part of ICRM-PD project implemented continuously for 5 years. Fishing gears used in the areas are collapsible crab trap, crab gill net, squid cast net with light luring, and shrimp trammel net, Indo-Pacific mackerel gill net, mullet gill net, anchovy falling net with light luring and cuttlefish trap. Her working paper appears as WP04.

17. According to the survey, point out that natural resources without any enhanced program, resources were squid and Indo-Pacific mackerel is quite stable. Natural resources with occasional enhanced program shrimp resource depending on the relationship between releasing schedule and fishing season. Natural

resources with continuous enhanced program – i.e. crab bank of blue swimming crab provide good effect for resource increased.
In discussion, ghost fishing due to abandoned gear or loss of gear should be addressed. Study on the loss of trap could be considered particularly in the near shore areas considering that the areas are considered as spawning areas for crab. In response, the extent of ghost fishing in smalls-scale fishing is less compared to deeper waters or commercial fishing. Suggestion also made to enlarge mesh-size of bottom net of the trap to allow juvenile crab to escape and therefore considered a good selective gear.
Shrimp trammel net – in Malaysia is becoming a problem. Good catch and good price but fishers multiples their nets. Zone 1, 5 mile from shore, we should develop alternative gear catching shrimp. Management measures should be imposed to avoid destructive practices.

Encouraging Community-Based Resources Management

Zoning Arrangement

18. Mr. Tanadol Chantakhuan, Fisheries Officer, Chumphon Provincial Fisheries Office presented the background of the Royal project. He explained the process of making the announcement on the prohibition of fishing gear to operate in zone area of Chumphon waters. This included 3 kind of the prohibited fishing gears are namely trawler, push net, cockle cast net. This demarcated zone was merged to the Sea food bank project to transfer the right of fish-farming areas engagement as water deeds. Then, fish-farmer could use the water deed to get more financial arrangement from the formal financial system. His working paper appears as WP05.

In discussion, this is not fishing zones but demarcated areas for exclusive utilization such as specific fishing gear or cage culture. Regarding to the provincial law declaration, the demarcated areas did not prohibit anchovy purse seine to operate in the demarcated zone. This type of fishing gear should be added into the provincial law enforcement. Japanese expert commented that different zoning management and application varied by areas to areas and by local people interests.

Changes in Fishing Activities after the Coastal Zone Management Project

19. Ms. Pattarajit Kaewnuratchadasorn, on behalf of Mr. Sukchai Arnupapboon, the author of the paper, presented fishing activities changes during the project implementation at the first year (2002) and the last year (2006) of the project implementation. The study was focused on the indo-pacific mackerel gill net, collapsible crab trap; crab gill net and squid cast net. His working paper appears as WP06.

Crab Bank

20. Ms. Thitiporn Suppanirun, Fishery Biologist, CMDEC presented the topic. She introduced that the Crab Bank project started in 2002 by 15 members of collapsible crab trap fishers in Thung Maha Bay with the objectives to work towards "conservation, enhancement and awareness building for sustainable utilization." The crab bank was initiated in order to allow gravid crabs caught by fishing to spawn before sale. The profit from the sale of spawned crabs is used for the Bank's activities. Her working paper appears as WP07/1.

Activities generate awareness building and encourage strong involvement and initiatives by local fishers.

The survival rate of crabs that had not spawned in the cages was very low due to the number of crab was too dense, so they competed for the food. Therefore, the holding cages were modified to the floating cages type.

Addionally, Mr. Etoh presented the observation of crab bank as seen in His working paper appears as WP07/2 and WP07/3.

21. In the discussion, increasing trends of catching rate and total catch of swimming crab in the project site resulted from the gravid crabs of the Crab Bank. Question was whether any evidence to indicate that the spawned crabs are not migrates out of the project site.

According to the observation by the fishers and oceanographic study indicated that the project site for Crab Bank is suitable as a spawning ground for crabs (Evidence for correlation between crab bank and its contribution on resource enhancement). The result on marking of release crab indicated that the population of released crabs was caught in the project site. In case of Japan, indicators used are to look at the fishing efforts and abundance and quality of resources. Experience says that there is a trend of increase in total catch and average size of crabs caught. The Crab Bank does not only provide direct benefit in enhancing resources, but also encourage fishers to take initiatives. Basis for sharing experience which allow strong ownership and continuity of any initiative.

Local Enforcement Activity

22. Mr. Somporn Dechpakdee, Fisheries Administrative officer, Chumphon Marine Fisheries Patrolling and Enforcement Center, DOF made a presentation on the topic. The Center participated in the implementation Committee Meeting to plan on the patrol and enforcement of the project area. In 2006, the main activity of the enforcement unit was to establish local enforcement unit at the project site comprising selected volunteer fishermen. The activity enables the unit members to increase their awareness about conservation of the fisheries resources and on sustainable coastal fisheries resource management. The local enforcement activities included establishment of Local Enforcement Unit (LEU), recruiting and training of volunteers in fisheries laws and enforcement. LEU works in close coordination with the center such as meetings between LEU and the Center on a monthly basis to assess problems and constraints including solution to the identified problems. Besides, releasing juveniles of fishes are also conducted by the Center and LEU. The LEU is proved to strengthen fishers' communities to take an active part in management of coastal fisheries. His working paper appears as WP08 .

In the discussion, are they all volunteers, any incentive for Monitoring, Control and Surveillance (MCS), there is some budget from CMDEC supporting activities.

23. Ms. Jessica needed a confirmation on whether the local enforcement unit was voluntary basis. On the economic viewpoint, how this voluntary group had longer motivated to participate in the activity when they did not receive any incentive. The SEAFDEC Japanese expert affirmed that the local enforcement unit had not received any incentive. They sometimes got a support from the CMDEC for continually patrolling the coastal line. He added more information that the local enforcement unit has monthly meeting to discuss problems and means of management. Mr. Abd Hamid, a representative from Brunei wondered a little whether the local enforcement unit could have authority to arrest the offenders encroached into the demarcated zone. The director of the CMDEC clearly clarified that the local enforcement unit had no any authority to arrest the offender without accompanied with police or patrolling coastal guards or other governing official.

24. Mr.Wannakiat, Director of Phuket Marine Biological Center questioned that whether a local illegal fishing boat such as trawls existed in the community. Mr. Somporn confirmed that there was no local trawler inside the community. All of offenders were the outside trawler. Ms. Jessica, once again needed an explanation how process of court was for judging the offender. Mr. Somporn explained that the verdict of the offender just fine without putting into jail. SEAFDEC/Secretariat representative warned that there might be mistranslated the meaning of zone management. He, therefore suggested that local surveillance unit should be more appropriated than local enforcement unit. This is because the local surveillance unit was defined its functioning in coastal watching. Moreover, this unit had no any authority to arrest the offender without governmental official accompanied.

The Director of CMDEC added some information that both DOF and MCR official had an authority to enforce or control illegal fishing with enactment of the national fisheries law.

Local Business Development

Women's Group Development

25. Ms. Sumitra Ruangsivakul, Head of Socio-economic Section, SEAFDEC/TD. The women's group development was the one of the project component that had been implemented. The objectives of the activity was to create additional source of income for fisher's households, improve women's skills and knowledge on fish processing and product development and micro-financing, and to develop the existing low value local fish products into more value added product. The outcome of the activity was composed of improved role of women, to be more active and skillful in fish processing techniques, product development and micro-financing, creation of local business opportunity in the community, good relationship between government and community, and creation of women's group network. Her working paper appears as WP09 .

In the discussion, the participant questioned that whether any fisherwomen go to fishing. Women should not be considered as supporting activities. In some areas there are fishing activities by women.

Trial Production of Babylonia Shell

26. Mr. Sei Etoh presented the activity outcome, as business development is important, Coastal Fisheries Management can be taken up by communities unless and until the living conditions of fishers or communities member become improved. Local resource management institution should also consider enhancing their economic activities in order to sustain their initiatives.

The experiment of babylonia shell culture was conducted from August, 2005 to February, 2006. The first trial failed because stress and stop feeding as they are cultured in cages in too deep water. The second trial became successful as the cages were moved to shallow and clam water. The results of the study showed negative as expected income return is not good, seeds cost was still relatively high, the maintenance works could not be manage, and the growth rate has the affected from the environment condition. His working paper appears as WP10 .

In the discussion, for shell aquaculture first is to do technology development and verification and next commercialization (mass production and marketing)

Coastal Aquaculture Experiment

27. Ms. Nopparat Nasuchol presented the activity was initiated in response to the loss of fishing areas for push netters after the announcement of the provincial demarcated areas. CMDEC started demonstration and experiment on sea bass cage culture and blue swimming crab culture. Crab culture requires intensive care by fishers and therefore found not suitable for fishers. Her working paper as shown in WP11-12.

Human Capacity Building and Participation

Organization Pakklong Fishermen's Group (PFG)

28. Mr. Wara Kateumpai, Chairman of PFG. He explained the PFG started by organizing sub-group of fishers by types of fishing activities. His working paper appears as WP013.

In the discussion, Mr. Wannakiat, Director of Phuket Marine Biological Center, questioned that first, what the Pakklong Fishing community's opinions on the project, and second the activities that was had been operated during the project implementation answered the fishers' need. Mr. Wara replied that the activities could solve the problems such as the conflicts between fishermen and bird nest concession.

Training Courses and Study Tours

29. Ms. Thitiporn Suppanirun, Fishery Biologist of CMDEC, made the presentation of the training and study tour on "Capacity building forms part and puzzle of the project activities". Her working paper appears as WP14 .

In the discussion, PFG should take initiatives to identify capacity building needs and how to address it. The identified priority needs will be the basis for PFG to coordinate and collaborate with other agencies in enhancing capacity of the group and the communities. This will help ensuring the long-term capacity building process supporting sustainable management of coastal fisheries.

Most prepared activities are mangrove reforestation and fish releasing.

Resources Rehabilitation and Enhancement

Installation of ARs (Artificial Reefs) and FEDs (Fish Enhancing Devices)

30. Dr. Yuttana Theparoonrat, Head of Coastal Fisheries Management Division, SEAFDEC/TD, presented the works of resource enhancement activities, the installation of Artificial Reefs (ARs) and Fish Enhancing Devices (FEDs). This activity is a collaborative arrangement with another SEAFDEC project on resource enhancement. AR is set by DOF along the demarcated line of the project site. His working paper appears as WP15 .

After the installation of ARs, fish trap, squid trap, bottom gill net (trammel net), and collapsible crab trap fishing operation were conducted to assess the abundance and availability of fisheries resources at the AR sites to compare the results before and after the installation. In addition, benthos survey was also conducted to assess the benthos distribution in the ARs areas. Designs of the ARs modules should be selected considering the target species. Multi-species AR module should have complex structure such as small chambers inside.

Due to limitation of funding from SEAFDEC, ARs component of the project was dropped.

FED Training and Demonstration Program: FED is a permanent not temporary structure for pelagic resources meant for enhancing resources as the primary objective. Important principle for FED is to have materials locally available and can be installed by small fishing boats by few fishers.

During the experiment, FED unit lost due to stealing by fishers for using in cage culture or due to anchor ropes tied by fishing boats.

31. In the discussion, the meeting was recommended about the formation of ARs modules should consider possibility for trawlers to enter into the ARs areas. And, fisheries resources enhancement tools should be used in combination and coupled with appropriate management measures and control.

32. A participant from Malaysia asked what types of fishing gear and what is the good type of ARs installed in the project area considering suitability of topography? Appropriate ARs designs should consider various types of topography, formation of AR modules installation should consider how to avoid encroachment of trawl operation in the AR areas.

Releasing Fish fingerling and Mangrove Reforestation

33. Ms. Nopparat Nasuchol, Fishery Biologist of CMDEC, presented that resources enhancement activity which composed of three main activities; releasing of fingerlings, mangrove planting and installation of Artificial Reefs (ARs). She also emphasized on the monitoring after releasing by conducting the landing survey and tagging technique which was introduced by Japanese Expert. With regard to tagging

study, recaptured shrimps and sea bass were found in the project areas. Her working paper as shown in WP16-17.

It is important to find scientific evidence to prove the effectiveness and contribution of resource enhancement activities.

Releasing strategies particularly the releasing site should be carefully selected considering that the area should be appropriate to the life cycle of the species.

Field trip to Observe the Project Site

34. In addition to the progress and achievements presented above, the participants of the Seminar had an opportunity to visit Pakklong Sub-district, particularly the Crab Bank, Pakklong Fishermen's Group (PFG), and Women's Group.

Visited Crab Bank

35. All regional participants, CMDEC, MCR and SEAFDEC staffs visited crab bank fisher group at the village. Mr. Jang Fungfeang is a chairman of the Crab Bank fisher group. He is a key person to give information concerned the group conducted crab bank activity. The rationale of the crab bank started in year 2001 after the local fishers who engaged in collapsible crab trap fishing gear noticed the severe decline of crab resources.

He said that he accompanied with other five-six other fishers who used collapsible crab trap started releasing gravid crabs in a cage. Each fisher donated a gravid crab and put in the cage to let the gravid crab laid egg in order to increase crab recruitment in number. He and his members did not only keep gravid crabs in the cage, but they also reduce an exploitation of gravid crab in year 2002. Mr. Jang and his members established the fisher group. They seriously conducted donating a gravid crab by each member. In the same year, the DOF/CMDEC was a major government agency to provide a support to the fisher group such material for constructing fish cage and net mesh sized 1.2 inches.

At the beginning of the crab bank activity, each member had collapsible crab trap amounted to 300 boxes on average per a fisher. The amount of crab catches was only 5-6 kg per a fishing trip. After the practice of gravid crab bank begun, the fishers were very appreciated the result of the activity. They said that they could get crab catches numbered of 10 kg in a fishing trip by 300 boxes of collapsible crab trap.

Currently, the fisher group has 16 members. The group set up it own rule for implementing crab bank. The rule is every member has to give a gravid crab on daily basis. In one month, the member should give gravid crab not less 30 crabs in a month. The group also has a rule to control outsider who want to operate the collapsible crab trap in fishing ground surrounding to their village. The outsider has to use collapsible crab trap not more 500 boxes of the crab trap with 2.5 inches of bottom net mesh size.

The group therefore imported Japanese technique to contribute the crab resource enhancement by marking the crab carapace and release to the sea. When other fisher recaptured the marked crab, he will release the marked crab to the sea again without exploitation. This type of technique practices only from November to February annually started in year 2006. All participants self-experienced to visit the crab bank cage in the sea after they listened the explanation of the crab bank activity.

Visited the Pakklong Fishermen's Group (PFG)

36. A visiting Pakklong Fishermen's Group and Women's Group on fish processing activity was next program after finished visiting crab bank. All participants moved to Ban Thung maha village (village no.1) at the Pakklong fishermen's group, Mr. Wara, a chairman of the group welcomed all participants to exchange information about the group establishment, administration and management. The chairman

kindly gave his explanation on the group functions, and activities. Then, regional participants started to ask questions how he and his group member role its function on community development and coastal resource management.

The group chairman clarified the group activities were such saving and loan arrangement for members and activities concerned coastal resource enhancement. The saving and loan activities were strategies to contribute member developed their capacity in fishing and reduced their depended on local money lender. Main coastal resource enhancement activities were mangrove reforestation and fish fingering releasing.

Malaysian participant questioned to the group chairman that what the problem of the group and the community was. The group chairman answered that they noticed the decline of aquatic resource was major threat of the group and the community in developing fisheries sector. SEAFDEC/Secretariat participant raised a question on what factor contributed to the group achieved the group administration and management. The chairman said that the key factor was the group unity. This meant that they placed an emphasis on participated in discussing the group problem and defining solution which was best fitted means and solution for the group members. The indicator of the group unity tangibly practiced through three-monthly meeting and one annual meeting.

Visited Women's Group

37 Women group on fish processing activity was the last group where all participants visited. At the group outlet shop, the group had displayed its products such dry seasoning anchovy, salted and crispy dry anchovy and fish chili paste. The participants took a look the facility for produced varieties of fish products. Some of them bought the fish product as souvenir and brought the product back to their home country. Some participant said that a fish product was a tangible sample to promote this kind of activity for women in their home county to create alternative means of income.

Final Project Evaluation of ICRM-PD

38. Dr. Somsak Boromthanarat, Coastal Resources Institute (CORIN), Prince of Songkhla University presented his final project evaluation for ICRM-PD (WP18). In the conclusion of the report, the project design and objectives were commended as they could address the core need of the project site. Project components, namely base line survey, CBRM supporting activities, local business development, human resources development, extension activities, and resource enhancement were found relevant and directly contribute to the development of CBRM in the project site with strong ownership from the community of the project site. However, there was a lack of collaboration with other local institutions including Sub-district Administrative Organization (Ao.Bo.To).

39. Recommendations were provided on improvement of each project components. Moreover, the following recommendations were highlighted:

- Develop and disseminate project information and experience as a basis for decision-making, policy-making and improving management practices beyond the project site,
- Encourage more local community participation,
- Encourage participation of Ao.Bo.To,
- Adopt and inter-disciplinary and inter-sectoral approach at all levels
- More effective enforcement of laws and regulations through local community participation,
- Continued financial support until such time that the local groups can take up the process and the need for emergency funds for unexpected circumstances, and
- Need of scientific research and assessment of activities of the project such as artificial reefs, fish enhancing device, and stock enhancement.

VI. Description of the Project Approach and Progress in ICRM-PL, Malaysia

40. Mr. Krishnasamy, DOF, Malaysia gave a presentation on the background and progressive work of the ICRM-PL project sited in Pulau Langkawi, Kedah State, Malaysia. On the presentation, as seen in WP19, he sequently showed the structure of the project steering and implementing committee and function. He placed an emphasis on the outstanding outcome of the project such coastal zone demarcation and management system and traditional fish aggregating device for enhancing aquatic resources. The outcome of the project could see towards the fisher economic group establishment and administrative management called briefly KEN (Kumpulau Economy Nelayan). The KEN chiefly handled the group business such fishing gear and material shop, fuel oil, and ice storage. The women group is established namely KEW group (Kumpulau Economy Wanita). This KEW had its own activities concerned mainly on fish processing products such dry seasoning anchovy products, etc. KEW could also manage its own bookkeeping and accounting to show its own business performance and profit to member and outside observers.

Cambodian delegate raised question that why the Malaysian DOF, chosen Langkawi island to be the project site of the ICRM project. The presenter gave a reason that the ICRM in Langkawi island would be pilot project site. The outcome and output of the ICRM project would be introduced and transferred to other areas of Malaysia. The Japanese expert added more information that a socio-economic and base line survey was conducted earlier to provide needs and training course for local fishers and stakeholders. An introducing fishing gear friendly to eco-system was major principle to help improving a mean of fisher livelihood for sustainability.

The Myanmar delegate suggested that the safety at sea program should be considered to add in the ICRM project.

VII. Description of the Project Approach and Progress in ICRM-SV, Cambodia

41. Mr.Yos Chanthana, FiA, Cambodia presented the progressive work of the ICRM-SV project sited in Sihanoukville Province. His presentation is WP20. He started with the project background and continued the progressive work of the project particular coastal zone management and income generation activities. The coastal zone management activity implemented towards the designated area approach. The local enforcement unit was established and provided with training course on function and responsibility of the unit. An income generation was activity executing for improve local stakeholder livelihood through both in-and-outside fisheries sectors. Mud crab culture was introduced to local fishers to practice for earning income, Mushroom culture was also anticipated activity to create income to local fishers. Both these two types of income generations helped reducing pressure on aquatic resources and exploitation.

Based on experience coming from the Philippines, Ms. Jesscica reminded that the mud crab culture might cause to a high demand of trash fish as bait for feeding the cultured crab. A small-scale fisher might put much fishing effort to capture small fish for mud crab baits.

The Japanese expert cited that an introduction of income generation activities very important to improve local fisher and stakeholder living standard. He suggested that any activity was related and not related fisheries sector should be considered whenever the activity could produce an incentive to local fishers. He himself strongly encouraged local fishers to occupy in mushroom culture farm.

VIII. Presentation of the Country Papers on Current Approach Toward Realization of Community-based Fisheries Resources Management (CBFRM) Concept

Brunei Darussalam

42. Mr. Abd Hamid Haji Zainin, Department of Fisheries, Brunei Darussalam outlined the important role and contribution of the fisheries sector to national economy. He introduced the fisheries management systems applied in the country, including fishing zones. In the coastal area where fishers are small-scale, communities are involved in conservation and management programs including moratorium on fishing operation in zone 1 (to be started on 1 January 2008), habitat enhancement, conservation and management of sea turtles.

43. Mr. Abd Hamid Haji Zainin stressed the importance of the community consultation and involvement in fisheries management as it contributes to accountability of management; enhance ownership of initiatives leading to higher compliance and sustainability of initiatives. He outlined the roles of communities in fisheries management, namely documentation of popular and traditional knowledge, establishing of resource enhancement activities, and undertake livelihood activities.

44. Coastal communities play an important role in coastal fisheries. ICRM with group-user right system under the co-management approach are important and will be further promoted in the country. His presentation appears as WP21.

45. In the discussion, Role of communities in resource enhancement – ARs sponsored by Brunei Shell and the Government declares 1 km around the oil rigs to be off limit areas. The zone of Brunei waters is divided into 4 zones namely: Zone 1 (0-3 nm), solely for small-scale fisheries, Zone 2 (3-22 nm) for commercial scale, Zone 3 (22-45 nm) for commercial scale having 60.1-150 gross tonnages, and Zone 4 (45-up to EEZs) which currently under exploited resources. The meeting was asked that how many fishers fished in zone 1. The presenter answered that, there are about 2,767 full time fishermen and 4,878 do as part time, however there is concerned on the SSF operation as they are efficient by applying foreign workers and high horse powered engine. What is the legal status of CBFRM. Not at this stage.

Moratorium – how many fishers can be taken out from fishing. Target at reducing 43% of the pressure, priority for fishers to continue fishing is for those primarily depend on fishing.

What is enforcement arrangement. Enforcement is a joint force among Navy, policy, air force, and fishery patrolling. What happens to 80% of fishers to be pushed out to Zone 2. They can fish from Zone 2 onwards so no problem.

Indonesia

46. Mr. Sri Yono WS, Directorate General of Capture Fisheries, Ministry of Marine Affairs and Fisheries gave an overview of fisheries profile of the country. He explained about fisheries management mechanism based on fisheries management policy and supporting legal provision, which include protection, preservation and rehabilitation; allocation and effort control; enactment of laws and regulations in accordance with national laws and international instruments; licensing, fish stock utilization; and fisheries MCS. National EEZs is sub-divided into 9 fisheries management areas (FMA). In each FMA, allocation of fisheries potentials, fishing capacity and utilization as well as management authorities, regulations and plans will be defined.

47. Regarding fishing zones in Indonesia, Mr. Sri Yono explained that there are 3 zones. Zone 1 from 0 to 4 nm responsible by district government allowing boats up to 10 GT, Zone 2 from 4 to 12 nm responsible by provincial government allowing boats between 10 to 30 GT, and Zone 3 beyond 12 nm. responsible by the central government allowing boats beyond 30 GT. Indonesia imposes strong MCS programs covering installation of VMS, establishing observer programs, establishing inspection group by involving communities (i.e. in Malacca Straits refers to Pangli Ma Laut, which is a form of CBFRM using local customary laws and social sanctions), and other traditional management systems such as Tawi-Tawi. He also initiatives in managing fishing capacity by applying various management tools and measures. His presentation appears as WP22.

Myanmar

48. Mr. Than Oo Wai, Department of Fisheries, Myanmar gave the country and fisheries profile and policy. He explained the marine fisheries areas comprising in-shore fishery (5 nm from shore for Rakhine and 10 nm. from shore in Ayeyarwady and Taninthayi no more 12 hp engine and 30 feet long boats) and off-shore fishery (beyond in-shore area with engine beyond 12 hp and 30 feet long boats). Myanmar has enacted fisheries laws for foreign fishing vessels, aquaculture, marine fisheries, and inland fisheries.

49. Mr. Wai explained that, there are four main coastal resources, namely mangrove, coral, mud flat, and sand beach. He explained the roles and responsibilities of the Department of Fisheries for the fisheries development and management, including collection of fishery statistics and information, conservation and management of fisheries, extension services, etc.

50. Regarding ICRM, Myanmar currently implements a project on Integrated Mangroves Management through Community Participation in the Ayeyarwaddy Delta, supported by the Forest Department with JICA bilateral assistance. The project applies sustainable livelihoods approach, which first phase of the project has been completed. He highlighted some of the future directions in the implementation and promotion of ICRM as follows:

- Develop ICRM in collaboration with line agencies
- Develop regulation for the comprehensive management program in the coastal zone focusing the sustainability of habitats and fisheries resources
- Clarify responsibilities of each line agencies
- Capacity building of ICRM.

His presentation appears asWP23.

The Philippines

51. Ms. Jessica C. Munoz, Bureau of Fisheries and Aquatic Resources outlined issues in fisheries management in the country, namely resource depletion in coastal and inland waters, overfishing/illegal fishing, low income of fishing communities, etc. She provided background of a program on fisheries resource management. She outlined elements in the promotion of ICRM;

- National policies on coastal and fisheries management i.e. Fisheries Code, Local Government Code, NIPAS Act, Executive Order No. 533 on the promotion of ICRM in the Philippines
- LGU participation
- Information and education campaign
- Research-based management
- Partnership with private sector
- Capacity building
- Fisheries regulation and enforcement i.e. municipal fisheries licensing system, formation of fisheries law enforcement teams and coastwatch teams, etc.
- Community/fishers participation i.e. establishment of Fisheries and Aquatic Resources Management Councils (FARMCs) to give policy advices on resources management
- NGO/People's Organizations (POs)/Cooperatives participation
- Viable Income Diversification
- Resource rehabilitation projects i.e. mangrove reforestation in collaboration with Department of Environment and Natural Resources (DENR), fish sanctuary, riverbank bi-engineering

Challenges of a Sustainable Fisheries Management

- Allocation of appropriate budget
- Human resources and organizational structure
- Policies that support fisheries management
- Continuing education and information
- Regulation and law enforcement
- Research-based fisheries management

Her presentation appears as WP24.

Vietnam

52. Dr. Nguyen Chu Hoi, Director of Vietnam Institute of Fishery Economics and Planning (VIFEP), Ministry of Fisheries explained about fisheries profiles of the country, which is rich in biodiversity and

fisheries resources over the 3,000 km coastline. He underlined major challenges facing the fisheries sector in Vietnam, they are loss of biodiversity, degradation of fishery resources, more land-based impacts, coastal disasters and oil spills, increased coastal and marine pollution. Main threats to the fisheries sector include appeared red tide, low economic efficiency of fishing fleets, sectoral focus in coastal resources policy and management, multi-use of coastal resources and benefit conflicts (exp. Coastal fisheries VS tourism).

53. To address complex situation for coastal development and management, Dr. Chu Hoi underlined the importance of adopting ICRM. He provided a brief history of development of ICFM/ICRM since 1926 during the French's occupation. Until 2003, Law of Fisheries was enacted. He also introduced the country's planning for management of fishing capacity. This includes reducing number of fishing boats, marine zoning, maintaining the current fishery production at 1.8 m tons, establishment and management of MPA network, development of small-scale coastal fisheries under co-management concept, research in alternative jobs, improving national fishery information system, national program on living resources protection, coastal marine fisheries management in the framework of ICM and ecosystem-based approach, etc.

54. Fishing zones in Vietnam are subdivided into shore line to 4 nm responsible by communes or district government with assistance from coast guards, 4 to 24 nm responsible by provincial governments with assistance from marine policy, and beyond 24 nm responsible by the central government with assistance from navy.

55. He outlined key lessons learned from inter-sectoral approach and stakeholder participation as follows:

- Need a strong legal framework and enforcement by inter-sectoral approach,
- Need more participation/involvement of local fishermen community,
- Need community right-based and ecosystem-based management
- Fishery development plans have to link with poverty reduction/livelihood improvement for poor fishermen,
- Restructure of marine fishing activities toward responsible and sustainable fisheries,
- Development of human resources for marine fishing and aquaculture,
- Need more investments for fisheries and aquaculture, and
- Infrastructure development to mitigate environmental risks and diseases.

His presentation appears as WP25.

IX. Conclusion and Recommendations of the Regional Seminar

Overview

56. Integrated Coastal Resources Management (ICRM) is a process oriented activity implemented in a well defined area, which requires social preparation (people focused), capacity building of local fishers and institutions as well as partnership (co-management) among agencies concerned to enable the local people to work collectively towards long-term development of a local inter-sectoral management system.

ICRM initiatives should be developed based on interests and active cooperation among partners including cost-sharing arrangement (in kind/in cash), which will result in strong ownership and active involvement of all parties concerned in the project development process as well as follow-up phase.

Design and Objectives

57. Project design should consider developing from bottom up and involve users/stakeholders in the design. Community-Based Fisheries Resources Management (CBFRM) demonstrates a practical/tangibles starting process to work progressively towards and forms part of the broader ICRM framework.

Emphasis should also be given to stakeholder analysis to provide a basis for planning ICRM supporting activities.

Base line and Monitoring Surveys

58. Base line and monitoring surveys are costly and should be carefully planned and conducted in partnership with local fishers' group and stakeholders to provide a basis for sound data and information on coastal profile to support future ICRM activities and a bench-mark for assessing changes made by the projects and their activities. Local/indigenous knowledge should not be undermined and be used. This will therefore help enhancing their capacity for long-term learning process supporting ICRM.

Spatial and temporal data and information should be systematically stored (database), analyzed and disseminated to stakeholders for their own usage.

It is important to identify key simple/practical indicators covering social, economic and resource/ environmental aspects to be used in combination. The indicators help providing clearer profiles of the coastal areas and cross-check inter-relationship among various aspects.

Establishment of CBFRM

59. Social preparation is considered crucial to the establishment of CBFRM, particularly involvement and coordination among fishers, local agencies and other stakeholders right at the beginning of the process.

Success of CBFRM stems on the community organization and strengthening i.e. Local Fishers' Group as well as their legal status. Strong local initiatives and leadership is important aspect in forming local fishers' group.

In order to sustain activities of community organizations i.e. fishers' group, it is important that these organizations should be economically feasible.

Awareness and Capacity Building

60. Awareness and capacity building are considered important cross-cutting activities and should be tailored to suit the design and objectives of ICRM. Identification and implementation of awareness and capacity building activities should at the earliest possibility be led by the local fishers' group. The identification and implementation process is in itself a capacity building activity for the fishers' group.

The local fishers' group should take initiatives to identify capacity building needs and how to address it. The identified priority needs will be the basis for PFG to coordinate and collaborate with other agencies in enhancing capacity of the group and the communities. This will help ensuring the long-term capacity building process supporting sustainable management of coastal fisheries.

Local Business Development

61. LBD to support livelihoods of the local people should fully consider marketing aspects so as to ensure sustainability of the activities.

LBD helps foster collaborative spirit of working together among local fishers.

Resource and Stock Enhancement

62. Resource and stock enhancement tools/activities should not be developed in isolation but be coordinated among various tools and integrated into the local management systems. The tools and activities should be implemented together with other appropriate management measures to ensure their impacts.

Assessment of resource and stock enhancement tools/activities is important and should be jointly conducted with fishers to provide scientific evidence on their effectiveness and impacts to coastal resources and a basis to improve/adjust their future undertaking.

Key Achievements and Follow-up Activities of ICRM-PD

63. Refering to the presentations, capacity building for Ao.Bo.To.Seminar for local fishers and local authorities of the three project sites could be considered to exchange views and experiences.

A consultative meeting among local authorities of the three project sites (PD, PL and SV) to jointly develop proposals for future activities.

Transfer of Experiences to Other Countries

64. Experience and lessons learned from the ICRM project should be compiled for future dissemination for decision-making, policy-making and improving management practices to facilitate scaling up of activities at the national level as well as sharing of experience with other project sites (PL and SV) and other countries in the region.

Simplified synthesis of experience from various ICRM project sites (with acknowledgement of local efforts) should be developed as a regional reference. Translation of the synthesis, as and when appropriate, may be considered.

X. Closing of the Regional Seminar

65. Mr. Hideki Tsubata, Deputy Secretary-General of SEAFDEC, thanks all participants for their active participation and contribution to the success of the seminar. After that, he declared the seminar closed. His speech appears as Annex 6.

Annex 1

LIST OF PARTICIPANTS

Brunei Darussalam

Mr. Abd Hamid Haji Zainin
Head Fishermen
Department of Fisheries
Jalan Menteri Besar, Berakas BB3910
Bandar Seri Begawan
Tel: 673-2383067
Fax: 673-2-382069
E-mail: dol_1605@hotmail.com

Cambodia

Mr. Meas Chanda
Deputy Director of Sihanoukville's
Fisheries Office, Fisheries Administrative
Sihanoukville's Fisheries Office 01
Sangkat 4, Khan, Mittapheap, Sihanoukville
Tel: -
Fax: 885-23-215470
E-mail: measchanda@yahoo.com

Mr. Yos Chanthana
Chief of Administrative Unit
Fisheries Administrative
Sihanoukville's Fisheries Office 01
Sangkat 4, Khan, Mittapheap, Sihanoukville
Tel: 85-11-485486, 885-16-789200
Fax: 885-34-393904
E-mail: coastalzone_shv@yahoo.com.sg

Ms. Heng Ponley
Officer of Community Fisheries Development
office, Fisheries Administrative
Fisheries Administrative, Ministry of Agriculture
Forestry and Fisheries #186, Norodom Blvd.,
P.O.Box 582, Phnom Penh
Tel: 885 12-802711
Fax: -
E-mail : ponley_h@yahoo.com

Indonesia

Mr. Sri Yono WS
Head of Sub Directorate of Fisheries Resource for
Utilization in Sea, Territorial and Archipelagic
Water- Director for Fisheries Resources-Director
General of Capture Fisheries- NMAF
Directorate General of Aquaculture
Direktorat Sumber Daya Ikan-Ditjen
Tangkap-Gedung B 1t 6 Kanpus Deptan J1
Harsono RM No.3 Ragunan-Pasar
Minggu- Jakata Selatun
Tel: +62-21 7811672
Fax: +62-21 7811672
E-mail: dfrmdgf@indosat.net.id
masirssam@yahoo.com

Malaysia

Mr. Wan Mohd Aznan bin Abdullah
Deputy Director
Fisheries Department of Malaysia
Kedah 4 state Fisheries Department Level 5,
WISMb Poosekutubm
05400 AOR 8AR, Kedah, Malaysia
Tel: 604-7342135
Fax: 604-7304623
E-mail: wanmoh2307@yahoo.com

Mr.Anuar bin Omar
State Fisheries Officer
Fisheries Department of Malaysia
Kedah 4 State Fisheries Department,
5Th Floor, Wisma Persekutuan,
Jalan KG Baru, 05000 AOR Star, Kedah,
Malaysia
Tel: 604-7342135
Fax: 604-7304623
E-mail: anuaromaroi@yahoo.com

Mr. Krishnasamy Arunasalam
Fisheries Extension Officer
Fish Quality Control Section
Department of Fisheries
Level 3, Podium 1, Block 4G2,
Wisma Tani Percint 4,
62628 Putrajaya
Tel: 603-8870 4555
Fax: 603-8889 1055
E-mail: tvms2004@yahoo.com

Mrs. Sabidah Binti Saleh
Extension Officer
Department of Fisheries
District Fisheries Office Langkawi,
Bukit Malut, 07000 Langkawi, Kedah
Tel: 04-9665935
Fax: 04-9665937
E-mail: sabidahsaleh@yahoo.com.my

Myanmar

Mr. Than Oo Wai
Deputy Director of Department of Fisheries of Myanmar, Department of Fisheries
SINMIN Road, Yangon, Myanmar
Tel: 95-1-226860
Fax: 95-1-228258
E-mail: dof@mpt.net.myanmar

The Philippines

Ms. Jessica C. Munoz
Supervising Aquaculturist
Bureau of Fisheries and Aquatic Resources
Marine Building, Phil Coconut Authority
Elliptical Road Diliman Quezon city
Tel: (632)929-5877
Fax: (632) 929-5877
E-mail : jmunoz@bfar.da.gov.ph

Vietnam

Dr. Nguyen Chu Hoi
Director of Fisheries
Vietnam Institute of Fisheries Economic and Planning
10 Nguges Cong Hoan Str
Noi Ching, Vietnam
Tel: 84-4-7718451
Fax: 84-4-8345674
E-mail: nchei52@yahoo.com

Thailand

Department of fisheries (DOF)

Dr. Poonsap Virulhakul
Senior Expert on Fisheries Management
Chulaphon Building floor 6 Kasetklang,
Chatuchak, Bangkok 10900
Tel: 66-2-9406211
Fax: 66-2-5620571
E-mail: poonsapv@fisheries.go.th

Mr. Pirochana Saikliang
Acting Director, Chumphon Marine Fisheries Research and Development Center
408 Moo 8 Paknum, Muang, Chumphon 86120
Tel: 66-77-521919
Fax: 66-77-522006
E-mail: pirochana@yahoo.com

Mr. Tanadol Chantakhuan
Fishery Biologist
Chumphon Provincial Fisheries Office
Muang, Chumphon 86120
Tel: 66-85-888 3469
Fax: 66-77-504823
E-mail: teeneeteenee@hotmail.com

Mr. Somporn Dechpakdee
Fisheries Administrative officer
Upper Southern Gulf of Thailand Marine Fisheries Patrol Center
Muang, Chumphon 86120
Tel: 66-81-476 3201

Ms. Nopparat Nasuchol
Fishery Biologist
Chumphon Marine Fisheries Research and Development Center
408, Moo 8, Paknum, Muang, Chumphon 86120
Tel: 66-77-522006-7
Fax: 66-77-522006
E-mail: nasuchon@yahoo.com

Ms. Sansanee Srichanngam
Fishery Biologist
Chumphon Marine Fisheries Research and Development Center
408 Moo 8 Paknum, Muang, Chumphon 86120
Tel: 66-77-522006
Fax: 66-77-522006
E-mail: srichanngams@yahoo.com

Ms.Thitiporn Supanirun
Fishery Biologist
Chumphon Marine Fisheries Research and Development Center
408 Moo 8 Paknum, Muang, Chumphon 86120
Tel: 66-77-522006
Fax: 66-77-522006
E-mail: tsuppanirun@hotmail.com

Department of Marine and Coastal Resources (MCR)

Mr. Wannakiat Thubthimsang
Director of Phuket Marine Biological Center
92 Paholyothin Rd., Soi 7, Samsennai
Phayathai, Bangkok 10400
Tel: 66-2-2982055
Fax: 66-2-2982167
E-mail: wannakiat@yahoo.com

Ms. Sumana Kajonwattanakul
Marine Biologist
92 Paholyothin Rd., Soi 7, Samsennai
Phayathai, Bangkok 10400
Tel: 66-2-2982055
Fax: 66-2-2982167
E-mail: sumana11th@yahoo.com

Ms. Anchalee Chankong
Marine Biologist
Eastern Marine and Coastal Resources Research Center
237 Moo 6, Kram, Klaeng, Rayong 21190
Tel: 66-38-657383
Fax: 66-38-657383
E-mail: anchankong@yahoo.com

Coastal Resources Institute (CORIN)

Dr. Somsak Boromthanarat
Director of Coastal Resources Institute
Prince of Songkla University, Hatyai,
Songkla 90110
Tel: 66-74-212752
Fax: -
E-mail: somsak@ait.ac.th

Promotion Cooperative Department

Mr. Supat Promrak
Chumphon Cooperative Officer
Provincial Cooperative Promotion Office
Muang, Chumphon 86000
Tel: 66 -77-504621
Fax: 66-77-511688
E-mail : supat_ps@cpd.go.th

SEAFDEC/Secretariat

Dr. Siri Ekmaharaj
Secretary General/Training Department Chief
P.O. Box 1046 Kasetsart Post Office
Bankgkok 10903
Tel: 66-2-9405682
Fax: 66-2-9406336
E-mail: sg@seafdec.org

Mr. Hideki Tsubata
Deputy Secretary General/ Deputy Training Department Chief
P.O. Box 1046 Kasetsart Post Office,
Bangkok 10903
Tel: 66-2-9406331
Fax: 66-2-9406336
E-mail: dsg@seafdec.org

Mr. Suriyan Vichitlekarn
Program and Policy Coordinator
P.O. Box 1046 Kasetsart Post Office,
Bangkok 10903
Tel: 66-2-9406332
Fax: 66-2-9406336
E-mail: suriyan@seafdec.org

SEAFDEC/Training Department

Mr. Seiichi Etoh
Coastal Fisheries Management Expert
P.O. Box 97 Phrasamutchedi
Samutprakarn 10290
Tel: 66-2-4256139
Fax: 66-2-4256110-1
E-mail: etoh@seafdec.org

Dr. Yuttana Theparoonrat
Coastal Fisheries Management Division Head
P.O. Box 97 Phrasamutchedi
Samutprakarn 10290
Tel: 66-2-4256160
Fax: 66-2-4256110-1
E-mail: yuttana@seafdec.org

Mrs. Sumitra Ruangsivakul
Socio-economic Section Head
P.O. Box 97 Phrasamutchedi
Samutprakarn 10290
Tel: 66-2-4256157
Fax: 66-2-4256110-1
E-mail: sumitra@seafdec.org

Dr. Phattareeya Suanrattanachai
Fisheries Governance Management
Section Head
P.O. Box 97 Phrasamutchedi
Samutprakarn 10290
Tel: 66-2-4256167
Fax: 66-2-4256110-1
E-mail: phattareeya@seafdec.org

Dr. Taweekiet Amornpiyakrit
Resource Enhancement Section Head
P.O. Box 97 Phrasamutchedi
Samutprakarn 10290
Tel: 66-2-4256165
Fax: 66-2-4256110-1
E-mail: taweekiet@seafdec.org

Ms. Pattarajit Kaewnuratchadasorn
Fisheries Governance Management Scientist
P.O. Box 97 Phrasamutchedi
Samutprakarn 10290
Tel: 66-2-4256166
Fax: 66-2-4256110-1
E-mail: pattarajit@seafdec.org

Mr. Weerasak Yingyuad
Resource Enhancement Scientist
P.O. Box 97 Phrasamutchedi
Samutprakarn 10290
Tel: 66-2-4256164
Fax: 66-2-4256110-1
E-mail: weerasak@seafdec.org

Ms. Jariya Sornkliang
Socio-economic Scientist
P.O. Box 97 Phrasamutchedi
Samutprakarn 10290
Tel: 66-2-4256159
Fax: 66-2-4256110-1
E-mail: jariya@seafdec.org

Ms. Thanyalak Suasi
Socio-economic Scientist
P.O. Box 97 Phrasamutchedi
Samutprakarn 10290
Tel: 66-2-4256159
Fax: 66-2-4256110-1
E-mail: thanyalak@seafdec.org

Pakklong Fishermen's Group (PFG)

Mr. Wara Kateumpai
Chairman of Pakklong Fishermen's Group
52/2 Moo 1 Pakklong, Pathew District,
Chumphon 86210
Tel: 66 -84-8508707

Observers

Dr. Mali Boonyaratpalin
Advisor
Department of Fisheries, Chatujak
Bangkok 10900
Tel: 66-2-5620557
Fax:66-2-5620561
E-mail: boonyaratpalin@yahoo.com

Dr. Chongkolnee Chamchang
Senior Fisheries Biologist /RFPN/SIDA/
SEAFDEC
SEAFDEC/Secretariat P.O.Box 1046
Kasetsart Post Office, Bangkok 10903
Tel: 66-2-9551602
Fax: 66-2-9406336
E-mail: chongc@seafdec.org

Mr. Sombat Poovachiranon
Senior Marine Biologist
Department of Marine and Coastal Resources
Phuket Marine Biological Center
51/91 Muang, Phuket 83000
Tel: 66-76-391128
Fax: 66-76-391127
E-mail: pmbc@loxinfo.co.th

Annex 2-A

Speech by Director of Chumphon Marine Fisheries Research and Development Center

The Senior Expert on Fisheries Management, Guests, Ladies and Gentlemen:

My name is Pirochana Saikliang, Acting Director of Chumphon Marine Fisheries Research and Development Center

On behalf of Chumphon Province, we are very pleased that the Senior Expert on Fisheries Management accepted our invitation to declare opened the Seminar on the Regional Seminar on Integrated Coastal Resources Management in Southeast Asia: Lessons Learned Through Integrated Coastal Resources Management in Pathew District, Chumphon Province, Thailand.

I would like to brief you on the geographical information of Chumphon. Chumphon has 8 Districts with Fisheries are importance opportunities of local people because we have coastline of about 222 kilometers and 6 Districts are connected to the sea. The project is located in Pakklong Sub-District, Pathew District in the north of Chumphon, with the area of about 117 square kilometers or 73,125 rai. The topographical condition is slope, with eastern part is connected with the Gulf of Thailand, where the Royal Development Project is located, in Moo 5 of Pakklong Sub-District.

Pakklong Sub-District consists of 7 villages, Ban Thungmaha (Moo 1), Ban Bosomrong (Moo 2), Ban Thamthong (Moo 3), Ban Bangwan (Moo 4), Ban Numpu (Moo 5), Ban Bonrai (Moo 6) and Ban Tha-ad (Moo 7); with the population of approximately 4,128.

Most people in Pakklong Sub-District are engaged in agriculture and coastal fisheries because they have a shoreline of about 45 kilometers. There are 7 islands consisting of Randped island, Randkai island, Vieng island, Sikong island, Phra island, Kenok island and Rang island. Three of these islands were occupied with bird-nest concession, i.e. Sikong island, Rang island and Vieng island.

Integrated Coastal Resources Management Project was implemented in Pakklong Sub-District since October 2001. The tangible activities implemented by this project is the major task in re-organization of the fishermen's group which constitutes a core body to take charge in coastal resources management and total community development functions. The apex Pakklong Fishermen's Group (PFG) upheld by seven Sub-Fishermen's Groups was organized and the operation had been put in place. The major project approach lay in further strengthening of the capacity of the PFG so as to ensure taking over the coastal resources management and the total community development functions after the project was terminated.

We are grateful to the Department of Fisheries of Thailand and Southeast Asian Fisheries Development Center, who selected Chumphon to implement this pilot project in Integrated Coastal Resources Management.

Thank you

Annex 2-B

Speech by Secretary General of SEAFDEC

The Senior Expert on Fisheries Management of the Department of Fisheries, Thailand, Dr. Poonsap Virulhakul, the Japanese Trust Fund Manager, Mr. Hideki Tsubata, distinguished guests and participants, ladies and gentlemen, a very pleasant good morning.

I am very pleased to be here and honored to welcome all of you to this Regional Seminar on Integrated Coastal Resources Management in Southeast Asia: Lessons Learned through Integrated Coastal Resources Management in Pathew District, Chumphon Province, Thailand or ICRM-PD.

As you are already aware, the project "Integrated Coastal Resources Management in Pathew District" was started in October 2001 based on the decision during the 3rd ASEAN-SEAFDEC Fisheries Consultative Group Meeting in March 2000 that the SEAFDEC Training Department would collaborate with the Department of Fisheries, Thailand, in implementing a pilot project on community-based fishery resources management.

Prior to that, it was evident that the livelihood in the coastal fishing communities of Thailand had gradually deteriorated as a result of over-exploitation of the fishery resources and degradation of the coastal environment. This was a pivotal concern of the authorities of Thailand and the DOF was keen to tackle this problem. Under the circumstance where the country needs a regionalized approach in the application of fisheries co-management in collaboration with SEAFDEC, the 5-year ICRM-PD project was implemented from October 2001 until December 2006.

During the implementation of the project in Pathew District, similar sister projects were initiated in Langkawi, Malaysia and in Sihanoukville, Cambodia, starting in August 2003 and November 2005, respectively. This was because of the tangible and positive impacts of the original project to the stakeholders in the fishing communities in Chumphon.

Although the project completed its tenure as scheduled in 2006, its operation has been continued by the DOF under the auspices of the Royal Project and by concerned local authorities closely involved in the project's operation from its beginning. This arrangement will be continued for the next three years. During this follow-up period, emphasis will be placed on institutional as well as human capacity building for the fishing community, especially for the Pakklong Fishermen's Group (PFG). It is anticipated that the PFG will take over the project management after the completion of the current follow-up phase.

Ladies and gentlemen, this is an occasion for us to review the five-year outcomes of the project through various presentations on its activities and verify the impacts as well as its achievements. I am sure we can derive useful conclusions and recommendations from this review for the application of similar approaches in other SEAFDEC Member Countries and also for the follow-up operation of the project.

I am looking forward to your full cooperation by taking active part in the discussions and by giving views especially in the verification of the project achievements. We also expect your recommendations for the further development of community-based fishery resources management in the Southeast Asian countries.

Thank you for your attention

Annex 2-C

Speech by Senior Expert on Fisheries Management

Fisheries Provincial Officer of Chumphon Province, Specialist, Japanese Trust Fund Manager, Ladies and Gentleman:

I am very pleased and honored to be invited to declare opened the Regional Seminar on Integrated Coastal Resources Management in Southeast Asia: Lessons Learned through Integrated Coastal Resources Management in Pathew District, Chumphon Province, Thailand.

I agree with the objectives of this Seminar that, to report the achievement and outcome of the project during its 5-year implementation and review its progress in line with the original project concept, verify the impacts of the concept to the beneficiaries, from the project's activities in terms of quantity as well as quality considering both facets of community development as well as sustainable fishery resources management, and identify the necessary follow-up actions to be undertaken by DOF Thailand and other collaborating local agencies

I fully support this project and wish to tell you that the success of the project will be a form the cooperation and collaboration among those concerned. Mutual cooperation between local inhabitant and fishermen will lead to the success of the project. I believe that the success of this project will be a model of other projects not only in Thailand but also in other countries in the region.

I sincerely hope that the opinion, comments and suggestions which will be shared at this Seminar will be of benefit to the project implementation. I would like to thank everyone who engage in this Seminar as well as the participants.

Now, it is auspicious time to declare opening the Regional Seminar on Integrated Coastal Resources Management in Southeast Asia: Lessons Learned through Integrated Coastal Resources Management in Pathew District, Chumphon Province, Thailand.

Thank you

Annex 3

AGENDA AND TIMETABLE

9 July 2007 (Monday)

1300 – 1900	Participants from abroad and Bangkok move to Chumphon Province

10 July 2007 (Tuesday)

0830 – 0900	Registration
0900 – 0930	Opening of the Seminar followed by commemorative - Welcome remarks by Mr.Pirochana Saikliang, Acting Director of Chumphon Marine Fisheries Research and Development Center - Speech by Dr. Siri Ekmaharaj, Secretary General of SEAFDEC - Speech by Dr. Poonsap Virulhakul, Senior Expert on Fisheries Management, DOF, Thailand
0930 – 0940	Adoption of the Agenda
0940 – 1000	Deployment of ICRM projects in SEAFDEC member countries (WP01)
1000 – 1030	***Coffee break and Group photos***
1030 – 1050	Base line and Monitoring Survey – Result of Socio-economic Survey (WP02)
1050 – 1110	Coastal Marine Environmental Survey – Status of Coastal Marine Environment (WP03)
1110 – 1130	Marine Biological Survey – Status of Main Marine Species(WP04)
1130 – 1150	Locally Based Fishery Resources Management – Zoning Arrangement (WP05)
1150 – 1220	Locally Based Fishery Resources Management – Changes of Fishing Activities after the Implementation of the Project (WP06)
1220 – 1400	***Lunch***
1400 – 1420	Locally Based Fishery Resources Management – Crab Bank (WP07)
1420 – 1440	Locally Based Fishery Resources Management – Local Enforcement Activity (WP08)
1440 – 1500	Local Business Development – Women's Group Activities (WP09)
1500 – 1520	Local Business Development – Trail Production of Babylonia Shell (WP10)
1520 – 1530	***Coffee break***
1530 – 1550	Local Business Development – Fish Cage Culture and Crab Culture Experiment (WP11-12)
1550 – 1610	Human Capacity Building and Participation – Organization of Pakklong Fishermen's Group (WP13)
1610 – 1630	Human Capacity Building and Participation – Training Courses and Study Tours (WP14)
1630 – 1650	Resources Rehabilitation and Enhancement – Installation of ARs and FEDs (WP15)
1650 – 1710	Resources Rehabilitation and Enhancement – Releasing Fish Fingerlings, Mangrove reforestation, tree planting and eco-tourism (WP16 -17)
1800 – 2000	***Welcome party***

11 July 2007 (Wednesday)

0730 – 0900	Move from CMDEC to the project site (Pakklong Sub-District)
0900 – 1130	Visit the Crab Bank at Village No. 7 Visit PFG (Pakklong Fishermen's Group) and women's group at village No. 1
1130 – 1330	Leave from Village no. 1 to Ban Bang Bird ***Lunch***
1330 – 1400	Presentation of the country paper: Brunei Darussalam (WP21)
1400 – 1430	Presentation of the country paper: Indonesia (WP22)
1430 – 1500	Presentation of the country paper: Myanmar (WP23)

1500 – 1515	***Coffee break***
1515 – 1545	Presentation of the country paper: the Philippines (WP24)
1545 – 1615	Presentation of the country paper: Vietnam (WP25)
1700 – 19.00	***Dinner at Ban Bang Bird***

12 July 2007 (Thursday)

0830 – 0900	Description of the project approach and progress in ICRM-PL, Malaysia (WP19)
0900 – 0930	Description of the project approach and progress in ICRM-SV, Cambodia (WP20)
0930 – 1000	Conclusions and recommendations of the final project evaluation (WP18)
1000 – 1020	***Coffee break***
1020 – 1120	Winding-up discussions
1120 – 1145	Summarizing the conclusions and recommendations of the Regional Seminar
1145 – 1200	Closing the Regional Seminar
1200 – 1330	***Lunch break***
1330	Participants from abroad and Bangkok move to Bangkok

Annex 4

PROVISIONAL PROSPECTUS

INTEGRATED COASTAL RESOURCES MANAGEMENT IN SOUTHEAST ASIA: LESSONS LEARNED THROUGH INTEGRATED COASTAL RESOURCES MANAGEMENT IN PATHEW DISTRICT, CHUMPHON PROVINCE

10 – 12 July 2007

1. Background

Since 1999, SEAFDEC has implemented the regionalization of the Code of Conduct for Responsible Fisheries with emphasis on four thematic issues, i.e. fishing operations, aquaculture, fisheries management, and post-harvest processing and trade. Under the ASEAN - SEAFDEC Fisheries Consultative Group (FCG) mechanism, the regionalization project had Thailand as the lead ASEAN country and the Training Department (TD) as the lead implementing SEAFDEC Department for fisheries management related issues.

In 2001, SEAFDEC/TD and the Department of Fisheries (DOF) in Thailand conducted a collaborative pilot project on coastal fishery resources management with the cooperation of local fishing communities and other stakeholders, community groups and the local administrative authorities in Pathew District, Chumphon Province under the auspices of Japanese Trust Fund – 1 (JTF-1). The Chumphon Marine Fisheries Research and Development Center (CMDEC) served as the core implementing counterpart group and Chumphon Provincial and Pathew District Offices of Fisheries as the collaborating agencies.

The collaborative pilot project was initially named "Locally Based Coastal Resources Management in Pathew District (LBCRM-PD)", but was later renamed "Locally Based Coastal Fisheries Management in Pathew District (LBCFM-PD)" upon the suggestion of the 25th SEAFDEC Program Committee Meeting (PCM) held in Singapore in October 2002. The title of the project was again changed to Integrated Coastal Resources Management in Pathew Dsitrict (ICRM-PD) after the phasing-out of JTF-1 and simultaneously, at the start of the new Japanese Trust Fund – 4 (JTF-4) in 2005.

The project was designed to cover a timeframe of five years consisting of two phases. The first phase was on the preparation and implementation of the project in Pathew District, Chumphon Province, Thailand, testing the applicability of the CBRM to the fishing communities and various local administrative authorities, and also introducing the concept on devolvement of management authorities. In the second phase, the project continued the implementation of the CBRM concept giving SEAFDE/TD the responsibility in transferring the concept and the lessons and experiences learned to the other member countries. After having achieved tangible impacts from the CBRM, the other member countries were encouraged to propose their intentions to implement similar projects in their respective countries.

Thus, with the outcome of the implementation of LBCFM-PD, Brunei Darussalam, Indonesia, Malaysia, Cambodia and Myanmar expressed their interests to collaborate with SEAFDEC/TD in implementing similar projects in their respective countries. As a result, the project on Locally Based Coastal Resources Management was implemented in Pulau Langkawi (LBCRM-PL), Malaysia from August 2003. Taking into account the geographical advantage and its impact, the CBRM concept was introduced to the fishing communities under a new title Integrated Coastal Resources Management in Pulau Langkawi (ICRM-PL) from January 2005 when the project was transferred to JTF-4, for a period of three years. Similarly, an activity was also initiated in Sihanoukville, Cambodia titled Integrated Coastal Resources Management in Sihanoukville (ICRM-SV) for three years starting in November 2005. The respective time frames of the project activities are shown in Table 1.

Timeframe of the Program Implementation

No.	Component	Year							
		2001	2002	2003	2004	2005	2006	2007	2008
1	Component 1 Project 1: Thailand - LBCFM-PD: 1st Phase(JTF-1) - ICRM-PD: 2nd Phase (JTF-4)	←	—	—	—	→			
						←	—	—	→
2	Component 2 Project 2: Malaysia - LBCRM-PL: 1st Phase (JTF-1) - ICRM-PL: 2nd Phase (JTF-4)				←	—	—	—	→
						←	—	—	—
3	Component 2 Project 3: Cambodia - ICRM-SV (JTF-4)						←	—	—

As the first component of the program, the ICRM-PD project in Chumphon, Thailand was completed towards the end of 2006. The project's progress in the span of five years and two months was reported in detail in the respective biannual project progress reports since its inception. At this point, it is proposed that a review of the achievement of the ICRM-PD project and its impacts to the target fishing communities in accordance with the project orientation and goals, be conducted and that the lessons and implications derived from the review will be incorporated in the project operations of component 2, i.e. ICRM-PL and ICRM-SV.

Hence, this Regional Seminar on "Integrated Coastal Resources Management" is being proposed with its objectives, envisaged outcomes, date, venue, target participants, and agenda described below.

2. Objectives of the seminar

The proposed objectives of the seminar are as follows:

- To report the achievement and outcome of the project during its 5-year implementation and review its progress in line with the original project concept
- To verify the impacts of the concept to the beneficiaries, from the project's activities in terms of quantity as well as quality considering both facets of community development as well as sustainable fishery resources management
- To discuss its resultant rationale and implication in the dissemination of the project concept to other SEAFDEC member countries under component 2
- To identify the necessary follow-up actions to be undertaken by DOF, Thailand and other collaborating local agencies

3. Envisaged outcomes

The expected outcomes of the seminar are as follows:

- All data and information collected and analyzed during the project implementation are documented and presented
- The project activities are thoroughly reviewed and its impacts to the beneficiaries verified
- Through discussions, follow-up actions of the project to be undertaken by DOF, Thailand and other local agencies are recommended
- Description of the two other on-going activities in Malaysia and Cambodia is made and the rationale in implementing similar project approach discussed, and some recommendations may be derived for the possible reorientation of the project
- The seminar offers opportunities for member countries other than Thailand, Malaysia and Cambodia to consider the applicability of CBRM concept with its project approach
- In a sense, the seminar also serves as overall mid-term program evaluation and review

4. Dates and venue

The Regional Seminar, jointly organized by SEAFDEC/TD and DOF, Thailand, will be held in the conference room of Chumphon Marine Fisheries Research and Development Center (CMDEC), Chumphon Province, Thailand, from 10 to 12 July 2007.

5. Target participants

The criteria for the invited participants are as follows: they must have worked closely with coastal fishery resources management in their respective countries; coastal fishery resources management is their profession; and since the seminar will be conducted in English with no simultaneous translation to the Thai language, the designated participants should have good command of the English language to be able to actively participate in the discussion. The following target participants will be invited to the seminar:

- Representatives from SEAFDEC member countries: those who represent the SEAFDEC member countries' coastal fishery resources management programs as part of their fisheries development plan; i.e. one representative each from Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, the Philippines and Vietnam.
- Representatives from the host country of the project ICRM-PD: from the Department of Fisheries, Thailand, who has been involved in the project under the collaborative project framework with SEAFDEC/TD; 2 representatives
- Members of the project's operational teams from Malaysia and Cambodia: 2 each from ICRM-PL and ICRM-SV
- The project core staff: those who are directly involved in the practical operation of ICRM-PD at the site, i.e. SEAFDEC/TD (5), CMDEC (5), MCR (2), Chumphon Provincial Fisheries Office (1), Enforcement Unit (2), Aquaculture Center (1) and Local Administration Office (2) and Provincial Cooperative Promotion Office (1)
- Representatives from SEAFDEC Secretariat (3)

In all, it is expected that 34 participants representing the above groups will attend the Regional Seminar.

6. Tentative timetable and agenda

The tentative timetable for the regional seminar follows. The agenda is further described in detail in the attached annotated agenda.

9 July 2007 (Mon)	
13.00 – 19.00	Participants from abroad and Bangkok move to Chumphon
10 July 2007 (Tue)	
08.30 – 09.00	Registration
09.00 – 09.30	Agenda 1: Opening of the Seminar followed by commemorative photo session
09.30 – 09.40	Agenda 2: Adoption of the Agenda
09.40 – 10.00	Agenda 3: Background of the ICRM projects and the Seminar
10.00 – 10.15	Coffee break
10.15 – 12.00	Agenda 4: Description of the project activities and outcomes: ICRM-PD
12.00 – 13.30	Lunch
13.30 – 15.00	Continue description of the project activities and outcomes: ICRM-PD
15.00 – 15.15	Coffee break
15.15 – 16.30	Continue description of the project activities and outcomes: ICRM-PD
11 July 2007 (Wed)	
08.30 – 11.30	Agenda 5: Presentation of the country papers (Brunei Darussalam, Indonesia, Myanmar, Vietnam and the Philippines)
11.30 – 12.30	Lunch break
12.30 – 17.30	Agenda 6: Field trip to observe the project site in Pathew District

12 July 2007 (Thu)

08.30 – 09.30	Agenda 7: Description of the project approach and progress of ICRM-PL, Malaysia, and ICRM-SV, Cambodia
09.30 – 09.50	Agenda 8: Conclusions and recommendations of the final project evaluation
09.50 – 11.00	Agenda 9: Winding-up discussions
11.00 – 11.30	Coffee break
11.30 – 11.50	Agenda 10: Summary of conclusions and recommendations of the Regional Seminar
11.50 – 12.00	Closing of the Regional Seminar
12.00	Lunch

7. Discussion materials and working documents

The following discussion and/or presentation materials will be prepared by the respective designated party.

a. Background of deployment of the ICRM projects in Southeast Asian countries and the Regional Seminar (SEAFDEC)
b. Description of the project activity and outcome – Base line and Monitoring Survey: Result of Socio-economic Survey (SEAFDEC)
c. Description of the project activity and outcome – Base line and Monitoring Survey: Status of Main Marine Species (CMDEC)
d. Description of the project activity and outcome – Base line and Monitoring Survey: Status of Coastal Marine Environment (MCR)
e. Description of the project activity and outcome – Locally Based Fishery Resources Management: Zoning Arrangement (Provincial Fisheries Office)
f. Description of the project activity and outcome – Locally Based Fishery Resources Management: Changes of Fishing Activities after Implementation of the Zoning Management Project (SEAFDEC)
g. Description of the project activity and outcome – Locally Based Fishery Resources Management: Crab Bank (PFG / CMDEC)
h. Description of the project activity and outcome – Locally Based Fishery Resources Management: Local Enforcement Activity (Enforcement Unit / DOF)
i. Description of the project activity and outcome – Local Business Development: Women's Group Activities (SEAFDEC)
j. Description of the project activity and outcome – Local Business Development: Trial Production of Babylonia Shell (SEAFDEC)
k. Description of the project activity and outcome – Local Business Development: Fish Cage Culturing Experiment (CMDEC)
l. Description of the project activity and outcome – Local Business Development: Crab Culturing Experiment (CMDEC)
m. Description of the project activity and outcome – Human capacity building and participation: Organization of Pakklong Fishermen's Group (CMDEC / PFG / Provincial Cooperative Promotion Office)
n. Description of the project activity and outcome – Human capacity building and participation: Training courses and study tours (CMDEC)
o. Description of the project activity and outcome – Resources rehabilitation and enhancement: Installation of ARs and FEDs (SEAFDEC)
p. Description of the project activity and outcome – Resources rehabilitation and enhancement: Releasing fish fingerling (CMDEC)
q. Description of the project activity and outcome – Resources rehabilitation and enhancement: Mangrove reforestation, tree planting and eco-tourism (CMDEC)
r. Country paper – Current approach toward realization of CBFRM concept in Brunei Darussalam
s. Country paper – Current approach toward realization of CBFRM concept in Indonesia

t. Country paper – Current approach toward realization of CBFRM concept in Myanmar
u. Country paper – Current approach toward realization of CBFRM concept in Vietnam
v. Country paper – Current approach toward realization of CBFRM concept in the Philippines
w. Description of the project approach and progress, ICRM-PL in Malaysia (Malaysian project team)
x. Description of the project approach and progress, ICRM-SV in Cambodia (Cambodian project team)
y. Final Project Evaluation Report – Excerption (The outsourced Consultant)

8. Funding

A major component of expenses incurred during the conduct of the regional seminar is borne by SEAFDEC/ TD under the Japanese Trust Fund - 4, while some expenses incurred locally such as cost of venue, etc. will be borne by DOF Thailand under a cost sharing arrangement.

9. Others

Should you require any other information, please feel free to communicate with us at the address given below or e-mail to:

Ms. Sumitra Ruangsivakul
Secretary of Seminar
P.O. Box 97, Phrasamutchedi,
Samut Prakan, 10290, Thailand
Tel: (662) 4256100
Fax: (662) 4256110 and 4256111
e-mail: sumitra@seafdec.org and etoh@seafdec.org

Annex 5

LIST OF DOCUMENTS

Working Papers (WP)

WP01	Background of Deployment of the ICRM projects in Southeast Asian Countries and the Regional Seminar

Base Line and Monitoring Survey

WP02	Result of Socio-economic Survey
WP03/1	Status of Coastal Marine Environment
WP03/2	The Condition and Community Structure of Coral Reefs in Pathew District
WP04	Status of Main Marine Species

Locally Based Fishery Resources Management

WP05	Zoning Arrangement
WP06	Changes of Fishing Activities the Coastal Zone Management Project
WP07/1	Crab Bank
WP07/2	Optional Approaches for the Crab Bank Scheme
WP07/3	Introduction of the Japanese Model Crab Bank to a Fishing Community in Thailand
WP08	Local Enforcement Activity

Local Business Development

WP09	Women's Group Activities
WP10	Trial Production of Babylonia Shell
WP11	Fish Cage Culturing Experiment
WP12	Crab Culturing Experiment

Human Capacity Building and Participation

WP13	Organization of Pakklong Fishermen's Group
WP14	Training courses and study tours

Resources Rehabilitation and Enhancement

WP15	Installation of ARs (Artificial Reefs) and FEDs (Fish Enhancing Devices)
WP16	Releasing Fish Fingerling
WP17	Mangrove Reforestation

WP18	Final Project Evaluation Report – Excerption

Description of the Project Approach and Progress

WP19	Integrated Coastal Resources Management in Pulau Langkawi (ICRM-PL), Malaysia
WP20	Integrated Coastal Resources Management in Sihanoukville (ICRM-SV), Cambodia

Country Paper: Current Approach Toward Realization of CBFRM Concept

WP21	Brunei Darussalam
WP22	Indonesia
WP23	Myanmar
WP24	The Philippines
WP25	Vietnam

Annex 6

Speech by Japanese Trust Fund Manager

The Senior Expert on Fisheries Management of the Department of Fisheries, Thailand, the Secretary General of Southeast Asian Fisheries Development Center, distinguished guests and participants, ladies and gentlemen, good *day*.

It is indeed a pleasure for me to be here in order to participate in this Regional Seminar on Integrated Coastal Resources Management in Southeast Asia: Lessons Learned through Integrated Coastal Resources Management in Pathew District, Chumphon Province, Thailand. I have listened intently and participated in the discussions on the progress and status of this project. Before winding up this Seminar, I would like to say some words on behalf of one of the donors, the Trust Fund Program of the Government of Japan.

As all of you are already aware, the project on Integrated Coastal Resources Management in Pathew District was implemented under a collaborative project framework with funds allocated by DOF Thailand and the Japanese Government. During its 5-year project tenure, the DOF contributed about Baht 15,200,000 equivalent to USD380,000, which was allocated from the special fund of the Royal Project. The Japanese Government contributed Baht 15,000,000 equivalent to USD 375,000. Summing up, the total funds allocated for this project was about Baht 30,200,000 equivalent to USD 755,000.

During the Seminar, I have noted the very impressive achievements of the various activities. Particularly,....(*insert your observation and impression*)

It is also interesting to note that the project had positive impacts to the fishing community in Chumphon and that this resulted in the embodiment of community based fisheries resources management by the newly established fishermen's group, the Pakklong Fishermen's Group. I am also glad to note that follow-up implementation of the project was taken over by DOF Thailand and various local administrative agencies. In addition, the project impact has extended to the region such that similar approaches have been adopted in two member countries, namely Malaysia and Cambodia. The dissemination of the CBRM concept in the Southeast Asian countries based on the successful case studies conducted in Thailand, Malaysia and Cambodia is in fact complying with the goal that SEAFDEC is pursuing.

Before we leave this seminar, I would wish to extend my sincere thanks to DOF Thailand and the local administrative agencies for their dedication and contribution to the project, without their support we would have not achieved such tangible outcomes and achievements. Further, I would also wish to extend my appreciation to the Royal Project for its additional financial support that enabled the project to continue its operation for another 3 years during its follow-up phase. Such contribution will ensure the sustainability of the application of CBRM in the area. Although financial support from the Japanese Trust Fund for the project has been terminated, we are still bound to look after the newly born baby and ready to continue supporting to some extent follow-up activities in the future.

Lastly, I hope that this regional seminar was completed to the full satisfaction of each participant. My wish is for all of you to make the best use of the knowledge and experiences gained through this seminar for future application of CBRM approach in your respective countries.

Annex 7

The Project Chronology

No.	Date	Particulars
01	20.03.2000	The project concept was proposed at the 3rd Fisheries Consulting Group (FCG) meeting
02	05.10.2001	Project proposal formulated and submitted to Department of Fisheries (DOF), Thailand and SEAFDEC/TD
03	22.10.2001	Annual working Plan submitted to DOF
04	28.10.2001	Inter-Agency Discussion for Locally Based Coastal Resources Management in Pathew District (LBCRM-PD) in Chumphon Province
05	**09.11.2001**	**The project was approved by DOF, Thailand, and SEAFDEC/TD**
06	28.11.2001	The 1st Steering Committee (SC) Meeting in Chumphon
07	2-7.12.2001	Study tour to the Philippines(4 each from DOF and TD)
08	7-11.01.2002	Pre-tests on socio-economic survey was conducted.
09	14-18.01.2002	Training course for "Development of CBFRM" in Chumphon (Study tour was made to the Phannga Bay Project)
10	22.01.2002	Study tour to Rayong Province to observe small scale fish processing
11	22-25.01.2002	Training course on "Business Development of Fisheries Cooperatives by Zengyoren and Cooperative League in Thailand (CLT)
12	- .02.2002	Socio-economic survey commenced
13	- .02.2002	Oceanographic, environmental and fish landing survey commenced
14	13-15.03.2002	The PCM (Project Cycle Management) training course was held in Chumpon.
15	18.03.2002	The 4th FCG Meeting in Myanmar recommended dissemination of gained experience of LBCFM-PD to other member countries
16	26.03.2002	Training course on "Community Development in Pathew District"
17	27.03.2002	1st IC (Implementing Committee) Meeting
18	22-26.04.2002	Mobile training courses at five sites on "Concept of LBCRM"
19	27-29.05.2002	Training course on "Fish Processing" organized by Chumphon Marine Fisheries Research and Development Center (CMDEC)/Traininging Department (SEAFDEC/TD) for women's groups
20	- .05.2002	Women's groups were organized to process fish products
21	23-24.06.2002	Training course on 'Fish Processing – Phase II"
22	25-26.06.2002	Training course on "Fish cage culture" arranged by CMDEC
23	09-14.07.2002	Study tour to Kedha State, Malaysia, by TD staff to inspect the proposed project site.
24	06.08.2002	2nd Implementing Committee(IC) meeting in CMDEC - Technical
25	07.08.2002	Discharging shrimp fingerings began by CMDEC
26	19-29.08.2002	The task force team was formed to deliberate allotment of cage cultural areas.
27	16-19.09.2002	Study tour in Trang and Satun Provinces to observe self-regulatory community based fisheries management
28	20-27.09.2002	Training course for primary school students on environmental educational began in Chunphon
29	26.09.2002	Tambol-level meeting to discuss issues of zoning began.
30	04.10.2002	The demarcated zone arrangement was approved by the Cabinet (came into force on 06.November 2002)
31	28.10.2002	At the 25th PCM (Program Committee Meeting), Malaysia and Thai agreed to execute the collaborative project. The title of the project changed from LBCRM-PD to LBCFM-PD.
32	16.11.2002	Tambol Pakklong fisher's group network meeting – showed the preliminary area demarcation.
33	16-18.11.2002	Study tour by 7 women group members to Paknam Langsuan district to observe fish sauce and banana processing activities

34	19-21.02.2003	Local Seminar on Progress of LBCRM-PD in Chumphon Province
35	22-24.02.2003	Regional Seminar on Progress on LBCRM-PD in Phuket Province
36	17-18.08.2004	Local seminar "Orientation of Technical Research and Data Analysis"
37	01.09.2004	The 3rd IC meeting in Chunphon
38	02-03.09.2004	Local seminar "Direction of Development on Coastal Fisheries Management" in Bangkok
39	12.10.2004	The 4th IC meeting in Chumphon
40	1-3.11.2004	Training course on LBCFM-PD project orientation
41	13.12.2004	The 5th IC meeting in Chumphon
42	14.12.2004	The 2nd SC meeting in Chumphon
43	18-19.12.2004	The 1st Fishermen's General Assembly
44	18-19.01.2005	The 2nd Fishers Group Assembly, the Fishers Sub-groups organized.
45.	21-24.02.2005	The 1st Fishers Sub-Groups meetings
46.	22.03.2005	The 1st PFG (Pakklong Fishermen's Group) meeting (PFG was officially established)
47.	22.03.2005	The 6th IC meeting
48.	26.04.2005	Visit by Senior members of DOF Malaysia to the project site
49.	25.05.2005	Crab culturing experiment commenced
50.	07.06.2005	Visit to Chantanaburi to inspect Babylonia shell culturing
51.	08-10.06.2005	Local enforcement activity training began.
52.	27-30.06.2005	Exchange visit by KEN (Fishermen Economic Group) members from the Langakawi Project
53.	24-25.08.2005	Installation of 10sets of Fish Enhancing Devices (FEDs)
54.	31.08.2005	The 2nd PFG general meeting
55.	31.08.2005	The 7th IC meeting
56.	01.09.2005	Local seminar on project progress in Chumphon
57.	02.11.2005	Discussion on legalization of the PFG with Provincial Cooperative Promotion Office began.
58.	30.11.2005	Training course of legalization of the PFG followed by study tour
59.	21.12.2005	The 3rd PFG general meeting
60.	22.12.2005	The 8th IC meeting
61.	23.12.2005	Registration of PFG with the Provincial Cooperative Promotion with the name of Pakklong Aquaculturist Group (PAG)
62.	23.01.2006	The 4th PFG meeting (1st PAG meeting)
63.	24.01.2006	The 3rd SC meeting in Bangkok
64.	14.02.2006	The 5th PFG (2nd PAG) meeting
65.	20-25.03.2006	The project team of ICRM-SV visited the project site
66.	21.03.2006	The 2nd experiment on babylonia shell culture began.
67.	22.04.2006	Comparative fish farming experiment began.
68.	27.04.2006	Swimming crab culturing experiment began.
69.	10.05.2006	The 9th IC meeting
70.	17.05.2006	The 6th PFG (3rd PAG) General meeting
71.	12/15.06.2006	Enforcement training course in Pakklong (30 trainees)
72.	19/25.06.2006	Study tour to Japan on Crab Bank and CBRM approach
73.	26.06.2006	Installation of 10 units of FEDs
74.	26.06.2006	The 4th PAG General meeting
75.	09.08.2006	Mangrove reforestation organized by PFG / PAG
76.	10.08.2006	Fishermen's Workshop to report the outcome from Study tour to Japan
77.	31.08.2006	The 10th IC Meeting
78.	31.08.2006	The local seminar on project progress in Chumphon
79.	24.10.2006	Japanese Crab-Bank system was introduced.
80.	-. 10.2006	The Internal By-law of PAG was approved by Provincial Cooperative Promotion Office
81.	24.10.2006	The final project evaluation was commenced (completed in Jan. 2007).
82.	11-14.12.2006	Monitoring Socio-economic survey was conducted.

BACKGROUND OF DEPLOYMENT OF THE ICRM PROJECTS IN SOUTHEAST ASIAN COUNTRIES AND THE REGIONAL SEMINAR

Seiichi Etoh
Training Department, Southeast Asian Fisheries Development Center (SEAFDEC/TD)

I. DEPLOYMENT OF THE ICRM PROJECTS IN THE SEAFDEC MEMBER COUNTRIES

In Thailand, the deterioration of livelihood in coastal fishing communities as a result of the over-exploitation of fishery resources and the degradation of coastal environments has led the government to introduce the concept of community-based fisheries management (CBFM) within the framework of coastal fisheries development and management. Another important factor being considered is the pressure on the government to decentralize and devolve administrative authority to local actors. A successful example of this being the joint DOF and Bay of Bengal Project (BOBP) Phangnga Bay project set up in 1996. Another example was the 1989 DOF Fishing Rights Pilot Project (FRPP) in Bang Saphan and Bang Saphan Noi District. Following these successes, the DOF decided to start a new coastal fisheries management project in Chumphon Province as an integrated component of the comprehensive development project implemented by the Royal Project Council in early 2000.

Meantime, SEAFDEC had implemented the regionalization of the Code of Conduct for Responsible Fisheries under the four major themes; i.e. responsible fishing operations, aquaculture development, fisheries post-harvest, and fisheries management. Under the ASEAN-SEAFDEC Fisheries Consultative Group (FCG) scheme, Thailand took charge as the lead country for the SEAFDEC member countries and the Training Department as the lead SEAFDEC Department for the activities under the domain of fisheries management.

Under this scheme, it was decided in 2001 that the Training Department (TD) would collaborate with the DOF in implementing a coastal resource management program, and an existing project proposal for Chumphon was reformulated as a joint initiative for a period of five years. Thailand was designated as the lead country for the SEAFDEC Members and TD as the lead implementing SEAFDEC Department. It was further agreed that the knowledge and experience gained through the project operation would be disseminated to other member countries through the SEAFDEC information and technology transfer mechanism.

Thus, the project on "Locally Based Coastal Resources Management in Pathew District (LBCRM-PD)" commenced in November 2001 in Chumphon with the overall project objectives of: (1) establishing sustainable coastal resources management at the local level; (2) rehabilitating the coastal fishery resources; and (3) alleviating poverty in coastal fishing communities.

The project had produced tangible impact as acknowledged by the Members at the 4th SEAFDEC FCG Meeting in Myanmar in March 2002 and at the 25th SEAFDEC Program Committee Meeting in Singapore in October 2002. During the latter meeting, it was pointed out that it was time to impart the technologies, including the experience and knowledge gained, to other member countries. Thus, the Committee Member for Malaysia offered Langkawi as a pilot site for the implementation of a similar approach on a cost-sharing basis. Subsequently, SEAFDEC/TD missions to Langkawi were mounted to look into the possibility of setting up a similar coastal fishery resources management and development project. Eventually, the second project on "Locally Based Coastal Resources Management – Pulau Langkawi (LBCRM–PL)" took off in August 2003 for a period of four years.

These two projects were later reformulated to fit into the new thrust of the Japanese Trust Fund IV Program, which commenced in 2004. This new program on "Capacity Building of Human Resources and Participation in Integrated Coastal Resources Management" placed more emphasis on the component of human resources development (HRD) in each project. Thus, the projects' titles were changed to Integrated Coastal Resources Management in Pathew District (ICRM-PD) and Integrated Coastal Resources

Management in Langkawi (ICRM-PL), respectively, to take into consideration the thrust of the new program and these comprise the second phase of the project.

Meanwhile, further recommendations were put forward at the SEAFDEC Program Committee meetings in 2003 and 2004 specifying that experiences and knowledge gained through these project operations should be transferred to other SEAFDEC member countries under the collaborative project mechanism. To this end, Brunei Darussalam, Indonesia, Cambodia and Myanmar expressed their intensions to initiate similar projects in their respective countries. Among these countries, it was envisaged that the 3rd project would take place in Cambodia taking into account the geographical advantage and the prioritized need of a CBRM approach in the country. The preliminary site survey was carried out in June 2004 to inspect the proposed site and to collect relevant data and information with regards to responsible community fisheries. Based on the findings and observations from the survey, a tentative work-plan was submitted to the 27th PC Meeting held in December 2004 and was endorsed. Thus, steps were then taken to put the project forward for the initiation of its actual activity in 2005. Eventually, the project commenced its operation on 11 November 2005 for three-year tenure.

As scheduled, the project in Chumphon, the ICRM-PD was terminated in December 2006. The projects in Langkawi, the ICRM-PL and in Sihanoukville, the ICRM-SV will be terminated in December 2007 and 2008, respectively.

Timeframe of the Program Implementation

No.	Component	Year							
		2001	2002	2003	2004	2005	2006	2007	2008
1	Component 1 Project 1: Thailand - LBCFM-PD: 1st Phase(JTF-1) - ICRM-PD: 2nd Phase (JTF-4)	←				→			
2	Component 2 Project 2: Malaysia - LBCRM-PL: 1st Phase (JTF-1) - ICRM-PL: 2nd Phase (JTF-4)				←			→	
3	Component 2 Project 3: Cambodia - ICRM-SV (JTF-4)						→		

II. Regional Seminar on Integrated Coastal Resources Management in Southeast Asia

In the wake of the completion of the project ICRM-PD in December 2006, it was proposed that a regional seminar be organized to primarily review the project outcomes with participants coming from SEAFDEC member countries. The detailed description and background of the seminar are indicated in the Prospectus of the Regional Seminar.

1. Objectives of the Regional Seminar

The objectives of the Regional Seminar are:

- To report the achievement and outcome of the project during its 5-year implementation and review its progress in line with the original project concept
- To verify the impacts of the concept to the beneficiaries, from the project's activities in terms of quantity as well as quality considering both facets of community development as well as sustainable fishery resources management
- To discuss its resultant rationale and implication in the dissemination of the project concept to other SEAFDEC member countries under component 2
- To identify the necessary follow-up actions to be undertaken by DOF Thailand and other collaborating local agencies

2. Envisaged outcomes

The expected outcomes of the Regional Seminar are:

- All data and information collected and analyzed during the project implementation are documented and presented
- The project activities are thoroughly reviewed and its impacts to the beneficiaries verified
- Through discussions, follow-up actions of the project to be undertaken by DOF Thailand and other local agencies are recommended
- Description of the two other on-going activities in Malaysia and Cambodia is made and the rationale in implementing similar project approach is discussed, and some recommendations may be derived for the possible reorientation of the projects
- The seminar offers opportunities for member countries other than Thailand, Malaysia and Cambodia to consider the applicability of CBRM concept with its project approach in their respective countries
- In a sense, the seminar also serves as overall mid-term program evaluation and review.

3. Target Groups of the Regional Seminar

The seminar has two target groups of participants:

3.1 Foreign participants

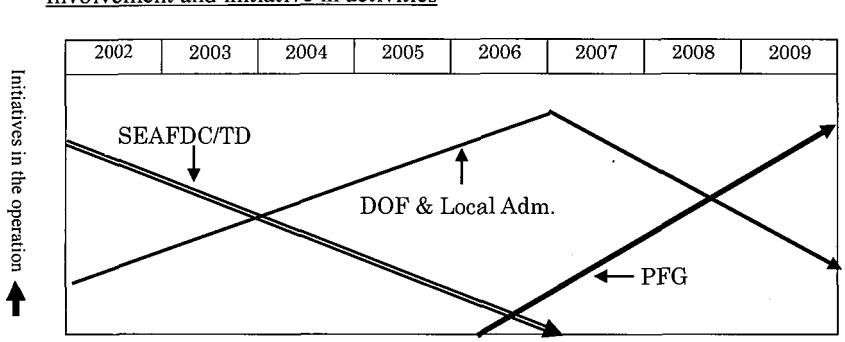
There are two groups in this category: representatives from the member countries and representatives from the ICRM-PL and ICRM-SV projects. The former participants are expected to be engaged in community-based fishery resources management field in their countries. They are expected to play an important role in this seminar by participating in the discussions reflecting their views and experiences in their respective countries. They are also expected to bring back in essence the outcomes of the seminar to their countries and make best use of them in their decision making in the deployment of similar approach. The latter participants will present their respective project approaches and the progress made although the projects are still currently on-going. They are expected to benefit from the seminar by reflecting on the recommendations, suggestions and outcomes and applying these in their future project implementation and approach.

3.2 Domestic participants

The executive agencies involved in the ICRM-PD are the DOF Thailand and SEAFDEC/TD under the collaborative project operational scheme. In addition, a number of local administrative authorities have been involved in the project operation as supporting agencies since its inception; e.g. Provincial Offices including the Provincial Cooperative Promotion Office and District Office and the Ao.Bo.To. Moreover, the most important role was played by the Pakklong Fishermen's Group (PFG) as the uppermost beneficiary in this project. Representatives from these agencies and groups are expected to present their activities to the seminar and review the impacts that the project had given to the community and the coastal fishery resources management system. Together with the views from the foreign participants, the recommendations from this group of domestic participants will be reflected in the project's follow-up stage.

In terms of the sustainability of the project activity, this occasion is vital for PFG in particular, as they are the end party concerned in this self-regulatory fishery resources management regime. As seen in the following chart, the managerial responsibility in the fishery resources management activity should be shifted from DOF and the local administrative agencies to PFG toward the end of the follow-up stage. By all means, the DOF has to continue its involvement in this activity as a monitoring and supporting agency.

4. Contents of the Regional Seminar



As dealt at length in the Prospectus of the Regional Seminar and in the Annotated Agenda, the Seminar is primarily designed to monitor the extent of each activity's achievement through presentation and discussion from various angles in order that future proper orientation in the project follow-up stage would be derived. Further, based on lessons learned and experiences gained through the project operation of ICRM-PD, two similar projects, i.e. the ICRM-PL and ICRM-SV were started in 2003 in Malaysia and in 2005 in Cambodia, respectively. The regional collaboration involved will be described and its impact discussed towards further dissemination of the ICRM concept and approaches to other member countries.

Country papers describing the current approaches on community-based coastal fishery resources management will be presented by representatives from the member countries except Thailand, Malaysia and Cambodia. These are intended to familiarize the other participants on the current status of CBFRM and the approaches adopted in each country. The participants will deliberate on the appropriate ICRM approaches and applications from the approaches that vary from country to country based on ideas expressed in the country papers.

The field trip to inspect various activities in the project site in Pathew District is also included in the seminar agenda. Although the project operation under the collaborative regime with DOF Thailand and SEAFDEC/TD has been terminated, the main activities have been ongoing at the follow-up stage by DOF Thailand and other local administrative authorities and also by the Pakklong Fishermen's Group, which has increased its pivotal role in the planning and implementation of the project.

In the last session of the seminar, conclusions, suggestions and recommendations will be finalized for the follow-up stage of ICRM-PD as well as for the future development in the domain of coastal fishery resources management approach in Southeast Asia. Particularly for the latter, these will include some selected issues related to SEAFDEC/TD's involvement in the deployment of such projects as a *modus operandi* at the regional scale and prospects for future development.

5. Acknowledgement

Taking advantage of this occasion, on behalf of all the project staff of ICRM-PD, we would like to extend our sincere appreciation to the DOF Thailand including CMDEC, Fisheries Technological Development Division, Chumphon Fisheries Provincial Office, Enforcement Unit and Aquaculture Center, Chumphon Provincial Administration Office including Pathew District Administration Office and Cooperative Promotion Office, the Chumphon Marine and Coastal Resources Research Center and SEAFDEC/TD. Special thanks are offered to the Government of Japan and the Royal Project in Thailand for the financial support to the project. Also, we are thankful to the Pakklong Sub-district Administrative Organization (Ao.Bo.To) for their contributions in kind, cash and loans for the project activities. Finally, we have to specifically state that the actors playing the main roles in the project operation are the fishers, *including fish-women by all means,* in the Pakklong Sub-district. Their self-motivation towards the realization of the CBRM concept and total community development is noteworthy, to which we extend a special appreciation. We wish the newly born fishermen's group, the PFG all success and prosperity in the future.

MONITORING SOCIO-ECONOMICS OF THE ICRM PROJECT PATHEW DISTRICT, CHUMPHON PROVINCE

Thanyalak Suasi
Training Department, Southeast Asain Fisheries Development Center (SEAFDEC/TD)

I. INTRODUCTION

This socio-economic survey is the second conducted in Pakklong Sub-District, Pathew District, Chumphon Province, with the first survey conducted on 7-11 January 2002. The results of the pre-survey indicated the need to give clarification on the parameters as they form part of the guideline for the design and implementation plans for each activity. The objective of the second survey is to compare the parameters with the first survey. The result of this survey will be used as indicator on the success or failure of the project operation.

The second socio-economic survey was conducted on 12-14 December 2006 in the project area. Rapid survey was employed it is essential and conducive for outsiders to learn, in a short period of time, about a community, and the area or an activity or the possible specific problems encountered in a community. The result will constitute the essential step for the commencement of any project involving community development. It is also applicable as a milestone for the project operation, as it can be used as means of measuring the degree of achievement within the period of a project's operation.

II. OBJECTIVES

The objectives of the survey are:

- To identify the present socio-economic conditions after the project operation
- To monitor changes in socio-economic status and environmental conditions in the project area
- To identify the degree of contribution by the project in fisheries resources management to the local people

III. METHODOLOGY

1. Components of the target group sampled

The component of the target group includes the head or members of a household engaged only in fisheries and/or both fisheries and agriculture. It also includes the head or members of a household earning income through the fisheries sector.

2. Size of the sample groups

The number of fishing households is the targeted number used to establish the number of the sample groups for the socio-economic survey. The total number of samples in this survey is the same as with the Pre-survey, i.e., 48% of the total fishing households (Provincial Operation Center: POC, 2003) assigned to represent the Pakklong Sub-district. Random sampling was the method employed to identify a respondents in Pakklong-Sub-district's six villages: village no. 1 (Thungmaha), village no. 2 (Bosamrong), village no. 3(Thumthong), village no. 5 (Ban Numpu), village no. 6 (Ban Bonrai), and village no. 7 (Ban Koh Tiep).

3. Design of the questionnaire

The set of questionnaires comprised four parts: Part I is related to the general information of the respondents; Part II is mainly concerned with the fisheries sector and the respondent's engagement in that sector; Part III emphasized on the people's participation and group establishment; and Part IV emphasized on the people's participation in the ICRM-PD project.

4. Data analysis

A number/code is run on the questionnaire to enable the data to be re-checked or for validation purposes. Each question in the questionnaire is given a code or identification number for easier collation of the data for analysis and interpretation.

A simple identification manual has been developed as a handy and simple way to understand the raw data, which are analyzed in terms of percentage and presented in tables or in matrix form. The tabulated data is a simple and easy way of understanding the socio-economic and environmental conditions of the community in Pakklong Sub-district.

IV. Results of the survey

1. The actual size of the sample

This survey was carried out by interviewing a sample group of 83 fishermen from six villages in Pakklong Sub-district, Prathew District, Chumphon Province. Samples in Moo 1, Moo 2, Moo 3, Moo 5, Moo 6 and Moo 7 were 27, 5, 14, 13, 9 and 15, respectively (Table 1). These are 50%, 21%, 70%, 87%, 35% and 43%, respectively of the total fishing households in each village (Provincial Operation Center Chumphon: POC, 2003). The total number of samples is 48% of the total fishing households in six villages.

Table 1. Number of fishing households and sample size

Village No	Moo 1	Moo 2	Moo 3	Moo 5	Moo 6	Moo 7	Total
Total number of fishing households	54	24	20	15	26	35	174
% of total fishing households (%)	50	21	70	87	35	43	48
Number of samples (persons)	27	5	14	13	9	15	83

2. Part I: General Information

2.1 Migration, marital status and educational level

The result indicated that the percentage of local respondents was higher than non-local respondents in each village. Moo 5 and Moo 7 had more non-local respondents than the other villages (38% and 33%, respectively, Table 2).

Most respondents in the six villages are married, about 78% to 93% (Table 2) followed by single (7%-20%). Widows and divorcees were low and found only in Moo 5, Moo 6 and Moo 7.
As for their educational level, 13.33% of Moo 7 respondents have not studied. Most respondents from Moo 1, Moo 2, Moo 5 and Moo 6 graduated from primary school levels, about 70% to 100% (Table 2). About 42.86% of Moo 3 respondents graduated from primary school level equivalent to junior school level.

Table 2. Place of birth, marital status and educational level of respondents, Pakklong Sub-District

Village No.	Place of birth		Marital status (%)				Educational Level (%)				
	Non-locals	Locals	Single	Married	Widow	Divorce	Have not studied	Primary school	Junior school	High school	no answer
Moo 1	19.00	81.00	11.11	88.89	0	0	0	70.37	3.70	18.52	7.41
Moo 2	20.00	80.00	20.00	80.00	0	0	0	80.00	20.00	0	0
Moo 3	21.00	79.00	7.14	92.86	0	0	0	42.86	42.86	7.14	7.14
Moo 5	38.00	62.00	7.69	84.62	7.69	0	0	100.00	0	0	0
Moo 6	11.00	89.00	11.11	77.78	0	11.11	0	77.78	11.11	11.11	0
Moo 7	33.00	67.00	0	93.33	6.67	0	13.33	46.67	0	6.67	33.33

2.2 Occupation

The occupation of the respondents was categorized into four groups, namely: fisheries, agriculture, fisheries and agriculture, fisheries and labor. Fisheries was a major occupation of respondents from Moo 1, 3, 5, 6 and 7 at 89%, 93%, 85%, 89% and 80%, respectively (Table 3). The second major occupation of the respondents was fisheries and agriculture, especially for 60% of Moo 2 respondents.

Table 3. Occupation of respondents, Pakklong District (%)

Village No.	Fisheries	Agriculture	Fisheries & Agriculture	Fisheries & Labor	Total
Moo 1	89	0	7	4	100
Moo 2	20	20	60	0	100
Moo 3	93	7	0	0	100
Moo 5	85	0	15	0	100
Moo 6	89	0	11	0	100
Moo 7	80	0	13	7	100

2.3 Source of daily income

Table 4 shows the percentage of Moo 1, 3, 5, 6 and 7 respondents earning their income from the fisheries sector at 92%, 93%, 100%, 89% and 93%, respectively. About 60% of Moo 2 respondents have their main source of income from agriculture sector while 20% derive their daily income from fisheries, and 20% from fisheries & agriculture.

Table 4. Source of respondents' daily income (%)

Village No.	Fisheries	Agriculture	Fisheries & Agriculture	Fisheries & Labor	Total
Moo 1	92	0	4	4	100
Moo 2	20	60	20	0	100
Moo 3	93	7	0	0	100
Moo 5	100	0	0	0	100
Moo 6	89	0	11	0	100
Moo 7	93	0	0	7	100

3. Part II: Fisheries Sector

3.1 Fishing gear and fishing grounds

The results also showed that the main fishing gear used by the respondents are large cast net, anchovy falling net, Indo-pacific mackerel gill net, mullet gill net, crab gill net, crab trap, squid trap, and shrimp trammel net. Their fishing grounds are divided into four zones, as in the Pre-survey.

Zone I: From Khao Bangbird Mt. to Khao Thumthong Mt.
Zone II: From Khao Thumthong Mt. to Ko Aeung island.
Zone III: From Ko Aeung island to Ko Rang island.
Zone IV: From Ko Rang island to Ko Khai island.

3.2 Main types of fishing gear

The main fishing gears, which the respondents used such as the large cast net, anchovy falling net, Indo-pacific mackerel gill net, mullet gill net, crab gill net, crab trap, squid trap, and shrimp trammel net, were their own investments. The large cast net was the most popular gear used by 50% of the respondents (Table 5) followed by anchovy falling net and crab gill net at 11.21% and 10.34%, respectively.

Table 5 also showed that the large cast net is heavily used in fishing Zone III (31.90%), where the mullet gill net, crab gill net, crab trap and shrimp trammel net were also used. Anchovy falling net is favorably used in Zone II and Zone III.

Table 5. Zoned fishing grounds and main type of fishing gears used (%)

Type of fishing gear	Zone				Total
	I	II	III	IV	
Large cast net	12.07	5.17	31.90	0.86	50.00
Anchovy falling net	2.59	3.45	3.45	1.72	11.21
Indo-Pacific mackerel gill net	3.45	0	4.31	0	7.76
Mullet gill net	0.86	0.86	6.90	0	8.62
Crab gill net	4.31	0	6.03	0	10.34
Crab trap	0.00	0	6.03	0	6.03
Squid trap	0.86	0.86	0	0.86	2.59
Shrimp trammel net	0.00	0	3.45	0	3.45
Total	24.14	10.34	62.07	3.45	100.00

3.3 Length of fishing boats

Some of respondents own more than one fishing boat. The main type of fishing boats are: in-board powered boat and long-tailed boat categorized into four lengths, <6 meter, 6-9 meter, 10-12 meter and >12 meter. Most respondents of Moo 1 used in-board powered boat and long-tailed boat both with length 6-9 meter at 35% and 27.5%, respectively (Table 6). Most Moo 2, Moo 5, and Moo 7 respondents used long-tailed boat with length 6-9 meter at 100%, 92.31% and 83.33%, respectively. About 42.86% of Moo 3 respondents used in-board powered boat with length 10-12 meter.

Table 6. Type and length of fishing boats used by respondents (%)

Village No.	In-board powered boat				Long-tailed boat			
	<6m	6-9 m	10-12 m	>12 m	<6m	6-9 m	10-12 m	>12 m
Moo 1	0	35.00	7.50	12.50	5.00	27.50	12.50	0
Moo 2	0	0	0	0	0	100.00	0	0
Moo 3	0	14.29	42.86	0	0	35.71	7.14	0
Moo 5	0	0.00	7.69	0	0	92.31	0	0
Moo 6	0	33.33	25.00	0	0	33.33	8.34	0
Moo 7	0	5.56	5.56	0	0	83.33	5.56	0

3.4 Main types of fishing gear by village

Table 7 shows that the main types of fishing gear used in Moo 1, Moo 3 and Moo 6 are the large cast net about 51.22%, 65% and 81.82%, respectively. About 57.14% of Moo 2 respondents used the mullet gill net. Large cast net and crab gill net were used in Moo 5, 36.84% and 26.32%, respectively. The fishing gears used by Moo 7 respondents are the crab trap (38.89%) and large cast net (27.78%).

Table 7. Main types of fishing gears employed in the villages (%)

Village No.	Large cast net	Anchovy falling net	Indo-Pacific mackerel gill net	Mullet gill net	Crab gill net	Crab trap	Squid trap	Shrimp trammel net	Total
Moo 1	51.22	17.07	9.76	2.44	14.63	0	4.88	0	100
Moo 2	42.86	0	0	57.14	0	0	0	0	100
Moo 3	65.00	30.00	0	5.00	0	0	0	0	100
Moo 5	36.84	0	21.06	5.26	26.32	0	5.26	5.26	100
Moo 6	81.82	0	9.09	0	0	0	0	9.09	100
Moo 7	27.78	0	0	16.67	5.55	38.89	0	11.11	100

3.5 *Catch distribution*

Table 8 and Table 9 show the catch distribution of respondents that have been recorded from two groups, through the middlemen and retail by the fishermen themselves.

The results showed that respondents from Moo 3 and Moo 5 favored to sell fresh squid, 7.76% and 6.03%, respectively. About 15.52% of Moo 1 respondents favored to sell dried squid. Moo 1 respondents usually sold fresh fish and crabs, 7.76% and 6.04%, respectively (Table 8).

Table 8. Catch by species (%)

Village No.	Squid		Fish		Shrimp		Crab	
	fresh	dried	fresh	dried	fresh	dried	fresh	meat
Moo 1	4.31	15.52	7.76	1.72	0	0	6.04	0
Moo 2	2.59	0	3.45	0	0	0	0	0
Moo 3	7.76	3.45	0.86	5.17	0	0	0	0
Moo 5	6.03	0.86	4.31	0	0.86	0	4.31	0
Moo 6	2.59	5.17	0.86	0	0.86	0	0	0
Moo 7	4.31	0	2.59	0	1.72	0	3.45	3.45
Total	**27.59**	**25**	**19.83**	**6.89**	**3.44**	**0**	**13.8**	**3.45**

Table 9 shows that most respondents sell their catch through the middlemen, but Moo 1 and Moo 5 respondents indicated that they sold their catch by themselves.

Table 9. Catch distribution (%)

Village No.	Squid		Fish		Shrimp		Crab	
	middleman	fisherman	middleman	fisherman	middleman	fisherman	middleman	fisherman
Moo 1	19.83	0	8.62	0.86	0	0	6.03	0
Moo 2	2.59	0	3.45	0	0	0	0	0
Moo 3	11.21	0	6.03	0	0	0	0	0
Moo 5	6.90	0	3.45	0.86	0.86	0	4.31	0
Moo 6	7.76	0	0.86	0	0.86	0	0	0
Moo 7	4.31	0	2.59	0	1.72	0	6.90	0
Total	**52.60**	**0**	**25.00**	**1.72**	**3.44**	**0**	**17.24**	**0**

3.6 *Income, costs and profit from fishing*

Table 10 shows the income, costs and profit per trip conducted by the respondents categorized into eight fishing gears, i.e., large cast net, anchovy falling net, Indo-pacific mackerel gill net, mullet gill net, crab gill net, crab trap, squid trap and shrimp trammel net. This result illustrates that the respondents receive significant incomes using each fishing gear. Costs represent use of fuel, labor and food, but do not include fix cost such as cost of the equipment.

Income of shrimp trammel net has been the highest (9,625 Baht), followed by the anchovy falling net and large cast net, 6,043.08 and 3,743.64 Baht, respectively.

Table 10. Income, costs and profit per fishing trip by fishing gear (Baht)

Fishing gear	Income	Costs	Profit
Large cast net	3,743.64	1,345.00	2,398.64
Anchovy falling net	6,043.08	3,569.23	2,473.85
Indo-Pacific mackerel gill net	2,038.89	359.44	1,679.45
Mullet gill net	1,842.00	284.50	1,557.50
Crab gill net	2,541.67	631.67	1,910.00
Crab trap	1,071.43	189.29	882.14
Squid trap	2,584.33	1,266.67	1,317.66
Shrimp trammel net	9,625.00	275.00	9,350.00

3.7 Sources of credit

About 75% of Moo 2 respondents accessed the loan service from the Government (Village Fund). Each village obtained credit from BAAC (Bank for Agriculture and Agricultural Cooperative), especially the Moo 1 respondents (Table 11).

The fisher's group is the main source of credit for Moo 5 and Moo 7 respondents (66.67% and 47.83%, respectively). About 52.94% of Moo 3 respondents and 30.77% of Moo 6 respondents accessed loans from the fish traders. Only few respondents borrow money from commercial banks, other groups and relatives/friends.

Table 11. Source of credit and loans (%)

Village No.	Government	BAAC	Commercial Banks	Fisher's groups	Other groups	Fish-traders	Relatives/ friends	Total
Moo 1	2.38	33.33	0	16.67	11.91	23.81	11.90	100
Moo 2	75.00	25.00	0	0	0	0	0	100
Moo 3	23.53	17.65	0	0	0	52.94	5.88	100
Moo 5	0	6.67	0	66.67	6.67	13.32	6.67	100
Moo 6	15.38	23.08	7.69	23.08	0	30.77	0	100
Moo 7	4.35	13.04	0	47.83	8.69	26.09	0	100

3.8 Problem and needs

There were various problems and needs identified by the respondents in the villages. These included: high price of fuel (increasing cost), and reduction and decline of aquatic resource (26.30% and 32.22%, respectively, Table 12). These were followed by lack of potable water (water pipe line for consumption) and illegal fishermen encroaching the area (11.18% and 7.24%, respectively).

Table 12. Problems and needs identified by respondents (%)

Problems and Needs	Moo 1	Moo 2	Moo 3	Moo 5	Moo 6	Moo 7	Total
Illegal fisherman encroaching the area	3.94	0	0	0.66	1.32	1.32	7.24
High price of fuel, increasing cost	7.89	1.32	3.94	2.63	3.29	7.23	26.30
Water pollution of shrimp farm and dirty beach	1.32	0.66	0	3.29	0.00	0.66	5.93
Reduction and decline of aquatic resource	13.15	2.63	5.92	2.63	4.60	3.29	32.22
Increasing number of small scale fishing boats	2.63	0	0.66	0.66	1.32	0	5.27
High wind and monsoon	1.32	0	0	0	0	0	1.32
Boat ports not enough	2.63	1.32	0	0	0.66	0	4.61
Lack of capital, agriculture land, low rubber price	0.66	1.32	0.66	0	0	0	2.64
Lack of potable water, water pipe lines for water consumption	3.29	0.66	1.97	0.66	0	4.60	11.18
Decreasing income	3.29	0	0	0	0	0	3.29
Total	40.12	7.91	13.15	10.53	11.19	17.10	100.00

4. Part III: People's Participation in Fishermen's Groups

There are eight existing fishermen's groups, namely: Fish Culture, Saving, Farmer's Group, Fisher's Group, Women, Village Fund, Volunteer, and Crab Bank.

The respondents are members of the various groups in each village. The Fisher's Group is the primary group with most respondents in Moo 1, Moo 5, Moo 6 and Moo 7 participating (39.39%, 100%, 62.50, and 50%, respectively, Table 13). Most Moo 2 respondents are members of the Farmer's Group. About 55.56% of Moo 3 respondents are members of the Village Fund. Crab Bank is a new group established in Moo 7.

Table 13. People's participate in fishermen's groups (%)

Village No.	Fish culture	Saving	Farmer's Group	Fisher's Group	Women	Village fund	Volunteer	Crab Bank	Total
Moo 1	24.24	6.06	21.21	39.39	6.06	3.04	0	0	100
Moo 2	0	0	100.00	0	0	0	0	0	100
Moo 3	0	0	11.11	22.22	0	55.56	11.11	0	100
Moo 5	0	0	0	100.00	0	0	0	0	100
Moo 6	12.50	12.50	0	62.50	12.50	0	0	0	100
Moo 7	0	0	0	50.00	0	11.11	5.56	33.33	100

5. Part IV: Attitude of fishers towards the Integrated Coastal Resources Management Project in Pathew District

5.1 Knowledge on the Integrated Coastal Resources Management Project in Pathew District

Most respondents know about the Integrated Coastal Resources Management Project in Pathew District, especially those from Moo 1, Moo 3, Moo 6 and Moo 7 (81.48%, 71.43%, 77.78% and 100%, respectively, Table 14). The percentage of respondents who know and participate in project is 74.70%.

Table 14. Respondents' knowledge about the ICRM-PD project (%)

Village No.	Knowledge		
	Aware	Not Aware	Total
Moo 1	81.48	18.52	100
Moo 2	40.00	60.00	100
Moo 3	71.43	28.57	100
Moo 5	46.15	53.85	100
Moo 6	77.78	22.22	100
Moo 7	100.00	0.00	100
Total	**74.70**	**25.30**	**100**

5.2 Respondents' interest in the activities of the ICRM Project

The Integrated Coastal Resources Management Project in Pathew District (ICRM-PD) conducted 16 activities. The activities that the respondents most appreciated are the installation of Artificial Reefs (ARs), mangrove reforestation, and crab bank (13%, 12%, and 11%, respectively, Table 15).

Table 15. Respondents' degree of appreciation of the project activities

Activity	%
1. Fisheries data collection	7
2. Women's activity	6
3. Crab Bank	11
4. Organization and functioning of Pakklong Fishermen Group (PFG)	6
5. Zoning arrangement	9
6. Various workshops, training courses and study tours	7
7. Local seminars	3
8. Mangrove reforestation	12
9. Flower planting	5
10. Experiment on Babylonia shell culture	4
11. Experiment on cage culture feeding	2
12. Experiment on swimming crab culture	3
13. Installation of Fish Enhancement Devices (FEDs)	6
14. Installation of Artificial Reefs (Ars)	13
15. Eco-tourism	2
16. Local enforcement unit	4
Total	**100**

These activities were implemented by the fishermen themselves and have benefited them. The results also showed that the respondents' interest and their involvement in each activity were in various proportions.

5.3 Evaluation of the project operation

The project was good and offered much help in fisheries resource management and community development.

Based on the ICRM-PD activities, most respondents agreed that the project has helped in fisheries resource management (76%), although some 5% of the respondents thought that the project was not of help in the management of the fisheries resource (Table 16).

Most respondents agreed that the community development was getting better (71%) while 24% thought that there was no change in community development (Table16).

The results however, indicated that the respondents were mostly pleased and agreed that the project was good and helpful in fisheries resource management and community development.

Table 16. Evaluation of the project operation (%)

Project	fisheries resource management	community development
Yes (getting better)	76	71
No change	19	24
No (getting worse)	5	5
Total	**100**	**100**

5.4 Income

Household income increased compared with those in 2002

After the project operation, 42% of the respondents thought their household income did not change compared with their 2002 income, however, 32% believed that their income increased a little from 2002 (Table 17).
In the case of household income that increased, the concerned respondents agreed that the project contributed significantly to such increases (84%).

Table 17. Attitude of respondents about household income

Household income	%	Income increase	%
Increased significantly	8	The project contributed	84
Increased little	32	the project not concern	16
No change	42	**Total**	**100**
Decreased little	13		
Decreased significantly	5		
Total	**100**		

5.5 Expectations from the future project operation

Most respondents expected to have more Artificial Reefs (ARs) installed (36%). Secondly, some respondents hoped the project would continue (11%). They also expressed interest in the increased installation of Fish Enhancement Devices (FEDs) as well as more activities related to fish releasing (10% each, Table 18).

Table 18. Expectations from the future project operation

Expectations	%
1. Increased installation of Artificial Reefs (ARs)	36
2. Non-stop Project and continue activity	11
3. Increased installation of Fish Enhancement Devices (FEDs)	10
4. More fish releasing activities	10
5. Mangrove reforestation	8
6. Coastal fisheries development, control trawler and illegal fisherman	6
7. Green mussel culture	5
8. Improved cage culture by feeding	5
9. Crab Bank	3
10. Introduction & training on Thai massage	2
11. Plan to treat water pollution from shrimp farms	2
12. High price of fuel	2
Total	**100**

V. CONCLUSION AND RECOMMENDATIONS

Part I General Information

1. Most fishers are married and obtained education from primary school levels.

2. The fishers' main occupation is in fisheries and also in fisheries and agriculture, just like in the Pre-survey, which showed that fisheries is their major occupation and has been benefiting them.

3. The fishers earn mostly their income from the fisheries sector, as also shown in the pre-survey.

Part II Fisheries Sector

4. The fishers favor to invest in the Large cast net for fishing, making them changed investment from the Indo-pacific mackerel gill net which was the main type of fishing gear in the pre-survey.

5. Crab trap and squid trap are additional fishing gears in the recent survey, and it was assumed that technology on these new gears have already been transferred to the fishermen.

6. Most fishers own long-tailed boat with length 6-9 meter and use long-tailed boat longer in length than indicated in the pre-survey. This indicates some improvements in the fishing technology they are adopting.

7. The fishers sell fresh squid and dried squid with nearly the same proportion and prefer to sell fresh fish, shrimp and crab than processing their produce. Majority of their catch is distributed through the middlemen.

8. Shrimp trammel net could provide high income for fishers but this gear could be operated only for a short period during the monsoon season, and the fishers receive the lowest income from crab trap fishing. The fishers income depend on various factors such as fisheries resource, catch price, operation cost, etc.

9. BAAC and the Government are the main sources of credits for the fishers. The proportion of the fishers accessing loans from the fishers group is increasing, showing the important role that the fishers group can play in the livelihood of the fishers and the benefits that the groups can give to the fishers.

10. Reduction and decline of aquatic resource, illegal fishermen encroaching the area and lack of potable water, water pipeline for consumption needs are still among the major problems and needs in the villages. High price of fuel, increasing cost and small scale fishing boat, requiring more boat ports are among the recent problems and needs raised during the survey.

Part III People's participation in fishers groups

11. Crab bank is a new group established in village no. 7, and most fishers signified interest in engaging themselves in this group. The proportion of members in the fishers groups is increasing signifying fishers increased awareness on the usefulness of the groups.

Part IV Attitude of fishers towards ICRM-PD

12. Most fishers know and participate in the Integrated Coastal Resource Management Project as the information was made accessible to them.

13. The fishers expressed their appreciation for the implementation of the various activities of the project that their assistance has been utilized such as in the installation of Artificial Reefs, mangrove reforestation and crab bank.

14. The fishers agree that the project has been helpful in fisheries resource management and community development.

15. Although some fishers think that their household income had no change after the project implementation, some fishers whose income had increased attributed such increase to the project operation.

16. The fishers expect to increase the installation artificial reefs and continue the project.

17. It is therefore very optimistic to say that most fishers were satisfied with the implementation of the Integrated Coastal Resource Management Project through its diversified activities.

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MARINE ENVIRONMENTS AND PHYTOPLANKTON IN THE AREA OF THE LOCALLY BASED COASTAL FISHERIES MANAGEMENT PROJECT: PATHEW DISTRICT, CHUMPHON PROVINCE

Sumana Kajonwattanakul[1] and Chumchoke Singharachai[2]

[1]Marine and Coastal Resources Research Center, The Central Gulf of Thailand,
Moo 8, Nathung, Muang, Chumphon 86000, Thailand

[2]Chumphon Marine Fisheries Development Center,
Moo 8, Paknam, Muang, Chumphon, 86120, Thailand

ABSTRACT

Investigations on marine environments were carried out at 10 sampling stations in the area of the Locally-Based Coastal Fisheries Management Project, Pathew District, Chumphon Province from 2002 to 2006. The depth of the bottom of the area ranged from 3.4 to 19.3 meters. The environmental variables were measured and the data are as follows: transparency 1.2 - 4.3 meters, mean surface temperature 29.44 ± 0.47°C, salinity 31.08 - 33.53 PSU, pH 7.26 - 8.93 and dissolved oxygen 4.83 - 6.25 mg/l. Nutrients, total suspended solids (TSS) and chlorophyll a were analyzed and the results are: average nitrite 0.010 - 0.290 µg-at N/l, average nitrate 0.121 - 13.570 µg-at N/l, average ammonia 2.153 - 22.294 µg-at N/l, average orthophosphate 0.189 - 0.684 µg-at P/l, average TSS 25.18 - 53.75 mg/l. The biological index used was the average chlorophyll a at 0.116 - 2.201 mg/m^3. Phytoplankton was investigated and 66 genera in 5 divisions were identified. Diatom was the most common. High density of phytoplankton was recorded in June 2004 and September 2005. In June 2004 the dominant species were Ditylum sole from 2.06 x 10^4 to 1.79 x 10^5 cells/l while in September 2005 Chaetoceros spp. was more pronounced from 3.45 x 10^5 to 1.79 x 10^6 cells/l. As experienced, this density level may cause the red-tide phenomena. Such phenomenon was observed when Noctiluca scintillans which almost entirely makes up the red tide, was dominant at Station 9 in August 2004.

The water quality in the study area is suitable for coastal aquaculture. The physical, chemical and biological indices of Pathew Bay showed that the Bay is at risk from phytoplankton blooms and accumulation of nutrients. Therefore, limitation on aquaculture in terms of area and density of fish stocks should be considered to prevent environmental damage due to plankton blooms and eutrophication when the load of aquaculture waste exceeds the carrying capacity of the Bay.

Key words: Marine environment, Phytoplankton, Locally-Based Coastal Fisheries Management Project: Pathew District, Chumphon Province

I. INTRODUCTION

A baseline survey on marine environment and phytoplankton was conducted as an activity of the Locally-based Coastal Fisheries Management Project, Pathew District (LBCRM-PD), a collaborative project between SEAFDEC/TD and Department of Fisheries (DOF). After the reorganization of the government sector in October 2004, Department of Marine and Coastal Resources (DMCR) carried out this activity since November 2004.

The purpose of LBCRM-PD project is to establish a practical framework for locally-based coastal resources management by encouraging fishers' participation, and to support the creation of alternative job opportunities in coastal fishing communities. Aquaculture is one of the alternative activities that the project plans to promote to the fishermen. However, aquaculture needs good farming management as it produces soluble inorganic and particulate wastes, which can result in organic enrichment of the local aquatic environment. In order to prevent unacceptable changes to the environment, an environmental management framework should be established to evaluate the potential impacts before any development permit is granted (Laongmanee *et al.*, 2003). Thus, marine environmental surveys need to be carried out for the duration of the project.

II. OBJECTIVE

The objective of this survey is to collect data on the marine environment in order to support aquaculture activity and monitor environmental changes, including the abundance of phytoplankton, the primary productivity of food web and the biological index of the rich and abundant marine and coastal resources.

III. MATERIALS AND METHODS

1. Study area

The project was planned to observe the marine environment variables along the coastal area of LBCRM-PD at 10 sampling stations from 2002 to 2006 (Fig. 1). The surveys were done onboard the R.V. Meen Niweth, a research vessel of the Chumphon Marine Fisheries Development Center of the DOF of Thailand.

2. Methods

The following activities were conducted:

2.1 Depths of all stations were measured using a Handy Echo Sounder.

2.2 Transparency was measured using Secchi disc.

2.3 The physical variables including water temperature, salinity, dissolved oxygen and pH were measured using YSI 556 MPS multi-sensor at the surface.

2.4 From 2005 to 2006, chemical and biological variables were analyzed at the Marine and Coastal Resources Research Center. The water samples were filtered through Whatman GF/C paper, diameter 47 millimeters. Chemical and biological variables including nitrite, nitrate, ammonia, orthophosphate and chlorophyll a were analyzed following the Strickland and Parsons (1972) method. Total suspended solids (TSS) were measured following the Standard Method for Examination of Water and Waste Water (APHA, AWWA and WPCF, 1980).

2.5 From 2004 to 2006, phytoplankton samples were filtered through plankton net, mesh size 22 micron, and preserved by Lugol's solution (Wongrat, 2003). Preserved samples were identified following the Davis (1955), Smith (1977), Fuguyo *et al.* (1990) and Wongrat, 2003. Phytoplankton density were

measured by using Sedgewick-Rafter counting cell, volume 1 milliliter, and calculated using the following formula:

Phytoplankton density (cells/l) = (AB/C) X 1000

where, A = number of phytoplankton (cells)

B = volume of preserved samples (milliliters)

C = volume of phytoplankton samples which passed through plankton net (milliliters)

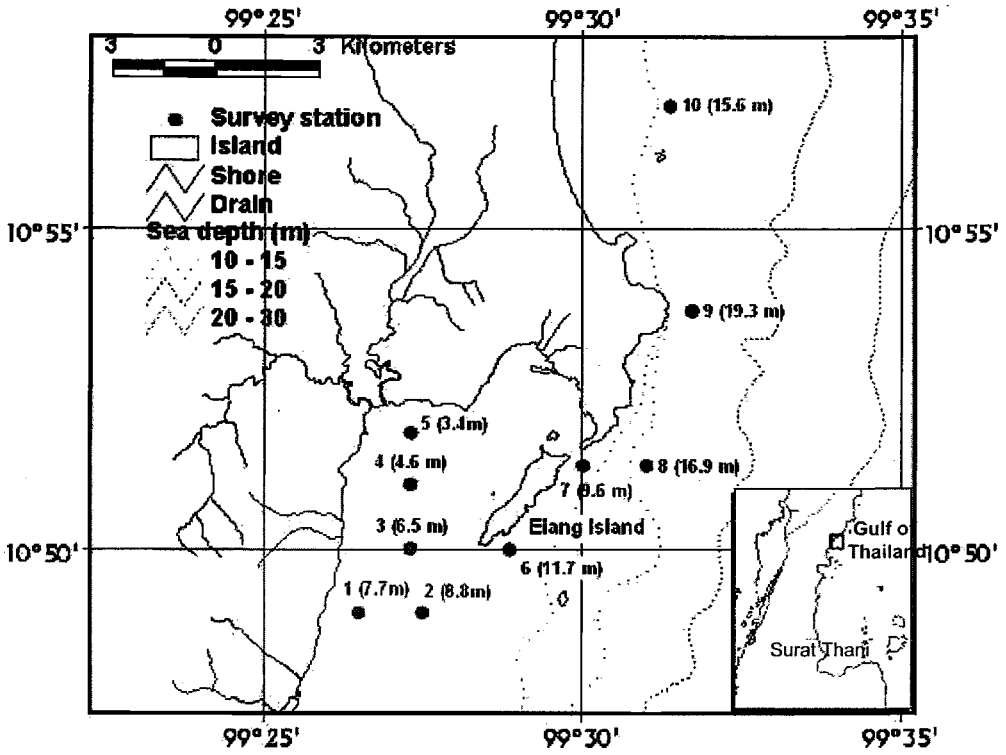

Fig. 1 Map of survey stations and bottom topography

IV. RESULTS

1. Bottom topography

The average depths during the survey period at each station were plotted and are shown in Fig. 1. The shallowest area was located in Ao Pathew.

2. Water quality

2.1 Physical variables

Transparency

This variable indicates the amount of light that penetrates the water column. An increased in transparency results when there is more light penetration. This is important for organisms relying on photosynthesis like the phytoplankton (Laongmanee *et al.*, 2003).

The average transparency in the area shows a significant positive relationship with the bottom depths ($r = 0.48$, $n = 136$, $P<0.01$). The areas with the lowest transparency were in Ao Pathew from 1.2 to 2.0 meters (Fig 2).During the dry season (January to May), transparency was higher than during the wet season (June to December) (Fig 3).

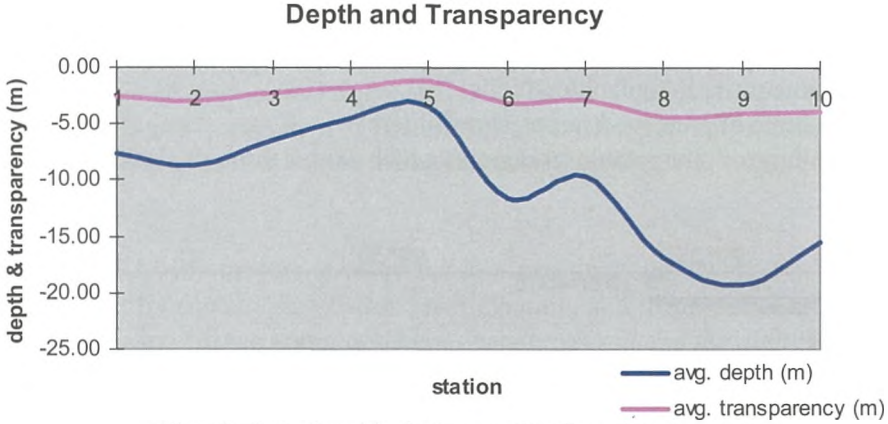

Fig. 2 Relationship between depth and transparency

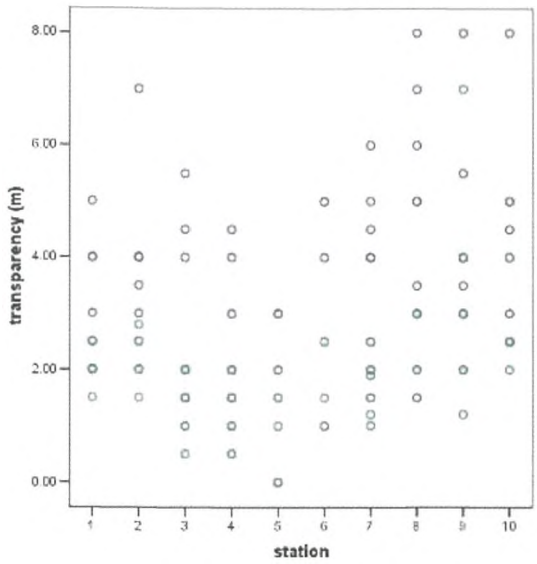

Fig. 3 Transparency in dry and wet

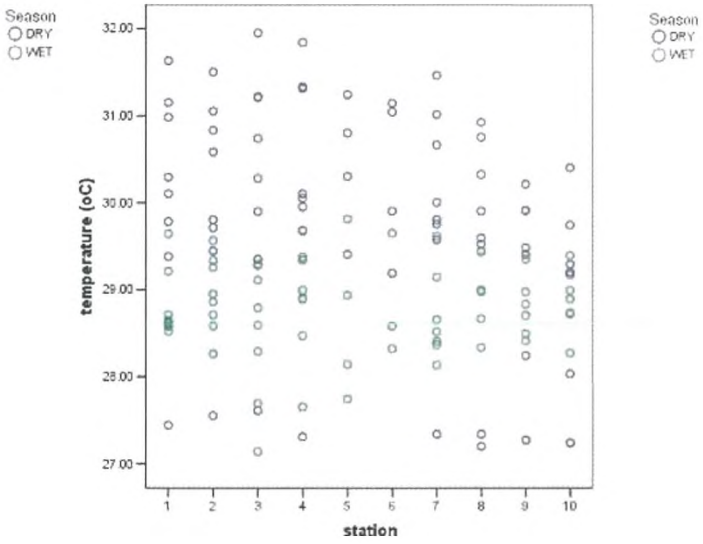

Fig. 4 Water temperature in dry and wet seasons

Water temperature

The mean surface temperature in all stations of the LBCRM-PD coastal area was 29.44 ± 0.47°C. Lowest temperatures were observed in February and August, 28.83 ± 0.22°C and 28.83 ± 1.21°C, respectively. The warmest surface temperature was recorded in April at 30.15 ± 1.55°C. Water temperature shows a significant relationship with the seasons ($r = 0.42$, $n = 136$, $P<0.01$). The temperature during the wet season is lower than during the dry season (Fig. 4).

Salinity

The salinity ranged from 31.08 to 33.53 PSU. In general, the salinity value shows little variation in each station. The salinity in wet season was higher than in the dry season (Fig 5), significant at $r = 0.54$, $n = 136$, $P<0.01$.

pH

The pH at all stations during the survey period ranged from 7.26 to 8.93. The pH values did show any difference between the dry and wet seasons (Fig 6).

Dissolved oxygen

During the survey period, dissolved oxygen ranged from 4.83 to 6.25 mg/l. The dissolved oxygen values showed a significant negative relationship with the surface temperature ($r = -0.26$, $n = 136$, $P<0.01$). This means that oxygen can be more dissolved at lower temperatures. The dissolved oxygen values did not show any difference between the seasons (Fig 7).

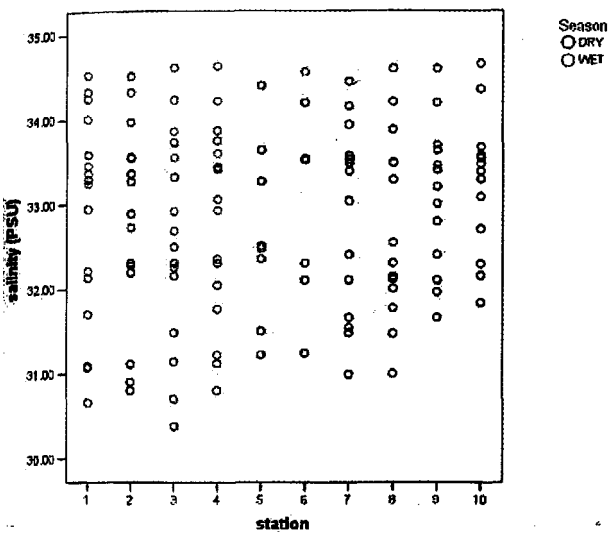

Fig. 5 Salinity in dry and wet seasons

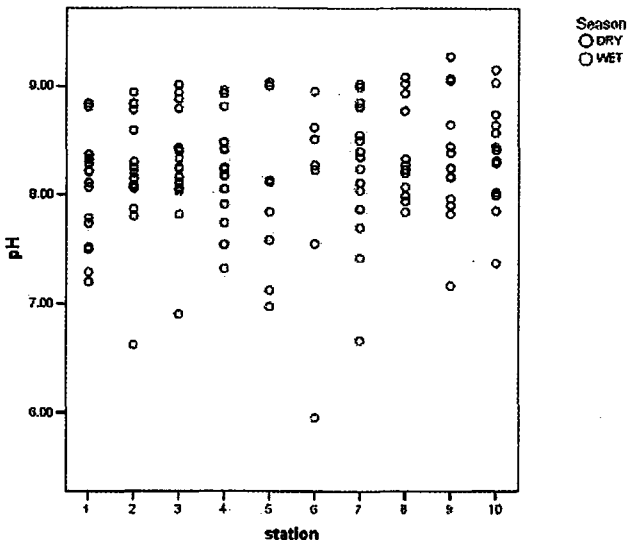

Fig. 6 pH in dry and wet seasons

Total suspended solids (TSS)

A measure of the TSS not only indicates the ability of light penetration in the water column but it can also indicate heavy storm, water runoff and land induced disturbing activity (Laongmanee *et al.*, 2003).

The TSS data showed a significant relationship with the seasons and depth ($r = 0.30$, $P<0.01$ and $r = -0.26$, $P<0.05$, respectively, $n = 74$). This means that in the wet season TSS value was higher than in dry season, and in shallow areas the value was high. The station in the area of Ao Pathew showed a TSS value higher than 110.00 mg/l in December 2005 (Fig 8).

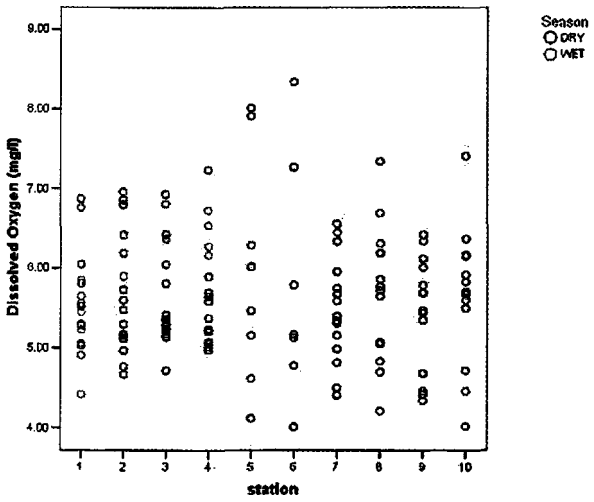

Fig. 7 Dissolved oxygen in dry and wet seasons

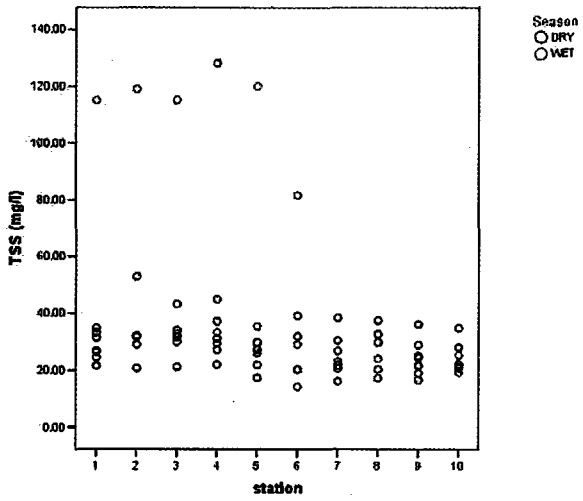

Fig. 8 TSS in dry and wet seasons

2.2 Biological variables

Chlorophyll a

Chlorophyll a is biological indicator for abundance of phytoplankton, food of some marine organisms. High chlorophyll a can indicate abundance of marine and coastal resources and the presence of phytoplankton bloom.

The area's average chlorophyll a ranged from 0.116 to 2.201 mg/m^3. The concentration of chlorophyll a did not show any difference between seasons (Fig 9). A significant relationship between chlorophyll a with nitrate and ammonia ($r = 0.39$ and 0.29, respectively, $n = 74$, $P<0.01$) was however observed.

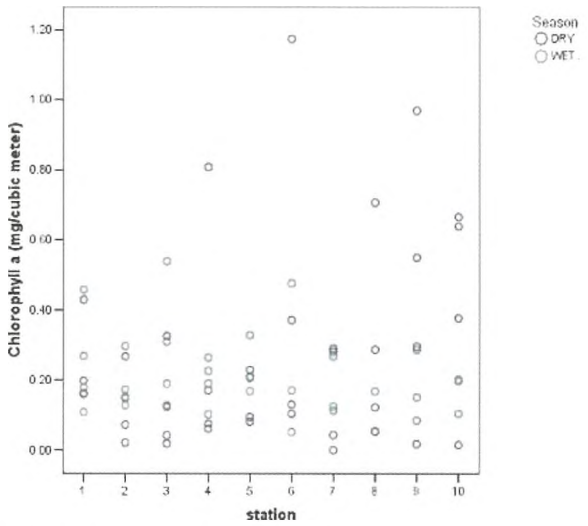

Fig. 9 Chlorophyll a in dry and wet seasons

2.3 Chemicals variables

Chemical variables in this study are nutrients, including nitrite, nitrate, ammonia and orthophosphate. These are essential for phytoplankton growth.

Nitrite

The average concentration of nitrite ranged from 0.010 to 0.290 µg-at N/l. Nitrite concentration showed significant relationship between the seasons ($r = 0.28$, $n = 74$, $P<0.01$), with the concentration higher during the wet seasons than in the dry season. The concentration of nitrite in each station in 2005 was lower than in 2006 (Fig 10).

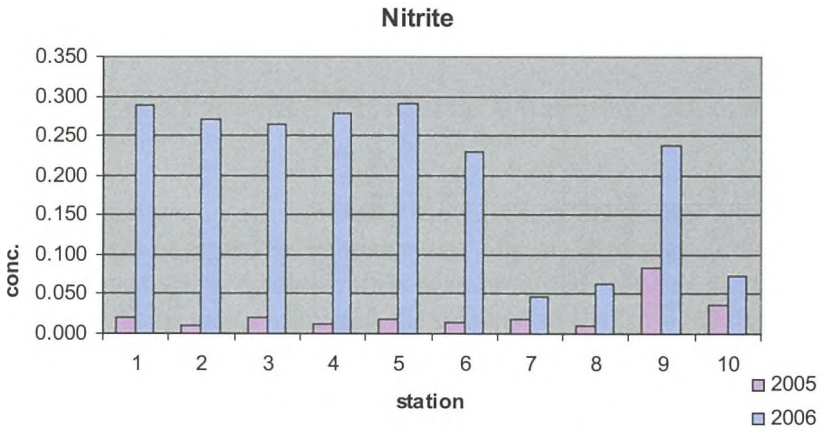

Fig. 10 Nitrite concentration in each station in 2005 and 2006

Nitrate

The average nitrate concentration ranged from 0.121 to 13.570 µg-at N/l. Nitrate concentration showed a significant relationship with pH ($r = 0.28$, $n = 74$, $P<0.05$). The concentration of nitrate in each station in 2005 was lower than in 2006, except in station 4 (Fig 10).

Ammonia

The average concentration of ammonia ranged from 2.153 to 22.294 µg-at N/l. The ammonia concentration showed a significant relationship with pH ($r = 0.30$, $n = 74$, $P<0.01$). The concentration of ammonia in each station in 2005 was lower than in 2006 (Fig 12).

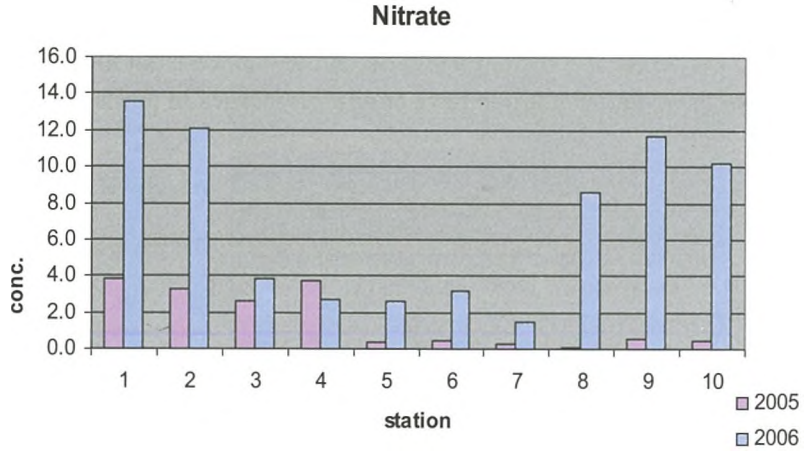

Fig. 11 Nitrate concentration in each station in 2005 and 2006

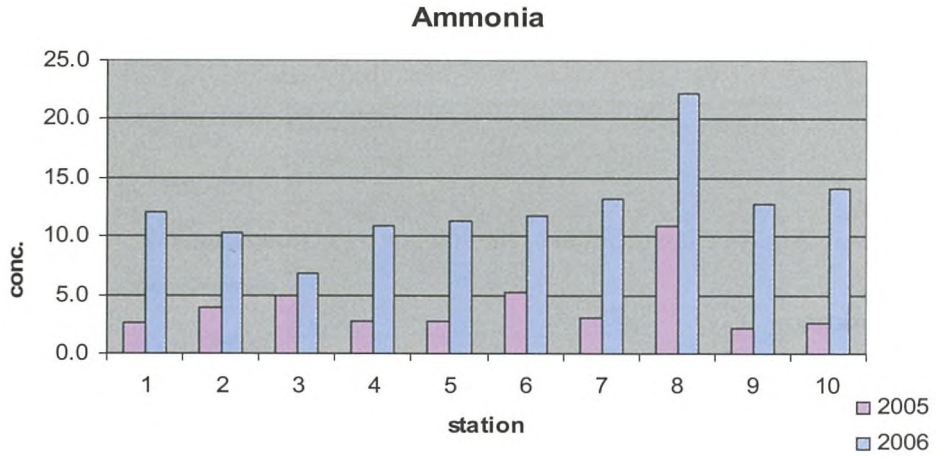

Fig. 12 Ammonia concentration in each station in 2005 and 2006

Orthophosphate

The average concentration of orthophosphate ranged from 0.189 to 0.684 g-at P/l. The orthophosphate concentration showed a significant relationship with ammonia ($r = 0.47$, $n = 74$, $P<0.01$). The concentration of orthophosphate in station 8 was very high, compared with those in other stations in 2006 (Fig 13).

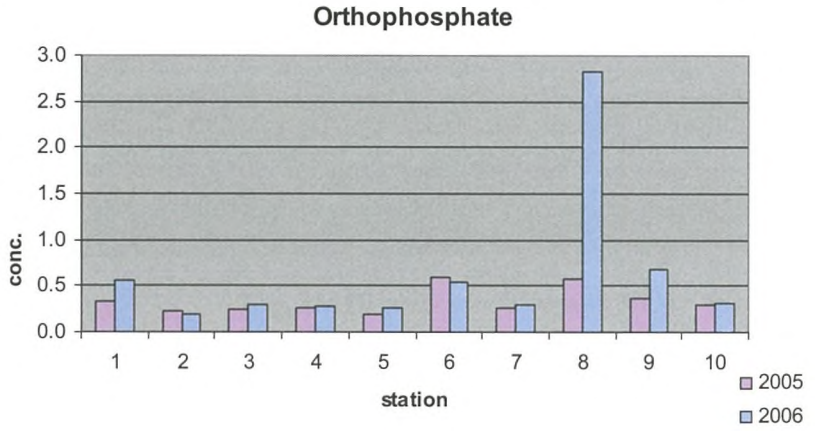

Fig. 13 Orthophosphate concentration in each station in 2005 and 2006

From the data on TSS, nutrients and chlorophyll a in 2004 until 2006, the stations were classified into 2 groups (Fig 14). Stations 1 to 5, located in Ao Pathew comprised the first group. The second group includes stations 6, 7 and 10, where the bottom depth of all stations were not more than 15 meters. The data indicate that the stations under each group have similar properties in terms of water quality.

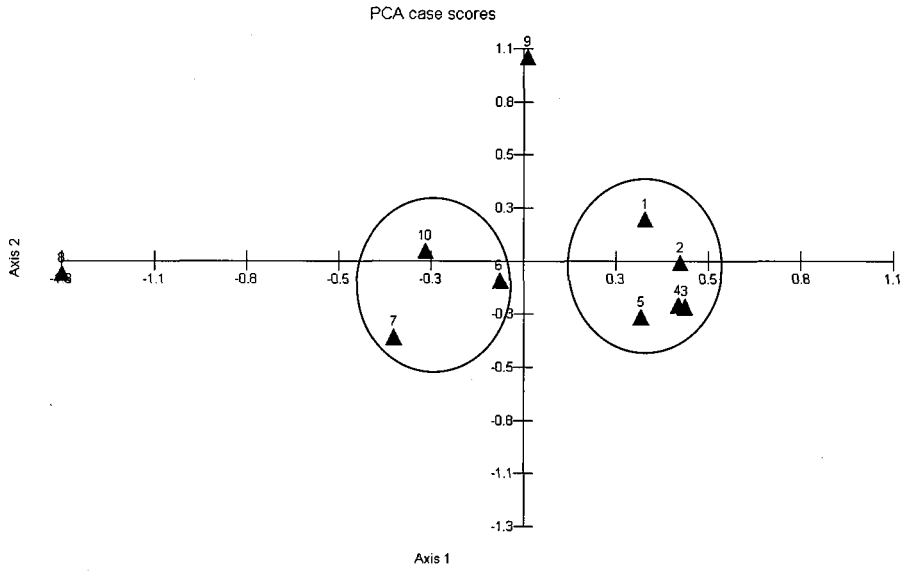

Fig. 14 Classification of the stations into Groups 1 and 2

3. Phytoplankton

Phytoplankton were investigated and 66 genera in 5 divisions were identified: (1) diatoms: 43 genera such as *Chaetoceros*, *Bacteriastrum*, *Pleurosigma*, *Nitzschia* and *Rhizosolenia* etc.; (2) dinoflagellates: 14 genera such as *Alexandrium*, *Dinophysis*, *Noctiluca*, *Ceratium* and *Protoperidinium* etc.; (3) blue green algae: 4 genera such as *Oscillatoria* and *Anabaena* etc.; (4) green algae: 3 genera such as *Closterium*, *Scenedesmus* and *Spirulina*; and (5) brown algae: 2 genera such as *Dictyocha* and *Dinobryon*. Diatom was the most common. The number of phytoplankton showed a significant relationship with the season ($r = 0.23$, $n = 74$, $P<0.05$). Phytoplankton was abundant in the wet season. The density of phytoplankton in 5 divisions is shown in Fig 15.

High density of phytoplankton was recorded in 2004 and 2005. In June 2004, the dominant species were *Ditylum sole* (Fig 16), blooming in the Ao Pathew area at stations 1 to 5 from 9.67×10^4 to 1.79×10^5 cells/l. Highest density was at station 3. While in August 2004, the dominant species were the *Chaetoceros* spp. (Fig 17) at stations 3 to 5 with from 1.25×10^5 to 1.44×10^5 cells/l. The highest density was at station 3. The dominant species in 2005 recorded in September was *Chaetoceros* spp. from 1.60×10^5 to 1.79×10^6 cells/l. There was also *Chaetoceros* spp bloom at station 5, 7 and 8, where the highest density was at station 5.

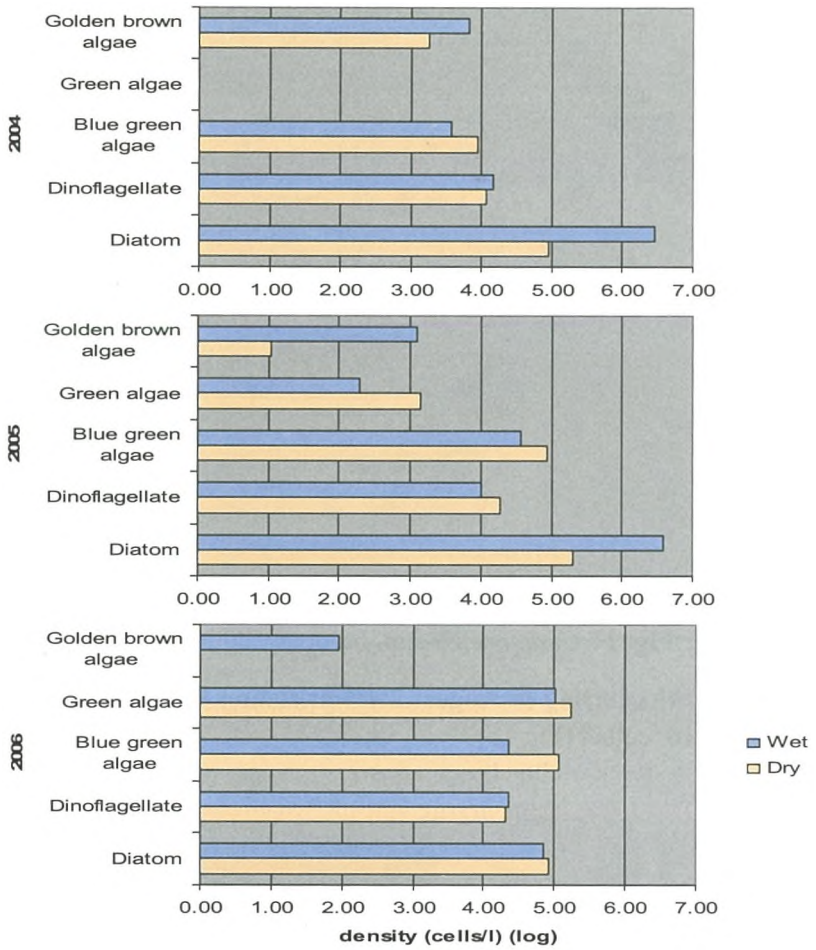

Fig. 15 The density of 5 divisions of phytoplankton

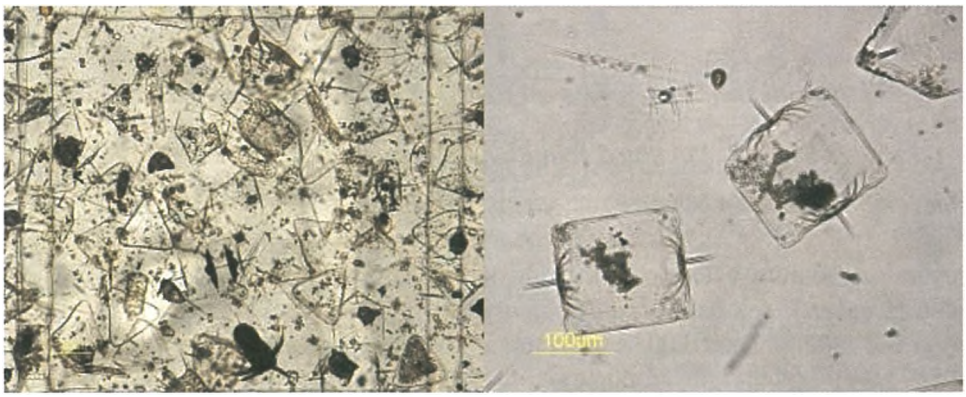

Fig. 16 *Ditylum sole* bloom in 2004

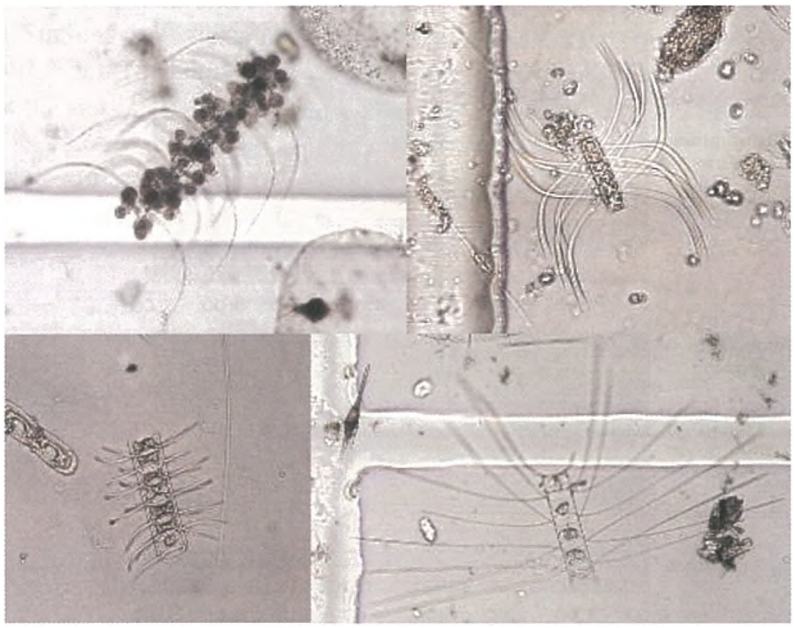

Fig. 17 *Chaetoceros* spp. bloom in 2004

A red tide phenomenon was occurring in August 2004 at station 9. This was caused by *Noctiluca scintillans* bloom at 5.77 x 10^3 cells/l (Fig 18).

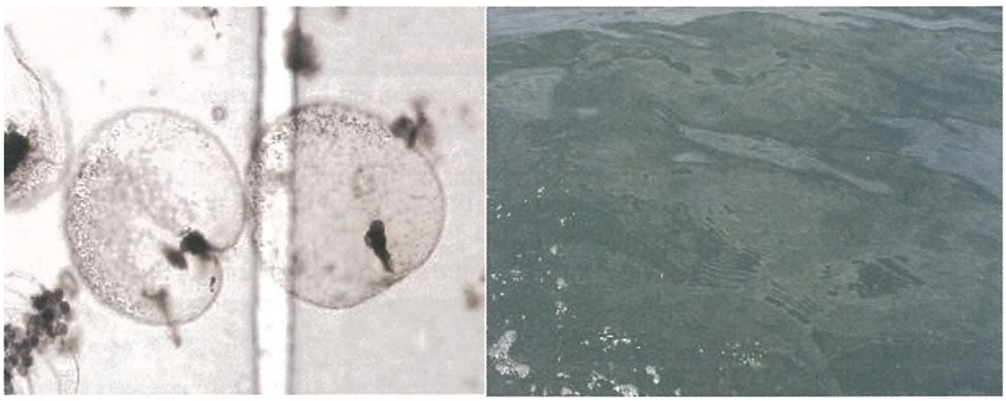

Fig. 18 *Noctiluca scintillans* bloom causing red tide

V. Conclusions And Discussions

There are several aquaculture activities in the study area composed of cage culture: grouper (*Epinephelus tauvina* and *E. bleekeri*), sea bass (*Lates calcarifer*), green mussel (*Perna viridis*) culture (Fig 19) (Arnupapboon and Laongmanee, 2003).

Generally, the water quality of the study area is suitable for coastal aquaculture. All variables were consistent with the standards for aquaculture and coral reef conservation (Pollution Control Department, 2006). In the Ao Pathew area, especially in the shallow area and the station along the coastline which is influenced by water runoff and human activities, TSS will be higher than in other stations. Transparency also decreased following the TSS in that area. The same result was also gathered by the study of Laongmanee and Singharachai (2004). Temperatures in some stations in the shallow area were higher than 29□C. Thus, the farmers should be aware of possible temperature shock in fish cage culture. Salinity in wet season was higher than in dry season. The total rainfall in 2003 and 2004 were higher in the wet season than in the dry season (Laongmanee *et al.*, 2003) and (Kajonwattanakul and Nokkate, 2005). This shows that water runoff and rainfall did not have any influence on the salinity in the study area. But salinity in this area was affected by the open sea.

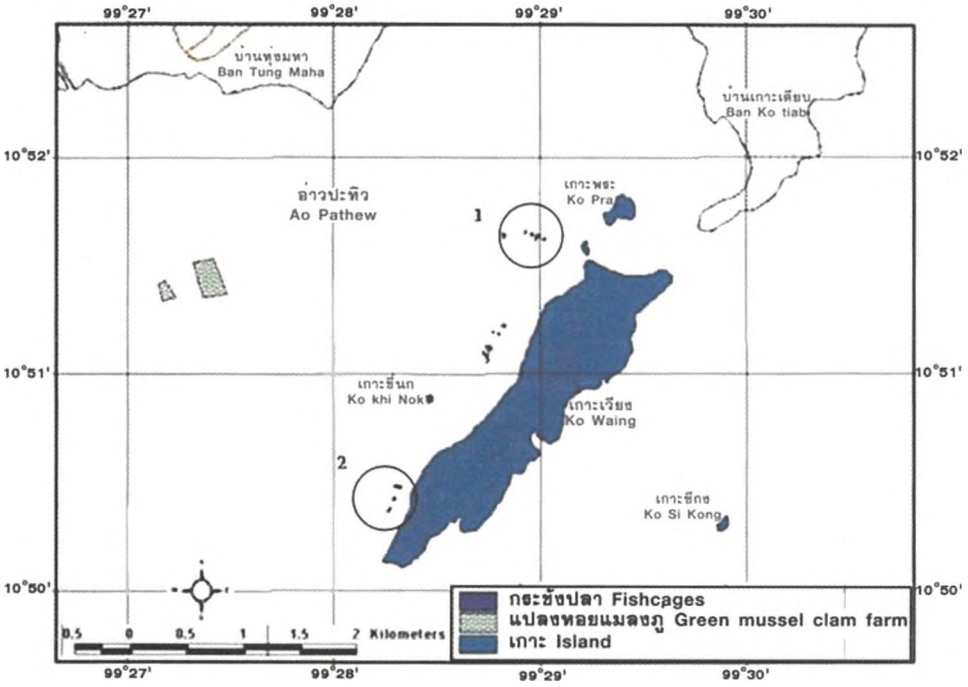

Fig. 19 Aquaculture activities near the LBCRM-PD) area

Laongmanee *et al.*, 2003 studied the water current speed and direction in this area. They found out that the current direction was southwestward. Strong current speed was observed during June at an average current speed of 0.09 m/s. Since the current direction and speed were not recorded all year, information from the fishermen were gathered and this indicated that in Ao Pathew, the current direction was northeastward during the southwest monsoon and southwestward during the northeast monsoon. Thus, the source of water in Ao Pathew comes from both the southern and northern parts of the sea.

Nutrient concentrations did not indicate the eutrophication in the area. But limiting the area for aquaculture and the density of fish stocks should be considered. Tookwinas *et al.* (2003) estimated the carrying capacity of marine finfish cage culture at Pathew Bay, considering the oxygen consumption of fish and oxygen supply in the area. They established that for cage culture in group 2 with 450 fishes: size 250-450 g/fish, the dissolved oxygen outflow during low tide is lower than the standard dissolved oxygen for aquaculture (4 mg/l). Sea bass and grouper were cultured at higher carrying capacity of 67.1% or 302 (450-148) fishes and 73.1% or 329 (450-121) fishes, respectively. For the cage culture in group 1 with 950 fishes: size 250-1000 g/fish), sea bass was cultured at lower carrying capacity around 33.45% or 217 (867-650) fishes, while grouper was cultured at higher carrying capacity of around 28.0% or 84 (300-213) fishes. This means that farmers can stock sea bass by about 33.4% more but need to decrease the number of groupers by around 28%.

Phytoplankton was abundant in wet season but did not show a significant relationship with chlorophyll a and nutrients. Several studies have indicated that phytoplankton can directly uptake inorganic nitrogen such as nitrite and nitrate (Libes, 1992 and Department of Marine and Coastal Resources, 2005) and the concentration of chlorophyll a is attributed to the concentration of dissolved inorganic materials (nitrite, nitrate, ammonia and orthophosphate). In this study however, the concentration of chlorophyll a showed a significant relationship with nitrate and ammonia.

Phytoplankton bloom and red tide phenomena were recorded 4 times throughout the period of this study. The Marine and Coastal Resources Research Center (2006) recorded the red tide phenomena from 2004 to 2006. It occurred 8 times along the Chumphon coastline. This phenomenon is caused mostly by *Noctiluca scintillans*, but only once did the mixed bloom of *N. scintillans* and *Ceratium furca* happened. When red tide phenomena occur, dissolved oxygen decreases due to photosynthesis by the phytoplankton, and as dissolved oxygen collapse, it uses microorganism as a decomposer. Although red tide did not

occur in the project site, but since most phytoplankton blooms happened in Ao Pathew area, cage culture farmers should keep a close watch when the red tide phenomenon is occurring.

VI. Acknowledgement

This study would not have been possible without the help and support of many colleagues. We especially acknowledge the staff of RV. Meen Niveth and those who participated in the survey including Saowaluk Suwanlaong, Jeamsak Sukwisuth and the excellent technicians of the Marine and Coastal Research Center of the Central Gulf of Thailand. We would like to thank Mr. Wannakiat Thubthimsang who kindly commented on this paper.

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THE CONDITION AND COMMUNITY STRUCTURE OF CORAL REEFS IN PATHEW DISTRICT, CHUMPHON PROVINCE

Anchalee Chankong[1] and Praderm Utthayanmani[2]

[1]Eastern Marine and Coastal Resources Research Center,
237 Moo 6, Kram, Klaeng, Rayong 21190, Thailand

[2]Marine and Coastal Resources Research Center, The Central Gulf of Thailand,
9 Moo 7, Nathung, Muang, Chumphon 86000, Thailand

ABSTRACT

The studying along coral reefs in Pathew District, Chumphon Province were conducted in 2002-2004. The objective of this study was to investigate condition of coral reefs and coral community structure. Manta-tow technique and Line intercept method (English *et al.*, 1994) were used in this study. The result showed that condition of the reefs varied. Most of reefs around islands were in very good condition, whereas reefs along shoreline were in very poor condition. In conclusion, the reef condition was very poor and still in same condition compared to the result in 2000-2001. The major components of coral community were branching form, *Pocillopora damicornis* and massive form, *Porites lutea*. The cause of degraded condition are discussed and considered the possibility of reef restoration.

Key words: Coral, coral reef, community structure, condition of coral reef, Chumphon

I. Introduction

This study was an activity under the Integrated Coastal Resources Management (ICRM-PD) project which participated between SEAFDEC/TD, Department of Fisheries (DOF) and Department of Marine and Coastal Resources (DMCR). A baseline and monitoring survey on status of coastal marine environment is important for aquaculture management. The reefs provide coastal populations with important resources, especially fisheries. Most fishermen are supported by reef fisheries. Coral reefs worldwide are experiencing substantial degradation (Wilkinson 2004). Extensive coral mortality can be attributed to natural stress such as coral bleaching, storms and catastrophic low tide events (Done, 1999; Brown *et al*, 2000). Human play a large role in reef degradation by dredging, destructive fishing method, over-fishing, sewage run-off such as nutrients and tourist-related activities. The effects are pollution, damage to reef, increased sedimentation, increased nutrients which can change community structure and reduce fish stock (Birkeland, 1997). Therefore, this study provides change in condition of reefs and a quantitative of coral community structure.

II. Objective

The objective of this survey is to investigate the present condition of coral reefs, also the change of the status of reefs and coral community structure of the reef in Pathew District, Chumphon Province.

III. Materials and Methods

1. Manta-tow technique

Study sites

The study was carried out in 2004. A total of 9 reefs along the islands and shorelines in Pathew District, Chumphon Province. The reefs along islands were Ko Si Kong, Ko Rang, Ko Eiang, Ko Phra, Ko Ran Pet, Ko Ran Kai, Ko Khai, Table Rock and Ko Chorakhe. The reefs along shoreline were Khao Tham Thong, Khao Laem Yai, Ban Thung Khai Nao to Ban Buek Khlone, Laem Taen, Laem Yang, Laem Sa Phli, Khao Pho bae and Khao Lan. (Fig. 1)

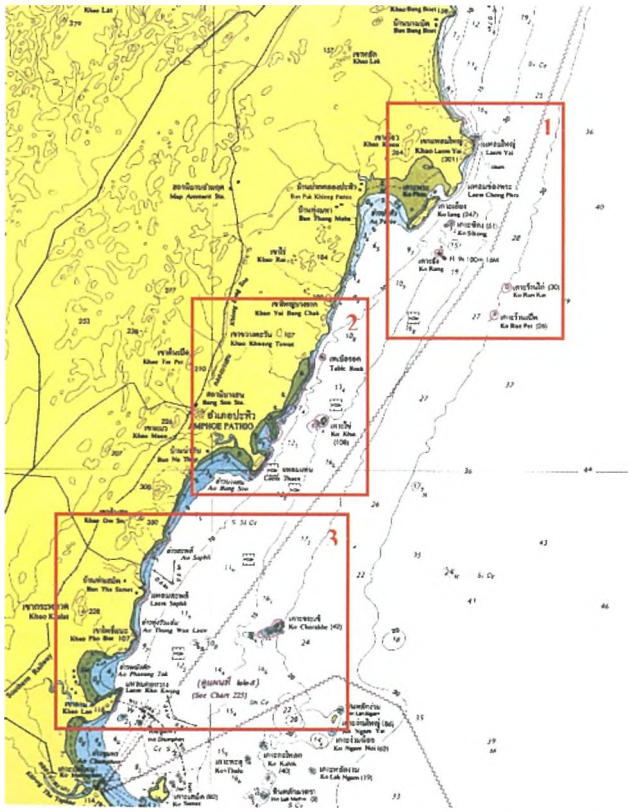

Fig. 1 Map showing location of study sites of reefs along the islands and shorelines in Pathew District, Chumphon Province.

Methodology

According to the Manta-tow technique (English *et al.*, 1994) involves towing 3 skin-diving observers, using a rope and manta-board behind a dinghy. Tows were carried out at a constant 2-knot speed around the perimeter of a reef edge-slope zone and were broken into units of 2 minutes duration. On board, the surveyors controlled the direction and recorded the position from GPS relating to underwater recorded data. During each 2-minute tow, observers made visual census then recorded data onto slate board. In addition, when the manta-tow was not possible due to either high turbidity of water, the spot-check was made instead. The 3 observers investigated the reefs at a covering area of about 120x10 $m.^2$. Several variables including percentage cover of the coral, dead coral, sand and rock were recorded. To The data of 3 observers was analyzed into average. The ratio of live to dead coral cover was used for interpreting the condition of the reefs as follows:

Live coral cover : Dead coral cover	Reef status	Legend in map
≥ 3 : 1	very good reef	1
2: 1	good reef	2
1 : 1	fair reef	3
1 : 2	poor reef	4
1 : ≥3	very poor reef	5

2. Line intercept method

Study sites

The study was carried out at the west coast of Ko Khai (Lat.10 °42' Long. 99 °24') in 2004.

Methodology

The line intercept method (English *et al.*, 1994) was used to reef assessment. The 30 m. long transect, 5 replicates were laid on slope zone of the reefs. All lines were laid parallel to the rim of the reefs. During measurements of reef substrate of a colony of live coral and other attached reefal organisms, such as zoanthid, corallimorphs, sea anemone, sponges and macroalgae as well as abiotic substrate such as sand and rock which intersected measuring tape, were recorded. The percentage cover of live corals (identified to the species level), other benthic organisms, sand and rock substrate and dead coral was collective calculated relative to the whole length of the transect. Since dead coral, was not measured, its cover was calculated by subtracting the cover of all measured substrate types from the total length of transect line. The condition of reefs was used the same criteria as those of the manta-tow data.

Additionally, profile of the reef was established by laying the transect from the shore to the end of slope, and recording the depth of the reef at 10 m. intervals. Whereas the percentage cover of corals and substrate along the whole profile line was observed separately at every 10 m. intervals by recording the absolute length of coral and substrate in the same manner as the line intercept assessment explained above.

Basic statistics to describe and compare the coral community were calculated: (1) number of species; (2) percent of coral cover; (3) Shannon-Weaver's species diversity index (H') by

$$H' = - \sum p_i \ln_{pi}$$ (Shannon and Weaver, 1949).

IV. Results

1. Reef condition surveyed by Manta-tow technique

The condition of reef was divided into 2 groups. The first group was the group of the reefs along islands and the second group was the group of the reefs along shorelines of mainland. (Table 1 and Fig. 2-4)

1.1 The group of the reefs along islands

Table 1. Showing coral reef area, towing distance and reef condition in Pathew District, Chumphon Province in 2004.

Island	Coral reef area (km^2)	Estimated* tow distance (km.)	Reef condition**				
			Very good	Good	Fair	Poor	Very poor
			(%)	(%)	(%)	(%)	(%)
Khao Tham Thong	0.04	0.6	12.50	37.50	50.00	-	-
Khao Laem Yai	0.04	0.8	28.57	14.29	57.14	-	-
Ko Eiang	0.01	0.2	100	-	-	-	-
Ko Phra	0.01	0.1	100	-	-	-	-
Ko Si Kong	0.02	0.1	50	50	-	-	-
Ko Rang	0.02	0.4	100	-			-
Ko Ran Kai	0.01	0.2	100	-	-	-	-
Ko Ran Pet	0.01	0.4	100	-	-	-	-
Table Rock	0.01	0.4	100	-	-	-	-
Ko Khai	0.15	1.3	42.86	0.00	28.57	7.14	21.43
Ko Chorakhe	0.19	2.2	37.04	11.11	37.04	-	14.81
Pathew shoreline	2.63	9.6	2.86	0.00	18.57	14.29	64.29
Laem Thaen	1	0.5	-	-	-	-	100
Laem Yang	1.5	0.6	-	5.13	15.38	38.46	41.03
Laem Sa Phli	0.5	0.4	8.33	8.33	33.33	25.00	25.00
Khao Pho Bae	1	2	-	17.65	52.94	17.65	11.76
Khao Lan	1.2	2.5	-	23.81	76.19	-	-
Total/ Average	8.34	22.3	15.64	7.82	28.81	13.17	34.57

* Calculated base on, estimated towing distance 120 m. at every 2 minutes

** Calculated from percent of towing number that surveyed in each location

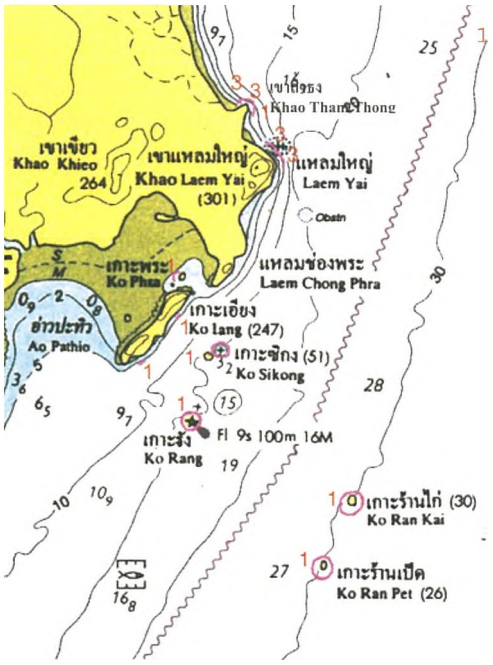

Fig. 2 Map showing condition of reefs along Khao Tham Thong to Ko Ran Pet

Fig. 3 Map showing condition of reefs along Table Rock to Laem Thaen

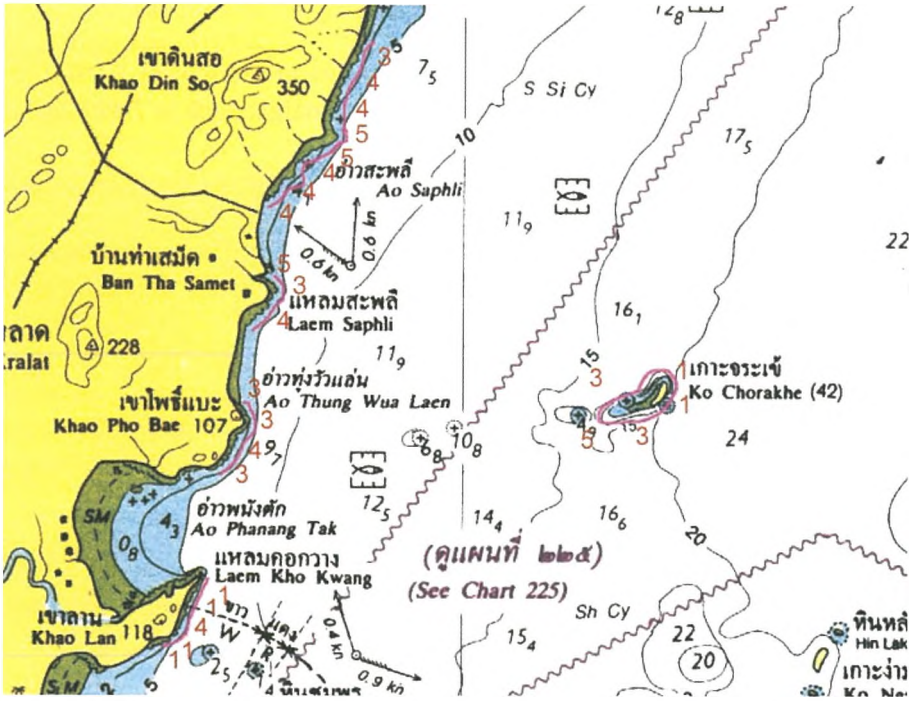

Fig. 4 Map showing condition of reefs along Laem Sa Phli to Khao Lan

Ko Si Kong and Ko Rang

The reef condition was very good. The average live coral cover was 30-60% and average dead coral cover was 5-25%. *Porites lutea*, *Pocillopora damicornis* and *Acropora* spp. were dominant species in these reefs.

Ko Eiang and Ko Phra

The reefs of Ko Eiang and Ko Phra was not true reefs. It was the community on rock. The reef condition was very good. The average live coral cover was 10-75% and average dead coral cover was 5-20%. *Turbinaria frondens*, *Pocillopora damicornis*, *Favia speciosa* and *Favites abdita* were dominant species in these reefs.

Ko Ran Kai and Ko Ran Pet

The reef condition was very good. The average live coral cover was 50-60% and average dead coral cover was 5-20%. *Porites lutea*, *Pocillopora damicornis* and *Acropora* spp. were dominant species in these reefs.

Ko Khai and Table Rock

The reef of Ko Khai was a true fringing reef. Most of reefs were 100-200 m. wide and end at 5-8 m. in depth. The reef condition was very good by the reef on south coast was in better condition than other area. The average live coral cover was 40-60% and average dead coral cover was 10-20%. Most of dominant species was *Turbinaria frondens*, *Pocillopora damicornis* and *Platygyra daedalea*.

The reef condition of Table Rock was very good. The average live coral cover was 25-40% and average dead coral cover was 5-15%. Most of dominant species was *Turbinaria frondens*, *Platygyra daedalea* and *Pocillopora damicornis*.

Ko Chorakhe

The reef was a true fringing reef. The reef expanded to cover an area 150 m. from shoreline and end at a depth of 3-5 m. The reef condition on north coast and east coast was very good. The average live coral cover was 30-60% and average dead coral cover was 5-15%. Most of dominant species was *Turbinaria frondens*, *Pocillopora damicornis*, *Platygyra daedalea* and *Porites lutea*.

1.2 The group of the reefs along shoreline

In general, the reefs along shoreline were true reef. The Most of reefs were 50-100 m. wide. Coral growth ended at a depth of 2-3 m. Many reefs covered with macroalgae such as *Turbinaria* sp., *Halimeda* sp.and *Sargassum* sp.

Khao Tham Thong and Khao Laem Yai
The reef condition of Khao Tham Thong and Khao Laem Yai was fair. The average live coral cover was 15-70% and average dead coral cover was 15-50%. Most of dominant species was *Galaxea* spp., *Acropora* spp., *Porites lutea* and *Platygyra daedalea*.

Pathew shoreline around Ban Thung Khai Nao to Ban Buek Khlone
The reef condition was very poor. The average live coral cover was 5-20% and average dead coral cover was 25-70%. Most of dominant species was *Porites lutea*, *Favia* spp. and *Platygyra daedalea*.

Laem Thaen, Laem Yang and Laem Sa Phli
The reef condition of Laem Thaen was very poor. The average live coral cover was 5-10% and average dead coral cover was 65-85%. Most of dominant species was *Porites lutea*, *Platygyra daedalea* and *Favia* spp.

The reef condition of Laem yang was very poor. The average live coral cover was 15-35% and average dead coral cover was 40-60%. Most of dominant species was *Porites lutea*, *Platygyra daedalea* and *Favia* spp.

The reef condition of Laem Sa Phli was fair. The average live coral cover was 45-50% and average dead coral cover was 35-40%. Most of dominant species was *Turbinaria frondens*, *Porites lutea* and *Galaxea* spp.

Khao Pho Bae and Khao Lan
The reef condition of Khao Pho Bae was fair. The average live coral cover was 15-40% and average dead coral cover was 35-40%. Most of dominant species was *Turbinaria frondens*, *Pocillopora damicornis* and *Galaxea* spp.

The reef condition of Khao Lan was fair. The average live coral cover was 30-60% and average dead coral cover was 10-40%. Most of dominant species was *Turbinaria frondens*, *Favia speciosa* and *Galaxea fascicularis*.

2. Line intercept method

The reef on the west coast of Ko Khai was approximately 150 m. wide. It gently sloped down and ended at about 1.5 m. at spring low water. In the section of the reef from 0 m. to 120 m., coral colonies were dense with dead corals averaged 77.3%, only few of live cover 1.2% and sand 13.4%. Most of live coral was small colonies such as *Porites lutea*, *Favia speciosa* and *Pocillopora damicornis*. In the section from 120-150 m. was the rim of the reef. The coral community became denser with an average total live coral cover 10-15%, dead coral approximately 75% and sand 11.5%. Live coral colony size such as *P. lutea*, *F. speciosa*, *P. damicornis* and *Acropora* sp. was bigger than the first section. (Fig. 5)

Five transects of 30 m. long were laid at a distance approximately 160 m. from shore at 1 m. depth. The composition of coral reef was coral branching (CB) 57%, coral massive (CM) 36%, coral encrusting (CE) 4% and coral foliose (CF) 3%. Most of coral life form was coral branching (CB) i.e. *P. damicornis* and the second one was coral massive (CM) i.e. *P. lutea*. (Fig. 6) Ten coral species, *Cyphastrea serailia*, *F. speciosa*, *Favites abdita*, *F. halicora*, *Montipora turtlensis*, *M. peltiformis*, *M. crassituberculata*, *Platygyra daedalea*, *P. damicornis* and *P. lutea* were found. They contribute to a cover of 4.51%. The cover of dead corals, sea anemone, macroalgae, giant clam, zoanthid and sand were 78.55%, 0.48%, 1.8%, 0.13%, 0.27% and 14.27%, respectively. (Table 2)

The coral species diversity was 1.5. The status of the reef at this site was very poor since the ratio of live to dead coral cover was 1:17.4.

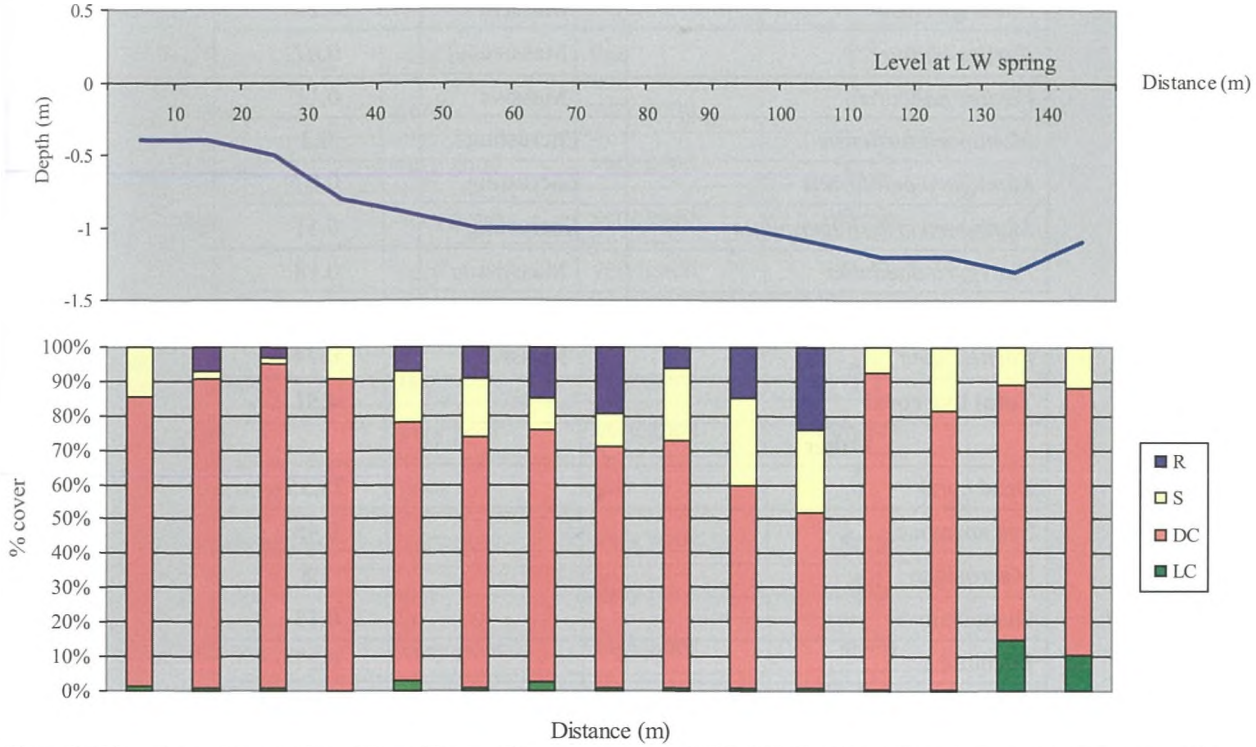

Fig. 5 Showing the coral reef profile on the west coast of Ko Khai (above) and percentage cover of live coral (LC), dead coral (DC), sand (S) and rock (R) at every 10 m. interval along reef profile (below)

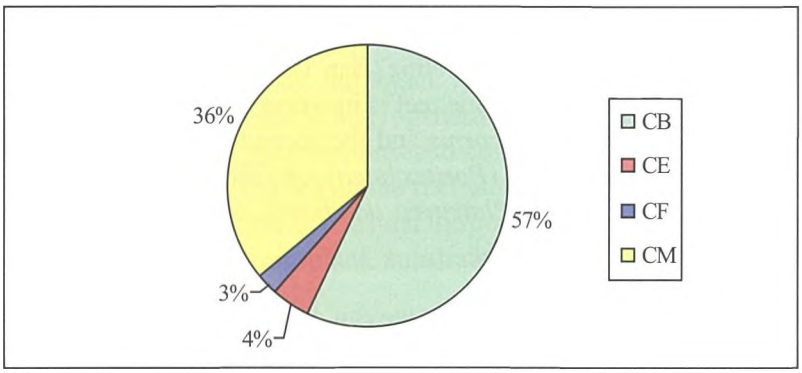

Fig. 6 Percentage life form of coral at the west coast of Ko Khai

Table 2. Percentage cover of live corals and other components under the transect line.

Coral species	Life form	%cover
Cyphastrea serailia	Massive	0.17
Favia speciosa	Massive	0.29
Favites abdita	Massive	0.07
Favites halicora	Massive	0.11
Montipora turtlensis	Encrusting	0.2
Montipora peltiformis	Encrusting	0.07
Montipora crassituberculata	Encrusting	0.11
Platygyra daedalea	Massive	0.18
Pocillopora damicornis	Branching	2.57
Porites lutea	Massive	0.74
Total live coral		**4.51**
Other		
Dead coral		78.55
Sea anemone		0.48
Macroalgae		1.8
Giant clam		0.13
Zoanthid		0.27
Sand		14.27

V. Conclusion and Discussion

In general, the coral reefs along Pathew District, Chumphon Province were in fair to very poor condition. The results from both manta-tow survey and line intercepts indicate the same trend of reef condition. In conclusion, the reef condition was very poor. To compare to past survey in 2000-2001 (Chankong, 2004), the reefs were still in same condition. Six locations of reef i.e. Khao Tham Thong, Ko Eiang, Table Rock, Ko Khai, Ko Chorakhe and Laem Sa Phli are in better condition. Six locations of reef i.e. Ko Si Kong, Ko Rang, Ko Ran Kai, Ko Ran Pet, Pathew Shoreline (Ban Thung Khai Nao to Ban Buek Khlone) and Laem Yang remain the same condition. Only one reef is in worse condition (Table 3). Most of coral life form was coral branching (CB) i.e. *P. damicornis* and the second one was coral massive (CM) i.e. *P. lutea*. The dominant species was hump coral (*Porites lutea*), cauliflower coral (*Pocilopora damicornis*), ring coral (*Favia speciosa*), brain coral (*Platygyra daedalea*), staghorn coral (*Acropora* spp.) and dish coral (*Turbinaria frondens*). (Appendix)

Due to the condition of reefs available in this study, we can divide into 2 groups. The first group was the group of reefs along the islands. Most condition of these reefs was better than in the latter group which was the group of reefs along shoreline of mainland. Together with the condition of reef at west coast of Ko Khai was very poor. Moreover, the coral species diversity index was 1.5 that was low. These results can be described that condition and coral community have been controlled by many environmental factor. Most of these reefs are shallow reef. Shallow reef areas are influenced by physical factors such as wave action, extreme low tides, while the deeper reef areas are controlled by biological factors such as predation (Guzman and Cortes, 1989, cited after Yeemin et al., 1994).

In addition, anthropogenic factor such as discharges of human waste and chemical pollution are both potential culprits for the decline in coral reef environment. The water quality including the physical, chemical and biological indice of Pathew bay showed that the bay is at risk from phytoplankton blooms and accumulation of nutrients (Kajonwattanakul and Singharachai, 2007). Effects of eutrophication on coral communities, in all instances eutrophication was found to have directly of indirectly negative effects

Table 3. Showing conclusion of reef condition and comparing of change of reef condition in Pathew District, Chumphon Province between 2000-2001 and 2004.

Location	Reef condition		Change of reef condition
	2000-2001	2004	
Khao Tham Thong	very poor	fair	↑↑
Ko Eiang	good	very good	↑
Ko Si Kong	very good	very good	↔
Ko Rang	very good	very good	↔
Ko Ran Kai	very good	very good	↔
Ko Ran Pet	very good	very good	↔
Table Rock	fair	very good	↑↑
Ko Khai	very poor	very good	↑↑↑↑
Ko Chorakhe	poor	fair	↑
Pathew shoreline	very poor	very poor	↔
Laem Taen	fair	very poor	↓↓
Laem Yang	very poor	very poor	↔
Laem Sa Phli	poor	fair	↑

on the coral reef. Local nutrient enrichment led to increase in growth of macroalgae, which smothered the coral polyps. Increasing of phytoplankton population led to water turbidity and decreasing of light. Coral vary in their ability to tolerate differences in temperature, salinity, light, turbidity, sedimentation, wave exposure (Woesik, 1994). In benign environments the availability of light is probably the most important resource on a coral reef. In order to obtain this light the corals need to occupy space. Change in these conditions can interfere with vital physiological process that can alter the ability of a species to exist in any one niche dimension. (Coles and Jokiel, 1978) Indeed, slight variations in habitat such as light, sedimentation, substrate stability *that* is heterogeneity, may allow the existence of the variety of coral community. Due to substrate stability responses to coral recruitment, this reason may cause that only small number of new colonies recruited on the reef at the west coast of Ko Khai. As coral reef in such a degraded condition, it is worthwhile to consider the possibility of reef restoration. The methods used for restoration vary including direct transplant, substrate enhancement for coral settlement and allowing natural colonization by suitable condition.

VI. Acknowledgements

We are grateful thank to Mr. Wannakiat Thubthimsang who kindly recommend studying of this project and Mr. Niphon Phongsuwan who teach underwater survey and other comment of writing the paper. We would like to thank Mr. Phadorn Petchkamnerd, Mr. Uthai Kaewnern, Mr. Anan Sutthipol, Ms. Saowaluk Suwanlaong and Mr. Sophon Chuinakhorn, staffs of Marine and Coastal Research Center, The Central Gulf of Thailand who participated in field survey.

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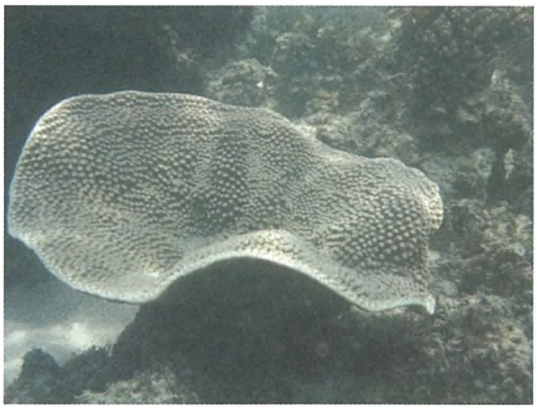
APPENDIX

Hump coral (*Porites lutea*)

Staghorn coral (*Acropora* spp.)

Cauliflower coral (*Pocillopora damicornis*)

Brain coral (*Platygyra daedalea*)



Dish coral (*Turbinaria frondens*)

Ring coral (*Favia speciosa*)

THE FISHERIES STATUS IN INTEGRATED COASTAL RESOURCES MANAGEMENT, PAKKLONG SUB-DISTRICT, PATHEW DISTRICT CHUMPHON PROVINCE

Sansanee Srichanngam, Jinda Petchkamnerd, Sumit Kaewmoon, Bangon Kumpee and Wanpen Chumai

Chumphon Marine Fisheries Research and Development Center
408 Moo 8, Paknam, Muang, Chumphon 86120

I. Introduction

This study was part of the Integrated Coastal Fisheries Management Project implemented in Pakklong Sub-district, Pathew District, Chumphon Province from 2002 to 2006. This project was the collaborative effort between the Department of Fisheries of Thailand (DOF) and the Southeast Asian Fisheries Development Center (SEAFDEC) to promote sustainable use of coastal fisheries resources. Pakklong Sub-district was chosen as a project site with six (6) activities implemented. Biological landing survey was continuously conducted for five (5) years because most of the local people in Pakklong Sub-district are fishermen and are the stakeholders of the fisheries sector, so marine resource is a major indicator of the livelihood of the people in this area. Suanrattanachai, *et al* (2002) reported that 6 out of the 7 villages in Pakklong Sub-district derive their main sources of daily income from the fisheries sector. Moreover, biological landing survey data have been used for the evaluation of the activities and for the whole program as well.

Eight (8) fishing gears were reported from the pre-survey data as the main fishing gears employed in Pakklong Sub-district. These are the: Indo-pacific mackerel gill net, squid cast net with light luring, crab gill net, shrimp trammel net, mullet gill net, anchovy falling net with light luring, collapsible crab trap, and cuttlefish trap. From these fishing gears, only four (4) fishing gears were continuously employed. For the data analysis of this study, the squid cast net with light luring and Indo-pacific mackerel gill net were chosen as representatives of the natural resources utilization fishing gears, while collapsible crab traps and shrimp trammel net were chosen as representatives of natural resources with enhanced utilization.

II. Materials and Method

1. Sampling area and period

The survey area is the Integrated Coastal fisheries Management Project area at Pakklong Sub-district, Pathew District, Chumphon Province comprising six (6) fishing villages. The survey was conducted between January 2002 and September 2006. Data and information were collected through interviews of the fishermen and from fish sampling at the piers in each village. Two main fishing gears were chosen as representatives of the natural resources, namely: the squid cast net with light luring and the Indo-pacific mackerel gill net. Another two main fishing gears represent the natural resources with enhanced utilization, namely: the collapsible crab traps and shrimp trammel net.

2. Data Analysis

2.1 Catch per unit effort of all species and target species of the shrimp trammel net and Indo-pacific mackerel gill net were reported in terms of kg/100 m net. For squid cast net, the CPUE was kg/haul and for collapsible crab traps was kg/10 traps.

2.2 The total catch of squid and blue swimming crab was analyzed using the following formula:

$$T = \frac{Nd}{\bar{d}} \left(\frac{W_1 + W_2 + W_3 + ... W_n}{n} \right) \frac{1}{1000}$$

Where
T = Total Catch (tons)
N = Number of fishing boats
d = Fishing day per boat (days)
$\bar{d}$ = Average day per trip (days)
$W_1, W_2, W_3 ... W_n$ = Catch of each sampling boat per trip (kg)
n = Number of sampling boat

2.3 Species identification of the catch are reported in terms of percentages.

2.4 The length of target species was recorded on punch paper by 0.5 class interval and analyzed as follows (Weera, 1994).

$$RF = \frac{W_t}{W_s}$$

Where
RF = Raising Factor
W_t = Total weight of target specie (kg)
W_s = Weight of sampling target specie (g)

$$\bar{X} = \frac{\sum_{i=1}^{n} f_i x_i}{N}$$

Where
$\bar{X}$ = Average length (cm)
f_i = Number in each length class interval
x_i = Median of each length class interval
N = Total number of that specie

III. Result and Discussion

1. Shrimp trammel net

1.1 Description of boat, fishing gear and fishing operation

There were 56 shrimp trammel net boats in Pakklong Sub-district. Most of the boats (18) were found in village no.1; while 16 boats were found in village no.7; 14 boats in village no.5; 6 boats in village no.6; and 1 boat each for village no.2 and 3 (Rotchanarut, 2004). Long tail boat was mostly used: 6-10 m in length with 7-90 horse power engines and 11-16 mostly.

Shrimp trammel net was 30 m in length each with 14 cm mesh size outer net and 4 - 4.5 cm mesh size inner net. About 10-15 nets are lined in 3-16 lines of nets using the water current direction, and marked with flags at the end of each line (Fig.1). The nets are left for 2-3 hours and hauled manually. The number of trips per day depends on the shrimp density and the sea condition. The target species are *Penaeus merguiensis* and *Metapenaeus spp.* for fresh consumption.

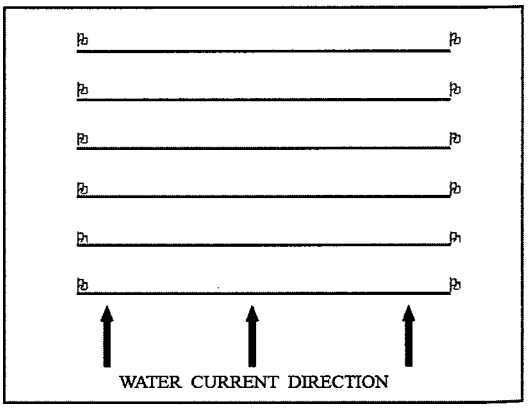


Fig. 1 Shrimp trammel net fishing operation in Pakklong Sub-district.

1.2 *Shrimp trammel net fishing season and fishing ground*

Fishing season for shrimp trammel net is during the northeast monsoon between November and February. The number of fishing boats per month is shown in Table 1. The fishing ground for shrimp trammel net is in 2-20 m water depth around Eiang island, Rung island , Sikong island, Thungmaba bay, Bang-bird bay, Tha-at fishing community and Lam-Yai cave (Fig. 2).

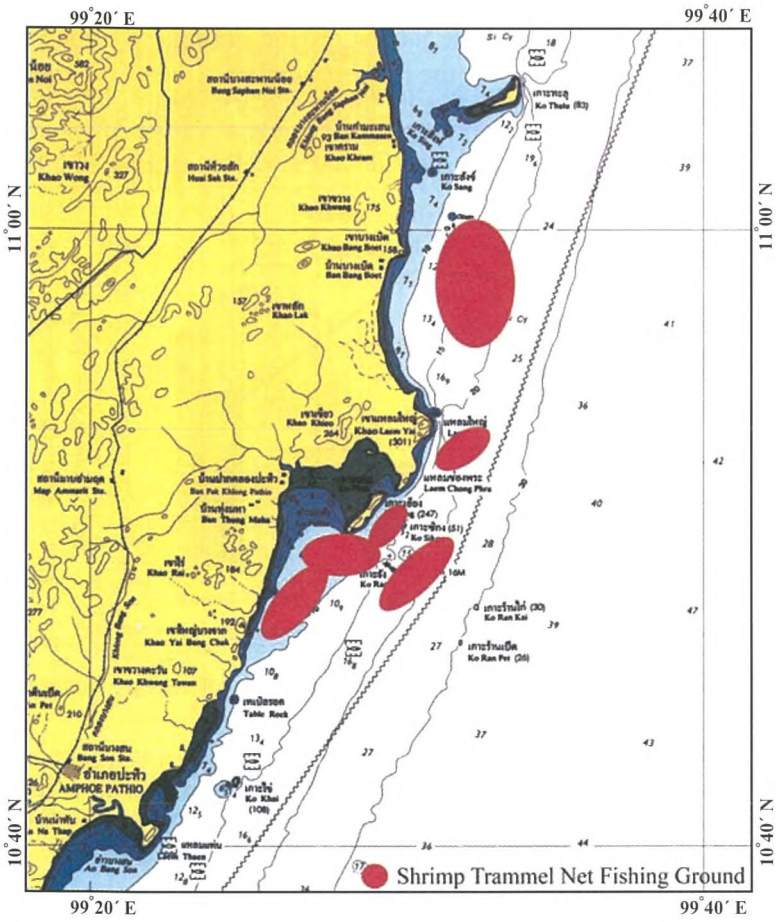


Fig. 2 Fishing ground of Shrimp trammel net in Pakklong Sub-district.

1.3 *Catch rate of shrimp trammel net*

All species and the shrimp catch per 100 m net are shown in Fig. 3. The CPUE of all species showed an increasing trend while the CPUE of the shrimps fluctuated.

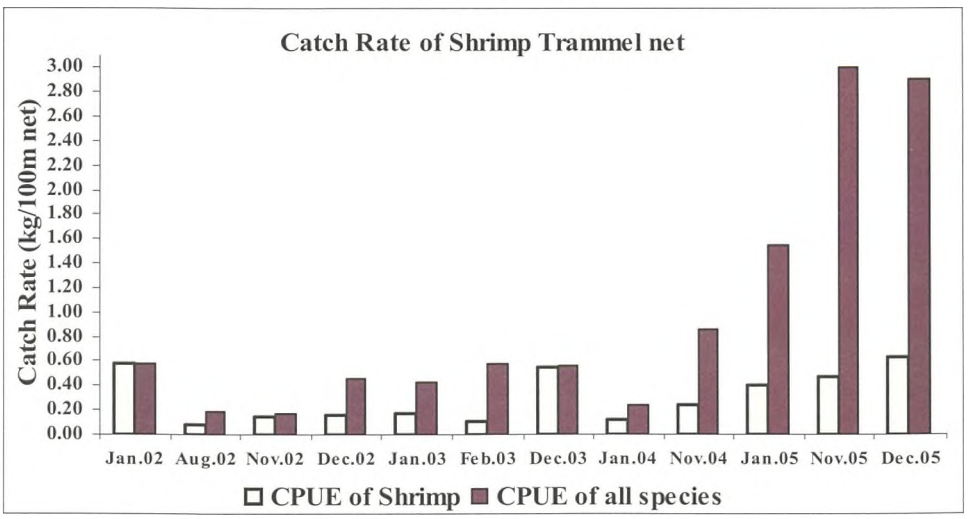


Fig. 3 Catch rate of Shrimp trammel net in Pakklong Sub-district.

The average CPUE of white shrimp (*Penaeus merguiensis*) by fishing season and the number of fishing boats per month was compared. (Fig. 4) Results showed that from November 2002-February 2003, and November 2003- February 2004, the CPUE of white shrimps had increasing trend, the same trend as the number of fishing boats indicating high density of the white shrimp resource. In November 2003- February 2004, the CPUE of the white shrimp was the highest while there was also high number of fishing boats. This period also showed the highest density of the white shrimp, which could be due to the white shrimp releasing program using P45 post-larvae conducted in June 2003. The shrimp had taken 7.5 months to reach about 15 cm total length and have moved to the fishing ground during the fishing season of the same year. From November 2004 to February 2005, the highest number of boats per month led to the decreased CPUE but the November 2005- February 2006 CPUE was a little bit higher because of the decreasing number of boats.

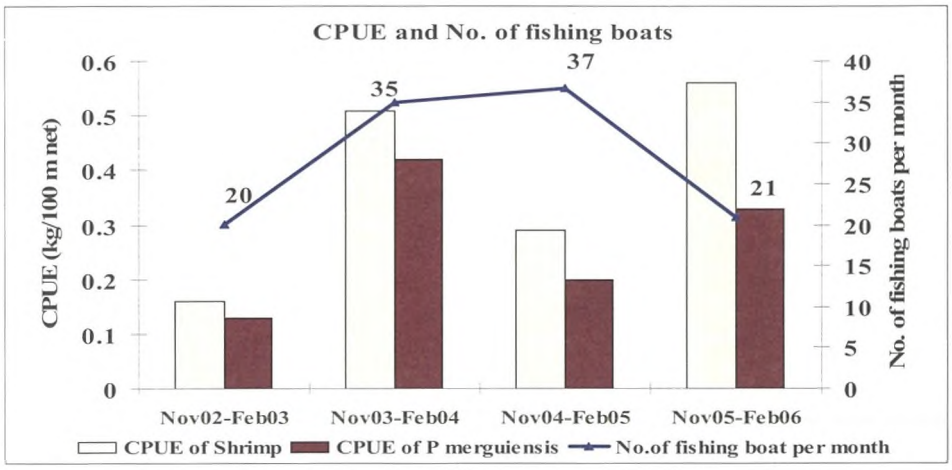


Fig. 4 CPUE of shrimp and white shrimp by fishing season and number of fishing boats per month of Shrimp trammel net in Pakklong Sub-district.

The average CPUEs of all species and shrimps between November 2002 to February 2003 were 0.36 and 0.16 kg/100 m net, respectively, while from November 2003 to February 2004, the CPUE were 0.54 and 0.51 kg/100 m net, respectively. From November 2004 to February 2005 the CPUE were 1.07 and 0.29 kg/100 m net, respectively and from November 2005 to February 2006 the CPUE were 2.95 and 0.56 kg/100 m net, respectively (Table 1).

1.4 Species composition and size composition.

The species composition of catch from the shrimp trammel nets was 40.41% shrimp consisting of *Penaeus merguiensis, P. monodon, Metapenaeus affinis* and other shrimps (26.30%, 1.49%, 11.25% and 1.37%, respectively (Fig. 5)). The monthly species composition is shown in Table 2.

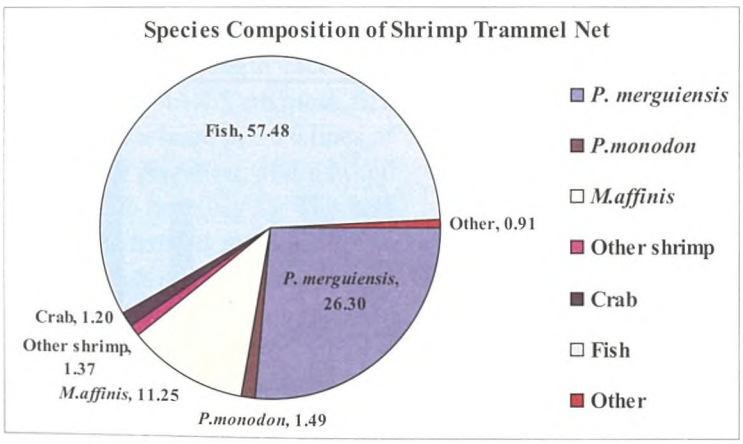


Fig. 5 Species composition of shrimp trammel net between 2002 – 2006 in Pakklong Sub-district.

Large size shrimps were selected by the shrimp trammel net's mesh size. The average total length of *P. merguiensis* was 12.73-17.74 cm and *M. affinis* from 11.50 to 13.07 cm (Table 3). Comparing the average total length of *P. merguiensis* to the first maturity size of 14.60 cm (Taweep, 1994), Fig. 6 shows that the catch were mostly bigger than the first maturity size. Thus, shrimp trammel net in Pakklong Sub-district was suitable for shrimp fishing without the gear destroying the marine shrimp resources.

Table 4 shows the age (t) and total length ( ) of *P. merguiensis* from shrimp trammel net by $L_t = 25.89(1-e^{-1.40(t+0.0048)})$ (Taweep, 1994) equation. *P. merguiensis* between 5.9 to 10.0 months old were however caught. The fishing season of shrimp trammel net in Pakklong Sub-district is November to February as described above. Therefore, any shrimp releasing program should be done between April and July during which time P45 shrimp post-larvae should be released.

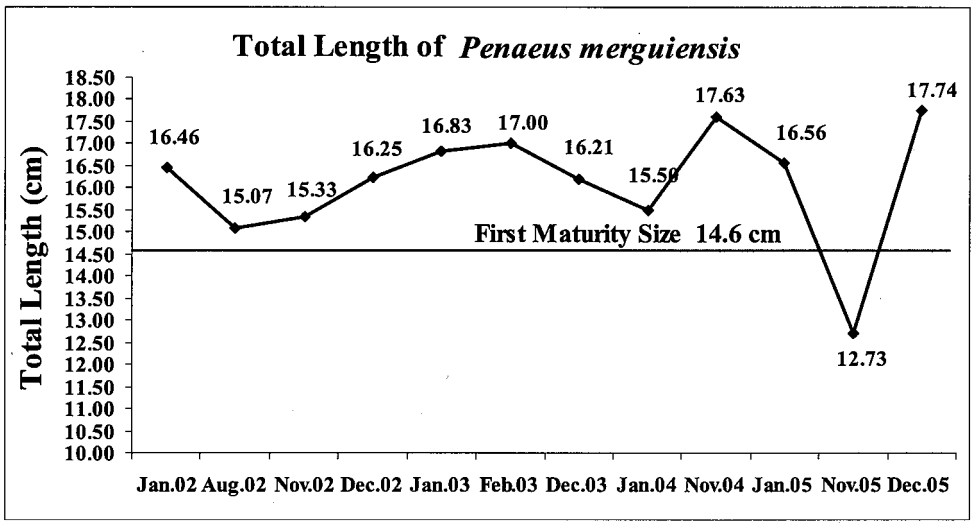


Fig. 6 Average total length of *P. merguiensis* compared to first maturity size

2. Squid cast net with light luring

2.1 Description of boat, fishing gear and fishing operation

There were 109 boats for squid cast net with light luring in Pakklong Sub-district, mostly found in village no.1 (46); 21 boats in village no.3; 18 boats in village no.6; 11 boats in village no.7; 8 boats in village no.5; and 5 boats in village no.2. (Sansanee, 2004)

Long tail boats were the mostly used in this area, 5-15 m in length and 7-11 m mostly while the boats with inboard engine were 11-15 m in length and 10-24 m mostly. Generators (1-2) were used to acquire 5-40 kw light power and 10-20 kw mostly. Fluorescent lamps (400-500 w) were also used (mostly 10-30 lamps, 10-15 lamps and a combination of 2-8 mercury lamps).

The squid cast nets had mesh sizes of 1-1.5 inches and 1.25 inches mostly, with width and height 4 and 1.5 times of the boat length, respectively. The cast net is hung to a square shape over the sea surface. The squids are lured with light, which keeps blinking until high density of squid is found. The net is cast covering the school of squids and using purse line, the net with the squid is hauled. (Fig. 7) Squid fishing is carried out for 2-23 days/month depending on the sea condition. Average fishing day per month in 2002, 2003, 2004, 2005 and 2006 were 19.66, 6.51, 4.06, 3.83 and 2.92 days/month, respectively, showing a decline in trend.

The target species, *Loligo spp.* are consumed as fresh and preserved as sun dried squid. Small pelagic fish caught with the squid are sold to middlemen for animal feed production in processing plants and other species are used for household and domestic consumption.

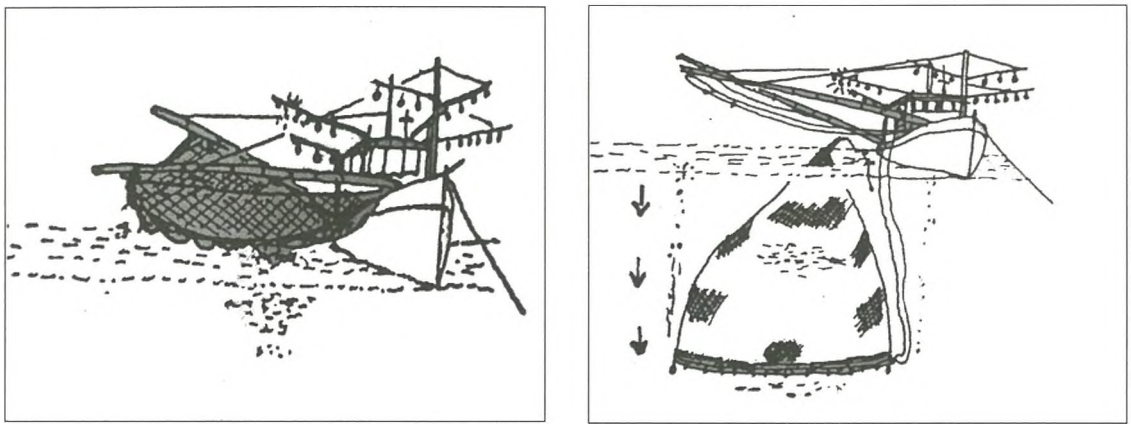


Fig. 7 Squid cast net with light luring fishing operation (Department of Fisheries, 1997)

2.2 Squid cast net with light luring fishing season and fishing ground

Fishing is done almost all year round but concentrated at the end of northeast monsoon and throughout the southwest monsoon between March to October. (Fig. 8 and Table 5)

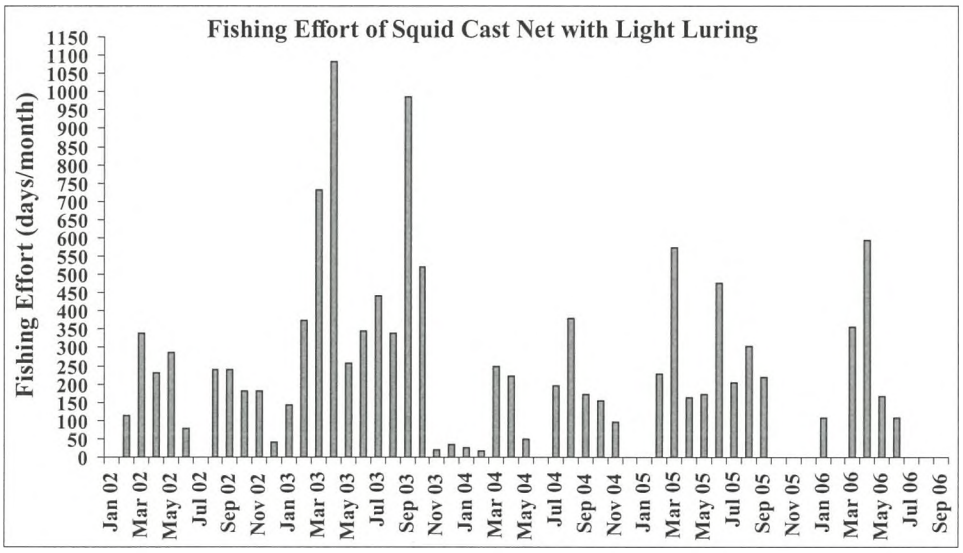


Fig. 8 Fishing effort of squid cast net with light luring in Pakklong Sub-district.

The fishing ground of the squid cast net is at 5-42 m depth waters, concentrated at 8-20 m depth around Eiang island, Rung island, Sikong island, Talu island, Ran-ped Ran-kai island, Thungmaha bay, Bang-bird bay, Thum-thong bay, in front of Bang chark mountain (Fig. 9).

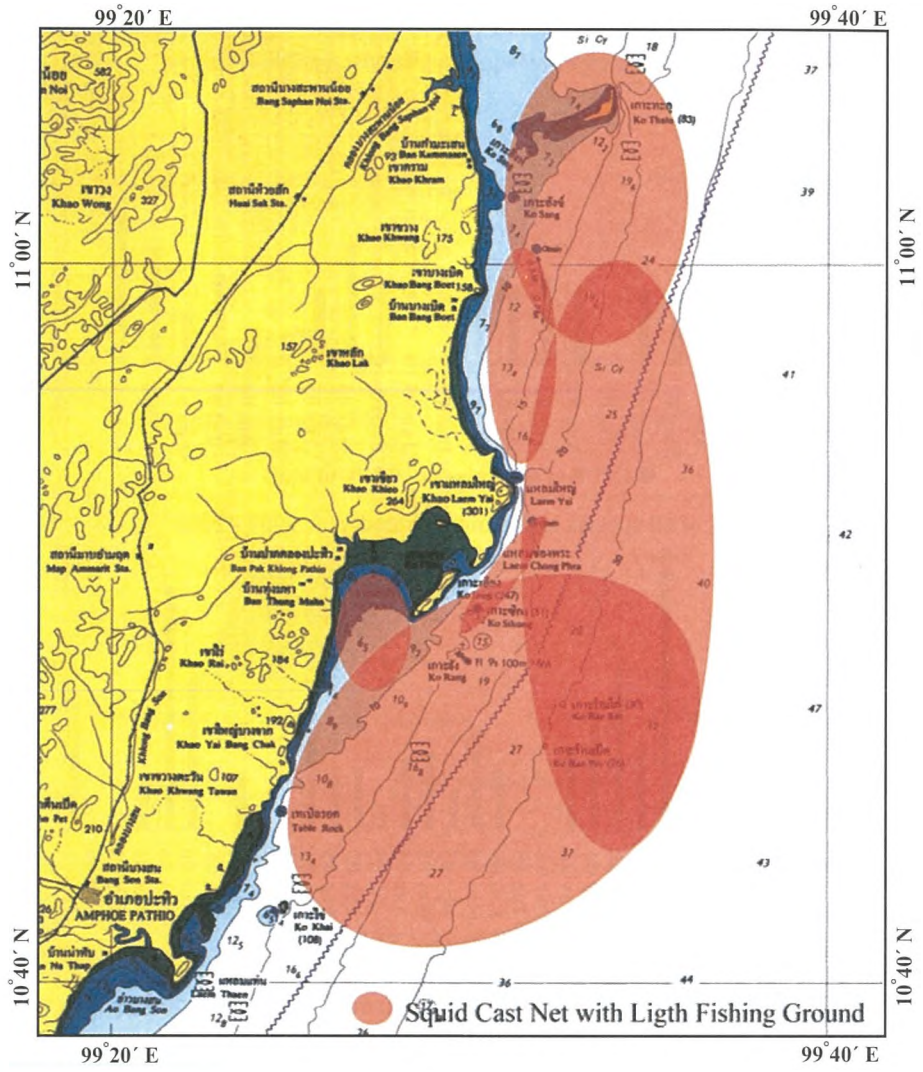


Fig. 9 Fishing ground of squid cast net with light luring in Pakklong Sub-district.

2.3 Catch rate of squid cast net with light luring

The all species and squid catch per haul are shown in Fig. 10. The CPUEs for all species and squid showed increasing trend at the end of the northeast monsoon (February-March) and at the end of the southwest monsoon (August-October). For the inter-monsoon season, the CPUEs showed a decreasing trend.

The average CPUE for all species and squid per trip in 2002, 2003, 2004, 2005, and 2006 were 41.10 and 39.70, 56.64 and 52.87, 55.51 and 36.97, 34.74 and 33.04, 88.48 and 41.80 kg/trip, respectively. The average CPUE per haul of all species and squid were 7.09 and 6.83, 10.70 and 9.99, 13.86 and 9.23, 7.12 and 6.77, 14.72 and 6.95 kg/haul, respectively. (Table 5)

A comparison of the average CPUE of squid per haul and average fishing effort (Fig. 11), indicated that in 2003 the CPUE of squid and fishing effort were the highest suggesting the highest density of the squid resource as well. In 2004, the CPUE of squid was lower than before with less fishing effort, indicating low density of squid because of water pollution. Based on the fishermen's observation, the direct releasing of waste water to the sea from shrimp farms may have caused this problem. In 2005, the fishing effort was higher than in 2004 and the CPUE has decreased a little bit and in 2006, the CPUE increased a little while the fishing effort decreased. Therefore in 2005-2006, the squid resource was stable.

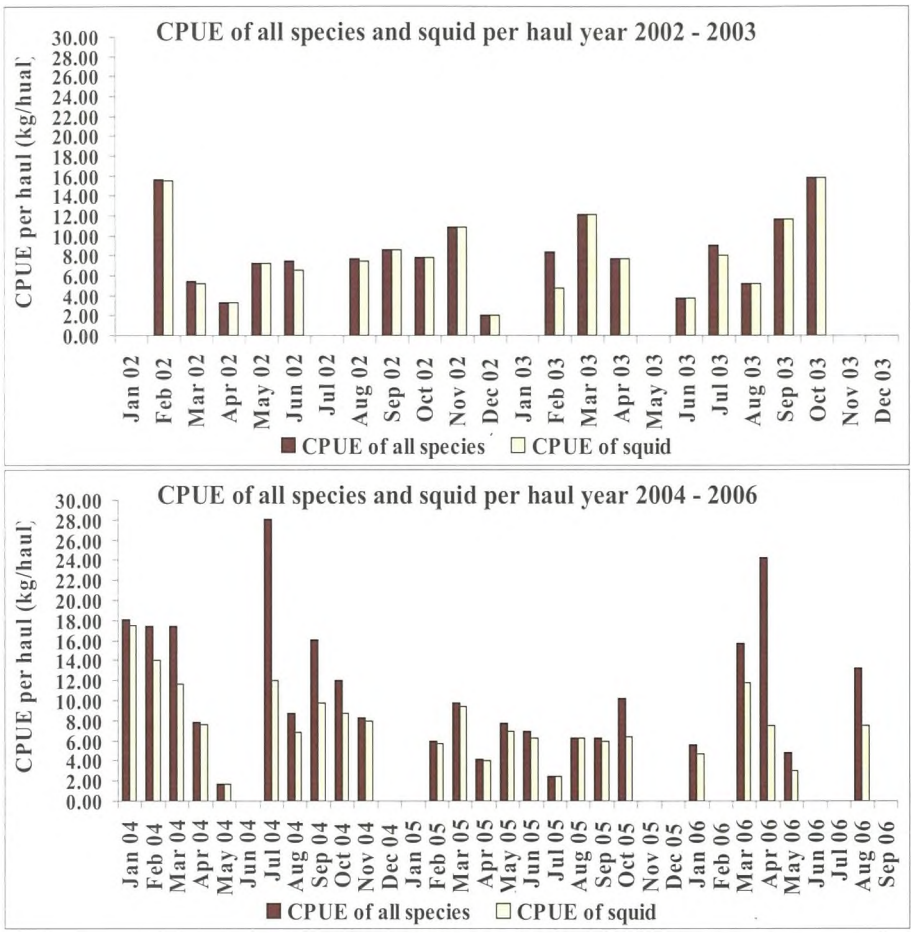


Fig. 10 CPUEs of squid cast net with light luring in Pakklong Sub-district.

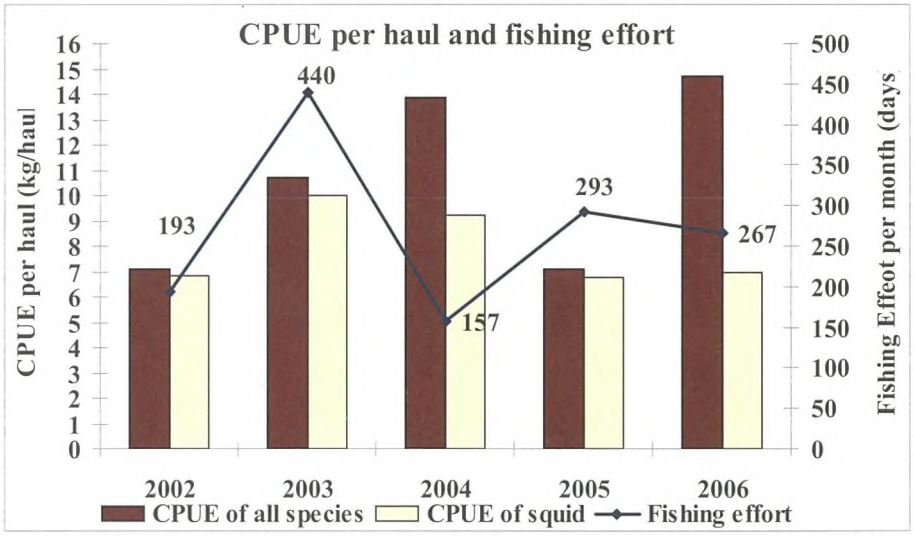


Fig. 11 CPUE and fishing effort of squid cast net with light luring in Pakklong Sub-district.

2.4 Species composition and size composition

The species composition of catch from squid cast net with light luring in 2002 was: 98.58% Indian squid, 1.17% pelagic fish, 0.24% other squids and 0.01% other fishes. In 2003, the composition was: 93.35% Indian squid, 6.02% pelagic fish and 0.63% other squids. In 2004, the composition was: 66.60% Indian squid, 33.16% pelagic fish and 0.24% other squids. In 2005, 95.10% Indian squid, 4.30% pelagic fish and 0.60% other squids; and in 2006, 47.25% Indian squid, 52.49% pelagic fish 0.24% other squids and 0.02% others. (Fig. 12 and Table 6)

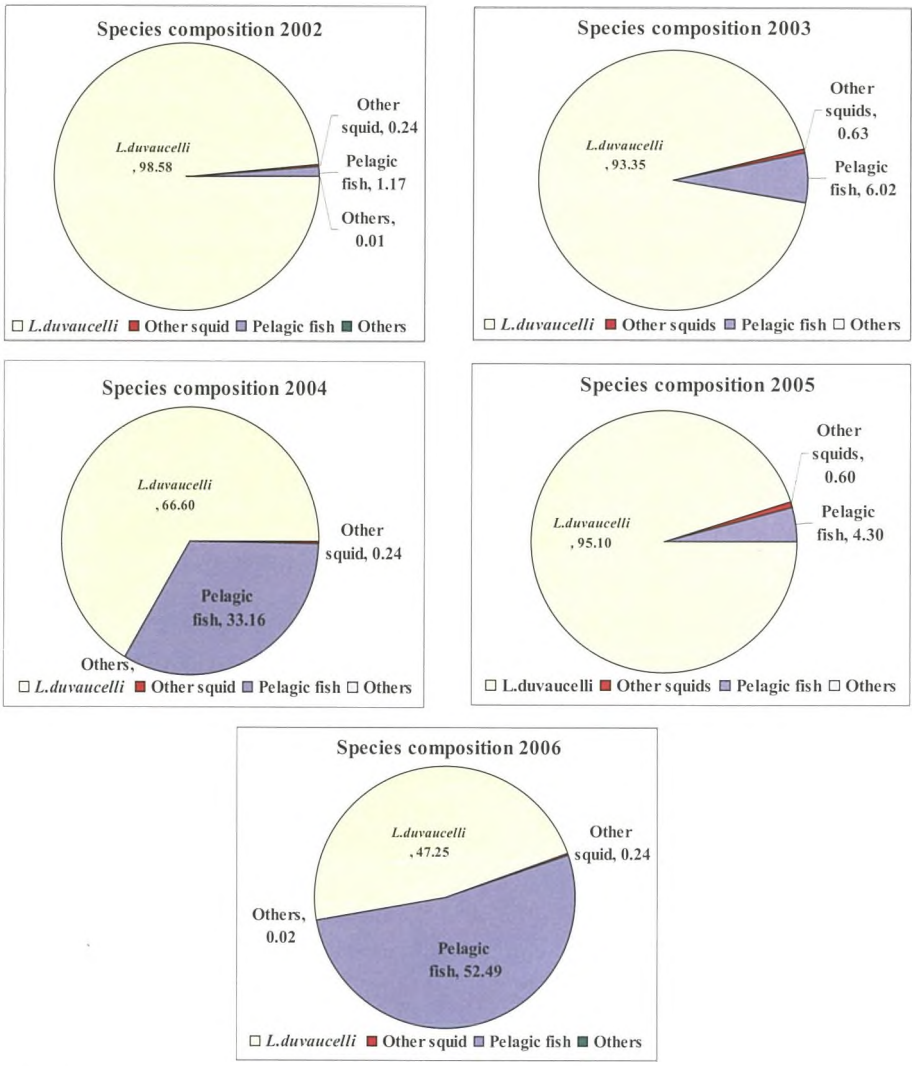


Fig. 12 Species composition of catch from squid cast net with light luring in Pakklong Sub-District.

The average mantle length of the Indian squid was 6.58-13.81 cm. (Table 7) A comparison of the average mantle length and the first maturity size of *Loligo duvaucelli* : 8.5 cm (Supongpan, 1998) is shown in Fig. 13. A high percentage of Indian squid with smaller mantle than the first maturity size was observed in February-April and July-September. (Fig. 14 and Table 8)

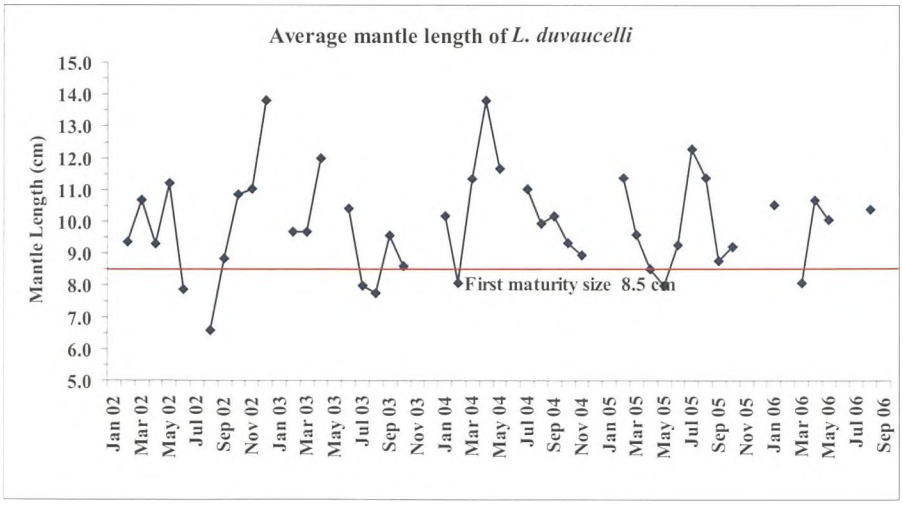


Fig. 13 Average mantle length of *L. duvaucelli* from squid cast net with light luring in Pakklong Sub-district

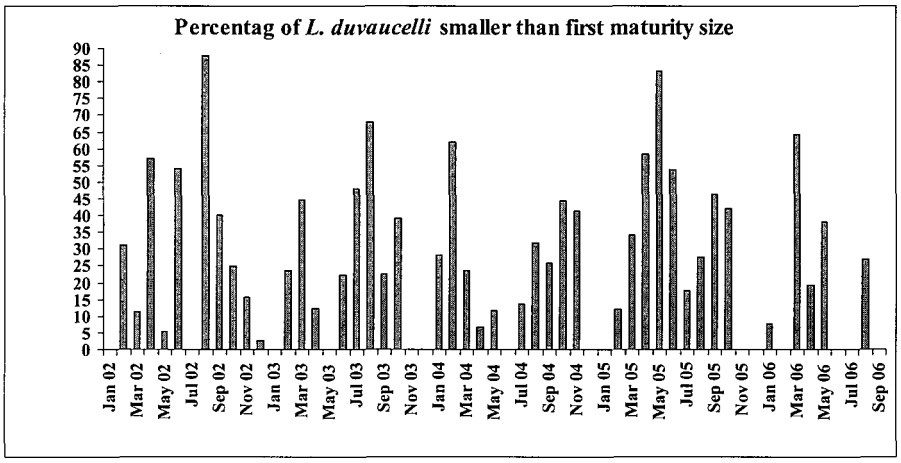


Fig. 14 Percentage of *L. duvaucelli* which smaller than first maturity size

Table 8 shows the age (t) and mantle length ( ) of *L. duvaucelli* from squid cast net with light luring by $L_t = 26.6(1-e^{-1.67(t+0.0026)})$ (Taweep, 1998) equation. *L duvauceli,* 2.1-5.3 months old was caught. A comparison of the age with the Chumphon spawning season (January-April and June-July) as Supongpan and Sinoda(1998) reported showed small catch of Indian squid from this area which high percentage smaller mantle than the first maturity size in February-April and July-September spawned in the same year.

2.5 Indian squid total catch

The total catch of Indian squid in 2002, 2003, 2004 and 2005 was 75.94, 279.01, 69.30 and 78.36 tons/ year, respectively (Table 7). The highest total catch was in 2003 due to high fishing effort.

3. Collapsible crab trap

3.1 Description of boat, fishing gear and fishing operation

There were 26 collapsible crab trap boats in Pakklong Sub-district, mostly found in village no.7 (17 boats); 6 boats in village no.1; and 1 each for village no. 3, 5 and 6. Long tail boats were used, 4.0-11.5 m in length with 5-13 horse power engines.

Collapsible crab traps are made of wire rectangular in shape, 36□52□18 cm estimated size with 2 entrances. The traps are covered with 1.25 inch mesh size polyethylene net except at the bottom side which has 2.5 inch mesh size. Trash fishes are used as bait skewered at the center of the traps. About 100-400 traps are used per fisherman by fixing these to a main line at a distance of 12 m from each other and fixed by 2 sinkers (10 g) between each trap. The sets of crab traps are put in the fishing ground in a zigzag direction. The distance between lines is 20-25 m and marked with flags at the end of each line. (Fig. 15) The traps are left overnight then hauled manually.

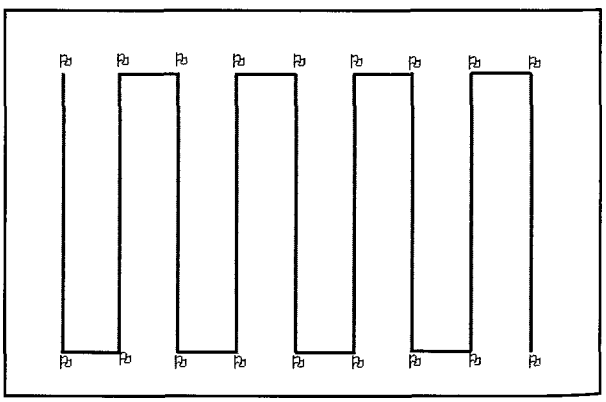


Fig. 15 Collapsible crab trap fishing operation in Pakklong Sub-district.

The target species is the Blue swimming crab (*Portunus pelagicus)*, which are processed as boiled crab meat and sold to middlemen.

3.2 *Collapsible crab trap fishing season and fishing ground*

The fishing season is all year round because of the shallow fishing ground and the island is protected from wind which is beneficial to the fishermen. The fishing ground for collapsible crab trap fishery is at 2-5 m depth in front of the Koh-Teab fishery community, Pra island and Eiang island (Fig. 16). The average fishing day per month in 2002, 2003, 2004, 2005 and 2006 were 20.67, 24.34, 24.64, 26.82 and 27.20 days/month, respectively (Table 9)

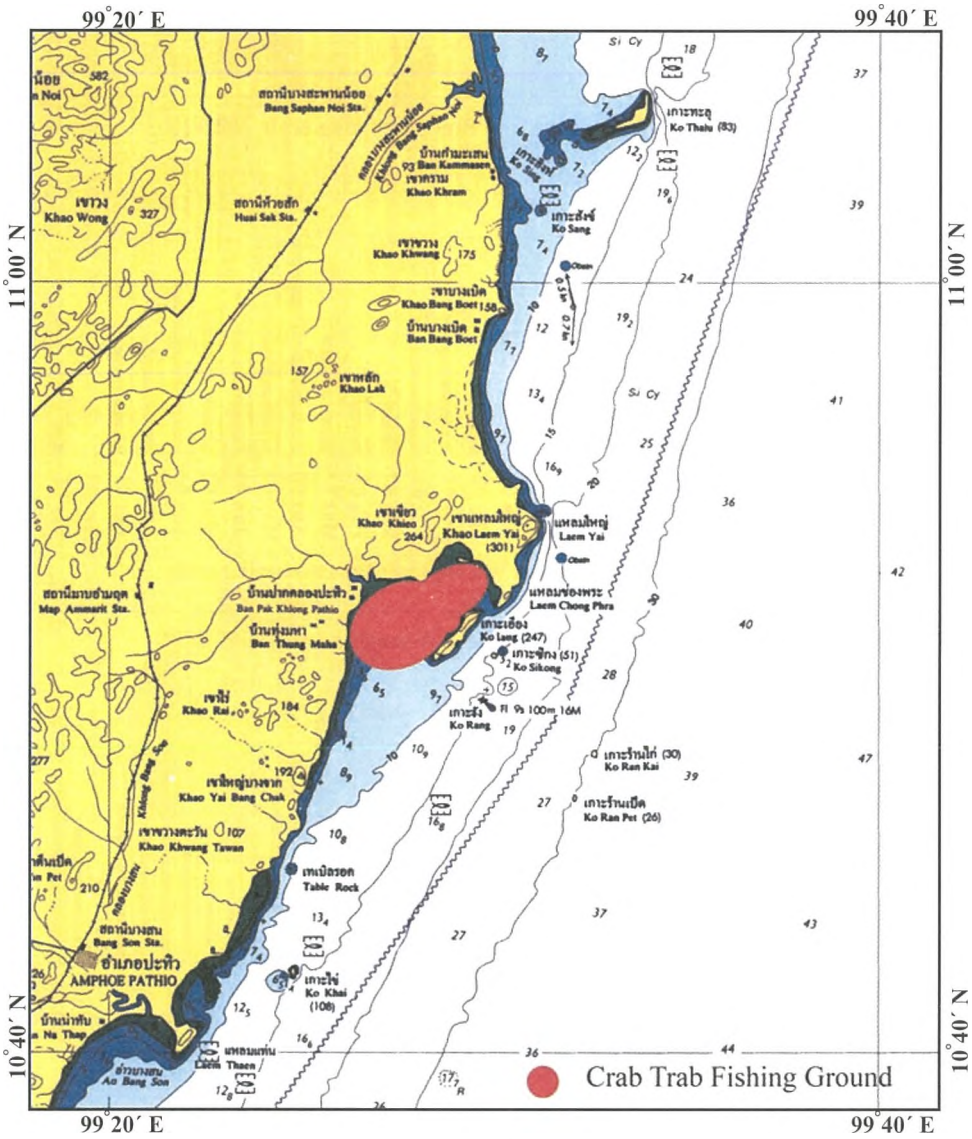


Fig. 16 Collapsible crab trap fishing ground in Pakklong Sub-district

3.3 *Catch rate from collapsible crab trap fisheries*

All species and blue swimming crab catch per 10 traps are shown in Fig. 17. The CPUEs of all species and blue swimming crab fluctuated, however, there was an increasing trend between April-June and September-November except in 2005, when in April-June the trend was not clear.

The average CPUEs of all species and Blue swimming crab per trip in 2002, 2003, 2004, 2005, and 2006 were 9.90 and 9.60 9.22and 8.49 14.84 and 14.44 14.71 and 13.54 14.44 and 12.96 kg/trip, respectively. The average CPUEs per 10 traps of all species and Blue swimming crab were 0.59 and 0.57 0.52 and 0.47 0.65 and 0.63 0.61 and 0.56 0.62 and 0.55 kg/10 traps, respectively (Table 9).

A comparison of the average CPUE of Blue swimming crab per 10 traps and the fishing effort (Fig. 18), showed that the CPUE in 2003 slightly decreased from 2002 because of higher fishing effort. In 2004, both CPUE and fishing effort were high indicating that the fishing effort of collapsible crab trap fisheries in this year was not higher than the blue swimming crab's production capacity. In 2005, CPUE slightly decreased from 2004 because of the highest fishing effort and in 2006 fishing effort declined while CPUE remained the same as before. Therefore, we can estimate the suitable fishing effort from the relationship between the CPUE and fishing effort in 2005 and 2006 for blue swimming crab resource management.

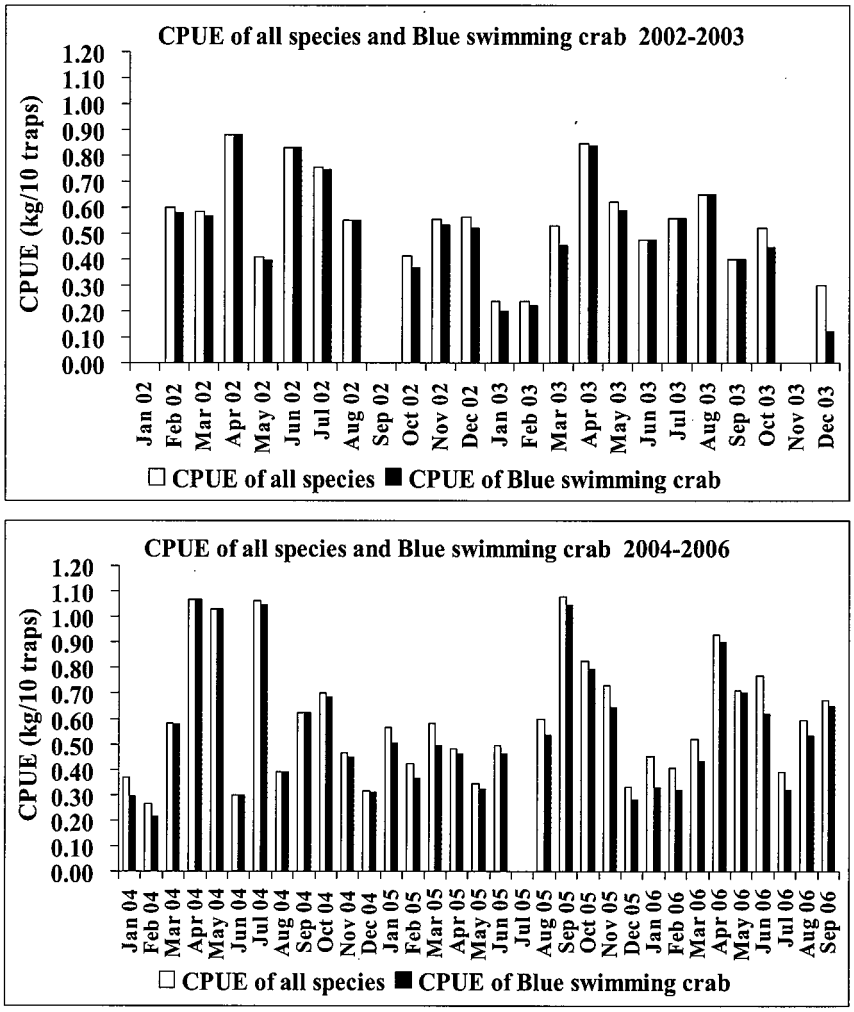


Fig. 17 CPUEs of all species and Blue swimming crab from collapsible crab trap fisheriesin Pakklong Sub-district.

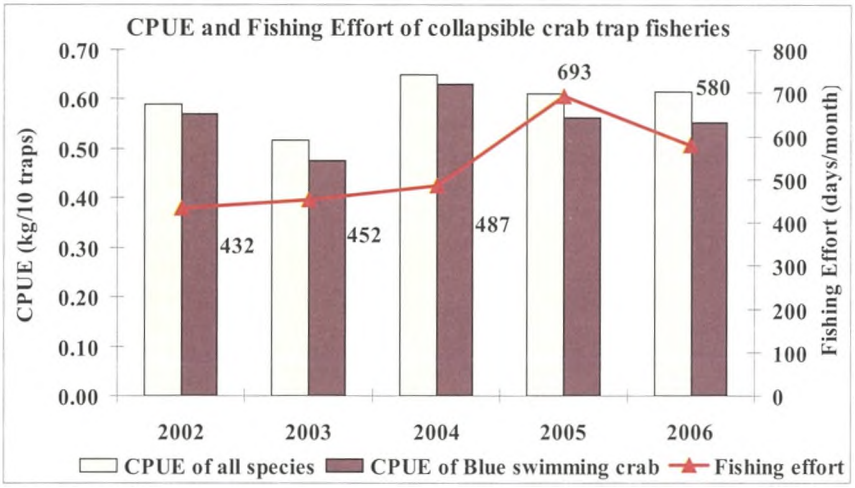


Fig. 18 CPUEs of all species and Blue swimming crab from collapsible crab trap fisheries in Pakklong Sub-district.

3.4 Species composition and size composition

The main species composition of catch from collapsible crab trap fisheries was the Blue swimming crab. In 2002, 2003, 2004, 2005 and 2006 the percentage of blue swimming crab were 97.02%, 95.34%, 97.29%, 91.98% and 89.76%, respectively. (Fig. 19 and Table 10)

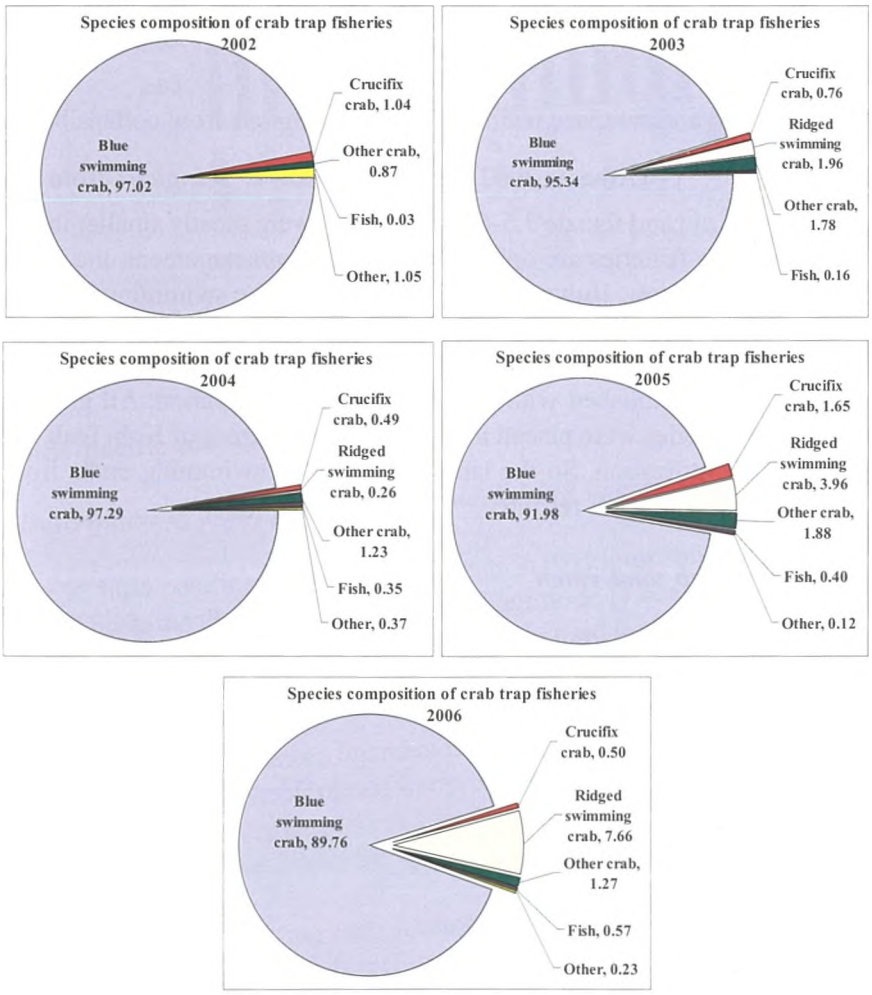


Fig. 19 Species composition of catch from collapsible crab trap fisheries in Pakklong Sub-district

The average carapace width of the male Blue swimming crab was 7.10-11.47 cm and female 7.80-11.09 cm. (Table 11) A comparison of the average carapace width to the first maturity size of female *Portunus pelagicus* of 9.74 cm (Amara, 2002) is shown in Fig. 20. Most female Blue swimming crab caught from collapsible crab trap fisheries in Pakklong Sub-district were smaller than the first maturity size because the fishing ground is in shallow waters same as Sansanee (2004) reported that Blue swimming crab caught in shallow waters was smaller than deeper waters even though bigger mesh size of crap traps were used.

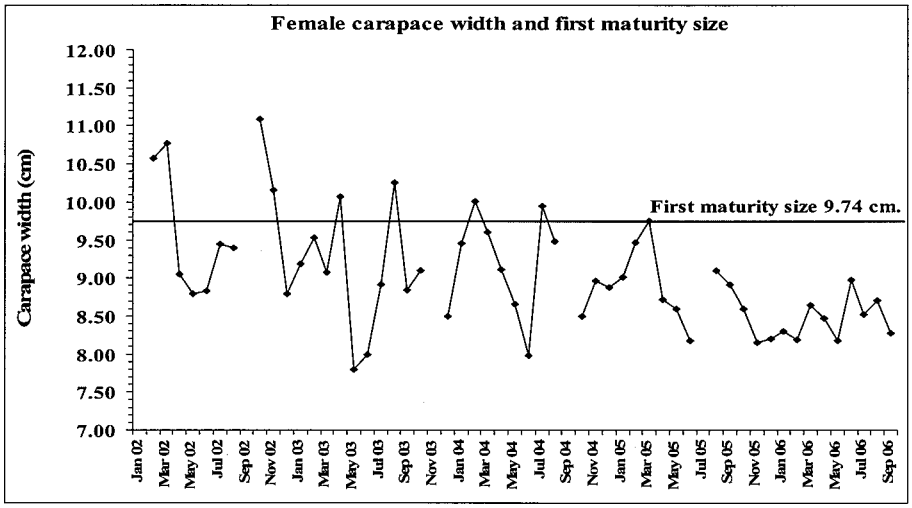


Fig. 20 Carapace width of female Blue swimming crab from collapsible crab trap fisheries in Pakklong Sub-district.

Table 11 shows the age (t) and carapace width ( ) of *P. pelagicus* from collapsible crab trap fisheries by $L_t = 18.48(1-e^{-1.64(t+0.041)})$ (Amara, 2002) equation. Male *P. pelagicus* from crab trap fisheries between 3.1 to 6.6 months old and female 3.5-6.2 months old were mostly smaller than the first maturity size. If collapsible crap trap fisheries are operated without any management, the Blue swimming crab resource will decline continuously. However, the CPUE of the Blue swimming crab in this area has not continuously declined because of the implementation of the Crab Bank enhancement program. Raising awareness programs were conducted continuously to change the fishermen's attitude and the Crab Bank enhancement program was established with the fishermen's participation. All gravid Blue swimming crabs from the crab trap fisheries were placed in floating cages in front of Koh-Teab fishery community for them to spawn before utilization. So the larvae of the Blue swimming crabs from the Crab Bank comprise the new recruit for the crab resource.

3.5 Blue swimming crab total catch

The total catch of the Blue swimming crab in 2002, 2003, 2004 and 2005 were 41.72, 44.34, 76.89 and 98.34 tons/year, respectively. (Table 12) High total catch was recorded in 2004 and 2005 because of high fishing effort in those years. (Fig. 21)

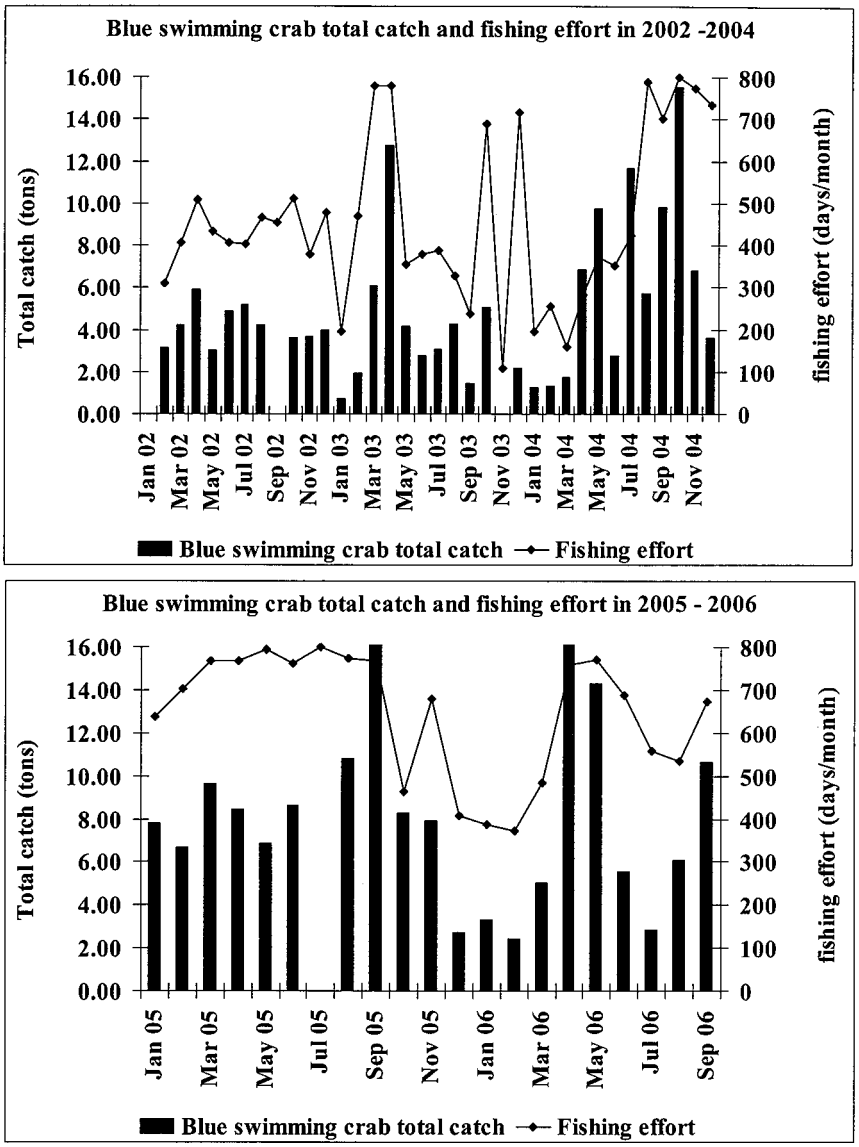


Fig. 21 Total catch of Blue swimming crab from collapsible crab trap fisheries and fishing effort in Pakklong Sub-district.

4. Indo-pacific mackerel gill net

4.1 Description of boat, fishing gear and fishing operation

There were 95 Indo-pacific mackerel gill net boats in Pakklong Sub-district, mostly found in village no.1 (27 boats); 22 boats in village no.7; 22 boats in village no.5; 11 boats in village no.6; 9 boats in village no.3; and 4 boats in village no.2. Long tail boats are mostly used in this area with 6-9.5 m in length and with 5-22 horse power engines.

Indo-pacific mackerel gill net is a ligament net with 2.5, 3.5, 4.0 and 4.5 inch mesh size, which 3.5 inch mesh size is mostly used. Small plastic buoy, 3.8 cm in diameter and 4.5 cm thick are attached at 50-90 cm apart along the net. For floats, 10 cm diameter plastic buoys are placed at 18-20 m apart along the net and 10 g sinkers are used at 30-60 cm apart. The total length of the net is 360-2,700 meters.

Operation time is usually during early mornings. The nets are bound together to the line and where flags are used to mark the end of each line (Fig. 22). The nets are left for 1-2 hours and then hauled manually. The Indo-pacific mackerel are removed from the nets and sold to middlemen for the local market.

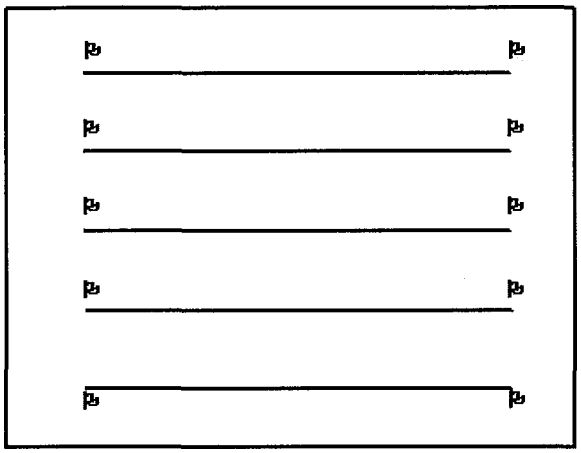


Fig. 22 Indo-pacific mackerel gill net fishing operation in Pakklong Sub-district.

4.2 Indo-pacific mackerel gill net fishing season and fishing ground

Indo-pacific mackerel gill net is operated at three (3) periods per year between January-March, May-June and September-October. (Fig. 23)

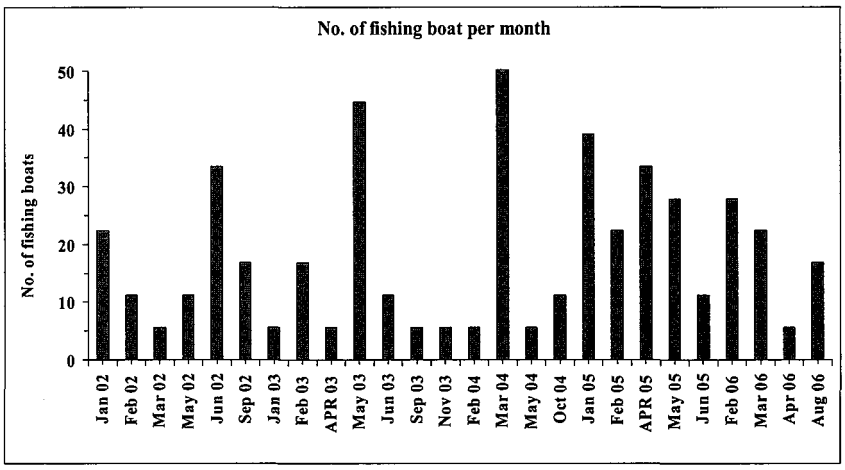


Fig. 23 Fishing effort of squid cast net with light luring in Pakklong Sub-district.

The fishing ground for the Indo-pacific mackerel gill net is at 3-22 m depth waters around Eiang island, Pra island, Rung island, Sikong island, Talu island, Singha island, Ran-ped Ran-kai island, Thungmaha bay, Bang-bird bay and Thum-thong bay. (Fig. 24)

The average fishing boats per month in 2002, 2003, 2004, 2005 and 2006 were 17, 14, 18, 27 and 18 boats, respectively. (Table 13)

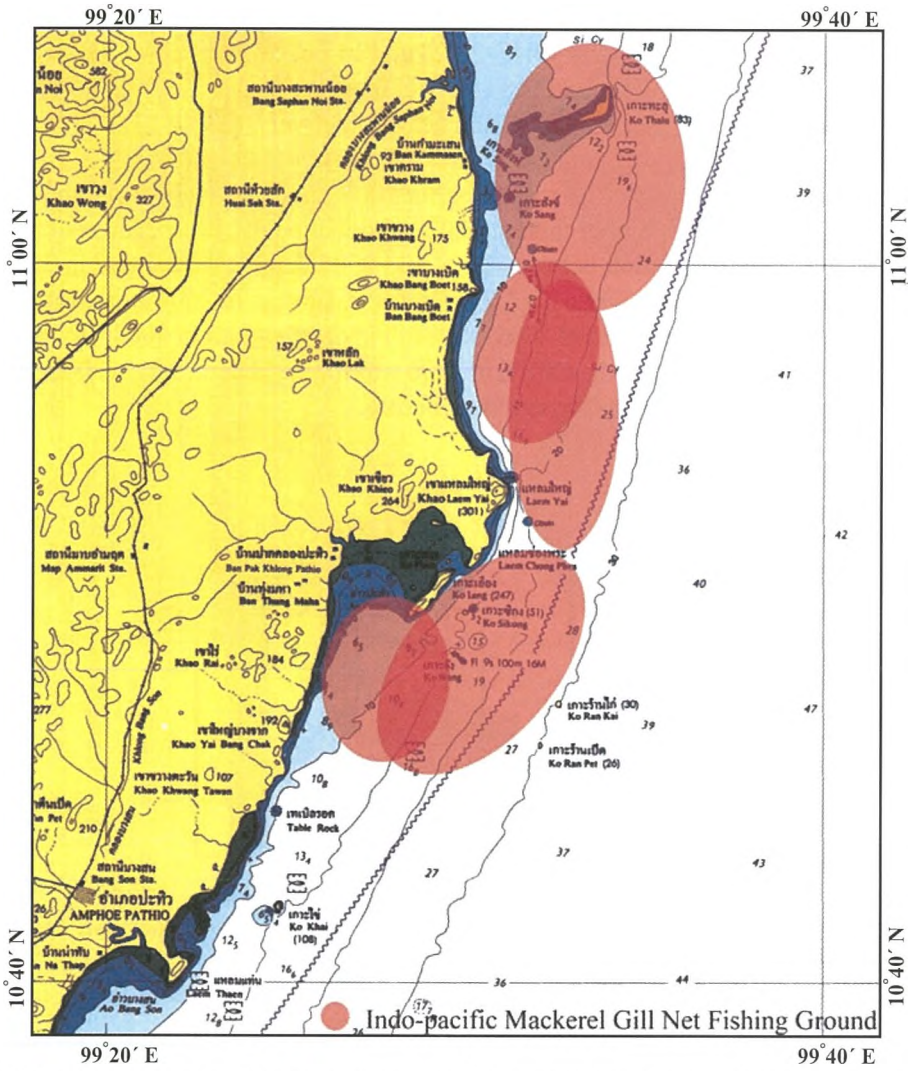


Fig. 24 Fishing ground of Indo-pacific mackerel gill net fisheries in Pakklong Sub-district

4.3 Catch rate of the Indo-pacific mackerel gill net

The average of all species and Indo-pacific mackerel per 100 m net fluctuated. High catch rate was observed during the first period of the year, i.e. in January and March 2002, February and April 2003, February 2005 and February 2006. (Fig. 25)

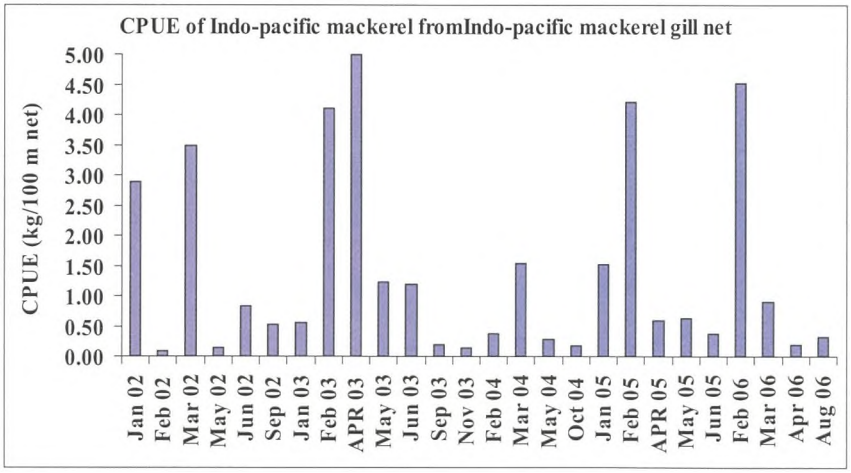


Fig. 25 CPUE of Indo-pacific mackerel from Indo-pacific mackerel gill net in Pakklong Sub-district

The CPUEs of all species and Indo-pacific mackerel per trip in 2002, 2003, 2004, 2005, and 2006 were 23.77 and 10.66, 33.55 and 23.34, 24.98 and 14.47, 23.24 and 14.66, 48.34 and 41.88 kg/trip, respectively. The CPUEs per 100 m net of all species and Indo-pacific mackerel were 2.14 and 0.96, 2.40 and 1.67, 2.04 and 1.18, 1.92 and 1.21, 2.61 and 2.26 kg/100m net, respectively. (Table 13)

A comparison of the CPUE of Indo-pacific mackerel per 100 m net and average fishing boats (Fig. 26) showed that the CPUE in 2003 was higher than in 2002 but declined in 2004 because of high number of fishing boats. However, the comparison between 2004 and 2005 data indicated that in 2005 the highest number of fishing boats was recorded while the CPUE was the same as in 2004 suggesting that the Indo-pacific mackerel in Pakklong Sub-district in 2005 was high in density than in 2004. In 2006, the number of fishing boats declined until 2004 but the CPUE in 2006 was higher. Therefore, in 2005-2006, the Indo-pacific mackerel resource was higher in density than before.

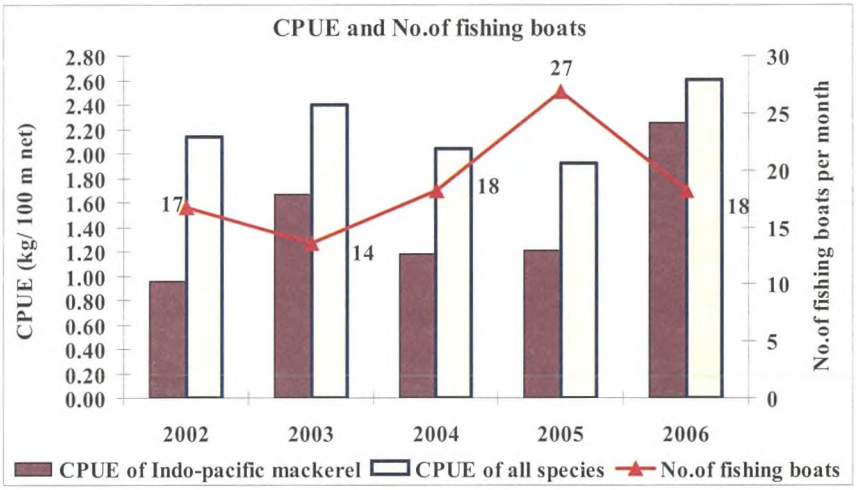


Fig. 26 CPUE and number of fishing boats of Indo-pacific mackerel gill net in Pakklong Sub-district

4.4 Species composition and size composition

Species composition of catch from the Indo-pacific mackerel gill net comprised mostly the Indo-pacific mackerel. In 2002, the composition was: 44.86% Indo-pacific mackerel, 26.84% other pelagic fish, 13.33% demersal fish, 6.00% others, 5.72% crab, 3.03% squid and 0.23% shrimp. In 2003, the composition was: 69.58% Indo-pacific mackerel, 17.23% demersal fish, 10.48% other pelagic fish, and 2.71% others. In 2004, the composition was: 57.92% Indo-pacific mackerel, 29.92% other pelagic fish, 7.91% others and 4.25% demersal fish. In 2005, 63.08% Indo-pacific mackerel, 18.04% demersal fish,16.42 % other pelagic fish, 2.25% others, 0.10% crab, 0.09% squid and 0.02% shrimp; and in 2006 86.64% Indo-pacific mackerel, 4.53 % others, 4.32% other pelagic fish, 4.12% demersal fish and 0.39% crab, respectively. (Fig. 27 and Table14)

The average total length of the Indo-pacific mackerel were 16.22-20.61 cm. The average total length in 2002, 2003, 2004, 2005 and 2006 were 17.63, 17.52, 17.72, 17.40, and 17.63 cm, respectively (Table 14). A comparison between the average total length and the first maturity size of *Rastrelliger brachysoma* at 18.49 cm (Ratana, 2001) is shown in Fig. 28, which indicated that the Indo-pacific mackerel catch from Pakklong Sub-district using 3.5 inch mesh size net was mostly smaller than first maturity size.

Table 14 shows the age (t) and total length ( ) of *Rastrelliger brachysoma* from Indo-pacific mackerel gill net by $L_t = 21.24(1-e^{-3.72(t+0.0025)})$ (Damri, 1990) eguation *Rastrelliger brachysoma* age between 4.6 – 11.3 months old were caught in this area.

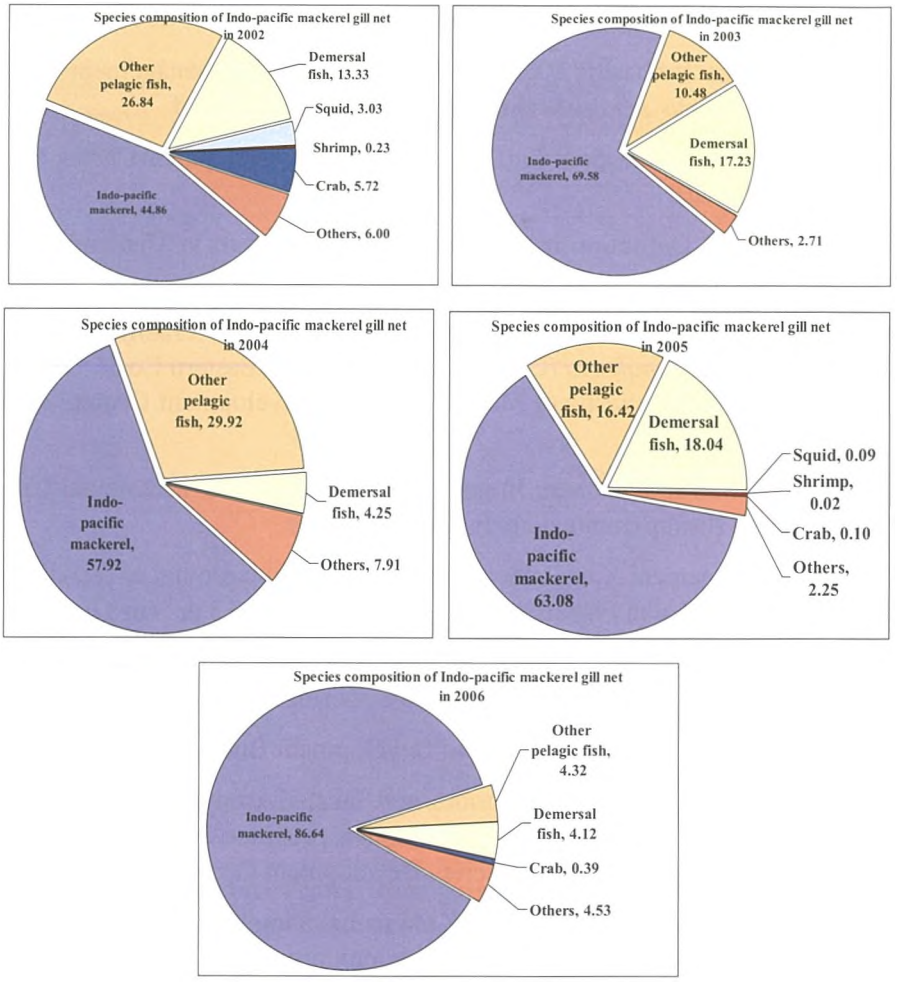


Fig. 27 Species composition of catch from Indo-pacific mackerel gill net in Pakklong Sub-district

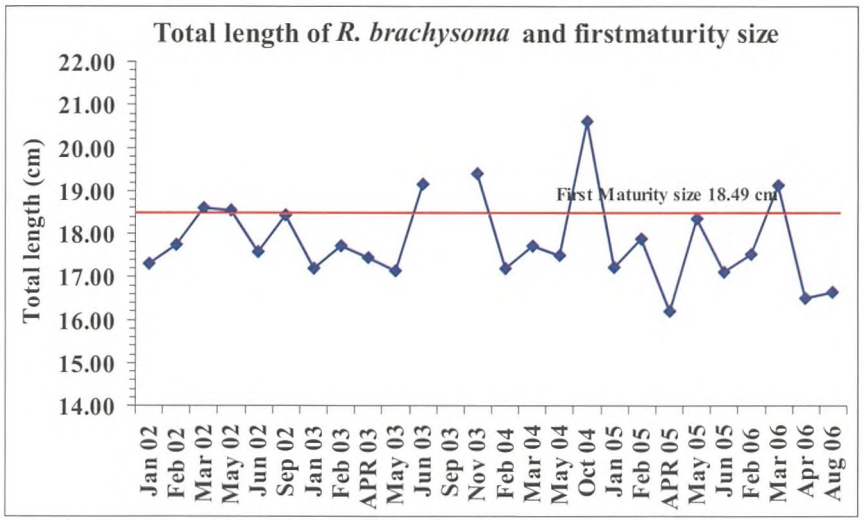


Fig. 28 Average total length of *R.brachysoma* from Indo-pacific mackerel gill net in Pakklong Sub-district compare to first maturity size

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Table 1 CPUEs of all species and shrimp of catch from shrimp trammel net in Pakklong Sub-district

Month	No.of fishing boats	CPUE of all species (kg/100 m net)	CPUE of shrimp (kg/100 m net)	CPUE of *P.merguiensis* (kg/100 m net)	CPUE of other shrimp (kg/100 m net)
January 02	18	0.58	0.58	0.11	0.47
August 02	7	0.18	0.09	0.09	0.00
Average	13	0.53	0.52	0.11	0.41
November 02	32	0.18	0.14	0.11	0.03
December 02	18	0.46	0.17	0.16	0.01
January 03	28	0.43	0.18	0.13	0.05
February 03	4	0.59	0.11	0.11	0.00
Average	**21**	**0.36**	**0.16**	**0.13**	**0.03**
November 03			No Data		
December 03	63	0.57	0.55	0.45	0.10
January 04	7	0.25	0.12	0.12	0.00
February 04			No Data		
Average	**35**	**0.54**	**0.51**	**0.42**	**0.09**
November 04	53	0.86	0.24	0.21	0.03
December 04			No Data		
January 05	21	1.55	0.40	0.16	0.24
February 05			No Data		
Average	**37**	**1.07**	**0.29**	**0.20**	**0.09**
November 05	21	3.01	0.47	0.39	0.08
December 05	21	2.91	0.63	0.29	0.34
January 06			No Data		
February 06			No Data		
Average	**21**	**2.95**	**0.56**	**0.33**	**0.23**

Table 2 Species composition of catch from shrimp trammel net in Pakklong Sub-district

Month	Percentage													
	P. merguiensis	*P. monodon*	*P. semisulcatus*	*P. japonicus*	*P. latisulcatus*	*P. longistylus*	*M. ensis*	*M. affinis*	*M. intermedius*	Other shrimp	Crab	fish	Other	Total shrimp
January 02	18.80	3.17	0.00	0.00	0.00	0.00	0.00	72.11	0.00	5.92	0.00	0.00	0.00	100.00
August 02	44.52	1.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.01	43.81	0.00	46.18
November 02	65.16	9.30	0.69	0.20	0.30	0.00	0.00	5.56	0.00	0.00	1.13	17.66	0.00	81.21
December 02	33.38	0.00	0.59	0.00	0.00	0.00	0.00	1.74	0.00	0.00	0.00	64.29	0.00	35.71
January 03	28.15	1.04	0.44	0.00	7.41	1.88	0.00	1.81	0.00	0.00	0.00	59.27	0.00	40.73
February 03	18.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.03	0.00	18.97
December 03	79.71	0.54	0.00	0.00	0.00	0.00	0.00	16.53	0.00	0.23	0.00	2.99	0.00	97.01
January 04	50.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.03	0.00	12.34	50.63
November 04	24.40	2.45	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00	0.00	72.18	0.00	27.82
January 05	10.39	2.81	0.15	0.00	0.89	0.00	0.00	11.63	0.00	0.15	4.61	68.83	0.54	26.02
November 05	12.70	0.74	0.16	0.00	0.62	0.00	0.34	0.94	0.00	0.00	1.84	77.39	5.27	15.50
December 05	10.07	0.00	0.00	0.00	0.15	0.00	0.00	11.43	0.00	0.00	0.00	78.35	0.00	21.65
Average	**26.30**	**1.49**	**0.12**	**0.00**	**0.66**	**0.10**	**0.06**	**11.25**	**0.00**	**0.43**	**1.20**	**57.48**	**0.91**	**40.41**

Table 3 Size composition of *P.merguiensis* and *M.affinis* from shrimp trammel net in Pakklong Sub-district

Month	Total length of *P. merguiensis* (cm)			Total length of *M. affinis* (cm)		
	Min - Max	Mode	Mean	Min - Max	Mode	Mean
January 02	14.00 - 19.50	17.75	16.46	10.00 - 19.00	12.75	13.07
August 02	12.00 - 18.50	15.75	15.07		No Data	
Average			**15.91**			**13.07**
November 02	12.00 - 20.50	14.75, 15.25	15.33	10.00 - 15.00	12.25	12.17
December 02	13.50 - 19.00	15.25	16.25	10.00 - 14.50	12.25	12.48
January 03	13.50 - 20.50	16.25	16.83	8.50 - 13.50	10.75,11.25,12.25,12.75	11.50
February 03	15.50 - 18.00	17.25	17.00		No Data	
Average			**16.08**			**11.98**
November 03				No Data		
December 03	11.50 - 21.00	15.75	16.21	7.00 - 15.00	12.25	12.31
January 04	10.50 - 19.50	16.25, 16.75	15.50		No Data	
February 04				No Data		
Average			**16.08**			**12.31**
November 04	12.50 - 23.00	17.25	17.63	7.00 - 15.00	12.25	12.15
December 04				No Data		
January 05	12.50 -24.00	15.25	16.56	7.00 - 15.00	13.25	12.75
February 05				No Data		
Average			**17.50**			**12.58**
November 05	10.00 - 21.00	11.75	12.73	8.50 - 14.00	11.75	11.92
December 05	13.00 - 23.50	16.25	17.74	10.00 - 17.00	12.75, 13.25	12.60
January 06				No Data		
February 06				No Data		
Average			**13.69**			**12.54**
Total average			**16.15**			**12.57**

Table 4 Total length and age of *P.merguiensis* from shrimp trammel net in Pakklong Sub-district

Month	Total length of *P. merguiensis* (cm)	Fraction of year	Age of *P. merguiensis* (months)	% smaller than first maturity size	% bigger than first maturity size
January 02	16.46	0.73	8.7	7.69	92.31
August 02	15.07	0.63	7.5	35.29	64.71
November 02	15.33	0.65	7.7	20.78	79.22
December 02	16.25	0.71	8.5	4.62	95.38
January 03	16.83	0.75	9.1	6.12	93.88
February 03	17.00	0.77	9.2	0.00	100.00
December 03	16.21	0.71	8.5	5.80	94.20
January 04	15.50	0.66	7.9	31.25	68.75
November 04	17.63	0.82	9.8	3.60	96.40
January 05	16.56	0.73	8.8	8.06	91.94
November 05	12.73	0.49	5.9	88.11	11.89
December 05	17.74	0.83	10.0	3.70	96.30
Average	**16.15**	**0.70**	**8.4**	**22.95**	**77.05**

Table 5 Number of fishing boats, CPUEs of all species and squids, fishing effort of squid cast net with light luring in Pakklong Sub-district

Month	No. of fishing boats	CPUE of all species (kg/trip)	CPUE of squid (kg/trip)	CPUE of all species (kg/haul)	CPUE of squid (kg/haul)	Fishing Effort per month (days)
Jan 02				No Data		
Feb 02	5	46.85	46.67	15.62	15.56	113
Mar 02	17	37.25	36.20	5.40	5.25	340
Apr 02	12	20.00	19.37	3.33	3.23	230
May 02	15	35.64	35.56	7.29	7.27	287
Jun 02	5	29.67	26.33	7.42	6.58	78
Jul 02				No Data		
Aug 02	12	44.29	42.90	7.75	7.51	240
Sep 02	12	56.43	56.43	8.59	8.59	240
Oct 02	9	45.00	45.00	7.76	7.76	180
Nov 02	9	52.00	52.00	10.83	10.83	180
Dec 02	2	8.30	8.30	2.08	2.08	40
Average		**41.10**	**39.70**	**7.09**	**6.83**	**193**
Jan 03	41	57.08		No Data		144
Feb 03	68	110.94	62.84	8.41	4.76	374
Mar 03	95	65.25	65.25	12.14	12.14	732
Apr 03	103	60.23	60.23	7.71	7.71	1082
May 03	89	37.91		No Data		258
Jun 03	69	31.88	31.88	3.75	3.75	345
Jul 03	79	39.57	35.31	9.05	8.08	442
Aug 03	69	25.77	25.77	5.22	5.22	338
Sep 03	69	54.70	54.70	11.71	11.71	987
Oct 03	102	62.71	62.71	15.90	15.90	520
Nov 03	7	46.19		No Data		21
Dec 03	20	49.41		No Data		34
Average		**56.64**	**52.87**	**10.70**	**9.99**	**440**
Jan 04	20	98.46	95.62	18.09	17.57	26
Feb 04	5	91.58	74.15	17.39	14.08	19
Mar 04	64	65.56	44.29	17.37	11.73	250
Apr 04	53	36.23	35.45	7.86	7.69	223
May 04	13	5.00	5.00	1.67	1.67	49
Jun 04				No Data		
Jul 04	25	123.80	53.01	28.14	12.05	195
Aug 04	68	59.25	46.25	8.78	6.85	381
Sep 04	41	91.76	55.71	16.06	9.75	172
Oct 04	64	49.67	36.27	11.99	8.76	154
Nov 04	32	33.10	31.84	8.27	7.96	96
Dec 04				No Data		
Average		**55.51**	**36.97**	**13.86**	**9.23**	**157**
Jan 05				No Data		
Feb 05	89	28.33	27.05	5.96	5.69	227
Mar 05	99	55.29	53.66	9.76	9.47	574
Apr 05	109	19.10	18.80	4.15	4.09	164
May 05	47	43.29	39.00	7.77	7.00	172
Jun 05	68	34.70	31.33	6.94	6.27	476
Jul 05	65	10.00	10.00	2.50	2.50	206
Aug 05	61	23.75	23.75	6.33	6.33	305
Sep 05	73	35.67	33.83	6.29	5.97	219
Oct 05	No Data	38.38	24.00	10.23	6.40	No Data
Nov 05				No Data		
Dec 05				No Data		
Average		**34.74**	**33.04**	**7.12**	**6.77**	**293**
Jan 06	109	28.17	23.56	5.63	4.71	109
Feb 06				No Data		
Mar 06	89	107.27	80.80	15.73	11.85	356
Apr 06	92	124.49	38.32	24.29	7.48	594
May 06	58	20.50	12.80	4.88	3.05	167
Jun 06	109			No Data		109
Jul 06				No Data		
Aug 06	No Data	63.60	36.20	13.25	7.54	No Data
Sep 06				No Data		
Average		**88.48**	**41.80**	**14.72**	**6.95**	**267**

Table 6 Species composition of squid cast net with light luring in Pakklong Sub-district

Month	Percentage			
	L. duvaucelli	Other squids	Pelagic fish	Others
Jan 02		No Data		
Feb 02	99.61	0.39		
Mar 02	97.19	0.13	2.68	
Apr 02	96.86	3.14		
May 02	99.76	0.06	0.07	0.11
Jun 02	88.76		11.24	
Jul 02				
Aug 02	96.88		3.12	
Sep 02	100			
Oct 02	100			
Nov 02	100			
Dec 02	100			
Average	**98.58**	**0.24**	**1.17**	**0.01**
Jan 03		No Data		
Feb 03	56.64		43.36	
Mar 03	100			
Apr 03	100			
May 03		No Data		
Jun 03	100			
Jul 03	89.23	10.77		
Aug 03	100			
Sep 03	100			
Oct 03	100			
Nov 03		No Data		
Dec 03		No Data		
Average	**93.35**	**0.63**	**6.02**	**0.00**
Jan 04	97.12	0.41	2.47	
Feb 04	80.97	0.51	18.52	
Mar 04	67.56	0.06	32.38	
Apr 04	97.84		2.16	
May 04	100			
Jun 04		No Data		
Jul 04	42.82	0.64	56.54	
Aug 04	78.06		21.94	
Sep 04	60.72	0.03	39.25	
Oct 04	73.03		26.97	
Nov 04	96.2		3.8	
Dec 04		No Data		
Average	**66.60**	**0.24**	**33.16**	**0.00**
Jan 05		No Data		
Feb 05	95.49	0.53	3.98	
Mar 05	97.06	0.32	2.62	
Apr 05	98.43	1.57		
May 05	90.1	2.31	7.59	
Jun 05	90.29	0.83	8.88	
Jul 05	100	0	0	
Aug 05	100	0	0	
Sep 05	94.86	0	5.14	
Oct 05	62.54	2.61	34.85	
Nov 05		No Data		
Dec 05		No Data		
Average	**95.10**	**0.60**	**4.30**	**0.00**
Jan 06	83.64	1.14	15.11	0.11
Feb 06		No Data		
Mar 06	75.32	0.27	24.41	
Apr 06	30.78	0.2	69.02	
May 06	62.44		36.9	0.66
Jun 06		No Data		
Jul 06		No Data		
Aug 06	56.92		43.08	
Sep 06		No Data		
Average	**47.25**	**0.24**	**52.49**	**0.02**

Table 7 Total catch and size composition of catch from squid cast net with light luring in Pakklong Sub-district

Month	All species total catch (tons)	Squid total catch (tons)	Mantle length (cm)		
			Min - Max	Mode	Average
Jan 02			No Data		
Feb 02	5.31	5.29	3.50 - 13.50	9.75	9.36
Mar 02	12.66	12.31	5.00 - 17.50	11.25	10.66
Apr 02	4.59	4.45	4.50 - 21.00	7.75	9.31
May 02	10.22	10.19	6.50 - 20.00	10.75	11.2
Jun 02	2.32	2.06	4.50 - 12.50	5.75	7.86
Jul 02			No Data		
Aug 02	10.63	10.30	1.50 - 19.50	5.25	6.58
Sep 02	13.54	13.54	3.00 - 18.50	4.75	8.84
Oct 02	8.10	8.10	4.00- 20.00	9.75	10.86
Nov 02	9.36	9.36	7.00 - 19.50	10.75	11.03
Dec 02	0.33	0.33	6.50 - 21.00	10.75	13.81
Average (Sum)	**(77.07)**	**(75.94)**			**9.11**
Jan 03	8.22		No Data		
Feb 03	41.49	23.50	5.00 - 19.00	9.25	9.67
Mar 03	47.76	47.76	4.00 - 20.00	6.25	9.67
Apr 03	65.17	65.17	5.00 - 22.50	10.75	11.98
May 03	9.78		No Data		
Jun 03	11.00	11.00	7.00 - 14.50	7.75	10.42
Jul 03	17.49	15.61	4.00 - 14.50	8.25	7.98
Aug 03	8.71	8.71	3.50 - 16.00	7.75	7.75
Sep 03	53.99	53.99	5.00 - 18.00	9.25	9.55
Oct 03	32.61	32.61	3.50 - 19.00	8.25	8.6
Nov 03	0.97		No Data		
Dec 03	1.68		No Data		
Average (Sum)	**(298.89)**	**(279.01)**			**9.45**
Jan 04	2.56	2.49	3.50 - 19.50	10.75	10.18
Feb 04	1.74	1.41	4.00 - 20.00	7.25	8.07
Mar 04	16.39	11.07	6.00 - 22.00	7.25	11.34
Apr 04	8.08	7.90	6.00 - 19.00	11.75	13.81
May 04	0.25	0.25	7.00 - 22.00	9.75	11.66
Jun 04			No Data		
Jul 04	24.14	10.34	4.50 - 16.00	11.25	11.01
Aug 04	22.57	17.62	3.50 - 15.50	12.75	9.94
Sep 04	15.78	9.58	3.50 - 23.00	10.75	10.19
Oct 04	7.65	5.59	3.50 - 21.50	10.75	9.33
Nov 04	3.18	3.06	3.00 - 18.00	8.75	8.96
Dec 04			No Data		
Average (Sum)	**(102.34)**	**(69.30)**			**9.97**
Jan 05			No Data		
Feb 05	6.43	6.14	4.00 - 22.00	11.25	11.37
Mar 05	31.74	30.80	4.50 - 21.00	8.75	9.59
Apr 05	3.13	3.08	4.00 - 19.00	6.25	8.52
May 05	7.45	6.71	4.50 - 40.00	7.75	7.99
Jun 05	16.52	14.91	4.00 - 19.50	7.75	9.26
Jul 05	2.06	2.06	7.00 - 17.50	11.25	12.28
Aug 05	7.24	7.24	4.50 - 21.50	11.25	11.38
Sep 05	7.81	7.41	4.50 - 20.00	8.75	8.77
Oct 05	No Data		4.00 - 21.00	9.25	9.21
Nov 05			No Data		
Dec 05			No Data		
Average (Sum)	**(82.38)**	**(78.36)**			**9.24**
Jan 06	3.07	2.57	5.00 - 17.50	9.75	10.53
Feb 06			No Data		
Mar 06	38.19	28.76	4.00 - 18.50	8.25	8.07
Apr 06	73.94	22.76	4.50 - 21.00	9.75	10.68
May 06	3.42	2.14	4.50 - 22.00	7.75	10.07
Jun 06			No Data		
Jul 06			No Data		
Aug 06	No Data		5.00 - 21.00	9.75	10.39
Sep 06			No Data		
Average					**10.52**

Table 8 Age and percentage of *L.duvaucelli* smaller than first maturity size from squid cast net with light luring in Pakklong Sub-district

Month	Average mantle length (cm)	Fraction of year	Age (months)	Smaller than first maturity size (%)	Bigger than first maturity size (%)
Jan 02			No Data		
Feb 02	9.36	0.26	3.1	31.24	68.76
Mar 02	10.66	0.31	3.7	11.38	88.62
Apr 02	9.31	0.26	3.1	56.95	43.05
May 02	11.2	0.33	4.0	5.43	94.57
Jun 02	7.86	0.21	2.5	54.05	45.95
Jul 02			No Data		
Aug 02	6.58	0.17	2.1	87.82	12.18
Sep 02	8.84	0.24	2.9	40.13	59.87
Oct 02	10.86	0.32	3.8	24.94	75.06
Nov 02	11.03	0.32	3.9	15.47	84.53
Dec 02	13.81	0.44	5.3	2.50	97.50
Average	**9.11**	**0.25**	**3.0**	**44.46**	**55.54**
Jan 03			No Data		
Feb 03	9.67	0.27	3.3	23.43	76.57
Mar 03	9.67	0.27	3.3	44.50	55.50
Apr 03	11.98	0.36	4.3	12.38	87.62
May 03			No Data		
Jun 03	10.42	0.30	3.6	22.14	77.86
Jul 03	7.98	0.22	2.6	47.92	52.08
Aug 03	7.75	0.21	2.5	67.91	32.09
Sep 03	9.55	0.27	3.2	22.36	77.64
Oct 03	8.6	0.24	2.8	39.03	60.97
Nov 03			No Data		
Dec 03			No Data		
Average	**9.45**	**0.27**	**3.2**	**31.94**	**68.06**
Jan 04	10.18	0.29	3.5	28.27	71.73
Feb 04	8.07	0.22	2.6	61.82	38.18
Mar 04	11.34	0.34	4.0	23.39	76.61
Apr 04	13.81	0.44	5.3	6.59	93.41
May 04	11.66	0.35	4.2	11.63	88.37
Jun 04			No Data		
Jul 04	11.01	0.32	3.9	13.42	86.58
Aug 04	9.94	0.28	3.4	31.79	68.21
Sep 04	10.19	0.29	3.5	25.83	74.17
Oct 04	9.33	0.26	3.1	44.25	55.75
Nov 04	8.96	0.25	3.0	41.48	58.52
Dec 04			No Data		
Average	**9.97**	**0.28**	**3.4**	**38.00**	**62.00**
Jan 05			No Data		
Feb 05	11.37	0.34	4.0	11.90	88.10
Mar 05	9.59	0.27	3.2	34.15	65.85
Apr 05	8.52	0.23	2.8	58.10	41.90
May 05	7.99	0.22	2.6	83.13	16.87
Jun 05	9.26	0.26	3.1	53.54	46.46
Jul 05	12.28	0.37	4.5	17.65	82.35
Aug 05	11.38	0.34	4.0	27.58	72.42
Sep 05	8.77	0.24	2.9	46.38	53.62
Oct 05	9.21	0.26	3.1	42.11	57.89
Nov 05			No Data		
Dec 05			No Data		
Average	**9.24**	**0.26**	**3.1**	**50.36**	**49.64**
Jan 06	10.53	0.30	3.7	7.58	92.42
Feb 06			No Data		
Mar 06	8.07	0.22	2.6	64.15	35.85
Apr 06	10.68	0.31	3.7	19.11	80.89
May 06	10.07	0.29	3.4	38.15	61.85
Jun 06			No Data		
Jul 06			No Data		
Aug 06	10.39	0.30	3.6	26.90	73.10
Sep 06			No Data		
Average	**10.52**	**0.30**	**3.6**	**41.63**	**58.37**

Table 9 Number of fishing boats, CPUEs of all species and Blue swimming crab and operation days per month of collapsible crab trap fisheries in Pakklong Sub-district

Month	No. of fishing boats	All species CPUE (kg/10 traps)	Blue swimming crab CPUE (kg/10 traps)	Operation days per month (days)
Jan 02			No Data	
Feb 02	20	0.60	0.58	15.45
Mar 02	19	0.58	0.56	21.42
Apr 02	21	0.88	0.88	24.14
May 02	19	0.41	0.40	22.79
Jun 02	18	0.83	0.83	22.50
Jul 02	19	0.75	0.75	21.16
Aug 02	21	0.55	0.55	22.19
Sep 02	21		No Data	21.67
Oct 02	25	0.41	0.37	20.40
Nov 02	23	0.56	0.53	16.52
Dec 02	24	0.56	0.52	19.96
Average		**0.59**	**0.57**	**20.67**
Jan 03	11	0.24	0.20	17.82
Feb 03	26	0.24	0.22	18.00
Mar 03	26	0.53	0.45	30.00
Apr 03	26	0.85	0.84	30.00
May 03	13	0.62	0.59	27.23
Jun 03	13	0.48	0.48	29.23
Jul 03	13	0.56	0.56	29.77
Aug 03	13	0.65	0.65	25.23
Sep 03	10	0.40	0.40	23.70
Oct 03	26	0.52	0.45	26.50
Nov 03	20		No Data	5.35
Dec 03	26	0.30	0.12	27.50
Average		**0.52**	**0.47**	**24.34**
Jan 04	19	0.37	0.30	10.20
Feb 04	19	0.27	0.22	13.40
Mar 04	13	0.58	0.58	12.25
Apr 04	10	1.07	1.07	28.33
May 04	13	1.03	1.03	28.75
Jun 04	13	0.30	0.30	27.00
Jul 04	20	1.06	1.05	21.25
Aug 04	26	0.39	0.39	30.25
Sep 04	26	0.62	0.62	27.00
Oct 04	26	0.70	0.68	30.75
Nov 04	26	0.47	0.45	29.75
Dec 04	26	0.32	0.31	28.25
Average		**0.65**	**0.63**	**24.64**
Jan 05	26	0.56	0.50	24.50
Feb 05	26	0.42	0.37	27.00
Mar 05	26	0.58	0.49	29.50
Apr 05	26	0.48	0.46	29.50
May 05	26	0.34	0.32	30.50
Jun 05	26	0.49	0.46	29.27
Jul 05	26		No Data	30.77
Aug 05	26	0.60	0.54	29.77
Sep 05	26	1.08	1.05	29.50
Oct 05	26	0.83	0.79	17.77
Nov 05	26	0.73	0.64	26.08
Dec 05	24	0.33	0.28	16.92
Average		**0.61**	**0.56**	**26.82**
Jan 06	17	0.45	0.33	22.82
Feb 06	14	0.41	0.32	26.50
Mar 06	16	0.52	0.43	30.19
Apr 06	26	0.93	0.90	29.15
May 06	26	0.71	0.70	29.65
Jun 06	23	0.77	0.62	29.87
Jul 06	22	0.39	0.32	25.32
Aug 06	22	0.59	0.53	24.32
Sep 06	26	0.67	0.65	25.85
Average		**0.62**	**0.55**	**27.20**

Table 10 Species composition of collapsible crab trap fisheries in Pakklong Sub-district

Month	Percentage									
	Blue swimming crab	3 spots swimming crab	Crucifix crab	Ridged swimming crab	Sentinel crab	Other crab	Fish	Shrimp	Mantis shrimp	Others
Jan 02	No Data									
Feb 02	96.57		3.43							
Mar 02	97.06		2.94							
Apr 02	100.00									
May 02	97.32					2.03	0.28	0.37		
Jun 02	100.00									
Jul 02	98.88		1.12							
Aug 02	100.00									
Sep 02	No Data									
Oct 02	88.44		0.94							10.62
Nov 02	96.00	4.00								
Dec 02	92.59	5.19	2.22							
Average	**97.02**	**0.65**	**1.04**			**0.21**	**0.03**	**0.04**		**1.01**
Jan 03	84.44	8.89	6.67							
Feb 03	94.09		5.45			0.46				
Mar 03	85.98	2.52	3.62				7.88			
Apr 03	98.99		1.01							
May 03	95.10	4.49				0.41				
Jun 03	100.00									
Jul 03	100.00									
Aug 03	100.00									
Sep 03	100.00									
Oct 03	85.88					14.12				
Nov 03	No Data									
Dec 03	40.00			60.00						
Average	**95.34**	**0.76**	**0.76**	**1.96**		**1.02**	**0.16**			
Jan 04	79.59	18.37				2.04				
Feb 04	81.58		5.79	5.26		0.79				6.58
Mar 04	99.25					0.75				
Apr 04	100.00									
May 04	100.00									
Jun 04	100.00									
Jul 04	98.65						1.35			
Aug 04	100.00									
Sep 04	100.00									
Oct 04	97.38			0.14		0.50	1.26			0.72
Nov 04	95.84		4.16							
Dec 04	98.29		0.55	1.16						
Average	**97.29**	**0.96**	**0.49**	**0.26**	**0.00**	**0.27**	**0.35**			**0.37**
Jan 05	89.49	0.94	0.77	7.77		0.52				0.51
Feb 05	86.81	0.73	7.90	3.80			0.76			
Mar 05	84.76	0.30	8.70	5.31			0.42			0.51
Apr 05	95.54	3.34	0.05	1.07						
May 05	94.77	0.66		3.65			0.92			
Jun 05	93.14	2.71		3.98		0.17				
Jul 05	No Data									
Aug 05	89.42		0.81	9.77						
Sep 05	97.02			1.45		1.53				
Oct 05	96.01			1.26		2.58	0.15			
Nov 05	88.46	1.23	0.57	6.81	0.38	1.61	0.94			
Dec 05	82.87	5.30	2.18	3.74			4.98	0.93		
Average	**91.98**	**0.88**	**1.65**	**3.96**	**0.04**	**0.96**	**0.40**	**0.03**		**0.10**
Jan 06	72.87			24.26		1.35	0.82			0.70
Feb 06	78.42	1.22	2.41	14.52			2.12			1.31
Mar 06	83.55	0.31	1.67	14.47						
Apr 06	97.11	0.73		1.32		0.54	0.12			0.18
May 06	98.55			0.47			0.98			
Jun 06	80.40			19.60						
Jul 06	81.38	1.44	1.60	10.85		0.48	4.25			
Aug 06	89.60			1.40		8.97	0.03			
Sep 06	96.26		0.54	3.20						
Average	**89.76**	**0.37**	**0.50**	**7.66**		**0.91**	**0.57**			**0.23**

Table 11 Size composition and age of crab from collapsible crab trap fisheries in Pakklong Sub-district

Month	Male crab (cm)				Female crab (cm)			
	Min-Max	Mode	Average	Age (months)	Min-Max	Mode	Average	Age (months)
Jan 02	No Data							
Feb 02	6.00 - 13.50	11.25	10.10	5.3	6.50 - 14.00	11.25	10.57	5.7
Mar 02	8.00 - 13.00	11.25	10.66	5.8	7.00 - 14.00	11.25	10.77	5.9
Apr 02	6.00 - 10.50	8.25	8.30	3.9	6.50 - 13.00	8.75	9.06	4.4
May 02	5.00 - 11.00	8.75	8.64	4.1	6.00 - 10.50	9.25	8.79	4.2
Jun 02	4.00 - 10.00	7.25	7.52	3.3	7.00 - 11.00	8.75	8.83	4.3
Jul 02	7.50 - 12.00	9.25	9.35	4.7	6.00 - 11.50	9.75	9.45	4.7
Aug 02	7.00 - 12.00	9.25	9.07	4.4	7.00 - 11.50	9.75	9.40	4.7
Sep 02	No Data							
Oct 02	8.00 - 14.00	12.75	11.47	6.6	7.50 - 14.00	11.75	11.09	6.2
Nov 02	7.50 - 12.50	9.25	9.90	5.1	7.50 - 12.50	10.25	10.16	5.3
Dec 02	6.50 - 11.50	8.25	8.65	4.1	6.00 - 12.50	8.25	8.80	4.2
Average			**9.09**				**9.43**	
Jan 03	6.50 - 11.50	9.75	8.75	4.2	6.50 - 12.00	9.25	9.19	4.5
Feb 03	6.00 - 14.00	9.25	9.37	4.7	7.00 - 13.50	8.25	9.53	4.8
Mar 03	5.50 - 13.50	7.75	8.54	4.0	6.00 - 13.00	8.25	9.08	4.5
Apr 03	7.00 - 13.50	10.25	9.74	5.0	7.00 - 14.00	8.75	10.07	5.3
May 03	4.50 - 10.00	7.25	7.10	3.1	4.50 - 10.50	7.75	7.80	3.5
Jun 03	6.00 - 11.00	8.75	8.22	3.8	5.50 - 11.00	8.25	8.00	3.7
Jul 03	6.00 - 11.00	9.25	9.00	4.4	5.50 - 12.00	9.75	8.92	4.3
Aug 03	7.00 - 12.00	10.75	10.28	5.5	7.50 - 13.00	9.75	10.25	5.4
Sep 03	6.50 - 10.00	8.25	8.00	3.7	6.00 - 11.00	9.25	8.85	4.3
Oct 03	6.50 - 12.00	8.25	8.92	4.3	6.50 - 12.50	8.25	9.10	4.5
Nov 03	No Data							
Dec 03	6.50 - 11.50	8.25	8.55	4.1	6.50 - 11.50	8.25	8.50	4.0
Average			**8.81**				**8.90**	
Jan 04	6.50 - 13.00	8.75	9.36	4.7	6.50 - 16.00	8.25	9.46	4.8
Feb 04	7.00 - 13.00	7.75	9.55	4.8	7.50 - 13.00	8.25	10.01	5.2
Mar 04	6.50 - 13.00	8.25	8.93	4.3	7.50 - 13.00	8.75	9.60	4.9
Apr 04	6.50 - 12.50	8.75	8.96	4.4	6.50 - 14.00	9.75	9.11	4.5
May 04	6.50 - 13.00	8.75	9.12	4.5	4.50 - 14.00	8.25	8.65	4.1
Jun 04	6.00 - 11.00	7.75	7.73	3.5	6.00 - 15.00	7.75	7.98	3.6
Jul 04	6.50 - 12.50	8.25	9.39	4.7	7.00 - 14.50	10.25	9.95	5.2
Aug 04	8.00 - 11.00	8.25	9.00	4.4	7.50 - 12.00	9.25	9.48	4.8
Sep 04	No Data							
Oct 04	5.50 - 12.00	8.75	8.27	3.8	5.50 - 13.00	8.25	8.49	4.0
Nov 04	5.00 - 12.00	7.75	7.72	3.5	5.00 - 16.00	8.25	8.96	4.4
Dec 04	6.50 - 11.50	7.75	8.44	4.0	6.00 - 12.00	8.25	8.87	4.3
Average			**8.67**				**8.88**	
Jan 05	5.50 - 14.00	7.75	8.44	4.0	6.00 - 12.50	8.75	9.02	4.4
Feb 05	6.00 - 13.00	9.25	9.41	4.7	6.00 - 13.00	8.75	9.47	4.8
Mar 05	6.00 - 14.00	8.75	9.70	5.0	6.00 - 13.50	10.25	9.76	5.0
Apr 05	6.50 - 12.00	8.25	8.49	4.0	6.50 - 12.50	8.75	8.72	4.2
May 05	6.50 - 11.00	9.25	8.60	4.1	5.50 - 12.00	9.25	8.60	4.1
Jun 05	5.50 - 11.50	7.75	7.99	3.7	6.00 - 11.50	7.25	8.18	3.8
Jul 05	No Data							
Aug 05	5.50 - 11.00	8.25	8.47	4.0	6.50 - 12.00	8.75	9.11	4.5
Sep 05	6.00 - 10.00	7.75	8.38	3.9	5.50 - 12.00	8.75	8.92	4.3
Oct 05	6.00 - 10.50	8.25	8.25	3.8	5.50 -11.50	8.25	8.60	4.1
Nov 05	5.50 - 12.50	7.75	7.97	3.6	5.50 - 13.00	7.75	8.16	3.8
Dec 05	5.00 - 13.50	7.75	7.76	3.5	5.50 - 12.50	8.25	8.20	3.8
Average			**8.46**				**8.73**	
Jan 06	6.00 - 12.50	7.75	8.09	3.7	6.50 - 12.00	7.75	8.30	3.9
Feb 06	5.00 - 12.50	7.25	8.31	3.9	3.50 - 12.00	8.75	8.19	3.8
Mar 06	4.50 - 10.50	8.75	8.58	4.1	4.50 - 11.50	9.25	8.64	4.1
Apr 06	6.50 - 12.50	7.25	8.63	4.1	5.50 - 11.50	9.25	8.48	4.0
May 06	5.50 - 12.50	8.75	8.30	3.9	5.50 - 12.50	7.75	8.18	3.8
Jun 06	7.50 - 10.50	9.25	9.25	4.6	7.50 - 10.50	8.75	8.97	4.4
Jul 06	5.50 - 13.50	7.75	8.34	3.9	6.00 - 12.50	8.25	8.52	4.0
Aug 06	6.00 - 12.00	7.75	8.29	3.9	7.00 - 11.50	8.75	8.71	4.2
Sep 06	5.00 - 12.00	8.75	8.31	3.9	5.00 - 11.50	8.75	8.27	3.9
Average			**8.40**				**8.39**	

Table 12 Total catch of Blue swimming crab from collapsible crab trap fisheries in Pakklong Sub-district

Month	CPUE of Blue swimming crab (kg/trip)	Fishing day (days/month)	Fishing effort (days/month)	Total catch of Blue swimming crab (tons/month)
Jan 02			No Data	
Feb 02	10.06	15.45	309	3.11
Mar 02	10.35	21.42	407	4.21
Apr 02	11.63	24.14	507	5.90
May 02	6.90	22.79	433	2.99
Jun 02	12.00	22.50	405	4.86
Jul 02	12.86	21.16	402	5.17
Aug 02	9.10	22.19	466	4.24
Sep 02	No Data	21.67	455	No Data
Oct 02	7.08	20.40	510	3.61
Nov 02	9.60	16.52	380	3.65
Dec 02	8.33	19.96	479	3.99
Average (Sum)	**9.60**	**20.67**	**432**	**(41.72)**
Jan 03	3.80	17.82	196	0.74
Feb 03	4.14	18.00	468	1.94
Mar 03	7.80	30.00	780	6.08
Apr 03	16.33	30.00	780	12.74
May 03	11.65	27.23	354	4.12
Jun 03	7.25	29.23	380	2.76
Jul 03	8.00	29.77	387	3.10
Aug 03	13.00	25.23	328	4.26
Sep 03	6.00	23.70	237	1.42
Oct 03	7.30	26.50	689	5.03
Nov 03	No Data	5.35	107	No Data
Dec 03	3.00	27.50	715	2.15
Average (Sum)	**8.49**	**24.34**	**452**	**(44.34)**
Jan 04	6.50	10.20	194	1.26
Feb 04	5.17	13.40	255	1.32
Mar 04	11.00	12.25	159	1.75
Apr 04	24.30	28.33	283	6.88
May 04	26.00	28.75	374	9.72
Jun 04	7.94	27.00	351	2.79
Jul 04	27.50	21.25	425	11.69
Aug 04	7.25	30.25	787	5.71
Sep 04	14.00	27.00	702	9.83
Oct 04	19.43	30.75	800	15.54
Nov 04	8.80	29.75	774	6.81
Dec 04	4.89	28.25	735	3.59
Average (Sum)	**14.44**	**24.64**	**487**	**(76.89)**
Jan 05	12.21	24.50	637	7.78
Feb 05	9.52	27.00	702	6.68
Mar 05	12.57	29.50	767	9.64
Apr 05	11.04	29.50	767	8.47
May 05	8.61	30.50	793	6.83
Jun 05	11.31	29.27	761	8.61
Jul 05	No Data	30.77	800	No Data
Aug 05	13.95	29.77	774	10.80
Sep 05	26.89	29.50	767	20.62
Oct 05	17.95	17.77	462	8.29
Nov 05	11.69	26.08	678	7.93
Dec 05	6.65	16.92	406	2.70
Average (Sum)	**13.54**	**26.82**	**693**	**(98.34)**
Jan 06	8.47	22.82	388	3.29
Feb 06	6.58	26.50	371	2.44
Mar 06	10.44	30.19	483	5.04
Apr 06	22.96	29.15	758	17.40
May 06	18.51	29.65	771	14.27
Jun 06	8.04	29.87	687	5.52
Jul 06	5.10	25.32	557	2.84
Aug 06	11.32	24.32	535	6.06
Sep 06	15.79	25.85	672	10.61
Average	**12.96**	**27.20**	**580**	

Table 13 Number of fishing boats, CPUEs of all species and Indo-pacific mackerel from Indo-pacific mackerel gill net fisheries in Pakklong Sub-district

Month	No. fishing boats per month	CPUE of all species (kg/trip)	CPUE of Indo-pacific mackerel (kg/trip)	CPUE of all species (kg/100 m net)	CPUE of Indo-pacific mackerel (kg/100 m net)
Jan 02	22	25.75	20.85	3.58	2.90
Feb 02	11	30.05	0.81	3.34	0.09
Mar 02	6	60.00	24.43	8.57	3.49
May 02	11	6.35	2.74	0.34	0.14
Jun 02	34	19.08	9.06	1.76	0.84
Sep 02	17	25.83	7.56	1.79	0.52
Average	**17**	**23.77**	**10.66**	**2.14**	**0.96**
Jan 03	6	8.30	5.70	0.83	0.57
Feb 03	17	39.33	36.67	4.40	4.10
APR 03	6	120.00	100.00	6.00	5.00
May 03	45	32.88	19.34	2.09	1.23
Jun 03	11	11.50	9.89	1.40	1.21
Sep 03	6	20.00	3.60	1.11	0.20
Nov 03	6	18.00	3.00	0.87	0.14
Average	**14**	**33.55**	**23.34**	**2.40**	**1.67**
Feb 04	6	16.80	5.00	1.31	0.39
Mar 04	50	28.50	19.57	2.24	1.54
May 04	6	7.00	3.00	0.70	0.30
Oct 04	11	22.23	2.00	2.04	0.18
Average	**18**	**24.98**	**14.47**	**2.04**	**1.18**
Jan 05	39	26.27	16.95	2.36	1.52
Feb 05	22	38.78	32.04	5.10	4.22
APR 05	34	15.62	7.08	1.33	0.60
May 05	28	18.80	10.00	1.20	0.64
Jun 05	11	15.56	6.30	0.93	0.38
Average	**27**	**23.24**	**14.66**	**1.92**	**1.21**
Feb 06	28	96.00	91.40	4.76	4.53
Mar 06	22	25.68	17.20	1.36	0.91
Apr 06	6	5.00	3.88	0.25	0.20
Aug 06	17	13.56	4.93	0.90	0.33
Average	**18**	**48.34**	**41.88**	**2.61**	**2.26**

Table 14 Species composition of catch, total length and age of Indo-pacific mackerel from Indo-pacific mackerel gill net in Pakklong Sub-district

Month	Percentage							Total length (cm)			Age
	Indo-pacific	Other pelagic fish	Demersal	Squid	Shrimp	Crab	Others	Min-Max	Mode	Average	(months)
Jan 02	80.95	4.45	11.54	0.64	0.38	0.42	1.62	15.00 -	17.25	17.30	5.4
Feb 02	2.70	90.11	2.35				4.84	17.50 -	17.75	17.75	5.8
Mar 02	40.72	38.47	1.63				19.18	17.00 -	18.75	18.62	6.7
May 02	42.44	18.97	15.46	4.89		11.01	7.23	17.00 -	18.75	18.55	6.6
Jun 02	47.46	23.91	25.00	3.56	0.07		0.00	14.00 -	17.75	17.58	5.6
Sep 02	29.25	43.64	23.99				3.12	14.50 -	21.75	18.44	6.5
Average	**44.86**	**26.84**	**13.33**	**3.03**	**0.23**	**5.72**	**6.00**			**17.63**	**5.7**
Jan 03	68.67	13.18	16.83				1.32	15.50 -	16.75	17.20	5.3
Feb 03	93.22	1.37	4.96				0.45	16.00 -	17.25	17.72	5.8
APR 03	83.33	2.19	11.99				2.49	16.00 -	16.75	17.46	5.5
May 03	58.84	29.57	10.54				1.05	15.00 -	17.75	17.14	5.3
Jun 03	86.15	5.87	6.96				1.02	17.00 -	18.75	19.17	7.5
Sep 03	18.04	0.00	69.33				12.63	No Data			
Nov 03	16.50	83.50	0.00				0.00	17.50 -	19.25	19.42	7.9
Average	**69.58**	**10.48**	**17.23**	**0.00**	**0.00**	**0.00**	**2.71**			**17.52**	**5.6**
Feb 04	29.76	70.24	0.00				0.00	15.00 -	17.75	17.20	5.3
Mar 04	68.65	21.68	4.99				4.68	16.00 -	17.25	17.72	5.8
May 04	42.86	57.14	0.00				0.00	14.50 -	18.75,	17.50	5.6
Oct 04	9.00	52.00	12.00				27.00	19.00 -	19.25,	20.61	11.3
Average	**57.92**	**29.92**	**4.25**	**0.00**	**0.00**	**0.00**	**7.91**			**17.72**	**5.8**
Jan 05	64.54	11.84	20.90	0.09	0.02	0.10	2.51	13.50 -	17.75	17.24	5.4
Feb 05	82.62	10.78	6.60				0.00	14.50 -	18.25	17.90	5.9
APR 05	45.32	10.64	44.04				0.00	10.00 -	19.25	16.22	4.6
May 05	53.18	18.87	20.24				7.71	15.00 -	18.75	18.36	6.4
Jun 05	40.46	29.95	28.50				1.09	15.00 -	16.75	17.11	5.3
Average	**63.08**	**16.42**	**18.04**	**0.09**	**0.02**	**0.10**	**2.25**			**17.40**	**5.5**
Feb 06	95.21	0.50	4.13				0.16	16.00 -	17.75	17.52	5.6
Mar 06	66.95	23.02	3.67			0.39	5.97	17.50 -	18.75	19.14	7.4
Apr 06	77.60	16.20					6.20	12.00 -	17.25,	16.52	4.8
Aug 06	36.35	9.29	28.56				25.80	15.00 -	16.25	16.65	4.9
Average	**86.64**	**4.32**	**4.12**	**0.00**	**0.00**	**0.39**	**4.53**			**17.63**	**5.7**

ZONING ARRANGEMENT: INTEGRATED COASTAL RESOURCES MANAGEMENT PATHEW DISTRICT, CHUMPHON PROVINCE

Tanadol Chantakhuan
Fisheries Biologist, Chumphon Fisheries Provincial

I. BACKGROUND

The people of Chumphon Province donated a piece of land with an area of 400 rai (62.7 ha) to be made part of a royal property for the disposal of His Majesty the King. The project on Integrated Coastal Resources Management was conducted using the said piece of land that faces the beach, which is about 1.2 km long and part of a sand dune area.

In 2001, His Majesty the King remarked on the need to deploy a land area in order to implement projects aimed at preserving the sand dune for tourism, sustaining biodiversity, conserving the mangroves, developing agriculture on land, and promoting conservation and coastal resource enhancement.

In response to the requirement of His Majesty the King, Chumphon Province therefore, set up the Conservation and Coastal Resources Enhancement Project in Pathew District, Chumphon Province as a royal project. As stipulated in Order 114/2544 (2001) dated 13 June 2001, a committee was established to conduct a comprehensive development plan for the project.

At the beginning of the project, three offices were given their respective responsibilities for the project, as follows:

- Agriculture Department- conduct planting trials in the project site;
- Forestry Department- conserve forest, biodiversity and sand dune etc.;
- Fisheries Department- implement the project under the name Locally-based Coastal Resources Management in Pathew District

II. THE IMPLEMENTATION OF THE LOCALLY BASED COASTAL RESOURCES MANAGEMENT

The implementation of the Locally Based Coastal Resources Management in Pathew District was placed under the Chumphon Provincial Office of Fisheries. Under this Project, the responsibilities of the Office included:

1. Make announcement in Chumphon Province on the "Prohibition of some fishing gear to operate in zoned area of Chumphon waters" on 4 October 2002.

The rationale of the announcement included:

- information dissemination on the project site of the Locally-based Coastal Resources Management Project in Pathew District;
- the zoned area is the spawning and nursery area of economically important aquatic species;
- conservation of small scale fisheries resource

The content of the announcement included:

- The zoned area where some fishing gears are prohibited to operate (map) within an area of 58 km;
- The prohibited fishing gears include:

- Trawler
- Push net
- Cockle cast net (Dredging)

2. Make announcement in Chumphon Province on "the area for green mussel culture". Chumphon Province announced that the permitted area for green mussel culture under the project is at Village no.1 Pakklong Sub district, which has a total area of 318.75 rai (Map)

3. Investigate the right and conduct a survey of the land for farmers regarding the "Sea Food Bank" project

This is in relation to a campaign launched by the Department of Fisheries (DOF), Thailand regarding the Sea Food Bank, where a five-rai sea plot covered by "water deeds" would be granted to each poor family to be used for aquaculture but must comply with good aquaculture practices and related environmental regulations. The "water deeds" are non-transferable and must be renewed every three years. The Chumphon Provincial Office of Fisheries conducted an investigation on the right and conducted a survey of the sea plots provided to 10 farmers who are into fish cage culture (sea bass), with 142 fish cages covering an area of 2,389 km^2. The Provincial Office of Fisheries has been given permission by the DOF to use the area in the demarcated zone for aquaculture under the Sea Food Bank.

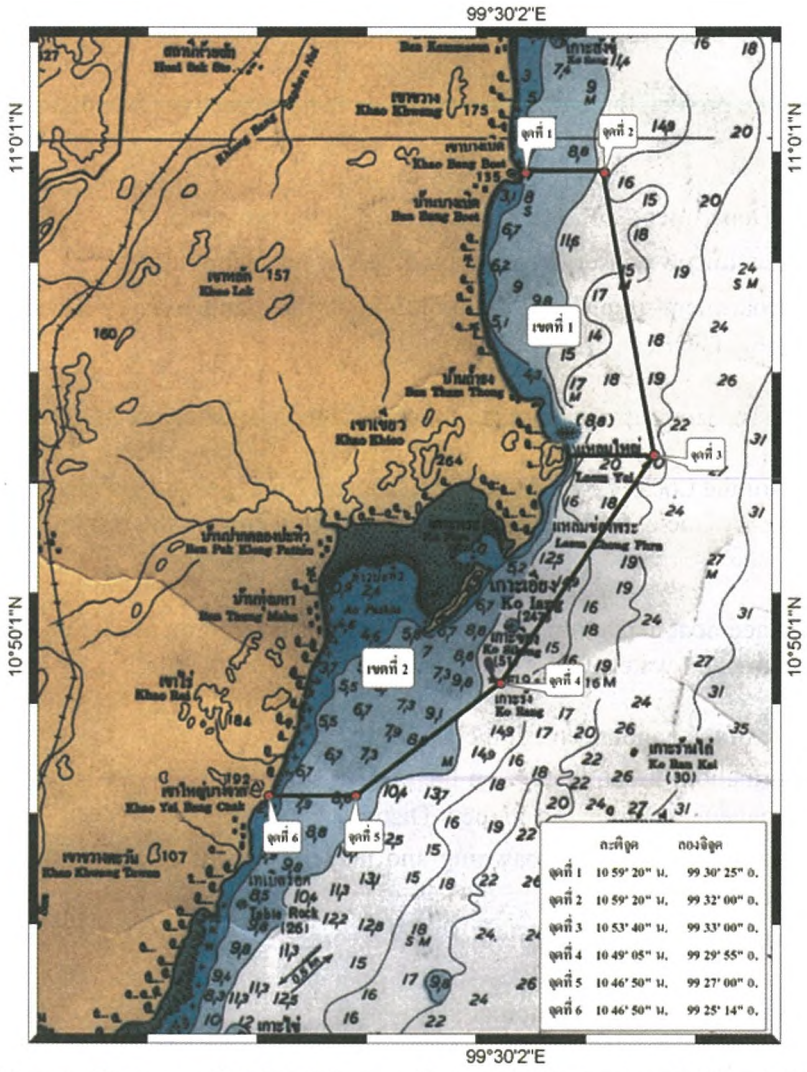
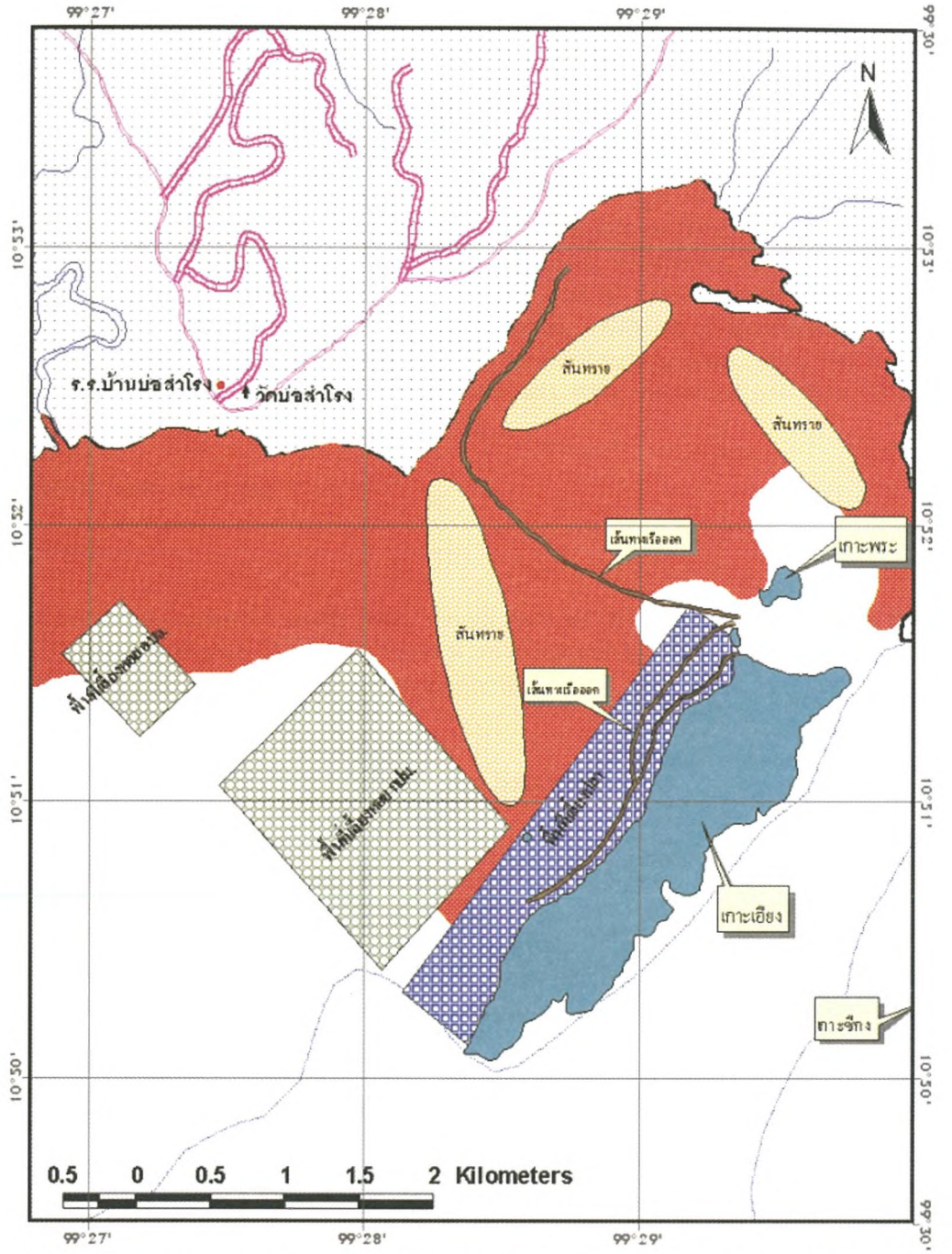


Fig. 1 The location of zoning arrangement area



จัดทำโดย นายศักดิ์ชาย อานุภาพบุญ และนางสาวศิริพร แพงศร กองวิจัย สำนักงานฝ่ายฝึกอบรม ศูนย์พัฒนาการประมงแห่งเอเชียตะวันออกเฉียงใต้ กุมภาพันธ์ 2546

Fig. 2 The area of green mussel culture at Village no.1, Pakklong Sub-District

CHANGES IN FISHING ACTIVITIES AFTER THE COASTAL ZONE MANAGEMENT PROJECT

Sukchai Arnupapboon
Trianing Department, Southeast Asian Fisheries Develpoment Center (SEAFDEC/TD)

I. INTRODUCTION

This paper aims to evaluate the changes in the fishing activities of local fishermen after the implementation of the coastal zone management (CZM) project at Pakklong subdistrict, Pathew District, Chumphon Province by monitoring the CPUE (catch per unit effort), and the fishing season and fishing ground. The five observed fishing gears in the study site (Arnupapboon, 2004), which include one type of prevailing fishing gear (collapsible crab trap) and four types of seasonal fishing gears (squid cast net, Indo-Pacific mackerel gill net, crab gill net and shrimp trammel net), were monitored and their CPUE data were recorded.

II. MONITORING METHODS

1. CPUE

Landing survey was conducted nearly every month from six (6) landing sites covering Pakklong sub-district, Chumphon Province. Catch effort data were monitored by observing the total catch per fishing trip. The CPUE is calculated using the following formula:

$CPUE_t = C_t/N_t$

t = Type of fishing gear
C = Total catch of each fishing boat per trip
N = Number of fishing boats

2. Fishing season and fishing ground

Interview of local fishermen was conducted at the approach of the fishing season, while information on the fishing ground affected by the CZM project was also gathered. Monthly interview of the fishermen was done during the first and last years of the CZM project's implementation period. The questionnaire used during the survey is shown in Appendix .

III. SUMMARY OF STOCK ENHANCEMENT ACTIVITIES

Stock enhancement activities were conducted in the study site starting in 2002 during the first year of implementation of the CZM project, in order to firstly, improve the fisheries environment by constructing or restoring the habitats, i.e., mangrove reforestation, installation of fish enhancing device and artificial reefs; and secondly, to restock the fisheries resource by releasing aquatic marine species, implementing a crab bank, and replacing the mesh size of the collapsible crab trap. The details of the each activity are explained in this paper. The summary of the stock enhancement activities is shown in Table 1.

Table 1 Summary of the five-year (2002-2006) stock enhancement activities

Activities	Description	Month
A	Initiating a crab bank for mature size swimming crab	June 2002
B	Mesh size replacement: from 1.2 to 2.5 in at the bottom of collapsible crab trap	August 2003
C	Releasing of shrimps : 1,000,000 pcs	August 2002
C	Releasing of shrimps: 1,000,000 pcs giant sea perch: 20,000 pcs swimming crab: 300 (mature size)	June 2003
C	Releasing of shrimps: 1,200,000 pcs giant sea perch: 20,000 pcs mud crab: 300 (mature size)	December 2003
C	Releasing of giant sea perch : 20,000 pcs swimming crab: 20,000 pcs	March 2004
C	Releasing of giant sea perch : 20,000 pcs swimming crab: 20,000 pcs	August 2004
C	Releasing of shrimps : 1,000,000 pcs	December 2004
C	Releasing of shrimps: 600,000 pcs giant sea perch : 24,000 pcs swimming crab: 3,700 pcs	May 2005
C	Releasing of shrimps: 1,000,000 pcs giant sea perch : 50,000 pcs	August 2005
C	Releasing of shrimps: 1,500,000 pcs	March 2006
D	Installation of artificial reefs (8 units)	March 2004
E	Installation of fish enhancing devices	June 2006
F	Reforestation of Thung Maha Bay	August 2006

Remark: A: Crab bank
B: Mesh size Replacement
C: Releasing post larvae
D: Installing artificial reef
E: Installing fish enhancing devices
F: Reforestation

IV. Observed Changes in Fishing Activities After the Implementation of the Coastal Zone Management Project

1. Fishing season and CPUE

Results from monitoring the fishing season and CPUE indicated that the fishing season of squid cast net, Indo-Pacific mackerel gill net, crab gill net, collapsible crab trap and shrimp trammel was not different during the first and last years of the project implementation. There was however, a clear change in the CPUE of some fishing gears.

Fishing season

Squid cast net is operated nearly throughout the year except when strong current occurs because it could cause damage to the fishing boat. Strong current normally occurs when the northeast monsoon starts to affect the study site. Indo-Pacific mackerel gill net and swimming crab bottom gill net are operated throughout the year, and highly operated even during the restricted season from July to September. The fishing season for Indo-Pacific mackerel gill net is in accordance with the migration behavior of the mackerel while that of the swimming crab bottom gill net is still not clear. Collapsible crab trap is operated the whole year with one to two operations per day. Shrimp trammel net is operated when the northeast monsoon occurs, i.e. from November to January. The fishing season of the fishing gears is shown in Table 2.

Table 2 Summary of fishing season in Pakklong subdistrict, Chumphon Province

Fishing Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A												
B												
C												
D												
E												

A: Squid cast net
B: Indo-Pacific mackerel gill net
C: Swimming crab bottom gill net
D: Collapsible crab trap
E: Shrimp trammel net

Seasonal fishing gear

Prevailing fishing gear

Low season
Normal season
High season

CPUE

The CPUE data monitored during the implementation of the stock enhancement activities showed that the abundance of swimming crab and shrimps obviously increased while the abundance of squid increased only slightly. However, the abundance of the Indo-Pacific mackerel seemed not to have any change as shown in CPUE fluctuation.

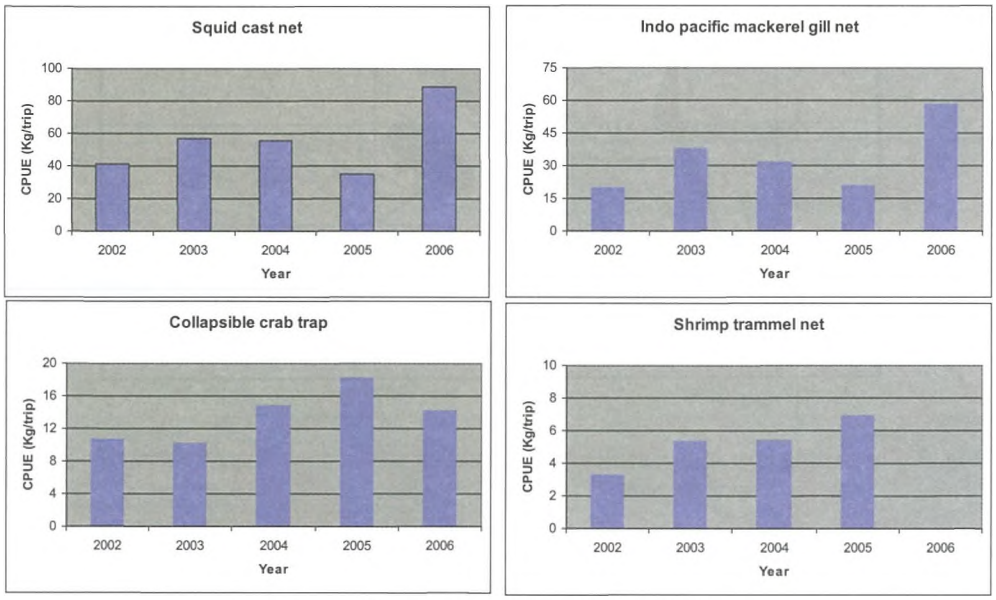


Fig. 1 CPUE of each fishing gear, 2002-2006

The CPUE data of each fishing gear (Fig. 1) indicate that the fishery resource of non-migrating species like crabs and shrimps could be restored in the study site through coastal management such as stock enhancement in order to rejuvenate the fishing community and enhance the existing population. However, stock enhancement may not be applicable for migrating fish species such as the Indo-Pacific mackerel as shown in Fig. 1. The CPUE of swimming crab bottom gill net is not included in this paper due to insufficient data.

2. Fishing ground

Most of the fishermen believed that fisheries resource has been restored in the study site after the implementation of the coastal zone management project. About 11.2% of fishermen who responded to our questionnaire had already changed their fishing ground, because of the installation of the artificial reefs (ARs) and fish enhancement device (FADs) in the casting area. Fig. 2 shows the casting area and Fig. 3 shows the fishing ground of each fishing gear.

Squid cast net and Indo-Pacific gill net operations

These fishing gears are still operated in the study site as was the practice before the implementation of the project. It was also observed that operations are mostly concentrated in the casting area because most of fishermen are convinced that there are more fishes and other marine organisms gathering and living around this area. In fact, some fishermen had intended to shoot their nets near the casting area.

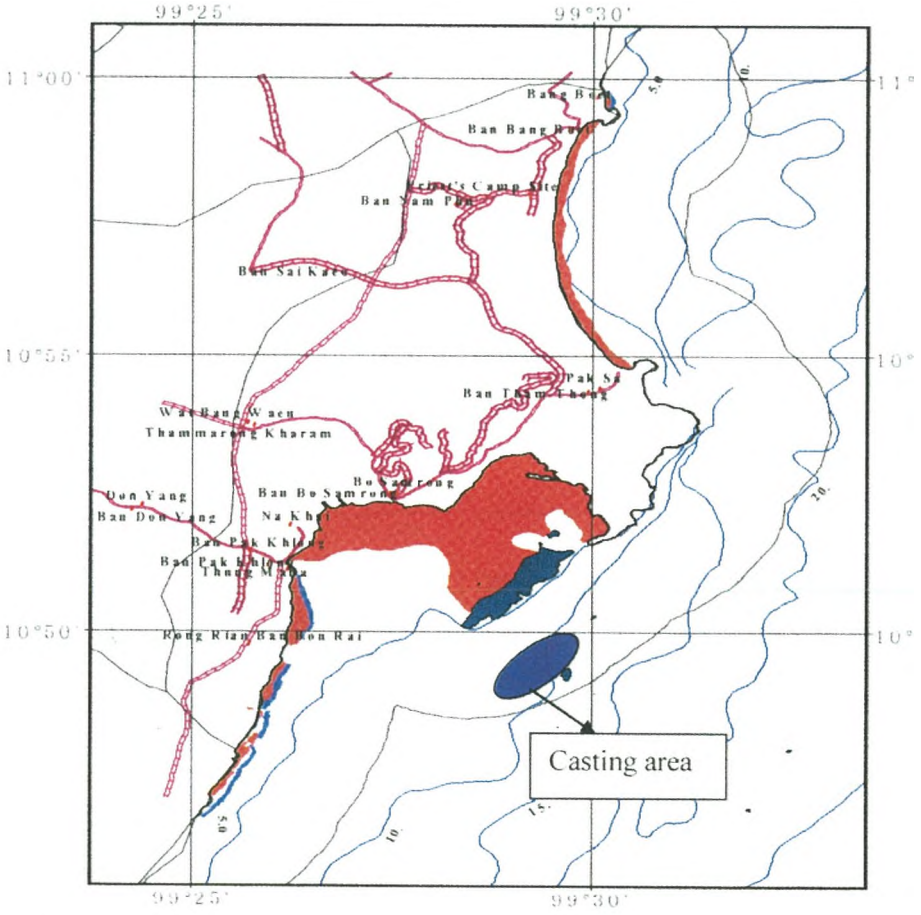


Fig. 2. The casting area of the artificial reefs and fish enhancement (aggregating) device

Shrimp trammel net operation

The stock enhancement activity has affected the shrimp trammel net operations apparently diminishing the fishing ground. Before the installation of the artificial reefs and fish enhancement device, the fishermen used to shoot their nets across the tide and allowed the nets to drift with the current for about three to four hours. Presently, the fishermen have to reduce the drifting time and haul their nets as early as possible in order to avoid entangling these with the new obstruction, i.e., the artificial reefs and the fish enhancement device.

Crab gill net and collapsible crab trap

The stock enhancement activity was observed to have no effect on the fishing ground of these two fishing gears. The collapsible crab trap is only operated in Thung Maha Bay because the fishermen could not operate far from the shore (i.e. in the casting area) as it is too dangerous for small fishing boats. Crab gill net, on the other hand, is operated with long net and long soaking time (i.e. three to four days), thus, the fishermen have to operate farther than two km from the shore line which beyond the casting area.

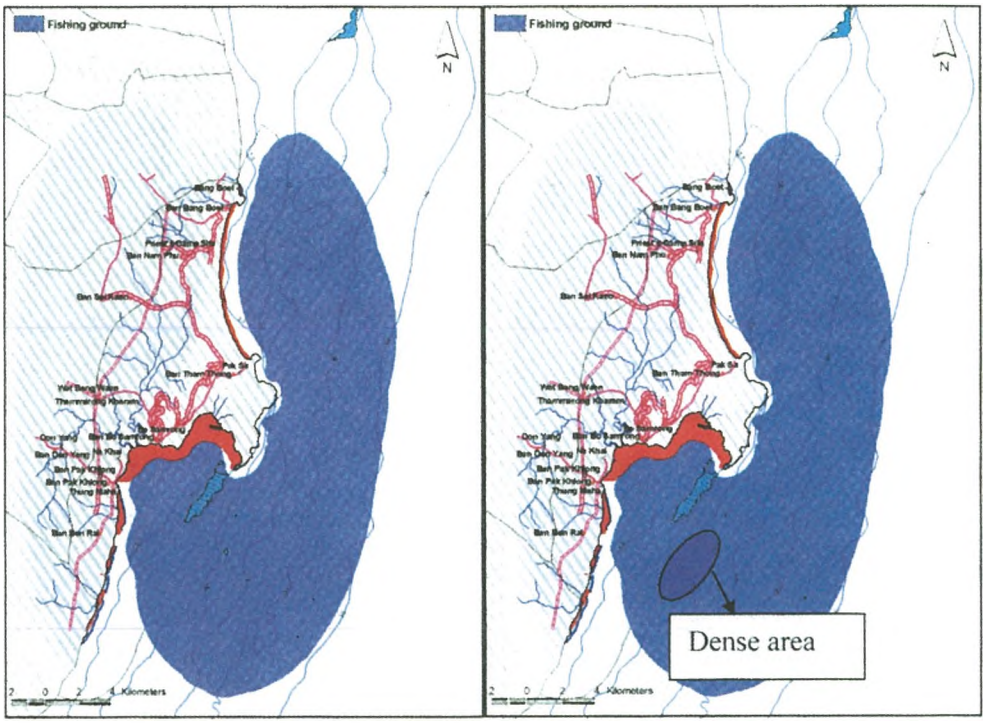


Fig. 3.1 Fishing ground of squid cast net before and after the implementation of the project

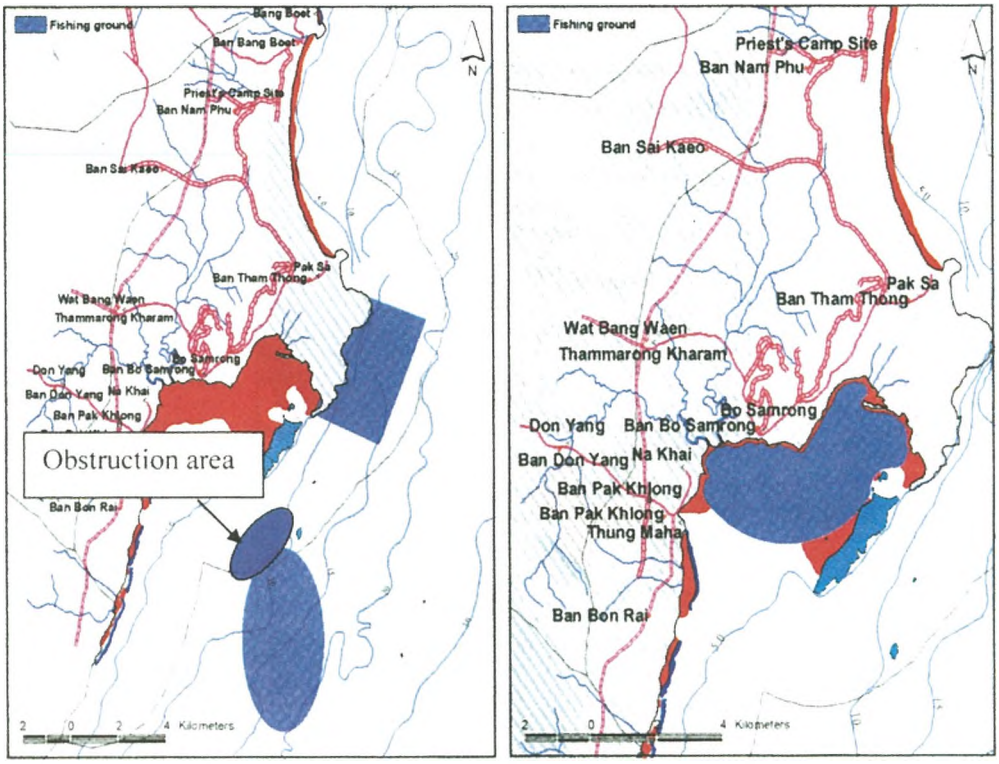


Fig. 3.2 Fishing ground of Indo-Pacific mackerel gill net before and after the implementation of the project

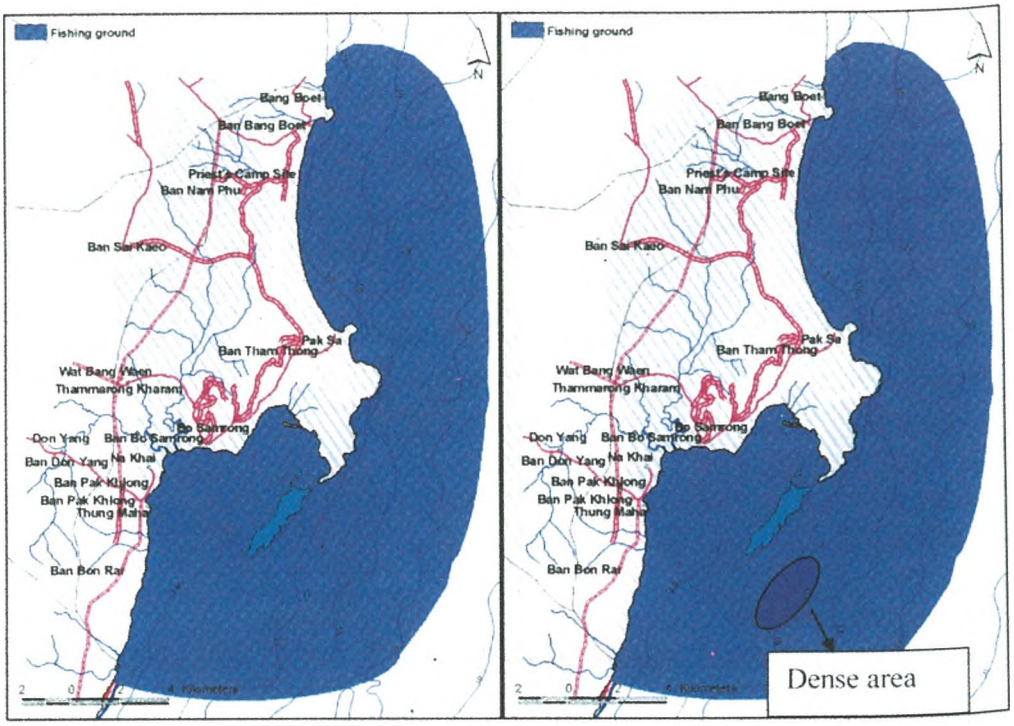


Fig. 3.3 Fishing ground of Shrimp trammel net (left) and Collapsible crab trap (right)

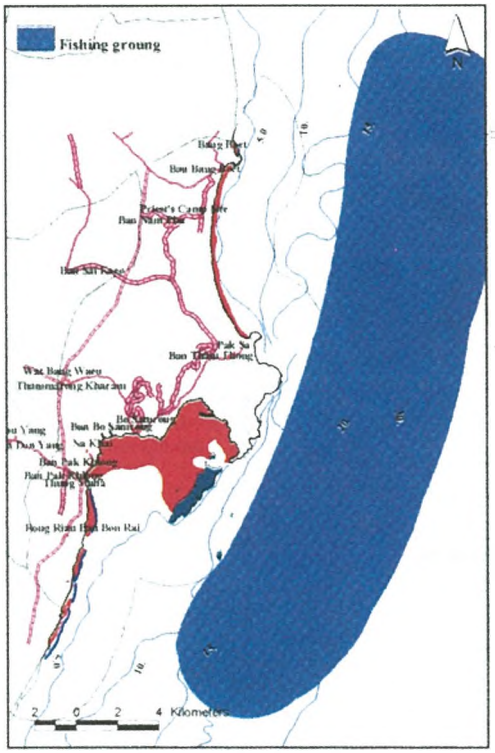


Fig. 3.4 Fishing ground of crab gill net

Appendix

Questionnaire: Fishing Ground of Each Season

Date ...../...../.....(dd/mm/yy)

Interviewer.....

Interviewee.....

Address.....

.....

.....

Vessel name..... Vessel size.....meter

Engine Power.....hp Engine type.....

Type of gear are owner.....

Type of using gear..... Size of gear*.....(.....:.)*

Depth Fisher.....Meter Far from shore.....Kilometer

Fishing time Start.....Finish..... Duration of trip.....

No.of Haul per trip.....

Remark.....

.....

.....

**Size of Gear should be separate type*

Gill net: Net length, Net width (No. of net)

Trap: Trap width, Trap high (No. of trap)

Cast net, Falling net: Circumference of net (don't input)

Purse seine: Net length, Net width (don't input)

Catch data

Catch (species,Quantity)

1).....Kg

2).....Kg

3).....Kg

Estimated total catch.....Kg

CRAB BANK

Thitiporn Suppanirun
Chumphon Marine Fisheries Research and Development Center
408 Moo 8, Paknam, Muang, Chumphon 86120

I. BACKGROUND

Crab Bank activity in Pakklong Sub-district was started in 2002 by 15 members of the crab trap fishers fishing along the shore line of Thung Maha Bay and Eang Island. They deposit mature blue swimming crabs with eggs in the cage of the crab bank. The crabs are allowed to spawn in the cages after which they are sold to the local market. Everyday, all members give gravid crabs to the leader of group who takes the crabs to the crab bank.

The idea of a crab bank first took place in Ban Pred Village, Rayong Province supported by Thailand Environment Institute and the Thung Maha Mangrove Conservation Network after observing from a study trip that the fishermen had problems because of decreasing catch of crabs. Members of the Ban Pred community discussed and campaigned for gravid mangrove crab conservation giving opportunity for gravid mangrove crabs to spawn on forth - sixth day of the October waning moon, and this campaign was successful as seen from the increasing catch of crabs. The fishermen in Pakklong used the idea to apply it in the management of the resources through the crab bank method. The initial cage used to pre-test the method was provided by the chief of village no. 7 and later another two cages were provided by the Chumphon Provincial Fisheries Office.

There are now 18 members of the group operating the Crab Bank with the slogan "Enhancement, Conservation and Awareness for Sustainable Utilization". The Integrated Coastal Fisheries Management in Pathew District, Chumphon Province (ICFM-PD) and Pakklong Sub-district Administrative Organization (AO.BO.TO.) have been supporting the group financially and technically since 2003.

II. OBJECTIVE

The main objective of the Crab Bank is to protect gravid crabs and encourage community awareness in resource conservation in order to maintain the sizes and improve the quantity of crabs caught.

III. METHODS AND MATERIAL

1. Crab trap fishers of Ban Kho Teab, Moo 7 were grouped to discuss the method and select the committee members who will carry out the activity of the crab bank

2. Procure and prepare holding cages for the crab bank

3. Activities: Receive gravid crabs from each member everyday. Everyday, the leader of the group Mr. Chang Fungfeang, takes the gravid crabs to the crab bank and records the data. Feeding is done by members when they go fishing near the crab bank. After crabs spawned, spent spawners are harvested by members to sell every 3 months. Every month, fishermen deposit income, may apply for loan, and pay interests on loan.

4. The profit from the sale of spent crab spawners is divided into four parts:
   50% for loan in the group
   30% for cage maintenance
   10% for food fed to the crabs
   10% for operating expenses

5. Extend technology to students and other interested persons

Cage and equipment

Pre Test: cage from Chief of village No. 7

First year: 2 cages size 4x4x4 m from Chumphon Provincial Fisheries Office

From second year until now: 2 holding cages size 4x4x4 m and reserved cages from ICRM-PD and 10 floating cages size 1x1 m

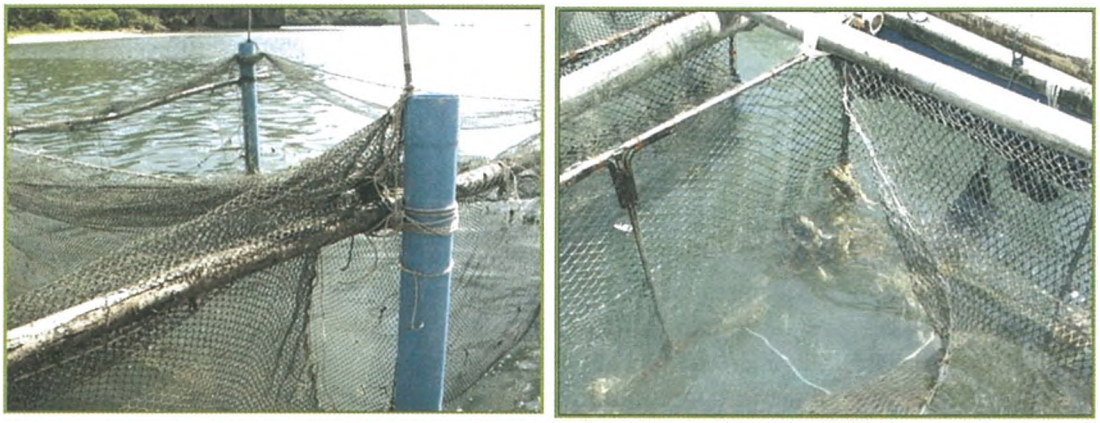


Fig. 1 Holding cage (left) and floating cage (right)

IV. Results

From June 2002 until May 2007, the Crab Bank received a total of 19,475 gravid crabs from the members and other fishermen who were not members of the group (Table 1).

Table 1. Number of gravid crabs turned over to Crab Bank from 2002 to 2007

Period	Number of Gravid Crabs
June - October 2002	557
February - November 2003	3,436
February - November 2004	2,192
January - November 2005	6,049
February - October 2006	4,238
**26 October 2006 – 17 January 2007	-
17 January - May 2007	3,003
Total	19,475

** marking on carapace and released directly to the sea

Since 2002, the Chumphon Marine Fisheries Research and Development Center (CMDEC) conducted landing surveys on the CPUE of blue swimming crabs by crab trap. Results showed that the CPUE from 2002 to 2006 was 9.40, 9.45, 14.44, 17.13 and 12.96 kg/trip, respectively. The average length of male blue swimming crab from 2002 to 2006 was 8.6, 9.17, 9.55, 10.15, and 10.9 cm, respectively while for the female crabs 8.97, 9.56, 10.01, 10.34 and 10.62 cm, respectively (Table 2).

Table 2. CPUE and average size of blue swimming crabs caught by crab trap in Pakklong Sub-district

year	Catching rate (kg/trip)	Average carapace length (cm)		Total catch (mt/year)
		Male	Female	
2002	9.40	8.6	8.97	41.72
2003	9.45	9.17	9.56	44.34
2004	14.44	9.55	10.01	76.88
2005	17.13	10.15	10.34	98.33
2006	12.96	10.39	10.62	67.47

Activities of the members of the Group

In August 2003, the Chumphon Provincial Fisheries Office provided 2.5 inch bottom mesh size of crab traps to crab trap fishermen group, 100 traps per person in exchange for their old traps (Fig. 2). The enlarged mesh size (from 1.25 inch to be 2.5 inch) of the crab traps was more effective as scientifically monitored by CMDEC for one year. The CMDEC has been promoting the use of 2.5 inch bottom mesh size for the crab traps. The result was positive showing an increasing trend in terms of carapace size as well as total catch volume even if the data was yet marginal. When mesh size used was 1.25 inch, the average length of female was smaller than first mature size (9.74 cm) by 63.36%. After using the enlarged mesh size of 2.5 inch, the average length was smaller than first mature size (51.98%) as for the male crabs, before increasing the mesh size the average length was smaller than first mature (6.50 cm) by 17.45%. With enlarged mesh size the average length dropped to 4.18% (Jinda, 2004) as shown in Table 3. Therefore, the enlarged mesh size resulted in higher benefits in terms of exploitation.

Table 3. CPUE and size of blue swimming crabs from crab traps in Pakklong Sub-district

Period	Catching Rate (kg/trip)	Average carapace length (cm)	
		Male	Female
*January - August 2003	10.02	8.56	8.71
**September 2003- January 2004	8.54	8.98	9.10
***February - May 2004	16.44	9.06	9.00

crab trap bottom mesh size:
*1.25 inch only, **1.25 and 2.5 inch, ***2.5 inch only

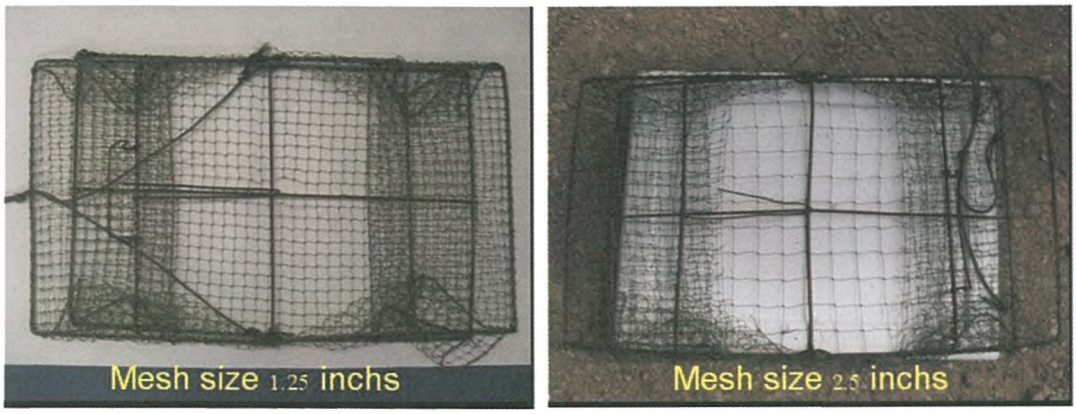


Fig. 2 Crab trap bottom mesh size: 1.25 in (left) and 2.5 in (right)

The Southeast Asian Fisheries Development Center (SEAFDEC) and the Department of Fisheries (DOF) provided 200 T-shirts for sale, the income was used for the operating expenses of the group (Fig. 3). In 2007, total fund of 81,858 Baht has been accounted for the operating expenses of the group. The group also participated in the government efforts for releasing seeds of sea bass, banana shrimps, small blue swimming crabs, and in mangrove reforestation.

Nowadays, the Crab Bank is well-known and the name Mr. Chang Fungfeang rings a bell in coastal resource management by word of mouth as well as in newspapers such as the Daily News, Post Today, Kom Chad Louk and in television: Ch7, modern 9 TV, Ch 11, ITV. Moreover, many people visited the project and learned about the method to be applied in their places.

In 2004, Ao Bo To built Crab Bank Hall to support study tours (Fig. 4) and provided 100,000 Baht as tax-free loan for the group.

Fig. 3 T-shirt for sale supported by SEAFDEC

Fig. 4 Crab Bank Hall by AO.BO.TO

During southeast monsoon, the crab bank method is not appropriate because the big waves make it difficult to manage the crab bank. In June 2006, an NGO in Japan invited Mr.Jang Fungfeang to visit Japan for exchange of experiences, where he also learned a Japanese method of crab conversation through marking on the crab carapace before releasing to the sea (Fig. 5). After he came from Japan, the crab trap group started this new technique during southeast monsoon. SEAFDEC provided the markers, towels to clean the carapace and reward for first, second, third and forth persons who are fast to mark and release the crabs (Fig. 6). Last monsoon, a total of 786 marked crabs was released.

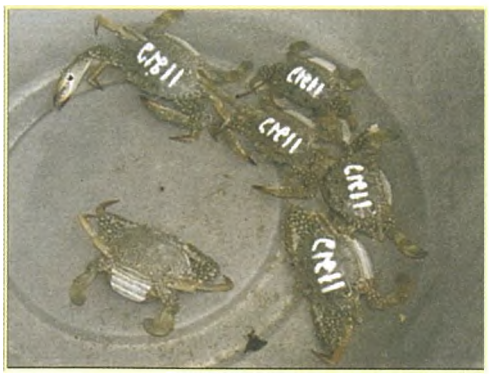


Fig. 5 Marked gravid crabs

Fig. 6 Reward for releasing marked crabs

Students from schools in Pakklong Sub-district and other places visited and learned about crab conservation. They were taught the primary lessons on the crab bank method (Fig. 7).

Fig. 7 Students visit

V. Conclusion

Survival rate of crabs that have not yet spawned in the crab bank was very low because there was not enough food for their high density and the weak crabs were eaten by the stronger ones. The holding cage was modified to floating cage, which is easy to look after, feed, and harvest thus, reducing the loss of crabs remaining in the cage. The floating cage was modified from 10 experimental Babylonia shell cages, size 1x1 m by SEAFDEC.

A total of 43,700 crabs with carapace width of 4-6 cm were released on March, August 2004 and May 2005 (Fig. 8).

Fig. 8 Releasing of blue swimming crab juveniles

VI. Reference

Jinda Petchkamnerd, Thawon Rootjanarat, Iiraporn Ratthanaphrom and Khunruthai Chaikaew.2004. Fishing Gear Replacement Project: changing mesh size at bottom side of Crab Trap in Pakklong Sub-district, Chumphon Province. Department of Fisheries.TD/RES/86.LBCFM-PD No.29.12 p

OPTIONAL APPROACHES FOR THE CRAB BANK SCHEME

Seiichi Etoh
Training Department, Southeast Asian Fisheries Development Center (SEAFDEC/TD)

I. BACKGROUND

A swimming crab is served as delicacy in the Southeast Asian countries and consumed as one of favorite dishes. Naturally, this trend drives fishermen competitive overexploitation of the resource. The fisheries authorities and institutions in the region have been expressed this phase as a matter of deep concern, but no effective measures to control the impetus have been in fact put in place. Meantime, the phenomenon of reducing the size of crab and the volume of catches has been witnessed on end in fishing communities of the region and the fishermen themselves have become to realize the possible risk of the resources extinction in foreseeable future. Under these circumstances, some leading fishermen groups initiated the actions to alleviate the trend in a few fishing communities of Thailand. Their approaches are described in this report, and further the effectiveness of systems and possible improvement measures are studies.

II. CRAB BANK SCHEMES

1. Approach in the ICRM-PD project operational area, Pakklong Sub-district, Chumphon Province

An attempt so-called "Crab Bank" to protect gravid swimming crab has been practiced by the Crab Trap Fishing Sub-group of the Pakklong Fishermen Group (PFG). The idea of the Crab Bank was originally introduced by the NGO Thai Environmental Institute under the project "Mangrove Conservation in Tungmaha Bay" in 2002 after conducting a study tour to the fishermen group in Trat Province. (In fact, this fishermen group has suspended the scheme due to the group management constraint.) Since then, it has been developed by crab trap fishermen in a way that all gravid crabs are deposited in cages until they have hatched. The crabs in the cages are normally checked once a month and those having spawned are removed from the cages and sold to the buyers. The leader of the group feeds the crab in the cages with trash fish every day.

Of the sales, 50% is saved as the credit scheme fund, 40% is used for installation and maintenance of cages and the rest 10% is for feed supply. The accumulated amount for the credit scheme accounts for as much as Baht 10,000 so far. This system has been successfully maintained with the 16 members of the crab trap fishermen by the very prominent leadership of the group. This is commendable as most other similar attempts in Thailand have been failed due to the poor group management skill.

Table 1. Record of Crab stock[1]

Month	No. of Crab (pc.) in cages			No. of crab Sold (pc.)	No. of crab lost/dead (pc.)	Survival rate (%)
	Remained	Deposited	Total			
April	129	829	958	425	433	54.8
May	100	713	813	450	216	73.4
June	147	770	917	350	238	74.0
July	329	1,068	1,397	500	678	75.4
August	219	734	953	300	427	-

[1] Source of data: Saivason 2006

↑Discharging gravid crab

↑ Crab hatching cages

2. Approach by the Bang Saphan Bay Pilot Project, located in Prachuap Khiri Khan Province

The Bang Saphan Bay Pilot Project (BSBPP) has been in operational in pursuing the community-based coastal fishery resources management concept since over 10 years by the DOF Thailand. They initiated the crab bank in a way of copying from the method employed by PFG in 2005. They constructed 2 cages for trial but an attempt to stock gravid crab as done in the PFG was discontinued soon after initiation due to its cumbersomeness of handling (daily feeding, repair and maintenance of cages etc.) as well as unfavourable sea condition. The coastal line of Bang Saphan is rather exposed to the open sea compared with the one in Phakklong.

After experiencing the negative trial as such, they started to challenge the batch system with hatching tanks. In this system, gravid crab in the last stage of spawning (with black coloured eggs) are kept in plastic tanks with the capacity of around 100 lit until eggs are hatched. A tank is equipped with an air-stone. The eggs hatched are kept in the tank for a few days and then those zoea are released into the sea. The mother crab after hatching are sold to the buyers by the fishermen who caught the crab.

↑ Hatching in plastic tanks

In this system, the project provides the fishermen with necessary facilities, equipment and electricity supply and each fisherman is responsible for transportation and looking after stocking and feeding. The transportation and discharging of zoea are carried out by the project. The main limitation factor in this system lies in that only gravid crab with matured eggs of black coloured can be protected but not all gravid crab.

3. Approach by the Settsu-Harima Fishermen Cooperative in Hyogo Prefecture, Japan

Aimed at enhancing the dwindling crab resource, a voluntary organization called "Gazami Fuyasou Kai (Swimming Crab Resource Enhancement Association – SCREA) was established in December 1986 in the Hyogo Prefecture, Japan with the following justification, approach and activity.

- The objective of this association lies in enhancing the crab resource in a way of protecting gravid crab.
- Under the normal environmental condition, a crab spawns 3 – 4 times from May to September a year. A gravid female crab hatches about 1.8 million (between 1 to 3 million) zoea each time.

- The SCREA purchases gravid crab from fishermen at the prices which differ depending on sizes and paints the red cross-marks on the carapaces and returns them back to the sea.
- When fishermen catch any crab with the red cross-marks on, they have to return them back to sea.
- Female crab are normally molded after hatching a few times. Then, the red cross-marks are disappeared. Then, those are allowed to be harvested.
- Crab under 12cm in carapace length and with soft-shells are not allowed to be harvested and to be returned back to the sea.
- The control season is limited for the spawning period of 5 months from 1st May to 30th September.
- The cost of purchasing gravid crab is borne by the fund contributed by the members of SCREA.
- Anyone can be a member of SCREA and half of them are not necessarily engaged in fisheries but ordinary people.
- Those who have become the member of SCREA are endowed the membership cards.
- The target number of members is 800 and the amount of annual contribution per a member is 1,000 yen equivalent 330 Baht.

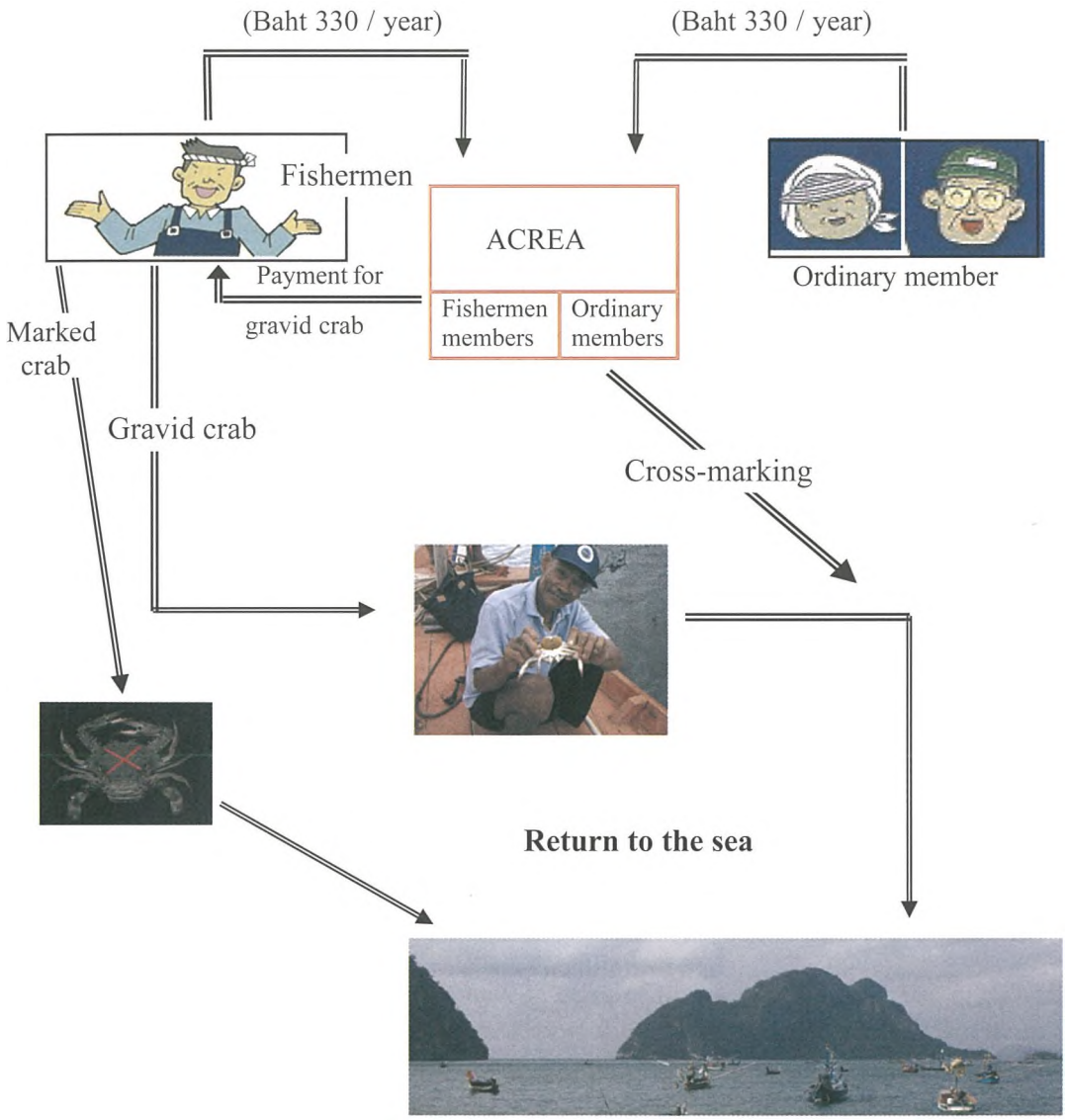
The system of this SCREA is depicted in the chart of Fig.1. The major advantage in this system lies in high survival rate of gravid grab and zoea compared with the cage or the batch systems in Thailand.

III. Discussion

Among the above three systems, there are certainly advantages and disadvantages as discussed in detail in the table 2.

As seen in the table, it is obvious the Japanese approach seems to be the most effective method thinking in terms of scientific recovery of the resources since gravid crab are returned to the natural environment where ensures the gravid crab and zoea higher survival rate and protected until the spawning seasons are over. Most gravid crab released are to spawn a few times more during a season. On the other hand, the gravid crab are protected only once in the systems that are employed in Chumphon and Bang Saphan. Also, the cost of initial investment and operational expenses are considerably higher compared with the Japanese system.

However, implantation of the concept in resources management among fishermen is crucial factors in evolvement of the crab bank scheme, and taking this point into account the approaches in Thailand are more reasonable than the one in Japan demonstrating a visible impact to all beneficiaries concerned. This is a sizable advantage.



IV. Conclusion and Recommendations

The scheme initiated by the self-motivation of fishermen in Chumphon is admirable and encouraging. This has been operated with purely voluntary spirits by the members of CB under the self-regulated resources management framework as the members are not expecting any direct return from offering a part of their catches but just through possibly happening benefit of utilization of loan in future.

Thinking in terms of technical as well as scientific effectiveness, however, there seems to be some room to be further improved. In this senses, one can say that a model would be the one prevailing in Japan. However, it seems to be too haste to introduce such a system in Chumphon now. Certainly, the visible impact by the crab bank in Chumphon induces the fishermen to participate in the scheme. It may take time for them to realize the natural mechanize that multiply the crab resource in the natural environment. Also, an expansion of the awareness level to the public is essential for the fund raising purpose like having been practiced in Japan. The efforts should be continuously exerted toward application of such a system in future.

Table 2. Comparison sheet in the three crab bank systems

Assessment / Sytem	Stocking in cages (Chumphon)	Stocking in tanks (Bang Saphan)	Releasing to the sea (Japan)
1. Survival rate of gravid crab	Low (about 50%)	High (only a few days stocking)	High (in the natural environment)
2. Survival rate of zoea	High (in the natural environment)	Relatively low (in air-agitating tanks)	High (in the natural environment)
3. Target gravid crab	All gravid crab	Only matured crabs before hatching (with black coloured eggs)	All gravid and potentially gravid crab (marked)
4. Operational season	During the calm seasons	All seasons	Spawning seasons
5. Cost of investment & operation **- Initial investment** **- Labour** **- feed** **- fuel** **- Maintenance**	 High (cages etc.) High (daily attendance at sea) High (one month at maximum) High (daily attendance at sea) High (repair of cages)	 High(shed, plastic tanks, air pumps ect.) Medium (daily attendance on land) Negligible (a few days at maximum) Negligible (combined with fishing) Negligible (repair of air pumps etc.)	 Nil Marginal (only marking) Nil Negligible (may rely on fishing trips) Nil
6. Income for the member fishermen	Nil (indirectly yes in the form of loan)	Sale of mother crabs after hatching	Sale of gravid crabs to the Crab Bank
7. Institutional support	Marginal	Need to some extent	Need to some extent (PR etc.)
8. Organization	Need a strong leadership and coordinator	Need a strong leadership and coordinator	Need a strong public awareness
9. Fund raising	Not necessary	Not necessary	Relying on fishermen as well as public contributions
10. Sustainability	Subject to the leadership	Subject to the leadership	Subject to the public awareness
11. Visibility of impacts	High	High	Low

INTRODUCTION OF THE JAPANESE MODEL CRAB-BANK TO A FISHING COMMUNITY IN THAILAND

Seiichi Etoh
Training Department, Southeast Asian Fisheries Development Center (SEAFDEC/TD)

1. BACKGROUND

Prior to the project initiation in Pathew District, Chumphon Province, in November 2002, the crab fishermen were concerned about dwindling crab production along with reducing their sizes year by year. To cope with the problem, measures were taken to initiate reserving gravid crab in the spawning cage in the village No. 7 of Pakklong sub-district under the guidance by the NGO Thai Environmental Institute. This scheme was taken over by the SEAFDEC / DOF Thailand Collaborative Project (Integrated Coastal Resources Management in Pathew District – ICRM-PD). Further, another measure to reduce juvenile crab catch in crab trap fishing was introduced by initiation of the project in a way of minimizing the mesh size of crab trap from 1.2 inch to 2.5 inch from August 2003. Since then, both the crab catch volume and the sizes of harvested crab have shown an encouraging trend as seen in the following table and figure. At this stage, however, it is difficult to predict whether these increases of harvesting volume and individual size are attributed by the effect of crab bank or the one by mesh-size control or the combined. Therefore, it is intended to continue both the measures by all means.

Fig 1: Increases of crab catches and and sizes

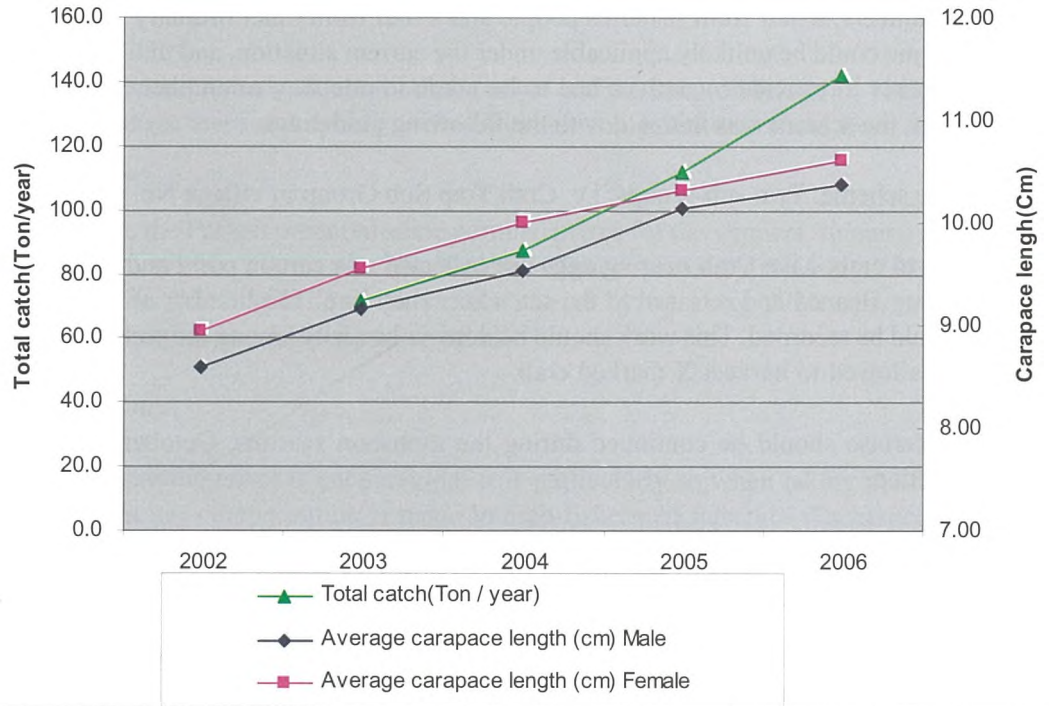


Table 1: Swimming crab catch record in Pathew District

Data:CMDEC 2007

year	Average carapace length (cm)		Total catch (Ton / year)
	Male	Female	
2002	8.60	8.97	-
2003	9.17	9.56	72.1
2004	9.55	10.01	87.6
2005	10.15	10.34	112.6
2006	10.39	10.62	142.6

In the village No. 7, the Crab Trap Fishing Sub-Group was organized under the framework of Pakklong Fishermen's Group (PFG) in 2004 and the crab bank was incorporated in the PFG's undertaking as one of their activities. The crab bank continued their activity in a way that gravid crab were collected from crab-trap fishermen and stocked in a cage for a month or so until eggs were hatched. However, they encountered some problems through their operation like loss by thefts, high mortality, high feeding cost and laborious work in stocking. Meantime, the study tour to Japan was conducted in May 2006 to inspect crab bank practices prevailing in Hyogo-Prefecture since last 20 years under the financial auspices of a NGO group, Hunet ASA in Japan. In this study tour, the Leader of Crab-Bank, the Chairman of the Pakklong Fishermen's Group and the Extension Worker participated. They were impressed by the different type of approach from the different angle in the crab resources management and considered positively its application to their crab bank system, especially during the monsoon seasons when the maintenance of stocking cages would become difficult. Thus, a trial introduction of the Japanese system was initiated in the project site with the Crab Trap Fishing Sub-Group of PFG. after setting in the monsoon season in October 2006.

The brief comparison of advantages in both the methods is described in Table 2: Optional approaches for the Crab-Bank Scheme.

II. Application of the Japanese system of crab-bank

When envisaging introducing the Japanese style Crab Bank System to the project area, the major difficulty lay in the operational fund. In case of Japan, the gravid crabs were purchased by the fund donated by a few thousand volunteers; a half from fisheries people and a half from other ordinary volunteers. In the project site, the same could be unlikely applicable under the current situation, and until such time would come, some measures to provide incentives had to be taken in one way or another. Taking the above factor into account, the scheme was initiated with the following guidelines.

Participants of the scheme: Two sub-groups; i.e. Crab Trap Sub Group in village No. 1 and 7

Collection of gravid crab: Live Crab bearing eggs are collected at a certain point and marked **X** on the carapace after being cleaned and released to the sea where they live. The number of crab collected by each member should be recorded. This work should be done voluntarily among the members. Thereafter, no fishermen are allowed to harvest **X** marked crab.

Duration: This exercise should be continued during the monsoon seasons, October to March, as an experimental practice.

Incentives: Some incentives are awarded by SEAFDEC/TD for the fishermen whose contributions in collection of gravid crab are prominent compared with others.

Required equipment and materials: Equipment and materials necessary for this trial such as cleaning towels, special markers and logbooks are provided by SEAGDEC/TD.

III. Implementation of the scheme

The trial to introduce the Japanese system of crab bank initiated on 20 October 2006 in both the villages No.1 and 7. The crab fisherman in the village No. 1 has continued the operation until now and will continue in future, while those in the village No.7 resumed the conventional system when the monsoon season was over in January 2007. They said that they would resume the Japanese system when the monsoon season sets in. During the course of operation, however, the fishermen found that many marked crabs were caught by crab-gillnet fishers in off-shore where was demarcated from the crab-trap fishing by the mutual agreement. Further, it was reported that some marked crab were caught in the next province at the distance of over 30km from the project area within one month's time. With these facts, the notion that the Japanese crab system has benefited to other fishermen than due beneficiaries has

become prevailing among members of crab fishers and affected to continuation of the trial beyond January 2007. The discussion was made with the crab fishermen on the issue on 6th March 2007 and they expressed that they would like to continue the crab bank operation with the combination of their own system in calm seasons and the Japanese one during monsoon seasons. As to the crab fisherman in the village No. 1, only one active crab-trap fisherman though, he expressed that he would like to continue the Japanese system even in future.

IV. Result of the trial

As aforementioned, the trial continued for 3 months from October 2006 to January 2007 in the village No. 7 and 5 months from October 2006 to March 2007 in the village No.1. As seen in the detailed record in Annex 2: Crab releasing record from October 2006 to March 2007, 405 crabs were released for 5 months by 3 fishers of the village No.1 and 786 crabs for 3 months by 12 fishers of the village No.7, amounting to 1,191 crabs in total. The number of crabs released per a fishing trip / boat is 3.33 pcs.

Participant

Village No.1: Only one fisherman is engaged in crab-trap fishing in this village (Mr. Winai Sakulnum). In fact, other two fishers participating in this trial purchased gravid crabs from Mr. Winai Sakulnum for the sake of voluntary contribution, which means all 405 crabs were caught by Mr. Winai.

Village No.7.: There are 20 crab-trap fishers registered as members of Crab-trap Fishing Sub-group of PFG. Of those, 12 fishers participated in the trial.

Equipment

The project provided fishers with logbooks, a towel and markers (oil felt-pen). They complained that the Thai-made markers were susceptible to discoloration compared with these from Japan.

Prize awarding

As an incentive, the Project prepared some nominal prizes for the winners, runners-up and third winners. In the village No.7, Mr. Somjit was awarded the winners prizes by releasing 235 crabs. While, in the village No.1, Mr. Winai was done the winner's prize by releasing 293 crabs. All participants were provided with T-shirts as prizes of participation.

V. Discussion

It is no doubt that the result is encouraging. It is particularly so when taking the fact into account that neither payment nor compensation is made to crab-fishermen for crabs discharged unlike those in the crab bank of Japan whose are enjoying compensation against releasing crab from the fund donated by the public. The awareness rising among crab fishers on crab resources conservation is appreciable.

In relation to the above, two PFG members in the village No.1. purchased 112 gravid crabs from a crab fisherman and released them to the sea voluntarily. Such a voluntary participation to the resources conservation activity is noticeable.

Crab is one of major fish catches and constitutes important incomes in the project operational area. Therefore, sustainable and optimum natural resources utilization is the vital factor for the fish-folks' well-being. They have already experienced a negative trend on dwindling crab resources and based on such experiences and lessons they have challenged some measures to cope with. Their activity is highlighted not only in the country but also in the neighboring countries as a vanguard to practice effective crab resources management tactics. The advancement of this activity is no doubt attributed by the voluntary and energetic contribution by the leader of Crab Trap Sub-group of PFG. His dedication to the crab-bank is commendable.

During the course of trial, it was disclosed that crabs marked by the member fishermen were caught by gillnet crab fishers who were operating in the off shore and some were found in the neighboring fishing village at the distance of 30km. Since then, the member fishermen started to argue on effectiveness of Japanese model crab-bank saying that the exercise of releasing gravid crab voluntarily would mostly benefit to outsiders. For this reason, the crab fishermen in the village No.7 resumed the old methods of crab bank that kept gravid crabs in cages until spawning. An explanation about the phenomenon of crab movement and reciprocal common benefit with the shared resources were made at the sub-group meeting on 6th March 2007 in a bid to persuade them to continue the trial. They agreed to resume the Japanese method when the next monsoon season set in. This is simply caused by the visibility effect against impacts by crab releasing as described in Annex 1: Comparison sheet in three crab bank systems. It takes time until all fishermen realize the real concept of common resources management. It needs tenacious efforts. It took 20 years even in Japan to reach the present goal.

VI. Conclusion

The trial is considered successful in a sense that awareness development and beneficiaries' positive participation in crab resources conservation have been stimulated to a great extent through this exercise. The fishers in the village No.1 continues the Japanese system which is considered more effective by all means. Also, those in the village No. 7 will resume the Japanese system from October 2007. The SEAFDEC/TD terminated the project operation in December 2006 but the project operation will be continued for next 2 years until December 2009 by the consolidated government institutes under the financial auspices by the Royal

Project. Given the fact that the crab bank operation has just got its impetus and need more support, SEAFDEC/TD should continue technical supports on end in future.

VII. Acknowledgement

Taking advantage of this occasion, I would like to express a sincere appreciation to Hunet ASA for rendering such a great chance for the project as well as the fishing community in Chumphon to become acquainted with the advanced crab-bank system in Japan, which will be by all means conducive to the coastal fishery resources management approach in Thailand. Also, a particular acknowledgement is for Prof. Hiroshi Fushimi for endeavoring to bring about this attempt through his dedicated coordination.

The cage for crab hatching

The leader of Crab Bank with gravid crab

Prize awarding to the winner

The shield for the winner

Crab releasing record from October 2006 to March 2007

No.	Name	Village No.	Total released	Date		Fishing trip	Average crab release/trip
				strating	closing		
1	Winai Sakulnum	1	293	27/10/2006	6/3/2007	75	3.91
2	Bun-Auen Somson	1	75	3/1/2007	3/3/2007	6	12.50
3	Wara Ket-Ampai	1	37	23/2/2007	27/2/2007	5	7.40
4	Somjit Fungfuang	7	235	26/10/2006	17/1/2007	39	6.03
5	Wanee Niyom	7	128	20/10/2006	6/12/2006	42	3.05
6	Amnaj Piwkhaw	7	81	28/10/2006	16/1/2007	37	2.19
7	Paisan Jinthanom	7	80	27/10/2006	10/1/2007	29	2.76
8	Arnong Annacha	7	72	27/10/2006	11/1/2007	29	2.48
9	Pranom	7	57	28/10/2006	3/1/2007	23	2.48
10	Jang Fungfuang	7	47	26/10/2006	17/1/2007	30	1.57
11	Wisut Namma	7	29	26/10/2006	21/11/2006	10	2.90
12	Prapat Khodkrit	7	23	30/10/2006	10/1/2007	18	1.28
13	Patsanan Puangmalai	7	21	26/10/2006	6/11/2006	9	2.33
14	Jatuphon Kuntongsuk	7	10	26/10/2006	10/11/2006	3	3.33
15	Porntip Tadee	7	3	20/11/2006	30/11/2006	3	1.00
	Total		**1,191**			**358**	3.33

Remark: -In Village No.1, Bun-Auen Somson and Mr.Wara Ket-Ampai released crab that she bought from Mr. Winai Sakulnum.
In Village No. 7, the closing day to release crab is 17 Jan 2007

LOCAL ENFORCEMENT ACTIVITY

Sompron Dechpakdee
Chumphon Marine Fisheries Patrolling and Enforcement Center

I. BACKGROUND

The Chumphon Marine Fisheries Patrolling and Enforcement Center under Department of Fisheries collaborated with the CMDEC and SEAFDEC/TD in implementing the Integrated Coastal Resources Management in Pathew District (ICRM-PD), Chumphon Province from 2002 to 2006. Representatives of the Center participated in the Implementation Committee Meeting to plan on the patrol and enforcement of the project area at Pathew Bay. At the Meeting, it was agreed that the enforcement staff will monitor the project site very month for 10 days per month.

In 2006, the main activity of the enforcement unit was to establish local enforcement unit at the project site comprising selected volunteer fishermen. The unit members would also participate in the coastal resource management under the fisheries law. This strategy will enable the unit members to increase their awareness about conservation of the fisheries resource and on sustainable coastal fisheries resource management.

II. RESULTS

1. Through the collaboration, the Local Enforcement Unit was established with the Tambol Administrative Organization (Ao.Bo.To.) recruiting volunteers from Pakklong Sub District, Pathew District in Chumpon Province. Thirty volunteers for the local enforcement unit attended the training course held on 9-11 July 2006.

2. The training course was aimed at transferring knowledge about fisheries resource management and fisheries law as well as establishing the role of the local enforcement unit. The group committee selected the Chairman and Vice Chairman for the operation.

3. The Local Enforcement Unit was established with location at Moo 1 fisher group Banthungmaha Pakklong Sub-District, Pathew District in Chumphon Province. This location also served as venue for the meeting of the members with the officers

4. The first activity of the Chumphon Marine Fisheries Patrolling and Enforcement Center was to coordinate the local enforcement unit and set up specific office with monitoring boat to arrest illegal fishermen.

5. The Chumphon Marine Fisheries Patrolling and Enforcement Center also implemented a pilot project on Community Strengthening of Fisheries Management in Pakklong Sub-District, Pathew District in Chumphon Province. The main objective of the pilot project is to promote effective fisheries resource management by the local fishermen. Once completed, the project could serve as a model for another fishing area and help fishermen engage in fisheries resource management. The project period is from October 2006 to September 2007

III. CONCLUSION

Based on the fishing control measures under the Integrated Coastal Resources Management project from 2006 to 2007, the following arrests were made by the local enforcement unit in the project site:

- Arrested trawler on 17 May 2006, 1 case, defendant 3 persons.
- Arrested trawler on 9 December 2006, 2 cases, defendants 7 persons.
- Arrested trawler on 13 December 2006, 2 case, defendants 6 persons.

WOMEN'S GROUP DEVELOPMENT: INTEGRATED COASTAL RESOURCES MANAGEMENT IN PATHEW DISTRICT (ICRM-PD), CHUMPHON PROVINCE

Sumitra Ruangsivakul
Training Department, Southeast Asain Fisheries Development Center (SEAFDEC/TD)

I. Background

The Integrated Coastal Resources Management Project (ICRM-PD) was established in Pathew District, Chumphon Province on 9 November 2001 as a collaborative effort between SEAFDEC/TD and the DOF of Thailand. The project aims to promote the sustainable use of coastal resources and transfer the experiences and lessons learned from the implementation of the project to other ASEAN member countries.

The ICRM-PD project has six main activities, namely: Base Line Survey (Activity I), Extend and Encourage LBCRM (Activity II), Encourage Local Business (Activity III), Enhance Human Resource Capability and Participation (Activity IV), Develop Extension Methodologies and Strengthening of the Extension System (Activity V), Rehabilitate and Enhance Coastal Resource (Activity VI).

Activity III: Encourage Local Business is concerned about increasing fishers income and creation of alternative job opportunities outside from marine capture fisheries. The alternative job opportunities could compensate part of the decreased income resulting from less dependence on marine capture fisheries. The project assists the fishers increase their incomes by encouraging local business opportunities, in two ways.

One way of increasing the income is not by expanding the amount of catch effort investment, but by improving the technologies of handling, marketing and processing of fisheries products. The second way is to create alternative job opportunities outside capture fisheries by promoting coastal aquaculture, shell culture and fish cage culture, etc.

The development of value added fisheries products is also an effective tool to increase their income, since there are many kinds of traditional fisheries products that are commercialized locally. Women play a vital role in promoting such small-scale local business opportunities. Since many of them are active members of community-based saving and financing groups, they also have easy access to the source of micro financing.

Under Activity III (Encourage Local Business), the women's group had concretely contributed in its realization specifically in the handling and processing of fish products. The women's group received funds from Tambol Administrative Organization (TAO/Ao.Bo.To.), which was allocated by Ministry of Interior under the One-Tambol, One-Product project.

II. Objectives

- Create additional source of income for the fishers' households
- Improve women's skills and knowledge on fish processing and product development and micro-financing
- Develop the existing low value local fish products into more value added products

III. Outcomes

- Improved role of women, to be more active and skillful in fish processing techniques, product development and micro-financing
- Creation of local business opportunities in the community
- Good relationship between government and community

4. Creation of women's group network

IV. PROCEDURE

Women in the community at the project site are the target groups to participate in Activity III (Encourage Local Business). The top priority objective of this activity is to increase the income of fishing households. The Project staff introduced and arranged activities for the women in the community on value adding of fisheries products. Value added fisheries product activity is an effective tool to realize the objective of Activity III. The project staff developed two cumulative methods of designing and implementing the value added fisheries product activity.

Conduct of a base line survey through a questionniare, comprising two parts. Part 1 was for a general data survey and Part 2 placed emphasis on the characteristics, functions and members of the women's group.

Appriasal assessment of the collected data was used to formulate and arrange a training course and related activities for the women that included the following:

- Study trip to fish processing implemented by active and successful women's groups in another province
- Seminar on local business adminstration and management
- Training course based on the women's needs
- Providing coordination between government related agencies
- Arranging discussions on problem analysis and finding solutions to problems

1. The first year (2002)

1.1 Action plan

In the project site, anchovy and squid are dried and marketed, without any value adding. Providing them with little incentives, fish traders and women would be able to begin producing value-added dried anchovy and squid. Technology on fish processing and information on equipment are the minimum requirements for the expansion of this small business enterprise. A micro credit scheme will be made feasible, as availed of currently by the existing groups actively doing business. A market survey on the particular species will be conducted to help the processors search for new outlets for their new products.

The main objectives of Activity III are: to disseminate information and conduct training courses. The topics for the training courses focus on post-harvest technology of fisheries products and methods to achieve enhancement of entrepreneurship. The tarining course targets mainly the fish traders and women who are involoved in the anchovy and squid processing businesses.

Improvement of post-harvest technology and introduction of new value added products were planned for 2002. These included the following activities:

Training course
Micro-credit scheme and its practices, Post-harvest technology and fish processing, and Food packing using natural materials

Exhibition
Dissemination of information on micro credit scheme, and encouraging women's participation in the new business venture

1.2 The results

Three women's groups were established in the project target area at the inception of the project; i.e. Ban Thungmaha (Village No.1), Ban Thumthong (Village No. 3) and Ban Ko Teap (Village No. 7). The women' groups encouraged their members to join the fish processing activities in accordance with the seasonal changes of fishing and resource conditions, to pay more attention on how to balance cost and profit, and to upgrade skills in bookkeeping. The members of the women's group at village No. 1 developed a system of fish production focusing on the standardization of their products. The standardization included taste of the fish products and packaging of the products. The group's outlet has become well known to the local people and outside, leading to the stability of their local marketing channel and the distribution of their products to the local urban markets.

Encouragement in fish processing activities has given rise due to the gradual expansion of the processing production through the Sub-District (Tambol). Village leaders support the activities of the women's groups, and guide them to get financial assistance from Ao.Bo.To. Since their prosperous activity encourages "One Tambol, One Product" policy in Pakklong Sub-District, the Tambol Administrative Organization (TAO/Ao.Bo.To.) decided to support their processed fish products as a major Tambol product. The success of the project activity on fish processing business is widely acknowledged by the people at the project site.

2. The second year (2003)

2.1 Action plan

Activity III is composed of two main sub-themes to justify and develop local business as means to achieve stability and standardization of "One-Tambol, One-Product" project. The first sub-theme is improving the post harvest technology for new value added products while the second sub-theme is the introduction of alternative job opportunities to support the "One-Tambol, One-Product" project.

Improvement of post-harvest technology for new value added products was planned to be implemented in 2003. This included the following activities:

Training courses
More advanced technology for food processing, Introduction of village outlet management, and Guidance on accounting and bookkeeping for the processing groups

2.2 The results

It was observed that the pace of participation by the women members became slower in most cases. In order to investigate the reasons behind this phenomenon, a survey in each village was conducted on 16-21 June 2003. The result indicated that processing activities done by women's group No. 1 can be continuously conducted but not those done by women's group no. 3 and 7. This was because different numbers of the members have fisheries as their main occupation having different working time in a day. Most women participating in the women's activities are housewives of fishers, as such they are fully engaged in processing fish products at home during the fishing season and can spare little time for other women's activities.

In general, there are structural and managerial problems prevailing in the women's groups and the project has intervened to coordinate and find solutions through repeated meetings and direct dialogue with each group. From the outset, Village No. 1 and Village No. 6 have jointly established a processing yard with subsidy from the DOF of Thailand, but now Village No. 6 is eager to set up one on its own. To do that, the farmer's group of Village No. 6 considered assisting their women's group in their financial requirements.

It was discovered that the accounting and bookkeeping in the women's groups was unsystematic and in order to avoid distrust from their members, it was decided as a matter of urgency to introduce an appropriate system. Contact was made with the Fisheries Economic Division of the DOF Thailand, which agreed to

collaborate with the project and to introduce basic accounting procedures to all women's groups in the project area.

Women's Group No. 1

Village No. 1 has initiated to register with the Development Community Department (DCD) and will therefore be recognized as a legitimate organization. The group also intended to apply for Good Manufacturing Practices (GMP) certificate for processing quality fish products. This certificate is issued by the Ministry of Public Health and guarantees the quality of goods produced and the reputation of the group. Discussions were held with the DOF Fish Technology Institute for collaboration in the improvement of their products quality and diversity of products in the project area. An official request was made to the DOF by SEAFDEC/TD in the previous reporting period and they agreed to collaborate, especially in quality control. A joint team has scheduled to visit the project site to inspect current processing methods and identify the needs and requirements for the certification.

A recent and encouraging development in Village No. 1 was their ducks raising venture, which began in May 2003 with financial and technical support from the project, the DOF, the Department of Community Development (DCD) and a local NGO (ZIP's fund). The group has about 1,100 ducks and was selling fresh and processed eggs.

Women's Group No. 4

In June 2003 another group, Ban Bang Wan (Village No. 4) began to process agricultural products like pun-seb (local snacks). They applied to the provincial and Ao.Bo.To offices for capital assistance, and the Ao.Bo.To provided 300,000 Baht to renovate an office space into a processing yard. The provincial office also provided 29,000 Baht to procure the necessary equipment. Coordination on the budget was provided by the project team, and the office space was scheduled to be opened in January 2004. Village No. 4 is one of oldest women's groups, having been set up in January 2001, even prior to the start of the project with focus on micro-credit and dried flower making.

Women's Group No. 6

In mid of 2003, the women of Village No. 6 wanted to join the women's group No. 1 and to take over most of the equipment belonging to Village No. 6 (which was hardly used). The Village No. 6 members objected, and asked the CMDEC to help them focus on batik printing instead.

3. The third year (2004)

3.1 Action Plan

- Develop standardization of products of women's group No. 1, 4 and 6
- Strengthen member's participation in group activities
- Promote local outlets and markets to distribute products
- Encourage women's group No. 1 and 4 to promote cost-return management in processing
- Establish a central marketing channel for fish products

3.2 The results

It was found that, the bookkeeping and accounting system employed in the group activity was not appropriate and was unsystematic therefore, it was deemed necessary to improve these for transparency of transactions and accountability. To improve the situation, training courses in Marketing Strategy, Bookkeeping and Accounting were organized between 28th and 30th June 2004 with instructors coming from the Chumphon Technology College (CTC). The training was repeated for the other groups in the villages; i.e. Village No. 1, 4 and 6. In the training courses, a general ledger which was devised by the CTC was introduced and the ledgers of product, material and labor developed by SEAFDEC/TD were also introduced. As a result of the training, Village No. 1 decided to employ an Accountant to look after all bookkeeping and accounting works.

A women's group comprising five members plus one officer from the DOF in Kuala Lumpur, Malaysia and an extension officer from the District DOF in Langkawi, Malaysia, where another co-management project is being implemented through SEAFDEC/TD, visited the project site in Chumphon form 28th April to 2nd May to inspect the product development work being carried out by the women's group in Chumphon and to exchange views on women's participation in the group activities. The activities promoted by the women's group in Chumphon were highly commended by the women's group from Langkawi.

A village development activity, the Pakklong Fair was held on 29-31 October 2004, at the project site specifically in Village No. 1. During this fair, the project was allocated few booths wherein the project activities were demonstrated and also various products made by the women's groups were sold to the public. There were a number of events like boat racing, a folksong concert, etc. that were arranged by the Ao.Bo.To.

Women's Group No. 1

The women's activity in this village was once the most active, but it faced business management problems. The featured program in duck farming was closed towards the end of June after having been in operation since May 2003 partly due to the bird flu epidemic. It is an unfortunate incident because the project expected to develop this business as an enterprise type venture of the women's group. The failure has taught them a good lesson on project management for future course of action towards a rational approach. The project made efforts to investigate the cause of the failure, which were identified as: (1) lack of technical guide on duck farming, (2) poor business management plan without proper financial feasibility study, (3) lack of proper accounting system, and (4) the unfortunate incidence of bird flu.

In an attempt to obtain a certificate of Good Manufacturing Practices (GMP) issued by the Ministry of Public Health, the project consulted with the Fish Technology Institute of the DOF for technical application. They agreed to first inspect the yards of the project area where the fish processing takes place and to provide suggestions to improve their production techniques, facilities and hygiene level. However, this did not materialized immediately because of DOF's tight working schedule.

Women's Group No. 4

This business group was established in 2001 with the start-up fund of 100,000 Baht provided by the Ao.Bo.To. in a form of a 5-year loan. The fund has been raised to 600,000 Baht by the members' savings since then. The current number of its members is 148, and the major business activity is micro-credit scheme to the members, which has been running soundly. In addition to the loan business, they are earning about 4,000 Bath a month from dried flower making. They are running the group relatively well without serious problems in management and financial aspects.

The dissemination of processing technology within the Province has been promoted by CMDEC, through a training course on processing fish products in village No. 4 on 27-28 May 2004. The main instructor was the chairwomen of the women's group in Sawe District and rendered her services voluntarily. There were 15 participants from the women's group in this training.

Women's Group No. 6

This group was originally organized as a farmers' group in 1949. Their main activity in addition to a loan business is the production of natural fertilizer, which was initiated in 2001 with an initial financing of 150,000 Baht provided by the Ao.Bo.To. The women's group was recently re-organized as a sub-group and started batik printing with the participation of 12 members after being trained by private batik printers in June. In addition, artificial flower making was also started in November.

4. The fourth year (2005)

4.1 Action plan

Expansion of local business
- Identification of potential local business opportunities
- Introduction and demonstration of local business
- Monitoring business improvement

Standardization of products
- Investigation of current production practices
- Training and/or advice for improvement and follow up
- Application for Good Manufacturing Practice (GMP)

Improvement of group management
- Identification of group management problems
- Training and/or advice on marketing promotion

Expansion of marketing channels
- Investigation on marketing channels and promotion opportunities
- Training and/or advice on marketing promotion

4.2 The results

The CMDEC organized a training course on small scale marketing strategy and group activity management on 18 August, with 20 participants from the women's groups. The Provincial Public Health Office provided guidance on the improvement of the hygiene and processing practices of the group's backyard plant in order to meet the required standards for Good Manufacturing Practices (GMP). Some modifications on their processing practices were carried out in October, which was supported financially through a loan from Ao.Bo.To.

Women's Group No. 1
In Village no. 1, the diversification of fish-based products was promoted and the variety of their products has now reached almost 10 kinds. The packaging materials were also improved, and the certificate of Good Manufacturing Practice (GMP) was awarded at the end of 2004. However, their bookkeeping and accounting systems were weak that needed follow-up for improvement. The group was unable to submit their transaction sheets for six months from January to June 2005. There are 10 regular women members in the group.

Village no. 1 was once very active towards sound group development but their working morale has gradually deteriorated. This issue was highlighted at the 2nd IC meeting held on 29 August. Some of their products were returned due to poor quality and naturally the marketing channels have become limited, which resulted in accumulated deficits in their account. The meeting therefore agreed that an intervention by the Fisheries Technology Development Division of DOF for quality improvement and the District Office for management and accounting improvement was necessary.

Women's Group No. 4
Their main products are dried flowers and some patties called Pan Sep and Thong Moun. They also prepare dried flowers and colored fabric decorations on such occasions as banquets, weddings and funerals upon request. However, their transaction was very meager and the mean income per head was only Baht 28.10 per month. This may be because the housewives in the group 4 are generally fully engaged in their activities in the rubber plantations and can hardly afford to spare their time for the group work.

Women's Group No. 6
The main business activity of the group is batik printing which began in June 2004 after having been trained by a professional batik printer. Their business was running well producing various batik printed materials like clothes, shirts, T-shirts, bags and handkerchiefs. The average monthly share per member

reached as much as Baht 2,170 which is a considerable amount since the members normally work 3 to 4 hours a day after finishing their work at the rubber plantations. There are 185 women members in the group but only 5 to 7 active and regular members participate in this group work. In addition to batik printing business, a training course in tailoring T-shirts was conducted in April by the Mobile Training Institute. This course was arranged by CMDEC with 17 members participating.

5. The fifth year (2006)

5.1 Action plan

The women's group were encourgaed to develop skills in production and management of cottage scale industries with special emphasis on the standardization of products including the improvement of the quality of their products as well as the packaging materials used and the design that lead to effective marketing promotion. The responsibility to coordinate this activity was transferred from TD to DOF Fisheries Technology Development Division (FTDD).

5.2 The results

Women's group No. 1

For Village no. 1, a follow up training course on good manufacturing practices for the women's groups in the southern part of Thailand was organized by the Fish Technology Development Division (FTDD) of DOF in November 2005. When the experts from FTDD visited the women's group no. 1 on 22 March 2006, they made a thorough investigation on the production processes involved in the cottage-scale fish processing yard. A number of suggestions to improve quality of the products were made, such as the need to change the packaging material from the presently used single layer PE to aluminum laminated PE. The FTDD expressed their interest to assist the group in monitoring the quality improvement of their products by sensory and chemical evaluation.

A part-time accountant was employed in January 2006 in order to improve their bookkeeping and accounting systems. The accountant prepared a simple accounting sheet showing transactions in sales and purchases from December 2005 onwards, to help improve the transparency of their operations as a group activity. Following the continued efforts exerted by the project in introducing proper bookkeeping and accounting systems, the group recruited a part-time accountant who was employed from July 2006. With such input, the accounting system has been evidently improved as shown in the foregoing tables. After all their efforts, the group was awarded the prize for having a well-maintained accounting system by the Cooperative Promotion Office of Chumphon Province on 26 October 2006.

The quality of the product and packaging has also been improved after incorporating the advice and suggestions from the Fisheries Technology Development Department (FTDD) of DOF, especially the introduction of a tray packing method. The products have since been well recognized and accepted by the OTOP in Chumphon Province. The production lines have been diversified with eight different types of dried anchovy products under the technical guidance by the FTDD. The processing yard was awarded the GMP (Good Manufacturing Practices) by the Ministry of Public Health in addition to the group's good accounting system. Corresponding to the efforts in standardization of the quality of their products, the marketing channels have also been expanded in other provinces such as in Surattani. However, a bottleneck in expanding their production emerged because of the limited capacity of their dryer oven. The total amount of standing orders received from regular customers reached 9,000 packets (equivalent to 1,800 kg of raw materials) per month, and the maximum capacity of the old dryer oven was 18 kg (in terms weight of raw materials) per eight (8) hrs at the maximum. The group was trying to cope with the limited oven capacity by operating round the clock in three (3) shifts, but it was still not sufficient.

Table 1: Transaction sheet in production of Anchovy products for the Group No.1. (2006)

No.	Month	Sales	Expenditure (Bath)								Gross income (Baht)
			Raw materials	Transport	Salary				Misc.	Total Expenditure	
					Employee	Member	Accountant	Total			
1	January	96,067	48,911	6,060	7,500	11,500	1,500	20,500	11,618	87,089	8,978
2	February	129,102	81,107	4,767	7,963	11,500	1,500	20,963	5,114	111,951	17,151
3	March	171,852	98,984	8,000	9,469	10,000	1,500	20,969	28,350	156,303	15,549
4	April	125,345	82,000	6,200	6,001	12,000	1,500	19,501	6,741	114,442	10,903
5	May	137,711	92,674	6,200	8,740	12,000	1,500	22,240	4,352	125,466	12,245
6	June	201,692	144,820	10,500	7,790	12,000	1,500	21,290	4,386	180,996	20,696
7	July	129,168	143,684	6,924	23,765	3,000	5,500	32,265	3,810	186,683	-57,515
8	August	203,080	142,931	10,282	15,352	3,000	5,500	23,852	2,924	179,989	23,091
9	September	207,765	218,192	13,655	17,648	3,000	5,500	26,148	8,650	266,645	-58,880
10	October	225,480	155,776	10,880	46,386	3,000	7,000	56,386	4,800	227,842	-2,362
11	November	206,216	157,907	10,393	27,924	3,000	7,000	37,924	9,118	215,342	-9,126
12	December	343,180	105,961	6,240	35,968	3,000	7,000	45,968	3,944	162,113	181,067
	Total	2,176,658	1,472,947	100,101	214,506	87,000	46,500	348,006	93,807	2,014,861	161,797

The FTDD suggested that the group procure a larger and modern oven to meet the required production capacity otherwise it would result in deterioration of the quality of their products. To meet such requirement, SEAFDEC/TD provided a new dryer oven in December 2006 costing Baht 32,240. The machine was made operational in January 2007 and since then, the production volume has been increased and the workload has been reduced.

The summary of transactions in 2006 (Table 1) showed that the women's group yielded a gross income of Baht 161,797 through their business activity. Of the gross income (Baht 161,797), Baht 113,233 was distributed to 71 members depending on the number of shares per member (Table 2). A balance of Baht 32,384 was retained in the group's fund as the group's share. Thus, Baht 1,595 was distributed to each member on the average as their share dividend in 2006.

Table 2: Distribution of the gross income in 2006 (Group No.1)

Gross income (Bath)	10% for committees' reward in kind (Bath)	Remained (Bath)	Number of share			Amount distributed per share (Bath)	Total amount distributed to members (Bath)	Total amount retained with the group (Bath)
			Member	Group	Total			
161,797	16,180	145,617	7,112	2,034	9,146	16	113,233	32,384

Women's group No. 4

The group continued to prepare flower and color fabric decorations on request during banquets, weddings and funerals. Since the village members are predominantly engaged in the rubber plantations, the women members can hardly find time to spare for the group work. The women's group started a new venture selling daily general commodities. The group applied for the SML under the Ministry of Interior for their initial capital and Baht 250,000 was granted to them in May 2006. The group organized a commodities retailing sub-group and have been appealing the group members to join in this new venture. As a result 36 members joined the original members and its chairperson and vice-chairperson were elected. The group recruited a shopkeeper and opened the shop on 9th June 2006, and the first stocktaking was made on 25th July. Their income showed a profit of Baht 7,162 in 2006 and was distributed among the members based on the following calculation.

Out of the total income, the profit was distributed as follows:

Bonus for regular buyers (members)	10%
Remunerations for committee members	20%
Bonus for the shopkeeper	5%
Reserved for interests	5%
Savings	20%
Administration fee	15%
Share for members	25%

The SML scheduled to evaluate the activity after one year's operation and depending on the outcome, additional funds may be provided in order to expand the group's business.

Dried flower making for occasions such as funerals was continued in 2006. This activity produced a total net income of Baht 44,355 which resulted in the distribution of Baht 6,409.76 to each participating member on the average as remuneration in 2006 (Table 3).

Table 3: Transaction sheet for the Group No. 4 (2006): Production dry flowers

No.	Month	Sales	Expended (Bath)				Gross income (Baht)	Saving (Bath)	Members attendance to work (Baht)	Share divided to a participant (Baht)
			Raw material	Transport	Misc.	Total Expenditure				
1	January	10,000	700	1,000	300	2,000	8,000	1,500	8	812.50
2	February	0	0	0	0	0	0	0	0	0.00
3	March	9,000	500	0	0	500	8,500	700	7	1,114.29
4	April	0	0	0	0	0	0	0	0	0.00
5	May	12,500	600	0	0	600	11,900	1,200	7	1,528.57
6	June	7,500	300	0	0	300	7,200	1,000	7	885.71
7	July	6,500	300	0	0	300	6,200	1,000	7	742.86
8	August	3,500	200	0	0	200	3,300	500	6	466.67
9	September	0	0	0	0	0	0	0	0	0.00
10	October	0	0	0	0	0	0	0	0	0.00
11	November	24,000	19,000	0	0	19,000	5,000	2,500	6	416.67
12	December	20,000	15,345	0	0	15,345	4,655	2,000	6	442.50
	Total	93,000	36,945	1,000	300	38,245	54,755	10,400		6,409.77

On the other hand, the production of snacks has been reduced due to lack of manpower (Table 4). Only Baht 373.06 was distributed to each participating member as remuneration in 2006.

The group's mini-credit scheme was still very active. Initiated in 2001, the current members have increased to 164. Their total savings reached Baht 680,250 and the total interests yield in 2006 through their transaction amounted to Baht 45,042, of which, Baht 31,529 was distributed to the members as share dividend after deducting the required expenses like reserves for the next year's operational cost, remunerations for the committee members, etc. Their bookkeeping and accounting are well maintained by an accountant, who is also a committee member and an officer of the Sub-District Office under the supervision of the District Office.

Table 4: Transaction sheet in production of snack for the Group No.4. (2006)

No.	Month	Sales	Expended (Bath)				Gross income (Baht)	Saving (Bath)	Members attendance to work (Baht)	Share divided to a participant (Baht)
			Raw material	Transport	Misc.	Total Expenditure				
1	January	0	0	0	0	0	0	0	0	0.00
2	February	800	346	0	54	400	400	100	5	60.00
3	March	0	0	0	0	0	0	0	0	0.00
4	April	0	0	0	0	0	0	0	0	0.00
5	May	1,600	680	0	50	730	870	100	9	85.56
6	June	0	0	0	0	0	0	0	0	0.00
7	July	0	0	0	0	0	0	0	1	0.00
8	August	800	400	0	40	440	360	0	4	90.00
9	September	1,000	450	0	0	450	550	0	4	137.50
10	October	0	0	0	0	0	0	0	0	0.00
11	November	0	0	0	0	0	0	0	0	0.00
12	December	0	0	0	0	0	0	0	0	0.00
	Total	4,200	1,876	0	144	2,020	2,180	200	-	373.06

Women's group No. 6

This group is producing various batik printed materials like clothes, shirts, T-shirts, bags and handkerchiefs. The average monthly share per participating member reached as much as Baht 4,500 at the highest which is a considerable amount as they are normally working for 3 to 4 hours a day after finishing their own work in the rubber plantations.

The main business venture of the women's group No. 6 is batik production. As seen in the transaction sheet for 2006 (Table 5), their income was Baht 62,575 and this was divided among two participants. Actually there were more members involved in batik painting work but their names did not appear in the balance sheet.

The sale of batik shirt in this reporting period has been reduced due to the trend of wearing yellow T-shirts that has become much more popular to honor His Majesty the King. Mass orders from institutions have been hardly received towards the end of 2006 and this trend became more conspicuous in 2007. Also, the group split into three and each sub-group started to produce batik prints individually in 2007.

Table 5: Transaction sheet for the Group No 6 (2006) : Producing batik

No.	Month	Sales	Expenditure (Baht)				Gross income (Baht)	Members attending to work (Baht)	Share divided to a participant
			aw materia	Transport	Misc.	Total expenditure			
1	January	5,400	4,800	0	0	4,800	600	2	300.00
2	February	4,758	4,098	0	0	4,098	660	2	330.00
3	March	5,400	3,600	0	0	3,600	1,800	2	900.00
4	April	9,900	6,600	0	0	6,600	3,300	2	1,650.00
5	May	13,500	9,000	0	0	9,000	4,500	2	2,250.00
6	June	27,000	18,000	0	0	18,000	9,000	2	4,500.00
7	July	26,100	17,045	0	0	17,045	9,055	2	4,527.50
8	August	36,000	32,000	0	0	32,000	4,000	2	2,000.00
9	September	54,000	48,000	0	0	48,000	6,000	2	3,000.00
10	October	60,750	43,200	0	0	43,200	17,550	2	8,775.00
11	November	13,050	9,280	0	0	9,280	3,770	2	1,885.00
12	December	6,500	4,160	0	0	4,160	2,340	2	1,170.00
	Total	262,358	199,783	0	0	199,783	62,575	2	31,287.50

V. Conclusion And Recommendation

Under Activity III: Encourage local business the focus was on alternative livelihoods that the project has helped developed or assisted to provide additional sources of income for the local people. The women's groups were encouraged to develop their production and management skills in cottage industries with special emphasis on the standardization of products including the improvement of the quality of their products and on packaging materials and design leading to effective marketing promotion. Aimed at strengthening transparency in accounting and business transactions, good bookkeeping and accounting systems were promoted in each group.

Learning new technologies and techniques to improve their production greatly help the local people in their livelihood. It was also necessary to update the knowledge of the local people on management, accounting, planning and marketing systems.

Women's Group No. 1
The members of this group comprised the fishermen and housewives, which is the main target group of the project.

Fish processing activity was a good alternative livelihood because it adds value to the fish products and enables them to have better profit.

Developing systems in terms of quality, better packaging, marketing and accounting resulted in the smooth flow of their business ventures.

This group is now under the OTOP network, which helps them in marketing, and in finding agencies that could assist the group when they encounter problems or are faced with issues that they cannot address by themselves.

Women's Group No. 4
The group has 13 active members, and each member helps in accepting orders for various occasions enabling them to deliver many orders at the same time.

This group has a number of activities as alternative livelihoods such as processing of Pan Sep and Thong Moun (local snacks), dried flower making and selling daily general commodities. The group is contemplating to continue the dried flower activity and selling daily general commodities only, because of the higher profits it brings compared to processing snacks.

Women's group No. 6
This group is involved in batik printing and eco-tourism business. Although batik printing is still going on, eco-tourism seems stagnant.

They are developing skills for negotiating with their clients, and expect that this venture would continue as they have developed a good network with Ao.Bo.To.

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DESCRIPTION OF THE PROJECT ACTIVITY AND OUTCOME LOCAL BUSINESS DEVELOPMENT: TRIAL PRODUCTION OF BABYLONIA SHELL

Seiichi Etoh
Training Department, Southeast Asian Fisheries Development Center (SEAFDEC/TD)

I. BACKGROUND

The project has exerted efforts in promotion of prospective local business among fishers and women's groups in the project area since inception of the project. The implication in this attempt lies in not only increasing supplemental income sources among fishers' families but also looking for alternative job opportunities to avert over-capitalization in fishing efforts.

Babylonia shells have been widely consumed in Thailand at relatively high price. Moreover, the demand for this shell has been boosted recently after the export market to Taiwan was exploited. Some substantial amounts of this shell must have been exported to the foreign markets although no precise statistic data is available. With such a marketing trend, the culturing Babylonia shell has commenced in the central part of Thailand especially in the Chonburi Province in order to offset the expanding domestic demand. Under this trend of increasing market demand, the project considered it worthwhile and promising to introduce this new venture among those who were interested.

Consonant with this implication, the experimental babylonia shell culture was conducted for 7 months from August 2005 to February 2006. However, the result was rather pessimistic with mal-growth of the shells, especially after 3 months' culturing. The suspected cause for this may be attributed to the unfavourable sea conditions after November when the monsoon season set in. Also, some other reasons were suspected as discussed in the report: Experimental Babylonia Shell Culturing (Etoh 2006). The experiment was not satisfactorily conducted as such, and in order to ensure commercial feasibility in this venture the 2nd experiment was conducted for 6 months from March to September 2006 during calm seasons in the improved way incorporating lessons learned through the first experiment.

II. MODE OF EXPERIMENT / DEMONSTRATION

1. Operational mode

The project provided all materials and equipment necessary for this experiment to the Aquaculture Sub-group of the Pakklong Aquaculturists Group (PAG) and the experiment was continued for 6 months under close supervision by the SEAFDEC/TD Field Extension / Liaison Officer. The intermittent technical supervision was provided by the research officers from the Chumphon Marine Aquaculture Station (CMAS).

2. Construction of cages and rafts

The old 10 cages used in the previous experiment were brought in the mechanical workshop of SEAFDEC/ TD for necessary repair and modification, particularly shortening the height of each cage and replacing plastic trays in the bottom basin. The raft with the bamboo frame was also reinforced and installed near the crab bank cage so that close monitoring to protect from likely theft became possible. Another advantage in this location lay in its calm sea protected by the island.

3. Experiment

The 2nd experiment was commenced on 21 March 2006. In each cage, 700 pcs of shell seed hatched in the Chumphon Coastal Aquaculture Center (CCAS) were released totaling 7,000 pcs in all. The average weight of a seed was 0.33g which was comparatively smaller than the one in the previous experiment, 0.48g. The price was 0.75 Baht per piece compared with 0.60 Baht in the previous experiment.

Daily taking care for maintenance of cages and feeding was exerted by the locally assigned SEAFDEC/TD extension officer with assistance of local fishing community. Small fish mainly caught by squid cast-netters as by-catch were purchased daily at around 12 to 15 Baht per Kg and fed to the cages after splitting. The daily feeding quantity were initiated 0.5Kg for 10 cages and increased to 2-3Kg judging from the remaining of unfed fish. The amount of feed given every day was recorded by the extension officer. Remaining residues were removed every day and the cages were cleaned once a week.

The growth in weight was measured and recorded by the extension officer every fortnight in a way that 100 pcs of shell were picked up at random from the cages No.1 and 10 to measure the growth of shells and the total numbers survived were countered in both the cages.

As such, the experiment was continued up to 22nd September 2006 with 185 operational days.

III. Observation

Toward the end of experiment, it was observed that some shells were tainted with black colour. The taste, texture and floavour were not different from normal ones. The consultation was made with the researcher in the CMAC was made to find a cause and seek a solution. As a result, it was found that the black colouring was attributed to the contact with the mud at most times. This black colouring was seen especially in shells in cage No. 4 and 9 most and 5 to some extent. This is something to do with the wave direction. When the tide is low, the bottom mud is swelled up with the current and dredged at the bottom of cages. However, the black colour would turn to normal after placing them in the clean sand for a while before delivery, the researcher from the CMAC suggested.

During the course of experiment, it was observed that there was noticeable unevenness in growth rate depending on the cages. As seen in the table 1 below, the largest group in the cage No. 4 (8.6g in mean) exceeds the smallest group (4.8g in mean) in sizes by as much as 44.2%. These were fed in the exactly same condition and volume. In reference to the figure 1 below, the cause could be reasonably attributed to exposure to the strong current; the groups in No.1 and 6 which are most exposed to the strong current are smallest one, while the groups No1 and 9 which are protected from exposure to the direct current are largest. This assumption was supported by the researcher of CMAC. This can be a valuable instruction in practical application in babylonia shell culturing.

At the last stage of experiment, it was found that two cages got damaged and some shell escaped. Given that this is the experiment in the calm season, the further reinforcement on the frame is necessary in case of commercial production which is bound to undertake even during the monsoon seasons.

On 22nd September 2006 after culturing for 185 days, the experiment was terminated as it had passed the targeted culturing period of 6 months and the shells were taken out of the cages and measured. The total weight is recorded at 35.45Kg. The weight, appearance and quality are described in the following Table 2.

Table 1: Average weight of shell in each cage

Cage No.	Number of sample (Pc)	Weight of sample (gr)	Mean weight (gr / pc)	Order in size
1	100	500	5.0	9
2	50	290	5.8	6
3	50	360	7.2	3
4	50	430	8.6	1
5	50	360	7.2	3
6	50	240	4.8	10
7	50	270	5.4	8
8	50	280	5.6	7
9	50	390	7.8	2
10	100	650	6.5	5
Average	-	-	6.4	

Fig. 1. Layout of each cage and shell sizes

No. 6 (10) 4.8g	No.7 (8) 5.4g	No.8 (7) 5.6g	No.9 (2) 7.8g	No.10 (5) 6.5g
No.1 (9) 5.0g	No.2 (6) 5.8g	No.3 (3) 7.2g	No.4 (1) 8.6g	No.5 (3) 7.2g

Note: ( ) – order of size

IV. RESULT

The results of periodical measurement every fortnight in weigh and also the amount of feed given are tabulated in the table 4 of Annex 1. As seen in the table, the growth rate of shells in the cage No.10 has been increased soundly until the end of experiment, while for the one in cage No.1 the pace of growth has been dwindled slightly after 105 days. The average sizes of shells in the cage No.1 and No.10 after 185 days culturing are 5.20g and 6.87g respectively, which can lead the mean size of all shells to 6.04g. The total feed given is calculated at 469.9Kg (the last period of data for feed given was lost and it was calculated based on the previous figure.)

Table 2: Production record of Babylonia shell culturing

Cage No.	Initial stock (pc)	Final stock (6 months)			Survival rate (%)	Remarks
		(pc)	Total wt.(gr)	Wt. per shell (gr)		
1	700	543	2,825	5.20	77.6	Many lost in the last month
2	700	535	2,975	5.56	76.4	
3	700	687	5,350	7.79	98.1	Good colour and sizes
4	700	601	5,400	8.99	85.9	Tainted with black colour
5	700	637	4,700	7.38	91.0	Tainted with black colour
6	700	262	1,300	4.96	37.4	Cage damaged, small sizes remained
7	700	186	1,000	5.38	26.6	Cage damaged, small sizes remained
8	700	484	2,600	5.37	69.1	Cage damaged, small sizes remained
9	700	560	4,700	8.39	80.0	Tainted with black colour
10	700	670	4,600	6.87	95.7	Tainted with black colour
Total	7,000	5,165	35,450	6.59	73.8	

Table 3: Quantity and expected prices by size and quality

Grade	Size / quality standard	Quantity (kg)	Expected beach price (Baht) / Kg	Expected gross sales (Baht)	Remarks
A	Over 7.8g (130 pcs. per Kg)	4.2	350	1,470	
B	Between 7.8 – 5.0g in average (130 – 200 pcs. per Kg)	11.2	250	2,800	
C	Under 5.0g	12.8	Immature	-	To be further cultured
D	Black tainted shell	7.2	No marketable	-	Mostly 8.3 – 10.0g size
Total		35.4		4,270	

V. Discussion

As seen in the Table 4 and Fig 2 of Annex 1, it is obvious that the shell growth in the cage No. 10 shows satisfactorily while for the ones in the cage No.1 the pace of growth becomes slightly retarded after passing around 105 days stocking. This difference in growth is certainly caused by the position of cages as dealt in 3. Observation. This exactly demonstrates the resultant observation in the first experiment that the wave and current tend to impede the growth of shell due to less feeding. It is striking when compared with the data of experiment conducted by Dr. Ninnard Chaithavisut, Chulalongkorn University in 2002 (Ref. Fig. 2). The trend of growth in the cage No.10 is closely consistent with the one in the laboratory experiment result. (In this laboratory experiment, it seems to be a bit unrealistic that the growth rate after 150 days increases abruptly. It could be stabilized or slightly decreased toward reaching the matured size.) In addition, judging from the fact that the growth rate of cage No. 10 is not highest but just in the middle (ref. in Fig 1), shells in some cages are much bigger than those in the laboratory experiment, e.g. shells in Cage No.4 which are almost 32% larger.

As for feeding practices, some irregularity is witnessed especially around 30 and 110 days. In these periods, growth rates were unreasonable decreased, although this slow growth may not be attributed to only the feed practices but something else as well.

The average feed conversion rate (FCR) is 13.7% which is reasonable and was improved compared with 9.0% in the previous experiment. Also, as shown in Annex 3, it is obvious that the growth rates in the 2nd experiment are improved by far compared with the one in the 1st experiment. This demonstrates the diagnosis given by the researcher of CMAC that the feeding habit of shell gets deteriorated in the shaking environment by monsoon is persuadable.

VI. Economic Feasibility

As for possible marketing outlet, it was consulted with the CMAC. A few middlemen visit Chumphon to purchase the babylonia shell whenever products are ready to deliver in quantity. The prevailing beach prices are Baht 350 and 250 per Kg for grade A and B respectively, although no transaction was realized in this experiment as the quantity was too small for a middleman to attract.

The cost and profit analysis in this experiment is shown in Annex 4, which ends up with deficit. The cost and profit analysis made by Dr. Ninnard in the Chulalongkon University explained that an expected expenditure of Babylonia shell per kg would be as little as Baht 199.50 based on his laboratory experimental result, which is by far low compared with the experiment result carried out by the project with PFG; i.e. 799.15 per kg shell.

Also, the cost and profit analysis is made in case of commercial operation with the expanded capacity of 50 and 100 cages as seen in the Annex 5. Even in this calculation, no possible profit can be foreseen in this venture. The expenditure is estimated at Baht 391.11 per kg shell in case of culturing 100,000 shells, which would be still too high to expect some profit as the best beach price is Baht 350 per kg. The major expenses are the cost of seeds and labour.

VII. Conclusion

In the wake of the first experiment conducted in August 2005 to February 2006, the 2nd experiment was initiated in March 2006 in the favourable environment as more positive outcomes were expected as suggested in the laboratory test result by the Chulalongkorn University and also some encouraging lessons were learnt through the 1st experiment. However, the result was again negative as seen in the economic calculation and it is not convincing for the PFG to envisage entering this venture in future under the present marketing trend. The reasons are;

- the expected economic return is negative or too marginal even if it turns to lucrative,
- the maintenance of cages requires laborious work in cleaning and repairing and can not be managed within part-time work,
- the cost of seed is still relatively high,
- the growth rate is largely affected by the environmental condition like wind, current, tide etc. therefore it is very fragile and difficult to cope with the weather changes,
- as having been commercially established, the culturing with the concrete tanks or in the ponds may be feasible but such attempts entail huge amount of initial investment.

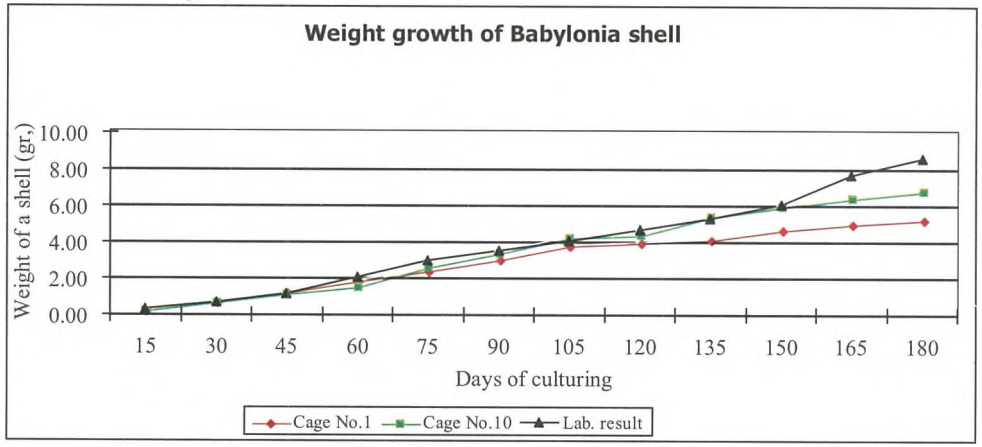
VIII. Reference

Ninnard C., Manual of Babylonia Shell Culture (Theory and Practice) 2002, 92P.

Annex 1 Table4: Growth of Babylonia Shell in the Experiment

Measuring date	Accum'ed culturing days	Cage No.1					Cage No.10					Total feed given		Lab. experiment
		Weight measurement		Number of shells (Pcs)			Weight measurement		Number of shells (Pcs)					
		Wt per 100 pcs (gr)	Mean per pc. (gr)	Survived	Dead	Escaped	Wt per 100 pcs (gr)	Mean per pc. (gr)	Survived	Dead	Escaped	(Kg)	(Baht)	Wt. per pc. (g)
21.03.2006	0	33.8	0.34	700	0	0	32.1	0.32	700	0	0	-	-	0.30
05.04.2006	15	80.0	0.80	700	0	0	78.6	0.79	700	0	0	7.3	108	0.73
24.04.2006	34	132.5	1.33	697	3	0	120.0	1.20	689	11	0	23.6	353	1.16
09.05.2006	49	196.1	1.96	697	0	0	163.9	1.64	689	0	0	23.0	230	2.07
24.05.2006	64	250.0	2.50	680	14	3	266.7	2.67	675	10	4	23.7	230	2.98
07.06.2006	78	308.8	3.09	680	0	0	348.2	3.48	675	0	0	25.4	253	3.52
24.06.2006	95	383.6	3.84	670	4	6	434.1	4.34	673	2	0	41.8	418	4.06
10.07.2006	111	400.0	4.00	670	0	0	450.0	4.50	673	0	0	80.7	968	4.70
24.07.2006	124	418.0	4.18	670	0	0	549.0	5.49	673	0	0	50.0	600	5.34
12.08.2006	144	470.0	4.70	670	0	0	600.0	6.00	673	0	0	60.0	720	6.08
02.09.2006	165	500.0	5.00	670	0	0	650.0	6.50	673	0	0			7.73
22.09.2006	185	520.0	5.20	543	5	122	687.0	6.87	670	3	0	*		8.63
Total				543	26	131			670	26	4	335.4	3,880	

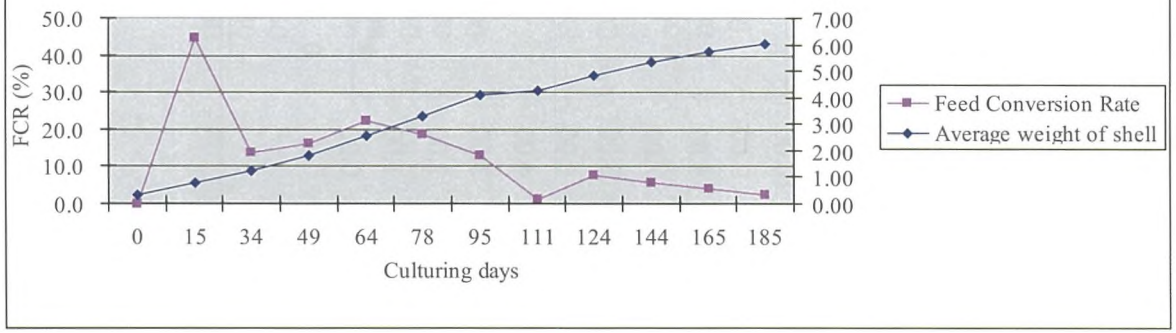
* Note: The total feed given (335.4Kg) is the total amount up to 144 days.



Annex 2 Table 5: Changes of Feed Conversion Rate of Babylonia Shell

Measuring date	Accum'ed culturing days	Duration of culturing (days)	Mean wt.per pc (g)				Survived shell				Calculated number of shells in all (pc)	Increased wt. of shells in all during the period (Kg)	Feeds given during the period (Kg)	Calculated Feed Conversion Rate (%)
			Cage No.1	Cage No.10	Average	Increased wt. during the period	Cage No. 1	Cage No.10	Average	Survival rate(%)				
21.03.2006	0	0	0.34	0.32	0.33	-	700	700	700	100	7,000	-	-	-
05.04.2006	15	15	0.80	0.79	0.80	0.47	700	700	700	100	7,000	3.3	7.3	44.8
24.04.2006	34	19	1.33	1.20	1.27	0.47	697	689	693	99	6,930	3.3	23.6	13.8
09.05.2006	49	15	1.96	1.64	1.80	0.54	697	689	693	99	6,930	3.7	23.0	16.1
24.05.2006	64	15	2.50	2.67	2.59	0.79	680	675	678	97	6,775	5.3	23.7	22.5
07.06.2006	78	14	3.09	3.48	3.29	0.70	680	675	678	97	6,775	4.7	25.4	18.7
24.06.2006	95	17	3.84	4.34	4.09	0.81	670	673	672	96	6,715	5.4	41.8	12.9
10.07.2006	111	16	4.00	4.50	4.25	0.16	670	673	672	96	6,715	1.1	80.7	1.3
24.07.2006	124	13	4.18	5.49	4.84	0.59	670	673	672	96	6,715	3.9	50.0	7.9
12.08.2006	144	20	4.70	6.00	5.35	0.52	670	673	672	96	6,715	3.5	60.0	5.8
02.09.2006	165	21	5.00	6.50	5.75	0.40	670	673	672	96	6,715	2.7	65.4	4.1
22.09.2006	185	20	5.20	6.87	6.04	0.29	543	670	607	87	6,065	1.7	69.1	2.5
Total													469.9	13.7

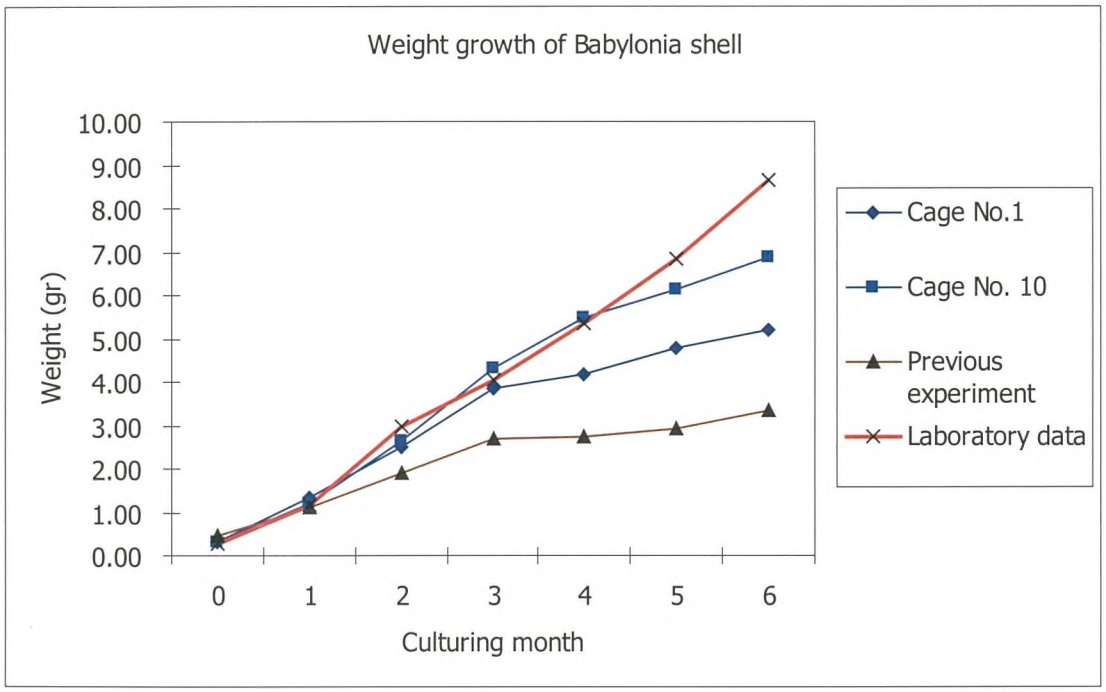
Fig 3: FCR and growth of shell



Annex 3 Comparative weight growth in experiment 1 and 2

Culturing month	Cultured shell (gr)			Laboratory data (gr)
	Cage No.1	Cage No. 10	Previous experiment	
0	0.34	0.32	0.48	0.30
1	1.33	1.20	1.13	1.16
2	2.50	2.67	1.93	2.98
3	3.84	4.34	2.70	4.06
4	4.18	5.49	2.76	5.34
5	4.78	6.14	2.94	6.82
6	5.20	6.87	3.33	8.63

* By Dr. Ninnard Chaithavisut, 2002



Annex 4

Cost & profit calculation (Experiment)

1. Base of calculation — Remarks
   - Cost of 10 cages; B aht 3,200 x 10 = 32,000
   - Depreciation term of cages: 5 years
   - Cage maintenance co st per season: 5 %
   - Cost of seed: Baht 0.75 per pc.
   - Cost of feed: Baht 3,880 per 7,000 pc
   - Cost of labour: Baht 1,500 per month
   - Fuel and lubrication : Baht 900 per month
   - Price of shell: A grade - Baht 350/Kg (over 8.0g)
     B grade - Baht 250 /Kg (over 5.0g)
     C grade - Baht 200/Kg (under 5.0g) — To be further cultured

2. Expenses	Baht	
Fixed cost		
- Depreciation cost for 6 months(Baht 32,000/10)	3,200	
- Cage maintenance cost (Baht 32,000 x 5%)	1,600	
- Labour cost (Baht 1,500 x 6m)	9,000	
- Fuel & lubrication (Baht900 x 6m)	5,400	
Sub- total:	19,200	
Variable cost		
- Cost of seeds (Bah t 0.75 x 7,000pc)	5,250	
- Cost of feed	3,880	
Sub- total:	9,130	
Total Expenses:	28,330	Baht 799.15/Kg shell

Income	Baht	
3. a. Sales		
- A grade: Baht 350 x 4.2kg	3,990	
- B grade: Baht 250 x 11.2kg	2,800	
- C grade: Baht 200 x 12.8kg	2,560	With assumption
Sales total:	9,350	
b. Income		
- Sales total	9,350	
- Expenditure total	28,330	
Net income:	- 18,980	

Annex5

Cost & profit calculation (in commercial scale)

	In case of 50 cages	In case of 100 cages	Remarks
1. Base of calculation			
- Number of cages:	50	100	
- Number of shell in a cage	1,000	1,000	
- Total number of shell to be cultured	50,000	100,000	
- Cost of cages; Baht 3,200 each	160,000	320,000	
- Depreciation term of cages:	5 years	5 years	
- Cage maintenance cost per season:	5%	5%	
- Cost of a seed:	Baht 0.75	Baht 0.75	
- Cost of feed per shell for 6 months:	Baht 0.55	Baht 0.55	
- Cost of labour per month:	Baht 5,625	Baht 11,250	
- Fuel and lubrication per month:	Baht 900	Baht 900	
- Price of shell: A grade(over 8.0g, average 10.0g)	Baht 350/Kg	Baht 350/Kg	
B grade (over 5.0 to 8.0g, average 6.5g)	B aht 250/Kg	Baht 250/Kg	
C grade (under 5.0g, average 4g)	Baht 200/ Kg	Baht 200/kg	Further cultured
- Mortality rate of shell:	5%	5%	
- Number of product in pc.: A grade (32%)	15,200	30,400	
B grade (32%)	15,200	30,400	
C grade (36%)	17,100	34,200	
Sub-total:	47,500	95,000	
- Quantity of product in kg: A grade (32%)	152	304	
B grade (32%)	99	198	
C grade (36%)	68	137	
Sub-total:	319	638	

2. Expenses	Baht	Baht	
Fixed cost			
- Depreciation cost of cages for 6 months	16,000	32,000	12.8%
- Cage maintenance cost (5% of initial investment)	8,000	16,000	6.4%
- Labour cost	33,750	67,500	27.1%
- Fuel & lubrication	5,400	5,400	2.2%
Sub-total:	63,150	120,900	48.5%
Variable cost			
- Cost of seeds (Baht 0.75 per a seed)	37,500	75,000	30.1%
- Cost of feed (Baht 0.55 per a shell)	26,813	53,625	21.5%
Sub-total:	64,313	128,625	51.5%
Total Expenses:	127,463	249,525	Baht 391.11/Kg

3. Income	Baht	Baht
a. Sales		
- A grade: Baht 350 per Kg	53,200	106,400
- B grade: Baht 250 per Kg	24,700	49,400
- C grade: Baht 200 per Kg	13,680	27,360
Sales total:	91,580	183,160

AQUACULTURE EXPERIMENT

Nopparat Nasuchol
Chumphon Marine Fisheries Research and Development Center
408 Moo 8, Paknam, Muang, Chumphon 86120

I. BACKGROUND

Fish culture in Thung Ma Ha Bay is mainly on sea bass, grouper and green mussels. Normally, the feeds for the fish culture are trash fishes caught by push net. Early in the morning, the fishermen operate their push nets around the fish cages, which are not more than 3 km from a relevant baseline. After CBRM project started in October 2001, a provincial coastal demarcated zone announcement on 4 October 2002 prohibited push nets, purse seines and dredges in the area. Many fish culturists got affected from this proclamation since they could no longer catch trash fish for their culture operations. While understanding the situation, the project tried to solve the problem. Thus in 2006, the Chumphon Marine Fisheries Development and Research Center (CMDEC) started a demonstration cum experiment with Chumphon Coastal Aquaculture Station (CCAS) on ARs feeds for fish culture. The responsibility of looking after the culture facilities and feeding the stocks was entrusted to a fish farmer who was designated by the aquaculture group.
Without cage culture, crab trap fishermen had problems because the crabs they caught were below the marketable size. In a group discussion among the staff of CMDEC and the crab trap fishermen in December 2004, they agreed to conduct an experimental crab culture in cages until marketable size. The CMDEC coordinated the whole scheme and provided the necessary expenses, while the crab trap fishermen were responsible for the practical implementation of the activity

II. SEA BASS AQUACULTURE

1. Objective

To demonstrate the benefit of ARs feeds in sea bass aquaculture

2. Fishermen participating in the sea bass aquaculture

Mr. Phirin Suwannaphut	4 cages
Mr. Niyom Daengtae	1 cage
Mr. Chaisit Chaiythui	1 cage
Mr. Cherd Khewmanee	3 cages
Mr. Teing Phumchat	3 cage

3. Experiment and demonstration

Equipment and Methods
12 fish cages, 4x4 meter, 6 cages for trash fish feeds and 6 cages for ARs feeds. Each cage was stocked with 1,000 fishes, size: 2-3 in and ave weight: 3.94 g.

Growth rate = (Final weight – First weight)/Number of days; measurement not by water technique

feeding and looking after the stocks by the fishermen. Consultant by CCAS

Experiment
The experiment commenced on 24th April 2006 with the transfer of 12,000 fishes from a private farmer in Phetchaburi Province. The ave weight of the fish was 3.94 g and the price was 4 Baht/piece. The fishes were distributed to the 12 cages at 1,000 pieces per cage.

In the Agreement, for ARs feeds, the capital was provide by CMDEC and after the culture and having profit, the fishermen will return the capital to CMDEC but for trash fish feeds, the fishermen had to find capital by themselves. A farmer stays in a hut to look after the culture facilities and feed the fishes. The amount of feeds given twice per day was recorded. The location of the trash fish feeds experiment was at sea while that of the ARs feeds experiment was set at a channel with salinity of 30-32 ppt and 15-16 ppt, respectively (Fig. 1). The weight was measured and recorded by CMDEC officer using a technique instead of the water technique in beginning and upon termination of the experiment.

Fig. 1 Location of trash fish feeds and ARs feeds experiment

Results

In the afternoon of 15 May 2006, one fish culturist, Mr.Cherd use anchovy bought from a middleman to feed the sea bass but in the morning of the next day all fishes in 3 cages were dead. While that of Mr.Teing's, the fishes were injured and found dead everyday because it was continuously raining during the first week of July 2006, so the experiment was terminated. For the ARs feeds experiment when it was raining in July, many fishes died because the farmer moved the fishes to a pond and he could not immediately find an air pump. He tried to keep the fishes in the pond until the situation became normal. In this connection, the researchers from CCAS observed that:

Fig. 2 Fish affected by bacterial disease

- All fishes that have been dead in the morning of 16 May 2006 may have been given trash fish with residues of chemicals used to preserve the fish.

- When it rains, low salinity stresses and agitates the fish and since there are parasites in the sea, when the fish rubs its body with the net where the parasites hold on, the bacteria enters the sore parts of the fish leading to mortalities (Fig. 2).

During that time, the staff of CMDEC checked the water quality in the canal, the results of which are shown in Table 1.

For the ARs feeds experiment during raining period in July, the culturist transferred the fishes to a small pond but could not find air-pump immediately. After 1 hour, some fishes with ave. length and weight of 18.5 cm and 75.78 g, respectively died while some 1,637 fishes survived. The surviving fishes were again cultured in the floating cages until 2 February 2007 (Fig. 3). In this experiment, sea bass grew satisfactorily in 63 days from initial ave. weight of 3.94 g to 75.77 g. In August, change ARs feed to bigger size that percentage of protein lower than old size. The fishes had ave. weight of 263.12 g within 214 days or at a growth rate of 1.18 g/day. A researcher from CCAS considers feeds as among the reasons for the slow growth. On 17 April, CMDEC sent ARs feed sample to the Freshwater Fish Feed Research Institute for the analysis of total protein content. The result showed that the protein content was standard for culture. In fact, with limited laboratory facilities, can not determine the protein content from fish meal or part of animals such as feather. For example , if use feather in ARs feed ,the total protein content was standard but may have been of lower in quality

4. Conclusion

In order to confirm the result, the farmer continued to culture the fish using trash fish. The results showed increase in weight of about 149.28 g during the next 61 days. On 3 May 2007, the farmer sold 121 kg sea bass with ave. weight of 500-700 g, 88 kg at 400-500 g, and 18 kg at 300-400 g valued at 20,050 Baht. The remaining 100 fishes weighed less than 300 g.

This experiment could not be concluded as a failure due to feeds, water quality or culture technique because the result from trash fish feeds could not confirm that the ARs feeds were of low quality. However, the fisherman learned that floating cages are better than fixed cages because these can be moved to another area when the water quality of a culture area starts to deteriorate.

Table 1. Water quality monitored in July

Water quality	normal	rainy
ammonia	0.11	0.103
nitrite	0.017	0.013
phosphate	0.73	0.100
DO	3.43	4.360
pH	9.06	9.230
salinity	16.07	3.160

5. Limitations

- Could not set the experiment in a neighboring location because the area was designated for aquaculture
- The project site was far from the CMDEC so its staff could not often visit the farmer and solve any problem immediately

III. Swimming Crab Aquaculture

1. Objective

To study the possibility of swimming crab culture in cages

2. Experiment and demonstration

Construction and installation of cages

In January 2005, cages with net mesh size of 6/8 inch were constructed by the fishermen in Ban Koh Teab. On 28 June 2005, staff from CMDEC and Crab Trap Fishermen group (CTFG) installed 10x10 m cages in the sea near the crab bank while installation of smaller cages, 4x4 m was done on 28 April 2006.

Experiment

This experiment has 2 phases: the first phase was from 28 June to 29 September 2005 in the 10x10 m cages stocked with 1,200 crabs of mixed sexes; and the second phase was from 28 May to 11 July 2006 in 4x4 m cages, one cage containing 100 male crabs, one cage had 100 female crabs and the other cage with mixed 50 female and 50 male crabs.

Chairman of CTFG, Mr. Chang looked after the culture and in feeding the crabs. Every day before or after operating the crab trap, he feeds the juvenile crabs with trash fish bought from middlemen at 10 Baht/kg. The feed quantity depends on the growth stages of the crabs.

Monthly sampling of data in the 10x10 m cages was done using the crab trap but before collecting the data, the crabs must not be fed for one day because it is easy to catch the crabs when they are hungry. For the 4x4 m cages, restricted net is used and making use of a boat to measure the weight and length (Fig. 4).

Fig. 4 Technique for collecting data on crabs in cage

3. Result

In 2005, good growth rate was observed in 2 months, from 22.22 g to 76.92 g but after that the increase was only 6.67 g in one month and survival was only 1.58% (Table 2).

Table 2. Growth of swimming crab in 10x10 m cage

month	weight(g)	Remain (crab)
1	22.22	1200
2	43.48	
3	76.92	
4	83.33	19 (1.58%)

Observations from the first experiment: culture period should not be more than 2 months. In 2006, the culture period was 45 days in the 4x4 m cages and using different sexes. Results indicated that the all male cage had ave size of 26.44 g at the start to 68.57 g during harvest with a survival of 13%. In the all female cage, the ave size was 28.48 g at the start to 58.92 g during harvest and survival of 7 %, while in mixed sex cage the ave size was 27.51 g at the start 58.39 g at harvest with survival of 56% (Table 3).

Table 3. Growth of swimming crab in 4x4 m cages

day	male		Female		Mixed female and male	
	weight(g)	remain	weight(g)	remain	weight(g)	remain
start	26.44	100	28.48	100	27.51	100
final	68.57	13	58.92	7	58.39	56

4. Conclusion

Swimming crab culture is not suitable for fishermen because more time must be used to be take care and observe behavior of the crabs. If the feeds given is not enough, the strong crabs eat the weak crabs especially during molting .The benefit is therefore not worthwhile.

PAKKLONG FISHERMEN'S GROUP

Wara Kateumpai
Pakklong Fishermen's Group
52/2 Moo 1, Pakklong, Pathew District, Chumphon 86210

I. BACKGROUND

The Integrated Coastal Resources Management Project was conducted by SEAFDEC in cooperation with the Department of Fisheries (DOF) Thailand for a period of five years starting in 2002 with an overall objective of promoting community fisheries co-management. Almost all activities were implemented in cooperation with the fishermen. However, it was found out that some group activities could not go on due to lack of coordination. Activities were conducted by people within the group and people outside the group could not participate, thus, all fishermen could not benefit from the results of the activities.

Each village of Pakklong Sub-district has their own fishermen's group that aims to carry out fisheries resources conservation in their areas. In 2005, the ICRM-PD Project reorganized the fishermen's groups into a cooperative in order to improve their efficiency.

II. REORGANIZATION OF PAKKLONG FISHERMEN'S GROUP

Three meetings were conducted:

1. The 1st meeting on 18-19 January 2005

Five representatives from each group, i.e., from six fishing gear groups and one aquaculture group attended the meeting, which aims to make the fishermen understand about cooperatives following the recommended Thai and Japan styles.

Summary of this meeting

1. A total of 59 participants attended this meeting, representing the fishermen and other stakeholders in project area.

2. The leading posts for each sub-group were selected.

3. Each sub-group identified the problems they encountered and suggested countermeasures. These included the following:
   - High price of oil/fuel. Solution: set up fuel fund by the cooperative.
   - Trawler problem. Solution: arrange for local Enforcement Unit.
   - Low price of production. Solution: arrange with the central market.

   This way, the fishermen had strength as a group and a good system to solve or reduce any problem

2. The 2nd meeting on 22-25 February 2005

This meeting was arranged 7 times for the 7 sub-groups to select the committee members and identify members for the sub-groups. The result of the Meeting follows:

Members of Squid cast net/Anchovy cast net group: 49 persons
Members of Mackerel gill net group: 18 persons
Members of Squid trap group: 18 persons
Members of Crab trap group: 27 persons
Members of Crab gill net group: 13 persons

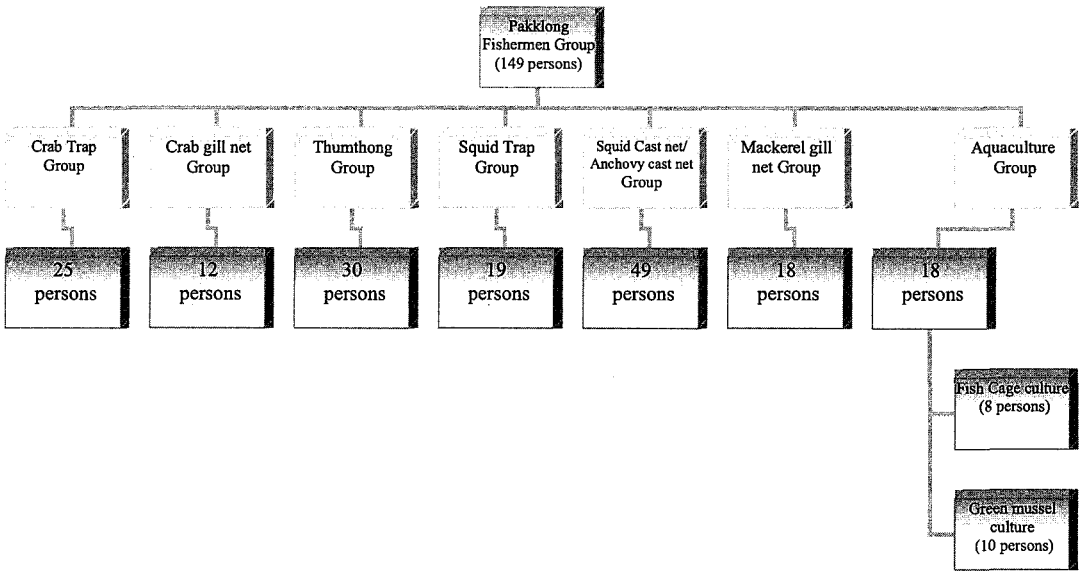
Members of Thumthong group: 32 persons
Members of Aquaculture group: 18 persons, broken down as:
Members of Fish culture group: 8 persons
Members of green mussel culture group: 10 persons

3. The 3rd meeting on 22 March 2005

This meeting was arranged to select the chief and committee members of the Pakklong Fishermen Group. Pakklong Fishermen Committee members are leaders and vice leaders of the sub groups. The names of the committee members are as follows:

Ms.Varah Ketumpai	Leader
Mr.Vinai Ketkaew	Vice leader
Mr.Vichain Tithada	Secretary
Mr.Payoa Srichan	Assistant secretary
Mr.Jang Phungpheang	Committee Member
Mrs.Jinda Thongchum	Committee Member
Mr.Suthan Srizungsom	Committee Member
Mr.Jesada sa-ard	Committee Member
Mr.Thanomsak Maimak	Committee Member
Mr.Suthum Srizungsom	Committee Member
Mr.Jumnong Srichan	Committee Member
Mr.Natee Yoosuk	Committee Member
Mr.Pirin Suwannabut	Committee Member
Mr.Suchart Yadum(Head of Sub district)	Advisor

4. Pakklong Fishermen Group Organization Chart



5. Duties and Responsibilities of Pakklong Fishermen Group

- To represent the fishermen in raising problems with the government.
- To coordinate with government and other fishermen groups.
- To find ways in promoting fisheries resources management and conservation.
- To patrol illegal fisheries in the project site.
- To participate in discussions on how to solve fisheries problems with the project staff.

6. Pakklong Fishermen Group Activities

- Participate in the government staff efforts in patrolling and arresting illegal fishers in the project site
- Conduct grouper culture experiments by feeding
- Conduct Babylonia culture experiments
- Participate in SEAFDEC activities related to installation of Fish Enhancing Device
- Conduct swimming crab culture experiments
- Support ecotourism in the area
- Take active part in the landing survey conducted by project staff
- Participate in fish releasing, mangrove reforestation and tree planting activities
- Take part in the Crab Bank Scheme

Activities in 2006

- On 23 December 2006 Pakklong Fishermen's Group (PFG) was registered to the Provincial Cooperative Promotion Office and renamed to Pakklong Aquaculture Group because it was overlapped to the Pakklong Fishermen group which was previously registered in 1993.

- Therefore, Pakklong District has two Fishermen Groups. The First group is Pakklong Fishermen Group, this group not registered. Second group is Pakklong Aquaculture Group (PAG), this group was registered. There are 120 members in PAG.

Pakklong Aquaculture Group (PAG)'s Activities

- Provincial Cooperative Promotion Office assisted PAG organized new committee and set up the rule of the group

- The first activity is saving money start from 50-500 Bath/month. Next activity is money loan. Provincial Cooperative Promotion Officer will come to check bookkeeping every month.

This group gets a financial support from sub-district administrative organization at an amount of. 300,000 Bath for loan by without interest in 5 year.

TRAINING AND STUDY TOUR

Thitiporn Suppanirun
Chumphon Marine Fisheries Research and Development Center
408 Moo 8, Paknam, Muang, Chumphon 86120

I. BACKGROUND

Training course and study tour formed part of Activity IV: Enhance Human Resource Capability and Participation of the project on Integrated Coastal Resource Management in Pathew District (ICRM-PD). The subjects and topics of the training courses focused mainly on Activity II: Establish and Extend LBCFM and Activity III: Encourage Local Business. Special topics such as local business management were occasionally included according to the people's demand. The training programs were arranged to suit the needs of the target groups of trainees, comprising the project staff, community leaders, fishers' group leaders, women's group leaders, and Ao.Bo.To council members.

II. TRAINING COURSE RELATED TO ACTIVITY III: ENCOURAGE LOCAL BUSINESS

In 2002, the following six (6) courses and one study tour were conducted:

1. The training on 22 January was attended by seven ladies from Tambol Pakklong Observation processing group in Rayong Province. Encouraging the leaders of women's group to create alternative income sources through group activities was the expected outcome of this training.
2. The participants during the 23-25 January training were staff from TD and seven ladies from Tambol Pakklong who also attended the seminar on "Development of Cooperative Businesses", which was organized by ZENGYOREN (National Federation of Fisheries Cooperatives in Japan) and the Cooperative League in Thailand.
3. On 1 March, the women's group in Tambol Pakklong demonstrated to the other members of the women's group their experiences with the project. The women's group have since then been experimenting with different kinds of value added products to be sold in local markets.
4. The training on fish processing technology targeting women in fishing households from Moo 1, 3, 6 and 7 was conducted on 27-28 May. A training session was conducted on 29 May 2002 to focus on packaging and marketing aspects.
5. On 23-24 June, Phase II of the fish processing training course was conducted, according to the requests from the participants in Moo 1, 3, 6 and 7. The DOF staff demonstrated many different kinds of products and the participants also tried to make new products by themselves.
6. Conducted on 23 August was a training course on cooperatives and business opportunities.
7. On 17 November, the project staff took the new women's group in Moo 7 Tambon Pakklong to the Lang-Suan District women's group to observe the success of the latter's activities as well as in the latter group's administration. The visitors gained more information and learned how such an organization could flourish and succeed (LBCFM-PD No.39).

In 2003, the following training courses were conducted:

On 16-21 June 2003, Phase II of the fish processing training course was continued according to the requests from the participants in Moo 1, 3, 6 and 7. The DOF staff continued to demonstrate many different kinds of products and the participants also tried to produce new products. This training session was conducted three (3) times for 30 persons at a time. The objective was to attain improved taste of the products and develop their own packaging (LBCFM-PD No.40).

In 2004 two (2) courses were conducted as follows:

1. Since almost all members of the women's groups finished primary school level, they lack knowledge on accounting. So, a training course on administrative marketing, primary accounting and balance sheet was conducted for the women' groups.
2. On 25-27 June 2004, the training course focused on packing for improved packaging for participants from village No. 6 (LBCFM-PD No.40)

In 2005, only one training course conducted because the project supported the production cycle:

During this year, the women' group in village No 6 had problem about marketing channel. So on18-19 August a training course on marketing to promote and develop their product by presentation technique and attraction in terms of product packaging was conducted. A trainer from Chumphon Technique Academy was invited as the Resource Person. The outcome of the training was positive since two (2)groups have their products distributed to the local markets and one of them get a 3 star from the government promotions in One Tumbol One Product contest, and their product has been accepted and distributed in supermarkets and shops.

III. Training Course Related to Activity II: Establish and Extend LBCFM

These training courses were for community leaders, fishers' group leaders, women's group leaders, and Ao.Bo.To council members.

Fishers
From 2002 to 2006, the following training courses were conducted:

1. On 22-26 April 2002, a mobile training course was arranged at five (5) sites. The purpose of the course was to disseminate the concept of the LBCRM-PD, and discuss the current situation and problems related to coastal fisheries, and steer a direction of the project activities. It was expected that an increase in people's participation in the project activities could be achieved after the training and that activities suggested by the participants could be incorporated in the project as applicable.
2. On 25-26 June 2002, a training course on fish cage culture was arranged in order to disseminate the modern, productive and environment-friendly technology on fish culture to fishers who are presently or will be in the near future engaged in fish cage culture. The number of participants in the training was 35 (LBCRM-PD No.19).
3. In 2003, a training course was arranged for 60 crab trap fishers for them to replace the bottom mesh size of their crab traps from 1.25 inch to 2.5 inch. The result of enlarged mesh size showed an increased trend in the carapace size of the crabs caught as well as increased in total catch. Enlarged mesh size brought higher benefits in terms of exploitation.
4. On 22-25 July 2003, a training course on coastal aquaculture focusing on "Babylonia shell culture" was conducted. Babylonia shell culture was considered an alternative livelihood for fish cage fishers. There were 15 fish cage culturist who attended the training, which had Mr. Luachai Darunchu, a Senior Biologist serving as the Resource Person and lectured on Babylonia shell culture. A study tour to Chon Buri Province was conducted to visit a Babylonia shell farm adopting both cage and pond culture systems.
5. On 1-3 April 2004, a study trip on aquaculture by ARs feed in Krabi, Trang and Song Khla provinces were conducted. The project intended to change their feeds from trash fish to ARs feed because they catch trash fish by push net that operate surrounding their cages near the shoreline.
6. In 2005,a training course on cooperative system was conducted by a Chumphon Province cooperative officer and study tour was conducted at Pangnga and Phuket provinces for observation on the successes of other fisheries groups.

7. In 2006, a study tour to Ban Prad, Trat Province was conducted to observe group management and mangrove management.

Community leaders

On 22-26 April 2004, a training course on coastal fisheries management was conducted for head of the village, fishers' group leaders, women's group leaders, teachers and Ao.Bo.To council members for two (2) days. On the third day, a study tour was conducted to exchange their experiences with the committee at Ban Kririwong in Nakhon-Srithumarat province which was successful in its local management.

Students

1. In 2002 and 2003, a total of 180 students in grades 5-6 coming from six primary schools in Pakklong Sub-district studied about the principles of coastal resource management and the ecosystem, and the status of fisheries resource through lectures and video presentations on coastal resource conservation.
2. On 5-6 August 2004, a study camp for 30 students in junior high school from Ban Bangvan School at Chumphon Marine Fisheries Research and Development Center (CMDEC) studied coastal resource management and ecosystem, mangroves, coral reefs, fisheries and sea grass. A field study trip was conducted to a mangrove forest near CMDEC to study about mangrove ecosystem (Figure 1) and to a fishing community to learn about fisheries code of conduct (Figure 2). The students were divided into groups for the brain storming and discussion about the coastal resource utilization and sustainability. The trainees received notebooks that campaigned to stop using destructive fishing gears (Figure 3) and t-shirts with the ICRM-PD project promotion design (Figure 4), supported by CMDEC and SEAFDEC.
3. On 19-23 July 2004, a total of 108 students in grades 5-6 from five (5) primary schools in Pakklong Sub-district studied the principles of coastal resource management and ecosystem, and the status of fisheries resource through lectures and video presentations on coastal resource conservation. The trainees received notebooks that campaign to stop using destructive fishing gears and t-shirts with ICRM-PD project promotion design, supported by CMDEC (Figure 5).
4. On 17-20 July 2005, a study camp was conducted in Pran Buri, Prachuab Khiri Khan Province, with 30 students in grades 5-6 from Ban Bonrai school and Ban Thamthong school. On the first day, a study tour to Prachuap Khiri Khan Coastal Fisheries Research and Development Center was conducted where a lecture on the importance of fisheries and aquaculture was given by a Fisheries Biologist. During the second day, the students were divided into six groups and each group learned about mangrove management habitat and ecosystem from the students of Paknam Pran Wittaya School who had experience in the maintenance of the mangrove forest near their school (Figure 6). The next day, the students studied the relationship of animals and wetland, and visited Pran Buri Nation Park (Figure 7). The trainees received hand bags which were product of ICRM-PD and t-shirts with the ICRM-PD project promotion design, supported by CMDEC.

On 10-11 June 2006, a training course was conducted for 30 students of the Ban Pakklong School. On the first day, they studied the principles of coastal resource management and the ecosystem, and the status of fisheries resource. On the second day, they planted 200 mangrove trees in the Thung Maha mangrove forest and learned about the activities of ICFM-PD, i.e. crab bank, aquaculture and the organization of the Pakklong fishermen's group especially on the management of coastal resources in sustainable ways (Figure 8-9). The trainees received t-shirts and notebooks supported by CMDEC. The notebooks given to the students campaigned for the stop of using destructive fishing gears and the t-shirts had ICRM-PD project promotion design, all supported by CMDEC (Figure 10).

Fig. 1 Field study trip about mangrove ecosystem on August 2004

Fig. 2 Making up fishing to learn about fisheries code of conduct

Fig. 3 Notebooks that campaign to stop using destructive fishing gears

Fig. 4 T-shirts with ICRM-PD project promotion design which supported by SEAFDEC

Fig. 5 T-shirts with ICRM-PD project promotion design which supported by CMDEC

Fig. 6 Learning about mangrove management habitat and ecosystem from experience student

Fig. 7 Visited Pran Buri National Park

Fig. 8 Study trip to learn about crab bank

Fig. 9 Study trip to learn about aquaculture in ICFM-PD

Fig. 10 T-shirts with ICRM-PD project promotion design supported by CMDEC

Fig. 11 Student joined with CMDEC and Pakklong fishermen's group to release fingerling

Fig. 12 Student joined with CMDEC and Pakklong fishermen's group to implement mangrove reforestation.

RESOURCES ENHANCEMENT PROJECT ACHIEVEMENT

Yuttana Theparoonrat
Training Department, Southeast Asian Fisheries Development Center (SEAFDEC/TD)

I. INSTALLATION OF ARTIFICIAL REEFS AT CHUMPHON PROVINCE, THAILAND

TD in collaboration with ASEAN and SEAFDEC member countries conducted Resources Enhancement project in Pathew Distric, Chumphon province, Thailand as a case study. This project is designed to integrated installation of artificial habitats in inshore waters with careful pre-assessment of environmental and socio-economic impact.

Department of Fisheries, Thailand propose to install artificial reefs at Chumphon province on March 2004. Two groups of cubic shape concrete type, 1.5x1.5x1.5m, total 1750 pieces, are set on the project area number 46-16-07 and 46-16-08 (Fig.1). The artificial reefs settle at 12m depth with area cover is 2 km^2.

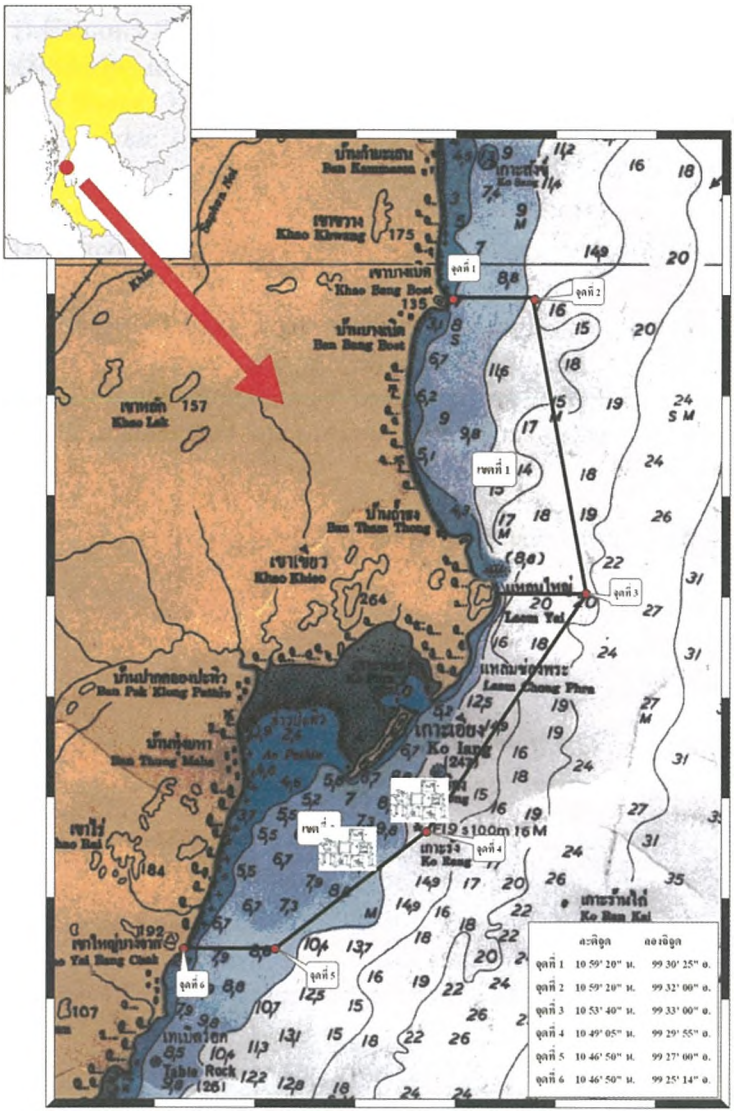


Fig. 1 Location of Artificial Reefs at Pakklong Sub-District, Chumphon Province, Thailand

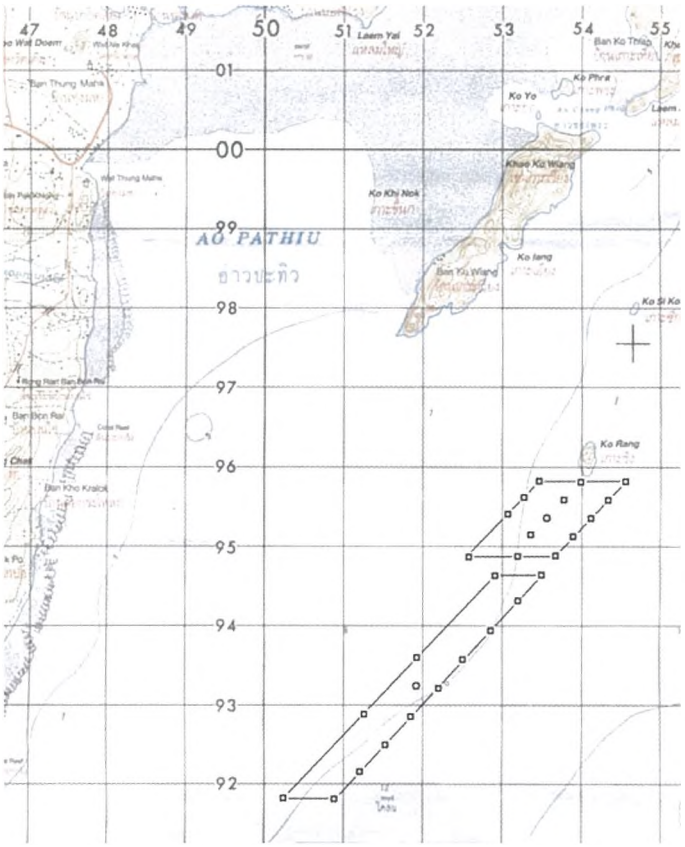


Fig. 2 Layout of two group of Artificial Reefs at project site, Chumphon Province, Thailand

SEAFDEC/TD staff in cooperated with Fisheries Officer, Department of Fisheries to conducted the installation of artificial reefs by M.V. Khaow Khang at Pathew District, Chumphon Province, during 10 – 31 March 2004. The installation method are performed by dumping cubical shape concrete from the vessel at marked position. The position and number of cubical shape concrete installing in the project site are shows as following;

Department of Fisheries, Thailand , Artificial Reefs Project for 2003

Project Number: 46-16-07

Locaton: Moo 2, Banborsamrong, Pakklong, Pathew District, Chumphon Province
Area: 1.0 x 1.0 kilometer
Water Depth: 11.0 – 16.0 meter
Bottom: Muddy sand
Dist. From Shore: 4.9 – 5.8 kilometer
Material: Concrete 1.5 x 1.5 x 1.5 meter, 875 pieces
Position: A. Lat. 10 – 49.00 N, Long. 99 – 28.85 E
B. Lat. 10 – 49.00 N, Long. 99 – 29.35 E
C. Lat. 10 – 48.50 N, Long. 99 – 28.70 E
D. Lat. 10 – 48.50 N, Long. 99 – 28.20 E
Budget: 3,000,000.- Baht

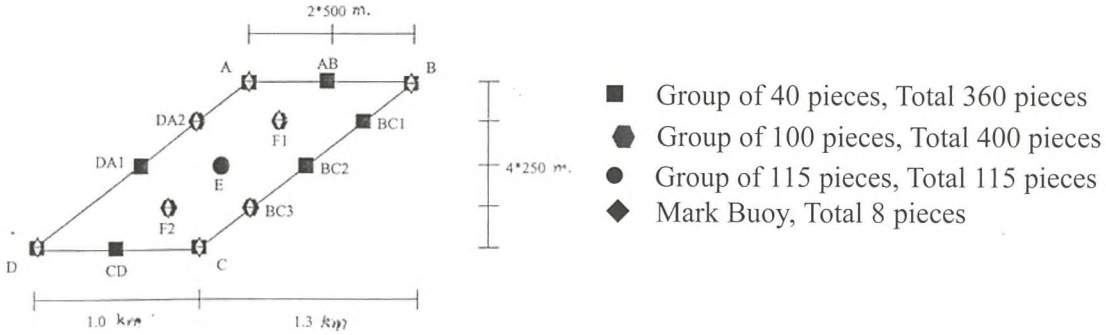


Fig. 3 Layout of Artificial Reefs setting at area number 46-16-07

Project Number: 46-16-08

Location: Moo 6, Banbonrai, Pakklong , Pathew District, Chumphon Province
Area: 0.5 x 2.0 kilometer
Water Depth: 9.5 – 11.0 meter
Bottom: Muddy sand
Dist. From Shore: 3.0 – 4.5 kilometer
Material: Concrete 1.5 x 1.5 x 1.5 meter, 875 pieces
Position: A. Lat. 10 – 48.20 N, Long. 99 – 28.05 E
C. Lat. 10 – 47.20 N, Long. 99 – 27.00 E
D. Lat. 10 – 47.20 N, Long. 99 – 26.75 E
Budget: 3,000,000.- Baht

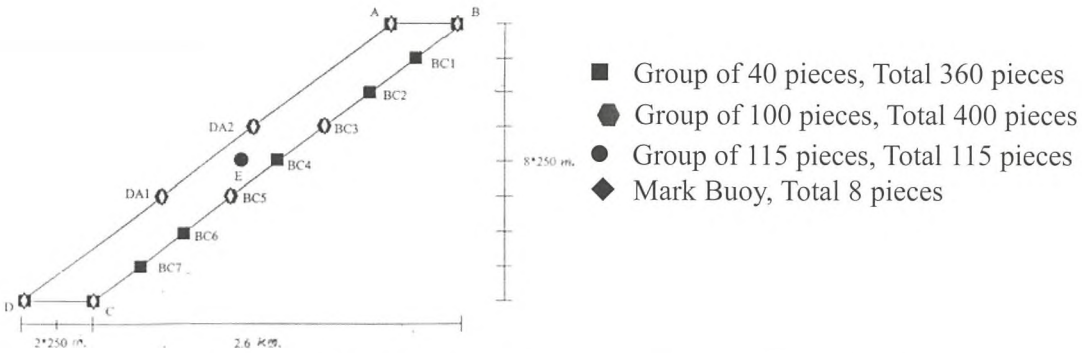


Fig. 4 Layout of Artificial Reefs setting at area number 46-16-08

Fig. 5 M.V. Khaow Khang, carry cubical shape concrete, artificial reefs to install at Pathew District, Chumphon Province

(a)   (b)

Fig. 6 Fork lift using for convey the cubical shape concrete dumping on the project site (a) the dumping position are marked by anchor flag buoy (b)

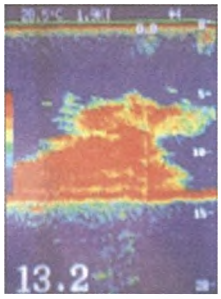


Fig. 7 An Echo-gram of Artificial reefs after installation

II. Survey and Data Collection on Environmental Studies on Artificial Reefs, Set Nets and Marine Cage Culture Project Sites

The SEAFDEC Training Department in cooperation with Department of Fisheries Thailand conducted environmental survey studies at the artificial reef installation site at Pathew District, Chumphon province, Thailand. The environmental survey studies was carried out by M.V.Plalung 1, 35 gross tons. The three survey cruise were conducted as followings; 16-24 November 2003 (pre-survey), 24 July- 4 August 2004, and 21-31 March 2005 (post –sutvey). Several fisheries environmental parameters were studies. Information on the oceanographic parameters including water current and speed/direction were collected. Biological information like benthos, phytoplankton, zooplankton, and fish larvae distribution was also collected. Fishing surveys using various fishing gear including the Trammel net, Fish trap, Squid trap, Crab trap were also carried out. In addition, a fish stock assessment by hydro-acoustic survey at the project site was performed. Several fisheries environmental parameters were studies as followings,

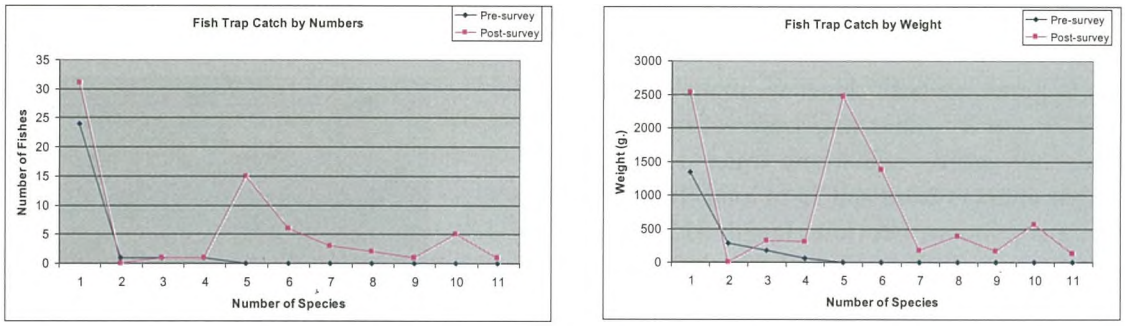
1. Fishing Operation Survey

1.1 Fish Trap Fishing Operation

Fish traps with dimension of 90Wx190Lx60H cm, PE net webbing mesh size 6.5 cm, wooden frame diameter 3.5 cm, entrance wire mesh #3.5 cm, were individual setting around the artificial reefs project site where water depth is 12 m. The 8 pieces of fish trap were setting fixed at bottom near by artificial reefs Project No. 46-16-07 A, DA2, E and F1, and for Project No. 46-16-08 BC3, BC5, DA2 and E. The fish caught were collected for species identification after 6 days of fishing operation.

Fig. 8 Fish trap fishing operation

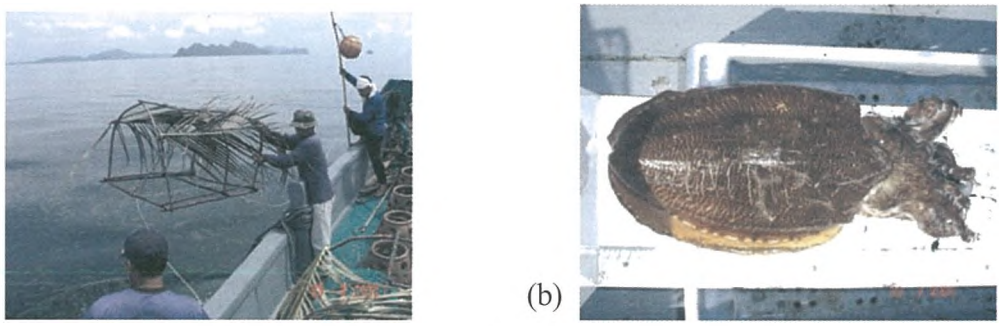


(a) (b)

Fig. 9 Amount of fish catch by fish trap in Pre. and Post-survey cruise in term of (a) number and (b) weight.

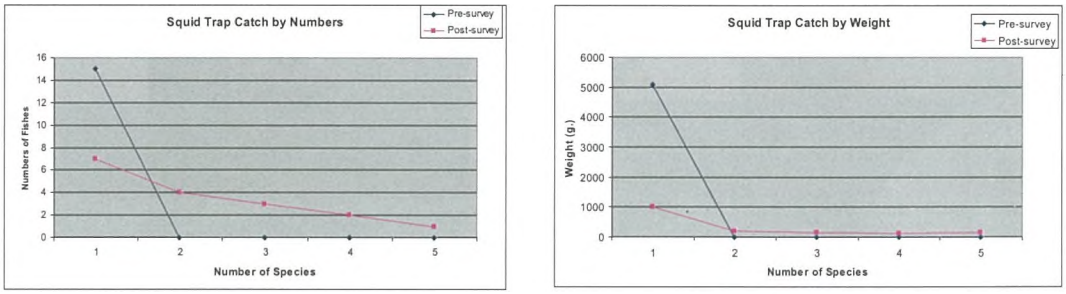
1.2 Squid Trap Fishing Operation

Squid traps with dimension of 85Wx110Lx70H cm, PE net webbing mesh size 5.5 cm, wooden frame diameter 2.5 cm, were individual setting around the artificial reefs project site where water depth is 12 m. The 12 pieces of squid trap were hang on the buoy line at 3 meter below water surface. The squid caught were collected daily in the morning time for 4 days for species identification and size composition study.



(a) (b)

Fig. 10 Squid trap fishing operation, (a) and (b)



(a) (b)

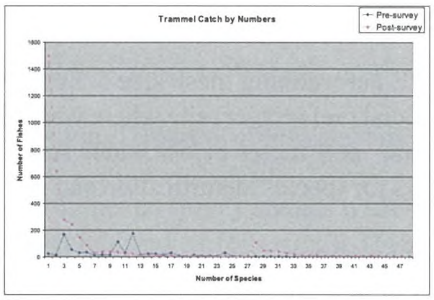
Fig. 11 Amount of fish catch by squid trap in Pre. and Post-survey cruise in term of (a) number and (b) weight

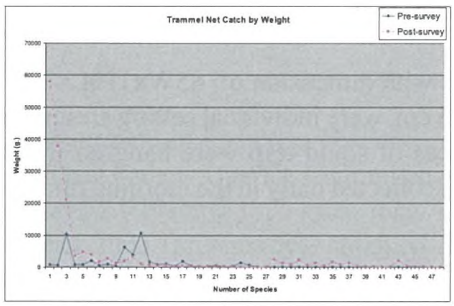
1.3 Bottom Gill net (Trammel net) Fishing Operation

Bottom trammel net with inner webbing mesh size 4.5 cm, and 26 cm for outer net, were setting around the artificial reefs project site where water depth is 12 m. The height of net is 2.4m and 35 m long. Total 15 pieces of joining continuous net (total length 525 m) were set fixing at bottom by anchor at both end. The fishing operation are conducted for 3 days with net soaking period of 15 hours from the evening to next day morning time. The fish caught were collected, species identification, size and weight measurement were performed.

Fig. 12 Bottom trammel net fishing operation

(a)





(b)

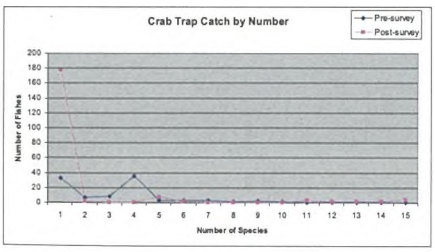
Fig. 13 Amount of fish catch by bottom gillnet (Trammel Net) in Pre. and Post-survey cruise in term of (a) number and (b) weight.

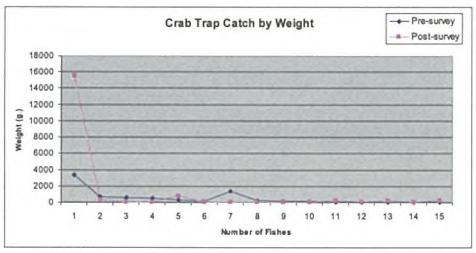
1.4 Collapsible Crap Trap Fishing Operation

Collapsible crap trap with dimension of 38Wx54Lx18H cm, PE net webbing mesh size 3 cm, iron frame diameter 4mm, were joining continuous setting around the artificial reefs project site where water depth is 12 m. The 80 pieces of crab trap were setting by long-line fishing operation pattern fixed at bottom for 3 days of operation. The traps soaking period is 15 hours cover on the nigh time operation. The crab caught were collected, species identification, size and weight measurement were performed.

Fig. 14 Collapsible crab trap fishing operation an its catch

(a)





(b)

Fig. 15 Amount of fish catch by collapsible trap in Pre. and Post-survey cruise in term of (a) number and (b) weight.

2. Benthos Survey

The survey stations for benthose were set at 0m, 250m, 500m, and 750m, in the direction of N,S,E, and W, away from the center position of each group of Artificial Reefs setting position. Total benthose sampling are 22 stations. At each station a random samplings of bottom sediment was collected using a Smith-McIntyre grab (area coverage 0.05 m^2). The sediment was washed through a set of sieves, the smallest one with a mesh size of 0.5 mm. Benthic animal were collected and fixed in 10% formaldehyde solution in sea water on board. The preserved macrobenthic fauna were brought to laboratory for further identify.

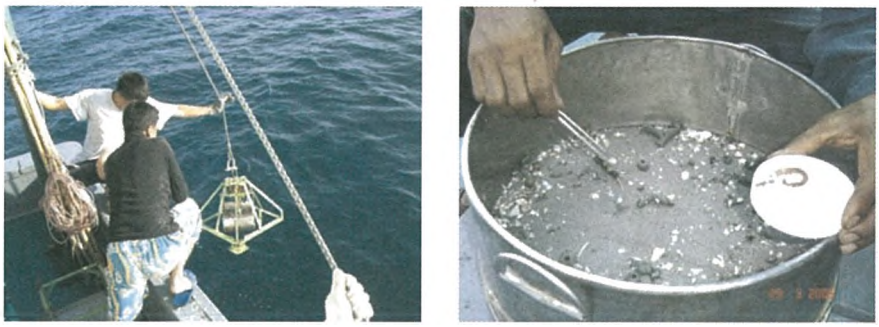


Fig. 16 Random sampling of benthos by Smith-McIntyre grab and washed through a set of three different mesh size sieves

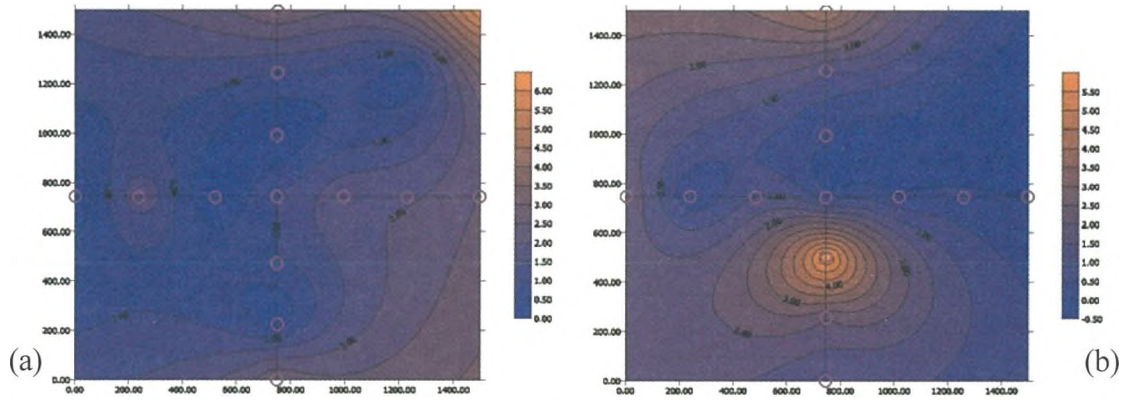


Fig. 17 Distribution of benthos Family Orbiniidae around the center group of artificial reefs during November 2003, (a) artificial reefs group A, (b) artificial reefs group B

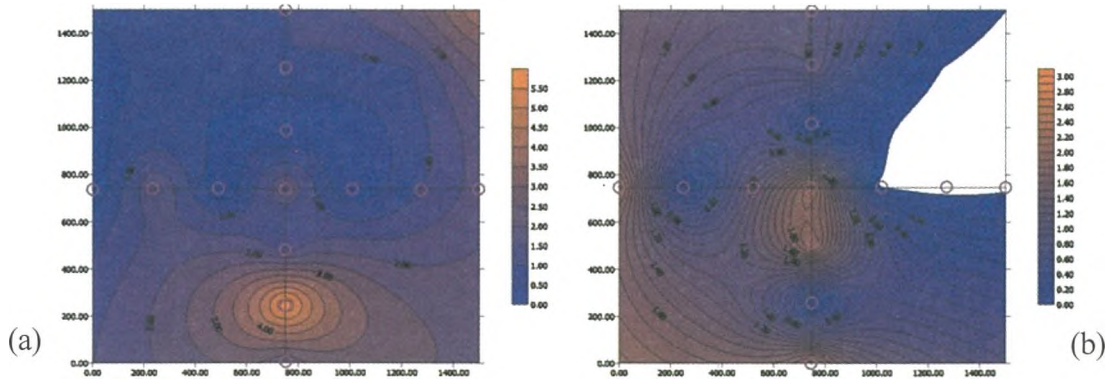


Fig. 18 Distribution of benthos *Nephtys sp.* around the center group of artificial reefs during November 2003, (a) artificial reefs group A, (b) artificial reefs group B

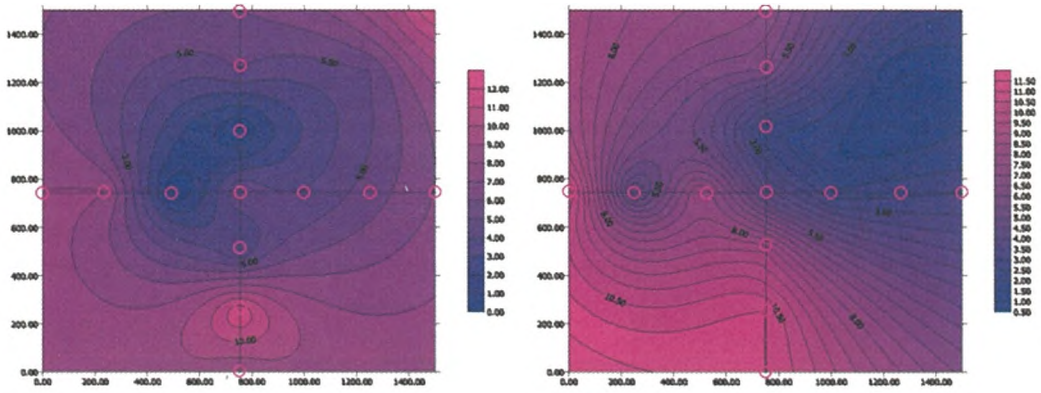


Fig. 19 Distribution of benthos all Family around the center group of artificial reefs during November 2003, (a) Artificial Reefs group A, (b) Artificial Reefs group B

3. Fish Larvae Survey

Sampling for fish larvae was carried out using M.V.PLALUNG 1. The bongo net, 60 cm. in diameter with mesh size 500 micron at the mouth part and 330 micron at the cod end, was employed for the horizontal haul. The net was towing at 1 meter below the surface with speed of 2 knots for 30 min. A flow meter was attached to the mouth of the net. Specimens were preserved in 10% formalin/sea water mixture immediately after a haul completed. Sorting and identification was done at the laboratory.

Fig. 20 Fish larvae collection by using bongo net

List of fish larvae found in the site of artificial reefs during the survey on November 2003.

Phylum CHORDATA	
Number	27
Fish larvae	
Engraulidae	5
Cobiidae	7
Callinymidae	2
Cynoglossidae	1
Nemipteridae	1

4. Phyto-Plankton Survey

The phyto-plankton samples was collected from water sampler at 1 m below the sea surface. Fifty liters of water samples were filtered through a phyto-plankton net (20 •m mesh size) and preserved in a 10% formalin/sea water mixture. The samples were concentrated by sedimentation. Cell count and identification were conducted in laboratory.

DIVISION CYANOPHYTA (Blue green algae)
CLASS CYANOPHYCEAE
Lyngbya sp.
Oscillatoria erythraea (Egrenberg) Geitler
Richelia intracellularis Schmidt
Unknow Blue-green algae

DIVISION CHROMOPHYTA
CLASS BACILLARIOPHYCEAE
Order Biddulphiales (Centric Diatom)
Order Bacillariales (Plannet Diatom)

CLASS DICTYOCHOPHYCEAE

CLASS DINOPHYCEAE (Dinoflaglet)

Fig. 21 Phyto-Plankton bloom

5. Zoo Plankton survey

Sampling for zoo-plankton was carried out using bongo net, 60 cm. in diameter with mesh size 300 micron with employed in the horizontal haul. The net was towing at 1 meter below the surface with speed of 2 knots for 30 min. A flow meter was attached to the mouth of the net. Specimens were preserved in 10% formalin/sea water mix immediately after a haul completed. Sorting and identification was done at the laboratory.

PHYLUM PROTOZOA
PHYLUM ECHINODERMATA
CLASS CILIATA
CLASS ECHINOIDEA
PHYLUM CHAETOGNATHA (ARROW WORM)
CLASS OPHIUROIDEA
CLASS SAGITTOIDAE
PHYLUM CHORDATA
PHYLUM NEMATODA
CLASS PELECYPODA
CLASS LARVACEA
PHYLUM ARTHROPODA
CLASS CRUSTACEA
PHYLUM MOLLUSCA
CLASS GASTROPODA

III. Installation of Fish Shelter Model for Particular Species on Artificial Reefs Areas

The installation of three type of fish shelter model were conducted by M.V.Plalung 1 during 23-26 March 2005. Three type of fish shelter are Vertical concrete tube (diameter 20cm, 60 cm long), Horizontal concrete tube (diameter 20cm, 60 cm long) and Oval ball shape earthenware (diameter 60 cm, 80 cm high).

The installation site are on two heap of artificial reefs at location of Latitude 10° 48'.88N, Longitude 99° 28'.94E and Latitude 10° 47'.56 N, Longitude 99° 27'.47 E. At each locati on, there are 18 units of each fish shelter type installed on artificial reefs. This experiment will conduct the observation diving to monitoring species and number of fish living inside the fish shelter. The collected information will using for design the shape of artificial reef with suitable for target fish species.

Fig. 22 Circular ball shape earthenware (diameter 60 cm, 80 cm high)

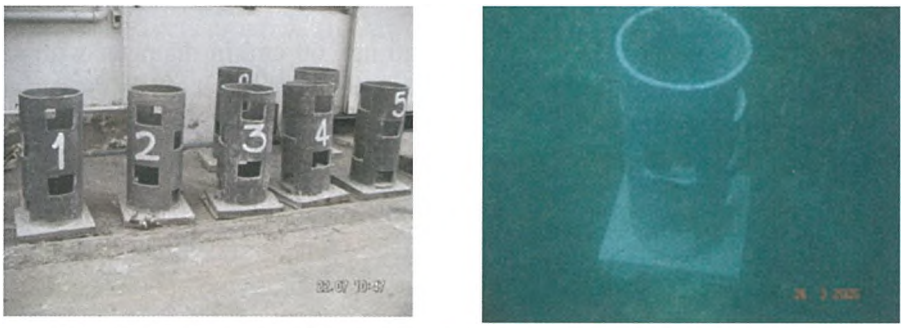


Fig. 23 Vertical cylinder concrete tube (diameter 20cm, 60 cm long)

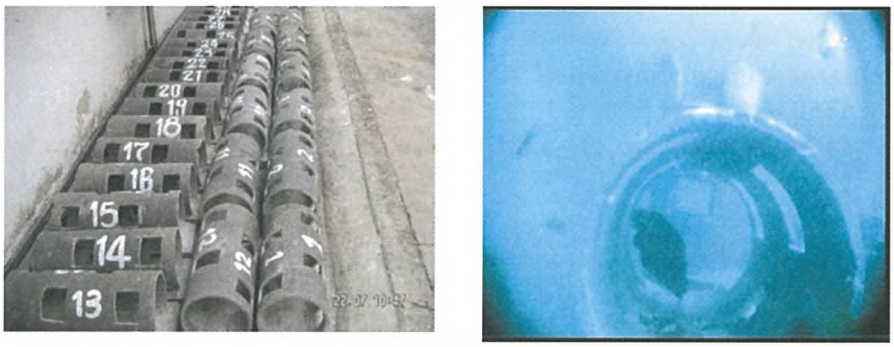


Fig. 24 Horizontal cylinder concrete tube (diameter 20cm, 60 cm long)

IV. Transplanting of Sea Weed (Sagassum) on Artificial Reefs Areas

Since artificial reefs installation size at Pak-klong Chumporn Province are located on soft muddy bottom with water depth of 13 m. There are only barnacle and green mussel could be growth on the concrete structure of artificial reefs after one year of installation. The environmental condition around artificial reefs on soft muddy bottom are the major limitation factors for marine ranching selective species and monitoring activity .

In order to improve the environmental condition around artificial reefs, transplanting of sea weed experiment on artificial reefs were conducted. Sagassum (*Sargassum polycystum*) were collected from Banphe Rayong province and planting on artificial reefs with supported by concrete bars. The transplantation experiment conducted on 24-26 March 2005. Growth up sagassum could be create a marine forest habitat to support a feeding and nursing ground for some fish species. The experiment need to further monitoring of effect of growth up sea weeds the fish behavior in the experiment site.

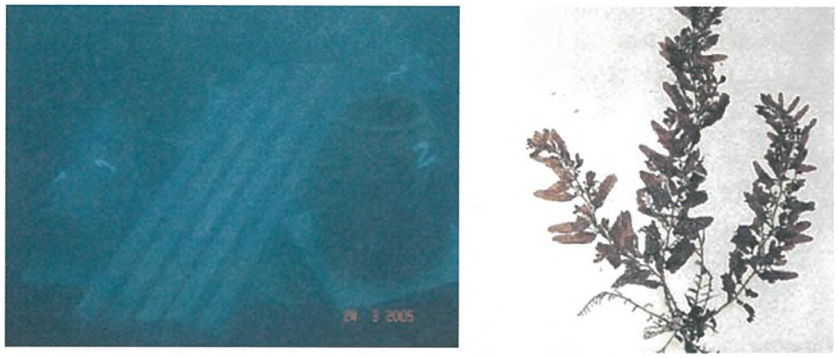


Fig. 25 Supported concrete bars for Sagassum (*Sargassum polycystum*) transplantation

Since, the Twenty-eight Meeting of the Program Committee of the Southeast Asian Fisheries Development Center (SEAFDEC) was held in Bangkok, Thailand from 7 to 9 December 2005. The national Coordinator for Japan commented that use of artificial reefs is based on national interests and capacity. To this end, pilot activities on artificial reefs should be given low priority. Then project activities concern on artificial reefs were scale down and terminated from second phase of Project on Rehabilitation of Fisheries Resources and Habitats/Fishing Grounds through Resources Enhancement 2006-2010.

V. Fish Enhanceing Device (FED) Training Program

SEAFDEC/TD under Resources Enhancement Project organized a training and installation program for a permanent Fish Enhancing Device (FED) by using a last long endurance synthetic material with new construction designed. The program was conducted for local fishermen group in Prathew district Chumporn province Thailand during 22-24 August 2005. The training was performed by introduction of the construction and performance of new designed FED to 50 participated local fishermen. The hand on training for fishermen to construction of 10 units of FED were performed. The installation of FED around the artificial reefs were conducted at water depth of 13-15 m. with soft muddy bottom.

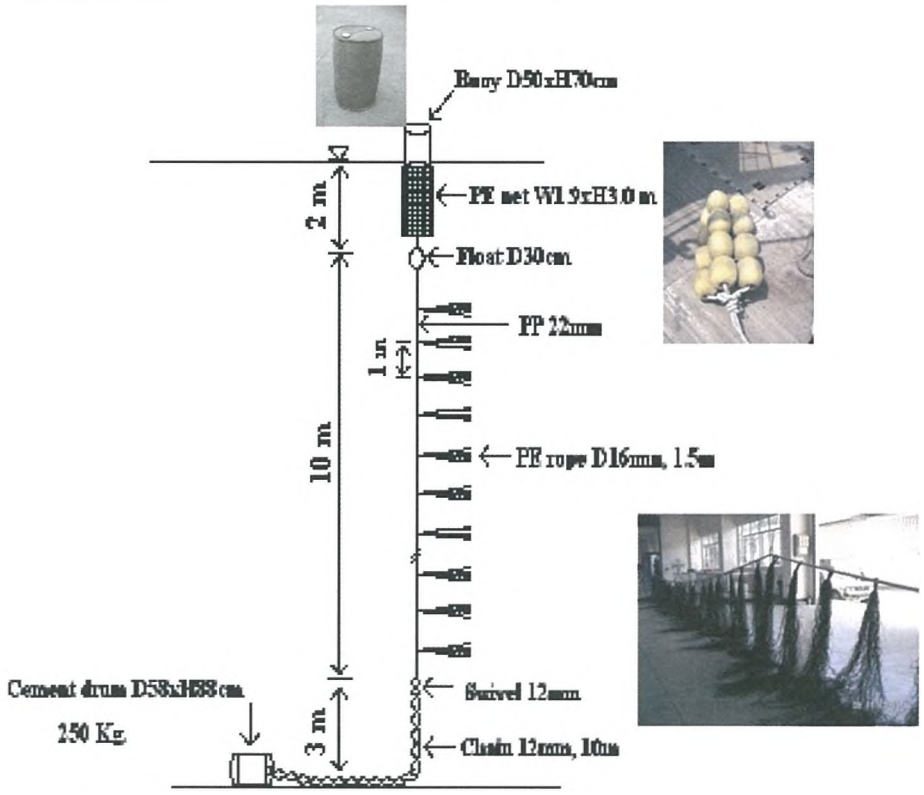


Fig. 26 FEDs design construction using at Pathew District, Chumphon Province, Thailand

Fig. 27 FED main rope, appendages and buoy construction

Fig. 28 FED installation by local fishing boat

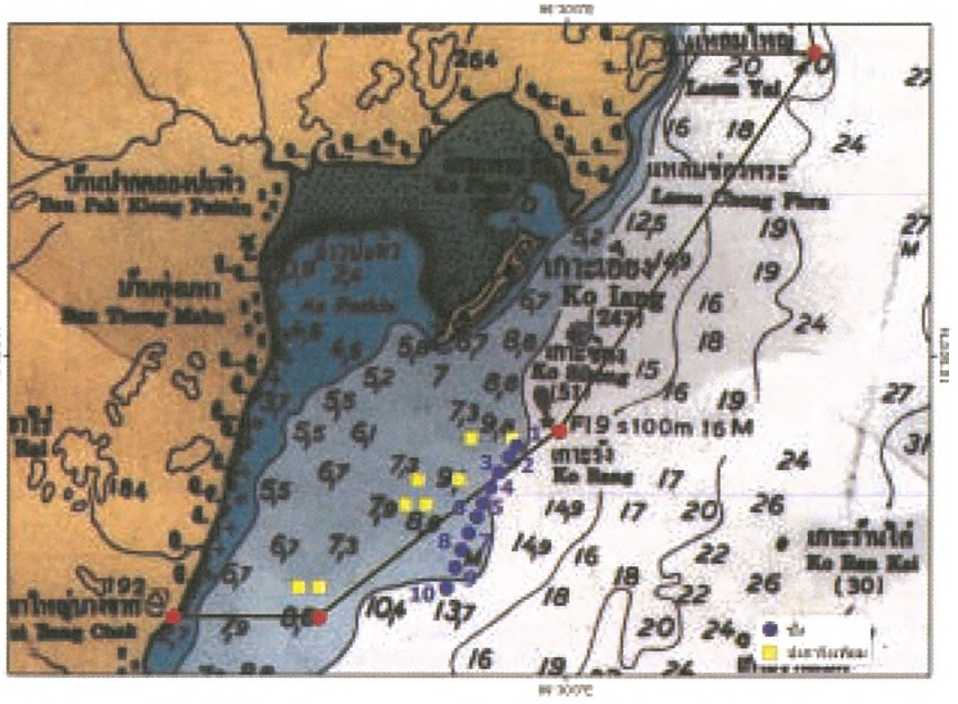


Fig. 29 Installation position (blue dot) of FEDs around artificial reefs (yellow dot) in Pathew District, Chumphon Province, Thailand

Ten unit of FEDs were installed by local fishing boat. The installation position was designed under consultation with the fishermen group of Prathew district. FEDs installation method was conducted along the cross eye bearing direction from Ko Rang to Ko Khai in direction of 115 degrees. FEDs were setting along the bearing direction in the interval of 400 meter. When the FEDs position were plotted on the chart, it found that some part of FEDs were located out of the boundary line of project area as shown in Figure 29. Observation of FEDs performance by underwater SCUBA diving by Chumporn Marine Fisheries Development Center (CMDEC) staffs was conducted on four months after installation. Result of underwater survey found that most of FEDs synthetic material were attached by marine growth such as oyster, green-muscle, barnacle, and coral. Fingering and juvenile of some pelagic species were found around FEDs.

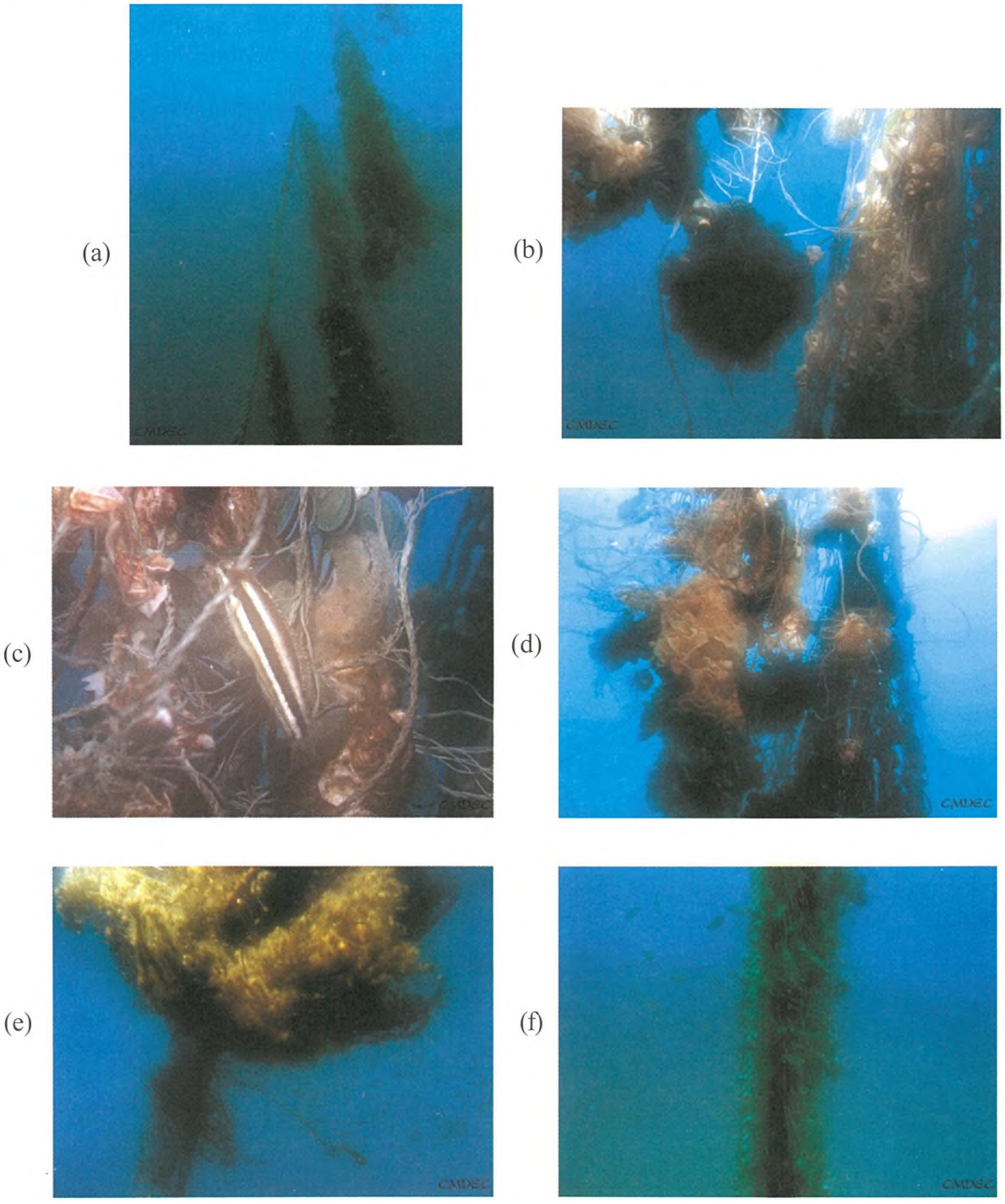


Fig. 30 FEDs synthetic material were attached by marine growth; Oyster, Green-muscle, Barnacle, and Coral (a-d). Fingering and juvenile of some pelagic species were found around FEDs (e-f)

However, it found that six months after installation, FEDs were lost due to plastic container buoy were cut off by several reason such as stolen of plastic buoy, buoy line were cut off by commercial fishing boat use as anchor, and break down of iron swivel part, etc.

Installation of new design FEDs in PathewDdistrict Chumphon Province, Thailand

In order to receive support from Local Administrative Authority (Ao Bo Tor) for additional installation of 60 units of FEDs in the project area of Prathew district. The experiment on new designed of FEDs were conducted. The installation of 10 unit s of FEDs were carried out at Phrathew district Chumphon province during 27-29 June 2006. The installation areas are located around artificial reefs installation site. The objective for installation of FEDs were testing on the design performance and durability as well as an effectiveness of resources enhancement. In order to approval of additional FEDs installation, Ao Bo Tor of Prathew district required for 6 months criteria of testing period for design performance and durability.

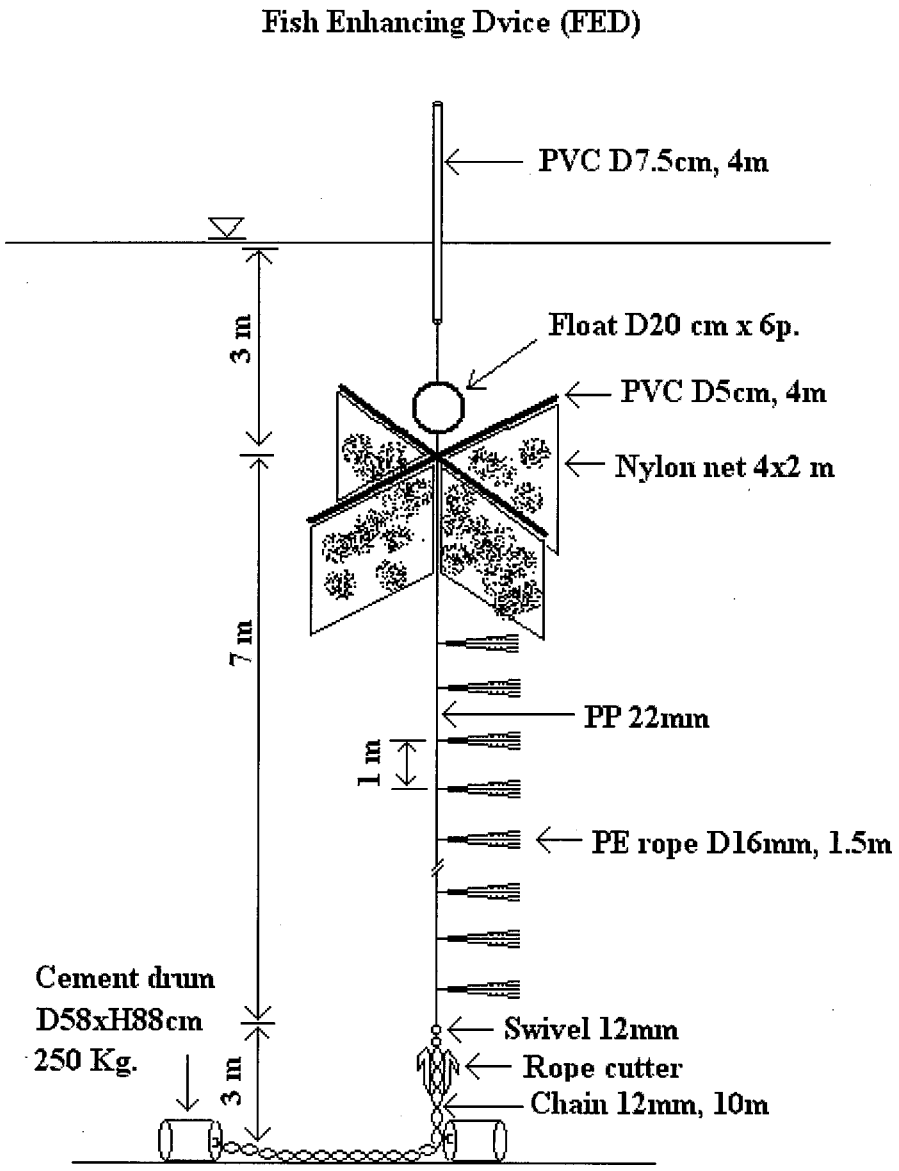


Fig. 31 Second designed FEDs using in Pathew District, Chumphon Province

The second designed of FEDs was modified for some weak points and must be improved for more durability and effectiveness. Many points were considered and improved on its construction such as replacing steel structures with rust-proof material as stainless steel, adding another cement sinker to secure the unit in place not to be taken away easily, enhancing its attracting performance by providing fine mesh netting panels under the supporting floats and avoiding from incidental damages by the fishing boat by using only a PVC pipe to mark its position at the surface (instead of using an expensive foam-inserted buoy as the previous one).

FEDs were installed in demarcated zone of artificial reef setting with water depth of 13-15 meter. In order to avoiding damage from surface passage boat, the Poly-propylene, 22 mm, standing rope, 7 meter, was hang on 6 pieces of plastic floats, 20 cm, at 3 meter under water surface. Appendage ropes, un-twisted PE 16 mm, 1.5 meter long, were attached at 1 meter interval along standing rope. Lower part of standing rope attached with 12 mm, 10 meter long, galvanize chain. Two concrete weight, 250 kg., were attached at the losses end of galvanize chain and at 3 meter apart from other end. Buoyancy of 6 plastic floats are sufficient to lift up galvanize chain on vertical standing at 3 meter from the bottom. A stainless steel rope cutter was attached at the upper part of standing chain at 3 meter above bottom. Top of standing rope was connected with two perpendicular PVC pipe, 5 cm, 4 meter long, with hanging net for shelter providing. A closeted ends PVC pipe, 7.5 mm, 4 meter long, was tie with under water plastic float by 16mm PE rope for indicated of FEDs position.

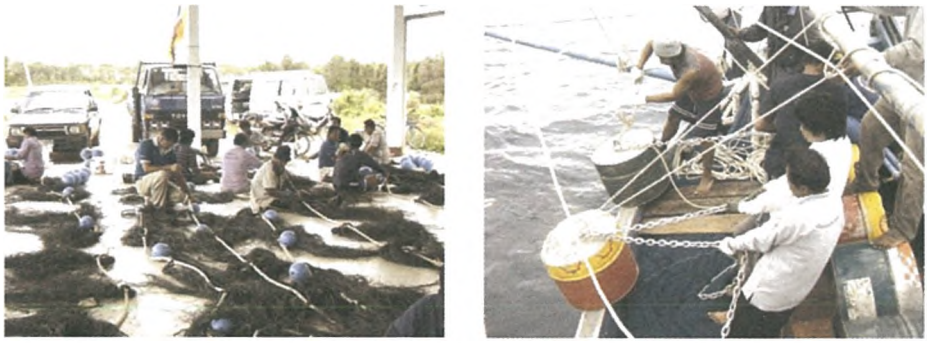


Fig. 32 FEDs construction and installation by fishermen group of Prathew district during 27-29 June 2006

The first investigation of FEDs condition after two months installation were conducted on 29 August 2006. Inspection performed by check position of FEDs by GPS and observation on the growth up of marine organism and fish aggregated around FEDs by under-water photography.

The result of investigation on 29 August 2006, found that 6 units of FEDs still remain and 4 unit are lost. Among the remain, one unit was relocated to a deeper place out off project area. The new position is Latitude 10° 48'.090 N Longitude 99° 28'.713 E. Since, information collection by interview local fishermen that there are 4 -5 bottom trawler operated trawl net inside the artificial reefs areas during 7-18 August 2006, just two week before the FEDs inspection are conducted.

The remain FEDs are in good condition. There are marine growth attached on the PE appendix. Most of marine growth are barnacle, green mussel, oyster and corral. Part of the vertical main rope was attached by lump of squid egg hang on waiting for hatching. Many pelagic school of various species were gathering around FEDs. Young fingering of some fish species were found around the FEDs for nursling and hiding from predator and strong current. Some demersal fish also found feeding on the FEDs appendage. In general, FEDs could be generated a new habitat for spawning, nursling and feeding environment for bivalve, fish and squid.

Table 1 Position of FEDs installed on 29 June 2006

No.	Latitude	Longitude	Remark
1	10° 48'.937 N	99° 29'.144 E	lost
2	10° 48'.840 N	99° 29'.101 E	lose
3	10° 48'.688 N	99° 28'.852 E	lose
4	10° 48'.588 N	99° 28'.690 E	remain but change position to Lat 10° 48'.090 N Long 99° 28'.713 E.
5	10° 49'.074 N	99° 28'.978 E	remain
6	10° 48'.928 N	99° 28'.900 E	remain
7	10° 48'.929 N	99° 28'.769 E	lose
8	10° 48'.797 N	99° 28'.655 E	remain
9	10° 48'.720 N	99° 28'.692 E	remain
10	10° 48'.683 N	99° 28'.485 E	remain

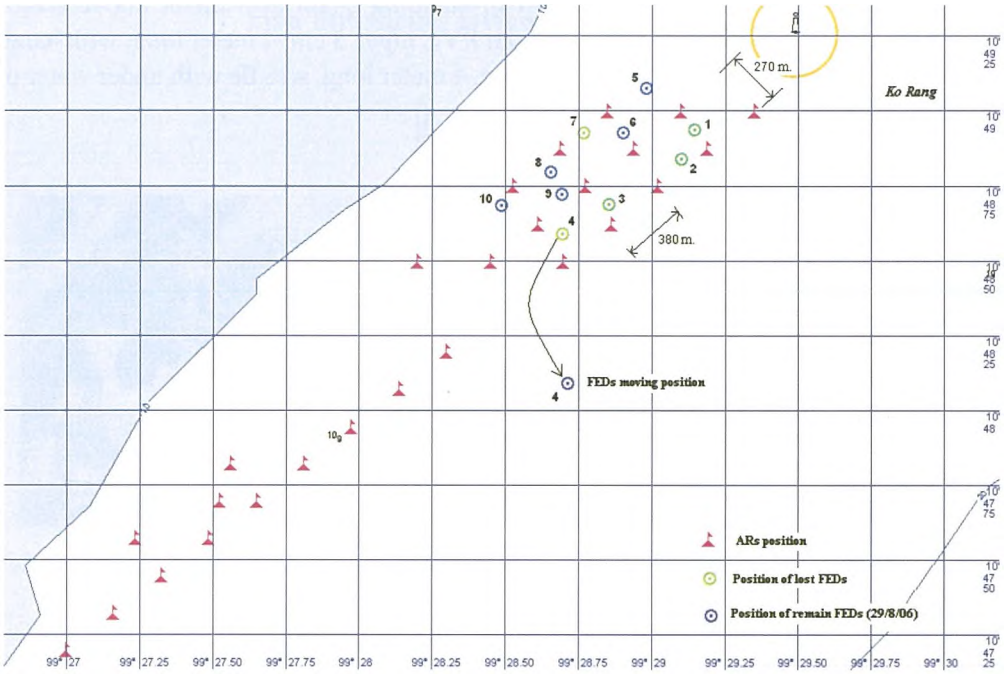


Fig. 33 The FEDs setting position (circle) around artificial reefs areas

Fig. 34 Marked buoy of FEDs on the surface and underwater net spreading pipes

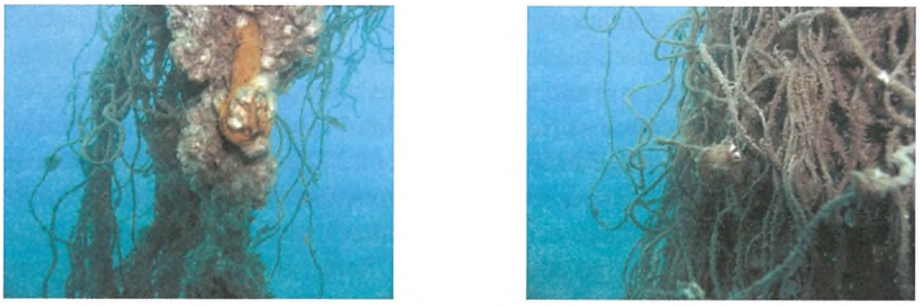


Fig. 35 Marine growth attached on FEDs appendage two month after installation

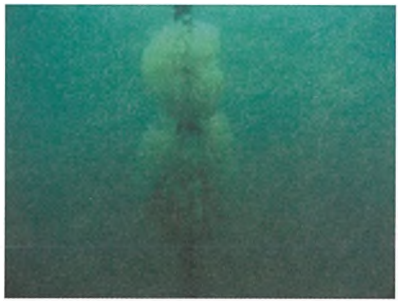


Fig. 36 Squid egg hang on vertical main rope waiting for hatching

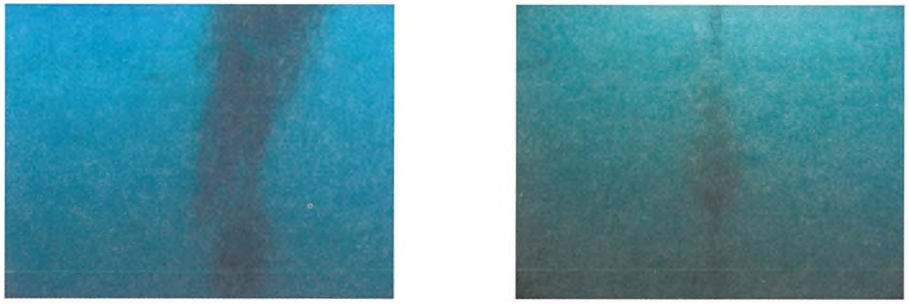


Fig. 37 Young fingering of some fish species were found around the FEDs for nursling and hiding from predator and strong current.

During inspection of FEDs, an information from interview to local fisherman found that there are bottom trawl net from others province operated in and around ARs installation site. The trawl net operation in side ARs installation areas would directed destroy some part of FEDs. Trawler could be conducted bottom trawl net fishing operation pass through the ARs installation site by using GPS navigation system to avoiding damage of net from ARs.

Fig. 38 An evident showing bottom trawl net operated along the coast line of Prathew district. Photo recorded on 1 September 2006, time 10:30 hours

The second investigation of FEDs condition were conducted on 1 December 2006. Inspection performed by Chumporn Marine Fisheries Research and Development Center staffs by observation of FEDs position and growth of marine organism and fish aggregated around FEDs by under-water photography. However, it found that all of FEDs are lose from the installation area. The information from interviewed to local; fishermen found that during their fishing operation on 20 November 2006, all of remain FEDs still can be observed by visual. Since, Starting the end of November, the effect from Northeast monsoon strong wind spreading cover the Southern part of Thailand. Most of the trawl net could not operated in the offshore area because of strong wind and high wave. Some of trawl net intruding into the coastal shore for illegal fishing inside 3 kilometer nursling zone, as well as around FEDs installation area at Prathew district. This is the main reason caused of damage and lost of FEDs by trawl net.

Fig. 39 Strong wind and high wave hit alone coastal zone of Chumphon Province during November – December 2006

VI. Conclusion and Recommendation

From the result of first inspection of FEDs, two months after installation, found that designed construction of FEDs make it well working performance. Some marine organism start to attached and grow up on FEDs appendage. There are both juvenile and mature fish found during under water inspection and photographing. There are 4 units lose and 1 unit re-located caused by bottom trawl net operation in the installation areas. Even through, FEDs were equipped with rope cutter on anchor chain at 3 meter above the bottom. The rope could be cut off the trawl net head rope but could not cut its ground rope with iron chain. However, the encroachments trawl net head rope could be damage by rope cutter. Normally, illegal encroachments trawl net are operating in the night time. They navigate the boat by using GPS along the channel inside ARs. This technique could be avoided from net stuck with ARs. Since, spacing between ARs in SE-NW direction around 380 meter and 270 meters in NE-SW direction. While trawl net otter board spreading distance was around 100 meter. Then spacing between ARs are wide enough for bottom trawl net to pass through.

In order to encounter with present trawl net encroachment problem, the installation of FEDs in the future should be install very near to each ARs units. The others counter measure is to install additional ARs in the middle of interval between ARs to reduce the boat navigation spacing. More often of patrol by DOF enforcement officer are also necessary.

However, with in the period of nearly 6 months just before the second inspection survey are performed, it showed that the second designed and construction of FEDs are function well. FEDs could be using longer than haft year durability. This result could be satisfied to the criteria of Local Administrative Authority (Ao Bo Tor) of Prathew district.

Since, limitation of program budget, then the investigation of the effective of FEDs on biology information aspect by TD staff could not be carry out properly. However, the survey were conducted by scientist of Chumporn Marine Fisheries Research and Development Center by using visual observation methodology. Unfortunately, FEDs were destroy by trawl net before further information were collected. The local fishermen in Prathew district who are directly benefit from the FEDs are fish trap, hand line and bottom gill net operator. This group of fishermen are strongly requested for continuous of the further FEDs installation in appropriated management measure for utilize and study on the efficiency of this kind of resources enhancement tools.

RESOURCE ENHANCEMENT

Nopparat Nasuchol
Chumphon Marine Fisheries Research and Development Center (CMDEC)
408 Moo 8, Pakna, Muang, Chumphon 86120

I. BACKGROUND

Resource enhancement in the maritime of Thailand comprises mainly of three activities, namely, releasing of fingerlings, mangrove planting and installation of artificial reefs (ARs). Releasing fingerlings and producing juveniles for coastal aquaculture involves major aquatic species such as the banana shrimp, tiger prawn, sea bass, swimming crab, and mud crab, their sizes follow certain organization requirements. ARs were first installed in 1978 in Rayong Province and later to other places in the Gulf of Thailand and the Andaman Sea. The materials used for the ARs were concrete tubes, concrete cube frames and old metals from cars, trains and ships. Mangrove planting, not a direct responsibility of the Department of Fisheries (DOF), has been carried out by the Department of Marine and Coastal Resource (DMCR), making it a co-management activity of two organizations; the DMCR for maintaining the nursery of the mangrove trees, and the DOF for coordinating the planting activities with the fishermen.

II. ESTABLISHMENT OF ARTIFICIAL REEFS

The DOF installed ARs at the project site of the Integrated Coastal Resource Management-Pathiew District (ICRM-PD) from March to April 2004. Two groups of 1750 pieces of concrete cube frames, 1.5x1.5x1.5 m were installed at 12 m depth covering an area of 2 km^2 and set at the following latitude and longitude (Fig. 1):

Position 1		Position 2	
A. Lat. 10-48.20 N	Long. 99-28.05 E	E. Lat. 10-49.00 N	Long. 99-28.85 E
B Lat. 10-48.20 N	Long. 99-28.30 E	F. Lat. 10-49.00 N	Long. 99-29.35 E
C Lat. 10-47.20 N	Long. 99.27.00 E	G. Lat. 10-48.50 N	Long. 99-28.70 E
D. Lat. 10.47.20 N	Long. 99.26.75 E	H. Lat. 10-48.50 N	Long. 99-28.20 E

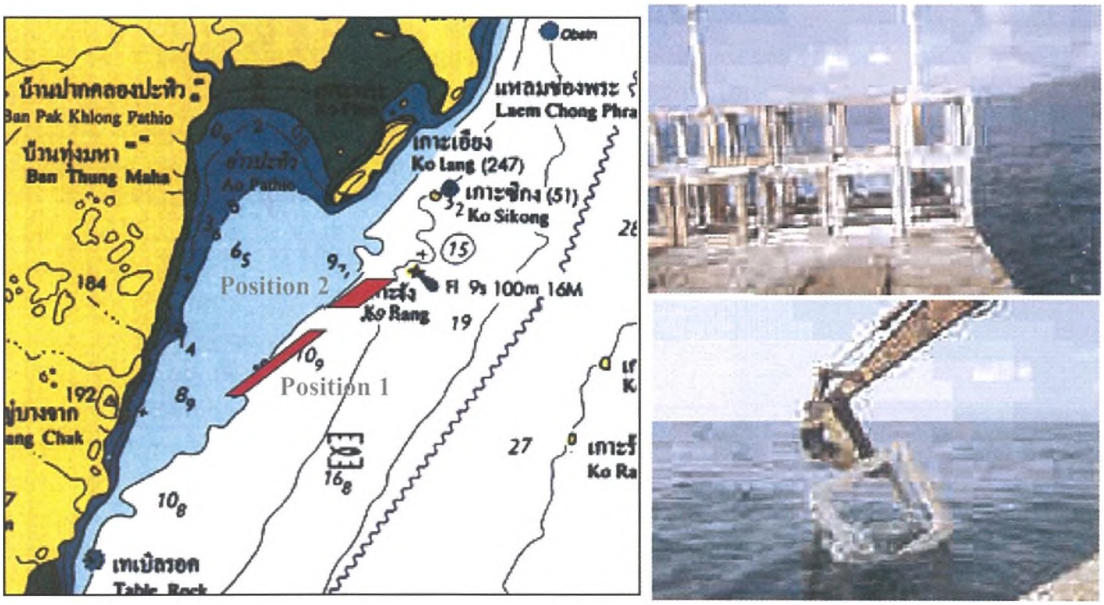
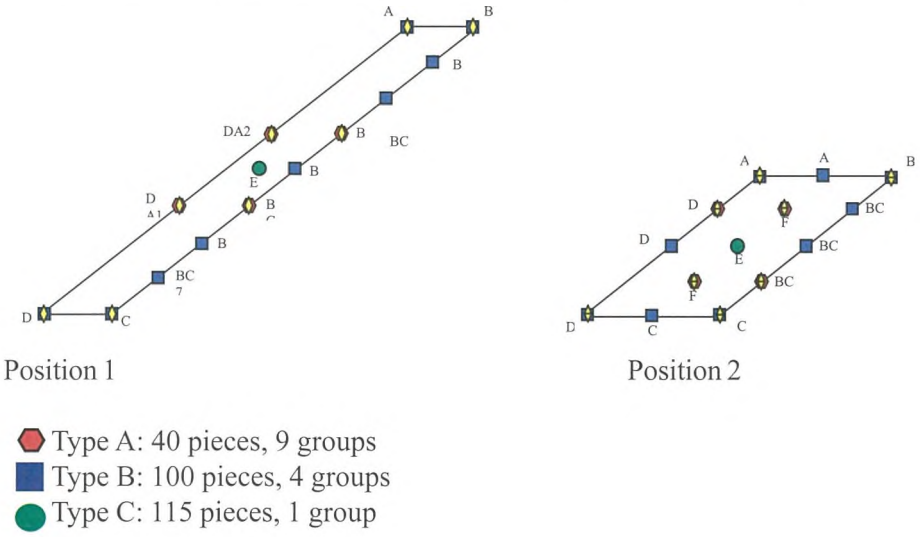


Fig. 1 Layout of two groups of ARs set at the ICRM-PD project site

The positions of groups 1 and 2 of the three types of ARs: 40,100 and 115 pieces, respectively are shown in Fig. 2.



Position 1 Position 2

Type A: 40 pieces, 9 groups
Type B: 100 pieces, 4 groups
Type C: 115 pieces, 1 group

Fig. 2 Layout of ARs set in positions 1 and 2

After the end of project in 2006, the fishermen asked DOF to install more ARs in the project site. The DOF considered the request and provided a budget of 3,000,000 Baht for the installation of ARs in a 1 km^2 area fronting Ban Thung Ma Ha (Fig. 3). The total ARs installed was 675 pieces as of March 2007.

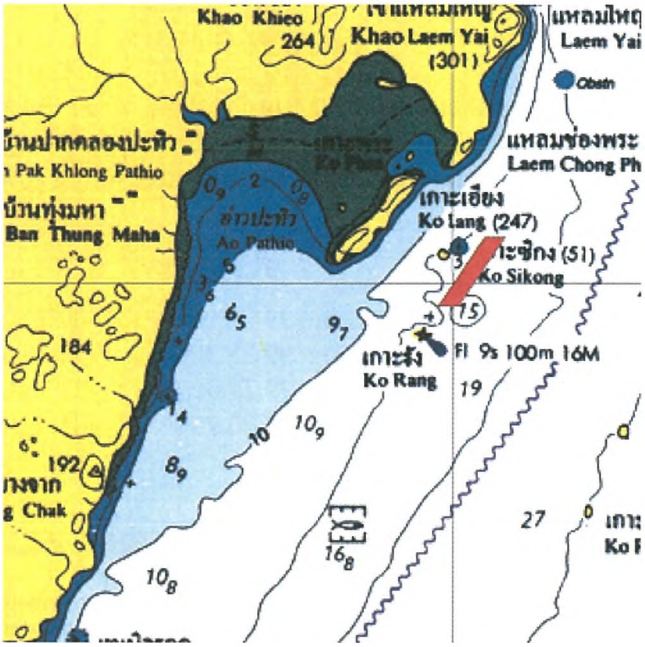


Fig. 3 Layout of ARs set at ICRM-PD project in March 2007

Results

The SEAFDEC-TD conducted a survey on marine resource at the ARs area in November 2003 (1st survey) and August 2004 (2nd survey) by fish trap, squid trap, bottom gill net and collapsible trap. The staff found 64 marine species, the top 10 species of which are listed in Table 1.

Table 1 List of top 10 marine species found at the ARs in the ICFM-PD project site

No	Common name	Species	1st survey		2nd survey	
			Number	Weight(g)	Number	Weight(g)
1	Pufferfish	*Arothron nigropunctatus*	171	10524	16	835
2	Croaker	*Johnius sp.*	165	10242	271	20918
1	Indo-pacific mackerel	*Rastreliger brachysoma*	111	6296	32	1805
4	Ponyfish	*Leiognathus sp.*	52	680	239	3362
5	Smooth-tailed trevally	*Selaroides leptolepis*	28	749	141	4600
6	Long tongue sole	*Cynoglossus lingua*	19	712	1492	57852
7	Flathead	*Sarsogona tuberculata*	11	586	638	37531
8	Blue swimming crab	*Portunus pelagicus*	32	3335	177	15480
9	Thredfin bream	*Nemipterus sp.*	30	1876	84	3678
10	Spotted butter fish	*Scatophagus argus*	24	1336	31	2525

III. Mangrove planting

Thung Ma Ha Bay is the richest mangrove area in Pathiew District with an area of about 6,552 rai. At present, the area has decreased by about 2,000 rai because shrimp farmers have converted part of the mangrove area for culture and for building dam inside the forest to keep water to be used in the shrimp farms. During low tide, the mangroves die affecting the nursery grounds of marine species. At first, Thailand Environment Institute coordinated the mangrove planting project in 2001-2002, after which DOF and SEAFDEC continued implementing the project under the ICFM-PD.

In 2005, the Pakkhong Fisherman Group (PFG) was established. Its members agreed to plant mangrove trees on Mother's Day of every year starting in 2005.

Preparation

During the Fisherman Group Committee Meeting, they agreed to distribute the responsibilities such as transporting the mangrove tree seedlings, providing the planting equipment, locating the area for planting and identifying the location for the ceremony. Then the CMDEC asked the Twelve Mangrove Forest Development Stations providing the mangrove tree seedlings to preside the ceremony and invited nearby schools and heads of villages to participate in the activities.

Results

In 2005 and 2006, 1000 and 2000 mangrove tree seedlings were planted, respectively (Fig. 4), near the forest area knowing that the forest could protect the seedlings wind and waves. In the previous two years, a mistake was made when the seedlings were planted far from the forest so that in the monsoon season, the seedlings were uprooted and some of the trees died. Now, they people feel possessive while observing the mangrove trees growing. Trespassers are driven away by officers responsible for protecting the mangrove area.

Fig 4 Planting mangrove at Thung Ma Ha Bay

IV. Post Larvae Releasing

Post larvae releasing supports the resource enhancement objective of the ICRM-PD project co-organized by SEAFDEC and CMDEC, Department of Fishery Thailand. Post larvae releasing also leads to increased income for the small scale fishermen. In the project area, the fishing gears are the squid net, shrimp gill net , crap tab and fish gill net. The main species released were fingerlings of the banana shrimps, tiger shrimps, blue swimming crabs and sea bass provided by the Chumphon Coastal Aquaculture Station (CCAS). The size of the shrimps was 1-2 cm, sea bass 1-2 in and blue swimming crab 4-6 cm (Fig. 5). Until now, there has been good support and participation in the activity by the locals, such as the local organizations that provided the equipment for the ceremony as well as the students and the fishermen.

Fig. 5 Releasing of fingerlings

1. Number of post larvae released

Since 2002, the total number of released fingerlings was 7,498,000 broken down as follows:

Banana shrimps: 4,300,000
Tiger prawns: 3,000,000
Sea bass: 154,000
Blue swimming crabs: 44,000

Releasing of the swimming crabs was done later because of their bigger sizes. As a form of natural conservation, the local organization established a crab bank to keep the gravid crabs and after spawning these are sold in the markets.

2. Evaluation after Releasing

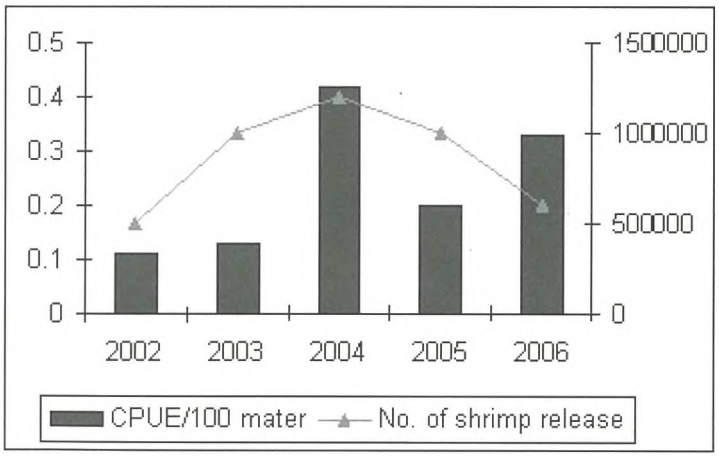
2.1 Monitoring by landing survey

From 2002 to 2006, monthly monitoring of the released stocks was done by the project staff considering the total catch of the fishermen through a landing survey. Two species recorded were banana shrimps and swimming crab that were collected by shrimp trammel net ,crab tap and crab gill net.

2.2 Results

CPUE of banana shrimp during short season from 2002 to 2006 was 0.11, 0.13, 0.42, 0.20 and 0.33 kg/ 100 meters, respectively. The relationship between the CPUE and the number of post larvae released is shown in Fig. 6. In 2005, the CPUE trend was lower because the year indicated the highest number of fishing boats.

As for the banana shrimps, the average size released was 1-2 cm in December, May and June of each year. The size of shrimps recaptured from trammel net in 2002-2006 was 15.91, 16.08, 16.08, 17.50 and 13.69 cm, respectively. Since the shrimps were between 7-9 months old (Taweeb, 1994), it could be assumed that the shrimps in the fishing area come from the stocks released. In 2004, Rochjanarut et al studied the average size of banana shrimps caught by shrimp trammel net in November to February of the next year at the ICRM-PD project site. The results showed that the average size recaptured was 15.73 cm and were believed to be 8-9 months old. Thus, the shrimps must have come from the stocks released in June 2004.



Remarks:
Fishing season
In 2002 ; Jan and Aug 2002
In 2003 ; Nov 2003-Feb 2004
In 2004; Dec 2004-Jan 2005
In 2005; Nov 2005-Jan 2006
In 2006; Nov 2006-Dec 2006

Fig.6 Relationship between CPUE and number of post larvae of banana shrimps released

For the blue swimming crabs, the number of juveniles released in 2004 and 2005 totaled 40,000 and 3,700, respectively. The number of crabs caught by crab trap in 2002-2006 was 746,226; 898,653; 1,450,304; 2,355,114; and 1,142,710, respectively. The relationship between the number of recaptured and released crabs is shown in Fig. 7.

The number of gravid crabs kept in the crab bank has also increased every year from 2002-2006: 557, 3436, 2192, 6049 and 4238, respectively.

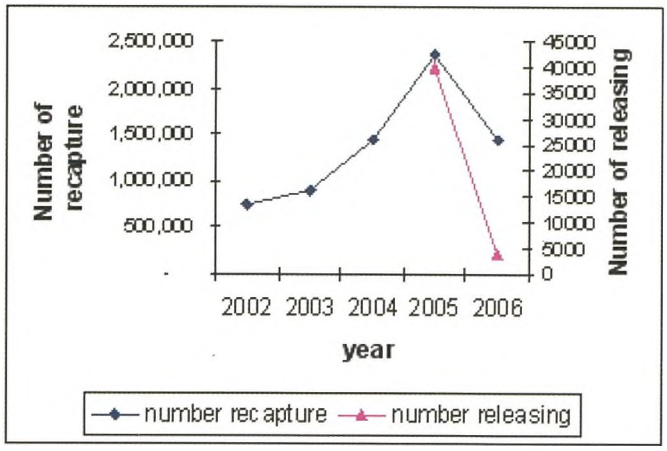


Fig. 7 Relationship between number of crabs recaptured and released

3. Monitoring by tagging

Tagging technique is a method used to estimate the number of marine animals recaptured after their released. The target two species tagged were sea bass and banana shrimps.

3.1 Experiment

On 8 December 2006, a total of 111 sea bass with length 6-10 cm were tagged under the spine dorsal fin using a tag gun (Fig. 8). After tagging, the fishes were treated with Iodine and kept in a 1 m^3 tank for 28 days. After 17 days, 3 fishes died while 25 fishes died after culturing for 26 days. On 5 January 2007, the remaining fishes were taken to the ponds. A CCAS officer concluded that the fishes died in the tanks because of limited swimming space and when the fishes became stressed they were prone to infection. It was therefore recommended that the suitable period for observing the fish before releasing them should not be more than 2 weeks.

Fig. 8 Position of the tags in shrimps and in sea bass

3.2 Procedure

On 22-24 December 2006, Professor Hiroshi Fishimi from Japan was invited by SEAFDEC/TD to teach tagging technique for shrimps to the project staff. He also provided 3 tag guns and 50,000 tag pins (Fig. 9).

Fig. 9 Professor Hirishi Fushimi teaching CMDEC staff the tagging technique on 22-24 December 2006

On the first day of May 2007, tagging was started for 372 banana shrimps with size 6-9 cm and ave size of 7.12 cm. After releasing for 20 days tag number A788 was recaptured by trammel gill net. It was observed that the shrimp increased in size by 2.4 cm (Fig. 10). For sea bass tagging was done on 11-15 June and released on 21 June 2007, total number tagged was 1,000 fishes.

Before and after releasing, announcements in the radio and newspapers were made regarding the shrimps tagged by CMDEC. A reward has been arranged for people who can turn over a tagged shrimp to the Center.

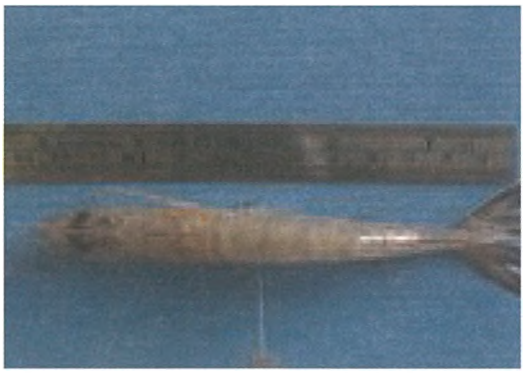


Fig. 10 Size of shrimp recaptured by trammel gill net on 21 May 2007

V. Conclusion

1. The shape of ARs in the project site was concrete cube frame. The ARs were installed in three groups valued at 9,000,000 Baht. The ARs could be referred to as "marine animal habitat" because 64 marine species were found in this area, comprising mainly the Pufferfish, Croaker and Indo-Pacific mackerel, etc.

2. Mangrove planting activity was conducted by the Pakklong Fisherman Group since 2005. Since they know the benefits from mangrove forest, they have volunteered to drive away trespassers and report them to the officer who is responsible for enforcement in the mangrove forest.

3. In five years, the trend of CPUE on banana shrimps and the number of blue swimming crabs have increased and assumed that the stocks must have come from the post larvae released. Although landing survey could surmise increasing CPUE of marine animals from post larvae released still the number of marine animals recaptured could not be estimated. Tagging was therefore carried out in order to confirm the number of marine animals recaptured based on the number released, and also in order to establish their growth rate and migration pattern.

VI. References

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FINAL PROJECT EVALUATION:
INTEGRATED COASTAL RESOURCES MANAGEMENT IN PATHEW DISTRICT, CHUMPHON PROVINCE (ICRM-PD)

Somsak Boromthanarat
Coastal Resources Institute (CORIN)
Prince of Songkla University, Hat Yai, Songkhla

I. CONCLUSIONS

The following conclusions have been derived based on the assessment of the project design and project outcomes.

Project design

The project design including its objectives is very well formulated because it is able to target the main issues that need to be resolved in the project site such as coastal protection and livelihood activities. These are the major issues concerning the local people as well as the region that has been prioritized by this project. The funds for the implementation of the project are adequate and the efficiency of the project leaders and members in managing, coordinating and facilitating the activities are commendable because they are able to reach the targets and intended beneficiaries. Even the inputs from external stakeholders are fully extended to ensure the success of the project. Although there are some activities which are not successfully implemented, the overall assessment of the project design is that it was excellently devised in the context of the project site. The application of this design may not necessarily work in other places but the lessons learned can be shared and may be adapted to suit needs in respective localities.

Project results

The activities of this project are well planned that every aspect of the issues are resolved. Baseline survey is assessed as very good because it provides all the important details needed to identify and prioritize the issues in the area. The CBRM activities are very significant in the understanding and learning process of the local people regarding the protection and conservation of the environment and the coastal resources. The local businesses of the villages are very significant as well because these provided them with alternative and/or additional sources of income to sustain their daily needs. More importantly, the dissemination of information materials to local people is a great way to keep them updated with and informed about recent developments and enables them to identify ways where they can participate and extend help. Lastly, the resource enhancement activities are very important in engaging the interest and participation of the local people rather than just giving them theoretical knowledge which is difficult for them to visualize and understand.

However, the weak point is the lack of collaboration between the OrBorTor and other agencies involved in this project. There is a need to gain their interest and full participation in this project. This is the reason for the failure to achieve decentralization that was planned at the initial stages. Instead, local ownership was promoted which yield very good results by boosting local people's confidence and capacity in resolving matters by themselves with minimal assistance from outsiders.

II. RECOMMENDATIONS

The following recommendations are suggested to ensure the sustainability of the project.

1. Project Design

The project design should focus on proactive strategies especially in making project proposals, workplans and annual plans. Monitoring mechanisms and indicators should be prepared to evaluate the planned and

contingent activities. Proper orientation and initial capacity building activities for people involved in the project are needed before the project's commencement. This will enable them to know clearly their functions and responsibilities. This will adequately prepare them to address issues in the field. Funds should be adequately provided and disbursed before the start of the activity to avoid delays in implementation.

2. Project results

Base line survey

There is a need to build the capacity of the local people regarding the conduct of survey and analysis through classroom training and hands-on experience. This gives them the necessary knowledge, skill and confidence to do it by themselves. This results to a greater sense of ownership, responsibility and accountability in the management of the environment and resources by the local people.

Encourage and extend CBRM

Capacity building on CBRM concept is needed by the local people to help them understand about the activities they are participating at. There is also a need for them to exchange information and knowledge with other groups from other places, i.e how to ensure the success of their activity such as the LEU.

Encourage local business

Learning new technologies and techniques to improve their production will greatly help local people in their livelihood. It is necessary to update local people regarding management, accounting, planning and marketing systems.

Enhance human resources capability and participation

Exchange of information and experiences for the PFG from others areas in the country. Since they are just starting, there is a need for them to be exposed and see how other groups from other places are doing things.

Develop extension methodologies and extension systems

Published documents provided to the local people are sufficient. At this stage, it is useful to train them how to make their own information materials since they will be responsible in managing their own activities.

Rehabilitate and enhance coastal resources

Additional financial support is needed to facilitate the rehabilitation and enhancement of coastal resources. The active participation of schools and communities is a good indication of their interest in continuing with these projects.

3. Others

Present gathered data to policy makers

The project indicates that high quality information and data obtained through scientific research, upgraded extension materials, and increased public support through communication of the results are crucial to guide policymakers and decision makers in properly formulating policies and for practitioners to improve and correctly implement coastal zone management principles. The main purpose is an informed decision-making, policy-making and management practice. Sharing of information should not be limited at the Provincial Level. It should reach the National Level especially those departments working on environmental protection and coastal zone management policies. It is important that they get the right information as inputs to ensure successful planning and implementation of policies that are also applicable to other areas of the country.

Encourage more local community participation

The project reveals that coastal habitats can be managed and protected better by the local communities as they possess profound knowledge of the environment and are the key users of its resources. This is the fundamental principle of community-based management. A strong political will is needed from local institutions to likewise provide economic incentives to sustain the community efforts. Continuous technical and some financial support from the government are also needed especially in the first phase of the transition period when the project is being handed over to local people as the project ends.

The project implementation confirms the need of enhancing local community participation in coastal environment conservation, directly (e.g. community patrol) and indirectly (e.g. enhancing the capacity of the local community), and in the sustainable uses of coastal resources with associate economic benefit. It is also important to emphasize the active involvement of the coastal communities at the earliest stages of planning and management. The actual implementation of resource management has to be carried out at community level. Not only does this ensure the active participation of the community but it also makes use of the fact that local and indigenous communities often possess substantial accumulated specific knowledge on how best to manage resources. Management should make maximum use of this traditional knowledge.

The project also affirms that the most promising approaches to coastal and marine conservation involve an adaptive management scheme at the municipal level, where community-based development specialists, cross-trained in environmental and natural resource monitoring, assist the municipality in the development of regulations for local community development.

Encourage participation of Or Bor Tor

As mentioned in the project results, the common comment from local people and government agencies is the lack of coordination among Or Bor Tor, government agencies and the communities. The importance of gaining full participation of all stakeholders should not be underestimated. Support is not only limited to nor does it only refer to financial support. Once the full cooperation of Or Bor Tor is achieved, it is still possible to let them take charge of some of the activities of the project when it is fully turned over.

Adopt an inter-disciplinary and inter-sectoral approach at all levels

New problems are becoming increasingly complex and demand inter-sectoral coordination. At present, responsibilities for policy-making and implementation are generally dispersed among several agencies or offices, consequently, it is not clear to which agency or office certain mandates are allocated. The result is an overlap in competence. Hence, when something goes wrong, no specific agency can be pinpointed to resolve the issue and the entire sector suffers. Integrated management seeks to reduce the social costs associated with sectoral activities accruing both inside and across sectors.

Enforce the laws and regulations

Effective enforcement of laws through local community participation is indeed a crucial instrument for coastal area protection and management. Through training in ecology and paralegal aspects, the project can succeed in enhancing local community involvement in the protection of their coastal resources. For example, the Local Enforcement Unit (LEU) should be activated to reduce illegal fishing in the area. Local people should be encouraged to stop their illegal fishing activities.

Provide financial support

It is still advisable to provide financial support to the local groups until such time that they can stand on their own. Also, there should be emergency funds allocated in case of unexpected circumstances that will affect project activities.

Scientific research and assessment of the activities of the project

There is a need to conduct further scientific research and assessment on some of the activities of the project such as the artificial reefs, fish enhancement device, and stock enhancement. It is important to know the scientific basis of the effects or impacts of the activity to the environment and the coastal resources.

DESCRIPTIONS OF THE PROJECT APPROACH AND PROGRESS IN ICRM-PL, MALAYSIA

Krishnasamy Arunasalam
Department of Fisheries, Malaysia

INTRODUCTION

- LANGKAWI

Langkawi is the main island out of a total 99 islands at North West Coast of Peninsular Malaysia, 30 km from Kuala Perlis and 51 km Kuala Kedah

ICRM application in Malaysia...*an experience*

- Langkawi projects (Kuala Teriang)
- First ever structured coastal ICRM in Malaysia
- Collaborative project SEAFDEC/TD – DOF Malaysia, started in 2003
- KEN Kuala Teriang – as an anchor
- Envisaged to also benefit Kubang Badak, Kuala Chenang and Pantai Kok

Component of Langkawi's ICRM Project

- Base-line socio economic survey
- Establishment of local enforcement unit
- Resource rehabilitation
- Fishing gear technology improvement
- Expand the ICRM concept – *zoning arrangement*
- Creation of economic activities for women's group

MAIN ACTIVITIES - KUALA TERIANG

- **A traditional fishing village located at the west coast of P. Langkawi. South Cenang North Kubang Badak fishing villages.**
- **Number of fishermen 698, (K.Teriang,Melaka,Kok)**
- **Fishing gears gill nets, drift gill net, hook and line, traps (at AR,FAD's)**

PROBLEMS

- **Encroachment- Trawlers/ Purse Seine's**
- **Dwindling Catches / Resources**
- **Expenses (fuel / spare parts/materials)**
- **Less technical knowledge on fishing techniques and business ventures and (HRD development)**
- **Financial constraints**

STEPS TO OVERCOME

- **Downstream activities**
- **Reduce middlemen**
- **Improve fishing techniques**
- **Practice responsible fishing**
- **Conservation and sustainable fishing**

FORMATION OF KEN

(Fishermen Economic Group)

- KEN (Fishermen Economic Group), Kuala Teriang – year 2001
- Number of members : 50
- Headed by Mr. Mahadzir (Fisherman)
- Office building - local government
- Activities supervised by DOF
- Savings RM8,000

KEN'S OFFICE

KEN'S ACTIVITIES

Activities / Year	2003 (RM)	2004 (RM)	2005 (RM)
Ice	4,500	5,000	5,500
Lubricant	1,500	2,000	3,500
Repair Engine	250	500	750

SEAFDEC ASSISTANCE

- SEAFDEC – TD : Introduce, LBCRM-PL and later ICRM – PL – Project Leader Mr. Etoh (2003)
- To help improve the economic status of the village communities by introducing activities relevant and applicable to the environment and skill possessed – formulate plans and implement

KEN KUALA TERIANG

KPSP : Fisheries Resources Management Community (FREMAC)

KPSP

FORMATION OF KEW

- KEW (Women's Economic Group)
- Number of members : 12
- Chairwoman: Che Embon Saad (Housewife)
- Dried fish, squid
- Crispy anchovy (new product)

APPROACHES AND IMPLEMENTATION

- Study tour – KEN & KEW to Chumphorn Thailand (KEW on April 2004 and KEN on Jun 2005)
- Women Group (KEW) – started anchovies processing (Bilis Sira 3 Rasa) and premise's upgrading support by DOF
- Market potential very good and improve on GMP / GHP and Packaging – supervised by DOF
- Bookkeeping on production /sales / purchasers. Computer by SEAFDEC – TD
- FAD- Fishermen, AR- LKIM - FED – SEAFDEC-TD
- Engine Repair Workshop : Spare Parts – SEAFDEC & DOF
- Introduction and Training On suitable fishing gears by SEAFDEC / DOF

KEW'S ACTIVITIES

NATURAL DISASTER

- *Tsunami Dis. 2004*

REHABILITATION PROGRAM

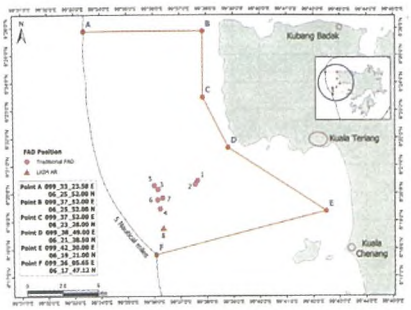
- DOF
- Japanese Govt. (Tsunami fund)
- Drainage Irrigation Dept.
- Fisheries Board of Malaysia
- LADA
- Local Government
- Forestry Dept.
- SEAFDEC- TD
- Private Company
- NGO (UNESCO)

REHABILITATION PROGRAM

* Overhead Bridge
* FEG (KEN) – Workshop
* FEG (KEW) – Processing Mini Factory
* Fish Landing Jetty
* Gear Repairing Premise
* Mangrove Re plantation

ZONING PLAN – (DRAFT)

- Preliminary draft for approval
- DOF staff stationed
- Maritime Agency



ACTIVITIES

- Workshop on fiber glass fishing boat repair
- Workshop's on FED
- Workshop on fishing gear improvement
- Book keeping (KEW)
- Mid term socio-economic survey

SIGNS OF POSITIVE RESULTS

KEN (FEG)

- Improved catches (species) / income
- Reduced encroachment
- Group active : Conduct meetings discussions and organized
- Resource awareness

SIGNS OF POSITIVE RESULTS

KEW

- Increase sales of product
- Improved in packaging and quality
- Diversification products
- Higher demand
- Improving accounts and records system

FUTURE DIRECTION

KEW

- New plant (Increase production)
- Diversification of products
- Tapping new markets
- Improve product quality
- Proper accounts
- SMI – entrepreneurship program

FUTURE DIRECTION

KEN

- Zoning gazette
- To improve catches (zoning) area
- Workshop repair engine /sales spare parts
- To formulate *crab bank* activity
- Mangrove Reclamation
- Tourist and information centre

REHABILITATION AFTER TSUNAMI

THANK YOU

DESCRIPTIONS OF THE PROJECT APPROACH AND PROGRESS IN ICRM-SV, CAMBODIA

Yos Chantana
Fisheries Administative,Cambodia

Integrated Coastal Resources Management Project in Sihanoukville under collaboration of FiA Cambodia and SEAFDEC/TD

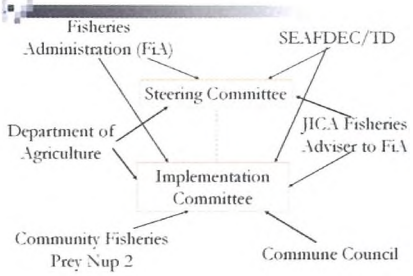
Project site in Sihanoukville

Base-Line Socio-economic and Fishing Surveys

Survey Report

Compiled in September 2005

Approval of Project Document



Project Opening Ceremony

Project Objectives

- **To develop capacity building of local human resources to empower them to manage and sustain coastal resources and community development**
- **To encourage people's participation on a voluntary basis**
- **Alleviation of poverty in coastal fishery communities**

Proposed activity

1. Baseline and monitoring survey
2. Encourage and extend CBFRM concept
3. Promotion of local business
4. Enhance human resources capacity and participation
5. Rehabilitation and enhancement of coastal resources
6. Fishing / fish handling technologies improvement

1.Baseline and monitoring survey

1.Socio-economic survey – March 2005

2. Fishing survey – March 2005

3. Fish landing data collection – February 2006 onward.

2. Encourage and extend CBFRM concept

1. Formulation of Community Fisheries Area Management Plan (CFAMP): Internal Law (IL), Community Fisheries By-Law (CFBL) and Zoning map (ZM) and management plan
2. Establishment and activation of Local Enforcement Unit (LEU)

2.1 Progress in CFAMP Development

CFAMP was prepared in the following steps:

- Investigation on the current situation or applicability of CFAMP
- Consultation with the stakeholders of Toeuk Tla CFs and the commune council on drafting CFAMP
- Draft CFAMP by the project in assistance from Municipal Fisheries Office, Sihanoukville
- Review and consult with the stakeholders in a plenary meeting of Toeuk Tla CF and commune council on the first draft of CFAMP
- Prepare the second draft of CFAMP incorporating view expressed in the plenary meeting

Demarcation of Community Fishing Area

Progress in CFAMP Development

- Submit the second draft to Municipal Fisheries Office for evaluation and suggestion
- Community Fisheries Area Management Plan was signed by:
  - The Community Fisheries Chief in each village
  - The Community Fisheries Chief of Prey Nub2
  - The Village Chief
  - The Chief of commune Toeuk Tula
  - The Governor of District Prey Nup
  - Chief of Municipal Fisheries Office Sihanoukville
  - the Head Agricultural Department in Sihanoukville
  - The governor of Sihanoukville

2.2 Progress in local enforcement unit

- The community is working closely with local authorities and Fisheries office, especially Fisheries Unit in Prey Nub district.
- Patrolling service required some evidences against violators, and responding to this request the project provided the LEU with a camera which could be of help to some extent.

Progress in local enforcement unit

- Local enforcement unit went patrolling quite frequently, so illegal fishing activities decreased considerably.
- In fact, fishermen now acknowledged that, the can catch more fish than in the previous time.

Progress in local enforcement unit

- Comparing with CFs in SHV, CFs Prey Nub2 can protect well mangrove forest because
  - Fishermen in Toeuk Tla understood well about the important of mangrove;
  - When fishermen see illegal mangrove cutting, they will stop (if possible) and inform fisheries staffs to intervene.

Progress in local enforcement unit

- Experiences shown that, when fishermen found illegal fishing or mangrove fellers, they informed CFCs and fisheries staffs to intervene :
  - Arrested 7 illegal fishing boats
  - Confiscated 30 drag nets and 2 push nets and 80m of mosquito nets
  - Arrested 18 offenders

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Key successes in Local Enforcement Unit

1. Leadership of CFs head
2. Strong supports from Fisheries Office and the Commune Council
3. Communication through mobile phone provided by SEAFDEC
4. CFs's awareness on the important of natural resources in their livelihoods
5. Participation from CFs

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Obstacles in Local Enforcement Unit

1. CFs committee and enforcement unit are busy in fishing
2. Water in the estuary CFs is shallow, so it is impossible to arrest big boats and bring into the patrolling house
3. Some CFs Committee members did not participate in patrolling due to personal reasons.

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3. Promotion of Local Business

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3.1 Promotion of local business – mushroom production

1. Organization of Women's group
2. Identification of potential local business and conduct a feasibility study
3. Training women's group in mushroom production
4. Establishment and initiation of cottage scale industry
5. Training course in simple bookkeeping and accounting system

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Auditing women's business

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Profit and loss analysis

Item	K.Chin	Prek sanke	Prek Pros1	Prek Pro2	Prek toal	total
Produced (kg)	1,014.8	627.4	136.4	159.0	523.9	2,461.5
Sale	686.50	411.50	110	98.85	352.47	1,660.32
Expenditure	347.16	409.90	279.62	81.23	375.12	1,493
Gross incoom e	340.33	1.60	-169.62	17.62	-22.65	167.17
E. return	166.0%	1.0%	-118.4%	17.5%	-9.2%	-

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The advantages of mushroom cultivation

1. Using simple technology
2. Materials are available locally
3. Economic viability
4. Generating income for women with part-time cultivation.
5. Reducing the import of mushroom products from other provinces

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The advantages of mushroom cultivation

1. Other places copied this model for their own business
2. Before the project, people want to know mushroom cultivation, they have to pay 500$ for training fee.
3. Increasing availability of agriculture products in the CFs, commune…

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Key successes of women group

1. Leadership of group leader
2. Accountability and transparency in running business
3. Physical contribution of each members into the business
4. Considering this business as their own job, not the project

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The major problems of mushroom business

1. The women group faced marketing issues
2. Strong completion from other producers
3. Mushroom can be kept only during one day. So the group has to sell off mushroom at low price, if not, the products will be spoiled.
4. Water shortage during dry season

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Strategies for mushroom cultivation

1. Strengthening women group on bookkeeping
2. Providing technical assistance
3. Fisheries Office committed to facilitate the marketing channel at Sihanoukville
4. Producing and selling mushrooms in packages

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3.2 Promotion of local business – Crab culture

1. Organization of Fish farmers' group
2. Training Fish Farmers' group in Crab culturing
3. Construction of culturing ponds
4. Establishment and initiation of cottage scale industry
5. Training course in simple bookkeeping and accounting system

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Pond digging

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Mud crab culture

- The actual operation for culturing commenced on 13 February 2007.
- The training course in practical crab culturing techniques was conducted for the members of Crab Culturing Sub-group on 10th January 2007. The trainer was the expert working in DOF in Thailand.
- The operation was suffered with the high mortality rate . The cause should be clarified and improvement should be made for the future operation.

Some reasons behind high mortality rate

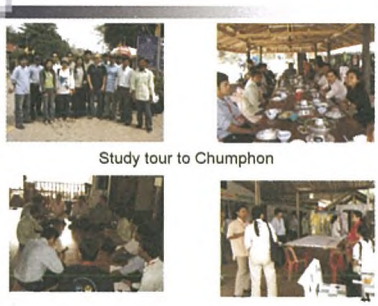
- Pond depth may be shallow(80cm)
- Lack of experiences in culture
- Management issues
- Not clean pond before stocking
- And other…

Measures for improving crab culture

- Digging pong more deeply around 1.3m
- Drying and cleaning the ponds before stocking
- Need technical supports
- Strengthening pond management
- Controlling water quality more carefully

4. Enhance human resources capacity and participation

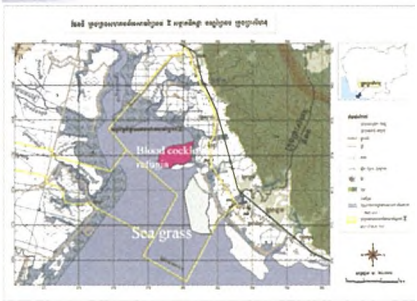
1. Workshop on disseminating data and information
2. Reinforcement of structure and capacity of TTCF
3. Encourage participation in community development work



Study tour to Chumphon

5. Rehabilitation and enhancement of coastal resources

- It has been envisaged to establish a fish conservation area called "*fish refugia*"
- The Sihanoukville Fisheries Office has organized a technical group to study a possibility to establish the one in the project operational area.



Public meeting on mangrove protection

CURRENT APPROACH TOWARDS REALIZATION OF COMMUNITY BASED FISHERIES RESOURCES MANAGEMENT (CBFRM) CONCEPT IN BRUNEI DARUSSALUM

Abd Hamid Haji Zainin
Department of Fisheries, Brunei Darussalam

CURRENT APPROACH TOWARDS REALIZATION OF COMMUNITY BASED FISHERIES RESOURCE MANAGEMENT (CBFRM) CONCEPT IN BRUNEI DARUSSALAM

ABDUL HAMID HAJI ZAININ
DEPARTMENT OF FISHERIES
MINISTRY OF INDUSTRY AND PRIMARY RESOURCES
BRUNEI DARUSSALAM

CONTENTS

1. Introduction

Fisheries sector plays an important role in the economy of Brunei Darussalam.

The per capita consumption of fish[1] is about 47kg/year which is considered to be one of the highest in the world.

The total local production of fish in 2006 produced from 3 sectors namely the capture fishery, aquaculture and seafood processing is 18,342 metric ton with the value of B$ 106 millions.

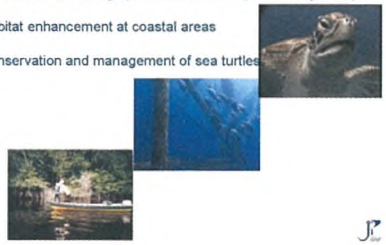
2. Fisheries Management

Having limited fishing grounds, it is important that proper fisheries management is adopted in this country. The measures includes :-

Limitation of fishing licenses especially in the commercial scale operation
Implementation of moratorium on for demersal trawling of zone 2 (3-20 nm)
The implementation of new mesh size regulation using 51mm square-meshed code end of trawl net
Creation of zones for fishing grounds
Moratorium on fishing operation in zone 1
Conservation and management program
- Artificial reef
- Conservation and management of sea turtles

3. Areas Where Community Can Play Their Role, Conservation and Management Program.

Moratorium on fishing operation in zone 1 (1st January 2008)
Habitat enhancement at coastal areas
Conservation and management of sea turtles



3. Areas Where Community Can Play Their Role, Conservation and Management Program.

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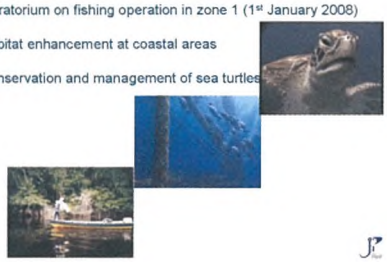


5. Community Participation

Accountability and responsibility (sense of belonging)
Sustainability
Local knowledge, experience and skills
Conservation and protection
Public education and awareness

6. How we involve the community

Stakeholders consultation
Involvement of coastal communities
Management through community- based groups or organizations (Village Head)
Focus in specific areas through their capability and strength

7. Roles of the community

- Documentation of popular and traditional knowledge,
- Establish resource enhancement activities
- Undertake livelihood activities Plan

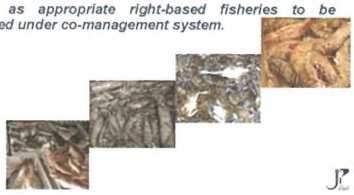
8. Impact of the Community Involvement

Better understanding on the intention of the Government in promoting the Fisheries Resource Management.

Respect on nature matters (marine resources, coral reefs, mangroves etc)

9. Conclusion

It is important to note that, the coastal communities play an important role in contributing to the local food security and sustainable livelihood. In view of developing and improving the Coastal Resource Management, "group user rights" may be considered towards certain extend as appropriate right-based fisheries to be promoted under co-management system.

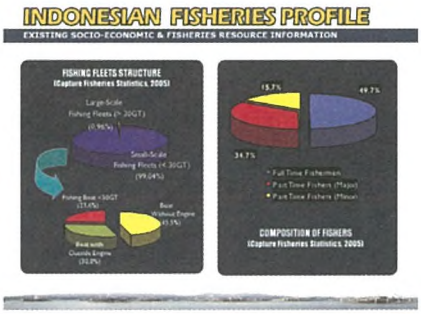


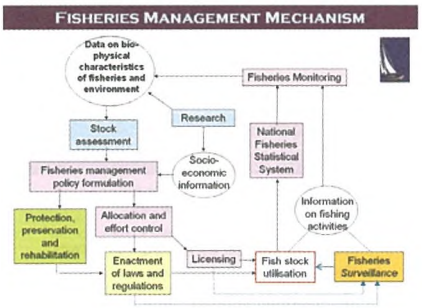
Fisheries Department
Brunei Darussalam

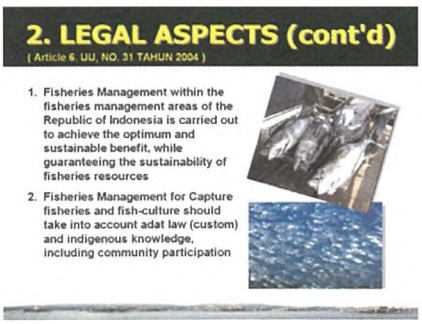
THANK YOU

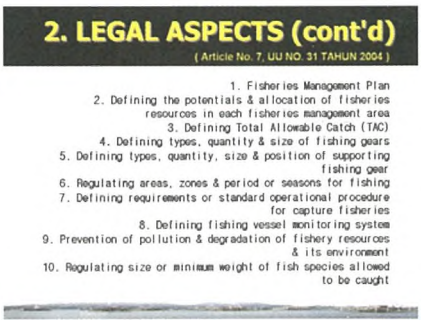
INTEGRATED COASTAL RESOURCE MANAGEMENT EXPERIENCES IN INDONESIA

Sri Yono WS
Directorate General of Aquaculture, Indonesia









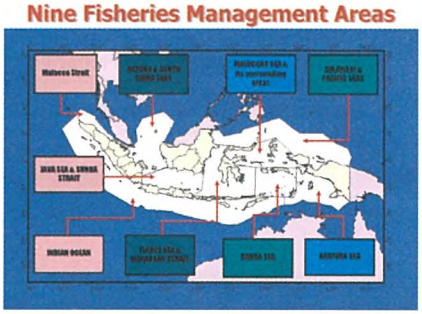
2. LEGAL ASPECTS (cont'd)

- Article 65, UU No. 31/2004: Delegation of function, authority and supporting mandates from the Government to the regional government & further regulated by Government Regulation, PP No. 54/2002 concerning Fisheries Business (under revision)
- Article 18, UU No. 32/2004: Delegation Authorities to regional government on management of marine and fisheries in certain areas

3. DEFINING FISHERIES POTENCY

1. Defining The Potency of Fisheries Resources
   - Establishing the National Committee for Fisheries Stock Assessment
   - Determining MSY thru methods of scientific researches, which also including consideration of socio-economic aspects
   - Validation through FKPPS (communication forum)
2. Defining Total Allowable Catch (TAC)
   - TAC is 80% of MSY (pre-cautionary)

Nine Fisheries Management Areas



Fisheries Status

4. REGULATING UTILIZATION OF FISHERIES RESOURCE

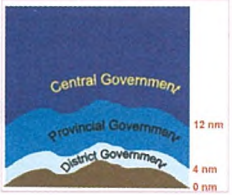
1. Defining Fisheries Allocation for each WPP
   - Data of potency for each WPP as determined previously
   - Effort data (vessel and fishing gears per WPP)
   - Determine allocation for each WPP
   - Production data used for comparison and finding out the status of the resources in each WPP (next figure...)

4. REGULATING UTILIZATION... (cont'd)

2. Utilization methods shall Consider:
   a. Regulations on fishing lanes and allowed fishing gear in each lane (defined by Ministerial decree)
   b. Management Authorities (delegation of authority to the regional government based on UU 32/2004 & PP 54/2003)
   c. Fisheries Resource Management Plan in each WPP
   d. Other supporting regulations such as trawl ban, mesh size limitation and etc.

MANAGEMENT AUTHORITY OF MARINE RESOURCES

(Autonomy Law no. 22/1999 rev. 32/2004)



Vessel size (GT)	AUTHORITY TO ISSUE FISHING LICENSE (Government Reg. No. 17 of 2006)
>30	Central Government
>10-30	Provincial Government
≤10	District Government

4. REGULATING UTILIZATION... (cont'd)

3. Several implementing Policies related with utilization of fisheries resources:
   a. Allocation will be given if the fisheries resources is under fishing (based on TAC)
   b. Fisheries resource management shall be carried out by rationale ways among others thru limitation of fishing effort, close fishing ground (DPI) & season, transformation DPI from high to less density of WPP or to WPP
   c. Controlling & restructuring of WPP and development of fisheries management plan in each WPP

4. REGULATING UTILIZATION... (cont'd)

d. Optimization of fisheries resource management in waters area bordering with other countries
e. Strengthening FKPPS roles both in national & regional levels, minimizing violations & conflicts among users in DPI and balancing between allocation & utilization of fisheries resources
f. Identifying, empowering, streamlining and implementing local wisdoms into formal regulations & rules

5. DEVELOPING MCS PROGRAMS

1. Implementing of MCS Program
   - Installation VMS at fishing vessel
   - Establishing Observer Programs
   - Establishing Inspection Group which involving community (POKWAMAS)
   - others
2. Several Policies related with MCS:
   - Intensive monitoring of fisheries resource utilization which well planning & involving fisheries experts in its assessment

5. DEVELOPING MCS... (cont'd)

- Government Institution shall carry out the control of fisheries which involving community participatory
- Evaluation on policies & implemented management measures will be conducted periodically as inputs for further policy formulation
- Determining joint consensus in fisheries resource utilization to avoid conflicts among fishermen

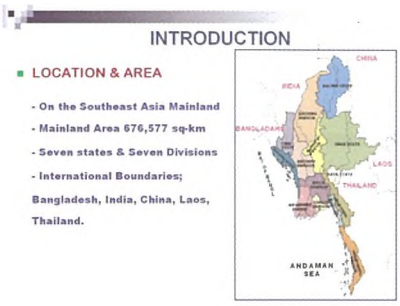
6. OTHER MANAGEMENT ASPECTS

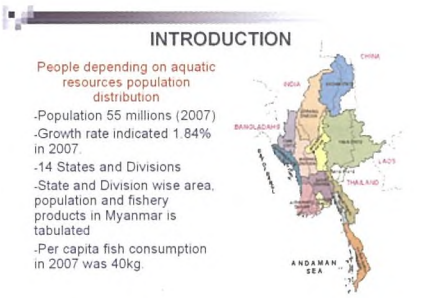
Other aspects considered for development of management for fishing capacity:

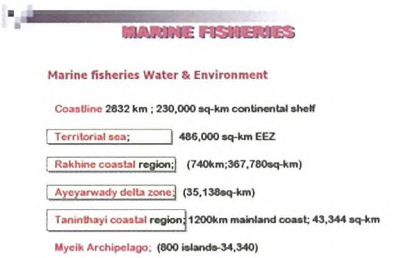
1. Improving fisheries statistic, information & indicator programs
2. Strengthening Co-Management Programs
3. Human Resource Development: establishing HRD Center under MMAF (latest development)
4. Improving fisheries facilities & infrastructure
5. Stock enhancement programs
6. Others: including NPOA fishing capacity that will be drafted in 2007

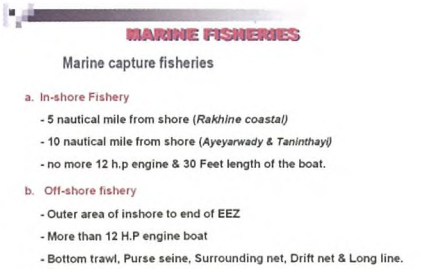
INTEGRATED COASTAL RESOURCE MANAGEMENT EXPERIENCES IN MYANMAR

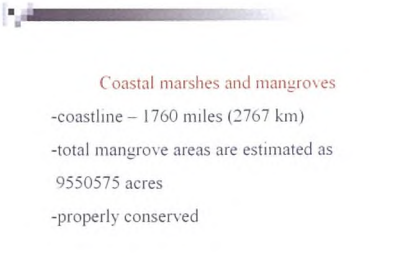
Than Oo Wai
Department of Fsiheries of Myanmar











Policies and practical measures taken for marine farming for stock enhancement

- **Myanmar Government has separate Ministry regarding the fisheries**
- **That is the Ministry of Livestock and Fisheries**
- **Under this Ministry, Department of Fisheries is sole competent authority for management and development fisheries**

- Also fishery resources management conservation, stock enhancement, trainings, research, collection of revenues, compilation of fishery statistics are major components in the main tasks of Department of Fisheries

- Fisheries policies in Myanmar are;
  - to promote all-round development in fishery sector
  - to increase fish production for domestic consumption and the surplus to export
  - to encourage the expansion of aquaculture.
  - to upgrade the socio-economic status of fisheries communities.

- Production of fish and shrimp seed , distribution and stocking into open and natural water bodies are major activities of the Department of Fisheries

Fishery Laws

- In order to conduct fisheries management four Fishery Laws have been promulgated as follows:-

(1) Law Relating to Fishing Rights of Foreign Fishing Vessels (1989)

(2) Law Relating to Aquaculture (1989)

(3) Myanmar Marine Fisheries Law (1990)

(4) Freshwater Fisheries Law (1991)

- These Laws encourage to develop fishery sector, prevent extinction of fish and fishery resources, safeguard environmental
- These laws prohibit illegal fishing and operations and utilization of explosives, poison, chemicals , etc.

Pollution and habitat degradation

- Pollution is seldom found in all types of fisheries water even near urban or industries areas
- Despite the systematic surveillance and monitoring, there might have some problems of silt invasion and chemicals discharged by gold mines
- Substantial destination of habitats and changing fish stocks

Existing statistics

- Myanmar has very elaborate fishery collection statistical system
- Various levels of fisheries offices are deployed strategically at fishery intensive areas
- Township level collect data. District level compile data and report to State and Division level that finalize and report to statistics section at head office of Director-General of DOF

PRESENT SITUITION OF COASTAL RESOURCES IN MYANMAR

The coastal resources in Myanmar could be classified as : -

1. **Mangrove**
2. **Coral reefs**
3. **Mud flat**
4. **Sand beach**

Mangrove :

There are extensive mangrove forests in Ayeyarwady delta, Rakhine and Tanintharyi coastal regions. It has been recorded the prevailing mangrove forest covers about 382023 hectare in the countries.

prevailing of mangrove forest in Myanmar

Coastal region	Area (Ha)	Proportion(%)
Rakhine coastal region	64752	16.9%
Ayayawaddy delta region	177256	46.4%
Tanintharyi coastal region	140024	36.7%
Country	382032	100%

Department of Fisheries being recognized the resources as national heritage and undertake following activities on turtle beach : -

1. Preserve and restore spawning , feeding and nesting habitats.
2. Prepare and make nesting beaches by eliminating adverse impact through law enforcement
3. Implement beach cleaning and predators prevention activities
4. Minimized the activities that might pollute marine environments around turtle beach
5. Implements activities to increase public awareness and participation on " Sea Turtle Conservation" through extensions and public education works.

The Responsibilities of Department of Fisheries for Development and Management are as follow as : -

- Conservation and rehabilitation of fishery resources;
- Promotion of fisheries researches and surveys;
- Collection and compilation of fishery statistics and information;
- Extension services;
- Supervision of fishery sectors;
- Sustainability of fishery resources;

Also we have natural resources management policies in Myanmar, The activities include

1. Set up strategy to increase fish production by stocking fish and prawn seeds into dams, reservoirs and natural water bodies;
2. Lease holders have to hold fish seeds in pens, to release at the beginning of next season . In this way, there is significant increase in fish production by such culture based capture system in Myanmar;
3. Promoting education programs related to conservation and rehabilitation of fisheries resources.

(a) Related Marine Research

1. Data collecting on some marine aquatic animals (shark, turtles, mammals);
2. Marine fisheries resources survey with the assistant of SEAFDEC;
3. Ayeyarwaddy Dolphin Surveys;
4. Mariculture practices.

(b) Others

1. Implementation of HACCP system in fishery products industries;
2. Training and demonstration on various aquaculture techniques;
3. Planning for fishery sectors development;
4. Strengthening of fisheries laws enforcement.

Fisheries Extension and Education

In the information age, training and education are getting more important than ever before. As all known , human resource development is recognized as the most important factor for economic development .

Type of Training Course	Number of Training Course	Number of Personnel
Post Harvest Technology	2	65
Aquaculture	21	669
Other	3	35
Total	26	769

CURRENT ICRM PROJECTS

The project on ' Integrated Mangrove Management through Community Participation in the Ayeyawaddy Delta" is the most recent pilot project related to the ICRM undertaken by the Forest Department under the JICA study during 2004 and 2005. The project was mainly aimed the following -

1. To confirm practicability of the " Integrated Mangrove Management through Community Participation".
2. For the capacity building of the stakeholders
3. For the implementation of Community Forest by users group and forest department

METHODOLOGIES AND MEASURES

The project evaluation is based on the Sustainable Livelihood Approaches (SLA) developed by DFID. The SLA aims at formulation of a sustainable project within the context of the environment of the study areas and the capacity of peoples related to the project. The capacity of the project was evaluated the following as the Phase I.

1. Confirm the facts attained from the two pilot projects in 2003-04
2. Comparing the results from the two projects
3. Estimate the anticipated capacity of stakeholders

Then the activities are categorized into 5 sectors as -

1. Human (technology, knowledge, ability, engage in works, health)
2. Social (organization, communication, cohesiveness)
3. Physical (infrastructure, tools and equipment)
4. Natural (land, forest, water, aquatic resources)
5. Financial (income, budget and funding)

POSSITIVE OUTCOME OF THE PROJECT

The project was carried out to confirm the practicability of the " Integrated Mangrove Management through Community Participatory" in the piloted areas and the results confirms the existence of ability to implement the tasks.

GENERAL COMMENTS AND IDEAS FOR FURTHER DEVELOPMENT

For the sustainability of fisheries resources intended the food security through fisheries sector the following comments would be set : -

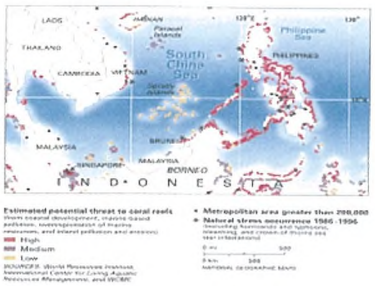
1. Develop Integrated Coastal Resources Management in collaboration with line agencies.
2. Develop regulation for the comprehensive management program in the coastal zone focusing the sustainability of habitats and fisheries resources
3. Clarify the responsibilities of every each of line agencies on the functioning of ICRM
4. Capacity building for ICRM approaches
5. Dissemination of information among line agencies
6. Implement and build up capacity to monitor coastal environments

Some Fisheries Activities in Myanmar


Thank you

INTEGRATED COASTAL RESOURCE MANAGEMENT IN THE PHILIPPINES:
THE FISHERIES RESOURCE MANAGEMENT PROJECT(FRMP) EXPERIENCE

Jessica C. Munoz
Department of Aquaculture, Bureau of Fisheries and Aquatic Resources (BFAR)

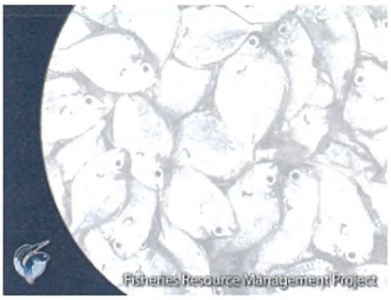


ISSUES IN FISHERIES MANAGEMENT

- Resource depletion in coastal and inland waters
- Overfishing/illegal fishing
- Low income from fishing
- Need for stronger law enforcement
- Need for adequate and capable institution and manpower
- Non-accessibility to credit by fishers
- Pollution

FACTS ABOUT CYANIDE FISHING

- popular as a fishing method due to the very profitable exotic reef market e.g. for grouper, wrasse and the aquarium trade
- cyanide fishing has produced an annual profit of 1 billion dollars
- over 330,000 gallons of cyanide are dumped over coral reefs in the Philippines every year; causes coral bleaching



RATIONALE

Address the two critical issues of

- fisheries resource depletion and
- persistent poverty among municipal fisherfolk

LONG-TERM GOALS: Sustainable development; Poverty reduction

PRIMARY: Reverse fisheries resource depletion

SECONDARY: Promote alternative employment

SCOPE

New

Lingayen Gulf
Sapian Bay
Butuan Bay
Gingoog Bay
Honda Bay
Puerto Princesa Bay
Davao Gulf

Calauag Bay
San Miguel Bay
Ragay Gulf
Lagonoy Gulf
Sorsogon Bay
Tayabas Bay
Carigara Bay
San Pedro Bay
Ormoc Bay
Sogod Bay
Pangul Bay

Old

FSP

PROJECT COMPONENTS

one	PHILFIS & GIS (Philippine Fisheries Information System and Geographic Information System)
	Resource and Social Assessment (RSA)
two Income Diversification	Information, Education and Communication (IEC)
three Capability-building	Coastal Resource Management (CRM) Planning and Implementation

PROJECT COMPONENTS

one Fisheries Resource Management	Integrated CRM in Puerto Princesa
	Fisheries Legislation and Regulation
two Income Diversification	Community-Based Law Enforcement
three Capability-building	Regional Coordination Through MCS Centers (Monitoring, Control and Surveillance)

PROJECT COMPONENTS

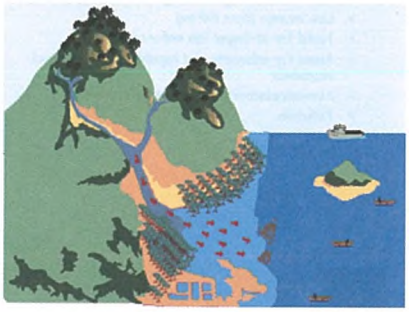
one Fisheries Resource Management	Community Organizing
two Income Diversification	Promotion of Microenterprises
three Capability-building	Mariculture Development

PROJECT COMPONENTS

one Fisheries Resource Management	
two Income Diversification	
three	Training and On-Site Coaching
	Project Management

IMPLEMENTATION ARRANGEMENTS

Executing Agency	Department of Agriculture
Implementing Agencies: National	Bureau of Fisheries and Aquatic Resources through a Project Management Office (PMO)
Regional	BFAR Regional Offices through Project Implementing Units (PIUs)
Municipal	Local Government Units through Fisheries Management Units (FMUs)
Other Partners *In Implementation*	FARMCs and other POs, coastal communities, research institutions, NGOs, & the private sector



Elements in the Promotion of Integrated Coastal Resources Management

National policies on coastal and fisheries management

Republic Act 8550
The New Fisheries Code
A Primer

- Fisheries Code
- Local Government Code
- NIPAS Act
- Executive Order No. 533

LGU participation

The LGU of Tagkawayan (Ragay Gulf) has built a P100,000 Coast Watch tower and training center to support FLET operations using its counterpart funds

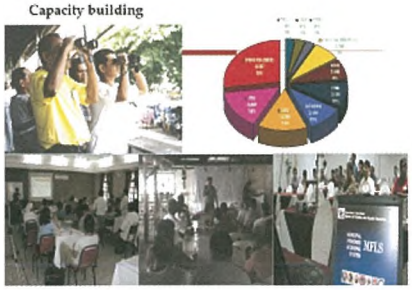
IEC Campaign

IEC materials are available to partner implementors

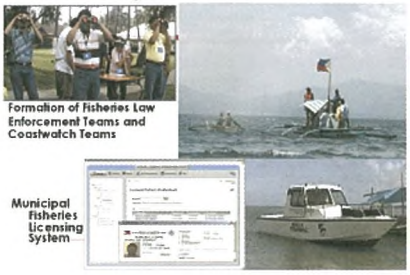
Research-based management

rsa *Resource and Social Assessment*

Capacity building



Fisheries Regulation and Enforcement



Community/fishers participation

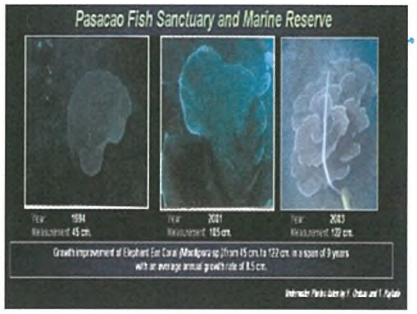
NGO/PO/Cooperative Participation

Viable Income Diversification

Linkage between peoples organizations/cooperatives and corporations such as San Miguel and Nestle Philippines has been established for the large-scale production of cassava, peanut, corn and coffee.

Womenfolk have become income earners after joining POs and participating in livelihood projects.

Resource Rehabilitation Projects (REPs)



Riverbank bio-engineering

fisheries resource management project

PROJECT IMPACTS

- LGUs are starting to issue IDs and licenses to fishermen in several municipalities such as Padre Burgos in Quezon Province and Panabo, Davao del Norte based on the Municipal Fisheries Licensing System
- Apprehension and conviction of illegal fishers has improved significantly. In Tayabas Bay, 1,121 persons have been convicted by the FLET/Bantay Dagat since 1999 with P 1.5 million in fines collected

- LGU Project counterpart for law enforcement has been increasing

- The LGU of Tagkawayan (Ragay Gulf) has built a P100,000 Coast Watch tower and training center to support FLET operations using its counterpart funds.
- Illegal fishing as reported in a fisherfolk survey in Astorga, Bato, Coronon in Davao Gulf has decreased significantly in the last five years

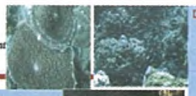
- Dynamite fishing has greatly reduced in Tvisaa municipality (Sapian Bay) as reported by the LGUs in 2004; additional budget of P50,000/year given by LGU to protect the fish sanctuary

- Sariaya (Tayabas Bay) has purchased 3 additional patrol boats worth 300,000 to support the FRMP boat
- In Quezon, total LGU counterpart for the Project increased by 280% from P 3.5 M in 1999 to P 13.3 M in 2004

- Because of combined law enforcement and sanctuary establishment, LGUs report that average fish catch has increased from 1-1.5 kg/day to 5-6 kg with an average incremental income of P150-200/day/fisher

- Protection of endangered species such as marine turtles, whale shark and dugong, has become a regular concern in many FRMP communities such as Agdangan, San Francisco and Sta. Lourdes

Resource Enhancement



- Top shell (an endangered species used for first class buttons and which fetches P35/pc or P175,000/MT) was stocked in the Binduyan FS (around 27,000 pcs) in 2003; a recent survey showed that population inside the sanctuary was 5 times more than outside

- 2004 survey show that the fish sanctuary in Binduyan, Honda Bay increased catch per unit effort by at least 27% for handline, three years after FS establishmeat
- Based on 2003 and 2004 surveys, fish catch in Region 4A has increased in many municipalities from 1 kg to 3-5 kg per day. In Quezon municipality, live coral cover improved from 28% in 2001 to 35% in 2004. Similar improvemeat s noted by fishers in

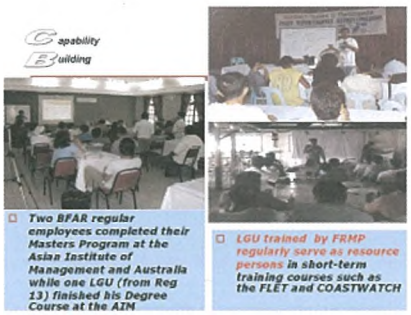
Resource Enhancement

- Fish stocks in Kapatagan (Panguil Bay) has increased by 30-50% while fish catch has improved from 3 to 5 kg per day near the sanctuary based on 2004 LGU survey
- Mangrove cover in Kolambogan and Maigo municipalities in Region 12 has increased by 13 hectares and 1.3 hectares, respectively because of Project efforts. Fishers report an increase of broodstock (adult fish) in mangrove areas by 50%

Information Education & Communication

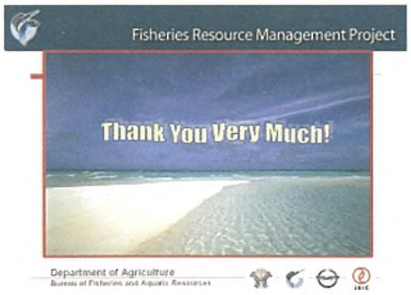
- Project has developed LGUs capability to produce their own IEC materials

- Davao City LGU now regularly publishes its own newsletter FISH TALES, while OIDCI, a local NGO, publishes its CRM-themed BUGSAY newsletter
- Special events such as the Youth Camps, Voices for the Sea and CRM Education through Music have helped link BFAR with other agencies, NGOs, and academe that help promote fisheries conservation even after FRMP



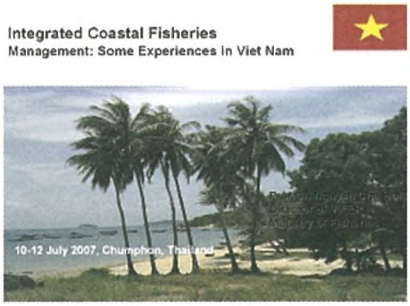
CHALLENGES OF A SUSTAINABLE FISHERIES MANAGEMENT

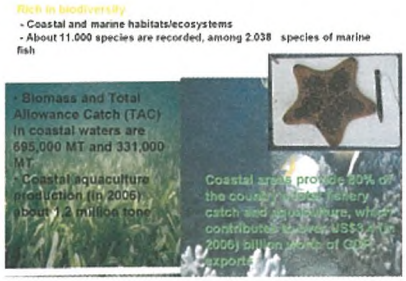
- Allocation of appropriate budget
- Human resources and organizational structure
- Policies that support fisheries management
- Continuing education and information
- Regulation and law enforcement
- Research-based fisheries management

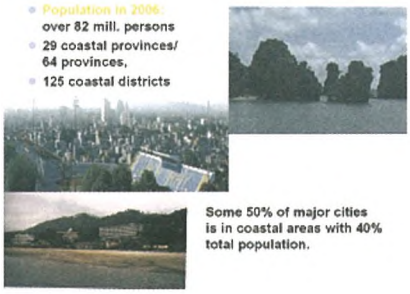


INTEGRATED COASTAL RESOURCE MANAGEMENT IN VIETNAM

Nguyen Chu Hoi
Institute of Fisheries Economic and Planing, Department of Fisheries of Vietnam

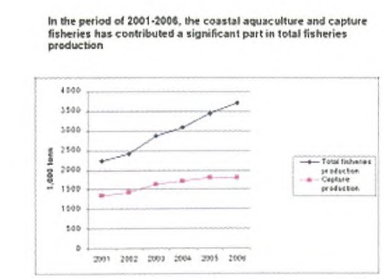


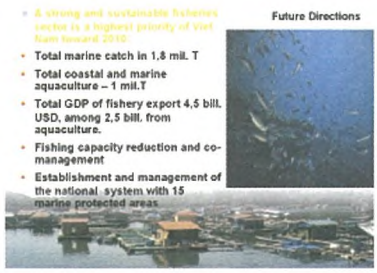




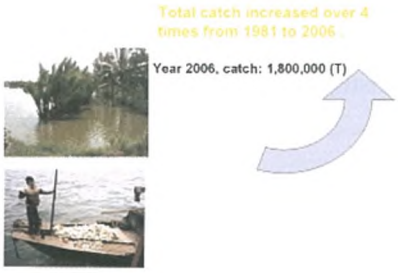
Status of Fisheries and Aquaculture in Vietnam

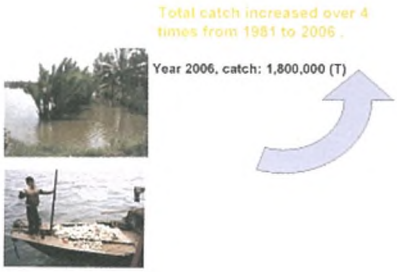
Year	1981	2006
Total aquaculture production (MT)	231.200	1.720.000
Total catch (MT)	419.740	1.800.000
Total fishing boats (unit)	28.021	92.000
Total engine power (Hp)	553.915	4.800.000
Total export value (Mill. USD)	80	3.400






Main Challenges
Loss of biodiversity
Degradation of coastal marine ecosystems/habitat destruction


Total catch increased over 4 times from 1981 to 2006 .
Year 2006, catch: 1,800,000 (T)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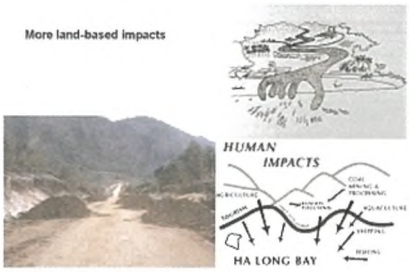
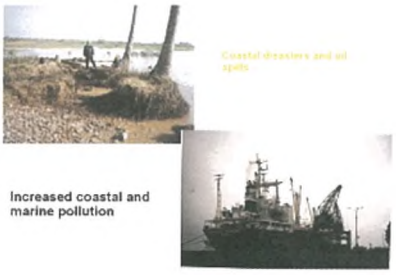
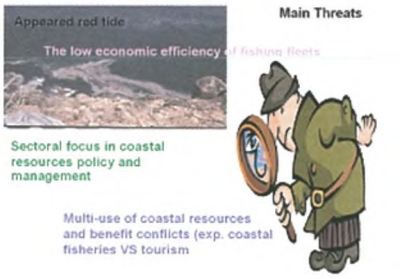
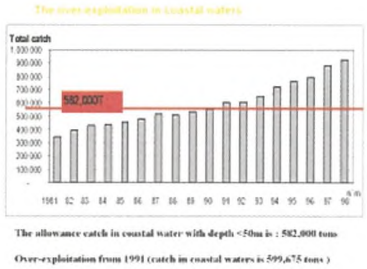
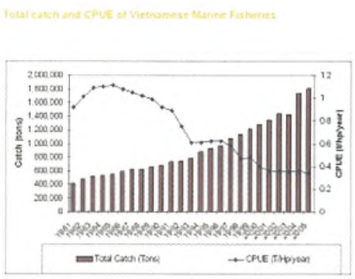
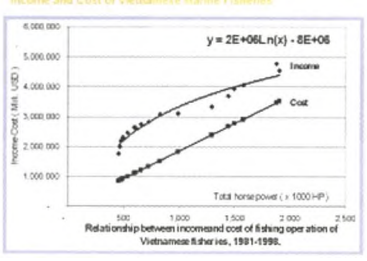

More land-based impacts
HUMAN IMPACTS
HA LONG BAY

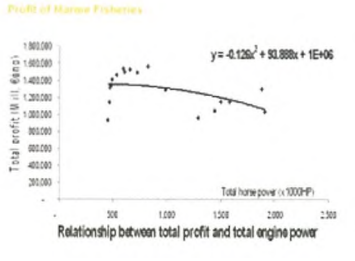

Coastal disasters and oil spills
Increased coastal and marine pollution


Main Threats
Appeared red tide
The low economic efficiency of fishing fleets
Sectoral focus in coastal resources policy and management
Multi-use of coastal resources and benefit conflicts (exp. coastal fisheries VS tourism


The over-exploitation in coastal waters
Total catch
582,000T
The allowance catch in coastal water with depth <50m is : 582,000 tons
Over-exploitation from 1991 (catch in coastal waters is 599,675 tons)


Total catch and CPUE of Vietnamese Marine Fisheries
Catch (tons)
CPUE (T/Hp/year)
Total Catch (Tons)
CPUE (T/Hp/year)


Income and Cost of Vietnamese Marine Fisheries
y = 2E+06Ln(x) - 8E+06
Income
Cost
Income-Cost (Mill. USD)
Total horsepower (x 1000 HP)
Relationship between incomeand cost of fishing operation of Vietnamese fisheries, 1981-1998.


Profit of Marine Fisheries
y = -0.126x² + 93.888x + 1E+06
Total horsepower (x 1000HP)
Relationship between total profit and total engine power

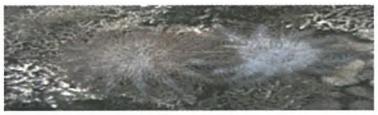
Integrated Coastal Management (interactive activities)

Some experiences in Vietnam's ICFM

- The first official decree on fisheries issues was the Law of Fishing for colony nations in 1926 (French time);
- Ordinance of fishing and aquatic resource conservation (1989), but not enforcement;
- Law of Fisheries (2003) of which Chapter III focuses on fishing (include key principles, offshore fishing, inshore fishing, fishery resources survey/ research, fishing zone management, fishing permit/ withdraw and relevant conditions, reporting and logbook, rights and obligations of institutions and individuals in fishing, and prevention and mitigation of natural hazard in fishing;
- Especially, the law emphases on integrated fisheries management

Supportive Policies for Fisheries Sector

- Agenda 21 of Viet Nam on Sustainable Development (2004).
- National Biodiversity Action Plan (BAP) have been also developed and enacted by Gov. in 1995, including MPA priority.
- Regarding coastal and marine concerns, Viet Nam has adopted the key laws such as: Law of National Boundaries (2003), Law of National Security (2004), Code of Navigation (1990 and amended 2005), Law of Oil and Gas (1993 and amended in 2000), Law of Environmental Protection (1993, 2005), and Order of Tourism (1999), Order of National Boundary Guards, including Coast Guards (1997) and Order of Marine Police (1998).



National Planning for Management of Fishing Capacity

- Reducing number of fishing boats and ships into 50,000 in 2010
- Marine space zoning and recentralization into local level for fishing and management
- Keep fishing production at 1.8 mill. tons toward 2010 and beyond
- Establish & manage effectively the MPA system
- Development of small-scale coastal fisheries co-management
- Research in job alternative for local communities by changing the destructive gears into others un-destructive, into ecotourism in MPA site, as well as development of adaptive aquaculture, recreactional fishing and catching etc.

Management of Fishing Capacity

- National project on comprehensive survey of marine biodiversity and marine living resources
- National program on living resources protection and environment toward 2015
- Improving national fisheries information system and warning of sea-fishers safety from natural hazards

- Improving regional, international cooperation activities in marine fisheries in implementation of global commitments
- Coastal marine fisheries management in the framework of ICM and ecosystem-based
- Completion of national fisheries policy system to meet requirement of international fisheries/sea policies in WTO

A national system of 15 MPAs is established to create "spillover effect"

Inter-sector institutional framework

The MoFi Steering Committee on Agenda 21 for sustainable fisheries established

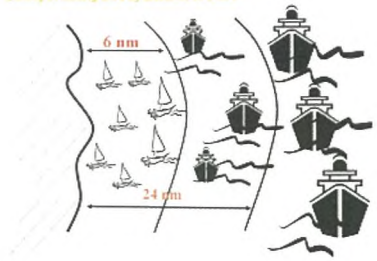
A Inter-sector Steering Committee of MPAs established

A national network of protected area managers in coastal areas is established to exchange management experiences

Supportive tools

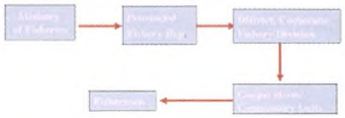
- Continue administration reform in the state management for fisheries sector, focusing on decentralization down to localities.
- Preparation of National Guidelines of applying coastal small-scale fisheries co-management and a Charter of fisheries co-management models
- Transfer the right of coastal water-use in aquaculture and catch for local communities by Decree 123/2006/ND-CP of Government.
- MoFi inter-agency coordinating mechanism for the management of fishing capacity established
- Strengthen awareness of local communities in living resources protection with gender issues
- Improving patrol operations on the seas in linking with coast guards and NAVY to protect living resources.
- Apply coastal function zoning and integrate environmental considerations/issues into coastal development plans to harmonize concerns of coastal stakeholders and communities.

Zoning of fishing area by distance to share



Community right based management

Chain of fishery management is lacking "the bridge" connecting the Government to fishermen



❖ It is necessary to set up the model "Co-management"

Inter- sectors and stakeholders

Key lessons learned

- Need a strong legal framework and enforcement by inter-sectoral approach
- Need more participation/ involvement of local fishermen community
- Need community right-based and ecosystem-based management
- Fishery development plans have to link with poverty reduction/ livelihood improvement for poor fishermen
- Restructure of marine fishing activities toward responsible and sustainable fisheries
- Development of human resources for marine fishing and aquaculture.
- Need more investments for fisheries and aquaculture infrastructure development to mitigate environmental risks and disease

For our common benefits from fish!

SEAFDEC ADDRESSES

THE SECRETARIAT
P.O.Box 1046
Kasetsart Post Office
BANGKOK 10903,Thailand
Tel : (662) 9406326-29
Fax: (662) 9406336
E-mail: secretariat@seafdec.org
http://www.seafdec.org

The Secretariat coordinates and oversees the general policy and planning of the Center, and acts as the focal point for channeling and implementing the decisions and resolutions of the SEAFDE Council of Directors. It organizes the annual meetings of the Council and the Program Committee, inter-departmental meeting, *adhoc* consultative meetings with international organizations, as well as technical seminars and workshops. The Secretariat also coordinates the development and implementation of the Strategic Plan to guide all Departments towards the common goal.

TRAINING DEPARTMENT(TD)
P.O.Box 97, Phrasamutchedi
Samut Prakan 10290, Thailand
Tel : (662) 4256100
Fax : (662)4256110,4256111
E-mail : td@seafdec.org
http://www.seafdec.org/td/

TD focuses on technology transfer in the marine fishery sector through training in marine engineering, navigation, fishing technology and extension methodologies: and through information dissemination, and extension work. TD also conducts research on fishing technologies, fishing gear improvements, fishing ground surveys, socio-economic profiles and a collaborative fishery resource survey program on the marine environmental system that sustains the fish stocks and their distribution in the South China Sea.

MARINE FISHERIES RESEARCH DEPARTMENT (MFRD)
2 Perahu Road, Off Lim Chu Kang Road
SINGAPORE 718915
Tel : (65)790-7973
Fax : (65)861-3196
E-mail : mfrdlibr@pacific.net.sg
http://www.fishsafetyinfo.com/

MFRD specializes in fishery post-harvest technologies to optimize the utilization of marine catches through research into development of new products especially from unutilized fish, preservation, improved processing, packaging and shelf-life, and improvements in quality control and harmonization of quality standards. MFRD is also active in technology transfer through training and information dissemination, and works closely with seafood processors, handlers and consumers to achieve these objectives.

AQUACULTURE DEPARTMENT(AQD)
Tigbauan 5021, ILOILO, Philippines
Tel : (63-33)511-9171,336-2965
Fax : (63-33)335-1008, 511-8709, 511-9070
E-mail : aqdchie@aqd.seafdec.org.ph
http://www.seafdec.org.ph

AQD conducts research on the generation and improvement of aquaculture technologies, covering aspects of broodstock development, fish nutrition and disease management. The Department disseminates information through training, extension and other outreach activities, and works closely with universities in manpower and expertise development. AQD has already gained a reputation as a leading aquaculture research center in Southeast Asia

MARINE FISHERY RESOURCES DEVELOPMENT AND MANAGEMENT DEPARTMENT(MFRDMD)
Taman Perikanan Chendering
21080 Kuala Terengganu, Malaysia
Tel : (609) 616-3150
Fax : (609) 617-5136
Email : mfrdmd@mfrdmd.org.my
http://www.mfrdmd.org.my

MFRDMD focuses on providing assistance to member countries on the development and management of marine fishery resources through resource exploration and stock assessment, applying modern technologies; investigations on fishery oceanography and the environmental conditions that sustain commercial fish stocks; migration of tunas; conservation of coral reefs and such endangered marine animals as marine turtles; as well as data management, training and information exchange on related common issues

Training Department(TD)
P.O. Box 97, Phrasamutchedi, Samut Prakan 10290, Thailand
Tel : (662) 4256100 Fax : (662) 4256110-11
Email : td@seafdec.org
http://www.seafdec.org/td