



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 fisheries development in Southeast Asia.

Mandate

SEAFDEC is mandated to develop the fisheries potential of the region by rational utilization of the resources for providing food security and safety to the people and alleviating poverty through transfer of new technologies, research and information dissemination activities.

Objectives

SEAFDEC has the following objectives:

1. To promote rational and sustainable use of fisheries resources in the region;
2. To enhance the capability of the fisheries sector to address emerging international issues and for greater access to international trade;
3. To alleviate poverty among the fisheries communities in Southeast Asia; and
4. To enhance the contribution of fisheries to food security and livelihood in the region.

Membership

SEAFDEC membership is open to all Southeast Asian Countries. The Member Countries of SEAFDEC at present are Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam.

**Proceedings of the
REGIONAL SEMINAR ON
INTEGRATED COASTAL RESOURCES MANAGEMENT APPROACH IN SOUTHEAST ASIA:
REVIEW OF THE ICRM-SV PROJECT**

26-27 JANUARY 2010

Bangkok, Thailand



Training Department
Southeast Asian Fisheries Development Center



Fisheries Administration
The Kingdom of Cambodia

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FOREWORD

Under the ASEAN-SEAFDEC collaborative framework and with funding support from the Japanese Trust Fund (JTF), the SEAFDEC Training Department has been implementing projects on coastal fishery resources management (CRM) since 2001 with the first project conducted in Pathew District, Chumphon Province, Thailand in collaboration with Department of Fisheries (DOF) of Thailand. The first pilot project was originally named the “Locally-based Coastal Fishery Management in Pathew District (LBCFM-PD)”, which was renamed in 2005 as the “Integrated Coastal Resources Management in Pathew District (ICRM-PD)” under the 2nd phase of the CRM project.

When tangible outcomes were reported at various SEAFDEC Program Committee Meetings, several SEAFDEC Member Countries proposed that the knowledge and experiences gained from the project’s operation in Thailand should be disseminated to other countries in Southeast Asia. Responding to such requests, SEAFDEC started the 2nd pilot project in Pulau Langkawi, Malaysia in August 2003 in collaboration with Department of Fisheries (DOF) Malaysia.

The successful project operations were convincing enough to prove that the project approach was rightly applicable to the countries in the region. Thus, the other countries requested again to commence the project operation in their respective countries. In response, SEAFDEC decided to implement the third pilot project in Shihanoukville, Cambodia in collaboration with the Fisheries Administration (FiA) Cambodia. The actual project operation began in November 2005 with three years tenure until December 2008. However, towards the end of the project’s operation in 2008, SEAFDEC and JTF considered the request of the Cambodian Government to extend the project tenure for another year to complete the implementation of relevant activities which were still ongoing. Thus, the project was extended for one year until the end of December 2009.

After the completion of the direct involvement of SEAFDEC and JTF in the project operation in December 2009, the project wrap-up seminar was held on 26-27 January 2010 in Bangkok, Thailand. The “Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-SV Project” aimed to report the progress of the project during the four years and two months operation and verify the impacts of the project operation to the beneficiaries. In addition, the final evaluation of the project was conducted by an outsourced consultant in July 2009 where the findings were also presented during the Regional Seminar. At this point, SEAFDEC wishes to acknowledge with much gratitude the commitment expressed by the Fisheries Administration during the Regional Seminar, to sustain the implementation of the project activities after the completion of the direct involvement of SEAFDEC in the project in December 2009.

This publication provides a summary of the outcomes of the Regional Seminar including the impacts of ICRM-SV project on the target communities and the achievements in line with the original project objectives. With pertinent representatives from most Member Countries participating in the Regional Seminar, it is expected that the lessons learned and the implications derived from the review of the ICRM-SV project could be reflected and incorporated in similar projects carried out in their respective countries.

At this juncture, SEAFDEC extends our sincere appreciation for the collaborative effort exerted by the FiA of Cambodia and also for the financial as well as technical assistance provided by the Japanese Embassy and JICA Office in Phnom Penh, Cambodia. Without such collaboration and assistance, the project could not have achieved tangible and outstanding outcomes.

It is also the desire of SEAFDEC that the outcomes of the Seminar could be used in the formulation and implementation of similar project approaches in other SEAFDEC Member Countries in order that sustainable management of the coastal resources could be attained in the Southeast Asian region.



Chumnarn Pongsri, Ph.D.
Secretary-General of SEAFDEC and
Chief of SEAFDEC Training Department

PREFACE

The SEAFDEC Training Department (SEAFDEC/TD) and the Fisheries Administration (FiA) Cambodia co-organized the Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-SV Project in Bangkok, Thailand from 26 to 27 January 2010. The Regional Seminar was supposed to be organized in the project operational site in Sihanoukville, Cambodia, but the attempt could not be realized primarily due to financial constraints and difficulties in the travelling arrangements for the participants. To make up for the inability of the participants to undertake actual physical inspection of the project site, a video production on the project activities including the perceptions of the community beneficiaries on the impacts of the project was shown. This was aimed at providing a real vision of the project activities to some participants who have not visited the project site, in order that they would be able to impart useful inputs during the discussions in the Regional Seminar.

The ICRM-SV project was implemented in Prey Nup II, Sihanoukville, Cambodia from 2005 to 2008 and was further extended until December 2009. The major activities being carried out under the ICRM-SV project include: Baseline and Monitoring Survey; Promoting and Extending Locally-based Fishery Resources Management; Promotion of Local Business; Enhancing Human Resources Capacity and Participation; Rehabilitation and Enhancement Coastal Resources; and Fishing/Fish-handling Technology Improvement. The Regional Seminar was aimed at discussing the achievements and outcomes of the ICRM-SV project during its implementation in line with the original project concept; verifying the impacts of the project to the beneficiaries in terms of quantity as well as quality in the light of both facets of community development and sustainable fisheries resources management; evaluating the rationale, implications and prospects for the possible dissemination of the project concepts to other SEAFDEC Member Countries; and identifying the necessary follow-up actions to be undertaken by FiA Cambodia, SEAFDEC/TD and other collaborating local agencies. The summary of the report of the Regional Seminar with the adopted Conclusion and Recommendations as well as the reports on the major activities and sub-activities conducted under the project, are included in this publication.

The Regional Seminar had offered the opportunities for SEAFDEC Member Countries other than Thailand, Malaysia and Cambodia, to consider the applicability of the community-based coastal fisheries resources management (CBRM) concept in their respective countries following the ICRM project approach. SEAFDEC/TD and FiA Cambodia have learned lessons and gained valuable experiences from the application of the ICRM project approach in Prey Nup II, Sihanoukville, Cambodia. For its part, the Prey Nup II community has also benefited in terms of overall development in relation to increased awareness in CBRM and the holistic approach to fisheries management, recognizing the importance of active participation in activities related to fisheries management and conservation as well as developing and enforcing rules and regulations on the management of fish refugia for blood cockles, a newly introduced concept in Cambodia. In addition, the leadership and managerial capacities of the community beneficiaries in CBRM and fisheries co-management were enhanced while local community voluntary work and participation in resources conservation were also improved.

The institutional capacity of the Community Fisheries (CF) in Prey Nup II has been reinforced through the day-to-day project operation and the involvement of its members in the project activities. The comparative results of the baseline survey and the monitoring survey indicated that the living conditions had been improved and the fishers have foreseen bright future in fisheries. The Community Fisheries Area Management Plan (CFAMP) developed by the community was a major accomplishment of the Project. Having been endorsed by the Government of Cambodia, CFAMP has paved the way for empowering the community to manage their fisheries resources. The Self-regulatory Measures formulated by the Blood Cockerle Fishers Group (BCFG) to conserve the resources of blood cockle in the demarcated fish refugia zone was a notable achievement of the CF through the project. Endorsed by FiA Cambodia, this regulation including the requirements, has been disseminated to adjacent fishing villages. The women's activity in production of mushroom as one of the features of the project has been recognized as a successful model in the development of fishing communities in Cambodia.

The Conclusion and Recommendations adopted during the Regional Seminar are important for SEAFDEC/TD and FiA Cambodia as well as the other collaborating partners, to consider when formulating future plans and programs related to ICRM more particularly in sustaining the activities of the ICRM-SV. Moreover, the SEAFDEC Member Countries could make use of the outcomes of the Regional Seminar as basis in the promotion of co-management and CBRM approaches in their respective countries. Eventually, it is expected that sustainable and responsible fisheries in the Southeast Asian region could be achieved.

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**Report of the
Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia:
Review of the ICRM-SV Project
Bangkok, Thailand
26-27 January 2010**

I. INTRODUCTION

1. The Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-SV Project was conducted from 26 to 27 January 2010. Considering that it was not possible to conduct the Regional Seminar at the project site in Sihanoukville, Cambodia due to various constraints, the SEAFDEC Training Department (SEAFDEC/TD) as the Lead Department for the ICRM Project arranged for the conduct of the Regional Seminar in Bangkok, Thailand instead.

2. The Regional Seminar was originally envisaged to be organized in the project operational area in Sihanoukville, Cambodia, in order that a physical inspection of the project site could be undertaken as this is vital for verifying the project impacts on the beneficiary communities. However, owing to the financial constraints under the project operation, difficulty with transportation means from Bangkok to Sihanoukville and other logistic arrangements in the project site, it was eventually decided that the Regional Seminar would be held in Bangkok, consistent with the agreement between SEAFDEC and the Fisheries Administration (FiA) of Cambodia.

3. The Regional Seminar was attended by representatives from Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Vietnam who are involved in fisheries management in their respective countries as well as representatives from the projects ICRM-PD (Thailand), ICRM-PL (Malaysia), and ICRM-SV (Cambodia) and beneficiaries of the ICRM-SV project. The Deputy Director General of FiA Cambodia, the Deputy Director General for Community Development of Cambodia, the Deputy Secretary-General of SEAFDEC and senior officers of the SEAFDEC Secretariat and Training Department, the Legal Adviser and JICA Expert for the Director of Fisheries Office in Sihanoukville, and the Consultant for the Final ICRM-SV Project Evaluation as well as observers from Universiti Putra Malaysia and from the Hyla Poud AB of Sweden, also attended the Seminar. The List of Participants appears as **Annex 1**.

4. Since physical inspection of the project site by the participants in the Regional Seminar was not possible as earlier mentioned, the progress of the relevant activities was recorded by SEAFDEC/TD and shown at the start of the Seminar. This has enabled the participants to have a quick look at the activities of the project and learn about the views of the beneficiaries on the impacts of the project to their fishing communities.

5. The Regional Seminar was aimed at discussing the achievements and outcomes of the ICRM-SV project during its more than four years implementation period based on the original concept of the project; verifying the impacts of the project activities to the beneficiaries in terms of quantity and quality in the light of both facets of community development as well as sustainable coastal fisheries management; discussing the resultant rationale and implication in the dissemination of the project concept to other SEAFDEC Member Countries; and identifying the necessary follow-up actions to be undertaken by FiA Cambodia, SEAFDEC/TD and other collaborating agencies. Further details of the Regional Seminar appear as **Annex 2**.

II. OPENING OF THE REGIONAL SEMINAR

6. The Project Leader of the SEAFDEC Project on Integrated Coastal Resources Management and Head of the Coastal and Small-Scale Fisheries Management Division of SEAFDEC/TD, *Dr. Yuttana Theparoonrat* welcomed the participants and observers to the Regional Seminar. He reiterated that as agreed between FiA Cambodia and SEAFDEC/TD, the Regional Seminar should be held in Bangkok in view of the financial and other administrative constraints confronting the project operations. He expressed the hope that the video presentation on the project activities prepared by SEAFDEC/TD could serve the purpose of verifying the impacts of the project activities from the point of view of community development.

7. On behalf of SEAFDEC as the co-organizer of the Regional Seminar, the Deputy Secretary-General of SEAFDEC, *Mr. Hideki Tsubata* welcomed the participants to the Regional Seminar. He reiterated that during the final seminar for the ICRM Project in Pathew District in Chumphon, Thailand and the ICRM Project in Pulau

Langkawi, Malaysia, follow up actions were identified, resulting in the commitments of the Department of Fisheries of Thailand and the Department of Fisheries Malaysia, respectively, to continue the implementation of relevant activities under their respective projects, thus assuring the sustainability of the project even after the support of SEAFDEC had already been completed. He added that as envisaged, the newly formed project management committee of FiA is expected to pursue the community-based fishery resources management functions considering that support from SEAFDEC had already been very minimal after December 2009.

8. Recognizing the fact that other Member Countries of SEAFDEC have signified their interest in implementing the project in their respective countries, he regrets that this may not be possible due to financial constraints. However, he encouraged that the lessons learned and the experiences gained from the implementation of the aforementioned three projects should be referred to for the adaption of the project concept in the other countries. He also emphasized that the outcomes of this third ICRM project could also offer opportunities for Member Countries other than Thailand, Malaysia and Cambodia to consider the applicability of community-based fishery resources management concept in their respective countries. His Statement appears as **Annex 3**.

9. On behalf of the host country of the ICRM-SV, the Deputy Director-General of FiA Cambodia, *Mr. Ing Try*, expressed the apology of FiA Cambodia for not being able to organize the Seminar in Sihanoukville due to various constraints that included the inconvenient geographic conditions of the project site. He thanked SEAFDEC/TD for the arrangements to hold the Seminar in Bangkok instead of in Sihanoukville. He recalled the many incidents and events that finally led to the implementation of the ICRM project in Cambodia in November 2005. Since then implementation of various activities had been pursued towards attaining the goals of the project. He also mentioned that the project has served as model for the other similar approaches being pursued in his country. His Statement appears as **Annex 4**.

III. ADOPTION OF THE AGENDA

10. The Agenda of the Regional Seminar which appears as **Annex 5** was adopted.

IV. BACKGROUND OF THE ICRM PROJECTS AND THE SEMINAR

11. The Background of the Deployment of the ICRM Projects in Southeast Asian Countries was presented by *Mr. Seiichi Etoh*, ICRM Expert and former staff of SEAFDEC/TD. While working at SEAFDEC, *Mr. Etoh* initiated the adaption of community-based fishery resources management concept in Southeast Asia more particularly in Thailand, Malaysia, and Cambodia.

12. The Integrated Coastal Resources Management (ICRM) Project in the Southeast Asian countries was aimed at mitigating the deterioration of livelihoods in coastal fishing communities resulting from the over-exploitation of fishery resources and the degradation of the coastal environments. Recognizing that one of the approaches towards attaining this goal is the introduction of the concept of community-based fishery resources management within the framework of coastal fisheries development and management, SEAFDEC with financial support from the Trust Fund Program of the Government of Japan initiated a coastal resource management project in November 2001 in Chumphon Province, Thailand with the collaboration of the Department of Fisheries of Thailand.

13. Before the direct involvement of SEAFDEC in the ICRM-PD Project in Chumphon was completed in December 2006, and considering that it was an opportune time to impart the technologies as well as the experiences and knowledge gained from the ICRM-PD Project to the other Member Countries, SEAFDEC agreed that the second ICRM project would be implemented in Langkawi, Malaysia. Thus, the four-year ICRM-PL project took off in August 2003 in collaboration with the Department of Fisheries Malaysia.

14. After further recommendations to transfer the experiences and knowledge gained from the two ICRM projects to the other Member Countries and prior to the completion of the direct involvement of SEAFDEC in the ICRM-PL Project in December 2007, Cambodia was chosen to host the third ICRM project from among the candidate countries being considered, taking into account the geographical advantage and the prioritized need of a community-based fishery resources management approach in the country. Thus, the ICRM-SV project was made operational in November 2005 in Sihanoukville with the collaboration of FiA Cambodia.

15. In order to assess the impact of the ICRM projects on the beneficiary communities and to consider the ways and means of disseminating the project concept to other Member Countries, seminars for the ICRM-PD and ICRM-PL projects were conducted on 10-12 July 2007 and 21-23 October 2008, respectively. The Proceedings from these two Regional Seminars were published and disseminated to the SEAFDEC Member Countries.

16. Like in the ICRM-PD and ICRM-PL projects, the achievements of the ICRM-SV project in Sihanoukville, Cambodia which has been in operation since 2005 would be reviewed. Thus, consistent with the project design, the two-day Regional Seminar on “Integrated Coastal Resources Management Approach in Southeast Asia: Review of the Project ICRM-SV” was conducted from 26 to 27 January 2010.

17. As envisaged, the outcomes of the Regional Seminar would include analysis of the data and information collected during the project implementation; verification of the impacts of the project activities to the beneficiaries; and recommended follow-up actions to be undertaken by FiA Cambodia and other collaborating agencies. In order to achieve such goals, the participants in the Seminar comprise the representatives from SEAFDEC Member Countries who are involved in fisheries management in their respective countries and who are expected to make use of the outcomes of the project in deploying a similar approach in their respective countries; representatives from the ICRM-PD and ICRM-PL projects to share their views and experiences in the implementation of the ICRM project and specifically on how the follow-up phases are being carried out; officers of FiA Cambodia and representatives from the beneficiary groups of the ICRM-SV project to provide the first hand information on the progress of the activities under the project including problems, constraints and prospects for future development. The List of Documents for the Regional Seminar is shown as **Annex 6**. The Chronology of Major Events of the ICRM-SV Project is shown in **Annex 7**.

18. In terms of sustainability of the project activities, the Seminar is expected to hand over the managerial responsibility in fisheries resources management to FiA through the Community Fisheries of Prey Nup II. FiA Cambodia is expected to serve as the supervising and supporting agency after the completion of the follow-up stage. In addition, SEAFDEC would continue to provide the necessary follow-up technical support and monitoring of the ICRM-SV project.

19. Thus, in order to sustain the activities of the Project after the completion of the direct involvement of SEAFDEC in December 2009, **FiA Cambodia committed to continue supporting the Project and that the corresponding budget would be proposed to the Royal Government of Cambodia to continue the project’s activities.**

V. DESCRIPTION OF THE ICRM PROJECT APPROACH

20. The deployment of the ICRM projects in the Southeast Asian countries started in 2001 with the implementation of the “Locally Based Coastal Fisheries Management in Pathew District (LBCFM-PD)” in Chumphon Province, Thailand. The LBCFM-PD aimed to establish sustainable resource management at local level, rehabilitate the coastal resources, and alleviate poverty in coastal fishing communities. This was followed by the LBCFM-PL in Pulau Langkawi, Malaysia which commenced in 2003.

21. These two projects were jointly financed by their respective governments and the Japanese Trust Fund I Program through SEAFDEC. Later, the projects were reformulated to fit into the new thrust of the Japanese Trust Fund IV Program, which gave more focus on “Capacity Building of Human Resources and Participation in Integrated Coastal Resources Management” and 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 Pulau Langkawi (ICRM-PL), respectively in order to take into consideration the thrust of the new Trust Fund IV Program.

5.1 Progress of ICRM-PD, Thailand

22. The progress of the project on Integrated Coastal Resources Management in Pathew District (ICRM-PD) in Chumphon Province, Thailand was presented by *Ms. Thitiporn Suppanirun* of the Chumphon Marine Fisheries Research and Development Center, Department of Fisheries, Thailand.

23. During the implementation of the ICRM-PD Project in Chumphon Province, Thailand, six major activities were carried out, namely: (1) Baseline Survey (biological, oceanographic and environmental, fisheries, and

socio-economic); (2) Encourage and Extend Community-based Resource Management; (3) Encourage Local Business; (4) Enhance Human Resources Capability and Participation; (5) Develop Extension Methodologies and Strengthen the Extension System; and (6) Rehabilitate and Enhance the Coastal Resources. The outcomes from these activities were reported during the Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-PD Project conducted at the Chumphon Marine Fisheries Research and Development Center (CMDEC), Chumphon Province, Thailand from 10 to 12 July 2007. The Proceedings of the Regional Seminar was published in September 2007.

24. After the completion of the direct involvement of SEAFDEC in the collaborative project in 2006, the Department of Fisheries of Thailand (DOF) through the CMDEC has continued to support the implementation of the relevant activities under the project. Specifically, the implementation of five (5) community-based projects was sustained, namely: (1) initiating green mussel culture; (2) supporting the activities of the Pakklong Fisheries Group; (3) enhancing the crab bank system; (4) conducting training courses for students; and (5) encouraging local business.

5.2 Progress of ICRM-PL, Malaysia

25. The progress of the project on Integrated Coastal Resources Management in Pulau Langkawi (ICRM-PL), Malaysia was presented by *Mr. Krishnasamy A/L Arunasalam*, Fisheries Officer of the Fisheries Extension Division, Department of Fisheries Malaysia.

26. The LCBFM-PL/ICRM-PL in Pulau Langkawi, Malaysia, which was initiated in August 2003, conducted six (6) major activities, namely: (1) Baseline and Monitoring Survey; (2) Locally-based Fishery Resources Management; (3) Local Business Development; (4) Fishing and Vessel Repair Technology Improvement; (5) Enhancement of Human Resources Capacity Building and Participation; and (6) Rehabilitation and Enhancement of the Coastal Resources. The outcomes of the aforementioned activities were discussed during the Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-PL Project which was held on 21-23 October 2008 in Langkawi, Malaysia. The Proceedings of the Regional Seminar was published in December 2008.

27. After the direct involvement of SEAFDEC in the ICRM-PL project was completed in December 2007, the Department of Fisheries Malaysia has sustained the implementation of the project activities, specifically on the: (1) promotion of the zoning arrangement; (2) strengthening of the local enforcement unit at the project site in Kuala Teriang; (3) enhancement of the crab bank activity; (4) installation of artificial reefs and fish enhancement devices; (5) strengthening of the mangrove rehabilitation project; (6) promotion of fish cage culture; (7) strengthening of activities on ice making and sale; (8) sustaining the fishing equipment sale and engine workshop; and (9) enhancing the fish processing activity of the women's group. In addition, more projects have been lined up by DOF Malaysia for implementation in 2010. These include activities on: (1) disposal of lost fishing gear, and (2) human resource development.

28. The successful implementation of ICRM-PL has gained recognition by the other states of Malaysia, resulting in the intensified promotion of ICRM-related models and the establishment of 70 Fishery Resources Management Community/*Komuniti Pengurusan Sumber Perikanan* (FRMC/KPSP) throughout the whole country.

29. The DOF Malaysia continues to take a strong and committed approach to sustain its assistance to the ICRM-PL project especially exerting efforts to address the requests from other states of Malaysia to implement the model in their respective fishing areas. One state that has been notified as possible recipient for the adaption of the ICRM concept is the Federal Territory Labuan, where the fishing communities share similarities in terms of geographical, social and economic background.

VI. THE ICRM-SV PROJECT

30. The Project Team Leader of the ICRM-SV Project, *Mr. Yos Chantana*, who is also the Deputy Director of the Marine Fisheries Development and Resources Institute, briefly introduced the background of the ICRM-SV project and the various activities conducted under the project at the project site in Sihanoukville.

31. The third ICRM project was initiated in 2005 in Cambodia under the collaborative arrangement between SEAFDEC and FiA Cambodia. The project site is located in Prey Nup II in Sihanoukville comprising four villages, where a core body has already been established to implement the community-based resources management concept prior to the implementation of the project. Cambodia is the only country in Southeast Asia where a fishery resources co-management regime is established through the Royal Decree on Establishment of Community Fisheries and the Sub-Decree on Community Fisheries Management. This led to the changes within the FiA Cambodia governing structure and the creation of the Inspectorate Division to take charge of fisheries development at provincial level. Thus, Kampong Som FiA Cantonment was established in place of the former Fisheries Office of Sihanoukville Municipality.

32. Among the major achievements of ICRM-SV is the development by the local fishers of the Community Fisheries Area Management Plan (CFAMP) with the corresponding Community Fisheries Zoning Map (CFZM) and the Community Fishing Area Agreement (CFAA). These instruments govern the implementation of the community-based fisheries resources management concept in Sihanoukville, Cambodia under the ICRM-SV project framework.

33. The objectives of the ICRM-SV are to: (1) develop the capacity of local human resources to empower them to manage and sustain coastal resources and community development; (2) encourage local peoples' participation in community activities; and (3) alleviate poverty in coastal fisheries communities. In order to achieve the objectives, five (5) major activities have been conducted under the project, namely: (1) Baseline/Monitoring Survey; (2) Promoting and Extending Locally Based Fishery Resources Management; (3) Promotion of Local Business; (4) Enhancing Human Resources Capacity and Participation; and (5) Rehabilitation and Enhancement of the Coastal Resources.

34. During the discussion on the outcomes of the aforementioned activities under the ICRM-SV Project, the following general recommendations were made and adopted during the Seminar:

<p><i>Recommendation 1</i></p> <p>While encouraging fishers to utilize their own resources, expansion of related activities as part of the project (<i>e.g.</i> ecotourism) should take into consideration the socio-economic well-being of the concerned fishers and the ecological aspects of the resources.</p> <p><i>Recommendation 2</i></p> <p>In going into new business ventures, the main objectives should include increasing the incomes of fishers as well as reduce fishing efforts.</p> <p><i>Recommendation 3</i></p> <p>Caution should be taken in releasing fry and fingerlings of aquatic species that have been selected for a long time, as means of enhancing the aquatic resources, in order to minimize the adverse genetic implications on the natural resources as well as the possible impact on the indigenous species.</p> <p><i>Recommendation 4</i></p> <p>All project documents should be translated into the Khmer language.</p>
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6.1 Baseline and Monitoring Socio-economic Surveys

6.1.1 Socio-economic surveys

35. The outcomes of the baseline and monitoring socio-economic surveys of the project operational area were presented by *Ms. Thanyalak Suasi* of SEAFDEC/TD.

36. Socio-economic surveys were conducted to collect the baseline information before and after the project implementation in order to identify the needs and problems as well as the future plans to sustain the project. Under the ICRM-SV project, the preliminary baseline socio-economic survey was carried out in Teuk Tla Commune of Prey Nup II in March 2005, by interviewing 112 fishermen from four villages, namely: Prek Pos, Prek Sangke, Prek Tal, and Kampong Chin, the results of which were used to formulate the ICRM-SV project document.

37. Considering that the direct involvement of SEAFDEC in the project was scheduled to be completed towards the end of 2009, monitoring socio-economic survey was conducted in Prey Nup II in February 2009 in order to monitor the changes in the socio-economic conditions after the project implementation, compare the

current socio-economic status and the current status of adoption of coastal resources management, and evaluate the beneficiaries' reception and perceptions of the project operation. The survey was conducted by interviewing 115 fishermen in the four villages of Teuk Thla commune. Results of these surveys were analyzed and published to be used as reference for future community development activities.

6.1.2 Daily fish landing surveys

38. The results of the fish landing and data collection activities and the status of the marine species in the project operational area were presented by *Ms. Penchan Laongmanee* of SEAFDEC/TD.

39. The objective of the fish landing data collection from February 2006 to December 2009 was to monitor the fishery resources in the fishing ground of the Teuk Thla in Prey Nup II. The data were collected from middlemen who recorded the fish they purchased in logbooks. The data were analyzed and published by SEAFDEC/TD. To enable the staff of FiA to analyze the fish landing data after the involvement of SEAFDEC in the project is completed in 2009, a training course on fish landing data analysis was conducted by SEAFDEC/TD on 17-19 February 2009.

40. Using CPUE to investigate the abundance of the marine resources in the fishing ground, the results of the activity indicated that the swimming crab resource which was determined through the crab traps used by fishermen was not depleted. The survey also showed that the mud crab resource has not declined while the blood cockle resource showed increasing trend. In general, the surveys suggested that the fishery resources in the project operational area have not changed much from the time the project was started. In this connection, the Seminar adopted the following recommendation.

Recommendation 5
Assessment of the CPUE should be conducted as a routine activity should be standardized,
and data on the size of aquatic species in terms of length or width frequency
should also be collected.

6.1.3 Marine biological surveys

41. The initial outcome of the marine biological research on blood cockles conducted at the project site was presented by *Ms. Jariya Sornkliang* of SEAFDEC/TD.

42. This activity was conducted in line with the establishment of fish refugia for blood cockle for fisheries management and conservation of the blood cockle resource. In order to formulate the regulatory measures for blood cockles in the fish refugia area, it was deemed necessary to obtain the biological data and abundance of blood cockles in the area. In this connection, a research study on the gonad development of blood cockles was conducted in Prey Nup II while the abundance and distribution of the cockles were also determined. In view of the above, the Seminar adopted the following recommendation:

Recommendation 6
The biological research on the gonad of blood cockles should be conducted more frequently
in order to confirm the regulations on the harvesting of blood cockles imposed by FiA.

43. From the results of the study, the spawning season of blood cockles could be established thus, supporting the restriction of harvesting size of the blood cockles in the project area. However, the abundance of blood cockles in the fish *refugia* area could not be established because of inconsistent data collected during the survey. Nevertheless, the CPUE during the two-year data collection period showed almost the same trend as the CPUE data obtained from the fishermen.

6.2 Promoting Locally- based Fishery Resources Management

6.2.1 Zoning arrangement and formulation of fishery resources management plan

44. The concept of the Community Fisheries Resources Management adopted in Cambodia was presented by *Mr. Pech Bunna*, Deputy Director of the Community Fisheries Development Department, FiA, Cambodia.

45. The establishment of Community Fisheries (CF) has been carried out throughout the country which is now being legalized by the Sub-Decree on Community Fisheries. The duties and responsibilities of the CF include: participation in the management and conservation of the fisheries resources; participation in the establishment of conservation areas within the CF area, protection and reforestation of inundated and mangrove forests; assuring that all CF members have equal rights in the sustainable use of the fishery resources; and implementation of the CF by-laws and formulation of the community fishing area management plan (CFAMP).

46. Considering that CFAMP is crucial for managing the CF, the following recommendations were made during the Seminar in order to strengthen the roles and functions of CF:

Recommendation 7

FiA should assist CF to implement CFAMP by integrating CFAMP in the annual plan of the commune council, proposing the annual budget for supporting some activities of CFAMP, strengthening law enforcement, and disseminating CFAMP to other fishermen and not only to committee members.

Recommendation 8

CF should be utilized and involved in any kind of survey.

Recommendation 9

Community Fisheries Prey Nup II should work very closely with fisheries officers and local authority in order to incorporate CFAMP into the commune council development program.

6.2.2 Local enforcement activity

47. The progress of the activities undertaken by the Local Enforcement Unit (LEU) in the project operational area was presented by *Mr. Prak Sokhalay*, Vice Chief of Prey Nup II Community Fisheries, Prek Pros Village, Sihanoukville Province, Cambodia, assisted by *Mr. Yos Chantana*.

48. The main objective of the LEU is to minimize illegal fishing and encroachment in the fishing grounds of Cambodia more particularly in the project operational area. Consisting of 12 members, the LEU patrols the fishing ground at least five times a month and for protecting the mangrove forests from illegal activities, patrolling is done very often and any illegal activities are relayed to the CF leader. Considering the frequency of patrolling by the LEU, illegal fishing activities have decreased considerably as illegal fishermen are afraid of the CF. Since the operationalization of the LEU, many fishers have acknowledged that more fish could now be caught in the project operational area than before. After the discussion, the Seminar adopted the following recommendations in order to strengthen the LEU:

Recommendation 10

Local enforcement unit should be strengthened in terms of equipment and human resource development.

Recommendation 11

FiA’s commitment to assume the responsibility of providing fuel for the patrol boat starting in January 2010 should be pursued.

Recommendation 12

The number of LEU members should be increased.

Recommendation 13

The impacts of the obstacle-objects installed in the zoned area should be assessed.

Recommendation 14

FiA Prey Nup Division should continue patrolling the fishing ground more frequently to arrest illegal fishers, with the participation of CF members.

6.2.3 Establishment and management of fish refugia

49. The progress of the establishment of fish *refugia* in the project operational area was reported by *Mr. Duong Samath*, Director of the Fisheries Administration of Sihanoukville Province, Cambodia. In addition, achievements in managing the blood cockle *refugia* were presented by *Ms. Malaya*, Leader of the Blood Cockle Fisheries Group, Prek Sangke Village, Prey Nup II, Sihanoukville Province, Cambodia with the assistance of *Ms. Heng Ponley*, Deputy Chief of Fisheries Affairs Division, FiA, Cambodia.

50. The establishment and management of fish *refugia* was incorporated as one of the elements of the ICRM-SV project in conjunction with the UNEP/GEF project on the establishment of a system of fisheries *refugia* in the South China Sea and Gulf of Thailand. In this regard, FiA Cambodia initiated the activity towards the end of 2006 by identifying the locations along the coast of Sihanoukville where fish *refugia* could be established.

51. Extensive study to identify the area was conducted involving all stakeholders in the fisheries community, the villagers, and local authorities as well as the fishery offices. Two sites were initially identified in the project operational area: one is for sea grass and the other for blood cockle. Considering that blood cockle is one of the major marine products in the community and that the blood cockle resource was in the brink of possible of degradation due to rampant illegal fishing by dredgers, it was agreed by the stakeholders to establish a *refugia* for blood cockle in the project operational area.

52. As soon as the site and the target species for the *refugia* were identified, the beneficiary group known as the Blood Cockle Fisheries Group (BCFG) was organized with the main task of managing the fish *refugia* on blood cockle. Based on the findings of the BCFG regarding the site where there is dense aggregation of blood cockles and where abundant juvenile blood cockles are found, zoning of the area was undertaken. Along this vein, self-regulatory measures for blood cockles which include size regulations were developed by the BCFG.

53. The size regulatory measures were promoted by the CF with support from the fishery officers in the Kampong Som FiA Cantonment. The CF has been tasked to monitor the adoption of the said measures. In addition to the implementation of the Self-Regulatory Measures, another concern was raised on the need to protect the *refugia* area from illegal fishing boats especially those with mechanical blood cockle dredgers. In order to address such concern, the BCFG decided to install some obstacles in the demarcated zone that could obstruct the approaching illegal fishing boats, taking into consideration the impact of such objects to the environment.

6.3 Local Business Development

54. Development of local business is one of the main objectives of the ICRM-SV project in order to develop access to the sources of income and alleviate poverty in the communities. This activity was initiated as part of the activities of the women's group considering that the women were easily accessible, conforming to the outcome of the baseline socio-economic survey which indicated the need to provide job opportunities to the women's groups in the Teuk Thla commune.

6.3.1 Women's group activity

55. The progress of the women's group activity focusing on mushroom production was presented by *Ms. Hoc Tean*, Leader of the Kampong Chin Mushroom Production Group, Kampong Chin Village, Prey Nup II, Sihanoukville. She was also assisted by *Ms. Heng Ponley*.

56. Each village involved in the project formed their respective women's groups, and proposed activities that they were capable to undertake. Thus, four business ventures were initially identified by the women's groups considering their potentials in terms of available materials and technology, modest investment required, and potential market, namely: mushroom production, fish sauce production, aquaculture of fish, and poultry raising. After discussing the pros and cons of the proposed ventures, the groups agreed to focus on mushroom production.

57. The groups have also expanded their activity, and are now into mushroom spores production. The spores are used for their production and the excess are sold to neighboring villages. The production of mushroom by the

women's groups has been successfully advanced as a commercially viable venture. In fact, the groups have organized themselves into a business association type group now called the "Mushroom Producers Group or MPG" under the CF Prey Nup II. The MPG is now corporately managing their own activities including procurement of raw materials and marketing under the provisions of the Internal Rule of the Group.

6.3.2 *Mud crab culture*

58. The report on the progress of the mud crab culture was presented by *Mr. Yos Chantana*. Mud crab culture has been considered one of the activities under the local business development venture. In this regard, the plan was made in collaboration with a JICA Expert and submitted for funding under the Grassroots Fund of the Embassy of Japan in Cambodia. After the approval of the proposal, the Mud Crab Culture Group (MCCG) was organized under the framework of the Community Fisheries Prey Nup II. The MCCG had conducted four culture trials three of which were failures while only one trial was considered successful. Efforts are now being made to improve the conditions of the ponds with the assistance of the JICA Expert in order to raise this venture into commercial-scale operation.

6.3.3 *Research on the environmental effects on mud crab*

59. Mud crab fattening was another venture considered under the ICRM-SV considering that from the trials on mud crab culture, it was found more feasible to stock bigger sized mud crabs. The progress on the trials in mud crab fattening was reported by *Mr. Tatsuya Hatori*, JICA Expert, FiA Cambodia.

60. Based on the trials on mud crab culture which were mostly failures, efforts were made to address the major constraints, which included meteorological constraints such as distinctive changes in season, heavy downpour, high temperature and low humidity in dry season; methodological constraints such as structure of the ponds, finding the optimum density for pond capacity; and botanical constraints such as evaporation of pond water by mangroves on mounds, concentration of salinity by mangroves, and chemical reaction of mangroves. Thus, improvement in the culture system was made, which included provisions that the period of fattening should be from June to November; stocking should be limited at 200-300 pc/pond; mounds to be removed; the ponds to be 20-30 cm deeper; and removable shelters for molting crabs to be installed. In this regard, the Seminar adopted the following recommendations:

Recommendation 15

Sharing of experiences of the Southeast Asian countries on mud crab fattening and conservation of mangrove areas, should be promoted by SEAFDEC.

Recommendation 16

Since certain species of mangroves could have impacts on the aquatic animals, an interdisciplinary study involving botanists should be conducted to assess the total functions of mangroves.

6.3.4 *Sea bass culture*

61. Sea bass culture was another business venture tried under the ICRM-SV project. The progress of the sea bass culture trials was reported by *Ms. Hoc Tean* and *Mr. Tatsuya Hatori*. In order to initialize this activity the Fish Cage Culture Group (FCCG) was established to be responsible for the management of the cage culture of sea bass. After two trials of sea bass culture, the results were considered failure which was mainly attributed to the water conditions of the creek where the cages were installed. With the assistance of the JICA Expert, environmental data were collected which resulted in the shift of the cage culture location further down to the canal as the current location was not suitable due to low dissolved oxygen (DO) in the water.

62. Based on the experimental trials of the cage culture of sea bass, it was found that the best season for culturing sea bass in the area would be after the advent of the rainy period in July and the products should be harvested for the occasion of Chinese New Year which falls in January or February due to prevailing highest prices for all commodities during this time of the year. With this perspective, the project is intending to conduct more experiments in July/August.

63. Based on the results of the previous experiments in the cage culture of sea bass as well as the fattening of mud crab, it was suspected that the mangrove trees had unfavorable effects for maintaining the DO and salinity in the water which were the major reasons attributing to the higher mortality of mud crab and sea bass. The JICA

Expert having been involved in the project activity has inductively asserted the negative effects of mangrove trees on sound pond and cage aquaculture like the ones carried out under the project. It was therefore considered necessary to scientifically verify with comparative tests before entering into commercial-scale aquaculture venture in the project operational area. Depending on the outcome of the test, the orientation toward the future course of aquaculture business in the project site could be drastically changed.

6.4 Enhance Human Resources Capacity Building and Participation

64. The report on Human Capacity Building and Participation in workshops, training and study tours was presented by *Ms. Heng Ponley*, Deputy Chief of the Fisheries Affairs Division, FiA, Cambodia.

65. The main objectives of this activity are to: build awareness among the beneficiaries of the project activities, through education and training program; and motivate stakeholders to generate self-regulatory management framework and organize community-based development project on their own. After the beneficiaries such as the CF committee members, were conducted to study tours, and after they attended skills development training programs, their capacities have been improved. Specifically, they have gained knowledge in mud crab culture, sea bass culture, and mushroom culture, among others. The CF has also acquired good skills in bookkeeping and business management, and most of all they have also acquired good knowledge in community-based fisheries resources management. After the discussion, the Seminar adopted the following recommendations:

Recommendation 17

FiA should continue supporting the conduct of training courses, study tours, and fishermen groups meetings.

Recommendation 18

Capacity building on community-based fisheries resources management should be promoted.

Recommendation 19

The capability of the staff of FiA should be enhanced specifically on data collection and analysis.

Recommendation 20

Vocational training centers and relevant institutes in Cambodia as well as the Marine Aquaculture Development Center (MADeC) being constructed in Sihanoukville, should be tapped to assist in the human capacity building of the local communities as well as promoting information dissemination .

Recommendation 21

Information dissemination could be further enhanced through the publication of technical papers, non-technical papers, extension documents, flyers, brochures as well as through electronic media and websites.

Recommendation 22

Public awareness and education on the community fisheries management and resources conservation should be improved and continued.

6.5 Rehabilitate and Enhance Coastal Resources

6.5.1 Establishment and management of crab bank system

66. The progress on the establishment and management of crab bank system under the ICRM-SV project was reported by *Mr. Yos Chantana*.

67. The implementation of the crab bank system was carried out in the project operational area, taking into consideration the experiences of the ICRM-PD and ICRM-PL projects. The Crab Bank Group was also organized to take charge of releasing the gravid crabs and management of the crab bank. After the implementation of this activity, most members observed that the amount of swimming crabs was increasing and that a lot of small swimming crabs have been observed near the crab bank cages. Convinced that the crab bank activity is conducive for enhancing the swimming crab resources, and the members promised to continue this

activity in future. During the discussion, the Seminar adopted the following recommendations to improve the crab bank system under the ICRM-SV project:

<p style="text-align: center;"><i>Recommendation 23</i></p> <p>Considering that the crab bank is “an optimistic movement towards the bright future” as it could enhance the swimming crab resources, FiA should continue the scientific monitoring study on the crab resources and specifically on the measurement of the sizes and the CPUE of the swimming crab fishing.</p> <p style="text-align: center;"><i>Recommendation 24</i></p> <p>Study to monitor the effectiveness of the crab bank system should be conducted.</p> <p style="text-align: center;"><i>Recommendation 25</i></p> <p>FiA should continue supporting the crab bank in terms of administrative, financial and technical aspects.</p>
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6.5.2 Mangrove conservation and reforestation

68. The report on the mangrove conservation and reforestation activity was presented by *Mr. Nen Chamroen*, Deputy Director of FiA, Sihanoukville Province, Cambodia.

69. As part of the concept plan of the ICRM-SV project, mangrove conservation and reforestation was also carried out through the promulgation of Mangrove Plantation Day which aims to build awareness in the community including the children on mangrove conservation, and fostering voluntary participation among community members in environmental protection aspects. After the discussion, the Seminar adopted the following recommendations:

<p style="text-align: center;"><i>Recommendation 26</i></p> <p>FiA should find other donor agencies or organizations to support some activities of the project especially for the promotion of fish refugia and crab bank system.</p> <p style="text-align: center;"><i>Recommendation 27</i></p> <p>FiA should continue its reforestation program, which should be monitored frequently.</p> <p style="text-align: center;"><i>Recommendation 28</i></p> <p>Species and site selection should be taken into account before planting the mangrove seedlings.</p> <p style="text-align: center;"><i>Recommendation 29</i></p> <p>FiA should continue to promote mangrove conservation by educating the school children on the importance of mangroves to the natural aquatic resources.</p>
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VII. IMPACT OF ICRM-SV TO THE COMMUNITIES

70. The impacts of the ICRM-SV project on the communities from the beneficiaries’ view, were reported by *Mr. Prak Sokhalay, Ms. Hoc Tean and Ms. Malaya* with the assistance of *Mr. Yos Chantana*.

71. The beneficiaries made several declarations that include the following:

- (1) If SEAFDEC and FiA did not support the project in our commune, mangrove forest might have been taken by someone due the high price of land
- (2) Before the project started, at least 50 engine-operated push nets were operating in CF fishing ground, now in one night, 4-5 boats are still operating
- (3) We believe that crab bank system can produce a lot of small crab, and we think that we can get more crabs in the future
- (4) Agriculture production in the commune increased due to mushroom production and people now eat oyster mushroom
- (5) CF committee members are now able to write simple reports

VIII. FINDINGS AND RECOMMENDATIONS IN THE FINAL PROJECT EVALUATION

72. The report on the Final Project Evaluation of the ICRM-SV Project was presented by the Consultant, *Mr. Chum Chantol*, who was contracted for the final evaluation of the project. The evaluation which was carried out in July 2009 to assess the marine and biological impacts on the coastal fishery resources and the socio-economic impacts on the fishing communities, and to provide recommendations to FiA Cambodia and SEAFDEC/TD as the collaborative project's executing agencies and other donors on the necessary further steps to consolidate the progress and ensure the achievements of the project's objectives.

73. The report indicated that the project implementation demonstrated good collaboration work among SEAFDEC, FiA Cambodia, community fisheries leaders and other stakeholders. The active participation of and strong commitment from concerned agencies and the CF, are the key success factors in the resources management and contributed to the successful implementation of the ICRM-SV project.

IX. LESSONS LEARNED AND IMPRESSIONS ON THE ICRM-SV PROJECT OPERATION

74. Representatives from the Member Countries attending the Regional Seminar expressed their impressions on the operation of the ICRM-SV project as well as the lessons learned from the implementation of the ICRM projects in Thailand, Malaysia and Cambodia.

75. The representatives was of the consensus that the activities have drawn the attention of other communities considering that the promotion of coastal resources management led to increased fisheries resources and enhanced livelihoods. Moreover, they also emphasized that the success of this approach could only be attained with the active participation of fishers under the co-management framework. However, they also suggested that the needs of the fishing communities should be carefully assessed and the impacts of climate change should also be monitored during the implementation of ICRM projects.

76. Specifically, the representative from Myanmar, *Mr. Khin Maung Soe* commended SEAFDEC for the promotion of the ICRM projects as it is one approach that could alleviate poverty in fishing communities. He considered it noteworthy to learn that many stakeholders have benefited from the implementation of the project, not only in fisheries but in other areas as well. He suggested that this project should be strengthened as a regional activity for Southeast Asia. While acknowledging the lessons learned from the implementation of the ICRM projects, he suggested that SEAFDEC should continue monitoring the progress of the project and requested SEAFDEC for the possibility of extending the project to the remaining countries especially Myanmar.

77. The representative from Lao PDR, *Mr. Bounthong Saphakdy* informed the Seminar that the countries Fishery Law has just been promulgated, under which Community Fisheries have been established for inland fisheries. He observed that the approach on community-based fisheries resources management could also be applied in the inland waters of Lao PDR, and suggested that SEAFDEC should also consider promoting the project concept in Lao PDR.

78. The representative from the Philippines, *Ms. Sandra Victoria R. Arcamo* presented general views and impressions on the ICRM-SV Project. She specified that the positive outcomes of the implementation of the ICRM approach point to signs of local ownership of the projects, that the results of the socio-economic survey could provide the managers with an overview of the resource users and beneficiaries of the fisheries resources management project that would help in formulating fisheries resources management plans, and that the active participation of women contributes to the positive outputs of business development. She also suggested that the most common medium of communication should be used in order to hasten the dissemination of information, the positive points of mangrove reforestation should be expounded, and that caution should be made in the installation of artificial reefs taking into consideration its main purpose while also considering the impacts to the resources.

79. The representative from the SEAFDEC Secretariat, *Mr. Akito Sato*, who is also the Assistant Trust Fund Manager for SEAFDEC, expressed his view on the sustainability of the ICRM projects. He suggested that in the implementation of coastal resources management project, it would be necessary to consider the activities step by step from the small successes. Such advances should be reflected not only in the activities of the project but also in other projects in the same community or other communities.

X. CONCLUSION AND RECOMMENDATIONS

80. While concluding the Regional Seminar, the following observations and recommendations were expressed and adopted after the discussions:

- i. In order to sustain the activities of the Project after the completion of the direct involvement of SEAFDEC in December 2009, Fisheries Administration (FiA) of the Kingdom of Cambodia committed to continue supporting the Project and that the corresponding budget would be proposed to the Royal Government of Cambodia to continue the project's activities.
- ii. In order to sustain the implementation of the activities of the Women's Group, SEAFDEC was specifically requested to continue its support to the group's activities (i.e. fish refugia for blood cockle, sea bass culture, mushroom production, etc.). However, such request would still be proposed for consideration under the Japanese Trust Fund Program in SEAFDEC.
- iii. Considering that the Marine Aquaculture Development Center (MADeC) will be constructed in Sihanoukville, SEAFDEC and JICA were requested to assist in strengthening the capacity of the staff to enhance their capabilities in marine aquaculture, when the Center is operational.
- iv. The project should be strengthened considering the experiences gained from the implementation of the ICRM projects, and that SEAFDEC should continue to monitor the progress of the project in the three implementing countries.
- v. It is noteworthy that the CBRM concept initiated and successfully implemented in Japan has been used as basis for the implementation of the ICRM approach in the project sites after certain adjustments, in order to suit the varied community conditions and requirements of the Southeast Asian countries.
- vi. Considering that the Fishery Law in Lao PDR, which includes the establishment of community fisheries, has just been promulgated, the ICRM approach could also be adapted for the inland community fisheries of Lao PDR.
- vii. Taking advantage of the lessons learned and the experiences gained through the implementation of the ICRM approach in three pilot countries, the possibility of promoting the ICRM concept as a regional activity should be explored specifically the possibility of extending the project in the other Southeast Asian countries such as Myanmar should be considered.
- viii. As for the crab bank system which is a continuing effort not only in Sihanoukville but in many coastal communities of Cambodia, it is the Minister's policy to continue his government's support of the crab system.

XI. CLOSING OF THE REGIONAL SEMINAR

81. On behalf of Fisheries Administration of Cambodia, the Deputy Director General of FiA Cambodia, *Mr. Ing Try* reiterated its inability to make arrangements for the seminar venue at the project site. In spite of such handicap, the volume of presentations on the progress of the project was quite much and the discussions have been fruitful. He noted that project had positive impacts to the fishing community in Prey Nup II resulting in the embodiment of the community-based fisheries resources management by the newly established fishermen's group, the Community Fisheries Prey Nup II and various sub-groups like the Mushroom Producers Group (MPG), Mud Crab Culture Group (MCCG), Blood Cockle Fishers Group (BCFG) Fish Cage Culture Group (FCCG), which are upholding Community Fisheries. While also considering that most activities commenced in the later part of the project operation, he indicated that definitely FiA would continue the follow up activities so as to make best use of the momentum ignited by the joint efforts between SEAFDEC, FiA and other collaborating partners. However, he also expected SEAFDEC and JICA to also support the follow-up activities in the future.

82. In closing, he thanked SEAFDEC and especially the Japanese Trust Fund for the dedication and contribution to the project. For without such support, the project should have not achieved such tangible outcomes and achievements. He also extended the appreciation of FiA to the Japanese Embassy and JICA in Cambodia for the additional financial and technical support that enabled the project to pursue various additional activities. He assured the donors assure you that FiA would continue to promote the sustainability of the application of CBRM in the area in particular and the country in general, which has just been put in place. Although the financial support from the Japanese Trust Fund for the project has been terminated, he assured that

FiA is bound to look after the newly born baby and ready to continue supporting the follow-up activities to some extent, in the future. His Closing Remarks appear as **Annex 8**.

83. The Deputy Secretary-General of SEAFDEC, *Mr. Hideki Tsuabata* thanked the participants for their active participation in the Regional Seminar that led to the formulation of follow up actions for the dissemination of the ICRM concept in our region. While recognizing the significance of the ICRM concept for the sustainable development of fisheries in the region, SEAFDEC would try to continue its efforts in adopting the ICRM approach for the improvement of coastal fisheries management in the region taking into consideration the experiences gained during the implementation of the ICRM approach in three countries.

84. Before he closed the Regional Seminar, he thanked the Fisheries Administration of Cambodia for coordinating the ICRM-SV project and for its commitment through its newly formed project management committee to ensure the sustainability of the relevant activities under the project after the involvement of SEAFDEC had already been completed. He also expressed his gratitude to the representatives from the other ICRM projects for sharing their experiences during the Regional Seminar. He also thanked the Japanese Trust Fund through SEAFDEC, for making this Seminar possible and especially for providing the necessary funds although it was still not possible to conduct the Seminar in Sihanoukville in Cambodia. His Closing Statement appears as **Annex 9**.

85. Taking advantage of the occasion and on behalf of all the project staff of ICRM-SV, *Mr. Seiichi Etoh*, who has been instrumental in the implementation of the ICRM projects in Thailand, Malaysia, and Cambodia expressed his sincere appreciation to the Fisheries Administration of Cambodia including the Kampong Som FiA Cantonment for the efforts exerted in the implementation of the project in Sihanoukville. He also thanked the Embassy of Japan in Cambodia for their financial contribution to establish the experimental mud-crab fattening facilities, and to the JICA Experts for the technical inputs provided to the project operation. Finally, he specifically stated that the actors playing the main roles in the project operation are the fishers in the target villages in Prey Nup II. Their self-motivation towards the realization of the CBFMR concept and total community development is noteworthy, of which the project staff greatly appreciated. He expressed his wish for the success of the newly established Community Fisheries Prey Nup II and various sub-groups like Mushroom Producers' Group, Blood Cockle Fishers Group, Mud Crab Culture Group, Fish Cage Culture Group, and Crab Bank Group, and prosperity in the future.

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After the start of the project in Cambodia, an additional donor, the Japanese Embassy in Phnom Penh, Cambodia participated in the project operation with a fund contribution in the form of Grass-route Level Fund which was approved in August 2006. This fund was specifically utilized for the mud crab culture activity of the project.

The project has progressed towards its goals as regularly reported through the biannual project progress reports and taking the project scope into account its tenure was extended until December 2009. As planned, upon completion of the project operation, its impacts on the target communities and the project achievement in line with the original conceptual goals should be summarized and reviewed with the participation of concerned parties including the representatives from the SEAFDEC Member Countries. This is envisaged so that the lessons and implications derived from the review would be reflected and incorporated in similar project operations not only in the country site but also in other parts of the region.

Hence, this regional seminar on “INTEGRATED COASTAL RESOURCES MANAGEMENT APPROACH IN SOUTHEAST ASIA: REVIEW OF THE PROJECT ICRM-SV” was planned to be conducted with the objectives and agenda described below:

2. Objectives of the Seminar

The objectives of the Seminar are as follows:

- To report on the achievements and outcomes of the project during its over 4-year implementation period and review its progress in line with the original project concept;
- To verify the impacts to the beneficiaries from the project’s activities in terms of quantity as well as quality in the light of both facets of community development as well as sustainable coastal fishery resources management;
- To discuss the resultant rationale and implications in the dissemination of the project concept to other SEAFDEC Member Countries; and
- To identify the necessary follow-up actions to be undertaken by FiA Cambodia, SEAFDEC/TD 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 to be undertaken by FiA Cambodia, SEAFDEC/TD and other local agencies for the sustainability of the project, are identified; and
- The Seminar could offer opportunities for SEAFDEC Member Countries other than Thailand, Malaysia and Cambodia to consider the applicability of CBRM concept in their respective countries following the ICRM project approach.

4. Date and Venue

The Regional Seminar will be organized by SEAFDEC/TD at Windsor Suites Hotel, Bangkok, Thailand, on 26-27 January 2010.

The Regional Seminar was originally envisaged to be organized in the project operational area in Sihanoukville, Cambodia, including a physical site inspection which is vital for the verification of the project impacts on the beneficiary communities. However, owing to the various constraints including budgetary limitations with inflated cost of accommodation and related prices, difficulty with means of transportation from Bangkok to Sihanoukville and other logistic arrangements in the project site, it was eventually decided and consistent with the agreement with FiA Cambodia that the Regional Seminar should be held instead in Thailand where SEAFDEC/TD is located.

5. Target Participants

The requirements for the invited participants include: experience in working 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, designated participants should have good command of the English language to be able to actively participate in the discussion. The following target participants would be invited to the Regional Seminar:

- Representatives from SEAFDEC Member Countries: representing the SEAFDEC Member Countries' coastal fishery resources management programs as part of their fisheries development plan; *i.e.* one representative each from Brunei Darussalam, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Vietnam.
- Leaders of the ICRM project's operational teams in Thailand and Malaysia: 1 each from ICRM-PD and ICRM-PL
- Representatives from SEAFDEC Secretariat and Training Department
- The Consultant of the Final Project Evaluation
- Representatives from FiA Cambodia and the National Project Team of ICRM-SV
- Representatives from the beneficiary communities
- Former Team Leader of ICRM-SV
- JICA Expert from Cambodia

In all, it is expected that 30 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 Annotated Agenda.

1st day

08.30 – 09.00	Registration
09.00 – 09.30	Agenda 1: Opening of the Seminar followed by commemorative photo session
09.30 – 09.45	Coffee Break
09.45 – 09.50	Agenda 2: Adoption of the Agenda (Chairperson – SEAFDEC)
09.50 – 10.20	Agenda 3: Background of the ICRM Projects and the Seminar (Chairperson – SEAFDEC)
10.20 – 11.00	Video film showing on the ICRM-SV project operation
11.00 – 12.00	Agenda 4: Description of the project approach and progress of ICRM-PD, Thailand and ICRM-PL, Malaysia (Chairperson - SEAFDEC)
12.00 – 13.30	Lunch Break
13.30 – 14.30	Agenda 5: Description of the project activities (Chairperson – SEAFDEC)
	1. Baseline and monitoring surveys
	a. Socio-economic surveys
	b. Daily fish landing survey
	c. Marine biological survey
14.30 – 15.30	2. Encourage CBRM (Community Based Resources Management)
	a. Zoning arrangement and fishery resources management plan
	b. Local enforcement activity
	c. Fish refugia – Establishment and management of Fish Refugia
15.30 – 16.00	Coffee Break
16.00 – 17.20	3. Local business development
	a. Women's Group activity
	b. Mud crab culturing
	c. Research on environmental effects to mud-crab culture
	d. Sea bass culture
18.30	Dinner hosted by SG SEAFDEC

2nd day

Continue Agenda 5:

09.00 – 09.20	4. Enhance human resources capacity building and participation
	a. Workshops, training courses and study tours
09.20 – 10.00	5. Rehabilitate and enhance coastal resources
	a. Crab Bank
	b. Mangrove reforestation
10.00 – 10.20	Coffee Break

10.20 – 10.50	Agenda 6: Impact given to the communities – Beneficiaries’ views (Chairperson – FiA Cambodia)
10.50 – 11.20	Agenda 7: Findings and recommendations in Final Project Evaluation (Chairperson – FiA Cambodia)
11.20 - 12.20	Agenda 8: Lessons learned and impressions on the impacts of the ICRM-SV project operation from Member Countries (Chairperson – SEAFDEC)
12.20 – 14.00	Lunch Break
14.00 – 15.30	Agenda 9: Winding – up discussions followed by adoption of conclusions and recommendations (Chairperson – SEAFDEC)
15.30 – 15.50	Coffee Break
15.50 – 16.00	Agenda 10: Closing of the Regional Seminar (M/C – SEAFDEC)

7. Discussion materials and working documents

The following discussion and/or presentation materials will be prepared by the respective parties concerned.

<u>Doc. No.</u>	<u>Title of document</u>	<u>Responsible parties</u>
INF01	Provisional Prospectus	SEAFDEC/TD
INF02	Provisional Annotated Agenda	SEAFDEC/TD
INF03	List of Participants	SEAFDEC/TD
INF04	List of Documents	SEAFDEC/TD
REF01	Project Chronology of major project events	SEAFDEC/TD
REF02	Preliminary Socio-economic Survey in Commune Teuk Thla, Sihanoukville, Cambodia	SEAFDEC/TD
REF03	Monitoring Socio-economic Survey in Commune Teuk Thla, Sihanoukville, Cambodia	SEAFDEC/TD
REF04	Fish Landing Data in Prey Nup II, 2006-2007	SEAFDEC/TD
REF05	Fish Landing Data in Prey Nup II, 2007-2008	SEAFDEC/TD
REF06	Fish Landing Data in Prey Nup II, 2008-2009	FiA Cambodia
REF07	Study on Development of Blood Cockle Gonad in Prey Nup II, Sihanoukville, Cambodia	SEAFDEC/TD
REF08	Result of Abundance and Distribution Survey for Blood Cockle in the Fish Refugia	SEAFDEC/TD
REF09	Final Project Evaluation Report	Outsourced Consultant
WP01	Background of Deployment of ICRM Project in Southeast Asian Countries and Regional Seminar	SEAFDEC/TD
WP02	Description of Project Approach and Outcomes – ICRM-PD, Thailand	DOF Thailand
WP03	Description of Project Approach and Outcomes – ICRM-PL, Malaysia	DOF Malaysia
WP04	Baseline and monitoring survey - Outcomes of Baseline and Monitoring Socio- economic Surveys	SEAFDEC/TD
WP05	Fish Landing data collection	SEAFDEC/TD
WP06	Marine biological research in blood cockle	SEAFDEC/TD
WP07	Encourage CBRM – Establishment of Zoning and Formulation of Fishery Resources Management Plan	FiA Cambodia
WP08	Encourage CBRM – Establishment and Embodiment of Local Enforcement Unit (LEU)	FiA Cambodia
WP09	Encourage CBRM - Establishment and Management of Fish Refugia	FiA Cambodia
WP10	Local Business Development – Women’s Group Activity	Mushroom Producers Group/FiA Cambodia
WP11	Local Business Development – Mud crab culture	FiA Cambodia
WP12	Research on Environmental Effects to Mud-crab Culturing	JICA Expert
WP13	Local Business Development – Sea bass culture	FiA Cambodia

WP14	Enhance Human Resources Capacity Building and Participation – Workshops, training courses and study tours	FiA Cambodia
WP15	Rehabilitate and enhance coastal resources - Establishment and Management of Crab Bank System	Crab Bank Group/ FiA Cambodia
WP16	Rehabilitate and Enhance Coastal Resources – Mangrove Reforestation	FiA Cambodia
WP17	Impact given to the communities – Beneficiaries’ view	CF Leader/ FiA Cambodia
WP18	Finding and recommendations in Final Project Evaluation	Out-sourced Consultant

8. Funding

A major component of the expenses incurred during the conduct of the Regional Seminar is borne by SEAFDEC/TD under the Japanese Trust Fund IV Program.

9. Others

For further information, please feel free to communicate with us at the following addresses or send e-mail to:

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WELCOME REMARKS**By Mr. Hideki Tsubata****SEAFDEC Deputy Secretary-General****Deputy Chief of SEAFDEC Training Department and Trust Fund Program Manager**

Deputy Director-General of the Fisheries Administration of Cambodia, Mr. Ing Try;
 Representatives from the SEAFDEC Member Countries;
 Leaders and representatives from the ICRM-PD, ICRM-PL and
 ICRM-SV projects as well as beneficiaries of the ICRM-SV project
 Resource Persons;
 Representatives from the SEAFDEC Secretariat and Training Department;
 Ladies and Gentlemen, a very good morning!

On behalf of SEAFDEC, it is indeed my pleasure to welcome you all to this Regional Seminar which aims to discuss the outcomes of the Integrated Coastal Resources Management Project in Sihanoukville, Cambodia or the ICRM-SV project. As we are all aware of, this Seminar is also tasked to verify the impacts of the project to the beneficiaries as well as explore the possibility of disseminating the project concept to the other SEAFDEC Member Countries. Most of all, the Seminar is also envisaged to come up with actions to be undertaken by the concerned agencies for the sustainability of the project.

We all understand that during the final seminar for the ICRM Project in Pathew District in Chumphon, Thailand or the ICRM-PD and the Project in Pulau Langkawi, Malaysia or the ICRM-PL, follow up actions have also been identified. As a result, the DOF of Thailand and the Department of Fisheries Malaysia have continued implementing the relevant activities under their respective projects, assuring the sustainability of the project even after the support of SEAFDEC had already been completed. We hope that for this ICRM-SV Project, the newly formed project management committee of FiA would continue to pursue the community-based fishery resources management functions considering that the support from SEAFDEC would be very minimal after our actual involvement was completed in December 2009.

We are also aware that the other Member Countries of SEAFDEC have already signified their interest in implementing the project in their respective countries. However, we regret that due to financial constraints this may not be possible, but the lessons learned and the experiences gained from the implementation of the aforementioned three projects could be referred to for the adaption of the project concept in the other countries. It is therefore critical that the outcomes of this third ICRM project be thoroughly discussed during this last of the series of ICRM seminars. This Seminar could offer opportunities for member countries other than Thailand, Malaysia and Cambodia to consider the applicability of community-based fishery resources management concept in their respective countries.

Your active participation and full cooperation during this Seminar is therefore of utmost importance. Although we have a hectic schedule ahead of us during this two-day Seminar, I am confident that with your invaluable inputs we would be able to achieve our goal of actively promoting the development of community-based fishery resources management in the Southeast Asian countries.

With that note Ladies and Gentlemen, I now declare open this Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia to Review the ICRM-SV Project. Thank you and good day!

OPENING REMARKS

By Mr. Ing Try
Deputy Director-General of FiA Cambodia

Mr. Hideki Tsubata, Deputy Secretary-General of SEAFDEC,
Representatives from the SEAFDEC Member Countries,
Distinguished Guests and Participants,
Ladies and Gentlemen, very good morning!

First and foremost, I would like to apologize on behalf of the Fisheries Administration of Cambodia for not having organized this important Seminar at the project site in Sihanoukville, Cambodia due to the financial constraints of the project operation and the inconvenient geographic conditions of the project site. I would therefore like to extend my sincere appreciation to SEAFDEC for making the arrangements for this Seminar to take place in Bangkok instead of in Sihanoukville.

It is indeed an honor and pleasure for me to be invited to say a few words at the opening of this much anticipated Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-SV Project implemented in Cambodia. I wish to join SEAFDEC in extending our warmest welcome to all distinguished participants to this Seminar. Looking back upon the history of this project, I could say that there have been many dramatic incidents and events which moved me with deep emotion. Acknowledging the fact that the first collaborative project on CBRM approach in Chumphon, Thailand carried out by DOF Thailand and SEAFDEC, had produced tangible outputs in the early 2000s, FiA Cambodia kept proposing at every SEAFDEC Program Committee Meeting to initiate a similar project in our country's coastal fishing communities. Eventually, our appeal was taken up at the 27th Meeting of the SEAFDEC Program Committee in 2004 when the collaborative project was endorsed to be implemented in Sihanoukville. Actually, the project operation was officially launched during the opening ceremony by H.E. the Director General of FiA on 11 November 2005. Since then, the project has been pursuing various activities oriented towards its goals.

You will hear the progress of the project activities by the various presentations during this two-day Seminar. Please be informed that this project has also become model of other similar approaches in our country. This project has been operated jointly by FiA Cambodia and SEAFDEC/TD under the financial auspices of the Japanese Trust Fund. As you might have known, the project was originally intended to be completed towards the end of 2008. However, its extension for another year up to the end of 2009 was approved so as to ensure the completion of the unfinished components of the project activity by the Japanese Trust Fund Program, after an inspection of the project site. We are therefore very thankful to the Trust Fund Manager, *Mr. Hideki Tsubata*, for facilitating the approval of the extension of the project implementation.

Convening this two-day Seminar is very timely as this marks the completion of the direct involvement of SEAFDEC in the project. Nevertheless, this should not cause any hindrance for possible future cooperation between SEAFDEC and FiA Cambodia to ensure the sustainability of the project. It is acknowledged that through this project, Cambodia has gained invaluable experience and knowledge on integrated approach for CBRM. Specifically, the knowledge imparted by SEAFDEC over the past 4 years had benefited the community of Sihanoukville at large. SEAFDEC's continuous support to similar future project in the ASEAN countries and more particularly in Cambodia is most appreciated after proceeding from this project.

Considering that the direct involvement of SEAFDEC in the project has been completed, FiA Cambodia commit ourselves to exert all efforts to continue in one way or another, the project operation in the future to maintain the momentum of the integrated CBRM approach ignited by SEAFDEC. I would therefore like to take this opportunity to sincerely thank SEAFDEC and the project operation team of the FiA Cambodia at all levels for their hard work.

I would also wish to seek for your cooperation and active participation to make this Seminar a success. On this note, I take great pleasure in declaring "OPEN" the Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the Project ICRM-SV". Finally, I wish that we will have fruitful and rewarding deliberations. Thank you.

AGENDA AND TIMETABLE

26 January 2010 (Tuesday)

0830 – 0900	Registration
0900 – 0930	Agenda 1: Opening of the Seminar <ul style="list-style-type: none"> - Welcome Remarks by the ICRM Project Leader, <i>Dr. Yuttana Theparoonrat</i> - Statement by <i>Mr. Hideki Tsubata</i>, Deputy Secretary-General of SEAFDEC - Statement by <i>Mr. Ing Try</i>, Deputy Director-General of FiA Cambodia - Photo Session
0930 – 0945	<i>Coffee Break</i>
0945 – 0950	Agenda 2: Adoption of the Agenda (Mr. Hideki Tsubata – Chairperson)
0950 – 1020	Agenda 3: Background of the ICRM Projects and the Seminar (Mr. Hideki Tsubata – Chairperson) <ul style="list-style-type: none"> - Background of the ICRM Projects and the Seminar (WP01)
1020 – 1100	- Video film showing of the ICRM-SV project operation
1100 – 1200	Agenda 4: Description of the project approach and progress of ICRM -PD, Thailand (WP02) and ICRM-PL, Malaysia (WP03) (Mr. Hideki Tsubata - Chairperson)
1200 – 1330	<i>Lunch Break</i>
1330 – 1720	Agenda 5: Description of the ICRM-SV Project Activities (Dr. Yuttana Theparoonrat – Chairperson)
1330 – 1430	5.1 Base-line and monitoring surveys <ul style="list-style-type: none"> - Socio-economic survey (WP04) - Daily fish landing survey (WP05) - Marine biological survey (WP06)
1430 – 1530	5.2 Encourage CBRM <ul style="list-style-type: none"> - Zoning arrangement and fishery management plan (WP07) - Local enforcement activity (WP08) - Establishment and management of Fish Refugia (WP09)
1530 – 1600	<i>Coffee Break</i>
1600 – 1720	5.3 Local business development <ul style="list-style-type: none"> - Women’s Group activity (WP10) - Mud crab culture (WP11) - Study on environmental effects of mud-crab fattening (WP12) - Sea bass culture (WP13)
1830	<i>Dinner hosted by DSG, SEAFDEC</i>

27 January 2010 (Wednesday)

0900 - 0920	Continue Agenda 5 (Mr. Seiichi Etoh – Chairperson) 5.4 Enhance human resources capacity building and participation <ul style="list-style-type: none"> - Workshops, Training courses and Study tours (WP14)
0920 - 1000	5.5 Rehabilitate and enhance coastal resources <ul style="list-style-type: none"> - Crab Bank (WP15) - Mangrove reforestation (WP16)
1000 - 1020	<i>Coffee Break</i>
1020 - 1050	Agenda 6: Impacts to the Communities (Mr. Ing Try – Chairperson) <ul style="list-style-type: none"> - Beneficiaries’ view (WP17)
1050 – 1120	Agenda 7: Findings and Recommendations in Final Project Evaluation (Mr. Ing Try – Chairperson) <ul style="list-style-type: none"> - Project Evaluation (WP18)
1120 – 1220	Agenda 8: Lessons Learned and Impressions on Impacts of the ICRM-SV Project Operation from Member Countries (Mr. Ing Try/Mr. Seiichi Etoh – Co-Chairperson)
1220 – 1400	<i>Lunch break</i>
1500 – 1530	<i>Coffee break</i>
1530 – 1600	Agenda 9: Winding-up Discussion followed by Adoption of Conclusions and Recommendations (Dr. Yuttana Theparoonrat – Chairperson)
1600 – 1610	Agenda 10: Closing of the Regional Seminar (M/C - SEAFDEC)

LIST OF DOCUMENTS

<u>Doc. No.</u>	<u>Title of Document</u>	<u>Responsible parties</u>
Information (INF)		
INF01	Provisional Prospectus	SEAFDEC/TD
INF02	Provisional Annotated Agenda	SEAFDEC/TD
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Reference (REF)		
REF01	Project Chronology of Major Events	SEAFDEC/TD
REF02	Preliminary Socio-economic survey in Commune Teuk Thla, Sihanoukville, Cambodia	SEAFDEC/TD
REF03	Monitoring Socio-economic survey in Commune Teuk Thla, Sihanoukville, Cambodia	SEAFDEC/TD
REF04	Fish Landing data in Prey Nup II, 2006-2007	SEAFDEC/TD
REF05	Fish Landing data in Prey Nup II, 2007-2008	SEAFDEC/TD
REF06	Fish Landing data in Prey Nup II, 2008-2009	FiA Cambodia
REF07	Study on Development of Blood Cockle Gonad in Prey Nup II, Sihanoukville, Cambodia	SEAFDEC/TD
REF08	Result of Abundance and Distribution Survey for Blood Cockle in the Fish Refugia	SEAFDEC/TD
REF09	Final Project Evaluation Report	Out-sourced Consultant
Working Paper (WP)		
WP01	Background of Deployment of ICRM Project in Southeast Asian Countries and Regional Seminar	SEAFDEC/TD
WP02	Description of Project Approach and Outcomes – ICRM-PD, Thailand	DOF Thailand
WP03	Description of Project Approach and Outcomes – ICRM-PL, Malaysia	DOF Malaysia
WP04	Outcomes of Baseline and Monitoring Socio- economic Surveys	SEAFDEC/TD
WP05	Fish Landing data collection – Status of Main Marine Species	SEAFDEC/TD
WP06	Marine biological research in blood cockle	SEAFDEC/TD
WP07	CBRM – Establishment of Zoning and Formulation of Fishery Resources Management Plan	FiA Cambodia
WP08	CBRM – Establishment and Embodiment of Local Enforcement Unit (LEU)	FiA Cambodia
WP09	Establishment and Management of Fish Refugia	FiA Cambodia
WP10	Local Business Development – Women’s Group Activity	FiA Cambodia
WP11	Local Business Development – Mud crab culture	FiA Cambodia
WP12	Research on Environmental Effects to Mud-crab Culturing	JICA Expert
WP13	Local Business Development – Sea bass culture	FiA Cambodia
WP14	Enhance Human Resources Capacity Building and Participation	FiA Cambodia
WP 15	Establishment and Management of Crab Bank System	FiA Cambodia
WP16	Rehabilitate and Enhance Coastal Resources – Mangrove Reforestation	FiA Cambodia
WP 17	Impact given to the communities – Beneficiaries’ view	CF Leader assisted by Mr. Yos Chanthana
WP18	Finding and recommendations in Final Project Evaluation	Out-sourced Consultant

CHRONOLOGY OF MAJOR EVENTS
ICRM – SV Project
 (January 2004– December 2009)

<u>No.</u>	<u>Date</u>	<u>Activities</u>
<u>2004</u>		
01.	12.01.04	Proposal for project initiation was made during the 26 th SEAFDEC Program Committee Meeting (PCM)
02.	06.06.04	The preliminary project site inspection was made in Prey Nup II
03.	06.12.04	The outline of the project ICRM-SV was submitted to the 27 th SEAFDEC PCM and approved
<u>2005</u>		
04.	10.01.05	Inspection of the proposed project site in Prey Nup II and detailed discussions on the project outline were made
05.	10-14.03.05	Baseline socio-economic and fishing technology surveys were conducted
06.	29.05.05	Royal Decree on the establishment of Community Fisheries signed
07.	10.06.05	Sub-Decree on Community Fisheries Management signed
08.	24.06.05	Discussion on the draft Project document was made at the FiA office
09.	05.07.05	Attending the National Workshop for HRD in Fisheries Management in Phnom Penh
10.	12.07.05	Revised draft Project document (Prodoc) was sent to the FiA
11.	25.07.05	Trip for preparation of the project opening and inspection of the site for Japanese Grassroots Grant Aid was made
12.	26.09.05	The report on baseline socio-economic survey was completed and sent to FiA for comments
13.	17.10.05	Finalization of the Prodoc with FiA in Phnom Penh
14.	10.11.05	1 st SC meeting – the Prodoc was approved
15.	10.11.05	1 st ICC meeting
16.	11.11.05	The project opening ceremony
17.	14/15.12.05	The 1 st Fishers' Workshop / the 1 st Women's workshop
<u>2006</u>		
18.	07.02.06	The 2 nd SC meeting / fish landing data collection began
19.	08.02.06	The 2 nd Fishers Workshop
20.	09.02.06	The 2 nd Women's Workshop (organization of the women's group)
21.	20-25.03.06	Study tour to Chumphon Province, Thailand
22.	27.04.06	The 2 nd ICC meeting
23.	28.04.06	The 3 rd Fishers' Workshop
24.	2-6.05.06	Women's Training course in mushroom production
25.	21.05.06	The new Fisheries Law enacted
26.	7-20.06.06	The setting-up of mushroom production yards
27.	21-28.06.06	The 4 th Fishers' workshop in village level
28.	17.08.06	Bookkeeping and accounting training course for women's group
29.	25.08.06	Japanese Grassroots Level Fund approved
30.	14.09.06	Training course in mud crab culture/organization of the Mud Crab Culture Group
31.	03.10.06	Disbursement of the Japanese Grassroots Level Fund made
32.	21.11.06	Construction of the mud crab culture ponds began
33.	28-29.11.06	The 1 st Local Seminar
34.	30.11.2006	The 3 rd ICC meeting
<u>2007</u>		
35.	09.01.2007	Japanese Embassy mission visited to the project site for Grassroots Fund
36.	10.01.2007	Training course of Mud crab culture (Thai Mud-crab Specialist)
37.	25.01.2007	Tripartite meeting with the Japanese Embassy on Grassroots Fund in Phnom Penh
38.	13.02.2007	Mud crab culture experiment began.
39.	27.02.2007	Women's Group Workshop on reviewing mushroom production in 2006
40.	28.02.2007	Training Course for Mud Crab Culture Group in bookkeeping and accounting
41.	30.03.2007	The 3 rd SC meeting
42.	23.05.2007	The 4 th ICC meeting
43.	10.06.2007	Mud-crab culturing experiment was terminated.
44.	13-15.08.2007	Study tour to Siem Reap to inspect CBRM approach

45. 30.08.2007 Tripartite meeting on finalization of Japanese Grassroots Fund in Phnom Penh
46. 16.10.2007 The 6th Fishers Workshop on reviewing the outcomes of the study-tour
47. 17.10.2007 The 7th Fishers Workshop on reviewing the mud-crab culturing experiment
48. 18.10.2007 The 5th ICC meeting
49. 17.11.2007 The 2nd mud-crab culturing experiment commenced.
50. 05.12.2007 The 7th Fishers Workshop on establishment of Crab Bank
51. 05.12.2007 Mangrove plantation day
52. 06.12.2007 The 2nd Local Seminar
- 2008**
53. 01.02.2008 Final Report on Japanese Grass Route Fund was submitted to the Japanese Embassy
54. 18.02.2008 The Women's Group Meeting on establishment of the Mushroom Producers Group
55. 18.02.2008 Meeting for Crab Bank – identified the location of the cage
56. 19.02.2008 The 8th Fishers Group Meeting on establishment of Fish Refugia for blood cockle fishing
57. 19.02.2008 Inspection of mangrove trees planted in December 2007
58. 19.02.2008 Inspection of the proposed site for the sea bass cage culture
59. 20.02.2008 The 4th SC meeting
60. 01.04.2008 The 9th Fishers Workshop on monitoring mud-crab culturing
61. 01.04.2008 The 2nd follow-up meeting for Crab Bank
62. 02.04.2008 The 2nd Workshop of Blood Cockle Fishers Group/Data collection of the blood cockle/
the biological study for blood cockle began
63. 02.04.2008 The 2nd Workshop of Mushroom Producers Group
64. 03.04.2008 The 2nd Workshop of the cage culture group – establishment of the group
65. 05.04.2008 Study tour to Stung Hao to inspect Crab Bank
66. 08-09.04.2008 Study tour to Koh Kong to inspect mud-crab culturing
67. 25-28.04.2008 Cages of Crab Bank installed
68. 12.06.2008 The proposal of the project extension was submitted to SEAFDEC by FiA
69. 18.06.2008 The 10th Workshop for Mud Crab culturing
70. 18.06.2008 The 3rd Workshop of the cage culture group – economic feasibility
71. 19.06.2008 The 3rd Workshop of the Crab Bank Group and inspection of the cages
72. 19.06.2008 The 3rd Workshop of Blood Cockle Fishers Group
73. 20.06.2008 The 6th ICC Meeting
74. 11-14.08.2008 Inspection of the project activity of ICRM-SV by DSG of SEAFDEC
75. 12.08.2008 The 11th Workshop of Mud Crab Culture Group
76. 12.08.2008 The 4th Workshop of Crab Bank
77. 13.08.2008 The 4th Workshop of Blood Cockle Fishers Group
78. 13.08.2008 The 3rd Workshop of Mushroom Producers Group
79. 14.08.2008 The 4th Workshop of Fish Cage Culture Group
80. 14.08.2008 The meeting on project extension with the DG, FiA, and the DSG, SEAFDEC in PNH
81. 08.09.2008 The 3rd experiment of mud crab fattening commenced (completed on 10.09.2008)
82. 23.09.2008 The 1st sea-bass cage culturing commenced (completed on 30.09.2008)
83. 19.11.2008 The 12th Workshop of Mud Crab Culture Group
84. 19.11.2008 The 5th Workshop of Cage Culture Group
85. 20.11.2008 The 4th Workshop of Mushroom Producers Group
86. 20.11.2008 The 5th Workshop of Crab Bank
87. 20.11.2008 The 5th Workshop of Blood Cockle Fishers Group
88. 21.11.2008 The 7th ICC meeting
89. 15.12.2008 The 4th experiment on mud-crab culturing commenced
90. 06-12.2008 The training course in mushroom production for school children
91. 16-20.12.2008 The training course in spore production in Battambang
92. 24.12.2008 The 6th Workshop on Blood Cockle Fishers Group
93. 25.12.2008 The 3rd Local Seminar
94. 26.12.2008 Mangrove plantation day
- 2009**
95. 07.01.2009 The 2nd experiment in sea-bass cage culturing commenced
96. 08.02.2009 The 4th mud-crab culturing experiment completed
97. 09-12.02.2009 The monitoring socio-economic survey

98. 17-19.02.2009 The training course in fish landing data analysis
 99. 17.02.2009 The 1st meeting with the committee members of CF Prey Nup II
 100. 18.02.2009 The 13th Workshop on Mud-crab Culturing Group
 101. 18.02.2009 The 6th Workshop on Crab Bank Group
 102. 18.02.2009 The 6th Workshop on Cage Culturing Group
 103. 19.02.2009 The 7th Workshop on Blood Cockle Fishers Group
 104. 2-5.03.2009 Workshops in the neighboring villages to disseminate the concept of fish refugia
 105. 20-21.03.2009 Blood cockle group study tour to Svay Chrum District, Svay Rieng Province
 104. 16.03.2009 The Malaysia DOF mission visited the project site
 106. 17.03.2009 The 5th SC meeting
 107. 18.03.2009 The 8th Workshop on Blood Cockle Fishers Group
 108. 03.06.2009 Project gave 10 rewards to 10 members of 2 crab bank sub-groups
 109. 04.06.2009 The 8th ICC meeting
 110. .07.2009 Commencement of the final project evaluation
 111. 30.10.2009 Completion of the final project evaluation
 109. 30.11.2009 Publication of the final project evaluation report
 110. 24.08-12.09.2009 Commencement of the 5th mud crab culturing experiment
 111. 11-31.10.2009 Completion of the 5th mud crab culturing experiment
 112. 12.12.2009 Installation of obstacle objects in the fish refugia
 113. 01.10.2009 Commencement of sea bass culture in pond
 114. 21-22.12.2009 The project internal meeting for preparation of Regional Seminar
 115. 31.12.2009 Termination of the project operation
- 2010**
116. 26-27.01.2010 The Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: review of the ICRM-SV Project in Bangkok, Thailand

CLOSING REMARKS

By Mr. Ing Try
Deputy Director-General of FiA Cambodia

The Deputy Secretary General of SEAFDEC and Japanese Trust Fund Manager, Mr. Hideki Tsubata, distinguished guests and participants, ladies and gentlemen, good *day*.

It is indeed a pleasure for me to be able to participate in this Regional Seminar on Integrated Coastal Resources Management in Southeast Asia: Lessons Learned through the Project Integrated Coastal Resources Management in Sihanoukville. 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 Fisheries Administration of Cambodia.

In my opening speech, I expressed our inability to make arrangements for the seminar venue at the project site. In spite of such handicap, I have witnessed so much volume of presentations made on the progress of the project and very fruitful discussions were held during these two-day Seminar. Quite impressive indeed!

During the Seminar, I have noted the very impressive achievements of the various activities. Specifically, it is also interesting to note that the project had positive impacts to the fishing community in Prey Nup II and that this resulted in the embodiment of the community-based fisheries resources management by the newly established fishermen's group, the Community Fisheries Prey Nup II and various sub-groups like the Mushroom Producers Group (MPG), Mud Crab Culture Group (MCCG), Blood Cockle Fishers Group (BCFG) Fish Cage Culture Group (FCCG), which are upholding Community Fisheries. I have also noticed that the members of each sub-group have been eagerly participating in their respective activities with self-motivation. The tenure of the project was relatively short at 4.2 years. Considering that most activities commenced in the later part of the project operation, definitely FiA needs to continue the follow up activities so as to make best use of the momentum ignited by the joint efforts between SEAFDEC, FiA and other collaborating partners. However, we still expect and entreat SEAFDEC and also JICA to support our follow-up activities in the future.

Before closing this Seminar, I would wish to extend my sincere thanks to SEAFDEC, especially the Japanese Trust Fund 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 Japanese Embassy and JICA for the additional financial and technical support that enabled the project to pursue various additional activities. We would like to assure you that we will continue to promote the sustainability of the application of CBRM in the area in particular and the country in general, which has just been put in place. Although the 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 the follow-up activities to some extent, in the future.

Thank you very much and good day

CLOSING STATEMENT

By Mr. Hideki Tsubata
SEAFDEC Deputy Secretary-General
Deputy Chief of SEAFDEC Training Department and Trust Fund Program Manager

Distinguished participants, Ladies and Gentlemen, Good afternoon!

First of all, on behalf of the organizers, I wish to inform you that we are very happy for the success of this Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia to Review the ICRM-SV Project. I must say that I am most impressed by your active participation during the 2-day Seminar. We are also very pleased that although the schedule was quite hectic, the Seminar was able to come up with the necessary follow up actions for the dissemination of the ICRM concept in our region. SEAFDEC recognizes the significance of the ICRM concept for the sustainable development of fisheries in our region. Banking therefore on our experiences during the implementation of the ICRM approach in three countries, we should try to continue our efforts in adopting the ICRM approach for the improvement of coastal fisheries management in the region.

As this Regional Seminar comes to a close today, I would like to thank the Fisheries Administration of Cambodia for coordinating the ICRM-SV project and for its commitment through its newly formed project management committee to ensure the sustainability of the relevant activities under the project after the involvement of SEAFDEC had already been completed. We are also thankful to the representatives from the other ICRM projects for sharing their experiences. To the Japanese Trust Fund through SEAFDEC, we are also very grateful for making this Seminar possible and especially for providing the necessary funds although it was still not possible to conduct the Seminar in Sihanoukville in Cambodia.

Ladies and gentlemen, we are all aware that our work does not end with this Seminar considering that community-based fishery resources management is a continuing process. We should continue promoting the ICRM approach in order to improve the management of fisheries and achieve our goals of alleviating poverty in the fishing communities.

Finally, I wish you all the best and every success in your future challenges. May you have a safe journey back home. With that Ladies and Gentlemen, I now declare this Regional Seminar closed. **Thank you very much.**



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

Mr. Seiichi Etoh

ICRM Expert and Former Staff of SEAFDEC/TD

1. Deployment of the ICRM projects in the SEAFDEC Member Countries

In most Southeast Asian countries, the deterioration of livelihood in coastal fishing communities as a result of over-exploitation of fishery resources and the degradation of coastal environments had become a pivotal concern for fishery policy makers that led the concerned governments to introduce considerable measures to improve the situation. One of the recognized appropriate approaches was the introduction of the concept of community-based fishery resources management (CBFRM) within the framework of coastal fisheries development and management.

Meanwhile, during the implementation by SEAFDEC of the regionalization of the Code of Conduct for Responsible Fisheries, regional guidelines under four major themes had been established, namely: responsible fishing operations, aquaculture development, fisheries post-harvest, and fisheries management. Under the framework of the regional guidelines, the ASEAN-SEAFDEC Fisheries Consultative Group (FCG) agreed in 2001 that Thailand serves 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 responsible fisheries management.

Consistent with such understanding, the Training Department (TD) collaborated with the DOF Thailand, in implementing a coastal resource management program as a model case. The existing project proposal for Chumphon was therefore reformulated as a joint initiative of TD and the DOF for a period of five years. It was further agreed that the knowledge and experience gained through the project operation would be disseminated to the 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 Chumphon in November 2001 with the overall project objectives of: (1) establishing sustainable coastal resources management mechanism 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 SEAFDEC Member Countries at the 4th Meeting of the ASEAN-SEAFDEC FCG in Myanmar in March 2002 and at the 25th Meeting of the SEAFDEC Program Committee in Singapore in October 2002. During the latter meeting, it was pointed out that it was already an opportune time to impart the technologies including the experience and knowledge gained, to other member countries. It was then that the Committee Member for Malaysia offered Langkawi as a pilot site for the implementation of an approach similar to the LBCRM-PD. Subsequently, SEAFDEC/TD missions visited Langkawi to look into the possibility of setting up a similar coastal fishery resources management and development project. As the result, the four-year project on “Locally Based Coastal Resources Management – Pulau Langkawi (LBCRM-PL)” took off in August 2003.

These two projects were jointly financed by the respective governments and the Japanese Trust Fund I Program through SEAFDEC, and later reformulated to fit into the new thrust of the Japanese Trust Fund IV Program, which in fact commenced in 2005. This new Trust Fund IV Program focused on “Capacity Building of Human Resources and Participation in Integrated Coastal Resources Management” and 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 in order to take into consideration the thrust of the new program, and such thrust had been incorporated in the second phases of the aforementioned projects.

When 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, Brunei Darussalam, Indonesia, Cambodia and Myanmar expressed the wish to initiate the similar project approach in their respective countries. Among the candidate countries, it was decided that the 3rd project would be implemented in Cambodia taking into account the geographical advantage and the prioritized need of a CBFRM approach in the country. Thus, the preliminary site inspection survey was carried out in June 2004 to assess the proposed site and to collect relevant data and information related to responsible community fisheries.

Based on the findings and observations from the survey, a tentative work-plan was submitted to and endorsed during the 27th Meeting of the SEAFDEC Program Committee in December 2004. Steps were then taken to put the project in place especially for the initiation of the actual activities in 2005. However, the results of the detailed site survey which was conducted in January 2005 led to the changing of the proposed site to Prey Nup II due some constraints with the originally proposed location to implement the project. Conduct of a baseline socio-economic and fish technology survey took place in March 2005. On the basis of the findings and outcomes from such survey, the project document was formulated and submitted to FiA Cambodia in July 2005 for consideration. Eventually, the project document was approved by both executing agencies, *i.e.* FiA Cambodia and SEAFDEC/TD, in November 2005. Implementation of the three-year activities then commenced on 11 November 2005.

The ICRM-PD project in Chumphon was terminated as scheduled in December 2006 while the ICRM-PL project in Langkawi was extended for one year due to the unexpected disaster brought about by the devastating tsunami on 26 December 2004, and terminated in December 2007. After the completion of these projects, regional seminars were organized to review the impacts of the project to the respective fishing communities with particular insights to achieving the concept of the CBRM approach. The workshop for the project in Chumphon was held on 10-12 July 2007 while the workshop for the project in Langkawi was held on 21-23 October 2008.

Meanwhile, the ICRM-SV project in Sihanoukville, Cambodia was extended for another year until the end of 2009 to complete the on-going activities related to coastal fishery resources management practices along with the community development approach. The monitoring socio-economic survey was then conducted in February 2009 to evaluate the impacts of the project operation in the fisheries and socio-economic aspects of the communities. Also, the report of the final project evaluation which was carried out by an outsourced consultant in Cambodia from May to June 2009, together with the findings and the conclusions comprising some recommendations for the follow-up activities to be undertaken by the project executing agencies, have been compiled for publication.

The timeframe of the program implementation on the introduction of CBRM concept to the Southeast Asian countries is as shown in the following chart.

Table 1: Timeframe of Program Implementation

No	Project	Year								
		2001	2002	2003	2004	2005	2006	2007	2008	2009
1	Project 1: <u>Thailand</u> - 1 st phase : LBCFM-PD (JTF-1) - 2 nd Phase: ICRM-PD (JTF-4)		←			→		←		→
2	Project 2: <u>Malaysia</u> - 1 st phase : LBCFM-PL (JTF-1) - 2 nd Phase: ICRM-PL (JTF-4)				←		→	←		→
3	Project 3: <u>Cambodia</u> : ICRM-SV (JTF-4)							←		→

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

As the first component of the LBCRM/ICRM project, the LBCRM-PD/ICRM-PD in Chumphon Province, Thailand was completed in December 2006. The project’s progress in the span of five years and two months had been reported in detail in the respective biannual project progress reports. To consolidate the reports, a review of the achievement of LBCRM-PD/ICRM-PD project and its impacts to the target fishing communities was conducted through the Regional Seminar on Integrated Coastal Resources Management in Pathew District, Chumphon Province, Thailand from 10 to 12 July 2007, in which representatives from the respective SEAFDEC Member Countries participated. Similarly, the Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-PL Project was conducted from 21 to 23 October 2008 in Langkawi, Malaysia, after the completion of the project operation in December 2007. The outcomes were found very substantial and conducive not only for the beneficiaries but also for the agencies which took over the project operation after December 2007, as well as for the Member Countries that have envisaged to initiate or are already implementing the ICRM approach. The proceedings of the two workshops were compiled and published, and distributed in September 2007 and December 2008, respectively.

In the wake of such experience and consistent with the project design, it was decided to hold a two-day Regional Seminar on “Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-SV Project” from 26 to 27 January 2010. Compared with the regional seminars conducted for the former two

projects however, this seminar was organized in a sense, in a bit irregular way. Normally, it is considered more appropriate to hold the review seminar for any project at the site or at least near the site of the project implementation. In which case the regional seminar should have taken place in Sihanoukville, Cambodia. Such arrangement is certainly more effective and conducive for all participants to see each activity with more realistic view through actual physical inspection.

However, a number of problems have constrained the realization of the regional seminar in Sihanoukville, Cambodia, such as the location of the project site, logistic and traveling difficulties and most importantly taking into account the financial limitations. Serious arguments and discussions on these issues were repeated between the Fisheries Administration of Cambodia and SEAFDEC/TD since early 2009. Eventually, as a compromise and as the best solution in a way, it was agreed that the regional seminar would be held in Bangkok, Thailand. The project team has therefore made efforts to screen all activities of the project for this seminar, so that the participants could still imagine the activities as if they were in the project site in Sihanoukville and enable them to get the actual picture of the project activities.

2.1. of the Regional Seminar

Agenda

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 appropriate future orientation in the project follow-up stage could be derived. Furthermore, based on lessons learned and experiences gained through the project operation of ICRM-PD in Thailand, the second project was initiated in Langkawi, Malaysia in August 2003. Thereafter, the third project was similarly started in Sihanoukville, Cambodia in November 2005. As such, the regional collaboration involved will be described and its impacts discussed towards further dissemination of the ICRM concept and approaches to other SEAFDEC Member Countries.

As aforementioned, no site inspection of the project operation could be made during this Seminar. Instead, almost all project activities are to be screened to enable the participants to grasp the real picture of the achievements of the project activities.

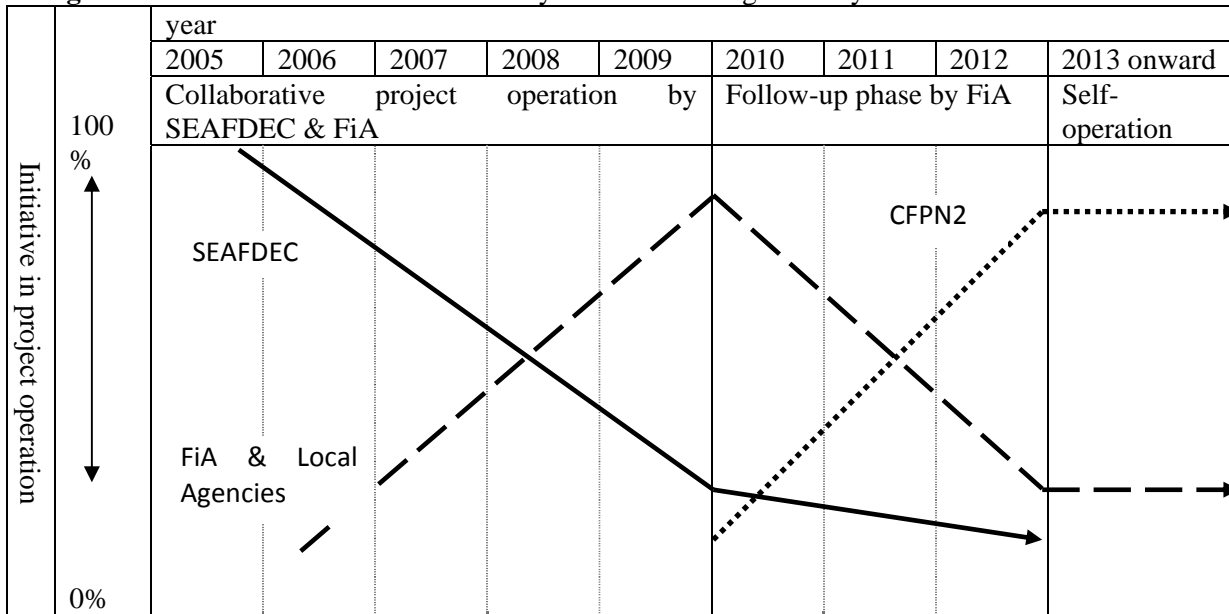
In the last session of the seminar, conclusions, suggestions and recommendations will be finalized for the follow-up stage of ICRM-SV as well as for the future development in the domain of coastal fishery resources management approach in Southeast Asia. Particularly for the latter, these will include 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.

3. Sustainability of the ICRM-SV project

In terms of sustainability of the project activity, this occasion is vital for the CF Prey Nup II (PN2) in particular, as the end party concerned in this self-regulatory fishery resources management regime. As seen in the Fig. 1, the managerial responsibility in the fishery resources management activity introduced by the joint initiatives of SEAFDEC/TD and FiA Cambodia would eventually be shifted from FiA Cambodia to CFPN2 towards the end of the follow-up stage, as stipulated in the Decree and Sub-decree of Community Fisheries in Cambodia. By all means, FiA Cambodia has to continue its involvement in this activity as the supervising and supporting agency after the completion of the follow-up stage.

Considering that the CFPN2 was just organized prior to commencement of the project operation, it might still be premature to leave them walking alone independently without any support, just like in the case of the Pakklong Fishermen's Group of the ICRM-PD project in Chumphon, Thailand, and KPSP of the ICRM-PL project in Langkawi, Malaysia. However, the sustainability of the project activity is the utmost and eternal goal of the project operation and therefore the FiA should exert all efforts to achieve the follow-up stage of the project implementation. In addition, SEAFDEC should continue to provide the necessary follow-up technical support and monitoring of the ICRM-SV project.

Fig. 1 Involvement and initiative in fishery resources management by CFPN2



4. Acknowledgement

Taking advantage of this occasion, on behalf of all the project staff of ICRM-SV, I would like to extend our sincere appreciation to the Fisheries Administration of Cambodia including Kampong Som FiA Cantonment for all the efforts exerted in the implementation of the project for 4.2 years. Special thanks are also offered to the Fisheries Agency of Japan for the financial support to the project operation and the Japanese Embassy in Cambodia for their financial contribution to establish the experimental mud-crab fattening facilities. Also, we are thankful to the JICA Experts for their technical inputs provided to the project operation. 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 target villages in Prey Nup II. Their self-motivation towards the realization of the CBFMR concept and total community development is noteworthy, to which we extend a special appreciation. We wish the newly established Community Fisheries Prey Nup II and various sub-groups like Mushroom Producers' Group, Blood Cockle Fishers Group, Mud-crab Culture Group, Fish Cage Culture Group and Crab Bank Group, all success and prosperity in the future.

INTEGRATED COASTAL RESOURCES MANAGEMENT IN PATHEW DISTRICT (ICRM-PD) CHUMPHON PROVINCE, THAILAND

Ms. Thitiporn Suppanirun

Chumphon Marine Fisheries Research and Development Center (CMDEC), Thailand

I. Introduction

In 2001, The Southeast Asian Fisheries Development Center (SEAFDEC) and the Department of Fisheries (DOF) in Thailand conducted the collaborative pilot project on coastal fishery resources management with the cooperation of the local fishing communities and other stakeholders, community groups and local administrative authorities in Pathew District, Chumphon Province under the auspices of the Japanese Trust Fund 1 (JTF-1).

The Chumphon Marine Fisheries Research and Development Center (CMDEC) served as the core implementing counterpart group and the Chumphon Provincial and Pathew District Offices of Fisheries as the collaborating agencies. The purpose of the project was to establish a practical framework for locally-based coastal resource management by encouraging fishermen's participation, and was supported by the creation of alternative job opportunities in coastal fishing communities.

The collaborative pilot project was initially named the "Locally Based Coastal Resources Management in Pathew District (LBCRM-PD)" which started in 2001 and ended in 2006. This was changed later to Integrated Coastal Resources Management in Pathew District (ICRM-PD) in 2004.

The project site covers an area of approximately 117 km² in Pakklong Sub-District, Pathew District, Chumphon Province. Pakklong Sub-District comprised seven villages with 879 households and a population of 4,152 (Fig. 1). The rural community has been engaged in capture fisheries, coastal aquaculture and agriculture. The various fishing gears used are the Indo-pacific mackerel gill net, squid cast nets with light luring, blue swimming crab gill nets, shrimp trammel net, mullet gill nets, anchovy falling net with light luring, collapsible crab trap and cuttlefish traps, and other kinds of small-scale fishing gear. For aquaculture, the fishers have been engaged in fish cage culture and shrimp farming. Rubber, coconut and palm oil are the other major income sources from agriculture.

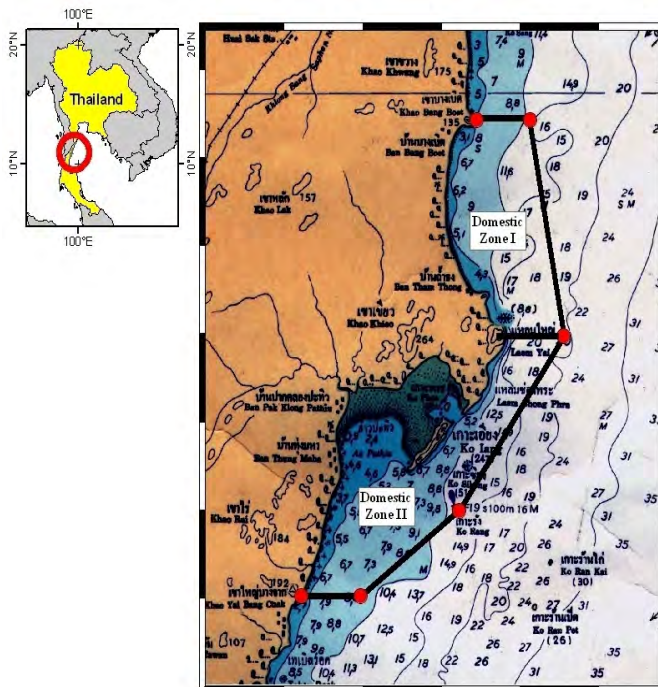


Fig. 1 Location of the ICRM-PD project site

II. Overall objectives

- Establishment of sustainable resource management at local level
- Rehabilitation of the coastal resources
- Alleviation of poverty in coastal fishing communities

III. Activities

The six main activities implemented in the project site are as follows:

3.1 Baseline Survey

In order to obtain the necessary information and data for the establishment of sustainable coastal resource management and community development, the participation of the resource users and stakeholders was promoted. The activity covered four major sub-activities (**Fig. 2**), the results of which are presented below:

3.1.1 Biological Survey

The survey was done to monitor the output of the fishermen in terms of catch per unit effort (CPUE) and identify the composition of the species caught. The local people collected the data daily, which were then handed over to CMDEC for monthly analysis.

3.1.2 Oceanographic and Coastal Survey

This activity was initiated by SEAFDEC/TD, CMDEC and the Chumphon Marine Coastal Resource Research Center. These agencies were involved in the survey, analysis and presentation of results of the status of the coral reefs, sea grasses, and water quality in the project site.

3.1.3 Fishing Ground and Gear Survey

The survey aimed to monitor the fishing ground for each type of fishing gear and the seasonal changes of the gears used by the Pakklong fishermen. The survey was conducted between January 2002 and September 2006 by SEAFDEC/TD.

3.1.4 Socio-economic Survey

The survey was conducted as a household survey in seven (7) villages of the project site in order to record the information into the database that could be utilized to develop an extension program and community development plans suitable for the target groups. The database could also be used by the community in assessing the changes in the community in terms of the number of households, population and occupation, which could be referred to during the evaluation of the project. The survey was conducted between 2002 and 2005 by SEAFDEC and CMDEC.

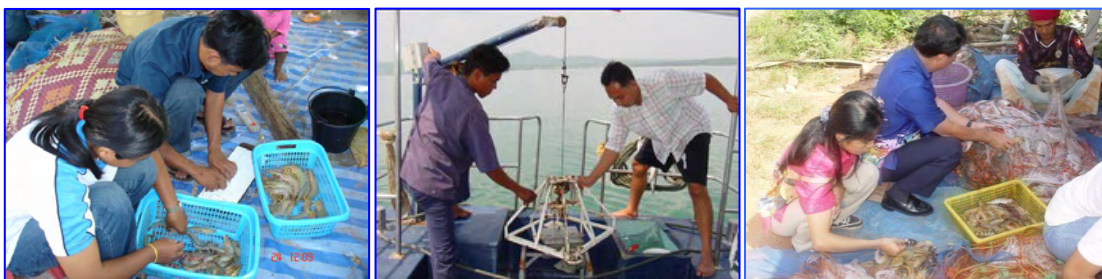


Fig. 2 Biological survey (left), oceanographic survey (center) and socio-economic survey (right)

3.2 Encourage and Extend Community-Based Resource Management

This activity aimed to promote responsible fishing and aquaculture activities as well as the fishers' participation in the monitoring, surveillance and control program of the demarcated coastal zones. This was also intended to enhance the communities' capacity to advance fisheries management among themselves. Three sub-activities were conducted under this activity:

3.2.1 Zoning Arrangements

The project staff, the fishermen, the Pakklong Sub-district Administrative Organization (Ao.Bo.To), and the stakeholders agreed to establish a maritime territorial area in the project site. Thus, the project's prohibited area was ratified on 4 October 2002 through the provincial mandate on the "Prohibition of some fishing gear to operate in the zoned area of Chumphon waters". This led to the banning of trawls, push nets and dredges from operating in the project area. Moreover, the aquaculture area in Tung Maha Bay was also divided into zoned areas (4 zones), namely: area to serve as cruising track of fishing boats, fish cage culture area, shellfish culture area, and monsoon avoidance area (**Fig. 3**).

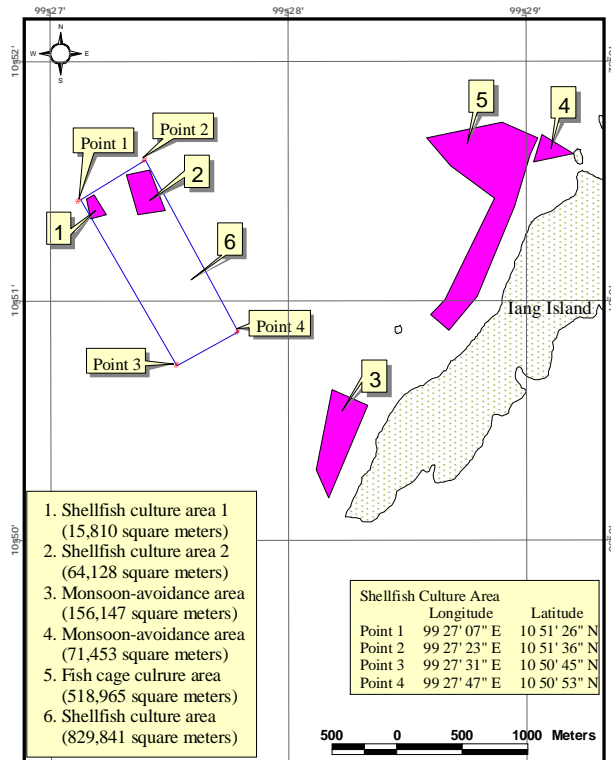


Fig. 3 Map of the aquaculture zoned area

3.2.2 Crab Bank and Mesh-size Control for Crab Traps

Crab bank was used in the study area as a scheme to conserve the crab resources. The fishers solve the decreasing catch of crabs by depositing the gravid blue swimming crabs in the cages of the crab bank. The crabs are allowed to spawn in the cages after which they are sold to the local market. The profit from the sales of the crabs is divided to four parts: 50% as funds for loan of the group, 30% for the cage maintenance, 10% for the feeds of the crabs, and 10% for operating expenses. The fishermen also changed the large mesh size of the bottom (from 1.25 inches to 2.5 inches) of the crab traps, which was more effective as scientifically monitored by the CMDEC for one year (Fig. 4). The result was positive as it showed an increasing trend in terms of the carapace size of the crabs caught as well as the total catch volume even if the data was yet marginal (Table 1). Therefore, the enlarged mesh size resulted in higher benefits in terms of exploitation (Fig. 5). The regulation in controlling the mesh size was adopted by the fishers from this group. Under this program, the fishers' motivation and morale have been very high.

Now there are two crab bank systems adopted at the project site, the crab bank in cages and the Japanese system. The crab bank in cages is operated from March to September while the Japanese system is operated from October to February (monsoon season).



Fig. 4 Crab bank (left) and mesh size control (right)

Table 1: Catch of swimming crabs from 2002 to 2006

Year	Average carapace length (cm)		Total catch (Ton/year)
	Male	Female	
2002	8.6	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

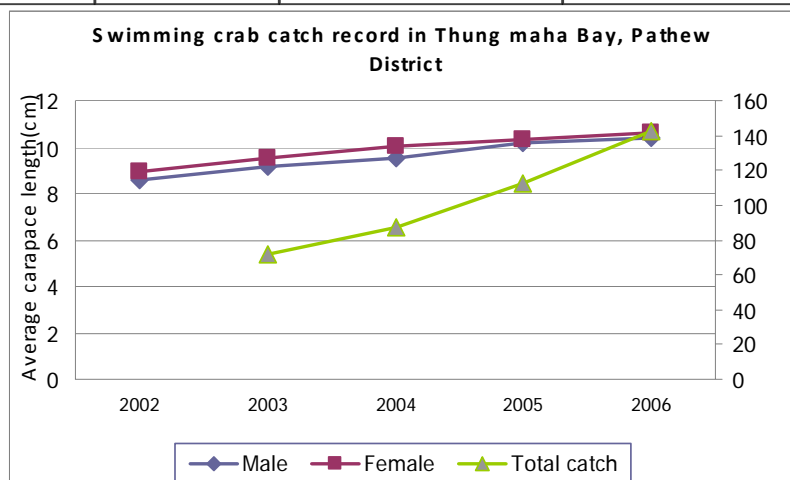


Fig. 5 Total catch of swimming crabs in Tung Maha Bay, Pathew District

3.2.3 Pakklong Fishermen Group (PFG)

The PFG was registered with the Provincial Cooperative Promotion Office with 108 fisher members. The main responsibilities of the PFG are to represent the fishermen in raising problems and discussions on how to solve fisheries problems with the government, find ways in promoting fisheries resource management and conservation, and patrol the project site from illegal fisheries (**Fig. 6**). The PFG was also involved in three activities of the project:

- Providing volunteer manpower for monitoring and surveillance of illegal fishing in the project area with the local enforcement unit participating in the government efforts;
- Participating in fingerlings releasing and mangrove reforestation activities; and
- Establishing the savings – loan funds



Fig. 6 PFG meeting (left), fish releasing (center) and mangrove reforestation (right)

3.3 Encourage local business

In order to reduce over-dependence on the coastal resources, the project encourages and enhances local businesses at the project site outside from capture fisheries. The project assists the people to increase their

household income in two ways: by improving the technologies of handling, marketing and processing fisheries products; and creating alternative job opportunities inside and outside the fishing communities.

3.3.1 Improving the technologies of handling, marketing and processing of fisheries products

The Project assists the people to increase their income by improving the technologies for handling, marketing and processing of fisheries product, and by creating job opportunities outside capture fisheries. The activities also support the “One Tambon One Product” (OTOP) product scheme that the Thai Government has been promoting. In collaboration with the Pakklong Sub-district Administrative Organization (Ao.Bo.To) and other local agencies, the project planned to provide the necessary technology and marketing information to the targeted people.

3.3.1.1 Fish Processing

Fish processing is operated by the women’s group in village No. 1. The members comprised both the fishers and their housewives. Fish processing activity was a good alternative livelihood because adding value to the fish products could lead to better profit (**Fig. 7**). Production is good for this group in terms of fish processing, packing, marketing and accounting system that resulted in the smooth flow of their business.

3.3.1.2 Local Snack and Dried Flower Making

A group of women from village No.4 conducted some activities as alternative livelihoods such as processing *Pan Sep* and *Thong moun* (local snacks), dried flower making, and selling grocery items (**Fig. 7**). The income of the members from this activity was very low may be because they have also been generally fully engaged in the activities in rubber plantations and thus, could hardly afford to spare some of their time for the group work.



Fig. 7 Processed fish products (left) and production of local snack (right)

3.3.1.3 Batik painting

A group of women from village No. 6 produced various batik painted materials like cloths, shirts, T-shirts, bags, and handkerchiefs (**Fig. 8**). The members work for 3-4 hours a day after finishing their own work in the rubber plantations.



Fig. 8 Batik products by the Batik Painting Group

3.3.2 Creation of alternative job opportunities inside and outside the fishing communities

3.3.2.1 Babylonia Shell Culture

Babylonia shell culture was also demonstrated in the project site (**Fig. 9**). The first experiment was conducted for 7 months from August 2005 to February 2006. The result was rather pessimistic

because of the small growth of the shells after three (3) months of culture. The suspected cause was attributed to the unfavorable sea conditions when the monsoon season set in. The second experiment was conducted for 6 months from March to September 2006 during the calmer season, which was an improved way and incorporating the lessons learned through the first experiment. The result was still negative as seen as in the economic calculations. This did not convince the PFG to envisage entering into this venture in the future under the present production results as well as considering the marketing trend of the *Babylonia* shell.



Fig. 9 *Babylonia* shell demonstration culture in the project site

3.3.2.2 Fish Cage Culture with Artificial Feeds

This activity aimed to solve the problem of continuous use of trash fish caught by push nets, for feeds in fish cage culture considering that push nets operations have been prohibited in the project site. The CMDEC cooperated with the fish farmers by demonstrating the use of artificial feeds for sea bass fish cage culture (**Fig. 10**). Although the growth rate of the fishes fed artificial feeds was rather low, the experiment could not be concluded as a failure due to feeds but perhaps due to the water quality or culture technique because the result from giving trash fish feeds could not yet be confirmed.

3.3.2.3 Swimming Crab Culture

The size of the blue swimming crabs caught from crab traps was smaller than the marketable size. The crab trap fishermen and CMDEC agreed to conduct an experiment on crab culture in cages until the crabs reach marketable size (**Fig. 10**). Swimming crab culture was however not suitable for the fishermen because more time must be spent to take care and observe the behavior of the crabs. If the feed was not enough, the strong crabs eat the weak crabs especially during molting. Such benefit therefore made the venture not worthwhile pursuing.



Fig. 10 Fish cage culture with artificial feeds (left) and blue swimming crab culture (right)

3.4 Enhance human resources capability and participation

Participatory training and educational courses were planned and prepared. Preparation of the courses was part of the objectives of Activity II on Establish and Extend LBCFM, and of Activity III: Encouragement of Local Business. 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. Moreover, since 2002 until the present, training courses on the sustainable use of the coastal resources are being arranged for 150 students from five (5) schools in the Project site every year.

3.5 Develop extension methodologies and strengthening the extension system

Extension services are required to develop technologies and their methodologies. Text, manuals as well as visual methods and materials produced from the experiments through the extension and training activities are being prepared and developed. Leaflets, posters, newsletters and calendars have been distributed to schools and the communities (**Fig. 11**). On the overall, 49 copies of published documents containing the results of the project's various activities were produced.



Fig. 11 Leaflets, posters, newsletters Published documents

3.6 Rehabilitate and enhance the coastal resources

This activity was planned and implemented by the DOF, which had allocated a certain amount of budget for the installation of artificial reefs (ARs) around the demarcated coastal zones. Setting up sustainable management and utilization of the resources around the areas of the deployed ARs was also planned as a target activity of Activity II on Releasing fingerlings.

3.6.1 Installation of Artificial Reefs (ARs) and Fish Enhancement Devices (FEDs)

The objectives of installing artificial reefs in the project area are to: (1) increase aquaculture production; (2) increase fishing ground; and (3) prevent illegal fishing activities such as the use of push nets. The DOF installed ARs at the project site from March to April 2004. Two batches of 1750 pieces of concrete cube frames, 1.5x1.5x1.5 m were installed at 12 m depth covering an area of about 2 km². In March 2007, ARs (675 pieces) were also installed in 1 km² area fronting the Ban Thung Maha Bay. In August 2005, SEAFDEC supported the purchase of materials and trained the fishermen on the construction of 10 units of fish enhancing devices (FEDs). The FEDs were installed around the ARs, however, the FEDs were lost 6 months after installation. In July 2006, experiment on the new design of FEDs was conducted (**Fig. 12**).

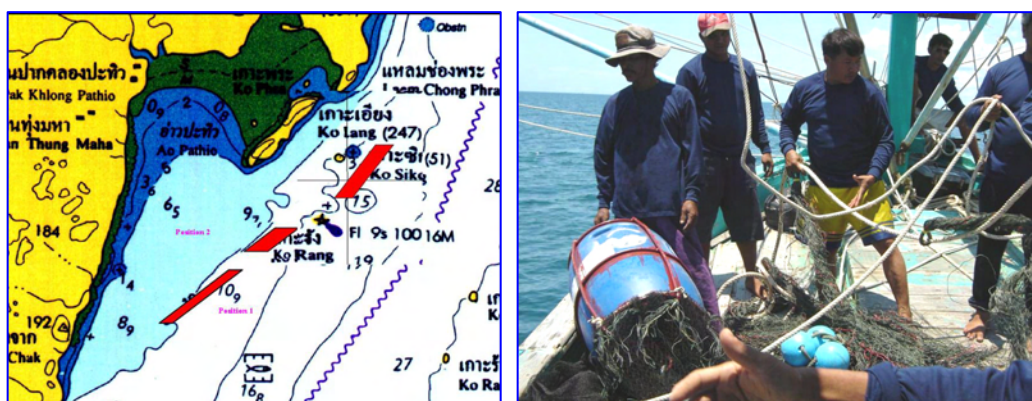


Fig. 12 Map of artificial reefs area (left) and FEDs constructed and installed by fishermen (right)

Since the FEDs design was observed to have some weak points, this was improved for more durability and effectiveness. The FEDs were installed between the groups of ARs, and 4 months after installation, 4 units were lost and disappeared as observed in November 2006. The fishermen expected the FEDs were destroyed by trawl nets or damaged by strong winds and high waves during the monsoon season.

3.6.2 Release of Fingerings and Evaluation of Tagging Technique

The fry and fingerlings that were released were provided by the Chumphon Coastal Aquaculture Station. These included:

- 5,800,000 banana shrimp, size 1-2 cm
- 3,000,000 tiger shrimp, size 1-2 cm
- 161,000 sea bass, size 1-4 inches
- 44,000 blue swimming crabs, size 4-6 cm

Releasing of fry and fingerlings is done by students, teachers, AoBoTo, fishermen, villagers, and staff of CMDEC and SEAFDEC since 2002 until the present. In 2007-2008, tagging technique was used to estimate the number and growth rate of the marine animals in the project site. In 2007 and 2008 releases, 1,000 and 1,968 respectively, of the tagged sea bass size 8.5-12.3 cm (**Fig. 13**) were recovered while 1,128 and 1,000 of tagged banana shrimps size 4.5-9.5 cm were recovered. The biggest tagged sea bass (51 cm) was caught in Thung Maha Bay after releasing for 413 days. The CMDEC provides T-shirts for fishers who return the shrimps/fishes that have been tagged. In addition, capture data collected by fishers indicated that 106 sea bass tagged were caught in Thung Maha Bay and the data were recorded from the shrimp trammel nets.

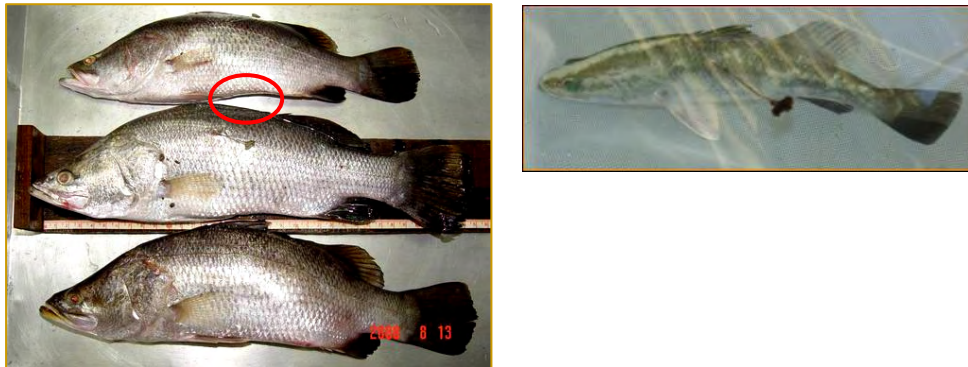


Fig. 13 Tagged sea bass recaptured from Thung Maha Bay

3.6.3 Mangrove Rehabilitation

The Pakklong Fishermen Group, students, teachers, Ao.Bo.To., fishermen, villagers as well as staff of CMDEC and SEAFDEC cooperated in planting 1,000, 2,200 and 500 mangrove seedlings in 2005, 2006 and 2007, respectively (**Fig. 14**).



Fig. 14 Mangrove reforestation in the project site

IV. Final Project Evaluation by the Coastal Resources Institute

The activities of this project were well planned in such a way that every aspect of the issues has been resolved. Baseline survey has been assessed as a very good activity as it provides all the important details needed to identify and prioritize the issues in the project area. The CBRM activities were found to be 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 were also very significant as well, because these provided them with alternative and/or additional sources of income to sustain their daily needs.

More importantly, dissemination of information materials to the local people was a great way to keep them updated with and informed about recent developments and enabled them to identify ways where they can participate and extend help. Lastly, the resource enhancement activities were also 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 observed was the insufficient collaboration between the Ao.Bo.To. and the other agencies involved in the project.

V. Follow-up of on-going project activities

After the completion of the collaboration project between the DOF and SEAFDEC/TD in 2006, the DOF through CMDEC has continuously supported the activities under the project, specifically on the following activities:

5.1 Initiating green mussel culture

It has been observed that in Thung Maha Bay, there is still plenty of green mussel spat. In the past, there was the green mussel bamboo stake culture but it was stopped because this technique was not suitable in this area during the monsoon season. Storm could cause great damage to the culture facilities, while parts of the bamboo stakes that broke became trash in the sea.

Due to the high price of fuel in 2007, the DOF initiated alternative livelihood for the fishers by promoting green mussel culture using rope materials tied on rafts. A group of members under the authority of the PFG undertake this activity with support from DOF which provides the materials for making and setting the rafts. This technique is considered much better than bamboo stake culture because it can reduce bamboo trash in the sea and could not be damaged during the monsoon season as the farmers can easily move the rafts to safer locations during strong winds. Another benefit is the ability of the green mussel rafts to also serve as living-artificial reefs for fishes.

For this activity, the group developed and implemented their self-regulations as follows:

- 3% of income to be provided to the PFG;
- refund 10,000 Baht to the PFG after harvest or 2 years later to be used as capital fund for other members; and
- group members must be members of the PFG.

5.2 Encourage activities of the PFG

The CMDEC provided 30 jackets to the MSC group, which provides volunteer manpower on rotation basis for the monitoring and surveillance of illegal fishing activities in the prohibited area. In case illegal fishing activities are observed in the prohibited area, the MCS group would call the enforcement officers of the local enforcement unit to reprimand the illegal fishers. The DOF also encourages awareness on fisheries conservation for the PFG members. Each year, the CMDEC staff work with the PFG for planning their activities, especially for fingerlings releasing and mangrove planting. For these activities, the DOF is responsible for providing the fingerlings and mangrove seedlings while the PFG is responsible for preparing the spout props, clearing the area, and providing the manpower.

5.3 The crab bank

The crab bank of ICRM-PD is the most popular blue swimming crab conservation system. Each year a lot of students from schools in Pakklong Sub-district and other places come to visit the crab conservation group. Moreover, many people (national and international) also visit the project to learn about the method to be applied in their respective places. The DOF supported the materials for the maintenance of the cages and rafts.

The members take care of recording the daily individual gravid crab donation, weight of the crab and environmental data. The data recorded are used for monitoring the status of the crab resource and crab fisheries in Thung Maha Bay. Once certain irregularities are observed from the monitoring activities or certain fisheries



problems are encountered, the group members would contact the fisheries officer immediately (DOF, Department of Marine and Coastal Resource and TAO) or raise the problems during the discussions in the PFG meetings.

5.4 Training courses for students

Training courses on coastal resources conservation approach for sustainable utilization of resources, for 150 students from 5 schools are conducted every year in the project site. The training courses take place at the King Royal Chumphon Province Project focusing on the coastal ecosystem and fisheries activities. The students also participate in fingerlings releasing and mangrove planting as part of the training course.

5.5 Encourage local business

Fish processing is implemented by village No.1 and the activities are managed by themselves. The products are distributed in the province and surrounding provinces. The activity of women’s group in village No. 4 was sustained by the Office of Small and Medium Enterprises Promotion. Village No.4 is also engaged in batik painting and would produce the products based on the quantities being ordered.

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INTEGRATED COASTAL RESOURCES MANAGEMENT IN PULAU LANGKAWI (ICRM-PL), MALAYSIA

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I. Background

In compliance with the regionalization of the Code of Conduct for Responsible Fisheries under ASEAN-SEAFDEC Fisheries Consultative Group (FCG), SEAFDEC/TD was given the task to coordinate, regulate and implement successful fisheries management-related activities in selected ASEAN member countries under the Japanese Trust Fund (JTF). Malaysia was the second country chosen to implement an ICRM pilot project following the successful implementation of the ICRM-PD activities in Pathew District, Chumphon Province, Thailand since 2001. At the SEAFDEC Program Committee Meeting in 2002, the suitable location for a pilot project in Langkawi, Malaysia was considered for the implementation of the ICRM project. In August 2003, the Locally-Based Coastal Resource Management (LBCRM-PL) program funded by JTF 1 and later JTF 1V and by the Malaysian Government for a duration of four years commenced in the identified and selected local traditional fishing village, Kuala Teriang in Pulau Langkawi (**Fig. 1**), after the site survey conducted by SEAFDEC/TD team of experts with the collaboration and assistance of the Department of Fisheries Malaysia. In December 2004, the ongoing program was disrupted when the project site was devastated and destroyed by the Asian *Tsunami*. After some rehabilitation works, the second phase of the project activities was continued. Eventually in 2005, the project was renamed as the Integrated Coastal Resources Management in Pulau Langkawi (ICRM-PL) whereby the element of Capacity Building of Human Resources and Participation was emphasized. The project was extended until the end of 2007 with successful outcomes and the direct involvement of SEAFDEC was also completed in 2007. **Table 1** shows the implementation scheme of the ICRM-PL project.

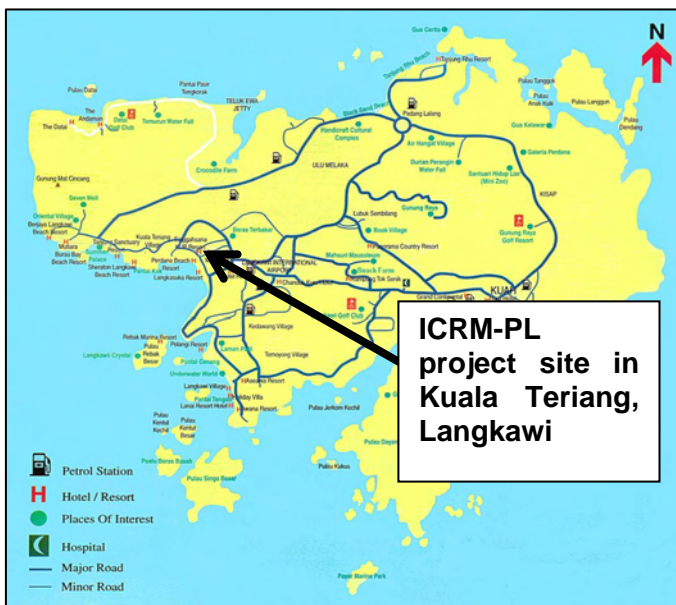


Fig. 1 Map of Langkawi Island, Malaysia

Table 1: Establishment of LBCRM / ICRM-PL

No	Component	Year							
		2001	2002	2003	2004	2005	2006	2007	2008
1	Malaysia	↔							
	FEG (KEN)								
2	LBCRM-PL: 1st phase (JTF-1)			↔					
	ICRM-PL: 2nd phase (JTF-4)					↔			

II. Objectives of the Project

- To provide technical advice and assistance for sustainable development of the coastal fisheries resources for the fishing communities in Langkawi
- To introduce the CBRM approach for the management of fisheries in Langkawi
- To implement a pilot project using CBRM/ICRM approach in Kuala Teriang
- To improve the socio-economic status of the local communities

III. Project Approach and Implementation

3.1 Non-Physical Development

Various methodologies were applied and emphasized in order to obtain valuable information and to study the existing skills, knowledge and strength of the fishers, by the implementing team going to the grounds, listening to the fishers' and stakeholders' views, giving and taking advice by way of training, visiting projects and exchanging information. Besides technical studies like baseline survey, biological and statistical survey and socio-economic data collection by SEAFDEC, human resources capacity building approaches and training programs were jointly conducted by SEAFDEC/TD and the Department of Fisheries Malaysia. Study tours to the ICRM-PD project at Chumphon, Thailand for the men's and women's groups, training on outboard and inboard engines for fishing vessels, fish landing data collection, fishing gear and equipment, training on simple book keeping and accounting for both the men's and women's group (KEN/KEW), construction and installation of FEDs, wooden fishing boat repair using FRP materials, CBFM approach training and study tour to Penang by the men's group, management and implementation of crab bank approach (**Fig. 2**), were carried out.

Besides SEAFDEC/TD, the Department of Fisheries Malaysia also initiated and conducted various training programs such as Motivational programs, Business Development training, Food Packaging, Good Management Practices (GMP), Good Hygiene Practices (GHP), as well as conducted meetings with the Committee Members and study tours to local successful fisheries projects for the members of FRMC (KPSP). A study tour to *Tagal*, river fisheries conservation project in Sabah was conducted in March 2009.



Fig. 2 Training activities under the ICRM-PL project

3.2 Physical Development

Infrastructure development for the FRMC (KPSP) was carried out during the period especially after the Asian *Tsunami* such as construction of the engine workshop and fisheries equipment sales office, fish landing jetty, overhead bridge, monitoring and surveillance office, fish processing plant for women's group, fishermen's workshop; rehabilitation of mangrove area; and the installation of artificial reefs (**Fig. 3**). Equipments and machinery were loaned and supplied to the FRMC to proceed with various activities as scheduled.



Fig. 3 Physical structures at ICRM-PL project

IV. Project Status and Development after Completion of Collaboration

4.1 Zoning Arrangement

The demarcated zone (**Fig. 4**) for gazettement under Section 61 of the Fisheries Act 1985, which is named as “Fisheries Protected Area” was tabled and submitted to the State Planning Economy Unit of Kedah State. Positive sign on the acceptance of the draft is on the way and the Legal Division of DOF Headquarters will be submitting the document to the Minister in charge for approval to be gazetted. Upon gazettement, the DOF with the stakeholders will once again disseminate the information through consultations, dialogues, flyers and conduct training sessions before implementation with the involvement and participation of interested parties.

There has been request from several states in Malaysia to implement this modal on zoning arrangements in their respective fishing areas and one such state which has been notified with near possibility is the Federal Territory Labuan, where the fishing communities share similarities on geographical, social and economical background.

4.2 Establishment of Local Enforcement Unit – Project Site Kuala Teriang

A new Monitoring and Surveillance building with a watch tower was constructed and equipped with communication equipment, binoculars and a cabin for a total cost of RM 50,000. It is being operated by duty officers from the DOF District of Langkawi from 4.00 pm to 8.00 am. Since its inception and functioning (**Fig. 5**), there has been very good response from fishers sighting and reporting on encroachment of trawlers, purse seine’s and monitoring any untoward incidents such as damaging the FEDs and fishing nets.

Coordination and cooperation by enforcement agencies such as the Malaysian Maritime Enforcement Agency (MMEA) or APPM with communities, has been supportive and encouraging. Regular discussions and dialogues with the anchovy purse seine operators are ongoing to prevent encroachments which is still a problem being encountered. Generally, there was a drastic decrease in encroachments for the past 3 years and positive signs of increased catches (Fig. 6) have been observed and heard from the communities including the surrounding fishing villages.

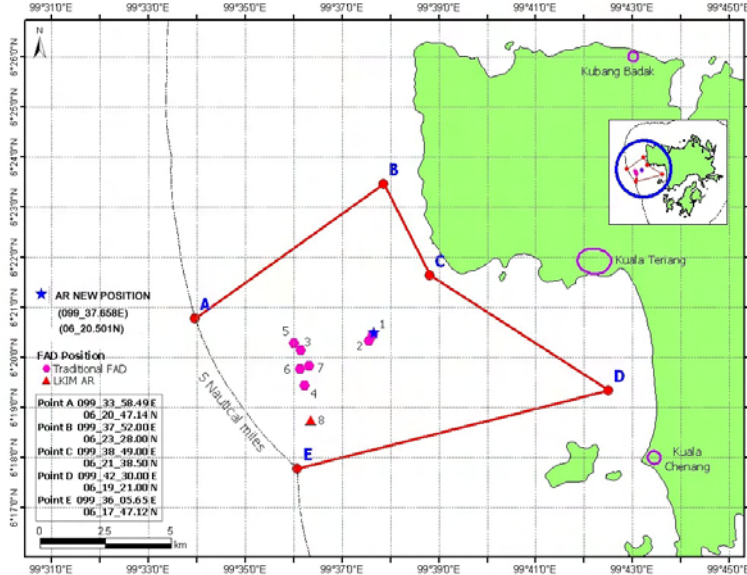


Fig. 4 Fisheries Resources Management Zone and Position of Artificial Reefs and FADs

Table 2: Monitoring and surveillance activity

	2003	2004	2005	2006	2007	2008	2009
COMPLAINTS	30	35	30	25	3	4	3
ARRESTS OF ENCROACHMENT	12	31	36	11	0	0	0



Fig. 5 Monitoring and surveillance office in ICRM-PL Langkawi

4.3 Crab Bank Activity

The catch and release Japanese crab conservation model was introduced upon request by the communities to preserve and protect the natural crab resources, as has also been practiced in Chumphon, Thailand and Sihanoukville, Cambodia. Crab trap methods of harvesting crabs has been less favored by the Kuala Teriang fishers, but harvesting by gill nets was more favorable. The catch and release activity is being continued but no documented records could be provided (Fig. 7). The sub-committee on crab bank is being revamped and reorganized by the main committee to keep the activity going. This program has been recognized by the fishing communities from various areas, and requested for the implementation and practice of similar concepts and aspects on resource management.

One such example is the FRMC (KPSP) at Tanjong Berembang, Penang, which produces giant freshwater prawn fingerlings (seeds) in hatcheries, for marketing and releasing a portion of the fry every production cycle as a

voluntary contribution to the natural resources (rivers). As of 2008, the number of fingerlings released was 127,000. Meanwhile several areas have been identified on request by concerned States to implement the practice of catch and release *crab bank* activities and the DOF Malaysia is taking the initiative to disseminate and implement such model starting in 2010.



Fig. 6 Increase in catches



Fig. 7 Crab bank activities

4.4 Artificial Reefs and FEDs

In addition to the existing artificial reefs and FEDs at the demarcated zone (Fig. 8), DOF Malaysia has increased the installation of artificial reefs (soft bottom) by another 13 units in 2009 at a cost of RM198,000 (Table 3). This was intended to enhance, support and act as a sanctuary; improve fishery resource productivity; and rehabilitate, enhance and conserve the resources beneficial for the communities.



Fig 8: Traditional FADs and soft bottom ARs

Table 3: Total number of FAD's and AR's at demarcated zone

Numbers of FAD's	10
Numbers of AR (LKIM)	3
Numbers of AR, DOF (soft bottom)	29

4.5 Mangrove Rehabilitation Project

Mangrove rehabilitation after the *Tsunami* for protection against natural disasters (**Fig. 9**), gave importance to natural ecosystems and community participation. At end of 2006, more than 12,000 seedlings have been planted but until today, survival and growth have been minimal due to varying factors such as strong waves, accumulation of logs and debris, pollution and diseases. During a recent discussion in December 2009 with FRMC (KPSP) committee members and DOF officials from Kedah State, it was decided to call for a discussion for another suitable and recommended rehabilitation program with the cooperation of the Local council authorities, Forestry Department, Drainage and Irrigation Department, NGO's and DOF as the coordinating agency to further implement the different techniques which will be proposed and recommended.



Fig. 9 Mangrove Rehabilitation Program

4.6 Fish Cage Culture

One (1) unit fish rearing cage comprising 10 compartments was constructed with funding from DOF. The operation was carried out by 4 sub-committee members using a total of 10,000 grouper fry imported from Bali, Indonesia at end of 2008 (**Fig. 10**). Using the *tiger grouper* species, the fish was cultured until marketable size and sold with an estimated profit of RM5,000 during the fasting month. Hence, the participants promised to continue with the second phase, this time the DOF advised them to use their own savings and also by getting loan from FRMC Kuala Teriang. About five percent of initial profit @ RM250.00 was contributed to the Kuala Teriang, FRMC funds.



Fig. 10 FRMC (KPSP) members (fishermen and fish culturist)

4.7 Ice Making and Sale

This activity which supports the fishing community by providing ice blocks to the local fishing vessels is well managed by a committee member and the records of sale and fees contributed to FRMC committee has been done annually based on the sales.

4.8 Fishing Equipment Sale and Engine Workshop

Fishing Equipment Workshop is being outsourced and a monthly rental of RM120.00 is being collected. For the latter a new mechanic interested in operating the workshop is being identified by the committee members of FRMC.

4.9 Fish Processing Activity (Women’s Group)

This activity (**Fig. 11**) has slowed down due to the high costs of raw materials such as dried anchovy and shortage of labor, although sales for the processed product is not a contributing factor. It is also due to the diversification of 3 members into different business activities such as tailoring, food stall operation and other businesses. Discussions with DOF and members resulted in assurance given with the remaining members to proceed with the activity either by employing local workers by the women’s group on a part time basis. Suggestions were made to purchase dried anchovy from mainland or from Thailand. One interesting factor here is confidence building, considering that business related training and exposure have resulted in the capability and ability of 3 women members to go on their own businesses.



Fig. 11 Women’s activity

V. New Activities Proposed for 2010

5.1 FRMC Annual General Meetings - Kuala Teriang)

The Annual General Meeting is scheduled to take place in early February 2010 whereby suggestions and changes in the present committee members could be expected. Meanwhile the State DOF is keeping a close watch by giving useful advice on the strength and future commitment of the organization and its follow-up activities.

5.2 Disposal of Lost Fishing Gear Activity

The DOF has taken into consideration upon request from committee members, to remove the entangled and lost fishing gears at existing FADs and FEDs which is destructive to the fishing environment and damaging the industry. Thus, the DOF is planning to organize an awareness program on “Diving and Removing Entangled Fishing Gears” with the assistance of divers from DOF, local fishermen and interested organizations.

5.3 Human Resource Development Programs

The DOF Malaysia will be carrying out several programs on training and skills enhancement activities, motivational programs and competitions among other FRMC (KPSP) apart from technical training sessions and dialogues with assistance from relevant agencies.

VI. Successful Implementation of Similar ICRM Projects

The successful implementation and concepts introduced through the ICRM-PL project has gained recognition and interests due to the various exposure programs organized by DOF to several states in Malaysia (**Table 4**). Thus, a number of ICRM related models have been created and are successful such as the FRMC Kilim and FRMC Cenang, Langkawi, Kedah; the FRMC Tg. Berembang, Penang; and FRMC Tok Muda, Selangor (**Fig. 12-15**).

Table 4: Number of FRMC (KPSP) Established in Peninsular Malaysia

STATE	PLS	KDH	P.P	PRK	SGOR	N9	MLK	JHR	PHG	TGNU	KLTN	TOTAL
FRMC	0	8	5	3	9	2	5	12	4	12	10	70



Fig. 12 FRMC Kilim - agrotourism



Fig. 13 FRMC Tg. Berembang - releasing of



Fig. 14 FRMC Cenang – recreational



Fig. 15 FRMC Tok Muda, Selangor – cockle sales

VII. Conclusion

The ongoing program will be sustained and the formulation of similar projects will continue to be undertaken in order to establish sustainable coastal resources management, rehabilitate the coastal fisheries resources and assist in alleviating poverty among coastal fishing communities. The ICRM-PL project has created awareness, responsibility, and commitment of the fishing communities and the stakeholders.

The DOF will continue to take a strong and committed approach to maintain its assistance to the ICRM-PL project considering it as a model and pilot project in the region, and playing the lead role to guide and assist in the co-management of the fishery until the community will be able to implement the CBRM measures to manage the fishery resources by themselves.

VIII. References:

- Proceedings on Regional Seminar on Integrated Coastal Resources Management Approach (Review ICRM-PL)
- Department Of Fisheries Kedah

OUTCOMES OF BASELINE AND MONITORING SOCIO-ECONOMIC SURVEYS

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1. Introduction

The Integrated Coastal Resources Management in Sihanoukville (ICRM-SV) project was initiated in November 2005 with emphasis on human resources development under the collaborative operational framework between the Fisheries Administrative (FiA) Cambodia and the Southeast Asian Development Center/Training Department (SEAFDEC/TD). This is the 3rd CBRM project implemented by SEAFDEC. Cambodia was chosen as the site of the third CBRM project considering geographical advantages and the prioritized need for a CBRM approach in the country.

Socio-economic surveys were conducted to collect the baseline information before and after the project implementation. Such surveys are useful in identifying the needs and problems as well as in identifying the future plans to sustain the project. In the ICRM-SV project site, the preliminary baseline socio-economic survey was carried out in Teuk Tla Commune of Prey Nup II in March 2005 to understand the socio-economic conditions in the project operational area and in order to formulate the ICRM-SV project document.

The ICRM-SV project was terminated towards the end of 2009 after 4.2 years tenure. The monitoring socio-economic survey was conducted in Prey Nup II, the project operational area from 9 to 12 February 2009 to assess the conditions of the community. This was considered useful as the changes in the project area during the project implementation could be assessed, and the results of which could also be used as reference during future community development planning exercises.

The results from both surveys were analyzed and compiled into reports dealing with the survey outcomes. This paper summarizes the contents of such reports and focuses mainly on the socio-economic changes occurring during the tenure of the ICRM-SV project.

2. Objectives

The objectives of the baseline survey were to identify the:

- socio-economic status of the fishing community,
- current local practices in coastal resources management and determine their status,
- gender roles and the role of the Community Fisheries (CF) members and their functions to develop community economics and manage coastal resources,
- problems, basic needs and local people's interests in providing appropriate extension services and capacity building in the local people development program, and
- prevailing fishing methods and fishing force for possible classification.

The objectives of the monitoring socio-economic survey were to:

- compare the current socio-economic status of the fishing community with those prior to the commencement of the project,
- compare the current status of adoption of coastal resources management practices with those prior to the commencement of the project,
- compare the current gender roles, functions of the Community Fisheries (CF) and involvement of its member in community economic development and coastal resources management with those prior to the commencement of the project,
- identify the current problems, basic needs and local people's interests in order to verify the improvements made during the project implementation, and
- evaluate the beneficiaries' reaction and perceptions of the project operation for future follow up action.

3. Methodology

3.1 Basic data collection

For this paper, the secondary data from two reference documents were collected, namely: Preliminary Socio-Economic Survey in Commune Teuk Tla, Sihanoukville, Cambodia; and Report on the Monitoring Socio-Economic survey in Commune Teuk Tla, Sihanoukville. These reports contained the results of the baseline and monitoring surveys, respectively.

The baseline socio-economic survey for the ICRM-SV project was conducted from 15 to 17 March 2005 to identify the socio-economic status of the fishing community, the current status of coastal resources management, the role of the Community fisheries (CF) members and their functions. The survey also assessed various concerns such as the basic needs, interests and problems by interviewing 112 fishermen from four villages, namely: Prek Pros, Prek Sanke, Prek Tal and Kampong Chin within Commune Teuk Tla, Prey Nup II.

The monitoring survey was carried out on 9-12 February 2009 to monitor the changes in the socio-economic conditions after the project implementation, compare the current socio-economic status and the current status of adoption of coastal resources management, and evaluate the beneficiaries' reception and perceptions of the project operation. The survey was conducted by interviewing 115 fishermen in the village of Teuk Tla commune, *i.e.* Prek Pros, Prek Sanke, Prek Tal and Kampong Chin.

3.2 Data Analysis

The data collected from the interviews were reviewed and analyzed using descriptive statistics to delineate the socio-economic information in terms of percentages and presented in tables or in matrix format. Tabulation of the data is done in a simple and easy form for better understanding of the socio-economic conditions.

4. Results

Part I: General Information

4.1 The actual size of the sample

The baseline and monitoring surveys were carried out by interviewing 112 and 115 fishermen of the respective sample groups from four villages in Commune Teuk Tla, namely: Prek Pros, Prek Sanke, Prek Tal and Kampong Chin. The average sampling representations based on the number of households for the two surveys were 13.3% and 12.4%, respectively (**Table 1**).

Table 1: Number of households and sample sizes

Village	Population	Households	Respondents	Representation (%)
Baseline survey 2005				
Prek Pros	1,833	317	41	12.9
Prek Sanke	924	201	29	14.4
Prek Tal	779	156	19	12.2
Kampong Chin	1,432	165	23	13.9
Total	4,968	839	112	13.3
Monitoring survey 2009				
Prek Pros	1,871	336	40	11.9
Prek Sanke	1,038	214	31	14.5
Prek Tal	863	183	25	13.7
Kampong Chin	1,088	195	19	9.7
Total	4,860	928	115	12.4

4.2 Age group of fishermen, marital status, family structure, education and occupation

The results of the baseline and monitoring surveys showed that most fishermen were aged between 36 to 45 years old, representing about 41.1% and 29.5% of the respondents, respectively. The percentage of fishermen aged between 16-25 years old engaged in the fisheries sector had increased from 13.4% in the baseline survey to 20% in the monitoring survey (**Table 2**). In addition, the data also indicated that most fishermen in the two surveys were married, representing about 90.2% and 92.1% of the respondents, respectively. Most fishermen in the baseline survey are Buddhists (61.1%) followed by Muslims (37.5%). On the other hand, most of the fishermen in the monitoring survey are Muslims (50.4%) followed by Buddhists (48.7%) as shown in (**Table 2**).

From both surveys, the average number of family members was 6.4 and 4.0, respectively, and it appeared that the average number of household members had decreased. As for their educational level, most fishermen in the two surveys graduated from primary school levels, representing about 53.6% and 78.3% of the respondents, respectively. The percentages of fishermen who have not studied in school decreased from 25.5% in 2005 to 15.7% in 2009.

Most fishermen in the two surveys were engaged in fisheries combined with agricultural activities as indicated by 41.3% and 48.7% of the respondents, respectively. The percentage of fulltime fishermen (32.2%) in the second survey has increased from the first survey (21.7%). Combined occupations with processing have only appeared in the first survey (**Table 2**) but not in the second survey.

Table 2: General information of the fishermen-respondents

Item	Baseline 2005		Monitoring 2009	
	Number	Percentage	Number	Percentage
Age group				
16 - 25	15	13.4	23	20.0
25 - 35	24	21.4	28	24.3
36 - 45	46	41.1	34	29.5
46 - 55	16	14.3	24	20.9
56 - 65	9	8.0	4	3.5
66 - 75	2	1.8	1	0.9
76 - 85	0	0.0	1	0.9
Marital status				
Single	6	5.4	5	4.4
Married	101	90.2	106	92.1
Widow	4	3.6	2	1.7
Widower	1	0.9	2	1.8
Religion				
Buddhist	69	61.6	56	48.7
Muslim	42	37.5	58	50.4
Christian	1	0.9	1	0.9
Family structure				
Average no. of family members	6.4	-	4.0	-
Education				
None	28	25.5	18	15.7
Primary school	59	53.6	90	78.3
Lower secondary school	21	19.1	5	4.3
Upper secondary school	2	1.8	2	1.7
Occupation				
Fisheries only	31	21.7	37	32.2
Fishing & Agriculture	59	41.3	56	48.7
Fishing & Trading	7	4.9	1	0.9
Fishing & Labor	15	10.5	2	1.7
Fishing & Processing	3	2.1	-	-
Fishing & livestock	18	12.6	10	8.7
Others	10	7.0	9	7.8

4.3 Monthly income

Results from the baseline survey in 2005 indicated that the full-time fishermen earned USD 46.8 per month while the part-time fishermen engaged in trading earned the highest income of 72 USD/month. In the monitoring survey, the full-time fishermen earned the highest monthly average income of 103.5 USD followed by the part-time fishermen and fishing combined with agriculture at 87.9 and 85.8 USD per month, respectively (**Table 3**).

Table 3: Monthly income of fishermen-respondents (in USD)

Average income	Occupation							
	Fisheries only	Combination with other profession						
		Fisheries	Agri.	Trading	Labor	Processing	Livestock	Others
Baseline	46.8	34.6	37.5	72.0	14.8	13.8	5.2	18.2
Monitoring	103.5	87.9	85.8	23.8	38.2	-	29.9	18.8

4.4 Ownership of fishing boats and other assets

The average ratios of boat owners in the two surveys were 68.8% and 84.3%, respectively, showing that the percentage of boat owners had increased in the monitoring survey. Most fishermen in both surveys lived in their own homes (97.0% and 93.6%, respectively), they owned land (91.8% and 69.3%, respectively) and also owned farmland (61.3% and 41.9%, respectively), as shown in **Table 4**.

Table 4: Ownership of fishing boats and other assets

Property	Baseline 2005 (%)	Monitoring 2009 (%)
Fishing boat		
Average ratio of boat owner	68.8	84.3
Other assets		
House	97.0	93.6
Land	91.8	69.3
Farmland	61.3	41.9
Cow	32.0	33.9
Buffalo	22.9	16.5
Pig	11.7	7.2
Chicken	15.0	8.6
Motorbike	13.7	20.0
Bicycle	9.5	9.3
other	6.0	0.0

Part II: Engagement in the fisheries sector

4.5 Fishing boat

The results from both surveys showed that the percentages of fishermen engaged in fishing without boats were 28.8% and 15.7%, respectively, indicating that the fishermen engaged in fishing without boats decreased since 2005. The percentage of fishermen fishing with self-owned boats with engine has increased from 18.9% in 2005 to 47.8% in 2009 as shown in **Table 5**.

Table 5: Fishing boats

Fishing boat	Baseline Survey 2005 (%)	Monitoring Survey 2009 (%)
Without boat	28.8	15.7
With engine	18.9	47.8
Without engine	52.3	36.5

4.6 Fishing gear used

The main fishing gears used by the fishermen in the baseline survey were the crab trap (39.1%) and hand push net (31.2%). Results of the monitoring survey showed that the crab trap was favorably used in the fishing operations as indicated by 59% of the respondents. However, none of the fishermen interviewed during the monitoring survey were engaged in mackerel gill net, hand fishing crab, set bag net/stow net or cast net, although these fishing gear were reported in the first survey (**Table 6**). The average catch from mackerel gill net and shrimp gill net in the baseline survey were 20.0 kg and 10.0 kg per trip, respectively. In the monitoring survey, the average catch from hook and line was highest at about 12.0 kg followed by shell hand fishing at 11.4 kg (**Table 6**).

Table 6: Main fishing gear used and the average catch per trip per boat

Fishing gear	Baseline Survey 2005		Monitoring Survey 2009	
	% of fishing gear used	Catch per trip per boat (kg.)	% of fishing gear used	Catch per trip per boat (kg.)
Crab gill net	2.9	4.8	13.1	5.2
Shrimp gill net	0.7	10.0	2.5	2.3
Crab trap	39.1	3.6	59.0	3.9
Fish gill net	7.2	4.3	5.7	5.2
Mackerel gillnet	2.2	20.0	-	-
Mullet gill net	2.9	6.0	4.1	4.0
Hand push net	31.2	3.6	4.9	6.5
Hand fishing of crab	1.4	1.7	-	-
Shell hand fishing	9.4	5.3	9.0	11.4
Hook and line	1.4	-	1.6	12.0
Set bag net/stow net	0.7	8.0	-	-
Cast net	0.7	-	-	-

4.7 Catch distribution

In the baseline survey, 6.4% and 8.1% of the fishermen's catch were used for family consumption and processing, respectively while the remaining catch (85.5%) was disposed for sale. On the other hand, the results of monitoring survey showed that the fishermen disposed of their catch in two ways: family consumption and for sale at 10.9% and 89.1%, respectively, but nothing was for processing. The average fish sale per day by different types of fishing methods varied from 1.0 to 20.0 kg in the first survey and around 1.6-14.8 kg in the second survey (Table 7).

Table 7: Disposal of fish catch and distribution

Disposal	Disposal			Average fish sale (kg.)
	Consumption (%)	For sale (%)	Processing (%)	
Baseline 2005	6.4	85.5	8.1	1.0 - 20.0
Monitoring 2009	10.9	89.1	-	1.6 - 14.8

4.8 Economics of fishing operation per trip (USD)

In the baseline survey, the average net income from using the shrimp gill net was the highest by about 16.5 USD per trip followed by crab gill net (5.8 USD per trip). For the monitoring survey, the fishermen had high net income from hook and line and fish gill net 20.7 and 15.5 USD per trip, respectively (Table 8).

Table 8: Net income of fishermen per trip (USD)

Fishing gear	Baseline Survey 2005			Monitoring Survey 2009		
	Average operation cost (USD)	Average income (USD)	Avg. net income (USD)	Average operation cost (USD)	Average income (USD)	Avg. net income (USD)
Crab gill net	0.8	6.6	5.8	2.0	10.1	8.1
Shrimp gill net	13.5	30.0	16.5	0.5	6.0	5.5
Crab trap	2.1	3.7	1.6	2.1	8.2	6.1
Fish gill net	1.2	3.9	2.7	1.5	17.0	15.5
Mackerel gillnet	1.3	6.0	4.7	-	-	-
Mullet gill net	0.2	3.4	3.2	0.5	6.0	5.5
Hand push net	0.1	3.4	3.3	0.5	4.3	3.8
Hand fishing crab	0.1	2.5	1.4	-	-	-
Shell hand fishing	0.2	1.5	1.3	1.3	2.8	1.5
Hook and line	-	-	-	3.1	23.8	20.7
Set bag net	0.5	1.3	0.8	-	-	-

4.9 Source of fishermen's credit

The results of the first survey indicated that most fishermen (50.9%) lack access to credit although some fishermen were able to access loans from commercial banks and middlemen (at 19.6% each). Only few fishermen utilized the credit scheme from other sources. In the monitoring survey, 28.7% and 23.5% availed of loans from commercial banks and middlemen, respectively, while the remaining 47.8% of the fishermen did not take advantage of any credit system (Table 9).

Table 9: Source of fishermen's credit

Source of credit	Baseline Survey 2005	Monitoring Survey 2009
	(%)	(%)
Without loan	50.9	47.8
Commercial Bank	19.6	28.7
Middleman	19.6	23.5
Others	9.8	-

Part III: Gender role and time devoted to fisheries-related works

4.10 Involvement of women in each fishing engagement

Table 10: Involvement of women in fisheries and household work

Involvement	Fishing gear repair & preparation	Fishing	Fish Trading	Fish processing	Fish culturing	other	laboring	House work
Baseline								
Women (%)	27.7	15.2	17.9	5.4	0	51.8	10.7	93.8
Days	12	16	22	19	0	-	18	30
Hours	3.4	9.0	2.6	4.0	0	-	6.4	7.6
Monitoring								
Women (%)	33.9	12.2	6.1	2.6	1.7	0	0	68.7
Days	14	22	24	11	16	0	0	29
Hours	3.4	7.0	4.2	1.5	1.5	0	0	6.6

Table 10 shows that the fishermen housewives in both surveys (27.7% and 33.9%, respectively) have been engaged in fishing gear repair and preparation. They also go fishing (15.2% and 12.2%, respectively) and spend their time in household work for 6-8 hours a day or around 29-30 days a month.

4.11 Involvement of men in each fishing engagement

Most fishermen (91.1%) in the first survey were engaged in fishing for 8 hours a day or 22 days a month. The fishermen in the two surveys (63.4% and 62.6%, respectively) were involved in fishing gear repair and preparation spending 2-4 hours a day or around 11-18 days per month. About 57.1% and 51.3% of fishermen in both surveys, respectively, were involved in household work for 2-3 hours per day or 20-22 days per month (**Table 11**).

Table 11: Involvement of men in fisheries and household work

Involvement	Fishing gear repair & preparation	Fishing	Fish Trading	Fish processing	Fish culturing	laboring	House work
Baseline							
Men (%)	63.4	91.1	9.8	3.6	0	15.2	57.1
Days	18	22	22	17	0	14	22
Hours	4.0	8.0	1.3	5.0	0	6.5	3.0
Monitoring							
Men (%)	62.6	47.8	1.7	0	0	0	51.3
Days	11	21	24	0	0	0	20
Hours	2.5	7.4	6.5	0	0	0	2.4

Part IV: Fishermen's participation in Community Fisheries (CF) activities or other fishery or community related activities

4.12 Membership in Community Fisheries (CF) and other groups

The country's Community Fisheries was established to delegate the management authority for coastal fisheries to the fishing communities. Most fishermen interviewed during both surveys (about 58% and 80.4%, respectively) were members in the Community Fisheries (CF), showing that the membership in Community Fisheries has increased since the baseline survey. About 21.4% of fishermen interviewed participate in the SEAFDEC project activities of the ICRM-SV (**Table 12**).

Table 12: Membership of Community Fisheries and SEAFDEC Project

Membership	CF membership		ICRM-SV Project	
	Non-member	Member	Non-participation	participation
Baseline 2005	42.0	58.0	-	-
Monitoring 2009	19.6	80.4	78.6	21.4

Part V: Problems, immediate needs and future expectations

4.13 Problems

The main problem reported in both surveys was encroachment by illegal fishing boats, reported by about 76.8% and 51.3%, respectively, followed by the declining fishery resources or fish catch (29.9%). About 12.5% and

13.9% of the fishermen respondents in two surveys, respectively, complained about the lack of medical care facilities in their area (**Table 13**).

Table 13: Problems of the fishermen respondents

Problems	2005 (%)	2009 (%)
1. Encroachment by illegal fishing boats	76.8	51.3
2. Declining fishery resources/fish catch	21.4	17.4
3. Lack of medical care facilities	12.5	13.9
4. Climatic changes	15.2	12.2
5. No water supply system	17.0	8.7
6. Insufficient income to sustain a family	13.4	5.2

4.14 Immediate needs

In the baseline survey, the need to install water and electricity supply system was expressed by 63.4% and 33.9%, respectively. In addition, about 34.8% of fishermen interviewed also indicated the need to construct clinics/hospital. In the monitoring survey, the percentage of fishermen respondents (45.2%) suggested the need for authorities (FiA) to intervene in the prevention of illegal fishing while the need to provide public credit system with low interest and construction of clinics/hospital was expressed by about 18.3% and 15.7% of the respondents, respectively (**Table 14**).

Table 14: Immediate needs of the fishermen respondents

Immediate Needs	2005 (%)	2009 (%)
1. Water supply system	63.4	4.3
2. Construction of clinics/ hospitals with services	34.8	15.7
3. Electricity supply system	33.9	0.9
4. Construction of a toilet in the house	21.4	0
5. Intervention by FiA for preventing illegal fishing	6.3	45.2
6. Public credit system with low interest	0.9	18.3

4.15 Future Expectation

Table 15: Future expectations of the fishermen respondents

Future expectation	2005 (%)	2009 (%)
1. Changing profession to animal husbandry	15.2	0
2. Changing profession to factory laboring	13.4	0
3. Operation with a bigger and motorized boat	11.6	0
4. Continue fishing occupation	10.7	7.8
5. Increasing fishery resources & catches	8.0	22.6
6. Eradication of illegal fishing	0	29.6

Table 15 shows that the fishermen in the baseline survey were willing to change their occupation to animal husbandry and factory labor (15.2% and 13.4%, respectively) while 10.7% of the fishermen offered to stick to fisheries. In the monitoring survey, the fishermen respondents (about 29.6%) expressed their wish to eradicate illegal fishers' invasion followed by rehabilitating the fishery resources in order to improve the fish catch (22.6%).

5. Conclusion

5.1 Most fishermen in the two surveys were aged between 36-45 years old (41.1% and 29.5%, respectively) and the fishermen aged between 16-25 years old engaged in fisheries sector had increased from 13.4% in 2005 to 20.0% in 2009. Most fishermen in both surveys were married and obtained education in the primary school level while the number of fishermen who did not study in school decreased from 25.5% in the baseline survey to 15.7% in the monitoring survey.

- 5.2 The average number of household members in the second survey was 4, a decrease from 6 members in the first survey.
- 5.3 The fishermen in both surveys were mostly engaged in fisheries combined with agricultural activities (41.3% and 48.7%, respectively) further showing that the percentage of the full-time fishermen had increased (from 21.7% in 2005 to 32.2% in 2009) while part-time engagement with processing did not appear in the last survey.
- 5.4 The full-time fishermen in the second survey earned an average income of 103.5 USD per month which was higher than the average monthly income of full-time fishermen in the first survey (46.8 USD). The average monthly income of part-time with combined occupations showed an increasing trend.
- 5.5 The average ratios of boat owners had increased from 68.8% in 2005 to 84.3% in 2009. Most fishermen in both surveys live in their own homes and own the land they were living on.
- 5.6 The number of fishermen using their self-owned boats with engine has increased from 18.9% in the baseline survey to 47.8% in the monitoring survey.
- 5.7 There are 9 fishing gear used in the project area. Most fishermen (about 39.1%) in baseline survey used crab trap for fishing and in the monitoring survey, 59% of the fishermen used swimming crab trap and mud crab trap in their fishing activities.
- 5.8 The fishermen in both surveys disposed their catch for home consumption at low percentages, and majority of their catch were sold (85.5% and 89.1%, respectively).
- 5.9 The fishermen interviewed had high net income of about 20.7 USD per trip from hook and line which was an additional fishing gear in the monitoring survey.
- 5.10 Most fishermen in the two surveys did not avail of any credit scheme, about 50.9% and 47.8%, respectively. The main sources of credit for the fishermen were commercial banks and the middlemen.
- 5.11 The fishermen housewives engaged in fishing gear repair and preparation had increased from 27.7% in 2005 to 33.9% in 2009. The housewives dedicated their time to household work for 6.6-7.6 hours a day or around 29-30 days per month.
- 5.12 The percentage of membership in Community Fisheries has increased to 80% in the monitoring survey compared with 58% in the baseline survey. This indicated more awareness on the part of the fishermen on the importance of their participation and the usefulness of the Community Fisheries.
- 5.13 About 21.4% of fishermen interviewed have participated in the activities of the ICRM-SV project.
- 5.14 The most serious problem that the fishermen indicated in both surveys was “intrusion by illegal or industrial fishing” as expressed by about 76.8% in the first survey and 51.3% in the second survey. They also indicated the need for the government to reinforce control over such intrusion. Moreover, the fishermen were still concerned about the declining fishery resources and environmental degradation.
- 5.15 The urgent need of the fishermen on the improvement of basic infrastructures such as water and electricity supply and construction of clinics/hospital showed a decreasing trend, while the fishermen in the monitoring survey (about 45.2%) put forward the need for authorities (FiA) to intervene in the prevention of illegal fishing which has increased from 6.3% in the baseline survey.
- 5.16 In the baseline survey, the fishermen were willing to change to other occupations like animal husbandry, factory labor, etc. This trend was changed in the monitoring survey where the fishermen set their priority in the eradication of illegal fishers’ invasion and in enhancing the fisheries resources and improving the fish catch (29.6% and 22.6%, respectively).

6. References

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FISH LANDING DATA COLLECTION IN 2006-2009 IN PREY NUP II, SIHANOUKVILLE, CAMBODIA

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

1. Background

Since November 2005, the Integrated Coastal Resources Management in Sihanoukville (ICRM-SV) project was initiated as a collaborative project under the operational framework between SEAFDEC/TD and FiA Cambodia. The project was aimed at introducing the sustainable community-based resources management approach in the community. Fish landing data is the fundamental tool in monitoring the marine biological changes in the project area in order to assess the trend of the fishery resources after the project has been implemented.

Fish landing data collection activity of the project was started in February 2006 to monitor the fishery resources in the fishing ground of the Teuk Thla fishermen. The fish landing data was collected by middlemen who recorded the fish purchased, in logbooks and sent to SEAFDEC/TD for analysis. After the results of the first landing data collected from February 2006 to November 2007 were analyzed, the report was published in December 2007 as the Fish Landing Data in 2006-2007 in Prey Nup II, Sihanoukville, Cambodia. The Fish Landing Data in October 2007-October 2008 in Prey Nup II, Sihanoukville, Cambodia was compiled and analyzed by SEAFDEC/TD and published in April 2009. The training course on fish landing data analysis was conducted in 17-19 February 2009 for Cambodian staff to enable them to analyze the fish landing data after the involvement of SEAFDEC in the project was terminated in the end of 2009, for the sustainability of the project. This report intends to summarize the fish landing data in 2006-2009 in Prey Nup II, Sihanoukville as this could present a picture of the total landing of the fishermen in the project operational area.

2. Objectives

The objective of fish landing data collection was to monitor the fishery resources in Prey Nup II, the project operational area from February 2006-December 2009.

3. Materials and methods

The fish landing data were collected through the middlemen's logbook from the fishing area of the ICRM-SV project site, comprising four villages within Commune Teuk Thla, namely: Prek Sanke, Prek Pros, Prek Tal and Kampong Chin. The main fishing gears used in the project site are crab trap, fish gill net and hand shellfish collection. Therefore the middlemen's logbooks consist of the crab trap logbook that recorded the buying date, number of traps and the weight of catch, and catch logbook for compiling data on buying date, types of fishing gear, main species composition and the catch weight (specifically of the swimming crab, mud crab and other species).

The fish landing data were sent to SEAFDEC/TD for analysis and compilation in terms of catch per unit effort (CPUE) on monthly basis. The average, maximum and minimum CPUE of each fishing gear could be used in monitoring the abundance of the marine resources in the fishing ground of the fishermen in the project site. The fish landing data of this report also refers to the Fish Landing Data in 2006-2007 in Prey Nup II, Sihanoukville, Cambodia and the Fish Landing data in October 2007 - October 2008 in Prey Nup II, Sihanoukville, Cambodia document. The results of this report have shown the CPUE of the main species in each year (2006, 2007, 2008 and 2009).

4. Results and Discussions

4.1 Swimming crab trap

The landing data of swimming crabs were collected from Prek Pros and Prek Sanke village, where most fishermen use 100-700 swimming crab traps. The average fishing hour of the crab trap fishermen in the area was about 10 hours with only 1 operation per day (SEAFDEC/TD, 2006, TD/RES/96). Due to the different fishing grounds being exploited, the CPUE of crab trap for swimming crab was analyzed into three categories, namely: CPUE of fishermen having less than 100 traps, with 100-250 traps and more than 250 traps. The other catch of this type of fishing gear was recorded in low percentage because the fishermen usually keep the other catch for household consumption. Therefore, the CPUE of swimming crab trap was based on weight of swimming crab per 100 traps.

Collection of data on swimming crab started in February 2006, there were no crab trap data from Prek Sanke during March 2006-August 2006 as the volunteer middlemen noted that the crab trap fishermen changed to other fishing gear during that period (Laongmanee, 2007, TD/RP/111).

4.1.1 Number of trap less than 100 traps

Table 1: CPUE (kg/100 traps) of crab traps used by fishermen, less than 100 traps/trip in 2006-2007

Month	2006				2007			
	CPUE (kg/100 traps) of crap trap (Calculate only crab weight)				CPUE (kg/100 traps) of crap trap (Calculate only crab weight)			
	Max	Min	Average	No.of data	Max	Min	Average	No.of data
January					8.0	3.0	6.2	5
February	9.7	1.2	3.0	22				
March	21.3	1.5	9.0	5	21.3	9.6	13.7	3
April								
May								
June					26.3	9.3	16.1	3
July					29.5	10.9	16.0	4
August					12.0	10.9	11.4	2
September	26.3	5.9	11.9	16	16.3	12.5	14.4	2
October	21.3	3.3	9.1	22				
November	19.2	2.5	6.7	31				
December	20.6	1.3	9.1	28				

Note: only few fishermen use less than 100 traps in 2008-2009, the CPUE of this category were not shown in these years

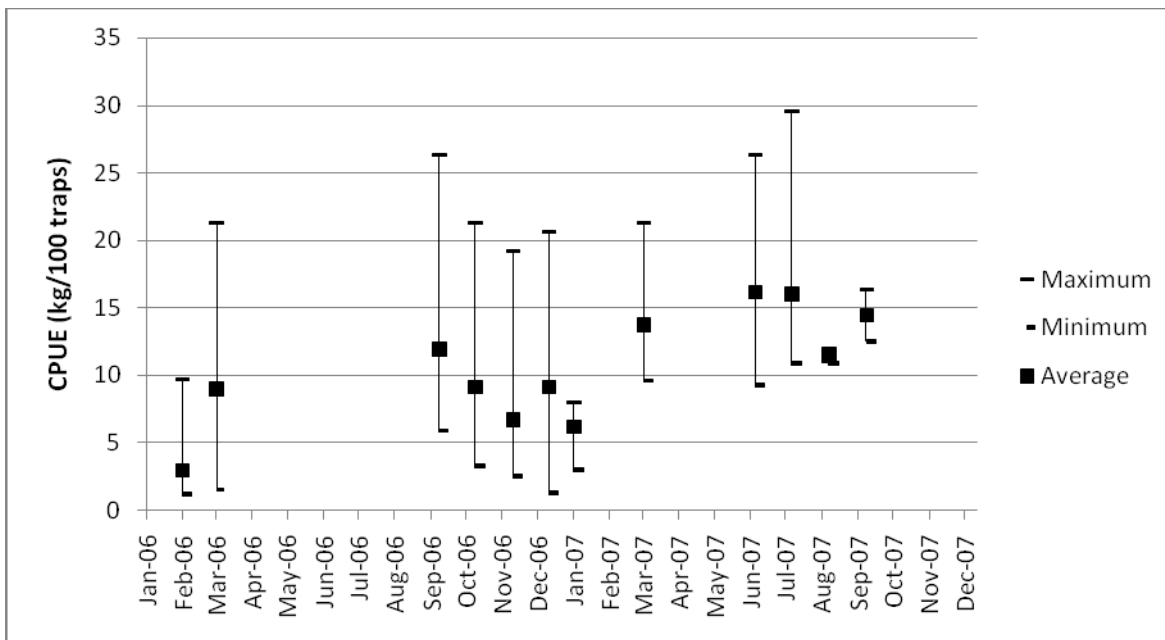


Fig. 1 Maximum, minimum and average CPUE (kg/100 traps) less than 100 traps setting

Table 1 and **Fig. 1** show that the average CPUE of the less than 100 traps in 2006 and 2007 were between 3.0-11.9 kg/100 traps and 6.2-16.1 kg/100 traps, respectively. The average CPUE in 2007 was higher than that in 2006, indicating that the fishermen caught more crabs in 2007 than in 2006. This could be possible because the fishermen have increased the number of crab traps for fishing leading to few fishermen using less than 100 traps in 2008-2009.

4.1.2 Number of traps: 100-250 traps

Since the landing data from November 2008 to August 2009 were not available; the CPUE could not be calculated during this period. For the fishermen use 100-250 traps, the average CPUE were 1.7-3.1 kg/100 traps, 1.6-3.3 kg/100 traps and 1.3-2.3 kg/100 traps in 2006, 2007 and 2008, respectively. For September – December 2009, the average CPUE was 2.4-3.9 kg/100 traps (**Table 2**).

Fig. 2 shows that the average CPUE of 100-250 swimming crab traps was almost constant within 3 years: 2006, 2007 and 2008 while the average CPUE in the end of 2009 was increasing (3.9 kg/100 traps). This could mean that the resource situation in the fishing ground of fishermen using 100-250 traps was the same from 2006 to 2009.

Table 2: CPUE (kg/100 traps) of crab traps used by fishermen, 100-250 traps/trip in 2006-2009

Month	2006				2007				2008				2009			
	CPUE (kg/100 traps) of crab trap (Calculate only crab weight)				CPUE (kg/100 traps) of crab trap (Calculate only crab weight)				CPUE (kg/100 traps) of crab trap (Calculate only crab weight)				CPUE (kg/100 traps) of crab trap (Calculate only crab weight)			
	Max	Min	Ave.	No. of data	Max	Min	Ave.	No. of data	Max	Min	Ave.	No. of data	Max	Min	Ave.	No. of data
Jan					5.2	1.0	2.3	58	2.5	0.2	1.3	146				
Feb	12.5	1.0	2.7	66					5.1	0.8	1.9	93				
Mar	8.3	0.6	3.1	84	8.3	0.6	3.1	76	4.2	0.7	2.0	181				
Apr	6.3	0.6	2.6	50	6.3	0.6	3.3	12	5.6	1.0	1.9	116				
May	7.2	1.3	1.9	41	4.9	0.7	2.3	58	3.8	0.8	2.0	86				
Jun	5.4	0.6	2.1	153	5.1	0.8	1.7	77	5.0	0.7	2.3	54				
Jul	3.6	0.5	2.1	76	5.4	0.8	2.1	26	4.0	0.9	2.1	39				
Aug	4.1	0.5	1.9	58	3.7	0.8	2.0	28	3.6	0.9	2.0	73				
Sep	2.9	0.7	1.7	52	2.3	0.7	1.6	22	3.4	0.9	2.0	65	4.3	1.4	2.4	29
Oct	4.7	0.4	2.2	38	5.6	0.9	2.0	66	4.0	0.7	2.1	42	4.1	0.7	2.4	54
Nov	7.1	0.6	2.4	109	3.7	0.7	2.0	124					6.1	0.6	2.6	79
Dec	6.4	0.6	2.5	118	4.0	0.7	1.9	186					12.0	1.0	3.9	143

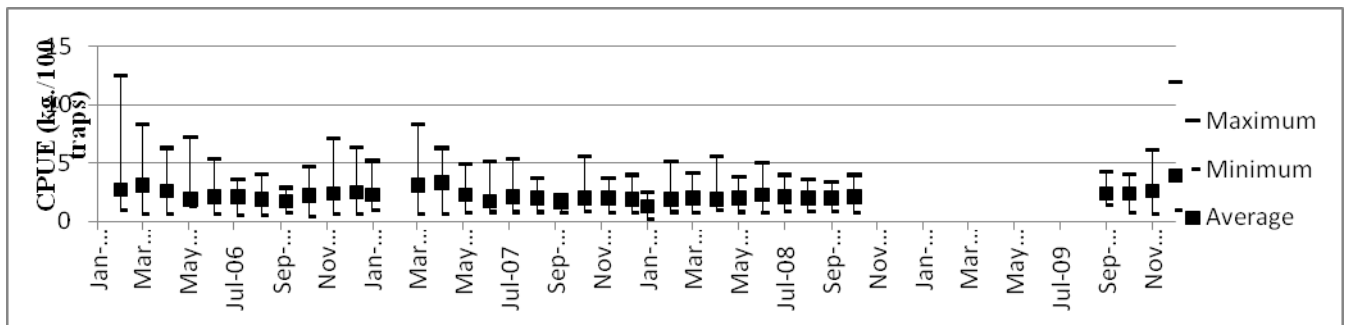


Fig. 2 Maximum, minimum and average CPUE (kg/100 traps) of crab traps, 100-250 traps setting

4.1.3 Number of traps: more than 250 traps

Based on the data in **Table 3** and **Fig. 3**, the average CPUE of the swimming crab traps of fishermen using more than 250 traps in 2006, 2007 and 2008 was 1.1-2.1 kg/100 traps, 1.3-1.7 kg/100 traps and 1.2-2.0 kg/100 traps, respectively. In 2009, landing data was available only 3 months from September to November. The average CPUE of swimming crab trap in 2009 was 1.8-2.1 kg/100 traps. The maximum CPUE of swimming crab trap in July and August 2007 (5.2 and 5.9 kg/100 trap, respectively) was higher than that of the other year. However, the average CPUE of swimming crab trap in each year was observed to follow the same trend.

The fishermen in the project site can operate crab trap whole year round. As shown in **Fig. 4**, low landing weight was observed in April 2007, when the middlemen noted that the fishermen change their fishing gear (Laongmanee, 2007, TD/RP/111). In 2006-2009, the highest landing weight of the swimming crab was recorded in March 2008 at around 1,925.6 kg. The trend of total landing weight of swimming crab in 2006-2008 was increasing. However, it should be noted that the landing data from Prek Sanke in June-October 2008 and also in November 2008-August 2009, were not available.

Fig. 5 shows that a fishermen having 700 traps can catch the same weight of crab compared with fishermen having 100-500 traps, implying that the fishing ground could be relatively limited. Therefore, there is a need for the fishermen to also consider the cost and return of their fishing activity.

Table 3: CPUE (kg/100 traps) of crab traps used by fishermen, more than 250 traps/trip in 2006-2009

Month	2006				2007				2008				2009			
	CPUE (kg/100 traps) of crap trap (Calculate only crab weight)				CPUE (kg/100 traps) of crap trap (Calculate only crab weight)				CPUE (kg/100 traps) of crap trap (Calculate only crab weight)				CPUE (kg/100 traps) of crap trap (Calculate only crab weight)			
	Max	Min	Ave.	No. of data	Max	Min	Ave.	No. of data	Max	Min	Ave.	No. of data	Max	Min	Ave.	No. of data
Jan					2.4	0.5	1.4	25	2.6	0.4	1.3	158				
Feb	2.1	1.6	1.8	7					2.1	0.2	1.2	96				
Mar	3.5	0.2	1.4	97	3.5	0.2	1.4	97	3.2	1.1	1.8	145				
Apr	3.3	0.3	1.8	35	3.3	0.3	1.7	21	2.3	0.9	1.7	151				
May	2.7	1.3	1.9	41	3.7	0.4	1.6	127	2.7	0.4	1.7	156				
Jun	2.8	0.8	2.1	58	4.3	0.7	1.6	134	2.9	0.6	1.9	82				
Jul	3.1	0.5	2.1	32	5.2	0.4	1.6	113	3.0	0.8	2.0	122				
Aug	3.0	0.3	1.6	54	5.9	0.4	1.5	108	2.7	0.4	1.7	153				
Sep	2.5	0.8	1.5	45	2.6	0.4	1.4	107	2.7	0.4	1.7	137	2.6	0.8	2.0	81
Oct	2.4	1.3	2.0	11	2.7	0.2	1.3	108	2.8	0.6	1.9	68	2.3	0.3	1.8	66
Nov	3.1	0.5	1.1	17	2.4	0.4	1.7	104					2.9	1.6	2.1	84
Dec	2.5	0.6	1.3	55	2.3	0.6	1.6	141								

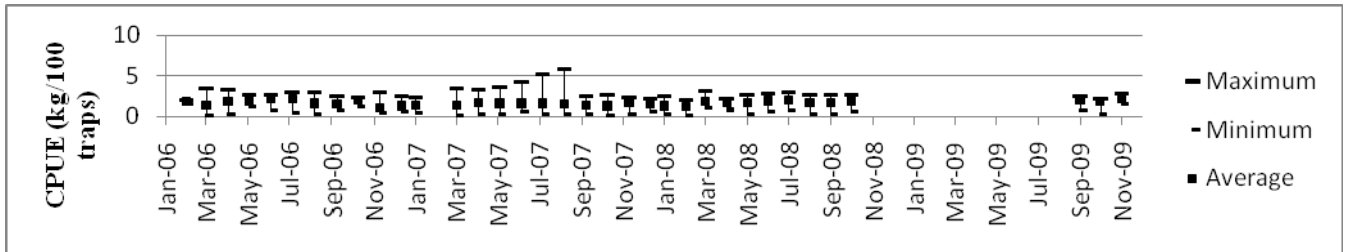


Fig. 3 Maximum, minimum and average CPUE (kg/100 traps) of crab traps, more than 250 traps setting

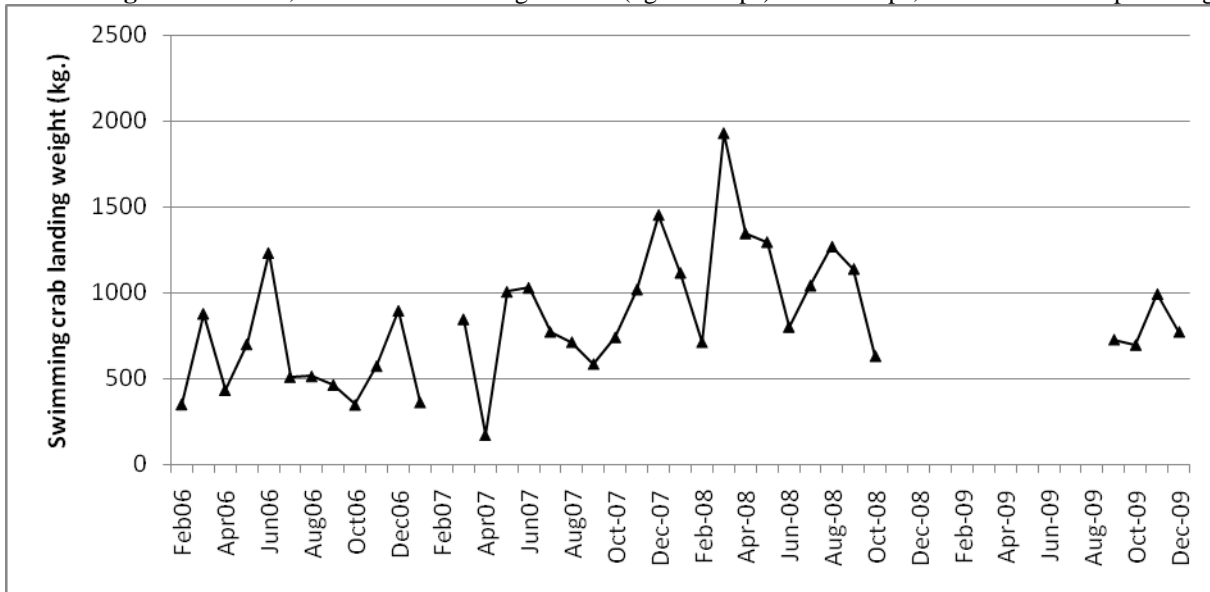


Fig. 4 Total monthly swimming crab landing weight

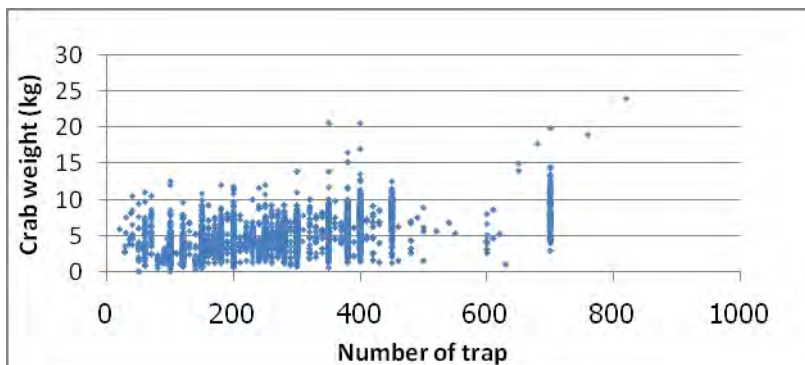


Fig. 5 Crab weight versus number of traps used in each fishing trip

4.2 Mud crab trap

The landing data of mud crab were collected from Kampong Chin village. The fishermen go fishing by setting the traps with bait in the mangrove areas. The marketable size crabs are sold in the market near the village while the small sizes are sold as seeds for culture (Laongmanee and Boros, 2006). The data showed that the number of traps used by fishermen in 2008-2009 had increased by 50-80 traps from 25-55 traps used in 2006-2007. The CPUE of mud crab trap in this report was calculated based on weight of the mud crab in kilograms per 50 traps.

The average CPUE was high in January 2007 and 2008 at about 10.5 kg/50 traps and 11.9 kg/50 traps, respectively and in February 2008 the CPUE was 11.7 kg/50 traps. This seemed to indicate that high CPUE was attained during the dry season (January to February, **Table 4** and **Fig.6**). In May and June 2006, the volunteer middlemen noted that the fishermen collected mud crab by hand therefore, those data are not included in **Fig.6**, which considered only the CPUE of the crab trap. The average CPUE of mud crab in 2006-2008 was not much different, which means that the resource situation in the fishing ground of fishermen using mud crab trap was the same from 2006 to 2008. However, since the landing data on May-October 2006 and November 2008-July 2009 were not available, calculation of the CPUE during such period was not undertaken.

Table 4: CPUE (kg/50 traps) of crab traps for mud crab in 2006-2009

Month	2006				2007				2008				2009			
	CPUE (kg/50 traps) of crap trap (Calculate only crab weight)				CPUE (kg/50 traps) of crap trap (Calculate only crab weight)				CPUE (kg/50 traps) of crap trap (Calculate only crab weight)				CPUE (kg/50 traps) of crap trap (Calculate only crab weight)			
	Max	Min	Avg.	No. of data	Max	Min	Avg.	No. of data	Max	Min	Avg.	No. of data	Max	Min	Avg.	No. of data
Jan					18.7	5.2	10.5	39	15.5	6.6	11.9	30				
Feb	11.5	0.4	3.9	35					15.4	6.6	11.7	25				
Mar	5.8	0.6	2.1	60					8.7	2.5	4.4	30				
Apr	2.4	0.7	1.3	13	9.3	2.5	5.3	28	7.0	1.9	4.0	30				
May					8.3	1.7	4.7	30	7.1	2.5	4.1	30				
Jun					7.5	2.5	4.9	29	4.6	1.3	3.2	30				
Jul					6.2	1.5	3.8	25	5.9	2.4	4.1	30				
Aug					11.9	0.3	2.6	61	6.0	1.9	3.9	31	3.9	1.3	2.8	30
Sep					11.9	0.3	1.9	30	6.0	2.3	3.8	30	4.3	1.6	3.0	30
Oct					6.4	1.9	4.1	31	4.9	2.4	3.6	30	1.6	0.8	1.1	4
Nov	8.1	3.1	4.9	7	5.6	1.9	3.8	30					4.8	0.3	1.8	15
Dec	12.5	1.3	5.8	32	6.8	2.5	4.2	31								
Average	8.1	1.2	3.6	29.4	8.2	1.7	3.9	32.8	7.3	2.6	4.8	29.6	3.7	1.0	2.2	19.8

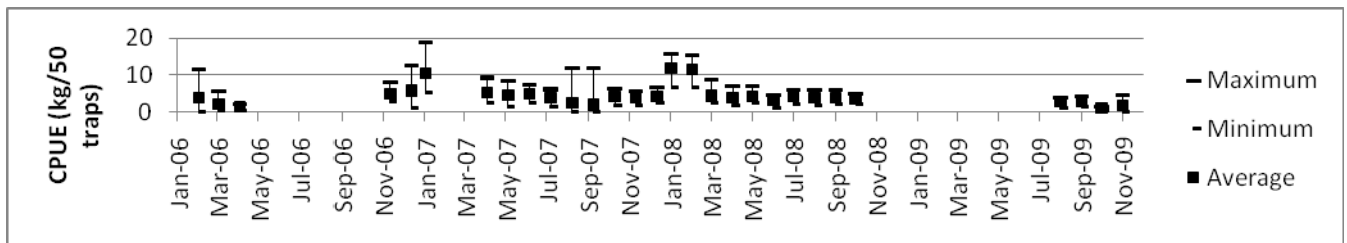


Fig. 6 Maximum, minimum and average CPUE of mud crab trap in Kampong Chin village

4.3 Shellfish collection by hand

There are two kinds of bivalves that the fishermen collect from the fishing area in the project site, namely: the marsh clams and blood cockles. Volunteer middlemen buy marsh clams from Prek Tal and Prek Sanke villages. However since April 2007, the middlemen in Prek Sanke bought blood cockles instead of the marsh clam. Most of the bivalves were collected by hand by women and sometimes children were also involved in bivalve collection on weekend and also during vacation (Laongmanee, 2007, TD/RP/111).

Thus, this report considers only blood cockle data because the middlemen did not record the other bivalve species. The CPUE of blood cockle was calculated based on kilogram per day in order to monitor the current situation and trend of blood cockle resources in the project operational area.

Blood cockle

The landing data collection of blood cockle started in Prek Sanke in April 2007. The blood cockle habitat is the muddy bottom in a bay or mangrove area. The fishermen can collect blood cockles by hand during low tide.

Table 5 and **Fig. 7** show that the average CPUE of blood cockle in 2007 and 2008 were 1.6-4.9 kg/day and 1.3-2.5 kg/day, respectively. The highest average CPUE of blood cockle was observed in October 2009 (15.4

kg/day). The trend of CPUE was increasing in 2009, even if the data of CPUE in 2009 was available for September-December only.

Table 5. CPUE (kg/day) of Blood cockle by hand

Month	CPUE(kg/day)			
	Maximum	Minimum	Average	Number of data
Apr-07	51.0	0.4	3.3	207
May-07	66.0	0.3	3.8	407
Jun-07	57.0	0.4	4.9	284
Jul-07	17.0	0.5	3.2	140
Aug-07	28.0	0.5	2.6	128
Sep-07	2.7	0.2	1.6	50
Oct-07	5.4	0.5	2.1	141
Nov-07	3.2	0.4	1.7	98
Dec-07	6.0	0.4	2.3	167
Jan-08	6.6	0.6	2.2	110
Feb-08	3.2	0.4	1.6	102
Mar-08	6.5	0.3	2.3	108
Apr-08	8.7	0.2	2.2	267
May-08	9.2	0.4	2.5	126
Jun-08	5.0	0.5	1.9	165
Jul-08	6.9	0.6	1.9	39
Aug-08	4.7	0.5	1.8	39
Sep-08	2.8	0.4	1.3	22
Oct-08	4.8	0.5	2.2	47
Sep-09	19.2	0.5	8.5	17
Oct-09	48.0	1.1	15.4	23
Nov-09	21.8	3.5	11.0	18
Dec-09	20.0	1.8	5.9	28

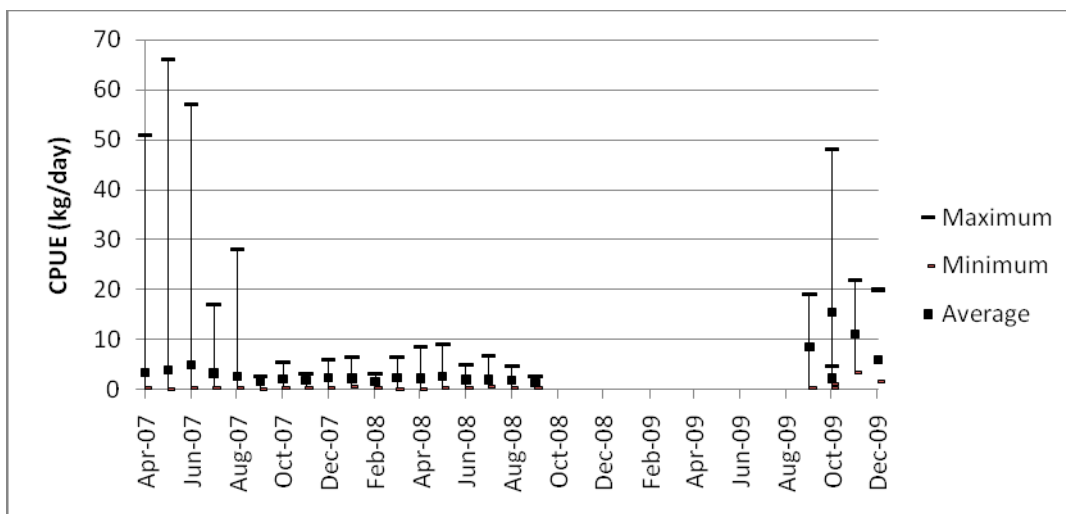


Fig. 7 Maximum, minimum and average CPUE (kg/day) of blood cockle collected by hand

5. Conclusion

Landing data collection is one of the main activities under the Integrated Coastal Resources Management in Sihanoukville (ICRM-SV) to monitor the marine biological changes along with the project implementation by using the middlemen's logbook with data collected from February 2006 until December 2009 and sent to SEAFDEC/TD for analysis. The CPUE calculation was used to indicate the abundance of the marine resources in the fishing ground.

The result of this activity found that the fishermen used small number of crab traps to harvest the swimming crab resources, showing a good sign that the swimming crab resource is still not depleted. Moreover, it was also observed that the average CPUE of fishermen using 100-250 traps and more than 250 traps was consistent respectively, indicating that the swimming crab resources in fishing ground have not yet declined. Likewise for mud crab, the average CPUE was constant while high CPUE of mud crab was observed during the dry season (January and February). For blood cockle, the CPUE of collecting blood cockles by hand showed increasing trend by the end of 2009.

Nonetheless, landing data collection is still faced with the problem of continuity and reliability of data which led to some difficulty in monitoring the fishery resources. To address such constraint, SEAFDEC/TD organized a training course on Fish Landing Data Analysis for FiA staff, who would take charge of this activity, in order to advance further the sustainability of the project.

Finally, the trend of fishery resources in the project operational area has not changed much from the time the project was started. The ICRM-SV project has conducted various activities to enhance and rehabilitate the coastal resources such as the establishment and management of Fish refugia and Crab Bank in April 2008. These activities will support the development of sustainable coastal fisheries management in Prey Nup II, Sihanoukville, Cambodia in the future.

6. References

- Laongmanee P., Boros Y. and Chantana Y. 2007. Fish Landing Data in 2006-2007 in Prey Nup II, Sihanoukville, Cambodia
- SEAFDEC/TD. 2009. Bi-annual Project Progress Report of Integrated Coastal Resources Management in Sihanoukville (ICRM-SV) January-June 2009
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MARINE BIOLOGICAL RESEARCH IN BLOOD COCKLE

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I. Introduction

The Integrated Coastal Resources Management project in Sihanoukville, which was started in November 2005, is a collaborative project between Southeast Asian Fisheries Development Center (SEAFDEC) and the Fisheries Administration (FiA) of the Kingdom of Cambodia, and aimed at promoting sustainable fisheries management. Fish *refugia* was therefore established for the management for blood cockle fisheries and conservation. For the formulation of the self regulatory measures for blood cockles in the fish *refugia* area, it was deemed necessary to obtain the biological data and abundance of blood cockles in the area. Therefore, a research study on the gonad development of blood cockles was conducted in Prey Nup II, and the abundance and distribution surveys for blood cockles in the fish *refugia* were also carried out.

II. Results of the study on gonad development of blood cockles conducted in Prey Nup II

The one-year research study on the gonad development of blood cockles was conducted from April 2008 to February 2009 in Prey Nup II, Sihanoukville. Every two months, 20 and 60 samples of blood cockles were collected and analyzed by histological and condition index methods. Sample collection in October was however, postponed to November because of traveling problems.

2.1 Histological Collection

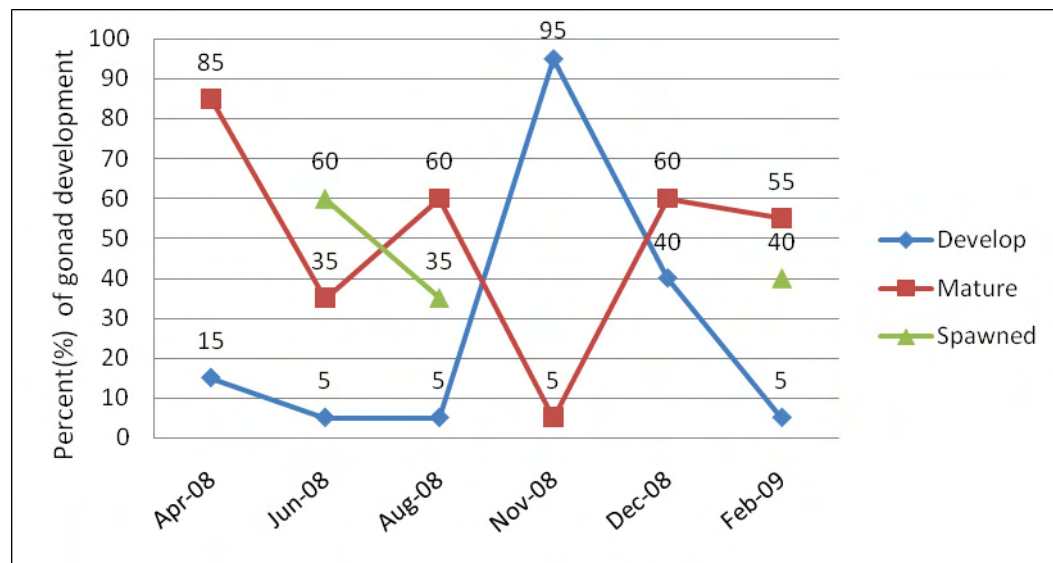
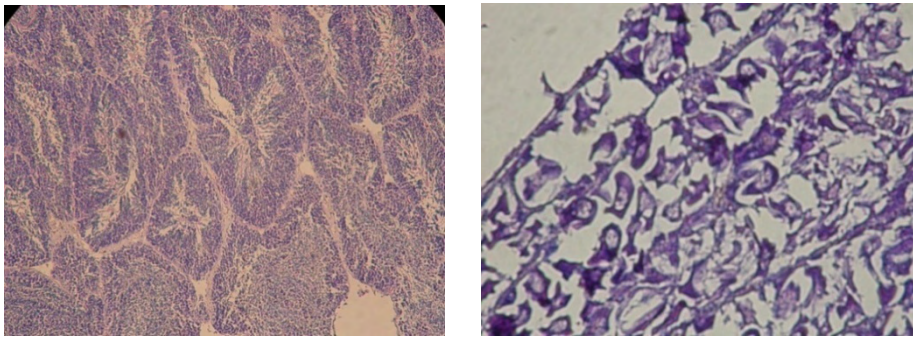


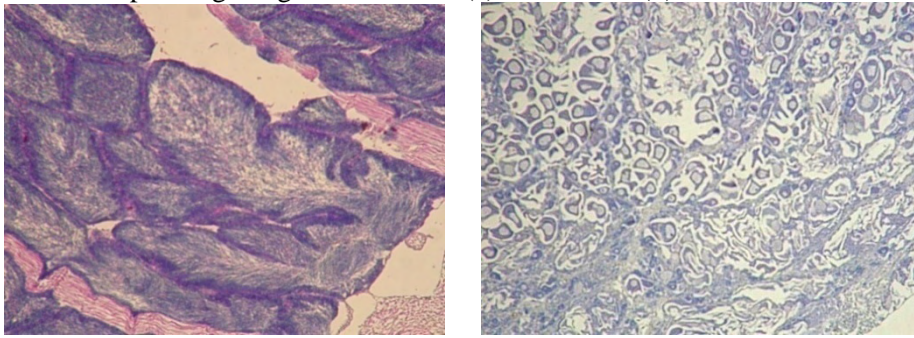
Fig. 1 Development of blood cockle gonads

Using the microscope, the samples collected in April 2008 indicated that 85% of the blood cockles had mature gonads while 15% had developing stages on the average (Fig. 1). In June, 60% of the cockles had spawned (with spent gonads), mature (35%) and developed (5%). In August, 60% of the samples were mature, 35% spawned and 5% with developed gonads. In November, 95% had developed gonads while 5% were mature. In December, 60% were mature and 40% had developed gonads. Finally in February 2009, 55% of the blood cockles were mature, 40% spawned and 5% developed (Fig. 2).

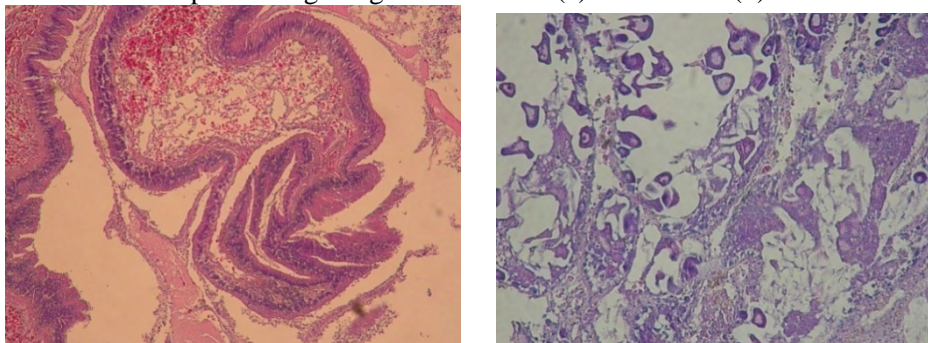
Fig. 2 Microscopic pictures of the development of gonads in blood cockles



1. Developed stage in gonads of male (a) and female (b) blood cockles



2. Mature development stage in gonads of male (a) and female (b) blood cockles



3. Spawned stages of gonads in male (a) and female (b) blood cockles

2.2 Condition index

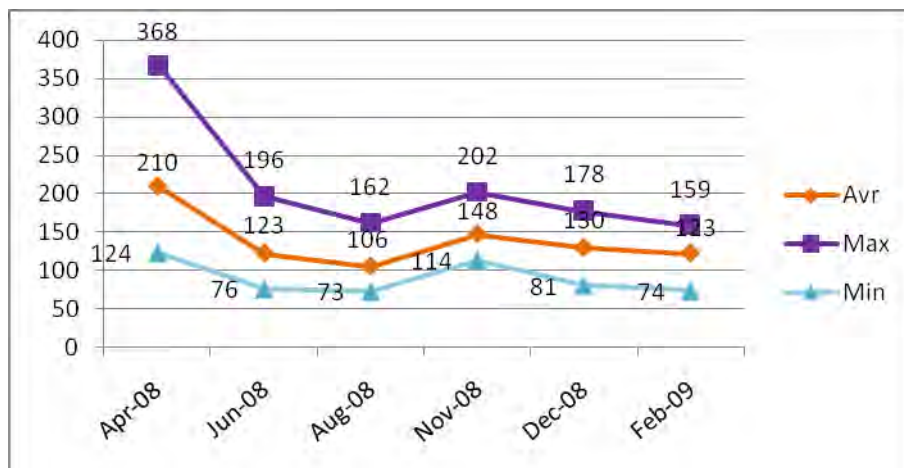


Fig. 3 Condition index of the gonads of blood cockles

Analysis using the condition index was conducted to support the histological method. The rapid declining of the stage of the gonads indicated the spawning period. **Fig. 3** shows low condition indices which averaged in June, August and February. This concurred with the results of the histological collection.

Based on the results of the experiment, there are two spawning periods in one year for blood cockles in Prey Nup II, *i.e.* June to August and February. In summary, harvesting for blood cockles could be allowed only during April to May and September to January.

III. Results of abundance and distribution survey for blood cockles in the fish refugia

3.1 Abundance

As shown in **Table 1**, sampling of the blood cockles was conducted for one year. Samples were collected every two months by the project staff and fishermen. However, the necessary data were collected only 5 times, because of traveling problems. As shown in Table 1, the number of blood cockles was high in April because sampling was done during the low tide and many people assisted in the collection. For another month, collection was not as lucky because it done during the high tide and not many people came to help in the collection. The data showed that the biggest size of blood cockle was found in February and smallest size in August.

Table 1. Catch per unit effort (CPUE) of blood cockles in Prey Nup II, Sihanoukville

Month	Sampling site	Sample size (pc)	Length (mm)			Weight (g)		
			Maximum	Minimum	Average	Maximum	Minimum	Average
Apr-08	1	51	27.3	17.80	22.90	6.25	1.73	3.96
	2	83	26.0	11.20	21.92	5.73	1.98	3.78
	3	39	36.0	18.70	22.98	17.24	2.05	4.31
	4	61	27.3	16.00	22.67	5.58	1.65	4.09
	Total of sampling	234						
Jun-08	1	2	35.0	20.00	26.00	24.0	15.0	19.0
	2	3	25.0	23.00	24.00	16.0	15.0	16.0
	3	2	25.0	23.00	24.00	18.0	15.0	17.0
	4	4	32.0	23.00	27.00	20.0	15.0	17.0
	Total of sampling	11						
Aug-08	1	6	25.0	21.00	24.00	16.0	13.0	15.0
	2	5	26.0	22.00	24.00	15.0	13.0	14.0
	3	6	28.0	26.00	22.00	18.0	15.0	17.0
	4	0	0.0	0	0	0	0	0
	Total of sampling	17						
Dec-08	1	5	34.0	26.00	30.00	16.00	7.00	11.40
	2	9	37.0	21.00	36.00	17.00	7.00	11.70
	3	2	45.0	37.00	28.00	31.00	16.00	23.50
	4	0						
	Total of sampling	16						
Feb-09	1	3	37.0	26.00	30.00	20.00	8.00	12.00
	2	3	45.0	34.00	39.00	32.00	16.00	23.00
	3	2	42.0	41.00	42.00	27.00	26.00	26.50
	4	1	49.0	49.00	49.00	33.00	33.00	33.00
	Total of sampling	9						

3.2 CPUE

Table 2: CPUE reported by four enumerators from July 2008 to December 2009

Month	No 1	No 2	No 3	No 4
Jul-08	0.3	0.2	0.7	
Aug-08		0.4	0.7	0.2
Sep-08	0.2	0.3	0.3	0.2
Oct-08	0.4	0.5	0.3	0.3
Nov-08	-	-	-	-
Dec-08	-	-	-	-
Jan-09	-	-	-	-
Feb-09	-	-	-	-
Mar-09	-	-	-	-
Apr-09	-	-	-	-
May-09	-	-	-	-
Jun-09	-	-	-	-
Jul-09	-	-	-	-
Aug-09	-	-	-	-
Sep-09	0.5	0.3	0.2	0.2
Oct-09	0.6	0.2	0.3	0.2
Nov-09	0.5	0.3	0.3	0.2
Dec-09	0.5	0.3	0.6	0.4

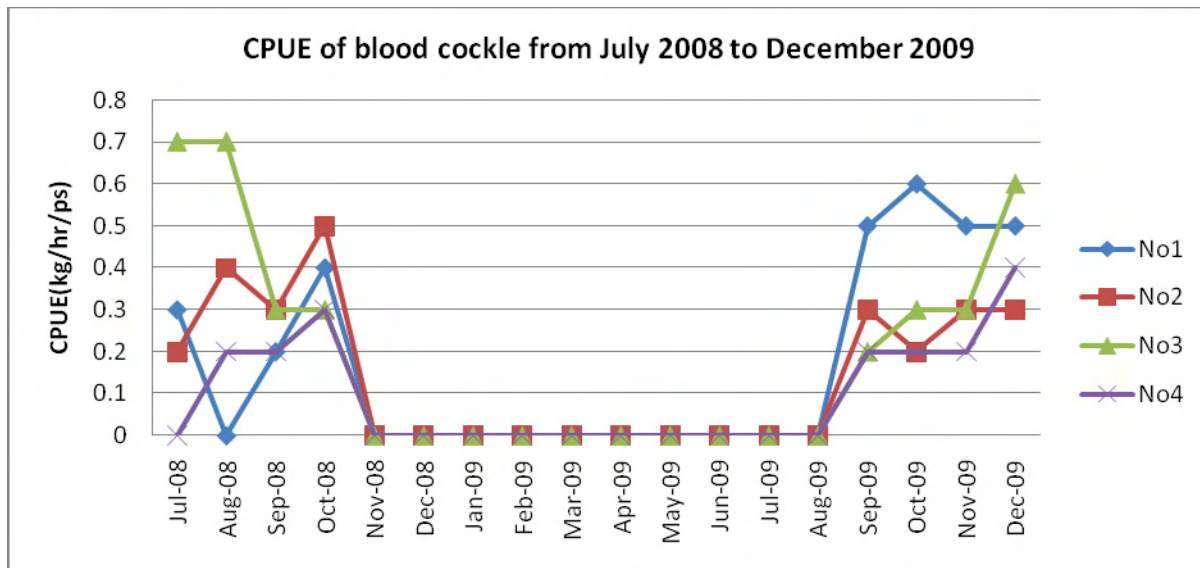


Fig. 4 CPUE of blood cockles from 4 enumerators

*No 1= first middleman

*No 3= third middleman

*No 2= second middleman

*No 4= fourth middleman

The data on CPUE obtained by four (4) enumerators in Prey Nup II is shown in **Table 2** and **Fig. 4**. The trend of the CPUE of blood cockles in the fish *refugia* area was taken from the CPUE data obtained from July 2008 to December 2009. It should be noted that from November 2008 to August 2009, the data was not obtained from enumerators as could be seen from the graph has been going down to zero.

The CPUE did not show any differences each month, with the maximum CPUE at 0.7 kg/hr/person and minimum at 0.2 kg/hr/person. From this data therefore, the CPUE of blood cockles in the area is 0.2-0.7 kg/hr/person. Comparing the trend in two years (September-November), the CPUE did not show much difference.

IV. Conclusion

The result of gonad research showed that spawning season of blood cockles could be in June to August and February. However, conclusion on the abundance of blood cockles in fish *refugia* area could not be made because of inconsistent data collected during the abundance survey. Nevertheless, the CPUE was more or less in the same range during the two year data collection period compared with CPUE data from the fishermen.

The results of the gonad research can support the restriction of harvesting the size of the blood cockles, as follows:

- Juvenile blood cockles, over 100 pc/ kg or less than 10 g/pc in weight or less than 32 mm x 22 mm (L x H) in size all year round
- Broodstock cockles, less than 50 pc/kg or over 20 g/pc in weight or over 40 mm x 28 mm (LxH) in size during one month in August (spawning season)

Moreover, considering that blood cockles have long spawning period, therefore it can be harvested during the whole year. However, during the spawning season the size restrictions for harvesting blood cockles should be enforced.

ZONING ARRANGEMENT AND FISHERY MANAGEMENT PLAN

Mr. Pech Bunna

Deputy Director of the Community Fisheries Development Department, FiA, Cambodia

Presentation outlines

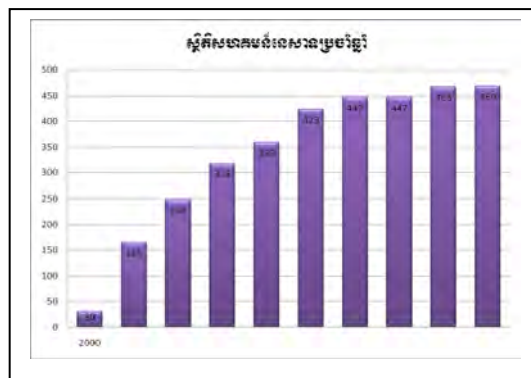
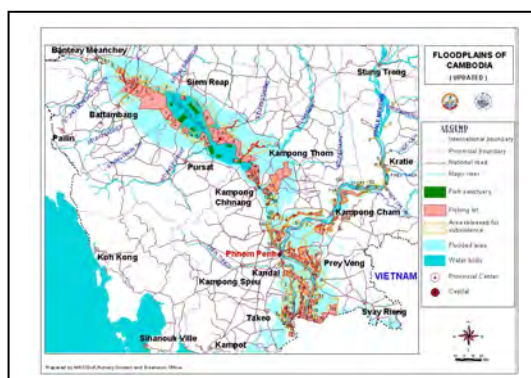
1. The fisheries reform
2. The Community Fisheries concept
3. Established of CF
4. The required document to registered CF
5. The roles and duties of CF
6. The right of CF members
7. The Responsibilities and Duties of CF
8. Procedure of CFAMP Development

1. The fisheries reform

- In 2000 the government of Cambodia announced a major change in fisheries management policy.
- About 56% (538522 ha) of total fishing lot area has been released to small-scale fishermen in inland.
- The reduction of fishing lot concession areas by 56%, 77 fishing lot, 538,522 ha.
- The establishment of Community Fisheries started throughout the country is in the process of being legalized by Sub-decree on Community Fisheries.

2. Community Fisheries (CF) Concept

A group of people living in one or more villages who voluntarily agree to cooperate and participate with each other for the purpose of participating in the sustainable management, conservation, development and use of fisheries resources in their local areas, and protecting the rights and interests.



4. The required document to registered CF

- A list of CF members and CF committee members;
- The by-laws and internal regulations of FC;
- A 1/50,000 scale map with clear coordinates;
- A CF Area Agreements between CFC and FIA ;
- CF area management plan.

5. The roles and duties of CF :

- Participate in managing and conserving fisheries resources
- Participate in establishment of conservation areas within CF area, protection and reforestation of inundated forest and mangrove forest
- Guarantee that all CF members have equal rights in the sustainable use of fisheries resource.
- Implement the CF by-laws and formulate the community fishing area management plan;

6. The right of CF members:

- To participate in the congress and vote equally and stand as a candidate for election to CFC.
- Receive information on the socio-economic status of the CF from the CF committee
- Make a complaints or provide information on any problems that impact on the interests of CF.
- To participate in all CF activities.

7. The Responsibilities and Duties of CF

- Participate in activities of CF for the benefit and prosperity of the community fisheries
- Participate in protecting, maintaining, and managing fisheries resources in the community Participate in monitoring, stopping, and reporting on all fisheries violations within the community fishing area.

8. Procedure of CFAMP Development

CFAMP was prepared in the following steps:

- Investigation on the current situation or applicability of CFAMP
- Consultation with the stakeholders of Tveuk Tla CFs and the commune council on drafting CFAMP
- Draft CFAMP by the project in assistance from Municipal Fisheries Office, Sihanouville
- Review and consult with the stakeholders in a primary meeting of Tveuk Tla CF and commune council on the first draft of CFAMP
- Prepare the second draft of CFAMP incorporating view expressed in the primary meeting

Demarcation of Community Fishing Area



Consultation on CFAMP with Community Fisheries



Procedure of 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 Hup 2
 - The Village Chief
 - The Chief of commune Tveuk Tla
 - The Governor of District Prey Hup
 - Chief of Municipal Fisheries Office Sihanouville
 - the Head Agricultural Department in Sihanouville
 - The governor of Sihanouville

Progress in CFAMP Implementation

- Local enforcement Unit has been working to make sure fishermen follow Internal Law and By-law
- As results, mangrove forest is protected well, and many illegal fishing activities were arrested
- Obstacle objects were install to protect fishing ground
- Mangrove reforestation was conducted aimed at encouraging CF to participate in resources management
- Fish refugia was established
- Local businesses were introduced

Weaknesses in CFAMP Implementation

- Annual fee for membership has not been implemented
- CF members implemented well the internal law and by-law, but the outsiders who committed illegal activities are still in place
- CF does not have its own budget for implementing the management plan
- The level of participation in CFAMP implementation is still limited

Weaknesses in CFAMP Implementation

- Annual fee for membership has not been implemented
- CF members implemented well the internal law and by-law, but the outsiders who committed illegal activities are still in place
- CF does not have its own budget for implementing the management plan
- The level of participation in CFAMP implementation is still limited

Opportunities in CFAMP Implementation

- Fisheries officers may assist CF through integrating CFAMP into the commune council development plan
- Fisheries officers and CFs have experiences in working together, so some parts of CFAMP may be supported by FIA
- CF leaders may have the opportunities to contact with other donors to support CFAMP implementation

Conclusion

- Development of CFAMP is very important for managing Community Fisheries
- All documents related to CFAMP were completed
- But the implementation is still in the starting point
- To implement CFAMP, it need time and resources

Recommendation

- FIA should assist CF to implement CFAMP through:
 - Integrate CFAMP in annual plan of commune council
 - Propose annual budget for supporting some activities of CFAMP
 - Strength law enforcement
 - Disseminate CFAMP to other fishermen, not only committee members
- CF itself should restructure the management in order to work more efficient such as:
 - Organize community assembly to select new leaders and Community Fisheries Committee
 - Collect annual fee for membership and use it in transparency way by using simple accounting system

LOCAL ENFORCEMENT ACTIVITIES

Mr. Rim Mou Soeur

Leader, Community Fisheries of Prey Nup II, Sihanoukville, Cambodia

Background

1. Local Enforcement Unit is under Community Fisheries Prey Nub 2
2. It was established since 2002 prior to the organization of Community Fisheries Prey Nub2 in 2004
3. The study on current practices of LEU was made at the 2nd Fishers Workshop on 8th February 2006 by SEAFDEC/TD
4. Patrolling activities have been conducted to protect mangrove forest and Community Fishing Ground

Community Fisheries Map needed to be protect



Facilities For Patrolling

- Patrolling boat with 12 hp engine supported by Fisheries Administration
- Mobile Phone for communication supported by SEAFDEC/TD
- SEAFDEC/TD support 25litres/month for patrolling
- 11 life jackets supported by SEAFDEC/TD
- One digital camera provided by SEAFDEC/TD

How to Conduct Patrolling

- Patrolling the fishing ground was conducted 5 times a month. But in the case of emergency, the patrolling time may be more than 5
- For protecting mangrove forest, in the case of having illegal activities, fishermen informed this information to CF leader

Who Participated in Patrolling?

- LEU consists of 12 members. Other fishermen were welcome to join on the volunteer basis
- During patrolling, at least one fisheries officer participated in this activity
- According to the community fisheries law, CFs need to collaborate with fisheries officer because CFs are not Juridical Police.

Illegal Fishing Activities happening in the fishing ground

- Blood cockle dredger using engine
- Push net using engine
- Mangrove felling
- Digging canal inside mangrove area
- Charcoals processor
- Small blood cockle and mud crab trading

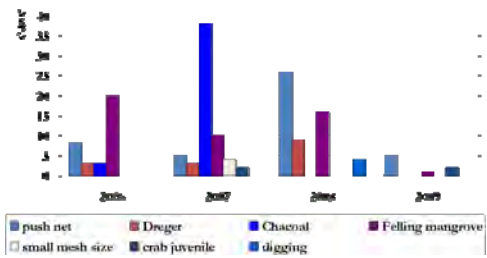




How to deal with illegal activities?

- Arrested fishing boats and fine according to the fisheries law
- Confiscate and burn fishing gears
- Write pledges not to do again
- for charcoals kiln, we need to destroy the kiln
- for small blood cockle and mud crab, we have to release into the CFs fishing ground

Results of Patrolling



Progress in local enforcement unit

- Local enforcement unit went patrolling quite frequently, so illegal fishing activities decreased considerably.
- Now, illegal fishermen are afraid CFs
- In fact, fishermen now acknowledged that, they 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 understood well about the important of mangrove;
- When fishermen see illegal mangrove cutting, they will stop (if possible) and inform fisheries staffs to intervene.

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

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.
4. Illegal fishing activities have not yet disappeared because:
 - 1.1 Resources are abundance, so they can get a lot of money from doing illegal fishing
 - 1.2 CFs can not go patrolling all times

Conclusion

1. LEU is very important to protect natural resources in the CF fishing ground
2. LEU is quite active
3. Some weak points were found and needed to be improve such as lack of participation, equipments and collaboration with local authorities

Recommendation

1. Fisheries officers should strengthen patrolling with participation from CFs
2. LEU members should be expanded
3. CFs should share information and inform Fisheries officers urgently when they find illegal activities
4. Patrolling boats is to old, so new boat should be provided
5. Fisheries Administration should continue to support gasoline for patrolling 25 liter/month

ESTABLISHMENT AND MANAGEMENT OF FISH REFUGIA

Mr. Seiichi Etoh

ICRM Expert and Former SEAFDEC/TD staff

1. Background

The Fisheries Agency (FiA) of Cambodia had collaborated with the UNEP/GEF project on “Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand” in 2006 and one of the project components was on the establishment and management of fish refugia along the coasts of Vietnam and Cambodia. SEAFDEC also collaborated with the UNEP/GEF project’s Regional Working Group on Fisheries (RWG-F) for the establishment of a system of fisheries refugia in the South China Sea and Gulf of Thailand that focused on the critical links between fish stocks and their habitats. In this connection, the establishment and management of fish refugia was incorporated as one of the elements in the ICRM-SV project along line with the sub-activity on “Encourage and extend locally based fishery resources management”.

Responding to the request by the UNEP/GEF project, FiA Cambodia initiated the activities towards the end of 2006, by identifying the locations along the coast of Sihanoukville where fish refugia could be established. The first task of FiA was to form a research group comprising representatives from the Community Fisheries (CF) and village administrations. This group carried out an extensive study in identifying the proper areas to establish the fish refugia. As the result, and after consultation with all stakeholders of the fisheries community, villagers and local authorities as well as the fishery office, two sites in the ICRM-SV project operational area have been identified in June 2007, i.e. one for sea grass and the other for blood cockle. Blood cockle is one of the major marine products in the community but the resource is encountering the risk of stocks degradation mainly due to the destruction of the fisheries habitats from rampant illegal fishing by dredgers and over-exploitation.

Considering this as a very critical issue, it has therefore become necessary for the CF to take imminent measures. As to sea grass, after an internal discussion with the project team and FiA Cambodia, eventually the suggestion was not taken up as it is outside the criteria of fish refugia as defined by the RWG-F of UNEP/GEF project, viz: *“Fish refugia is spatially and geographically defined marine or coastal areas in which specific management measures are applied to sustain important species (fisheries resources) during critical stages of their life cycle for their sustainable use”*. Also, since sea grasses are neither directly utilized for human consumption nor used for any commercial purposes, it was considered out of scope thus, only fish refugia for blood cockle was selected. This issue was discussed at length during the 5th project Implementation Coordination Committee (ICC) meeting on 18 October 2007, and it was agreed to incorporate the establishment and management of fish refugia for blood cockle in the project activity including various scientific research works to monitor the effectiveness and impact given to the resources dynamics. Furthermore, representatives from the ICRM-SV project participated in the Third Regional Scientific Conference of the UNEP/GEF Project: Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand held in Bangkok from 28 to 30 November 2007 where it was affirmed at such meeting that further collaboration between the ICRM-SV and UNEP/GEF projects should also be promoted.

2. Organization of Blood Cockle Fishers Group

After the site and the target fish species for fish refugia were determined, organizing the beneficiary group was initiated. The group would be directly involved with the establishment and management of the fish refugia on blood cockle. The first gathering of the group was arranged on 19 February 2008 at the project site of the ICRM-SV, which was attended by 25 blood cockle fishers and middlemen. In this workshop, the outcome of the preliminary survey was briefly described and the objective to establish the fish refugia was explained. The Blood Cockle Fishers Group (BCFG) was then formally organized during this workshop, under the Community Fisheries Prey Nup II. The leader, the vice-leaders and the secretary were also elected. The number of members was 25 at that time and increased to 208 towards the end of 2009.

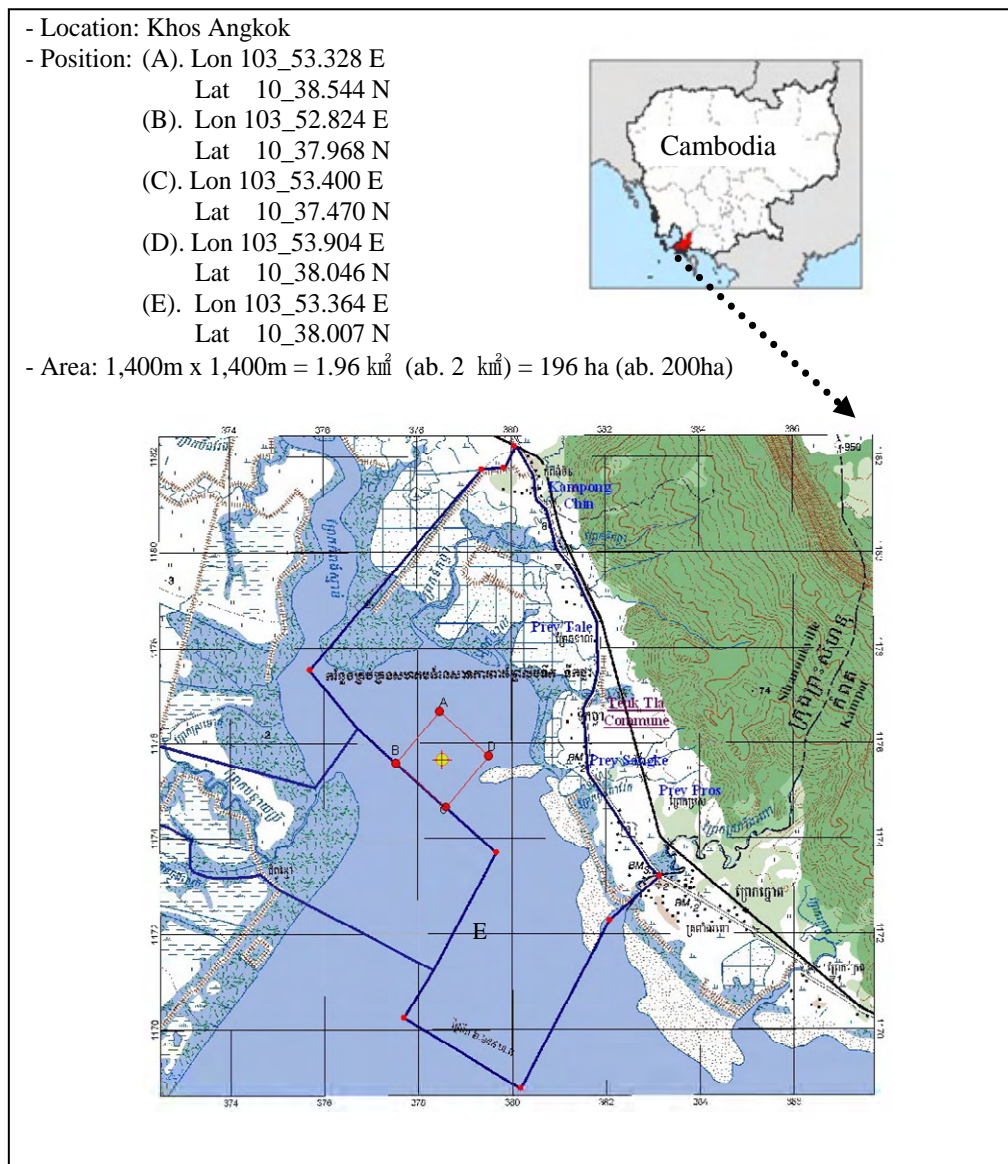


Fig 1 Committee members of BCFG

3. Establishment of fish refugia

Thus, selection of the proposed site for fish refugia was initiated in February 2008 by the fishers with sufficient experience at sea using their local knowledge. Based on their suggestion, the site where dense aggregation of blood cockles has been observed and where abundant juvenile cockles could be found was confirmed as the location of the fish refugia. As to its zoning, there was an argument during the subsequent meetings of the BCFG on determining the size of the demarcated dimensions. The project initially suggested that the area should be around 200 ha, while the FiA recommended only 48.9 ha. Discussions on the delineated location map with the members of BCFG were repeated over the months, where the members finally suggested that the refugia could be initiated in a limited dimension of 20 ha considering their practical managerial capacity. Respecting their opinion, it was finally decided to demarcate the zone for fish refugia with the dimension of 20 ha. There had been a long argument on this issue and the Cantonment of FiA intervened for reconsidering the size selected by the BCFG as the area of 20 ha could be too small to meet the requirements of a fish refugia dimension. As a result, it was eventually decided at the 4th Workshop of BCFG on 13 August 2008 that the demarcated zone should be 200 ha as originally suggested by the project. The map indicating the position of the fish refugia is shown in **Fig. 2**.

Fig 2 Position of fish refugia



4. Management of fish refugia

4.1. Self-regulatory measures

Along with the above zoning, a simultaneous effort to formulate the fisheries management plan on the self-regulatory measures within the concept of community-based fishery resources management was exerted. The draft Self-regulatory Measures for Blood Cockle Fishing in conjunction with the establishment of Fish Refugia was thoroughly discussed among the members and a consensus was reached during the 2nd workshop of BCFG on 2 April 2008. Such self-regulatory measures had been further discussed with the BCFG on 19 June 2008 in the light of technical applicability. At this workshop, it was agreed that the minimum size of harvestable blood cockle was limited to less than 100 pc/kg or over 10 g in weight or over 32x22 mm (LxH) in size.

Consistent with the size restriction, the mesh size of filter sieve was also fixed at 22x22 mm. However, after repeated tests in sifting the blood cockle samples, it was found that the appropriate sieve mesh size should be 18x18 mm and the recommended mesh size was revised accordingly. After this decision, 4 units of sieves were distributed to 4 blood cockle middlemen who were responsible in regulating the size of blood cockle purchased from fishers. In order to conserve the gravid blood cockles during spawning seasons, it was agreed to restrict harvesting of mature blood cockles with size exceeding 20 g per piece in weight or over 40x28 mm (LxH). However, since the period of spawning seasons was still not confirmed, therefore the application of such provisions had been pending subject to the finalization of the gonad research work. Eventually, it was agreed among all members of the BCFG at the 6th BCFG Workshop on 24 December 2008 that all blood cockles harvested were subject to being filtered through the agreed sieve when sold to the middlemen. The sample of the sieve is shown in **Fig 4**.

The size regulatory measures were introduced by the CF with support from the fishery officers in the Cantonment of FiA for the time being. The CF was also bound to monitor whether the self-regulatory measures were being observed. The content of the Fish Regulatory Measures is shown in **Table 1**. As a next step, the proposal on the establishment of Fish Refugia along with the Self-regulatory Measures accompanied with the demarcation map was submitted to Kampong Som FiA Cantonment by the Community Fisheries Prey Nup II through the regular channels in accordance with the Prakas on Guidelines of Community Fisheries in December 2008, and subsequently was officially approved. In the meantime, application of the Self-Regulatory Measures has been put in place.



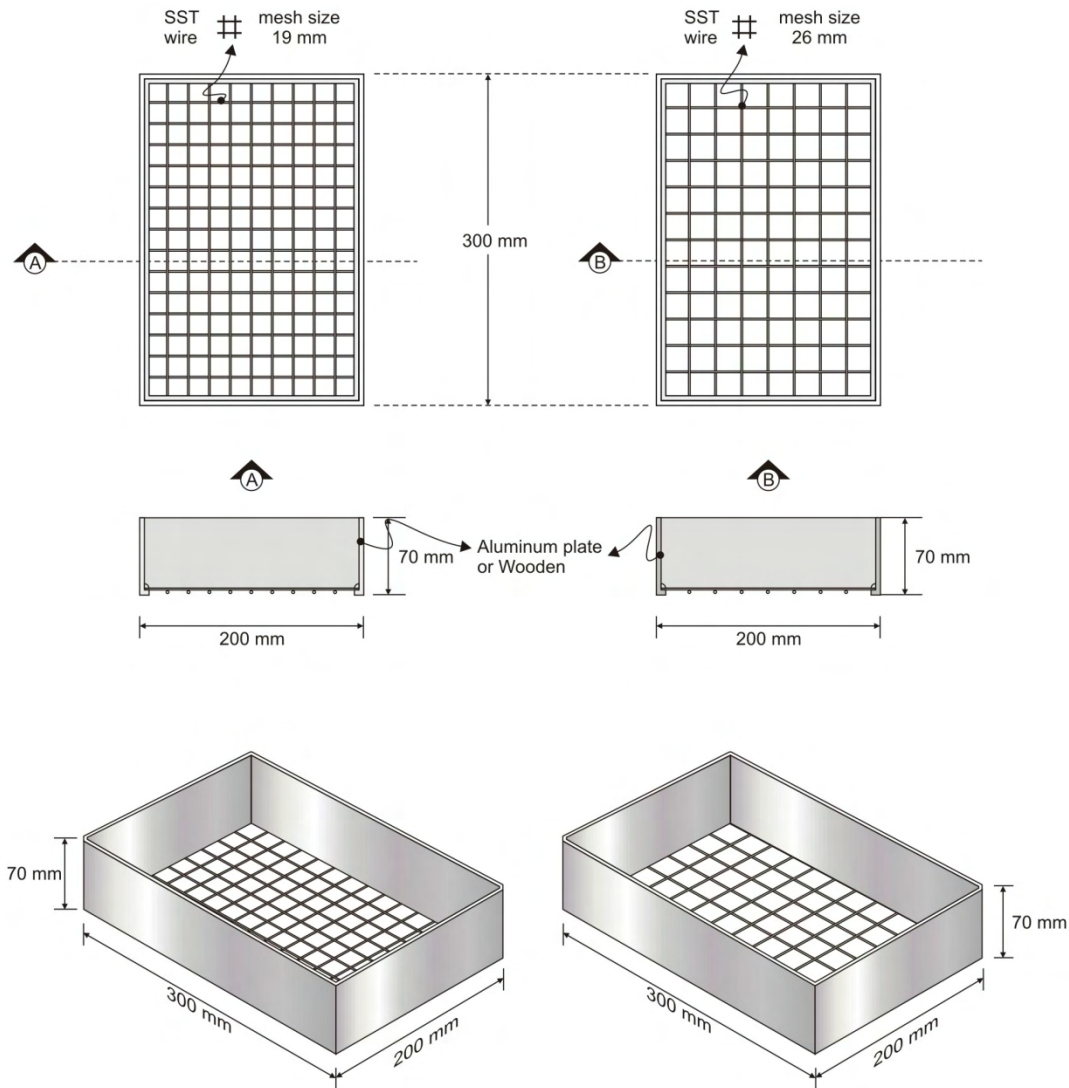
Fig 3 Filtering blood cockles with the recommended sieve

Table 1: Self-regulatory measures for blood cockles in the fish refugia

SELF-REGULATORY MEASURES FOR BLOOD COCKLE FISHING (Community Fisheries Prey Nup II)	
1. Demarcated fishing area	<ul style="list-style-type: none"> - Name of the demarcated zone: Khos Angkok - Spatial description: (A). Long. 103_53.328 E, Lat. 10_38.544 N; (B). Long. 103_52.824 E, Lat. 10_37.968 N; (C). Long. 103_53.400 E, Lat. 10_37.470 N; (D). Long. 103_53.904 E, Lat. 10_38.046 N; (E). Long. 103_53.364 E, Lat. 10_38.007 N - Area of coverage: 1,400 x 1,400m = 1.96 sq.km = 196 ha or about 200 ha - Area map indicates the geographical corner spots A, B, C and D, and the center point at E
2. Fishing right and entry	<ul style="list-style-type: none"> - The fishing right in the demarcated blood-cockle resource management zone is awarded not only to members of Blood Cockle Fishers Group (BCFG), but also to any outsiders who strictly abide by all the provisions spelled out in the self-regulatory measures.
3. Fishing methods	<ul style="list-style-type: none"> - The fishing method permitted in this demarcated zone is restricted to manual fishing or only using hand collection without any mechanically driven cockle collectors like a dredger.
4. Limitation of fishing seasons:	All year round
5. Limitation of fishing hours:	No limitation
6. Restriction on harvest size	<ul style="list-style-type: none"> - Juvenile blood cockle, over 100 pc/per kg or less than 10gr per pc in weight or less than 32 mm x 22 mm (L x H) in size all the year round - Broodstock cockle, less than 50 pc/kg or over 20 g/pc in weight or over 40 mm x 28 mm (LxH) in size during one month in August (spawning season)
7. Tool for size selection	<ul style="list-style-type: none"> - Filtering with a sieve with mesh size 19 mm x 19 mm (any blood cockle sifted through this sieve is not permitted for harvesting) - During one month in August, in addition to the above tool, another sieve with mesh size 26 mm x 26 mm is used for filtering gravid blood cockles (any blood cockle not sifted through this sieve is not permitted for harvesting)
8. Demarcated zone:	As indicated in the map

Fig 4 Designs of two sieves for sifting the blood cockles

SIEVE FOR BLOOD COCKLE



4.2. Installation of marking posts and obstacle devices

In conjunction with establishment of the fish refugia for blood cockle, the main concern of the fishers is on how to protect the area from invasion of illegal fishing boats especially those with mechanical cockle dredgers. The Local Enforcement Unit has been exerting their maximum efforts in arresting a number of dredgers, but invasions by illegal fishers are still rampant. To cope with such situation, it was decided that the most effective way would be the installation of some objects in the demarcated zone that could obstruct the invasion of illegal fishing boats. But, it should be borne in mind that such objects should be eco-friendly and conducive for fish resources and habitat enhancement. Considering also that the bottom strata of the area is covered with soft mud layers, the design of the objects should be similar with the structure of the ARs that had been successfully tested in Koh Kong which has similar bottom conditions.

Using this as the model, 30 units were constructed in December 2008 using SEAFDEC funds and installed by FiA in November 2009. Similarly, the marking poles in every 200 m distance around the area of the fish refugia were put up in order to define the area covered by the fish refugia.



Fig 5 Construction of obstacle objectives



Fig 6 Installation of obstacle objectives

4.3. Dissemination of the concept of fish refugia

After the establishment of the fish refugia, it is definitely crucial to disseminate its existence and its function to the neighboring villages where some fishers share the harvesting of blood cockles in the same area. The Self-regulatory Measures allows outsiders to harvest blood cockle under the provision that “the fishing right in the demarcated blood-cockle resource management zone is awarded to not only members of Blood Cockle Fishers Group (BCFG), but also to any outsiders who strictly abide by all the provisions spelled out in the self-regulatory measures”. Therefore, an effort to disseminate the context of fish refugia was exerted in a way, by the group consisting of the ICRM-SV project staff, FiA officers and representatives from CF of Prey Nup II during the organized workshop in each four surrounding villages in April 2009. In each village, the implication to establish fish refugia and its expected function in line with the self-regulatory measures were thoroughly explained. All participants appreciated such a new approach as they had shared with the same concern for so long and expressed their willingness to cooperate with this practice. Posters explaining the contents of the Self-regulatory Measures have also been put up on every community house in each village.

5. Scientific research work

In order to monitor the effectiveness and the impact of the establishment and management of fish refugia, the following scientific research works were simultaneously carried out:

- Regular fish landing data collection – as part of the regular fish landing data collection survey, which has been continued since the inception of the project to monitor the blood cockle harvest in the whole area of CF Prey Nup II.
- Marine biological survey: Measurement of size and weight variation by season, by measuring 200 blood cockles selected at random by size (length and width) and weight - commenced in April 2008
- Marine biological survey: Abundance survey by season to assess the abundance of blood cockles in the fixed area of fish refugia - commenced in April 2008
- Oceanographic survey: Conventional monitoring of water quality parameter such as depth, water temperature and dissolved oxygen, which was conducted when the JICA Expert joined the SEAFDEC project team at the site - commenced in April 2008
- Research study on gonad: This study was conducted from April 2008 to March 2009 and aimed at identifying the spawning seasons in the project operational area based on the suggestion that the spawning season recorded in the scientific report in Thailand might not be identical in the case of Sihanoukville. Defining the spawning season is crucial in determining of the suspension period for harvesting gravid blood cockles consistent with the context of the Self-regulatory Measures.

The results of the above research works have been compiled and reported separately.

6. Discussions and conclusions

An attempt to establish and manage fish refugia was prompted within the project activity along line with the part on “Encourage and extend locally-based fishery resources management”, in conjunction with the UNEP/GEF project to organize a regional network on dissemination of the concept of fish refugia among countries in the South China Sea and Gulf of Thailand. The direct beneficiary group was organized in February 2008 after passing quite some time for the preparatory stage and the formulation of the Self-regulatory Measures was finalized and approved by the FiA in December 2008. Thereafter, the newly established body, the Blood Cockle Fishers Group (BCFG) commenced the management activity in full swing with technical and financial support from the FiA Cambodia and SEAFDEC/TD. The installation of obstacle objects in the fish refugia has been completed and the neighboring fishing communities have expressed their intention to cooperate and uphold the basic practices defined in the provisions of the Self-Regulatory Measures. As such, the management practice of fish refugia has just taken off but still needs further technical follow-up as well as commodity support by the FiA Cambodia to enable the BCFG to attain substantial and sustainable outcomes.

7. Reference

- Fish Refugia Knowledge Document UNEP/GEF/SCS/Inf.4; UNEP/GEF Project “Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand”, 2007
- Preliminary Survey on Fish Refugia in CFs Prey Nup II; Meas Chanda, June 2007
- Fish Refugia; Yos Chanthana, June 2007

ENCOURAGE WOMEN'S GROUP IN TEUK THLA COMMUNE SIHANOUKVILLE, CAMBODIA

Mrs. Sumitra Ruangsivakul

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

1. Background

Following the series of official requests by the Cambodian Government at the SEAFDEC Program Committee Meetings (PCM) in 2003 and 2004 to initiate a collaborative project for the community based fisheries resources management concept in Cambodia, the project formulation process began in January 2005 with the preliminary survey mission composed of the staff of SEAFDEC/TD and FiA Cambodia. Further, the baseline survey was jointly conducted in March 2005 to understand the socio-economic conditions as well as the fishing situation and environment prior to the commencement of the project activities. Thus, the project Integrated Coastal Resources Management in Sihanoukville (ICRM-SV) began its activity in November 2005 after the endorsement of the project document during the Steering Committee meeting on 10 November 2005. One of the three main objectives of the project is to encourage people's participation in creating job opportunities and establishment of local business to increase access to the sources of income in order to alleviate poverty in the fishing communities and develop the economic scales of the communities.

Considering that promotion of local business is one of the activities of the project, the first step conducted was to identify the job opportunities to be introduced. This was followed by the second step, which was to organize working groups for the introduction of job opportunities and the third which was the introduction of new local business. Finally, the last step was to evaluate the sustainability of the business venture. The approach was first initiated as part of the women's group activities among others, as it was considered most vital and the women were easily accessible. This approach also conformed to the outcome of the baseline socio-economic survey which indicated the imminent need of providing job opportunities to the women's groups in the Teuk Thla Commune.

2. Objectives

- To increase income levels of the community
- To reduce fishing pressure
- To create and stimulate a harmonized group working spirit

3. Procedure of the implementation

There are four (4) villages of Teuk Thla Commune of the project site, namely: Prey Pros, Prey Sangke, Prey Tol and Kampong Chin. The SEAFDEC/TD project team conducted the following activities for the women in the aforementioned four villages:

3.1 Organization of women's groups

Consistent with the work plan in the project document which was endorsed by the Steering Committee meeting on 10th November 2005 in Sihanoukville, a women's group meeting was conducted on 15th December 2005 in the community house of the project operational site in Teuk Thla Sangkat, Sihanoukville, to discuss with the potential women's group and seek for the possibility of forming a women's working group to pursue the local business promotion. In the meeting, the SEAFDEC team presented the activities of the women's groups in the project sites in Chumphon, Thailand and Langkawi, Malaysia. As a result, the women's group agreed that they would discuss among themselves the prospective products and would later inform SEAFDEC on the outcome of their discussion in the succeeding month.

3.2 Identification of applicable business

Thus, each village organized their respective group with members and made a work plan. There were 26 participants from 12 members of Community Fisheries Committee and 14 representatives from the women's group, comprising 3 women of Prey Pros, 5 women of Prey Sangke, 3 women of Prey Tol, and 3 women of Kampong Chin.

At this meeting, two systems were proposed; *i.e.* in the first system only one group would be organized because the distance of each village was far, and in the second system there would be 4 groups, one in each village. Thus, the women were divided into 4 groups, and the chairman of each group was selected. Each group will be provided place for their activity operation. The recommendation of each village activities and the corresponding chairman agreed upon is shown in the following table:

Prey Sangke	Prey Pros	Prey Tol	Kampong Chin
Chairman: Ms. Ly Ngeb	Chairman: Ms. Chea Theun	Chairman: Ms. Sen Phas	Chairman: Ms. Hoc Tean
Priority activity: 1. Fish culture 2. Animal raising	Priority activity: 1. Fish culture 2. Pig culture 3. Mushroom	Priority activity: 1. Poultry 2. Fish Culture	Priority activity: 1. Aquaculture-fish 2. Mushroom 3. Fish sauce

3.3 Study on practicability and economic feasibility

After active deliberation and having considered the aforementioned recommendations, the following local business ventures were considered as having the potentials in terms of raw materials availability, technicality, modest investment cost required, and marketability of the products. Among the proposed business ventures, it was eventually agreed to focus on mushroom and fish sauce production.

- a. Mushroom production
- b. Fish sauce production
- c. Aquaculture of fish
- d. Poultry

3.4 Training course in mushroom production

To follow up with the above proposition, a training course in production of mushroom took place in the Battambang Province for 5 days from 1st to 5th May 2006 with 16 women attending (4 women from each village). The main objective of the training course was to learn the production and marketing technologies for both straw and oyster mushrooms (**Fig. 1**) including:

- construction and maintenance of the necessary facilities
- preparation of required equipment
- supply of required production materials like hyphae (fungus that produces the mushroom) or mycelium (mass of hyphae)
- production
- storage, distribution and marketing technologies
- marketing trend
- cost and profit calculation

3.5 Preparation for the production

Having been convinced of the economic viability after the completion of the training course, cottage-scale mushroom production yards were set up in each village starting on 7th June until 20th June 2006. This included the construction of necessary premises comprising:

- a steam chamber with 2 sets of steam vat for sterilizing spore bags (utilizing used 200-l oil drums),
- a cultivation house for storing spore cultivation bags (a simple local hut covered with wood bark and nipa leaves, wooden shelves for laying cultivation bags and occupying an area of 15m²)
- a working space for mixing ingredients like rice bran, lime and saw dust (a plastic ground sheet the dimension of which is 3 x 3 m) and packing,
- a storage room for ingredients and packing materials (any space could be utilized provided it is protected from rain and wind).

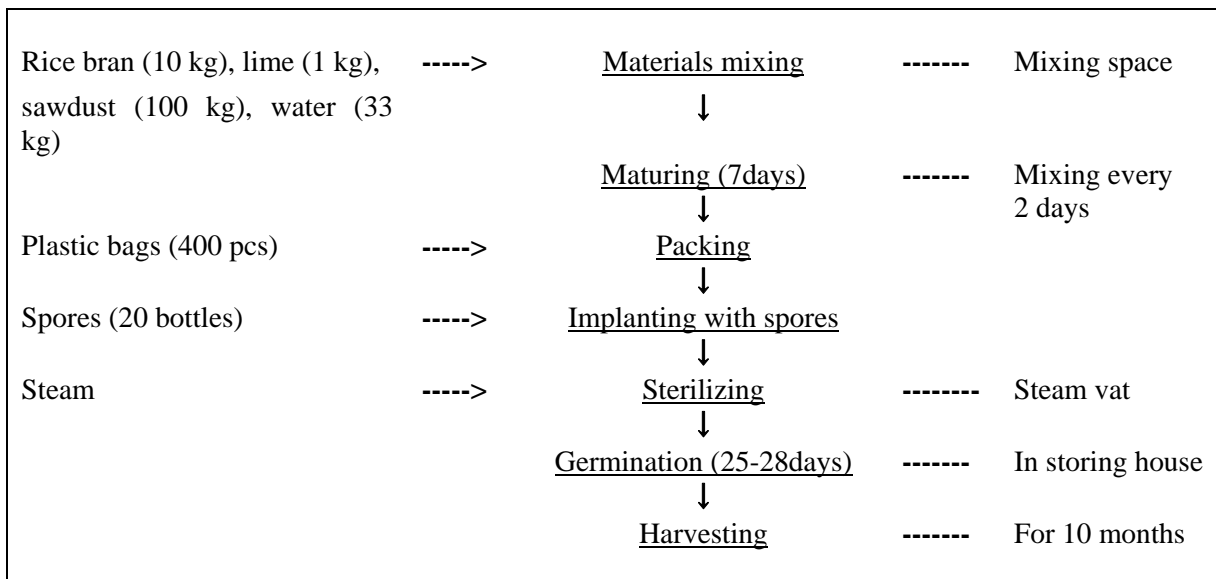


Fig 1 Sequence of mushroom production

3.6 Training course in Bookkeeping and Accounting

Upon commencement of the cottage scale venture, unlike in home-scale money counting, it is inevitable to introduce a simple, but still legitimate bookkeeping and accounting system to the management class of the group. This is important for transparency in the money transactions of the women's groups. It has been witnessed in many parts of the world that many organizations and groups have collapsed because of problems derived from unclear or messy accounting systems. To avoid such a case to happen and also from the viewpoint of human capacity development, village-level training course on simple book keeping and accounting was proposed with the following particulars.

This first (preliminary) bookkeeping and accounting training course attempted to demonstrate to the leading members of the women's groups the implementation of the simple bookkeeping and accounting system. Toward the end of fiscal year, the second (follow-up) training course was organized which was aimed at summarizing the monthly financial status, and based on the outcome of the "Profit and Loss" analysis, profit distribution would be legitimately determined.

The major objectives of the training course are:

- to introduce a simple bookkeeping and accounting system that can be applicable to the cottage-scale venture to be managed by the women's groups of Teuk Thla Commune,
- to develop a sense of economic viability in the business venture among the members of the women's groups.

4. The results

4.1 The first year (2005)

During the Fishers' Workshop on 14 December 2005, the approach in the promotion of local business venture was explained to the participants and a request was posed to the fishers to discuss among themselves and to identify any conceivable local business venture which could be considered applicable and promising for the community. The outcome would be further discussed in the next fishers' workshop in early 2006.

Discussion on the establishment of the women's group was also made during the above workshop based on the activities made in the two sister projects, *i.e.* ICRM-PD in Thailand and ICRM-PL in Malaysia, which were demonstrated to the participants. They were all impressed with the activities and impacts given and expressed willingness to begin similar activity in the project operational area. Thereafter, the orientation toward the initiation of the group activity was briefly discussed. It was suggested that one women's group should be formed in one village, meaning four groups should be formed in the project area in Prey Nup II.

As suggested, the structure of the group should include a chairwoman, a vice-chairwoman, a secretary and a cashier. It was also agreed that they would repeat internal discussions among themselves in order to bring forward a concrete proposal at the next meeting scheduled in January 2006.



Fig 2 Project Opening Ceremony and Fishers' Workshop

4.2 The second year (2006)

The 2nd Women's Group meeting was held on 9th February 2006 with 26 participants including the committee members of TTCF (Tuek Thla Community Fisheries) and the heads of the villages. The women's group was further divided into four sub-groups by villages and the leaders were elected. Discussion was held to identify the potential local business venture to be carried out by the women's groups. As aforementioned, among the various proposed potential business ventures, it was eventually agreed to begin with mushroom production.

As to the aquaculture of fish, the need to study attentively the various aspects was mentioned, like species selection, seeds' supply, marketability prior to setting up the work and therefore a feasibility study will have to be conducted. For poultry-raising, the project was reluctant to try this type of venture out especially during the current bird flu incidence which had been prevailing in the neighboring countries. Thus, such proposition was set aside for the time being. As for fish sauce production, further investigation was made and it was concluded that there could be certain difficulty in terms of steady supply of raw materials at reasonable prices. Hence, it was eventually decided to focus on mushroom production.

Following the above consequence, an effort was exerted to identify an appropriate institution which could train the women's groups for processing mushrooms. Finally, the Prey Konkhla Vocational Training Center (PKVTC) in Battambang Province was considered for the conduct of the required training course. Thus, a 5-day training course was initiated on 2nd May 2006 in the premises of the PKVTC and continued until 6th May. The instructors were capable in training and knowledgeable on the subject matter. The training included both practices and commercial application of relevant new technologies in the communities, and therefore it was fruitful and conducive for the women's groups. The training concentrated mainly on the production of oyster mushrooms and to a lesser extent the straw mushrooms.



Fig 3 Training on mushroom production at Battambang Province, 2-6 May 2006

The simple economic feasibility calculation was carried out with the data obtained during the above training. The result was positive as shown in **Table 1**. Thus, the setting-up of the cottage-scale mushroom production yards in each village was initiated on 7th June and completed on and around 20th June 2006. This included the construction of the necessary premises with storage rooms and a steaming kiln.

In the meantime, all the necessary equipment and materials like sawdust, rice bran, lime, mushroom spores, etc. were procured. Upon commencement of the production, the Director of PKVTC was invited as a consultant to guide the women's groups in installing the facilities and production arrangement for 5 days from 21 to 25 June. As such, production of mushrooms began simultaneously in each four villages towards the end of June. Actual production of mushroom spore bags began and the first shipment of production was made on and around 17 July 2006 simultaneously by the four groups. Since then, production has been increased as seen in **Table 2**: Record of mushroom production.



Fig 4 Mushroom production at Kampong Chin and Prey Tol villages

Table 1: Profit and loss calculation in mushroom production

A. Base of calculation			
- Production capacity:	5,000 packs		
- Production period:	8 months		
- Member of a group:	10 persons		
- Productivity	1Kg / pack/ 8 month		
		Cost	
		('000 Riel)	(USD)
B. Fixed cost		699	175
C. Total variable cost		1,893	473
(757,000 Riel x 2.5)			
D. Total initial investment cost		2,592	648
E. Profit and loss calculation			
1. Gross sales of production		13,500	3,375
(5,000kg x 2,700 Riel/Kg)			
2. Marketing overhead (15%)		2,025	506
3. Net sales of production		11,475	2,869
4. Incurred expenses			
- Depreciation of fixed		233	58
(Depriciation for 3 years)			
- Variable cost		1,893	473
Sub-total:		2,126	532
5. Gross income		9,349	2,337
6. Saving for investment			
or revolving fund (20%)		1,870	467
7. Net income before share		7,479	1,870
8. Share for each member/8 months		748	187
(10 members in all)			
9. Monthly share		93	23
(for 8 months)			

Table 2: Record of mushroom production in 2006

Women's Group	Production in Month (Kg)						Total (Kg)
	Jul	Aug	Sep	Oct	Nov	Dec	
1. Kompong Chin	66.0	83.5	112.0	237.5	295.5	150.5	945.0
2. Prey Sangke	23.0	85.7	92.1	122.9	168.4	135.3	627.4
3. Prey Pros I	8.0	42.6	26.0	40.4	14.3	5.1	136.4
4. Prey Pros II	0.0	0.0	0.0	11.0	72.5	80.0	163.5
5. Prey Toal	26.7	56.5	56.7	161.5	146.5	76.0	523.9
Total:	123.7	268.3	286.8	573.3	697.2	446.9	2,396.2

As seen in **Table 2** above, about 2.4 tons of mushrooms was produced for 6 months from the beginning of production to the end of December 2006. It is noticeable that the volume of production has been increasing by month except in December. This may be due to the setting-in of the dry season affecting the growth rate of the mushroom, which needs damp air. However, it was agreed that the trend should be traced further.

Since the location of processing yard in Prey Pros I was found inappropriate as it could be damaged by high tide and infested by rats, the facilities and equipment were shifted to another better site in September and the production has been continued with the other women's group, known as the Prey Pros II while the first group was Prey Nup II. Although the first group stopped producing spore bags in September, production of mushrooms has been continued using the remaining spore bags.

A major foreseeable problem in any local group business lies in the lack of transparency in accounting. This is a common problem in most women's group activities. Aimed at overcoming this predictable constraint, an introduction of simple bookkeeping and accounting system was attempted in a training course. In the training course held on 17 August 2006 for 20 leading members of four women's groups, very simple bookkeeping system was introduced and exercised. This comprised five ledger books, i.e. a general ledger book, an equipment ledger, a material ledger, a product ledger and labor ledger. An exercise of entering data into these books was made during the training course but the time given was rather too short to master the whole system. Therefore, in an effort to monitor the practical and correct application of this system, follow-up activities were repeated at the local level by regularly visiting each village by the extension worker and also by the SEAFDEC/TD team although intermittently. As such, the practical application of this new accounting system has been put in place although there were different levels of apprehension and subsequent practical application by the groups.

Thus, the amount of sales has been properly recorded by each group. **Table 3** shows the sales of mushrooms in 2006, which indicates that the total sales in 2006 amounted to 9,344,000 Riel equivalent to USD 2336. The economic analysis of this business venture was made during the Women's Workshop in February 2007 when a review of the transactions was made.

Table 3: Sales record of mushroom by each group in 2006

Women's Group	Sales amount in Month ('000 Riel)						Total ('000 Riel)
	Jul	Aug	Sep	Oct	Nov	Dec	
1. Kompong Chin	88	197	493	669	787	398	2,632
2. Prey Sangke	67	221	261	311	445	367	1,672
3. Prey Pros I	32	185	119	209	44	16	605
4. Prey Pros II	0	0	0	15	231	421	667
5. Prey Toal	49	176	316	748	1,144	1,335	3,768
Total:	236	779	1,189	1,952	2,651	2,537	9,344

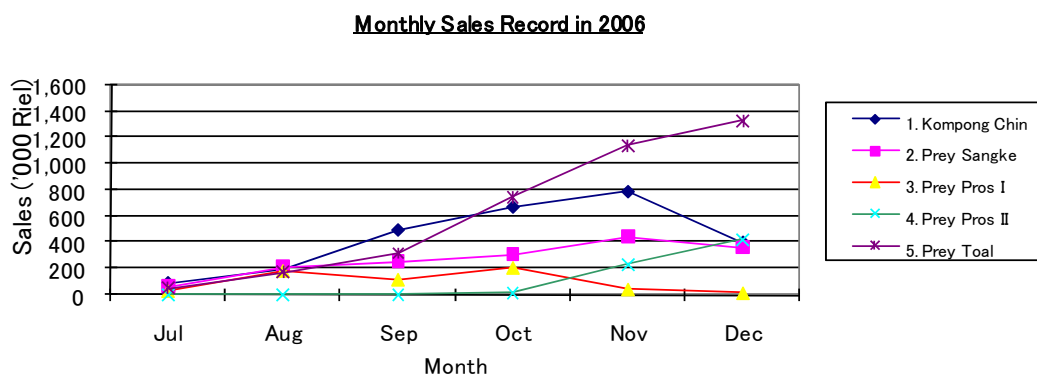


Fig 5 Sale mushroom product in 2006

Another serious problem lies on the need to expand the marketing channels. All products were initially sold collectively to the middlemen in the nearby market of Veal Rinh. Considering that production level has increased with the augmentation of the production capacity in each group, consequently the common markets have become easily saturated with mushrooms. This matter was discussed at the 3rd ICC meeting on 30 November 2006 and the expansion of marketing channels to Sihanoukville or Phnom Penh was suggested. In this regard, the Fisheries Office was asked to conduct a marketing research in Sihanoukville City. The project became the vanguard of producing mushrooms by the women's groups, and many other NGOs also followed later the same business venture, especially in and around Sihanoukville. Under such circumstances, the project encountered more difficulties in the marketing of the product and thus, more contemplated efforts would be needed for the possible expansion of the marketing channels.

4.3 The third year (2007)

The cottage-scale mushroom production has been promoted further and in order to evaluate its viability as an economic venture, a one-day workshop on the "Economic evaluation of mushroom production" was held in the project site on 27 February with 18 participants. At this workshop, the group leaders presented their transactions since the inception of the activity until December 2006 based on their accounting records. A brief description of the economic analysis of the groups' activities based on their transactions that were evaluated from the economic as well as practical points of views, are summarized as follows.

- a) Kampong Chin – Mushroom production for 6 months in 2006 was 945 kg. This group had the best and sound business transaction among the 4 groups with a gross income of Riel 1,361,333 (USD340.30) and a total share distribution of Riel 527,066 (USD 131.80) for its 5 members. The economic return of investment was 166.0%.
- b) Prey Sangke – Production for 6 months in 2006 was 627.4 kg with a gross income of Riel 6,433 (USD 1.60). The actual net profit was Riel 5,146 (USD 1.30).
- c) Prey Pros – The group split due to friction among its members especially on the selection of the location for its processing yard. The first group produced spore bags until September and thereafter the processing equipments were transferred to another location where the newly organized group started its production. The first group produced 136.4 kg of mushroom for 6 months while the second group produced 159.0 kg from October to December 2006. As a result, the first group had deficit in their operation [-Riel 678,500 (-USD169.60)] while the second group had a gross income of Riel 70,483 (USD 17.60).
- d) Prey Tol – Production for 6 months in 2006 was 523.9 kg. The gross income also showed a deficit amount of -Riel 90,600 (-USD 22.70).

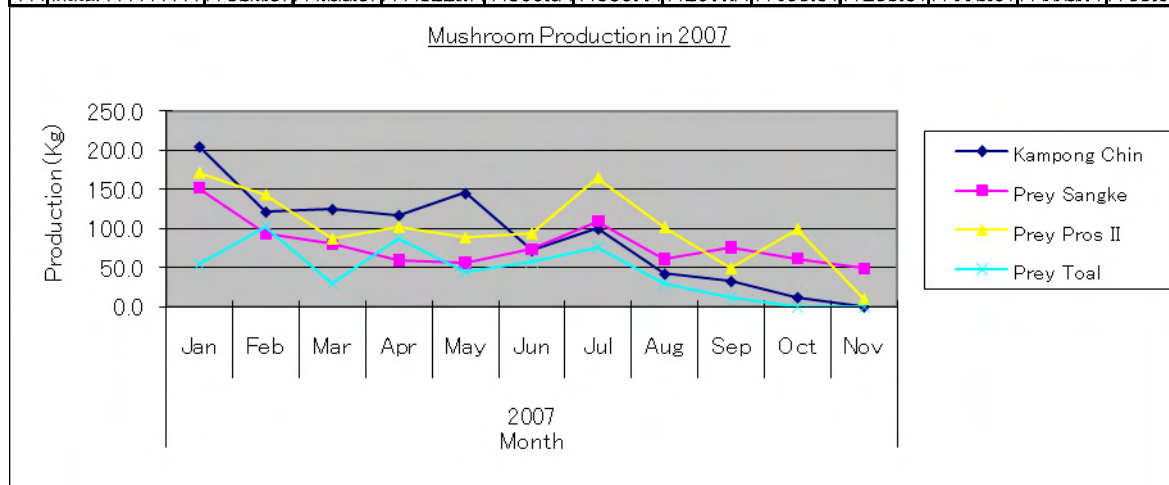
From the above results, the project is still optimistic about the future operations even if the three groups did not show encouraging economic returns. Although still an experimental trial but upon seeing that the group in Kampong Chin and the new group in Prey Pros had positive economic returns, all the women's groups indicated their willingness to continue mushroom production in full swing in 2007.

In the presentation of the accounting records at the workshop, it was noted that some errors occurred in the bookkeeping and accounting entries in their books of account. In order to correct the wrong entries and miscalculations, a follow-up on-the-spot training on bookkeeping and accounting was conducted on 28 February in each village. After all the errors were rectified, new accounting books were initiated for 2007. Monitoring the proper implementation of bookkeeping and accounting systems by the groups has been continued by scrutinizing each accounting book every time the SEAFDEC team visits the project site. Through this exercise the economic sense among the members of women’s groups on local business ventures could be fostered.

So far the financial outcomes of the mushroom production in 2006 showed a positive result, especially with the groups of Kampong Chin and Prey Sangke. In order to best utilize their profit, a separate account called Saving Accounts was opened for these two groups from January 2007. An on-site training was held on 24/25 April 2007 for the opening and managing of this new account, the initial fund of which was retroactively transferred as of 1st January 2007. This saving account was meant to be used as revolving fund for other business ventures such as a credit scheme and other profitable ventures. Initial funds of Riel 1,465,934 and 139,660 were transferred from the general accounts of the Kampong Chin group and Prey Sangke group, respectively. The cottage-scale mushroom production has been perfectly commercialized as an independently managed venture. Production has been continued using the accumulated revolving fund from their net income after one year of operation from June 2006. It is commendable that all groups have put the venture on commercial basis within the period of one year.

Table 4: Mushroom production in 2007 (in kg)

No.	Village	2007										Total	
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct		Nov
1	Kampong Chin	204.8	121.3	124.7	117.0	145.0	72.0	99.5	42.0	32.5	12.0	0.0	970.8
2	Prey Sangke	151.5	93.5	80.5	59.9	56.9	73.9	109.0	61.3	76.4	61.9	49.6	874.4
3	Prey Pros II	171.5	143.5	87.5	102.5	89.0	94.3	165.3	102.0	49.6	99.7	10.3	1,115.2
4	Prey Toal	54.0	102.0	30.0	86.5	44.5	57.5	76.5	30.0	12.0	0.1	0.0	493.1
	Total	581.8	460.3	322.7	365.9	335.4	297.7	450.3	235.3	170.5	173.7	59.9	3,453.5



The production record in 2007 (up to November) is shown in **Table 4**. However, as seen from this table, the production volumes for all groups have been gradually dwindling. Taking advantage of the occasion, a review of mushroom production in 2007 also took place. The production level in 2007 was comparatively sluggish and as seen in Table 4 and the corresponding figure, production had even dwindled towards the end of 2007. Explanations for such inactive production were made by each group leaders, including such factors as: (1) production rate of mushroom had been gradually slowing down, (2) low quality of spores as most new packets were spoilt or poorly produced, (3) strong windy days in November and December that caused mushroom spores to perish, and (4) no self-reliance in the procurement of necessary materials and equipment had been established as done by SEAFDEC in 2006. It is obvious that the monthly production rate had been reduced from 110.7 kg in 2006 to 72.6 kg in 2007.

It is incredible that the average production rate per month, in Kampong Chin for instance was 169.1 kg in 2006 but dwindled to only 80.9 kg in 2007. The average sale price also decreased from 2,667 Riel in 2006 to 2,251 Riel in 2007. This may be caused by the increased supply in the limited market. There were many other points that could be learned by the women’s group based on the practical lessons from their operation in 2007. The

decreasing trend was partly due to a transitional period when the project stopped financing and left the operations to the initiative of the groups, and also partly due to the fall in rice harvest in October and November seasons, thus the mushroom production pace also slowed down to some extent.

Further, an incident happened where the culture bags were spoilt due to inferior quality of spores supplied by the Vocational Training Center in Battambang in August. The supplier admitted their irregularities and promised to replace the product. In the meantime, one fisher from Shihanoukville began producing mushroom spores and the quality was tested to be very satisfactory. He has voluntarily participated in the training course for mushroom production in May 2006 at the Vocational Training Center in Battambang together with the women's group and began his private business by himself after returning from the training course. The women's group agreed to purchase the spore bottles from him.

4.4 The fourth year (2008)

The project had purchased all the required materials for mushroom production until April 2007 and also coordinated with the group purchasing the least. However, towards the end of 2007 all women's groups started joint purchasing of all necessary materials for mushroom production. This was initiated under the coordination of the project extension officer. Since then, the groups have to rely on themselves for procuring the necessary production materials as well as in marketing their products. In this sense, it was considered more beneficial and practical to organize an association under which joint procurement and marketing are coordinated and this was suggested during the 2nd Local Seminar. Hence, all of them basically agreed to form a mushroom processors' association.

In the wake of this movement, a meeting among the potential members of the association was held on 18 February 2008 to discuss the context of the proposed Internal Rules of the Association as well as its functions and structure. They were of the view that the title of the group as "Association" was not appropriate and agreed to use "Group" instead. The official title of the group was eventually named as the "Mushroom Producers Group (MPG) under Community Fisheries Prey Nup II". The first general assembly of the MPG was convened on 2nd April 2008, when the provisions of the Internal Rules of the Group were unanimously endorsed by over two-thirds of the members present. Thus, the Rules of the MPG was adopted, after which the Leader, the vice-reader and the committee members including one from the CF were also elected consistent with the Rules. As such, the impetus of mushroom production has been resumed through a joint corporate type of work including joint procurement of the necessary raw materials, joint marketing and sharing of information in a harmonized way after experiencing the transitional period to reform the production management from project type to a corporate one. As stated in the Local Seminar on 25 December 2008 by the leader of the MPG, it is convincing that production of mushrooms as upheld by the function of the MPG would be an optimistic venture in the future.

The production quantities in 2008 by the groups of Prey Sangke and Prey Pros were reduced compared with those in 2007 as seen in Fig 6, but the amounts of sales increased as seen in Fig 7. This is mainly attributed to the increased market price in 2008. The market prices of mushrooms varied from Riel 2,777, Riel 2,262 and Riel 2,916 per kg in 2006, 2007 and 2008, respectively. The great leap of sales by Kampong Chin in 2008 was attributed to the start in marketing of new products, *i.e.* the mushroom packets. This is very lucrative compared with selling the final products. Mushroom packet is marketed at Riel 1,000 – 1,100 per packet against the production cost at Riel 425, and a total of 1400 packets were sold in 2008. Mushroom production is getting popular in all the villages and the MPG arranged a training course for school children for 7 days in December 2008 at Kampong Chin with 15 participants. All the trainees have since then been conducting mushroom production in their respective villages.

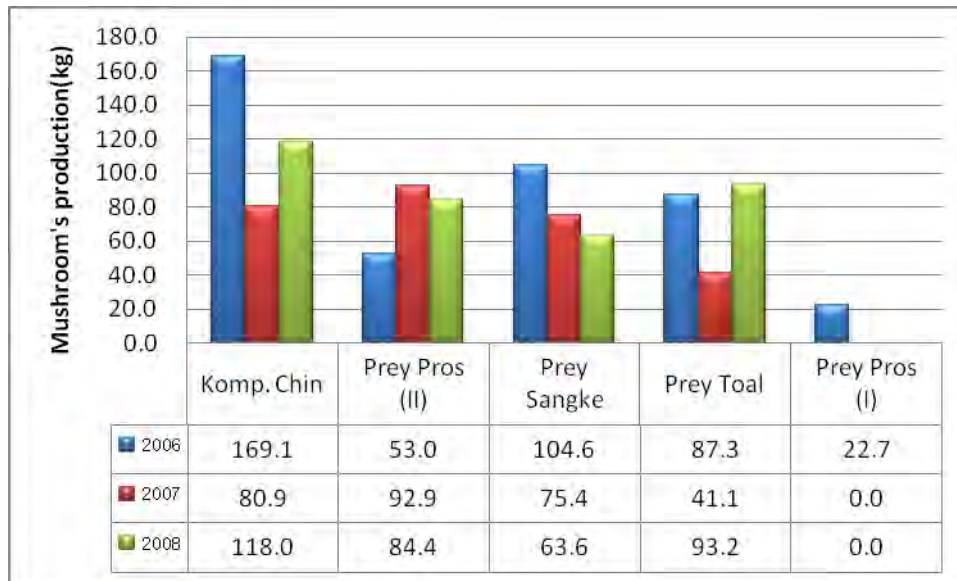


Fig 6: Mushroom Production 2006-2008

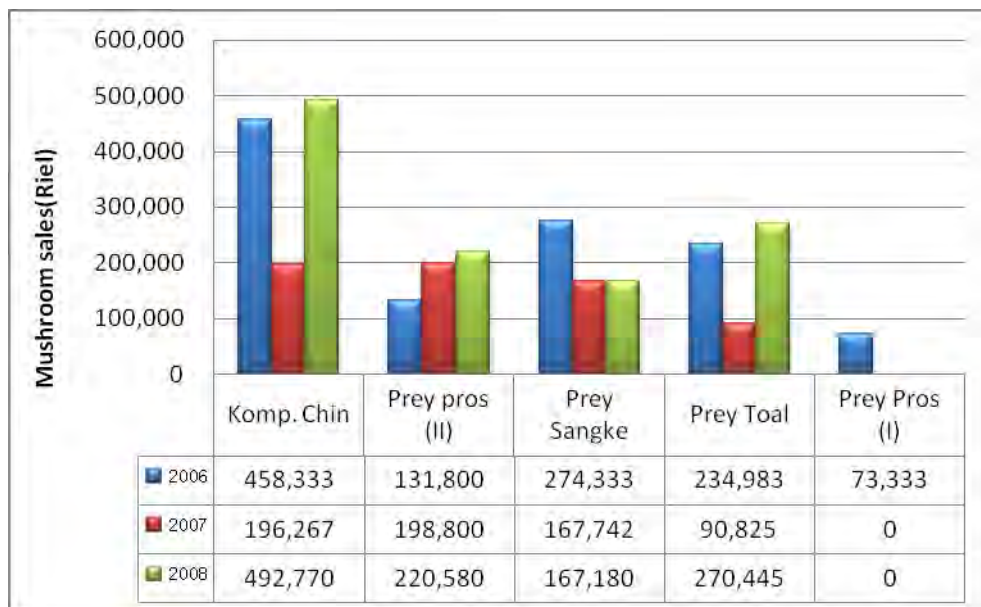


Fig 7 Mushroom Sale 2006-2008

Spore production

In 2008, the MPG observed that a number of mushroom incubation packets were spoiled due to the inferior quality of spores obtained from a private producer which led to the decreasing MPG economic balance sheet. This constraint was seriously discussed at the 7th ICC meeting of the project on 26 November 2008, where it was decided that production of spores should be tried by the MPG themselves with a view that the excess spores produced can be marketed to other potential producers. Considering that the FiA has envisaged to introduce mushroom production in remote fishing villages using the ICRM-SV model since demand for mushroom has gradually increased, the spores that are not used by the MPG could be marketed to such areas.

The technical viability in spore production was discussed with the Director of Prey Konkhla Vocational Training Center (PKVTC) where a JICA expert introduced the Japanese mushroom production model few years ago. He positively discussed the proposed new venture from the technical points of view and agreed to conduct the training course on the production of mushroom spores at PKVTC in Battambang Province for the project. Given

the above needs and the possibility, the training course on production of mushroom spores was conducted on 16 – 20 December 2008 in Battambang, where 4 leading members of MPG and the Project Team Leader attended. After returning back from the training course, the MPG established the spore production center in Kampong Chin at the cost of USD 372, which was shared equally between SEAFDEC and the MPG. The test production was actually initiated on 22nd December 2008.



Fig 8 Kampong Chin women's group started to produce mushroom spores in December 2008

4.5 The fifth year (2009)

The Internal Rules of the MPG was adopted at the group's first general meeting on 2nd April 2008 and the organizational function was legitimately commissioned under the structural framework of the Community Fisheries Prey Nup II. The training course on the production of mushroom spores was conducted in December 2008 in Battambang and the new venture commenced in January 2009. Inspection of the site for mushroom and spore production was conducted in all 4 villages. Simultaneously, verification and scrutiny of the bookkeeping and accounting records maintained by the four groups were continued by the project team.

The Prey Tol group suspended temporarily their production because they were simply waiting for the raining season to come. They started to purchase all the necessary materials in May and planned to re-start producing mushroom as soon as possible.

Table 5: Mushroom Production in 2009 (kg)

Month	Kampong Chin	Prey Sangke	Prey Pros	Prey Toal	Total
January	158.5	122.10	80.9	-	361.5
February	84.5	80.10	81.2	-	245.8
March	108.0	90.20	65.8	-	264.0
April	49.0	78.40	101.1	-	228.5
May	85.0	110.30	90.9	-	286.2
June	17.0	93.20	123.5	-	233.7
July	69.0	68.10	74.6	-	211.7
August	24.9	67.30	0.0	-	92.2
September	300.0	33.50	60.2	-	393.7
October	237.0	37.20	68.7	-	342.9
November	135.5	94.60	-	-	230.1
December	191.0	75.00	-	-	266.0
Total	1459.4	950.0	746.9	0.0	3156.3

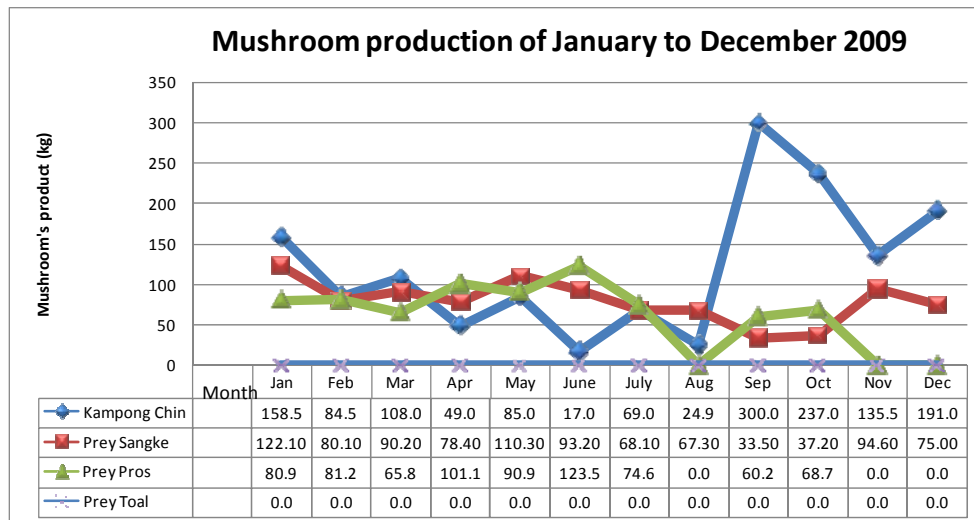


Table 6: Spore production in 2009 (bottle)

Month	spore products (bottle)
Dec-08	-
Jan-09	40
Feb-09	170
Mar-09	-
Apr-09	-
May-09	-
Jun-09	280
Jul-09	60
Aug-09	-
Sep-09	370
Oct-09	-
Nov-09	180
Dec-09	no data

5. Conclusion and recommendations

- As a whole, production of mushroom in the project operational area has been achieved with promising results
- Supplemental incomes were attained by the participating households to some extent through the attempts of the women’s groups in producing mushrooms, the scale of which could be further expanded, provided that efforts through a harmonized working spirit would be continuously exerted
- In general, the working morale among members of the women’s groups has been very high in a harmonized way and this has given very favorable social impacts to the community certainly bringing positive effect to the embodiment of community-based fishery resources management concept in the future
- As shown in the pilot operation, strong leadership and harmonized working relationship in a group are among the crucial factors leading to the success of the operation
- Based on the financial calculations, all groups are now financially capable of managing the operation by themselves without relying on financial inputs from SEAFDEC/TD as they have become financially independent through their own revolving funds as savings from past turnovers
- They have already established a business association type group, the “Mushroom Producers Group” under CF Prey Nup II and they are corporately managing their operation including joint procurement and marketing of their products under the provisions of the Internal Rule of the Group.

Production of mushroom by the women’s groups has been successfully put as a commercially viable venture. As such, testing and demonstrating the practicability and applicability in some potential ventures, are due obligations attributed to a project.

LOCAL BUSINESS DEVELOPMENT – MUD CRAB CULTURE

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1. Background

The project on Integrated Coastal Resources Management in Sihanoukville (ICRM-SV) began implementing its activities in November 2005 with the core project objective of promoting sustainable coastal resources management and community development. One of the main and important goals in community development lies in the alleviation of poverty in the society. Efforts in sustainable management of available resources should therefore contribute to a great extent to achieve this goal. There is no doubt that creation of new job opportunities for the unemployed labor force significantly improves the social life in a community. In addition, it could also provide the fishermen with an alternative source of income that may eventually have a positive effect in the reduction of fishing efforts.

As envisaged in the project activity, mud crab culture is one of the features in the development of a local business venture. A scheme was therefore designed in 2005 in collaboration with a JICA Expert and submitted for funding under the Grassroots Fund of the Embassy of Japan in Cambodia. The proposed activity was eventually approved by the Embassy of Japan in Cambodia in August 2006 and the necessary fund amounting to USD 11,402 was disbursed for the activity through the Director of Kampong Som FiA Cantonment (then Fisheries Department, Sihanoukville Municipality) in October 2006. Meanwhile, a Mud Crab Culture Group (MCCG) was established as a sub-organization under the framework of the Community Fisheries Prey Nup II with 12 members, one of whom was elected as the Group Leader.

The Kampong Som started the pond construction in November 2006 consistent with the financial disbursement guidelines provided by the Japanese Grassroots Fund (JGF) in October 2006. All the contract works and procurement of necessary equipment were completed in February 2007. Using the newly constructed ponds, the first experiment was started on 13 February 2007. In the original plan, it was envisaged to conduct a full-scale commercial operation after having been convinced of the profitability in the mud-crab culture just like in the case of mushroom production. However, it should be accepted that the first experiment could not yet prove the commercial profitability of the venture as it resulted in entire loss. Thus, the second, third and fourth experiments were carried out to seek for possible outcomes that would put the venture on the commercially profitable basis. Toward the end of the project operation, the 5th experiment was started aimed at confirming the practicability of mud-crab fattening during dry and cool seasons. The detail in this experiment is separately put forward.

2. Construction of ponds

Using the funds donated by the Japanese Embassy, construction of the ponds was commenced in November 2006. In fact, these were old ponds which had been abandoned for a long time and registered as public property. As seen in the layout of the ponds in Annex 1, the area consisted of 5 ponds with different sizes and the total surface area of the peripheral canal is 1968 m². The average depth of the peripheral canal is 120 cm. In addition, a community house and burglar fence were constructed as incidental facilities and various necessary equipment like a water pump, a wooden boat, a DO meter were procured with the funds from the Japanese Embassy and also a salinometer was purchased using the SEAFDEC fund. Construction work was completed in February 2007.

3. First experiment

3.1 Technical guidance and training

Prior to and upon the commencement of the experiment, three training courses as listed below were organized for the Mud Crab Culture Group (MCCG) as the members were not very familiar with the technical aspects of mud crab culture.

- 14 September 2006 – Introduction of mud crab culture technology (by JICA Expert)
- 10 January 2007 – Practices on mud crab culture (by the Expert from DOF, Thailand)
- 28 February 2007 – Bookkeeping and accounting for mud crab culture (Project Leader)

3.2 Stocking and acclimation

The experiment commenced on 13 February 2007 with the stocking of 1350 mud crab juveniles purchased from middlemen at Riel 7000 per kg, separated by sex (male and female) and stocked in two separate ponds: 733 male crabs in the pond No. 3 and 617 female crabs in pond No. 4. Later, on 4 March 2007 another 405 juvenile female crabs and 395 male crabs were brought to the project site by the Kampong Som FiA Cantonment. These were juvenile and weakened crabs confiscated by the Enforcement Division and provided to the project free of charge. Before stocking, the crab juveniles were acclimated in tanks containing pond water.

3.3 Feeding

Chopped fresh trash fish caught by gill-nets or push nets were used as feeds, given twice a day using feeding baskets. The feeding time and quantity were recorded in the logbook. About 10 to 15 kg of feeds were provided daily.

3.4 Water management

As originally designed in the operational plan, water change was supposed to be done by pumping water everyday using a diesel engine water pump. However, the cost of diesel for this method could reach an enormous amount, accounting for 38% of the total operational costs. It was therefore, decided to rely only on the natural tidal water current for the water exchange. During high tide the sluice gates were opened to allow fresh sea water to flow into the ponds, and once the water level reached the optimum level, the gates were closed. This practice was repeated every day.

3.5 Operation and management

Immediately after stocking, two members of the Mud Crab Culture Group (with 12 members), took turns daily for a 24-hour duty to look after the ponds. Their duty included purchasing feeds and feeding the crabs, monitoring and recording the water temperature and salinity twice a day, measuring the growth rate of the crabs every two weeks, allowing water circulation by opening the sluice gates, collecting and counting the dead crabs, and cleaning the surface of the ponds in addition to the routine day and night watch. Results of the measurements, observations, weather conditions and any happenings were entered in the daily logbook. The daily operation was closely monitored by the Extension Worker assigned to the project by FiA Cambodia.

3.6 Harvesting

During the experiment, it was reported that the mortality rate was extremely high. Technical consultations were made with the expert from DOF Thailand, but no sign of improvement was noticed. When the salinity started to drop with the advent of rain in May, the water temperature rose. Under these circumstances, it was considered better to stop the experiment and harvest the mature crabs before the situation turned worse. The first harvest was made on 24 May 2007 after 81 - 100 days of culture. The crabs were sold to a middleman at a nearby market. Harvesting by traps was continued until 29 May 2007 and small size crabs were transferred to pond No. 5. Then on 10 June 2007, all the ponds were dried by pumping out the water and the crabs that had survived were also sold.

3.7 Bookkeeping and accounting

Upon the initiation of the experiment, a training course on bookkeeping and accounting for the members of the Mud Crab Culture Group was conducted and follow-up on-the-job training was continued. During the above training, the following accounting and technical books were introduced.

- Logbook: To record the daily conditions of the ponds and crab culture
- General Ledger: To enter daily financial transactions

In addition, the following basic books were introduced by the extension worker and the project staff to maintain a record of the transactions of the mud crab culture business.

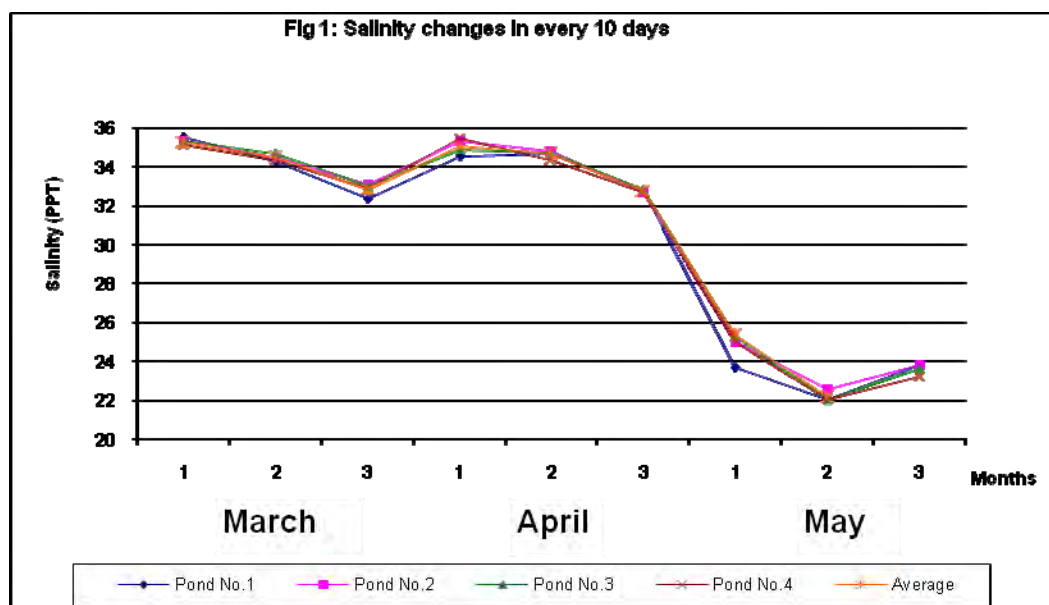
- Feeding record: To summarize the monthly feeding condition based on the description in the logbook
- Monthly stock record: To summarize the stocking condition based on description in the logbook
- Crab harvest record: To record the harvest condition whenever harvest takes place

3.8 Results

3.8.1 Water quality parameters

Salinity

Based on the data recorded in the logbook, abrupt changes in salinity occurred during the experiments as shown in Fig. 1. As seen in the graph, it is obvious that the salinity in March and April was within the range of 32-36 ppt, which was extremely high. The salinity declined suddenly in May when rain showers started to occur, but remained thereafter at around 24 ppt.



Water temperature

A thermometer was bought in April 2007 to measure the water temperature. The records showed that the temperature was 32 - 33°C in all 5 ponds.

pH

In order to measure pH regularly, litmus papers were also bought in April 2007. The recorded pH in the ponds was around 7.0.

The optimum water condition for mud crab culture based on the handbook published by SEAFDEC/AQD in March 1999 is shown in Table 1. A comparison of the actual water conditions in the experimental ponds is also shown in Table 1.

3.8.2 Circulation of water

Good circulation of the pond water is the most crucial factor in mud crab culture. In the original plan, the circulation of water relied mainly on pumping water from distant sources especially during the low tide. However, the cost of fuel for water pumping would account for almost 38% of the total expenditure, which could not be affordable by the local people.

Therefore, it was changed to rely only on the natural tidal flow in the water canal. It is positively admitted that the method employed was not sufficient to maintain the freshness, water temperature and salinity at optimum levels. In addition, the construction of the sluice gate may not have been good enough to be able to stop water leakage from the ponds during low tide, which caused the pond water to reduce to an unexpectedly low level.

Table 1: Comparison of the water conditions

No	Parameters measured	Optimum level (based on SEAFDEC/AQD handbook)	Actual parameters in the experimental ponds
1	Salinity	15 – 30ppt	22 – 36ppt
2	Water temperature	23 – 32°C	32 - 33 °C
3	DO concentration	≥ 4.0	-
4	pH	8.0 – 8.5	7.00
5	Water depth	≥80cm	100cm

3.8.3 Mortality rate

During the culture period, it was observed that the mortality rate was extremely higher than ever expected. Floating dead crabs were collected and the number was recorded in the logbook every day by the members of MCCG on duty. Table 2 shows the ratio of the lost and dead crabs in each pond during the experiment. As shown in the figures, the average ratio of lost and dead crabs reached 93.6%. It has been generally considered that for mud crab culture the maximum mortality rate (M/R) should be below 15¹.

The M/R in the experiment was extremely high as 1077 pc of crabs were accounted as dead although the actual figure could be around 1200 pc since over 100 pc of empty carapaces were found when the water from the ponds was pumped out.

Table 2: Ratio of lost / dead crab during experiment

Pond No	1	2	3	4	5	Total
1. Stock (pc)	405	395	733	617	0	2,150
2. Transferred (pc)	70	23	45	24	0	162
3. Remained (pc)	335	372	688	593	162	2,150
4. Sold (pc)	19	34	35	15	35	138
5. Dead (pc)	265	261	286	265	0	1,077
6. Missing (pc)	51	77	367	313	127	935
7. Lost total (pc)	316	338	653	578	127	2,012
8. Ratio of lost crab (%)	78.0%	85.6%	89.1%	93.7%	78.4%	93.6%

3.8.4 Growth rate

The following table shows the growth rate of mud crab during the culture period.

Table 3: Increase in weight of the crabs during the experiment

Date	Culture days	Average wt (g)	Growth rate per month (g)	Remarks
13.02.2007	0	73.3	0	Average from 13 Feb to 4 Mar
11.05.2007	87	197.8	42.9	
28.05.2007	104	229.0	58.5	Average from 24 May to 10 June

Although the available data are limited as shown above, the monthly growth rate of 42.9 ~58.8 g is relatively good compared with the figure in the guide book of SEAFDEC/AQD, *i.e.* 46.0 ~ 57.5 g.

3.8.5 Harvesting and marketing

Towards the end of May, some remaining mud crabs which had already reached grade II size were sold at the nearby market. The price structure of whole sale price of mud crab is shown in Table 4.

¹ Source: "Mud Crab" by SEAFDEC/AQD (1999)

Table 4: Whole sale price of mud crab by grade

Grade	Weight/ pc (g)	Price/kg (Riel)
I	over 400	23,000
II	200 - 400	15,000 – 17,000
III	under 200	7,000 – 10,000

Although no research has been made on the correlation between the growth rate and the feed conversion rate (FCR), it is obvious that harvesting mud crabs at Grade II size rather than stocking until reaching Grade I size is more economical under the above marketing conditions. After harvesting the crabs from pond Nos. 1 to No.4, the smaller size crabs were transferred to pond No. 5 for further fattening. Those transferred in pond No. 5 were however, harvested on 10 June when the experiment was terminated. The total number of crabs harvested was 138 pc (31.6 kg) which were marketed at Riel 402,650.

3.8.6 Bookkeeping and accounting

Although entry into the logbook was poorly initiated, it has been improved later. The most important accounting book, the General Ledger was maintained by a nominated member accountant who had a fairly good sense of accounting.

3.9 Findings and remedial measures

Judging from the outcomes of the abovementioned first experiment on mud crab culture, which had completely failed, all processes and findings were compiled in the technical report used as discussion materials by all parties concerned. This was aimed at reviewing the whole process of the first experiment on mud-crab culture, with the problems which need to be addressed in the second experiment.

4. Second experiment

The first experiment was continued up to the middle of June 2007, and although the result could not produce any promising outcome mainly due to unfavorable climatic conditions, it provided very useful experiences and knowledge to the Mud Crab Culture Group (MCCG). The technical report addressing the causes of low productivity in this experiment was issued in August 2007, based on which a preliminary meeting was held by FiA and SEAFDEC on 30 August 2007 in Phnom Penh in a bid to decide the future course of action for the mud crab culture activity. A number of identifiable concerns and problems needing remedies were presented at the meeting, after which it was finally decided to continue the mud crab culture scheme, provided that the following issues and concerns related to mud crab culture are properly addressed. Moreover, all parties concerned have also agreed to exert their utmost efforts towards the successful operation of the mud crab culture activity under the ICRM-SV project. The issues and concerns that need to be addressed included:

- Deepening of the pond bottom up to 30-50 cm should be immediately carried out by Kampong Som FiA Cantonment (herein after called FiA Cantonment).
- Renovation of sluice gates should be made using funds from SEAFDEC/TD.
- Since one of the crucial causes of the missing crabs in the previous experiment was due to theft, FiA should take an effective action to prevent the crabs from being stolen or poached.
- The FiA Cantonment should assign one officer permanently to the project site to attentively look after the whole operation of the mud crab culture.
- Measurements and recording of DO concentration, salinity, water temperature and growth rates should be carried out regularly without fail.
- In order to ensure technical backstopping, a communication network should be established among the four parties, *i.e.* the project site, the project office in Shihanoukville, JICA Expert in Phnom Penh, and SEAFDEC/TD in Bangkok.

Based on the outcome of the preliminary meeting as mentioned above, it was decided that the 2nd trial would be conducted starting in November 2007. In the meantime, preparation works like pond deepening and repair of the sluice gates were carried out as agreed upon.

A workshop was held on 17 October 2007 participated by all members of MCCG to review the mud crab culture practices, identify the causes of failure and find out solutions for improvement. At this workshop, lively discussions among the 25 participants resulted in the identification of the causes of high mortality and lost rate, and in finding out effective measures to be undertaken during the 2nd experiment. Possible solutions were concluded and listed in a table for all workshop participants to see. The summary of the conclusions reached at this workshop is shown in Table 5. After completion of all preparatory works, the 2nd experiment was started on 17 November 2007.

4.1 Stocking

After completing the pond renovation, purchase of juvenile mud crabs and release to the ponds commenced on 17 November 2007. The first batch comprised 847 pieces small crabs which were confiscated in Koh Kong Province from illegal traders who were attempting to smuggle juvenile size mud crabs to Vietnam, which is illegal in Cambodia. The small crabs, average size of 13.6 g were released in Pond No. 1 on 17 November 2007 without sorting by sex. The 2nd batch (ave. 81.1 g) was purchased from 19 to 25 November 2007, of which 574 pc were female crabs and 698 pc were male, and stocked in the 2nd and 3rd ponds, respectively. The third batch (ave. 79.5 g) was procured from 10 to 14 December 2007 with 450 pc female crabs and 619 pc male which were released in Pond No. 4 and 5, respectively. Thus, a total of 3188 juvenile crabs (total weight of 199.7 kg) were released in November and December 2007. Prior to releasing, proper acclimation process was carried out by spraying the crabs with pond water or by dipping them slowly into the ponds.

Table 5: Remedial measures to improve the recovery rate of crab production

Causes of low recovery rate	Physical observations and cases from the experiment	Suggested remedial measures and solutions	Responsible party(ies)
(A) High mortality			
1. High temperature	Hottest climate (March - May)	Cool season (Nov. to March)	All parties
	Shallow depth of ponds	Deepen ponds by 50 cm	FiA Canton.
	Leaking water from ponds	Repair sluice gates	SEAFDEC
	No monitoring of the temperature	Regular monitoring of water temperature	MCCG
2. High salinity	End of dry season (March/April)	Before end of dry season (up to Feb.)	MCCG
3. Low DO	No measurement of DO	Regular measurement of DO	MCCG & SEAFDEC
	No technical consultation	Consultation with JICA expert	FiA & SEAFDEC
4. Weak juveniles	Poor acclimation practices	Proper acclimation practices	MCCG
	Bulk purchasing of juveniles	Purchase limited number of juveniles (max. 100 pcs/day)	MCCG & SEAFDEC
	Purchasing of juveniles from a distant area	Purchase juveniles within the vicinity	MCCG & SEAFDEC
(B) Escaping			
5. Feeding	Improper feeding	Measure and monitor feeding	MCCG
	Presence of fish in ponds	Removal of fish in ponds	MCCG
	No regular measurement of growth rate	Regular measurement of growth rate (every 2 weeks)	MCCG
(C) Theft /Poaching			
6. Protection	Free access by thieves or poachers	Installation of a watch hut to prevent entry of thieves	MCCG & SEAFDEC
	Lack of sense of common property of the project by the community	Dissemination of the project roles and peoples' participation in the community	CF & FiA Canton.
	No representative from the authority	An officer representing FiA assigned at the project site	FiA

Note:

MCCG: Mud-Crab Culturing Group
 FiA Canton: Fisheries Office, Sihanoukville Municipality
 SEAFDEC: Southeast Asian Fisheries Development Center
 FiA: Fisheries Administration
 CF: Community Fisheries Prey Nup II

4.2 Feeding

After the crabs were stocked, feeding was initiated using fresh trash fish procured locally at about Riel 1000/kg. Feeding was made on meshed baskets placed in 4 separate positions and the remaining feeds were checked to control the succeeding feeding quantity. The quantity and time of feeding were recorded in the logbook daily. About 5 kg feeds on the average, were given to each pond in a day. The total feed given during the 2nd experiment was 1839 kg.

4.3 Harvesting and marketing

After the stocking of the juvenile crabs, growth rate was periodically monitored by measuring the average sizes and weight in each pond. When it was observed that most crabs reached marketable sizes after culturing for about 100 days, the crabs were harvested from 28 February to 16 March 2008. The harvest result is shown in Table 6. The total number of mud crab harvested was 77 pc with the total weight of 19.05 kg and average weight of 247.4 g/pc, which could fetch Riel 379,500.

4.4 Water conditions

All throughout the culture period, water temperature and salinity were measured daily by the members of the group and recorded in the daily log-book. The DO concentration was measured periodically whenever the JICA expert visited the site.

4.5 Bookkeeping and accounting

Entering appropriate figures in the logbook and the general ledger was properly practiced after learning the process during the first experiment. Based on the records, supplemental accounting books such as the Monthly Stock Record, Feeding Record and Crab Harvesting Record were compiled monthly. Each book was verified and scrutinized by the project team whenever they visited the site and necessary corrections and guidance in bookkeeping were made.

4.6 Discussion

Water condition

Compared with the 1st experiment conducted from February to June 2007, the climatic condition with mild temperature in the 2nd experiment seemed favorable for mud crab culture. Table 11 shows the comparative data for such parameters as salinity, water temperature and D.O. concentration monitored during the two experiments. As shown in this table, the water temperature was within the optimum range, salinity was slightly higher especially after January 2008 while the DO concentration was within the tolerable range. In general, the water condition was not much of a problem in this experiment. Yet, there were some contentious points that remained unclear such as the temperature and salinity differences between the surface and bottom of the ponds.

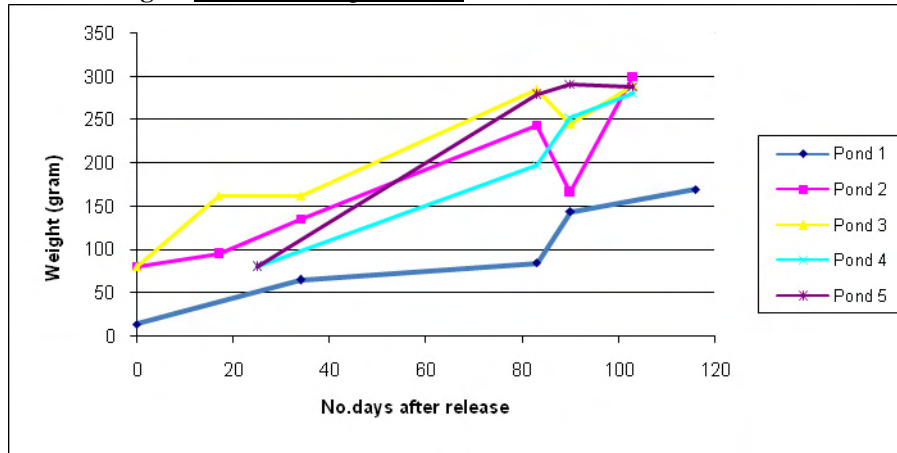
Table 6: Growth rate of mud crab during 2nd experiment

Pond No.	Stocking date	Harvesting date	Average stocking day	Change of weight (g)		Average wt. increase (g)		Rate of wt. gain per day (%)
				Initial	Harvesting	W. period	per day	
I (Mixed)	17.11.2007	14-16.03.08	120	13.6	170.0	156.4	1.3	9.6
II (Female)	19-25.11.2007	28.02.-01.03.08	100	81.1	300.0	218.9	2.2	2.7
III (Male)	19-25.11.2007	28.02.-14.03.08	102	81.1	290.0	208.9	2.0	2.5
VI (Female)	10-14.12.2007	28.02.-01.03.08	80	79.5	281.0	201.5	2.5	3.2
V (Male)	10-14.12.2007	28.02.-03.03.08	81	79.5	289.0	209.5	2.6	3.3

Growth rate

As indicated in Table 6 and Fig 2, the growth rate during this experiment showed a normal pattern although there were some uncertain figures due to lack of samples, *e.g.* crabs in Pond No. 2 on 18.02.2008. The results further showed no significant difference in growth rate of the crabs except in Pond No.1 (stocked with confiscated baby crabs) as well as between the female and male crabs. Fig. 2 shows that crabs can grow from 80 g to marketable size of 200 g within 55 – 60 days of culture. This should be taken into consideration in conducting the most economical crab fattening operation.

Fig 2 Growth in weight of crab



Productivity and survival rate

As shown in Table 7, survival rate as a whole in the 2nd experiment was merely 2.4%, which deteriorated further compared with the survival in the 1st experiment, *i.e.* 6.4%. This is beyond comprehension taking into account the fact that the environmental conditions in this experiment have relatively improved. At first glance, it could be suspected that higher mortality rate was due to the high density of the juveniles at stocking. The manual of mud crab fattening published by AQD suggested that the optimum stocking density of crab juveniles (ave. 20 g) should be 1.5 pc/m² or 30 g/ m². In the 2nd experiment of the project, the density of crab was 1.6 pc/m² and at an average size of 62.6 g, which is equivalent to 100.2 g/ m².

Table 7: Summary of stock and harvest record in the 2nd experiment

Pond No.	Original Stock (pc)	Harvested (pc)	Crab dead (pc)	Crab lost (pc)	Survival rate (pc)
1	847	27	80	740	3.2%
2	574	2	166	406	0.3%
3	698	21	225	452	3.0%
4	450	8	122	320	1.8%
5	619	19	141	459	3.1%
Total		77	734	2377	2.4%

4.7 Review of the 2nd experiment by MCCG

After the completion of the 2nd experiment in mud-crab fattening, which resulted in a failure with extremely low survival rate of 2.4%, a workshop attended by all the members of Mud-crab Culturing Group (MCCG) was held on 1 April 2008. This workshop aimed to review the whole exercise of the 2nd experiment and analyze the causes of the low survival rate. Based on the outcome, the group could decide on the future course of action including the option of withdrawing the potential venture of mud crab culture. In fact, after the first experiment was carried out in February to June 2007, the group analyzed the causes of failure, and remedial measures were decided and implemented prior to the commencement of the 2nd experiment. It was very convincing at that time that the cause of the failure in the 1st experiment was most attributed to the unfavorable environmental conditions during hot and dry seasons. Therefore, the best season for the 2nd experiment was selected from November to March, but the outcome ended up just as discouraging.

Understanding this fact, the workshop analyzed the failure and concluded the future course of operation, as follows:

- The major cause of low survival rate could be attributed to the fact that crabs escaped during the high tide in November and December when all the ponds was covered with sea water.
- Some crabs were lost by theft or poaching.
- The group structure was reorganized with 12 more active and young fishers as members, to consolidate their functions.

- A study tour to Kompot was organized, where one private crab farmer managed commercially a mud crab fattening business (This was done on 8 April 2008 under the financial auspices of JICA.)
- The JICA expert committed to contribute an automatic recording machine for salinity and temperature of the ponds, using JICA funds, the cost of which was estimated at around USD 5,000.
- The Chief of Community Fisheries Prey Nup II (CF) entreatingly requested FiA, SEAFDEC and JICA for a continued trial of crab culture with his commitment of maximum support.
- Finally, one more the mud crab culture activity could be implemented provided that:
 - the ponds should be thoroughly dried and cleaned, and applied with lime,
 - fattening (not culturing) should be started with young and healthy crabs (100 g ave. size) and harvested upon reaching marketable size of 200 g, the duration of culture is estimated to be about 2 months only,
 - the results of the observation during the study tour in Kompot should be discussed among the members and reflected in the next operation, and
 - the automatic recording machine to be donated by JICA should be installed and properly maintained by the project team and MCCG.

5. Third experiment

Since the 2nd experiment also resulted in a failure, a review session was held as aforementioned and stressed that the culture be tried again using the experiences and knowledge gained through the preceding experiments. The future course of action was further discussed in detail during the 6th Project ICC meeting on 20 June 2008. At this meeting, it was claimed that low recovery rate of the mud crab culture was most likely due to poaching as the leader of the MCCG had admitted. To cope with this constraint, FiA committed to assign one staff of the Cantonment of FiA at the project site to protect the crabs from being stolen. In addition, the Chief of the Community Fisheries also promised to patrol the ponds more often.

Thus, with such commitments and series of proposed actions, it was decided to conduct the 3rd experiment from July after completing the renovations and clearing of the ponds. However, the unprecedented rainfall that continued from the end of July until August delayed the preparatory works and the 3rd experiment commenced on 8 September 2008 using pond No. 2 and 3 as a test case.

Based on lessons learned and experience gained from the previous 1st and 2nd experiments, the 3rd experiment concentrated on the grow-out process with shorter stocking period by using larger sizes of the seed crabs.

5.1 Renovation and cleaning work on the ponds

Prior to commencement of the 3rd experiment, renovation and cleaning of the ponds were made in July and August that included the following:

- Closing of the existing sluice gates
- Installation of the two PVC 20 cm dia pipes at the lowest elevation of the ponds to facilitate the circulation of the stagnant bottom water
- Pumping out of the water to dry the ponds
- Removing of the bottom soil, applying lime and drying the ponds for one week
- Construction of feeding platforms (reflecting the findings from the study tour)

5.2 Stocking

After completing the pond renovation work, purchase of young mud crabs and release to the ponds commenced on 8 September 2008. A total of 268 juvenile crabs were stocked in pond No. 2 and 3. The average size of the crabs was 93 g (95 g for female and 90 g for male crabs). The status of young crabs released is shown in Table 8. Prior to releasing, proper acclimation process was carried out by spraying the crabs with pond water or by dipping them slowly into the ponds.

5.3 Feeding

After the crabs were stocked, feeding was initiated with fresh trash fish which was procured locally at about Riel 1000/kg. Feeding was made on meshed baskets placed in four (4) newly constructed feeding platforms based on the model of the private mud crab culture ponds in Kompot. The remaining feeds on the baskets were checked to control the feeding quantity. The quantity and time of feeding were recorded in the logbook daily. About 4 kg of feeds on the average were given to both ponds per day. Prior to harvesting, feeding was discontinued for a few days and the crabs weighing lower than the marketable size (200 g) were restocked in pond No.4 where feeding was continued. The total amount of feeds given during the 3rd experiment was 179 kg at the cost of Riel 191,000 (USD47.8).

Table 8: Stocking record of young crabs

Stocking date	Stock numbers by pond (pcs.)						Total wt. (Kg)	Total No. (pc)	Av. Wt. (g)
	No. 2 (Female)			No.3 (Male)					
	Wt. (kg)	No.(Pc)	Av.Wt.(g)	Wt. (kg)	No.(Pc)	Av.Wt.(g)			
08.09.2008	4.4	45	98	4.0	40	100	8.4	85	99
09.09.2008	4.2	46	91	3.3	41	80	7.5	87	86
10.09.2008	6.0	63	95	3.0	33	91	9.0	96	94
Total	14.6	154	95	10.3	114	90	25	268	93

5.4 Harvesting and marketing

After stocking the young crabs from 8 to 10 September 2008, the crabs were given feeds as described above. Growth rate was monitored by measuring the average sizes and weights in each pond. After 40 days of fattening, it was observed that most crabs reached marketable sizes, *i.e.* 200 g, and thus were harvested from 18 October to 4 November 2008. It was considered more profitable to harvest crabs just after reaching the grade II (200-400 g) size which can fetch a price of Riel 21,000 on the average. Table 9 shows the stocking and harvest summary in the 3rd experiment. The total harvested crab reached 36.65 kg amounting to Riel 774,900.

Table 9: Summary of mud crab stocked and harvested in the 3rd experiment

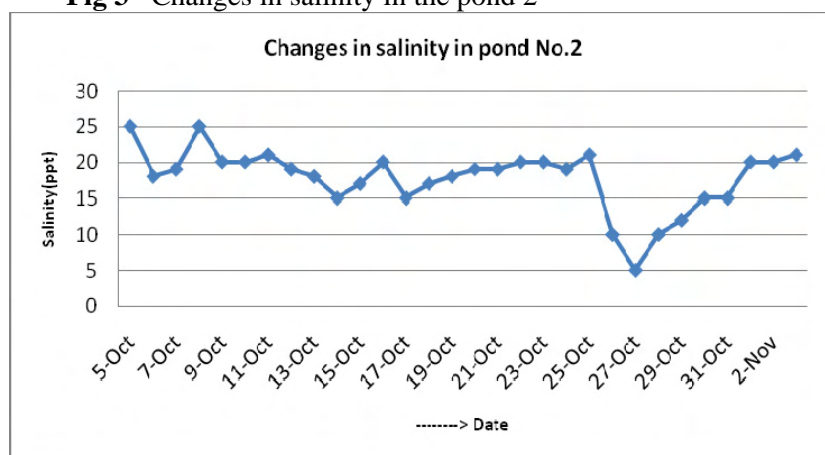
Pond No.	Stock		Harvested		Dead (pc)	Lost (pc)	Survival Rate (%)	Sales (Riel)
	(pc)	(kg)	(pc)	(kg)				
II (female)	154	14.60	94	22.65	19	41	61.0	478,450
III(Male)	114	10.30	59	14.00	20	35	51.8	296,450
Total	268	24.90	153	36.65	39	76	57.1	774,900

5.5 Water conditions

All throughout the culture period, salinity was measured by the members of the group and recorded daily in the logbook. Salinity changes in pond 2 after 5th October are shown in Fig. 3. As shown in the graph, the salinity noticeably varied during this season because of an unprecedented rainfall in October. It was claimed by the meteorological data that the rainfall in 2008 from July to November could be abnormally higher compared with any average year. The water temperature had not been measured as the water thermometer was reportedly damaged. The water quality parameters were measured on 18 November by the JICA expert and the result is shown in Table 10.

5.6 Bookkeeping and Accounting

Recording the appropriate figures in the logbook and the general ledger was practiced after learning the process during the first and second experiments. Based on the records, the supplemental accounting books such as the Monthly Stock Record, Feeding Record and Crab Harvesting Record were compiled monthly. Each book was verified and scrutinized by the project team whenever they visited the site and necessary corrections and guidance in bookkeeping were made. The summarized expenditures during the 3rd experiment are shown in Table 15.

Fig 3 Changes in salinity in the pond 2**Table 10:** Water quality of the mud crab ponds on 18 November 2008

Area	Time	Measure Depth	Temp. (°C)	Salinity (‰)	DO (ppm)	DO (%)	NO ₂ -N	NO ₃ -N	NH ₄ -N	COD
Estuary	11:15	Surface	29.46	22.59	4.70	70.0	<0.005	<0.2	=0.2	=10
		0.5 m	29.24	22.54	4.47	66.0				
No.3 pond (empty)	11:25	Surface	29.24	22.05	4.79	69.6				
		Bottom 0.6m	29.13	22.56	5.14	75.9				
No.4 pond (20 male left)	11:30	Surface	29.3	22.23	4.74	70.0				
		Bottom 0.6m	29.05	22.31	5.42	81.4				

Source of data: Hatori 2008

5.7 Discussions

Water conditions

Compared with the 1st and 2nd experiments conducted from February to June 2007 and November 2007 to March 2008, respectively, the climatic conditions in the 3rd experiment were more favorable for mud crab culture except the high and continuous rainfall. Table 11 shows the comparative data for such parameters as salinity, water temperature and D.O. concentration monitored during these three experiments. As shown in this table, the water temperature during the 3rd experiment was the lowest ever while DO was above the optimum level, although salinity was on the lower side. Judging from the growth and survival rates of the mud crabs, the change in salinity, particularly the low salinity, appears to give little negative effect to the survival rate of the crabs. In general, the water condition in this experiment seemed favorable. Yet, there were some contentious points that remained unclear such as the temperature and salinity differences between the surface and the bottom of the pond. This needs further attentive investigation especially in ponds where water is minimally circulated, although it is believed that the water circulation at the bottom of ponds has been improved by the installation of PVC pipes in the ponds. In addition, measurements of DO concentration as well as that of the weight and carapace length should be conducted more frequently.

Table 11: Comparison of water conditions in each experiment

Experiment	Period	Water temp (°C)	Salinity (‰)	DO concentration (ppm)
1 st / <u>1</u>	Feb – Jun 2007	32.0 – 33.0	20.5 – 37.0	-
2 nd	Nov/07 – Mar/08	29.4 – 31.6	21.8 – 35.2	4.25 – 5.98
3 rd / <u>2</u>	Sep – Nov 2008	29.1	5.0 – 25.0	4.79 – 5.14
Optimum figure / <u>3</u>		23 - 32	15 - 30	≥ 4.0

Note: /1 : Water temperature in the 1st experiment was measured only in April.

/2 : Water temp and DO in the 3rd experiment were measured on 18 November 2008.

/3 : Optimum figures are as described in the Aquaculture Extension Manual No. 27 by AQD (1999)

Growth rate and FCR

As indicated in Table 12, the growth rate during the experiment showed an encouraging trend. As seen in Table 13, the weight increase per day demonstrated at 3.3% is relatively high. The weight of the crab reached the marketable size (200 g) after 35 days of fattening (cf. Fig.4) and to 240 g on the average after 48 days. The data demonstrated that the environmental condition was favorable and the feeding practice was maintained in good balance (most likely too well-fed) in this experiment. This is a good sign for the future prospects of this venture.

Table 12: Growth rate of mud crab in the 3rd experiment

Date	Pond 2 (Female)		Pond 3 (Male)		Average	
	Weight (gr)	Length (cm)	Weight (gr)	Length (cm)	Weight (gr)	Length (cm)
09.09.08	90.0	7.63	100.0	9.38	93.8	8.50
30.09.08	158.6	9.73	176.7	9.78	166.7	9.75
19.10.08	217.7	-	-	-	-	-
03.11.08	-	-	236.0	-	-	-

Note: Measurements on 09.09.08 and 30.09.08 were based on the actual figure, while on 19.10.08 and 03.11.08 were calculated ones.

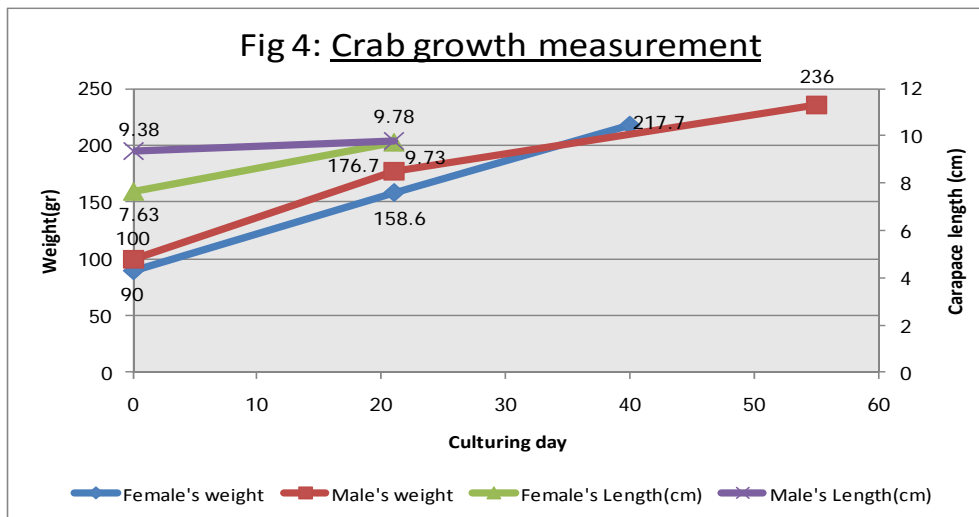


Table 13: Calculated figures on the growth rate of mud crabs

Pond No.	Stocking date	Harvesting date	Average stocking day	Change of weight (g)		Average wt. increase (g)		Rate of wt. gain per day (%)
				Initial	Harvested	W. period	per day	
II (Female)	08-10.09.2008	18.10 - 04.11.2008	47	95	241	146	3.1	3.3
III (Male)	08-10.09.2008	27.10 - 04.11.2008	49	90	237	147	3.0	3.3
Average	-	-	48	93	240	147	3.1	3.3

The FCR was also calculated as shown in Table 14. The average FCR was 5.3, a figure which was rather high compared with 2.7 as suggested in the AQD Manual (1999). This means more attentive observation is needed on feeding which could be controlled by properly monitoring the remaining amount of feeds in the feeding trays or baskets.

Table 14: Calculated figures on FCR

Pond No.	Number of crab (pc)			Total feed given (kg)	Average feed given per crab (gr)	Average weight increased (gr)	Calculated FCR
	Initial	Harvested	Mean				
2 (Female)	154	94	124	76.5	617	146	4.2
3 (Male)	114	59	87	88.5	1,017	147	6.9
Total	268	153	211	165.0	782	147	5.3

Productivity and survival rate

As seen in Table 9, the survival rates were 61.0% and 51.8% for female and male crabs, respectively, with average survival rate of 57.1%. This figure is a great improvement compared with those in the 1st and the 2nd experiments, *i.e.* 6.4% and 2.4%, respectively. It is considered that this noticeable improvement is simply attributed to the strict protection of the crabs from being stolen conducted by the newly assigned round-the-clock guard from FiA. In addition, this could also be due to the fact that the water condition in the 3rd experiment was by far more favorable than the conditions during the 1st and 2nd experiments. Although there were some encouraging factors, but still more efforts would be needed to improve the survival rate to at least 85%, as suggested in the AQD Manual (1999).

Economic account

The summary of income and expenditures which was compiled based on the monthly general ledger was prepared and described in Table 15, which indicated a total expenditure of Riel 1,794,800 (USD 448.7) against the total sale of Riel 774,900 (USD 193.7). This means that by all means there was still a deficit in the experimental operation by Riel 1,019,900 (USD 254.0). Unlike in the case of mushroom production by the women's group, however, the labor cost of Riel 570,000 (USD 142.5) which constituted over 30% out of the total expenditure was distributed to the members, which in a way was considered as shares of the members or income.

Based on the accounting figures as shown in Table 15, the economic feasibility in the simulated operations using all 5 ponds (total area of 1968 m²), is indicated in Table 16. In this table, the second column (calculation on actual base) is the economic analysis based on the information cited from the web site as "the terminal density should be 28 g/m²" (Hatori, September 2008). The third column indicates Scenario I which is based on the assumption that the terminal density could be increased to 50 g/m², while in the last column is Scenario II where the analysis is made on the basis of experimental data where the terminal density is 90 g/m² and survival rate of 87% based on reports from the Thai National Research Institute (Tiensoongrassnee, 2002). As could be interpreted from the above figures, it is obvious that no commercial profitability could be accounted for even with Scenario II under the current practices. When the research data from the Thai National Research Institute is applied, the commercial viability could be discussed with an optimistic point of view. The major question derived from the 3rd experiment lies in the realistic figure of the levels of density. The AQD Manual described the density as "1.5 juvenile crab (ab. 20 g) per m²" but no specific terminal density was mentioned. In the 3rd experiment, the initial densities in pond No. 2 and 3 were 41.5 and 23.8 g/m², respectively. These by far seemed to have exceeded the limit described in the AQD Manual. However, the fact is that neither signs of under-feeding nor crab-escaping from the ponds was reported in this experiment. As specifically described in Table 16, it is obvious that no commercial profitability could be gained unless the terminal density is increased to 90 g/m² or more, and also taking into account the depreciation and maintenance costs.

Table15: Income and Expenditures from the 3rd experiment

Item	Month			Total		Remarks
	9	10	11	(Riel)	(USD)	
1. Income						
- Received from SEAFDEC	900,000	720,000	0	1,620,000	405.0	
- Sales of crab	0	362,250	412,650	774,900	193.7	
- Others	94,350	0	0	94,350	23.6	B/F from March 2008
Sub-total:	994,350	1,082,250	412,650	2,489,250	622.3	
2. Expenditure						
- Purchase of crab seed	298,800	0	0	298,800	74.7	
- Transportation cost for seeds	15,000	0	0	15,000	3.8	
- Feed	88,000	98,500	4,500	191,000	47.8	
- Fuel	87,000	144,000	0	231,000	57.8	
- Labour	230,000	310,000	30,000	570,000	142.5	
- Water/ice	15,000	30,500	1,500	47,000	11.8	
- Charging battery	10,000	10,000	2,500	22,500	5.6	
- Equipment and materials	129,500	280,000	0	409,500	102.4	
- Transportation for materials	5,000	5,000	0	10,000	2.5	
- Communication cost	0	0	0	0	0.0	
Sub-total:	878,300	878,000	38,500	1,794,800	448.7	
3. Balance	116,050	320,300	694,450	694,450	173.6	

Table 16: Calculated Profit and Loss in Mud Crab Fattening for 2 months

1. Base of calculation	Calculation on actual base	Calculation on improved base	
		Senario 1	Senario 2
- Terminal density (gr / m ²):	28	50	90
- Number of seed crab (pc):	328	586	848
- Average weight of seed crab (gr):	100	100	100
- Total weight of seed crab (Kg):	32.8	58.6	84.8
- Calculated initial density (gr / m ²):	16.7	29.8	43.1
- Cost of seed crab (\$/Kg) :	3.0	3.0	3.0
- Survival rate (%):	70	70	87
- Number of crab harvested (pc):	230	416	738
- Average weight of harvested crab (gr):	240	240	240
- Total weight of harvested crab (kg):	55.2	99.8	177.1
- Cost of harvested crab (\$ / Kg):	5.25	5.25	5.25
- Period of fattening (days):	50	50	50
- Cost of feed fish (\$ / Kg):	0.38	0.38	0.38
- Expected FCR (% - actual result in 3rd trial):	18.8	18.8	18.8
- Amount of feed required (kg)			
{(328+230)/2*0.14/0.188}	208		
{(586+410)/2*0.14/0.188}		371	
{(848+738)/2*0.14/0.188}			591
	<u>Amount (\$)</u>	<u>Amount (\$)</u>	<u>Amount (\$)</u>
B. Profit and loss calculation			
1.Fixed cost			
- Depreciation	0.0	0.0	0.0
- Maintenance cost	0.0	0.0	0.0
Sub-total:	0.0	0.0	0.0
2. Variables			
- Labour cost (\$1.25 x 2ps. X 60dys)	150.0	150.0	150.0
- Cost of seeds (\$3 x 32.8kg)	98.4		
(\$3 x 58.6kg)		175.8	
(\$3 x 84.8kg)			254.4
- Cost of feed (\$0.38 x 208kg)	79.0		
(\$0.38 x 371kg)		141.0	
(\$0.38 x 591kg)			224.6
- Cost of misc. materials & services (actual)	180.0	180.0	180.0
Sub-total:	507.4	646.8	809.0
3. Gross sales of fattened crab (\$5.25 x 55.2kg)	289.8		
(\$5.25 x 99.8kg)		524.0	
(\$5.25 x 177.1kg)			929.8
4. Net sales	-217.6	-122.9	120.8

operation

6. Fourth experiment

In the wake of the successful outcome during the 3rd experiment, the 4th experiment was commenced to challenge the commercial application of mud crab culture on 15 December 2008. However, after the commencement of the 4th experiment, the salinity of the ponds gradually increased reaching to as high as 37-38 ppm towards the middle of January 2009. Consistent with increasing salinity, the number of dead crabs also augmented day by day, especially during molting, and eventually the experiment was obliged to be discontinued on 16 February 2009. Although the 4th experiment failed it gave useful lessons in the commercialization of the activity.

Based on the experiences and knowledge obtained all through the experiments for almost two years from February 2007 to February 2009, the 13th Workshop on Mud Crab Culture was held at the project site on 18 February 2009. The whole production process from the start was carefully analyzed by all participants from the MCCG, and the future course of action was discussed. As a result, the following conclusions were derived:

- Mud crab fattening needs attentive care therefore large-scale operation is technically difficult.
- Mud crabs are very susceptible to high salinity and temperature but can relatively tolerate low salinity and low temperature.

- Growth rate is also largely affected by the salinity and temperature.
- Judging from the above limitations, crab fattening in commercial scale can be attempted only twice in a year from July to January

- Lowering the water temperature by covering the ponds with black polyethylene sheets was also conducted. The comparative test on the effect of covering the ponds with black polyethylene sheets and the control (without covering) will be continued for a month.
- Pond No. 2 and 3 have been leased out to the private sector for them to use, taking into consideration the prevailing conditions such as salinity, water temperature and tide movement, which should be properly recorded in the logbook and subsequently submitted to the project.
- Responding to the invitation for commercial application, a member of CF Prey Nup II, showed interest in implementing a mud-crab fattening enterprise from July 2009. In order for him to pursue the enterprise, the lease contract with the CF Prey Nup II should be drawn and signed prior to the start of his work.
- Pond No. 2 & 3 should be dried and cleaned in March/April before the rainy season sets in.

In line with the above agreement, the pond cleaning was completed and the comparative test on covering the pond surface with black polyethylene sheets was made in March and April 2009. The result of the above comparative test showed some positive effectiveness in lowering the temperature within the range of 1 to 2°C.

7. Conclusions

After the completion of the 1st and 2nd experiments which resulted in pessimistic outcomes, the 3rd experiment was conducted from September to November 2008. The result produced very prospective outcomes with as much as 57.1% survival rate compared with 6.4 and 2.4% in the previous trials, although no successful result was led in the 4th experiment. The major improvement from this experiment was attributed to the improved approaches based on the experiences gained from the past trials such as:

- The culture system was changed from culturing juvenile crabs to fattening within a shortened stocking period, *i.e.* 40 – 57 days compared with 100 – 110 days in the 1st and 2nd experiments.
- The size of juvenile crabs used was 93 g on the average in this experiment compared with 73 g and 63 g in the 1st and 2nd experiments, respectively.
- The culture conditions were improved, *i.e.* construction of bottom water circulation channels, installation of feeding platforms, clogging the water leaking holes and closing of the sluice gates.
- Taking all environmental factors into account, the culturing seasons are limited to 7 months from July to January in a year. In order to attain commercial profitability in the pond operation, it is inevitable to venture some other culturing during the hot seasons from February to June. According to the current observation and experiences, it is most recommendable to try out with sea-bass fattening during this season.
- Assignment of a round-the-clock guard by FiA who reportedly protected the crabs from being stolen.
- More evidently, the self-consciousness among the members of MCCG as well as the committee members of the Community Fisheries against achieving successful operation has emerged.

Among others, the working morale among the fishers could have been evidently boosted through the day-to-day operation, which is the most invaluable asset of the project implementation.

Through this experiment, the project is convinced of the technical applicability of this venture and the next challenge is to put this venture into commercial-scale operation. In order to do that, a conceivable solution would be to increase the volume of mud crabs stocked in ponds as seen in Table 17. Bearing this in mind, a commercial based trial should be conducted with the following mode and approach.

- To test the possibility of high density stocking of mud crabs, *e.g.* 90 g/m² as the terminal density. This means that the number of harvestable and seed crabs should also be increased as shown in Table 17.
- To protect the mud crabs from escaping, especially during the predictable extreme high tide in December, protection plastic sheets (50

cm high) should be installed around the ponds.

Table 17: Recommended stocking rate of crabs

Pond No.	Dimensions (m ²)	No. of crab harvested	No. of seed crab
1	416	49	69
2	352	41	59
3	432	50	72
4	356	42	59
5	412	48	69
Total	1,968	230	328

Note: Calculated on condition that the terminal stocking is 90 g/m²,
The survival rate is 87% and the weight upon harvesting is 240 g

- The size of the seed crabs should be maintained at 90-95 g or more.
- The stocking duration should be maintained for 40-45 days, although this could also depend on the growth rate.
- The assignment of the round-the-clock guard should be continued.
- As initially trained, members of the MCCG should properly enter all data in the logbook without failure, such as the ambient and water temperatures, salinity, amounts of feed given, tide record as well as other relevant observations.
- All members of the MCCG should be fully conscious of the purpose of this trial and the high morale towards achieving the goal just like in the 3rd experiment should be maintained.
- Further efforts to reduce water temperature by a means of covering ponds with black plastic sheets, for instance, should be sought.

8. References

Aquaculture Extension Manual No.27 Mud Crab, AQD, March 1999

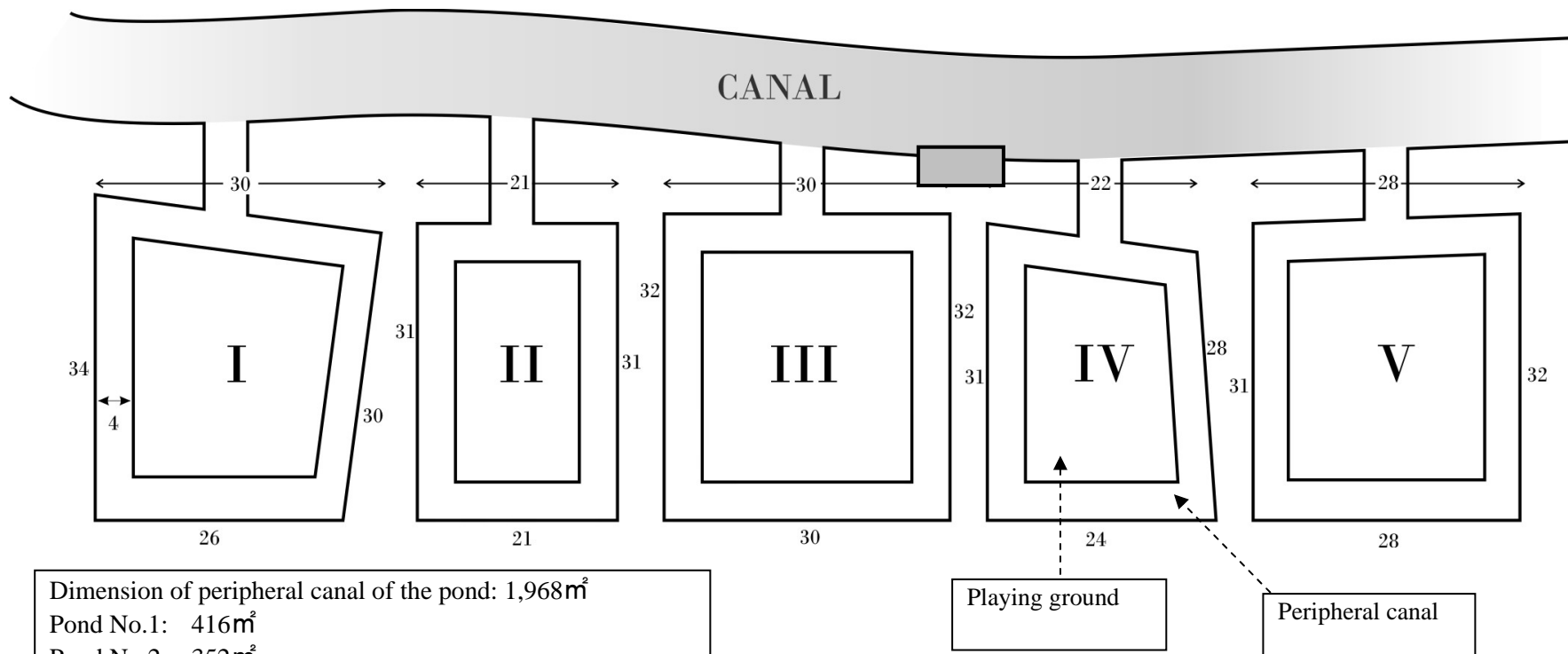
Report on Experimental Mud-crab Culturing in Sihanoukville, Etoh S., August 2007

Study tour on Crab Culture in Kampot Province, Longdy V., April 2008

Report on the 2nd Experiment on Mud-crab Culture in Sihanoukville, Etoh S., June 2008

Report on the 3rd Experiment on Mud-crab culture in Sihanoukville, Etoh S., December 2008

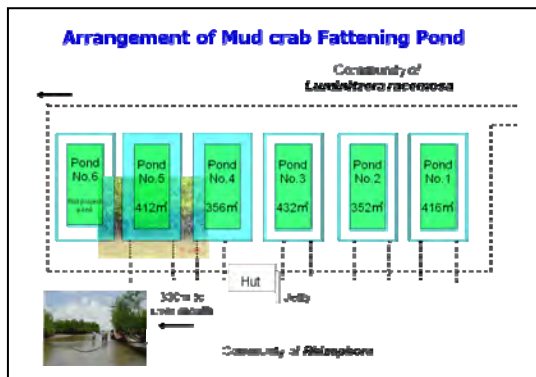
Annex 1: Layout of the ponds



Dimension of peripheral canal of the pond:	1,968m ²
Pond No.1:	416m ²
Pond No.2:	352m ²
Pond No.3:	432m ²
Pond No.4:	356m ²
Pond No.5:	412m ²

STUDY ON ENVIRONMENTAL EFFECTS OF MUD CRAB FATTENING

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 JICA Expert, FiA, Cambodia



Problem and Reasons of 1st, 2nd and 4th Experiments in Dry Season

Problem: Low yield (2 - 6 %) for three experiments in dry season due to high mortality in January and escaping of crab in November

Table 1: Summary of 1st Experiment (6 ponds total)

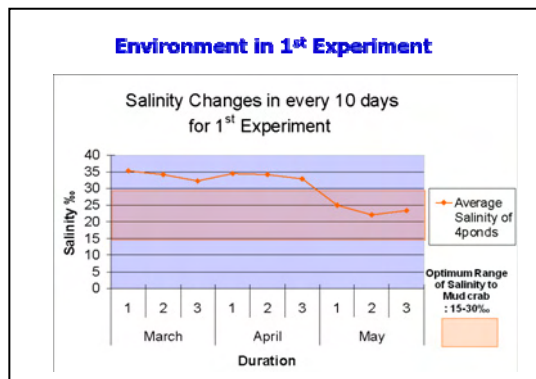
	Start	End	Days	Note
Flowering of Crab	12/25	1/25	31	Initial stock 12' Dec 2009
Escaping of Crab	1/25	2/15	21	Final stock 12' Feb 2010
Duration of experiment	12/25	2/15	51	* Escaping after 55 days

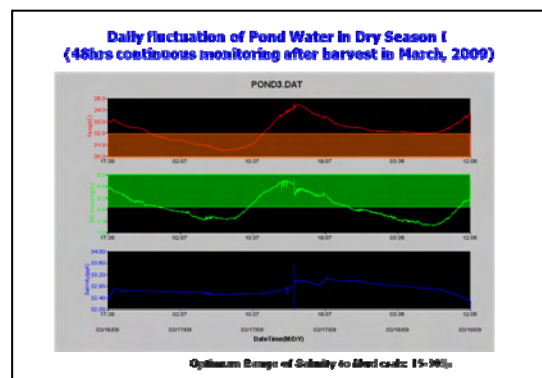
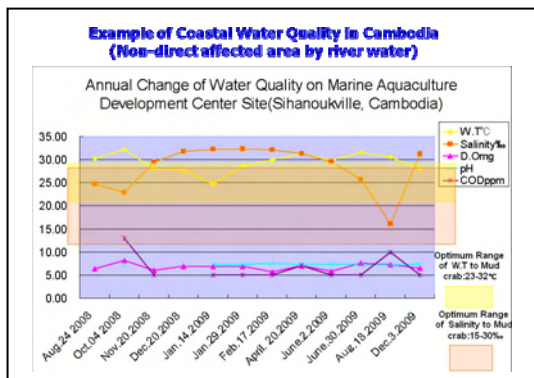
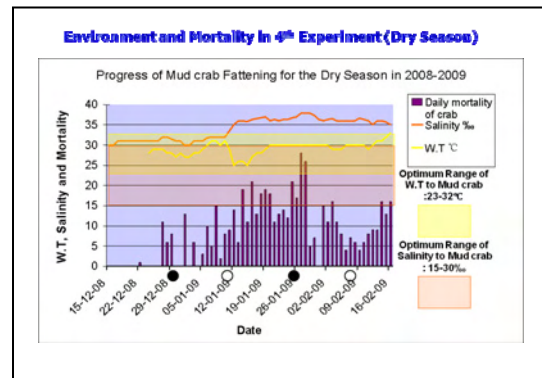
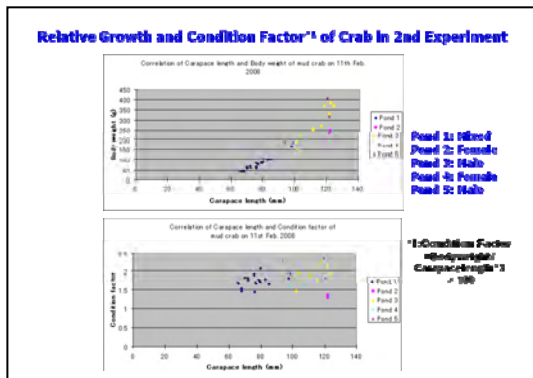
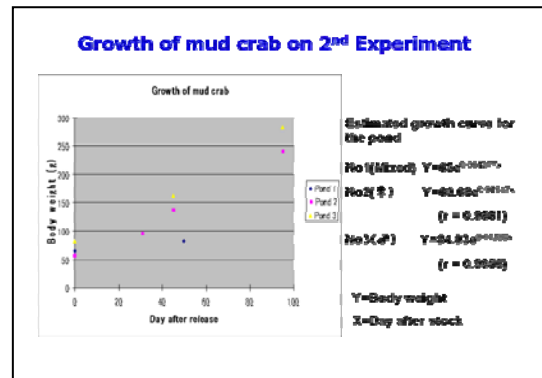
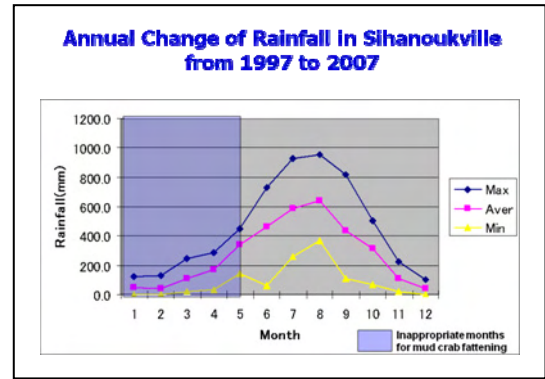
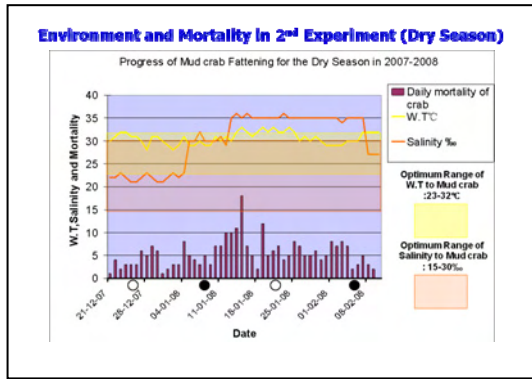
Table 2: Summary of 2nd Experiment (6 ponds total)

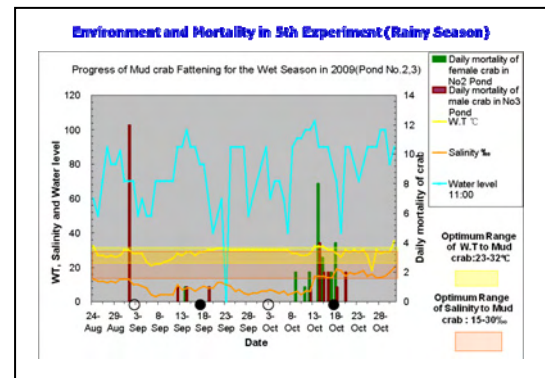
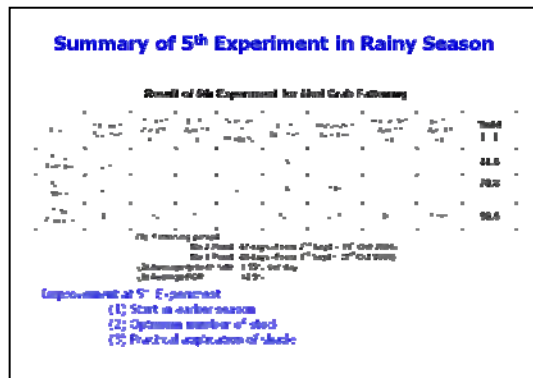
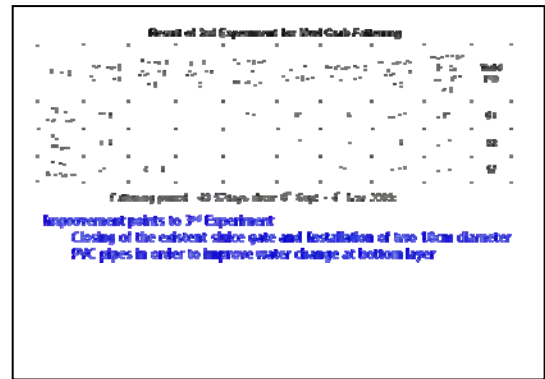
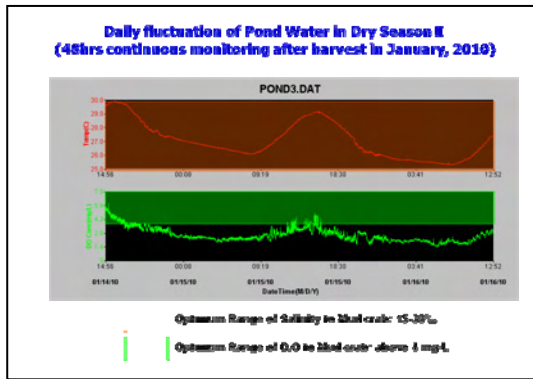
	Start	End	Days	Note
Flowering of Crab	1/25	2/7	14	Initial stock 12' Dec 2009
Escaping of Crab	2/7	2/15	9	Final stock 12' Feb 2010
Duration of experiment	1/25	2/15	51	* Escaping after 55 days

Table 3: Summary of 4th Experiment (2 ponds total)

	Start	End	Days	Note
Flowering of Crab	2/24	2/28	4	Initial stock 12' Dec 2009
Escaping of Crab	2/28	3/2	4	Final stock 12' Feb 2010
Duration of experiment	2/24	3/2	8	* Escaping after 65 days







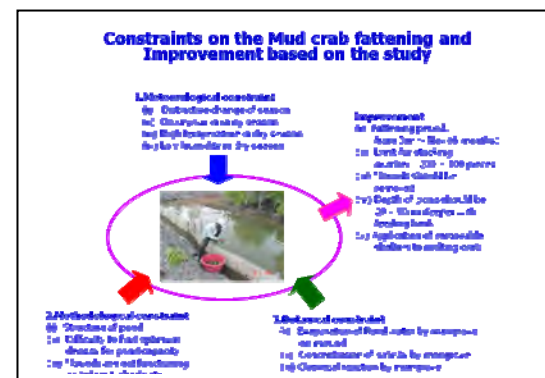
Environment of Mud crab pond in Oct. 2009 (5th Experiment in rainy season)

Sluice gate
 Sand filter. Sand sluice to control water temperature

Water lilies (to reduce water evaporation)

Feed fish kept in sea

10kg of mud crab before



LOCAL BUSINESS DEVELOPMENT: SEA BASS CULTURE

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

1. Background

The project on Integrated Coastal Resources Management in Sihanoukville (ICRM-SV) began implementing its activities in November 2005 with the core project objective of promoting sustainable coastal resources management and community development. One of the main and important goals in community development lies in the alleviation of poverty in the society. Efforts in sustainable management of available resources should therefore contribute to a great extent to achieve this goal. There is no doubt that creation of new job opportunities for the unemployed labor force significantly improves the social life in a community. In addition, it could also provide the fishermen with an alternative source of income that may eventually have a positive effect in the reduction of fishing efforts.

As envisaged in the project activity, fish culture is one of the features in the development of a local business venture. Parallel with the abovementioned mud-crab fattening venture, fish culture experiment of sea bass commenced on 14 November 2007, which was constructed by the Fisheries Officer of Sihanoukville Office. While the cost of purchasing the fingerlings was borne by Fisheries Sihanoukville Office, the experiment has been carried out using SEAFDEC funds.

It was proposed in the 2nd Local Seminar that the fishermen group in Kampong Chin was very remote from the mud crab culture ponds and therefore alternatively fish cage culture of grouper or sea bass should be tried out. They have earmarked the suitable land which was observed to be appropriate. This possibility should be examined in early 2008.

2. Group Organization

The preliminary inspection of the proposed site was conducted on 19 February by the project team. Located near the mouth of canal with minimum depth of 150 cm at the lowest tide, the site seemed suitable for fish cage culture. The Fish Cage Culturing Group (FCCG) was then organized as a sub-group of the Community Fisheries Prey Nup II in April 2008 with 6 members to promote a cage culture venture. Sea bass (*Lates calcarifer*) was selected as the species of fish to be cultured for a number of advantages in the area, even knowing that there might be some technical constraints like parasites, skin disease, etc. that should be tackled. As the next step prior to planning, an economic feasibility study was carried out and the outcome was thoroughly discussed with all the members on 18 June 2008 incorporating their local knowledge. The financial feasibility was concluded as positive as seen in the Table 1 with the culture to commence in September for a period of 6 months and conducted once a year. It is reckoned that the net profit to be distributed to the members should reach 1,918,000 Riel equivalent to USD 480 per 6 months operation. The economic return against the capital investment should be around 45.3 %. In the wake of such convincing economic feasibility study, preparation work was started in August in order to commence the experimental culture operation in September.



Fig.1 Fish cage culture group meeting and discussion on work plan

Table 1: Economic Feasibility Sheet on sea bass cage culture

1. Base of calculation

- Number of members: 6
- Species of fish for culturing: Sea bass (*Lates calcarifer*)
- Construction cost: Self-employed labor
- Dimensions of cage: 2.5x2.5x2.0 m (LxWxH)
- Number of cages: 6 sets
- Number of net: 8 sets (spare 2 nets)
- Cost of necessary construction materials (in USD)

1. Wood frames (1 m ³ x \$300)	300
2. Screw (2 kg x \$8)	16
3. Plastic buoy (12 pcs x \$20)	240
4. Rope (25 kg x \$4)	100
5. Netting material for 8 nets (72 kg x \$4)	360
6. Net construction (8 pcs x \$7)	56
Total:	1,072 (Riel 4,288,000)
- Cost of installation: Riel 4,288,000 (USD 1,072)
- Depreciation of facilities: 4 years for frame and 2 years for cages
- Culturing duration: 6 months
- Number of cropping per year: 1time (Sept to May)
- Marketable size of fish: 500 g
- Size of fingerling: 3 inch
- Cost of fingerling: 900 Riel per pc (3" size)
- Feed conversion rate: 3.0
- Price of fish feed (trash fish caught by set-net): Riel 1,500 per kg
- Price of marketable size of fish: Riel 16,000 per kg in Sihanoukville
- Mortality rate: 40%
- Number of harvestable fish: 1,500 pcs (500 g size)
(20 kg/m² x 2.5 m x 2.5 m x 6 cages/0.5 kg)
- Total weight of harvested fish: 750 kg
(1,500 pc x 0.5 kg)
- Number of fingerlings stocked: 2,500 pcs (3"size)
(1,500 pcs/0.6)

2. Annual Fixed cost	Riel ('000)	USD
- Depreciation of facilities (Frame for 4 years: Riel 656,000) (Cages for 2 years: Riel 832,000)	1,488	372
- Maintenance cost for facilities (Riel 4,288,000 x 5%)	214	54
Sub-total:	1,702	426

3. Annual variable cost		
- Cost of fingerling (2,500 pcs x Riel 900)	2,250	563
- Cost of feed (2,500 pcs x 0.8 x 0.5 kg x 3 x Riel 1,500)	4,500	1,125
- Cost of fuel (10l x 8 months x 5,000 Riel)	400	100
- Marketing overhead (750 kg x Riel 16,000 x 5%)	600	150
- Misc. including communication (Riel 3,000 x 210 days)	630	158
Sub-total:	8,380	2,095

4. Annual net income		
- Sales (750kg x Riel 16,000)	12,000	3,000
- Expenditure	10,082	2,521
- Gross income	1,918	480
- Share to each member per year	320	80

5. Return on investment		
- Initial investment cost	4,232	1,058
- Return on initial investment (%)	45.3 %	

3. Cage construction

Preparation work began in August in order to commence the experimental cage culture operation. Materials necessary for construction of the cages were provided by the SEAFDEC funds and all construction work were done manually by the members. Within the funds available, the cage culture raft containing 6 cages having dimensions of 2.5m x 2,5m x 2m = LWH was constructed by early September 2008.



Fig. 2 Fish cage construction at canal in Kampong Chin village

4. The 1st Experiment

A total of 2,500 pieces of sea bass fingerlings 2 inches long were procured using the FiA fund from Thailand and stocked on 23 September 2008. But by 30 September, all the stock was found dead. The members claimed that this was caused by the strong stream of water from the creek after a downpour on the 3rd day against which the small fish fingerlings could not survive. In order to investigate the cause of the mortality, various efforts were made.

Firstly, discussions were held with scientists and commercial fish cage culturists dealing with sea bass culture in Thailand. They were collectively with the view that:

- a. The fingerlings were too small, as the size should have been 3 inches at the minimum.
- b. Most probably, the cause of mortality could be disease from the hatchery considering that the fins were detached from the dead fish.
- c. The density may be too high.
- d. Sea bass can generally tolerate low salinity and therefore freshwater flow-in would not be a cause of the mortality.

Secondly, Mr. Tatsuya Hatori, JICA expert, investigated the parameters measured like salinity, DO and temperature in the creek on 19 November 2008. He discovered that the DO measurement especially in the bottom was fairly low at 3.66 ppm. This fact might be related to the mortality, as he suggested in his report as attached in Annex 1: Report on Site Inspection of Sea bass Cage Culture. He also pointed out that the high density could have contributed to the mass mortality.

Aimed at reviewing the failure in the first experiment, the 5th Workshop on the Cage Culture Group (CCG) was held on 19 November 2008. In this workshop, a description was made by the group leader on the course of stocking including the environmental changes toward the end of September. Based on such observations, technical as well as scientific views were presented to the workshop by the JICA Expert. As a result, it was agreed to repeat the experiment attentively taking into account the following cautious points:

- a. The position of the cages should be changed to the nearest place of the village where a strong current can be avoided and where the sufficient depth is 1.5 m at the lowest tide.
- b. Fingerlings to be procured should be 3" long at the minimum
- c. Size selection should be made every 2 weeks.
- d. Cages with 3 cm ST mesh size nets should be constructed in addition to the presently available cages with 1.5 cm ST mesh.

- e. Water temperature, salinity and DO should be attentively measured, using the salinometer and a water temperature gauge provided by SEAFDEC for this purpose.
- f. Feeding in the earlier stage should be made using the minced form of small fish, using the hand mincer provided by SEAFDEC.
- g. For the safety side in the trial, the maximum density of stocking should be kept within 600 pcs/cage, which can be reckoned at 25.6 kg/m² at harvest.

Abiding by the above instructions, the 2nd trial is expected to be conducted in early January 2009.

5. The 2nd Experiment

The 2nd experiment was commenced on 7th January 2009 with 800 fingerling of sea bass, 3-inch in size. Site inspection and collection of marine environmental data were carried out by the project team and the JICA expert on 18 February 2009. Based on the observation, the 6th Workshop on Cage Culturing was conducted on the same day. As the result, it was decided to shift the cage culture location further down to the canal as the current location was not a suitable place with low DO (Dissolved Oxygen). Thus, the location was shifted in the same stream of the creek.

After moving the cages to the new location, Mr. Tatsuya Hatori investigated the water parameters like salinity, DO and temperature in the canal on 3 June 2009, and observed that the environmental conditions have improved. The remaining number of sea bass was 80 in sound shape, which gave a good sign in terms of the future perspective.

Based on such experimental cage culture, it was found that the best season for culturing sea bass in the area would be after the advent of the rainy season in July and the products should be harvested for the occasion of Chinese New Year which will fall in January or February due to prevailing highest prices for all commodities of the year. With this perspective, the project is intending to conduct the 3rd experiment from July/August.

Through the previous experiment in the cage culture of sea bass as well as the mud crab fattening exercise, it was suspected that mangrove trees could have given unfavorable effects for maintaining the DO and salinity in the water and could have caused the major reason of the high mortality of the mud crab and sea bass. The JICA expert having been involved in the project activity, has inductively asserted the negative effects of mangrove trees against the sound pond and cage aquaculture like the ones carried out by the project. It is necessary to verify scientifically with the comparative test before entering into the commercial scale venture. Depending on the outcome of the test, the orientation towards the future course of aquaculture business in the project site would be drastically changed.

6. Recommendations

- Mr. Tatsuya Hatori, JICA expert recommend that, the location of fish cage culture in canal is not appropriate for fish culture, because every time the conditions are checked, the water quality and fish body do not appear good, while the result of water quality showed that DO is lower than standard, especially low oxygen at the bottom, salinity is zero, and a lot of parasites on the sea bass.
- Group management is not good, because of the failure to select the size, while good management entails the selection of size by the farmers which should be done every two weeks or one month,
- Fish culture may be appropriate at the estuary of a river, because this area has good salinity and nutrients



Deterioration of Water Quality on the 3rd Site

(1) The cage was not relocated to recommended 4th site even on 2nd April.
 (2) The water color is noticeably changed to black the January observation.
 (3) The water quality deteriorated to a worse level than the 1st site - the seabass being raised became the disease-prone and poor health condition.

Table Water Quality on the 3rd Site and the 4th Site (April 21st 2009)

Location	Depth	WT	D-O	D-O	Salinity	DOO	TKN-N	NO3-N	NO2-N	pH
		mg/l	mg/l	mg/l	‰	ppm	ppm	ppm	ppm	
2nd site	0	31.4	4.15	00.2	11.00	1.1	0.2	2.2	<0.05	7.2
0.5m	1.5	32.8	1.00	00.1	10.05	-	-	-	-	-
0.5m	2.0m	32.7	0.45	0.9	10.20	-	-	-	-	-
4th site	0	31.5	4.05	00.2	10.35	-	-	-	-	-
0.5m	1.5	32.8	1.47	0.6	10.05	-	-	-	-	-

**Total Length 13cm
Body Weight 50g**





Conditions after Relocation to the 4th Site on June 2nd 2009

(1) After relocation water quality improved. DO level was 4 mg/l water temperature was 26°C.
 The water flow velocity is slowly increased from the water transfer system.
 (2) The number of seabass - the survival rate was low to the seabass post-transfer.
 (3) The water color remained to be black and oxidized factor also.
 (4) The fish seems to be affected in individual water transfer system body arrangement.

Table Water Quality on the 3rd Site and the 4th Site (June 2nd 2009)

Location	Depth	WT	D-O	D-O	Salinity	DOO	TKN-N	NO3-N	NO2-N	pH
		mg/l	mg/l	mg/l	‰	ppm	ppm	ppm	ppm	
2nd site	0	30.1	4.05	00.5	10.0	1.0	0.2	2.2	<0.05	7.2
0.5m	1.5	30.1	2.1	0.5	10.0	-	-	-	-	-
0.5m	2.0m	30.1	1.0	0.7	10.0	-	-	-	-	-
4th site	0	30.1	4.05	00.5	10.0	-	-	-	-	-
0.5m	1.5	30.1	2.1	0.7	10.0	-	-	-	-	-



Conditions on the 4th Site on Aug.19th 2009

Only 3 sea bass survived due to parasitic of crustacean on the body, and waste of fish cover.

Table Water Quality on the 4th Site (August 19th 2009)

Location	Depth	WT	D-O	D-O	Salinity	DOO	TKN-N	NO3-N	NO2-N	pH
		mg/l	mg/l	mg/l	‰	ppm	ppm	ppm	ppm	
2nd site	0	26.6	7.29	02.1	10.0	1.7	0.2	2.2	<0.05	7.0
0.5m	1.5	26.6	7.10	00.4	10.0	-	-	-	-	-
0.5m	2.0m	27.0	1.10	14.6	10.04	-	-	-	-	-






Cage setting is a shallow depth on bottom Crustacean Crustacean are parasitic on seabass Crustacean sucked blood of seabass

Review on the Seabass Cage Culture

- (1) Cage culture in the creek is difficult to grow out seabass from fingerling to commercial size (kg) due to low oxygen at dry season and parasites in many season.
- (2) Other available location is difficult to find along the creek due to stagnant layer of low oxygen.
- (3) There is no suitable location in the estuary due to shallowness.
- (4) However, there seems a potential to combine with pond culture, but constant cost.
 - a) There is good gap between two communities to conduct pond culture and cage culture.
 - b) Environmental pond culture should be conducted to ensure potential to grow out from fingerling.
- (5) Market constraint also existed.
 - a) Delay to relocate the cage to better location.
 - b) Daily care such as net cleaning was not enough.

HUMAN CAPACITY BUILDING AND PARTICIPATION IN WORKSHOP, TRAINING AND STUDY TOURS

Mrs. Heng Ponley

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Objectives

- Build awareness and consensus on the project activities as the first step to achieve the smooth implementation of the project
- Realize the effort towards building awareness and consensus through appropriate education and training program
- Motivate people to generate self-regulatory management framework and organize community-based development project on their own

1. Study Tour

1.1 Study Tour to Chumphon

A study tour aimed at inspecting project activities and exchange views with the fishermen in the sister project was conducted on 20-25 March 2006 in Chumphon, Thailand

The major activities of the study tour were:

- (1) to study the applicability of a crab bank scheme which had been successfully implemented in Chumphon,
- (2) to study a newly challenging activity in relation to fisheries enforcement in the demarcated zones within the ICRH-PO by the Pailding Fishermen's Group (PFG); and
- (3) to observe the Babylonian shell culture and mud crab culture



Study tour to Chumphon



1.2 Study Tour to Siem Reap

- A study tour to Siem Reap Province was conducted on 14 August partly to observe other approaches to local business development with community fisheries
- The participants included 10 leading fishermen, 2 committee members, 1 Commune chief, a fisheries officer 4 national project staff and 3 SEAFDEC staff



1.3 Study Tour to Stung Hao District

- The study tour to Stung Hao was conducted to inspect the crab bank scheme initiated by FiA on 5th April 2006,
- 16 members of Crab Bank Group participated
- The Stung Hao Crab Bank was initiated in March 2006 based on the model in Chumphon, Thailand. The cages were installed at the top of a jetty which makes easy access for feeding and stocking.



1.4 Study Tour to Svay Rieng Province

- The study tour was conducted on April 2009 to inspect the Fish Refuge Management
- 5 members of Fish Refuge Group participated



2. Fisher's Workshop

The 1st Fishers Workshop was held in the Prey Mup II on 14-15 December 2005 aiming at:

- disseminating the result of socio-economic survey among stakeholders in the project site,
- disseminating the result of fishing gear survey and
- accounting the contents of the Royal Decree on Establishment of Community Fisheries and the Sub-decree on Community Fisheries Management recently signed and
- briefing them on establishment of a women's group

2. Fisher's Workshop

The 2nd fishermen workshop was organized on 8th February to discuss various issues like:

- organization of sub-fisher groups,
- steps to be taken to prepare the Community Fisheries Area Management Plan
- strengthening Local Enforcement Unit

The 3rd Fishers' workshop was held on 28th April 2006 to:

- explanation of the draft Community, By-Law / Internal Law and Community Management Plan
- brief on the training course for mushroom production by women's groups.

2. Fisher's Workshop

The 4th Fishers' workshop was held on 21 – 28 June 2006 for two days in each of the four villages aimed at

- disseminating the provisions of drafts of IL/BL and CFAMP; and
- expecting useful feedback from fishers.

The 5th Fishers' Workshop was conducted on 16 October 2006 with the major objective:

- reviewing the findings and observation made during the study tour;
- based on which discussions were made on how and what model could be applicable to the community in the project operational area

2. Fisher's Workshop

The 6th Fishers Workshop was conducted on 16.10.07 on:

- Reviewing outcomes of mud crab culturing
- Reviewing women's activities

The 7th Fishers Workshop was conducted on 05.12.07 on:

- Monitoring mud-crab and sea bass culturing
- Establishment of Crab Bank Group
- Monitoring mushroom production

2. Fisher's Workshop

The 8th Fishers Workshop was conducted on 19.02.08 on:

- Application of fish refugia scheme
- Preliminary discussion on cage culturing

The 9th Fishers Workshop was conducted on 01.04.08 on:

- Monitoring mud-crab culturing outcome
- Establishment of Crab Bank Group
- Establishment of Blood Coddle Fishers Group
- Establishment of Cage Culture

2. Fisher's Workshop

The 10th Fishers Workshop was conducted on 18.06.08 on:

- 2nd experiment of mud-crab fattening
- Practical and economic feasibility on sea-bass culture
- Debriefing on the outcome of study tour
- Formulation of Self-regulatory Regulation for blood coddle

The 11th Fishers Workshop was conducted on 18.02.09 on:

- maintaining a good communication between the project and Community Fisheries
- The progress of the 4th experiment
- Progress on the crab bank scheme
- Discussion with the BCFG members on practical application of the regulation

2. Fisher's Workshop

The 12th Fishers Workshop was conducted on 18.03.09 on:

- Follow up Installation of an additional cage at Prey Pros.
- Monitoring the progress to disseminate the concept of fish refugia in the neighboring fishing villages.

Fisher's workshop



3. Training Course


- The training course on mushroom production was conducted from 02-05 May 2006 at Kattambong Province

- 36 women from 4 villages participated




3. Training Course

- 10 Jan 2007, The training course in mud crab culture was conducted
- 9 February 2006: the bookkeeping and accounting training course
- 28 February 2007, training course on the introduction of simple bookkeeping and accounting system was conducted
- Monitoring on bookkeeping



3. Training Course

- The training course in production of mushroom spore was conducted in December 2008 in Battambang
- The new venture was commenced in January 2009.
- 4 women participated



Procure of Producing Spore



Procure of Producing Spore




3. Training Course

- Training course on data analysis on fish landing was conducted from 16-20.02.09
- 6 fisheries officers participated
- The training course aimed at providing enough knowledge for local staffs to analysis fish data when SEAFDEC/TD terminated



4. Local Seminar

Local seminar was conducted 3 times, at the end of the year 2006, 2007 and 2008 aimed at:

- To disseminate the current project achievement and status to all beneficiaries and concerning local institutions and agencies
- To expect feed-backs on project orientation and impacts from beneficiaries and concerning institutions and agencies
- To reflect findings and outcomes of the seminar into the future project operation
- To stimulate participations by all beneficiaries to the project operation more positively through such an event.

Local Seminar



Good Points

- Capacity of community fisheries committee members were improved
- Some community fisheries have knowledge and experiences in mud crab culturing
- Mushroom producer group is able to produce mushroom and spore.
- Community Fisheries have very good skill on bookkeeping and business management
- Community fisheries have broad understand on Community-base fisheries management

Weak Points

- The capacity of community fisheries members are still limited because of low education and low income generation
- Not all members of CFs have opportunities to participate in training course, study tours and workshop
- Lack of communication among 4 villages due to geographic feature and religion
- Fisheries offices have not enough capacity to analyze fish data due to training period is too short

Recommendation

- Fisheries Administration should continue supporting training course, study tour and fishermen meeting
- Capacity building on Community Based Fisheries Resources should be conducted
- FIA staffs should train more on data collection and analysis

THANK YOU VERY MUCH FOR YOUR ATTENTION

ESTABLISHMENT AND MANAGEMENT OF CRAB BANK SYSTEM

Mr. Seiichi Etoh

ICRM Expert and Former SEAFDEC's staff

Mr. Yos Chanthana

Deputy Director of Marine Fisheries Development and Research Institute, FiA, Cambodia

1. Background

In the project operational area, it is estimated that around 6,000 kg of swimming crabs are caught yearly by crab gill-net and trap fishing. As one of the most important marine species harvested from the area, the swimming crab resources has the tendency to decrease especially with the practice of crab fishing using more than 250 traps (Penchan, 2007). Aside from the declining trend, the size and quantity of the swimming crabs are also dwindling year by year as observed by the fishermen themselves and this has been their main concern. Meantime, a study tour to the project site of the Integrated Coastal Resources Management in Pathew District (ICRM-PD), Thailand was conducted by the leading members of Community Fisheries Prey Nup II in March 2006. They inspected the crab bank scheme that had been practiced for four years by the Crab Trap Fishing Sub-Group under the project ICRM-PD. This activity impressed the fishermen from CF Prey Nup II so much that they envisaged applying a similar approach to enhance their crab resources. Similarly, FiA Cambodia also expressed their keen interest in fully supporting the introduction of such a scheme in the country's coastal fisheries communities. Responding to their motivation as such, the project decided to introduce a crab bank system in the project operational area in Sihanoukville. As a first step, the project organized the 7th Fishers' Workshop on 5th December 2007 to discuss with the crab fishermen the mode of application of the crab bank in the case of Prey Nup II.

During the workshop, three possible approaches were discussed, *i.e.* the Japanese model, Chumphon model and Langkawi model, which were demonstrated to fishers prior to the commencement of the discussion. After the deliberation, they finally decided to employ the Chumphon model.

2. Prevailing crab bank system

The crab bank system was initiated in Japan over 20 years ago and similar approach was introduced by one of NGOs in Chumphon, Thailand, which had been further developed by the SEAFDEC ICRM project. The following is the description of the prevailing applications in Japan, Thailand and Malaysia.

Japanese model

The crab-bank in Hyogo Prefecture, Japan was initiated in December 1986, and since then it has been made operational by the Swimming Crab Resources Enhancement Association (SCREA) in the following manner.

- a) The SCREA purchases gravid crabs from fishermen at fixed price and record data in the log book by a member of SCREA.
- b) Gravid crabs are released back to the water after being marked "X" on their carapaces.
- c) Payment of the released crab are made to fishermen at the end of year.
- d) A fisherman catches crabs with the "X" marks on their carapaces should make sure to return these to the water.
- e) The fund to pay the fishermen for purchasing the gravid crabs is sourced from the voluntary contributions by the public through fund-raising and also from the members.

Chumphon model

The crab-bank was introduced in 2002 to Crab Sub-group of Pakklong Fishermen's Group (CSG-PFG) by one of the NGOs and the activity was taken over by the project ICRM-PD. Initially, they apply the following method.

- a) Any gravid crabs caught by the member of CSG-PFG are brought to the Chairman and the weight and the number are recorded in a logbook.
- b) The crabs are put into a cage with dimension of 3m x 3m x 3m (L x W x H) for spawning.

- c) The Chairman feed the crabs daily and once a week he picks up the spawned crab and sell them in the market.
- d) The sales from these crab are used for maintenance of the cage and feeds cost, and any remaining money are accumulated for the mini-credit scheme of the group. As such, no payment is made directly to the fishermen who bring gravid crabs to CSG-PFG but only by the motivation toward crab resources enhancement.

However, during the course of operation, they faced some difficulties like hard work to maintain the cage and feed gravid crabs, theft and high mortality rate especially during monsoon seasons. Therefore, they employed the combined system together with the Japanese model from 2006 as follows.

During calm seasons (April to October)

The same method is applied as above (a) – (d).

During monsoon seasons (November to March)

The Japanese model is employed with some modifications as follows.

- a) Gravid crabs caught are marked on carapaces onboard by fishermen and released to the water.
- b) Numbers of released crab are recorded in the logbook by the fishermen.
- c) Numbers in logbooks are totalled at the end of monsoon season (in March) and some prizes are given by SEAFDEC for the best five fishermen as incentives.

Malaysian model

The crab bank scheme was initiated with the project Integrated Coastal Resources Management in Pulau Langkawi (ICRM-PL) in June 2007 following to the Japanese model as follows.

- a) Participants of the scheme are the crab trap and crab gillnet fishermen
- b) Live Crabs bearing eggs are collected at a certain point and marked X on carapaces after which these are kept dry and released to the water where they live. The numbers of crabs collected by each member are recorded. This work is done voluntarily among the members. Thereafter, no fishermen are allowed to harvest the X-marked crabs.
- c) The fishing area for crab trap fishermen should be demarcated from the one used by the crab gill-net fishermen.
- d) Some incentives are awarded by SEAFDEC/TD for the fishermen whose contributions in the releasing of gravid crab are prominent compared with the others.
- e) The project provides participating members with a set of equipment like special oil markers, drying towels, logbooks, etc.
- f) A logbook is provided to each member by the project. The member is bound to record the number of released gravid crabs on this logbook. This logbook is collected by the extension officer of the District DOF Office periodically.

3. Establishment of crab bank system

3.1 Modus operandi

After studying the above three methods, it was decided to employ the following application which is the same as the one adopted by ICRM-PD in Chunphon.

Calm seasons (October to June)

1. Gravid crabs caught by the members of Crab Bank are brought to the chairman.
2. The number is recorded in a logbook with the name of the members by the chairman.
3. These gravid crabs are brought to the cages by the chairman or designated members
4. These crab are separated in two categories: to hatch out soon or to hatch out later, which are determined by the color of the eggs, and stocked in separate cages.

5. The chairman purchases feed every day and enter the weight and cost in the logbook and general ledger.
6. The Chairman or designated members feed the crab daily.
7. The chairman or designated members check the condition of gravid crab once a week and picks up spawned crab and bring to the chairman.
8. The chairman sells the spawned crabs to the middlemen, and the income is recorded in the logbook and the general ledger.
9. The sale of crab is used for maintenance of the cage and feeds cost.
10. The cages are cleaned from time to time and also repaired if necessary by voluntary contribution of the members. The mechanism of rotation of work has been initially decided.

Monsoon seasons (July to September)

1. Gravid crabs caught by the member of Crab Bank are brought to the chairman.
2. The number is recorded in a logbook with the name of members by the chairman (Sample logbook)
3. Gravid crabs are marked on carapaces by the chairman or designated members and released to the sea.
4. When any marked crabs are caught, fishermen must release these crab back to the sea.
5. Numbers in logbooks are totaled at the end of monsoon season (September) and some prizes are given by SEAFDEC for the best five fishermen as incentives.

3.2 Organization of crab bank group

The Crab Bank Group (CBG) was established under the framework of CF Prey Nup II during the 7th Fishers Workshop on 5th December 2007 with 11 fishermen as members who elected their leader, the sub-leader and the cashier.

3.3 Training on Crab Bank management

The training in construction, actual operation and management of the Crab Bank was held on 18 February 2008. During the training, the method of marking was also demonstrated using a special oil pen. Training in maintaining the log books was also conducted during the course.

Meanwhile, the FiA Cambodia had shown keen interest in introducing the crab bank system along the coastline in Cambodia and, to begin with, the scheme was initiated in other crab landing stations in Stung Hao by FiA in March 2008. To inspect their activities, the study tour to Stung Hao was conducted on 5th April 2008, with 16 members of the Crab Bank Group.

3.4 Construction of the cages

In the wake of the above training course on 18 February 2008 and the study tour in Stung Hao, construction of cages began by the members of CBG following to the design shown in Fig 1. The construction was completed on 28 April 2008.

4. Operation and management of Cab Bank

After the completion of crab bank cages, stocking of gravid crabs was initiated on 16 May 2008. However, the number of gravid crabs contributed by the members was relatively limited and in a bid to improve the situation, the 4th Workshop on Crab Bank was held on 12 August 2008 with 29 participants. In this workshop, the progress from the outset of the crab bank scheme was described by the group leader. The actual number of gravid crabs stocked from May to July was only 13 pcs, which was really disappointing. The explanation for this poor result was that (1) the area where the group is fishing is near the shore with few gravid crabs caught, and (2) the most active members were the crab gillnet fishers while many crab trap fishers did not take part in the scheme. The CBG members exerted their efforts to persuade more crab trap fishers in Prey Pros to become members of the group. As the result, 12 crab trap fishers became new members and the total number of members was increased to 38. This attributed to the great leap in the number of gravid crabs released from August 2008 as shown in **Table 1**.

Also, the modality for stocking gravid crabs was discussed in this workshop and they reached certain agreements that include the following:

- Each member brings gravid crab to the cage every day for stocking.
- The Crab Bank leader stays at the cage for one hour every day to receive the gravid crabs from the members.
- The gravid crab is marked by a member on the carapace with a white magic pen and the details are recorded by the leader in the logbook. The marking should include the date and name for subsequent identification.
- After hatching, the crabs are taken out by the leader for marketing when necessary and relevant information is entered into the logbook and the general ledger.

Fig 1 Sketch of crab bank cages

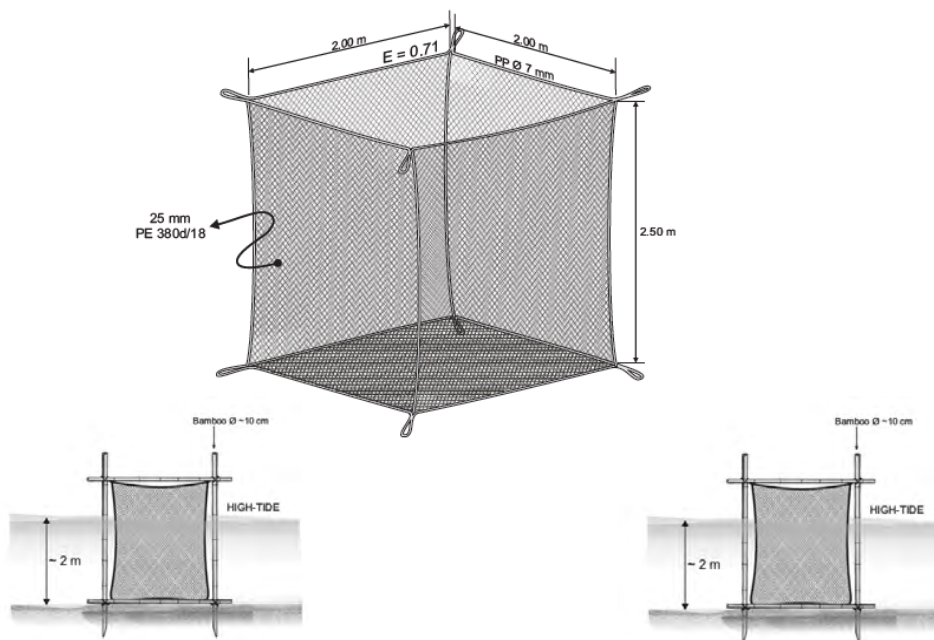


Table 1: Quantity of gravid crab released by fishing methods in 2008

Village	Fishing gear used	Number of members	Crab released in 2008								Total	(%)
			May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Prey Pros	Trap	12	0	0	1	0	51	0	0	0	52	24.6
	Gill net	1	0	0	0	0	5	0	0	0	5	2.4
	Sub-total:	13	0	0	1	0	56	0	0	0	57	
Prey Sangke	Trap	0	0	0	0	0	0	0	0	0	0	0.0
	Gill net	4	0	2	1	9	2	2	2	0	18	8.5
	Trap /gill net	5	0	1	1	15	4	6	3	8	38	18.0
	Middlemen	2	0	0	0	13	7	1	4	12	37	17.5
	Sub-total:	11	0	3	2	37	13	9	9	20	93	
Cantonment	FiA	-	5						56		61	28.9
Total		24	5	3	3	37	69	9	65	20	211	100.0

5. Reorganization of CBG

The Crab Bank Group was organized during the 2nd workshop of CBG on 1 April 2008 and started to release gravid crabs on 16 May 2008, since then the activity has been continued. However, as the outcome from such trial was way below the satisfactory level, an improvement plan was discussed among them at the 6th Workshop on Crab Bank Group on 18 February 2009 and it was agreed to seek the possibility of persuading the crab trap group of Prey Pros to install an additional cage close to their village to serve as a crab bank.

As the result of the 7th workshop of the crab bank group on 18 March 2009, the project had re-organized the group into 2 sub-groups, namely the Prey Pros and Prey Sangke sub-groups which were placed under the Prey Nup II Crab Bank Group. The Prey Sangke sub-group was renamed the Prey Angkor with 13 members (26

members as of December 2009), while the Prey Pross sub-group was named the Kampong Kandow with 39 members (31 members as of December 2009).

For the newly organized Kampong Kanow Sub-group, the budget to construct cages and the initial operational fund were provided and the cage construction started immediately after the workshop. Thus, this group started to release gravid crabs on 28 March 2009.

6. Results

The total numbers of crab released from the beginning by the two sub-groups are as follows.

- Kampong Kandow sub-group with 31 members: 408 crabs from March to June 2009
- Prey Angkor sub-group with 26 participants: 303 crabs from May 2008 to August 2009

It is noticeable that the number of crabs released by the newly formed sub-group reached 408 crab within 4 months against 303 crab released by the other old sub-group for 1.3 year.

As promised initially, 10 prizes (6 prizes from SEAFDEC, 2 prizes from FiA and 2 prizes from JICA) were awarded to 10 members of 2 sub-groups for the successful implementation of the relevant activities.

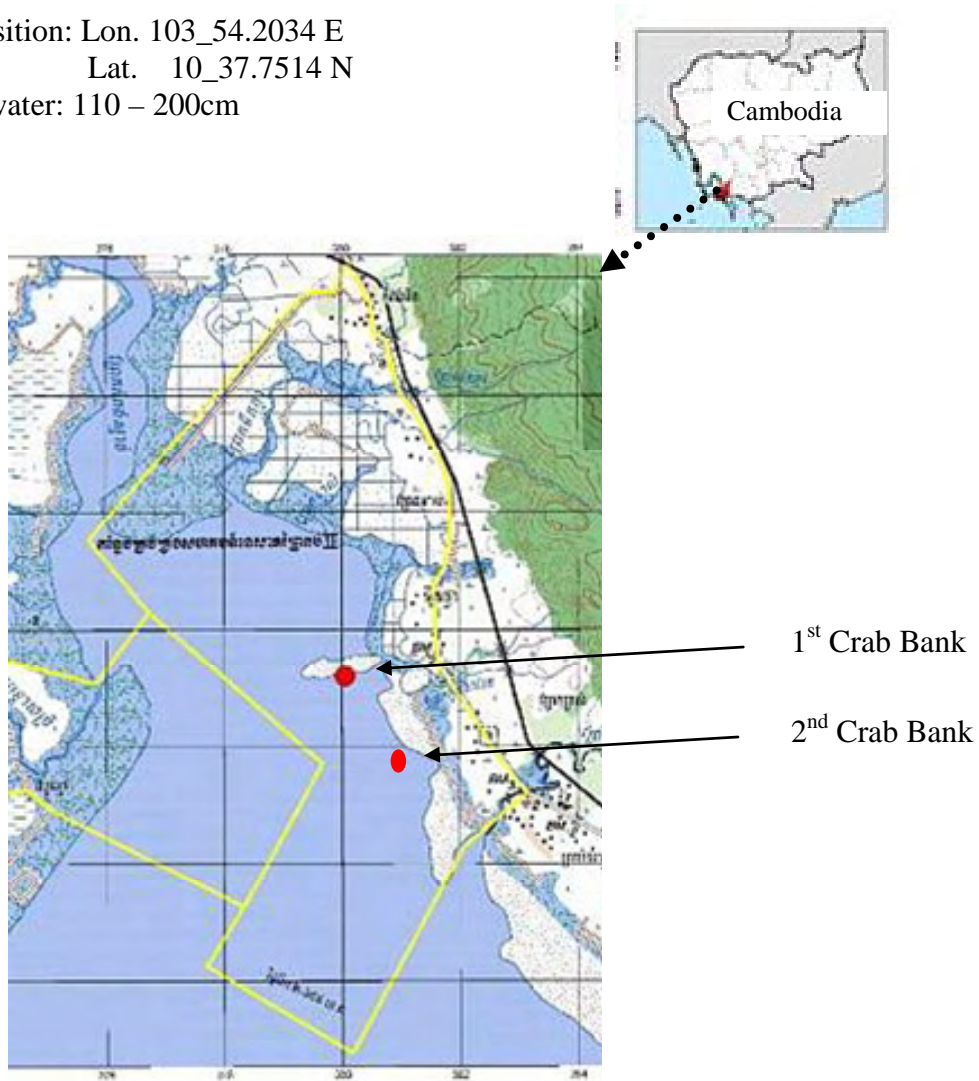
7. Conclusion

While releasing gravid crabs has just begun one and a half years ago and the group was reorganized into a good shape, this has demonstrated a good sign of increasing the number of released crabs. It should be noticed as “an optimistic movement towards the bright future”. In fact, the concerned crab fishermen themselves clearly recognized and stated that great numbers of baby swimming crabs had been observed near the crab bank cages which had never been seen before. They believed that the crab bank activity is conducive for enhancing the swimming crab resources, and they promised to continue such activity in the future, as they expressed at the workshops. Still, the FiA should continue the scientific monitoring to convince the fishers of its effectiveness in terms of measuring the sizes of crabs and the CPUE.

Appendix 1

Position of Crab Bank

1. Responsible party: Crab Bank Fishers Group (CBFG), Community Fisheries Prey Nup II
2. Location:
3. Spatial position: Lon. 103_54.2034 E
Lat. 10_37.7514 N
4. Depth of water: 110 – 200cm



Appendix 2

Table 2: Monthly record of crab released by Crab Bank Group – Prey Angkor

Month	Crab remained (pc)	Crab released (pc)	Crab sold			Feed given		Crab returned (pc)	Crab dead (pc)	Crab lost/ disposed (pc)	Remarks
			(pc)	(kg)	(Riel)	(kg)	(Riel)				
May-08	0	5	5	-	12,000	-	2,000	0	0	0	
Jun-08	0	3	3	-	1,500	-	600	0	0	0	
Jul-08	0	3	0	-	0	-	1,000	0	0	3	Consumed
Aug-08	0	37	13	-	5,500	-	8,400	14	0	4	Stolen
Sep-08	6	69	22	-	11,500	-	14,500	11	16	0	
Oct-08	26	9	0	-	-	-	2,500	12	0	0	
Nov-08	23	65	72	7	63,000	-	3,000	5	7	0	
Dec-08	4	21	12	-	3,300	-	18,800	0	5	0	
Jan-09	8	3	8	-	2,500	-	8,000	0	1	0	
Feb-09	2	14	8	-	3,000	-	7,000	0	5	3	
Mar-09	0	11	5	-	1,700	-	4,000	0	3	3	
Apr-09	0	30	14	-	4,800	-	12,000	11	4	1	
May-09	0	13	0	-	0	-	6,000	13	0	0	
Jun-09	0	12	9	-	2,000	-	2,000	3	0	0	
Jul-09	0	8	0	-	0	-	0	5	3	0	
Aug-09	0										
Total		303	171	7	110,800	0	89,800	74	44	14	

Table 3: Monthly record of crab released by Crab Bank Group – Kampong Kandow

Month	Crab remained	Crab released	Crab sold			Feed given		Crab returned	Crab dead	Crab lost/ disposed	Remarks
			(pc)	(kg)	(Riel)	(kg)	(Riel)				
Mar-09		7						7			
Apr-09		154	33				31,000	102	19		
May-09		129					60,000	104	25		
Jun-09		15					58,000	15			
Jul-09		0					0	0			
Aug-09		0					0	0			
Sep-09		29					13,000	29			
Oct-09		34					10,000	34			
Nov-09		40					28,000	40			
Dec-09											
Total		408	33	0	0	0	200,000	331	44		

MANGROVE REFORESTATION

Mr. Nen Chamroeun

Deputy Director of Fisheries Administration Office, Sihanouk Province, Cambodia



Background

- It is widely recognized that mangrove forests are playing an important role in conservation and enhancement of fishery resources.
- According to the Law on Fisheries, Mangrove forest is protected by the law
- The study tour to Siem Reap Province, was conducted on 13 – 15 August 2007 with leading CF members.
- Through this study tour, they learned the practical approach in the forest protection and its impact given to fishery resources management.
- Further, an attempt of mangrove reforestation was discussed at the Project Implementation Coordination meeting held on 18 October 2007
- It was agreed to promote mangrove reforestation in the next operational year.

Objectives

The objectives in Mangrove Plantation Day lie in:

- Awareness building in the community, including children, for mangrove reforestation
- Thereby, preventing illegal logging of mangrove,
- Planting 2,000(2 times) mangrove seedlings and
- Fostering the voluntary participation among community members in environmental protection activity

First Planting mangrove on 7 December 2007

- 180 people including 100 students participated in the event
- 1,000 seedlings were prepared by FIA
- Necessary water bottles and snack were prepared by FIA
- 100 T-shirts for students embossed with the event's design in Khmer were provided by FIA
- 150 T-shirts for adults were provided by SEAFDEC/TD.
- 500 notebooks described with the event's significance in Khmer were provided by SEAFDEC/TD
- All necessary local transportation for participants were arranged by themselves



Status of mangrove seedling

Survival rate around 50% due to:

- Occasionally monitoring
- Unsuitable species of mangrove

Good points

- People participated voluntarily in planting mangrove which indicated that they realized the importance of mangrove
- Engaging school children in mangrove planting, it will motivate them in conserving natural resources
- Mangrove planting will encourage fishermen to participate in natural resources use in sustainable way
- Increasing good collaboration between community fisheries with fisheries officers and local authority

Weak Points

- Low survival rate
- Seedling species were not suitable for planting in permanent flood area
- Planting site is directly affected by strong wind and wave



Recommendation

- Fisheries Administration should continue planting mangrove forest at the former mangrove area
- Seedling species should be same as the existing one at the planting area
- Fisheries administration should educate school children on the importance of mangrove to natural resources

IMPACT GIVEN TO THE COMMUNITIES: BENEFICIARIES' VIEW

Mr. Rim Mou Soeur

Leader, Communities Fisheries Prey Nup II, Sihanouk Province, Cambodia

**Impact given to the communities
Fisheries:
Beneficiaries' view**

Prepared by: Rim Mousoeur

Fisheries Resources

- For fisheries resources, mangrove forests are maintained 100% in good condition.
- *"If SEAFDEC and FA did not support project in our commune, mangrove forest might be taken buy someone due to high price of land"*
- Now, generally fishermen can get a lot of bivalves inside mangrove area and in the
- For last 2 year, even illegal fishing activities still remain in the CF fishing ground, but generally fishermen living standard is becoming better.

Fisheries Resources

- For fisheries resources, mangrove forests are maintained 99% in good condition.
- Now, generally fishermen can get a lot of bivalves inside mangrove area
- For last 2 year, even illegal fishing activities still remain in the CF fishing ground, but generally fishermen living standard is becoming better

*"Before the project started, at least 50 engine-push nets was operating in CF fishing ground.
Now, one night around 4-5 boats are still operating"*

Fisheries Resources

"We believe that crab bank system can produce a lot of small crab, and we think that we can get more crab in the future"

- Fishermen found a lot of small swimming crabs near mangrove forest when they were conducting hand push net
- Sea grass bed is in good condition
- If we use one piece of wood put in the water strongly, we can see small fish fly
- After installing Obstacles objects, no illegal fishing operating in the install area.

Livelihoods: mushroom

- For mushroom, 16 women get direct benefit
- Around 50 women and children get benefit through working as labor
- 120 school children are able to produce mushroom themselves; no need to learn from other places
- Agriculture production in the commune increase
- Before people did not eat oyster mushroom, now they realize that it is delicious and good for health

Livelihoods: mushroom

- Mushroom Producer Group (MPG) is becoming
 - the center of distributing spores to other places
 - the center for mushroom training
 - One commune product
- Since successful in producing mushroom, 10 places in Sihanouville started producing mushroom after learning from MPG

Livelihoods: Mud crab culture

- Even mud crab culture can not be achieved by the group, but if culturing individually, it will be useful
- Mud crab culture group get a lot of knowledge and experiences in:
 - Culture technique
 - Water quality measurement such as salinity, temperature, tidal range, NH4, NO2, NO3...
 - Bookkeeping

Capacity Building Enhancement of CF

- Community Fisheries Committee members are able to write simple report
- They also understand the CFAMP
- They have enough capacity to manage business through using accounting book
- Blood coddle members are able to conduct survey on density of blood coddle
- Fishermen know how to record fish landing

Weaknesses

- Even fisheries resources are improved, illegal fishing activities still remain
- Fisheries Administration should continue planting mangrove forest at the former mangrove area
- Seedling species should be same as the existing one at the planting area
- Fisheries administration should educate school children on the importance of mangrove to natural resources

Suggestion

- FIA should continue crab bank even SEAFDEC stop supporting
- Illegal fishing should be eliminated in order to sustain fisheries resources
- FIA should install more obstacles object by considering long-term use and effective objects

Thank You

FINDING AND RECOMMENDATIONS OF THE FINAL PROJECT EVALUATION

Mr. Chum Chanthol
 Consultant, Sihanouk Province, Cambodia

Integrated Coastal Resources Management in Sihanoukville (ICRM-SV)

Finding and Recommendations of the Final Project Evaluation

Training Department (SEAFDEC/TO)
 &
 Fisheries Administration, Cambodia

Project Objectives

- Develop capacity building of local human resources
- Develop people's participation in resources management and community development
- Alleviation of poverty through creation of job opportunities.

Project activities

- Baseline / monitoring survey
- Encourage and extend locally-based fishery resources management
- Promotion of local business
- Enhance human resources capacity and participation
- Rehabilitation and enhancement of coastal resources
- Fishing/fish-handling technology improvement
- Project management meetings
- Project evaluation

Specification of targets

- Fisheries resources were declining
- Illegal fishing was operating in this area and fishermen conducted patrolling voluntarily to protect the fisheries resources themselves
- Community fisheries structure was available

Beneficiaries

- Direct : fishing community in Tek Tla commune, their families
- Indirect: middlemen local trader, services provider and fishing communities in adjacent villages




Prospects for Sustainability

- Provincial fisheries office and commune council can assist CF through the integration of CFs activities into the annual commune plan
- FIA Cambodia also committed to continue project activities such as mangrove plantation, crab bank, fisheries resource protection and aquaculture)
- For local business, the agriculture department of Sihanoukville would be able to continue these activities.

Efficiency & Adequacy of Project Implementation

- Funds – sufficient
- all equipments have been used until the period of evaluation
- Timeliness of Input – output agree by SEAFDEC and Japanese Embassy are consistent and delivered within time frame planned



Efficiency & Adequacy of Project Implementation

- All concerned parties cooperate well to implement the project
- National project team worked hard, work very closely and friendly with CFs members
- But...The national team did not have enough capability to assist on the technical aspects of aquaculture

Implementation difficulties at the national, provincial and local levels

- National level:
 - Limitation of budget
 - Some activities planned by SEAFDEC were not reflected in the fiscal budget.
- Provincial level:
 - Project site far from the fisheries office
 - Limitation of budget
- Local level:
 - Illegal fishing still operates in the community fishing ground
 - CFs members are so busy in fishing
 - Lack of full cooperation from CFs members
 - Lack of responsibility of the CFs leader
 - CFs did not have any budget so it depended on the project budget
 - Lack of unity among the group members

Monitoring & Reporting

- List of documents prepared including:
 - Project Document
 - Fish landing data in Prey Nup II Report
 - Socio-economic Survey Report
 - Biannual Project Progress Reports
 - Annual Project Progress Reports
 - Travel Reports
 - Minutes of Project Steering Committee and Implementation Coordination Committee
- Scientific report were produced, these reports were prepared with illustration chart... and would be useful for students and fisheries staff
- Monitoring works were conducted by The CFs, EW, IRL, SEAFDEC
- CFs were requested by project to record all daily activities in each group

Project Results

- Resources Monitoring Survey
 - Fish landing data collection in CFs (Tek Tila commune) had been developed
 - Socio-economic base line survey was conducted and published
 - Socio-economic monitoring survey was conducted, but report was not found.
 - So SEAFDEC should finish this report on time because it is very important to inform the fishermen if their living standard has improved after the project termination.
- CBRM
 - CFAMP and other related documents like I/L, B/L, CFZM were complete and endorsed by Provincial Governor

Project Results

- Local Enforcement Unit
 - CFs members understood well the importance of mangrove forest for their livelihood
 - CFs members frequently conduct patrolling
 - Strong support from local authority and fisheries officers
- Resource enhancement activities
 - Mangrove reforestation, crab bank establishment, fish refuge and obstacle objects

Mushroom Producer Group

- Good points
 - Mushroom production is still continuing
 - The group did not face any difficulties in selling their products
 - The group started to use the income from mushroom to diversify to other business opportunities
 - Now the living standard of the group members is improved
 - Not only group members get the benefit from mushroom production, children can learn and get income from packaging the mushroom. Based on the result of interview with an authority leader, he expressed his appreciation on the mushroom production

Mushroom Producer Group

- Weak points
 - MPG is still new and lack of experience
 - The group members are still the same as before. It means that production capacity has not expanded yet, so only group members can get direct benefit from mushroom production
 - One group member stopped production without giving any acceptable reasons and the money acquired from sale of mushrooms could not be returned to the other members to continue production.
 - SEAFDEC did not take any action to claim back the money from those who stopped their production

Aquaculture

- Mud crab culture did not show profitability, but mud crab group can get benefit in the following:
 - knowledge and experiences in mud crab culture
 - Being able to use technical equipment such as saline meter, pH, NO₂, NO₃, NH₄, H₂S, tidal range measure.
 - Being able to record data in the general ledger
 - For Sea bass culture, during the evaluation period, the sea bass group did not show any capacity in running and managing sea bass culture

Framework to ensure sustainability of Project

Development of framework to ensure the sustainability of CBRM was not found, but some mechanism have been introduced by the fisheries administration in the following aspects:

- Contact local authority to integrate CFAMP into commune council development program funding from the Royal Government of Cambodia and DANIDA
- Commit to follow up SEAFDEC activities such as crab bank, aquaculture, mushroom production, environmental campaign etc.
- Department of Community Fisheries Development, FMA will be involved more in the
- development of CF Prey Nup II.

Conclusions

- Impact of project on coastal fisheries resources could not be quantitatively assessed
- Socio-economic changes is difficult to quantify but people's perception acknowledge the stable income in fisheries and increased awareness in CBRM approach to fisheries management
- Most of the activities of the project successfully implemented

Recommendation

- Obstacle-object impact on fisheries resource should be assessed
- All project documents should be translated in Kmer language
- CFs should be utilized and involved in any kind of survey
- A study to monitor the effectiveness of the crab bank should be conducted
- FIA should continue supporting the crab bank group
- FIA should assist and strengthen the local enforcement unit
- FIA should prepare the budget in fiscal year 2010 to continue the project activities
- FIA Division Prey Hub should continue patrolling the fishing ground more frequently to arrest illegal fishers with participation from community fisheries

./contd./

Recommendation

- Mangrove reforestation should be monitored frequently. Species and site selection should be taken into account before planting the seedling
- Information dissemination could be further enhanced through publication of technical papers, non-technical papers, extension documents, flyers, brochures as well as through electronic media.
- Public awareness and education on the community fishery management and resources conservation should be improved and continued
- Community Fisheries Prey Hub II should work very closely with fisheries officers and local authority in order to incorporate CFANP into the CDC program
- FIA should find other NGOs to support some activities of the project such as fish refugia



Publications on the SEAFDEC ICRM Project

List of ICRM-PD Publications

No.	Title of publication	Author(s)	Date of publication	Language
1	Locally Based Coastal Resources Management: LBCRM in Pathew District, Chumphon Province	SEAFDEC		Thai
2	Background and Project Proposal of Locally Based Coastal Resources Management in Pathew District, Chumphon Province	Yamao, Phattareeya (Eds)	July 2002	Eng
3	Marketing and Utilization of Fish Products In Tambol Pakklong, Pathew District, Chumphon Province	Yamao, Amporn	August 2002	Thai
4	People's Groups and Community-Based Arrangements in Tambol Pakklong, Pathew District, Chumphon Province	Sumitra, Yamao, Jirapa	September 2002	Eng
5	Marketing and Utilization of Fish Products in Tambol Pakklong, Pathew District, Chumphon Province	Amporn, Yamao	August 2002	Eng
6	Women's Group with Fisheries Production Potential in Tambol Pakklong, Pathew District, Chumphon Province	Sumitra, Yamao, Jirapa	September 2002	Thai
7	Pre-survey of the Community to Formulate Implementation Plans and Activities of the LBCRM Project: Project Site in Pathew District, Chumphon Province	Phattareeya, Jinda, Kongpatha, Jirapa, Baramee	September 2002	Eng
8	Develop Extension Methodologies and Strengthening the Extension System in Locally Based Coastal Resource Management in Tambol Pakklong, Pathew District, Chumphon Province, Thailand	Kongpathai	September 2002	Thai
9	Quarterly Report No. 1	Yamao (Ed)	January 2002	Eng
10	Quarterly Report No. 2	Yamao (Ed)	April 2002	Eng
11	Quarterly Report No. 3	Yamao (Ed)	July 2002	Eng
12	Quarterly Report No. 4	Yamao (Ed)	October 2002	Eng
13	Report on the Study Trip to the Philippines	Yamao (Ed)	January 2002	Eng
14	Report on the Study Trip to Malaysia	Yamao (Ed)	August 2002	Eng
15	Overview of Fishing Activities in the Pakklong Sub-district Coastal Area, Pathew District, Chumphon Province	Sukchai, Wirote	January 2003	Eng
16	Catch Composition and the Length Frequency Distribution of Indian Squid (<i>Loligo duvauceli</i>) from Squid Cast Nets in the Coastal Area of Pakklong Sub-district	Phattarajit, Phamornpan, Khunruthai, Boonyarith, Chaiyan	January 2003	Eng
17	The Marine Environmental Condition of the Pakklong Sub-district Coastal Area and their Effect on Coastal Aquaculture	Penchan, Sumana, Chumchoke	January 2003	Eng
18	Quarterly Report No. 5	Phattareeya (Ed)	February 2003	Eng
19	Annual Report of the Locally Based Coastal Resource Management in Pathew District, Chumphon Province: Year 2002	SEAFDEC/TD Socio-economics Section	March 2003	Eng

No.	Title of publication	Author(s)	Date of publication	Language
20	Seminar on Community Based Fisheries Management Concept in Pathew District, Chumphon Province (19-21 Feb 2003)	SEAFDEC	April 2003	Eng
21	Report on the Study Trip to Malaysia Part II	Phattareeya (Ed)	May 2003	Eng
22	Large Cast Net and Anchovy Falling Net Fisheries: Community Based Economic Development: Survey in Pakklong Sub-district, Pathew District, Chumphon Province	Phattareeya, Jinda, Kongpathai, Jirapa, Baramee	September 2003	Eng
23	Proceedings of the Toward Further Development of Coastal Resource Management: Lessons Gained Through Locally Based Coastal Resource Management in Pathew District, Chumphon Province, Thailand (with CD)	SEAFDEC	September 2003	Eng
24	Quarterly Report No. 7, April – June 2003	Sei Etoh(Ed)	October 2003	Eng
25	Quarterly Report No. 8, July – September 2003	Sei Etoh (Ed)	December 2003	Eng
26	Quarterly Report No. 9, October – December 2003	Sei Etoh (Ed)	March 2004	Eng
27	Crab Fisheries Survey to Sustain Community-Based Economic Development: In Pakklong Sub-District, Pathew Distirct, Chumphon Province	Phattareeya, Jinda, Kongpathai, Jirapa	June 2004	Eng
28	Crab Fisheries in Locally Based Costal Fisheries Management, Pathew District, Chumphon Province	Jinda, Sansanee, Phattarajit, Sukchai	September 2004	Thai
29	Fishing Gear Replacement Project: Changing mesh size at bottom side of crab trap in Pathew Sub-District, Chumphon Province	Jinda, Thaworn, Jiraporn, Kwanruthai	September 2004	Thai
30	Squid Fisheries in Pakklong Sub-District, Pathew District, Chumphon Province (2003-2004)	Sansanee, Phattarajit, Sukchai	September 2004	Thai
31	Marine Shrimp From Shrimp Trammel Net in Locally Based Costal Fisheries Management Pathew District, Chumphon Province	Rojjanarut, Thaworn, Jiraporn, Kwanruthai	September 2004	Thai
32	The Status of Coral Reef in Pathew District, Chumphon Province	Uncharee	September 2004	Thai
33	Report of Household Survey in Pakklong Sub-District, Pathew District, Chumphon Province	Phattareeya, Jinda, Kongpathai, Jirapa	September 2004	Eng
34	Carrying capacity estimation of marine finfish cage culture at Pathew Bay, Chumphon Province, Southern Thailand	Tookwinas, Songsangjinda, Kajonwattakul, Singharachai	March 2004	Eng
35	Overview of Fishing Activities in the Pakklong Sub-District Coastal Area, Pathew District, Chumphon Province	Sukchai	July 2004	Eng
36	Monitoring of Density and Distribution of Meiofauna in the Pakklong Sub-District Coastal Area	Jarumon, Panitnard, Penjan, Summana, Chumchoke, Chanchai	March 2004	Eng
37	Manual of Fishing in Coastal Resources Management Area, Pathew District, Chumphon Province	SEAFDEC		Thai
38	Bi-annual Project Progress Report of LBCFM-PD	Sei Etoh (Ed)	September 2004	Eng
39	Mid-term Evaluation of LBCFM-PD	Somsak Chullasorn	September 2004	Eng

No.	Title of publication	Author(s)	Date of publication	Language
40	Seminar Recommendations on Research, Technical and Data Analysis (17-18 August 2004)	SEAFDEC	September 2004	Thai
41	Seminar on Development Concept of Coastal Fisheries Management in Pathew District, Chumphon Province	SEAFDEC	September 2004	Thai
42	Bi-annual Project Progress Report of LBCFM-PD	Sei Etoh (Ed)	February 2005	Eng
43	Bi-annual Project Progress Report of LBCFM-PD (Jan-June 05)	Sei Etoh (Ed)	June 2005	Eng
44	Bi-annual Project Progress Report of LBCFM-PD (July-Dec 05)	Sei Etoh (Ed)	Dec 2005	Eng
45	Bi-annual Project Progress Report of LBCFM-PD (Jan-June 06)	Sei Etoh (Ed)	June 2006	Eng
46	The New Experience of Sub-district Administrative Organization	Phattareeya, Jinda, Jirapa	January 2007	Eng
47	Final Evaluation of LBCFM-PD	Somsak		Eng
48	Bi-annual Project Progress Report of LBCFM-PD (Jul-Dec 06)	Sei Etoh (Ed)	December 2006	Eng
49	Proceeding 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)	SEAFDEC	September 2007	Eng

List of ICRM-PL Publications

No.	Title of publication	Author(s)	Date of publication	Language
1	Program Document on Locally Based Coastal Resources Management	SEAFDEC		Eng
2	Bi-annual Project Progress Report of LBCRM-PL	Sei Etoh (Ed)	September 2004	Eng
3	Bi-annual Project Progress Report of LBCRM-PL	Sei Etoh (Ed)	April 2005	Eng
4	Bi-annual Project Progress Report of ICRM-PL	Sei Etoh (Ed)	July 2005	Eng
5	Bi-annual Project Progress Report of ICRM-PL	Sei Etoh (Ed)	January 2006	Eng
6	Bi-annual Project Progress Report of ICRM-PL Jan-Jun 06	Sei Etoh (Ed)	September 2006	Eng
7	Bi-annual Project Progress Report of ICRM-PL Jul-Dec 06	Sei Etoh (Ed)	February 2007	Eng
8	Bi-annual Project Progress Report of ICRM-PL Jan-Jun 07	Sei Etoh (Ed)	July 2007	Eng
9	Marine Resources Monitoring in Pulau Langkawi, Malaysia (2004-2006)	Penchan Laongmanee	September 2007	Eng
10	Bi-annual Project Progress Report of ICRM-PL Jul-Dec 07	Sei Etoh (Ed)	January 2008	Eng
11	Final Project Evaluation of the Integrated Coastal Resources Management in Pulau Langkawi	Ibrahim bin Saleh	May 2008	Eng
12	Report on Monitoring Socio-economic Survey in Kuala Teriang, Pulau Lanngkawi, Malaysia in August 2006	Sei Etoh, Thanyalak, Saivason	November 2007	Eng
13	Proceedings of the Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the Project ICRM-PL	SEAFDEC	December 2008	Eng

List of ICRM-SV Publications

No.	Title of publication	Author(s)	Date of publication	Language
1	Project Document on Integrated Coastal Resources Management in Sihanoukville (ICRM-SV)	Etoh S.	Jul. 2005	English
2	Preliminary socio-economic survey in Commune Teuk Thla, Sihanoukville, Cambodia	Etoh S., <i>et al</i>	Sep. 2005	English
3	Preliminary socio-economic survey in Commune Teuk Thla, Sihanoukville, Cambodia		Jan. 2006	Khmer
4	Annual Project Progress Report of Integrated Coastal Resources Management in Sihanoukville (ICRM-SV), 2005	Etoh S.	Jan. 2006	English
5	Bi-annual Project Progress Report of Integrated Coastal Resources Management in Sihanoukville (ICRM-SV), Jan.-Jun.	Etoh S.	Sep. 2006	English
6	Bi-annual Project Progress Report of Integrated Coastal Resources Management in Sihanoukville (ICRM-SV), Jul.-Dec.	Etoh S.	Jan. 2007	English
7	Women's group activity in Production of Mushroom Community Fisheries Prey Nop II Sihanoukville, Cambodia	Etoh S.	Jun. 2007	English
8	Bi-annual Project Progress Report of Integrated Coastal Resources Management in Sihanoukville (ICRM-SV), Jan.-Jun.	Etoh S.	Aug. 2007	English
9	Fish landing data in Prey Nop II under the project Integrated Coastal Resources Management in Sihanoukville (ICRM-SV)	Laongmanee P., <i>et.al</i>	Dec. 2007	English
10	Bi-annual Project Progress Report of Integrated Coastal Resources Management in Sihanoukville (ICRM-SV), Jul.-Dec.	Etoh S.	Feb. 2008	English
11	Bi-annual Project Progress Report of Integrated Coastal Resources Management in Sihanoukville (ICRM-SV), Jan.-Jun.	Etoh S.	Jul. 2008	English
12	Bi-annual Project Progress Report of Integrated Coastal Resources Management in Sihanoukville (ICRM-SV), Jul.-Dec.	Etoh S.	Feb. 2009	English
13	Fish landing data in Prey Nup II under the ICRM-SV, in October 2007- October 2008	Socio-economic section	Apr. 2009	English
14	Bi-annual Project Progress Report of Integrated Coastal Resources Management in Sihanoukville (ICRM-SV), Jan.-Jun.	Ruangsvakul S.	Aug. 2009	English
15	Study on Gonad Development of Blood cockle in Prey Nup II, Sihanoukville	Sornkliang J.	Sep. 2009	English
16	Final Project Evaluation Integrated Coastal Resources Management in Sihanoukville (ICRM-SV)	Chanthol C.	Nov. 2009	English
17	Report of the Monitoring Socio-economic survey in Commune Teuk Thla, Sihanoukville	Etoh S., <i>et al</i>	Jan. 2010	English
18	17. Bi-annual Project Progress Report of Integrated Coastal Resources Management in Sihanoukville (ICRM-SV), Jul.-Dec.	Ruangsvakul S.	Feb. 2010	English
19	19. Proceedings of the Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review on ICRM-SV Project	Socio-economic Section	Feb. 2010	English

