FISH for the PEOPLE

A Special Publication for the Promotion of Sustainable Fisheries for Food Security in the ASEAN Region

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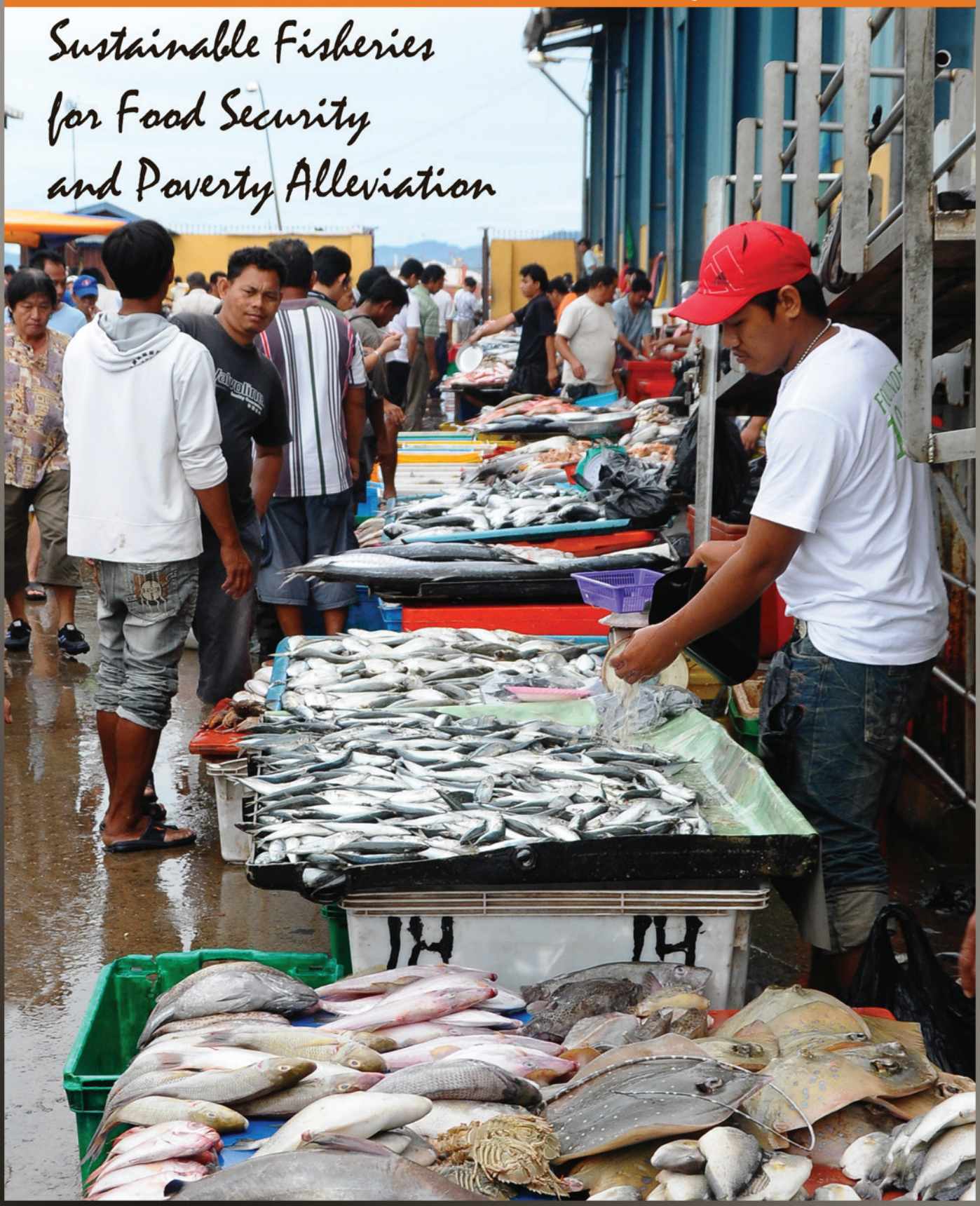
Sustainable Fisheries for Food Security and Poverty Alleviation



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Editorial

We can always say that food security is attained when food is available for everybody's access, and when people do not go hungry or do not fear of possible starvation. FAO suggested that when all people have physical and economic access to sufficient and safe food at all times, then food security is in place. Parallel with this, the US Department of Agriculture identified two main aspects of food security, viz: ready availability of nutritionally adequate and safe foods, and daily assurance of access to acceptable foods in a socially acceptable way. Food security seems very simple to achieve, but the situation is not always favorable especially for the fishing communities in the Southeast Asian region, where poverty still prevails and where access to food in a socially respectable way is still difficult to achieve.

In the Southeast Asian region, most households in fishing communities depend on fishing for their livelihoods with no other alternative sources of incomes because of limited know-how and insufficient financial resources. Meanwhile, outside the fishing communities and elsewhere around the globe, the demand for more food fish is on the rise. In an effort to supply the much needed demand for food fish, many fishers continue to maximize the exploitation of whatever resources are left for them, to the extent of resorting to irresponsible means without looking ahead of the possible effects of their actions on the environment and the remaining resources. The continued practice of irresponsible fishing operations such as the use of dynamite and chemicals as well as over-fishing promotes food security crisis in areas where the fisheries resources that have been degraded are squeezed further to the last drop.

It is along this vein that SEAFDEC has been exerting efforts to strike a balance between improving the health of the ecosystems and satisfying the essentials for human well-being. Projects relevant to alternative livelihood promotion as well as habitat rehabilitation and conservation through responsible fisheries operations have been pursued under the framework of the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region which was adopted in 2001. SEAFDEC would also continue to strive for attaining food security in the region through sustainable fisheries development in the midst of the new and emerging issues that threaten the sustainability of fisheries. The ASEAN-SEAFDEC Conference planned for 2011 is therefore envisaged to pave the way for the development of ways and means of addressing the issues that would possibly impede the efforts of SEAFDEC and the ASEAN towards maximizing the contribution of responsible fisheries to food security and poverty alleviation.

This issue includes some of the efforts of SEAFDEC and also those of the SEAFDEC Member Countries in attempting to achieve a scenario where there is a balance between healthy ecosystem and socially enhanced well-being of the peoples in this region.

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FISH for the PEOPLE is a special publication produced by the Southeast Asian Fisheries Development Center (SEAFDEC) to promote sustainable fisheries for food security in the ASEAN region.

Convening "Fish for the People 2020" for Food Security in the ASEAN Region

About ten years ago, the ASEAN and SEAFDEC co-organized the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium: "Fish for the People" or Millennium Conference, in November 2001 in Bangkok, Thailand. The "Resolution" and "Plan of Action" on Sustainable Fisheries for Food Security for the ASEAN Region which were adopted during the Millennium Conference have been used as policy framework and guiding principles in the sustainable development of fisheries in the Southeast Asian region.

The ASEAN-SEAFDEC Conference "Fish for the People" 2001

While SEAFDEC during the past decade, had continued to contribute towards the development of fisheries in the Southeast Asian region under the aforementioned policy framework, many new factors have emerged that threaten the sustainability of fisheries in the region, such as climate change, stringent international fish trade requirements, world economic recession, among others. SEAFDEC therefore considers it an opportune time to assess the possible effects of such emerging factors and develop the next decade regional framework for sustainable fisheries development and food security in the ASEAN region.

In order to address the priority issues that tend to impede the sustainable contribution of fisheries to food security of the region, the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020: "Fish for the People 2020" would be convened in Bangkok, Thailand from 13 to 17 June 2011 and would be hosted by the Department of Fisheries of Thailand. Specifically, the Conference is also envisaged to increase the competitiveness of fisheries in addressing food security and poverty reduction, and assist the ASEAN countries in developing adaptive measures to tackle the new emerging situations.

The Conference would also allow for the identification of follow-up actions that could be implemented immediately after the adoption of the new decade Resolution and Plan of Action. As part of the preparatory works of the Conference, the Steering and Organizing Committees have been organized as well as the Technical and Administrative Sub-committees. Moreover, Regional Technical Consultations are being convened by SEAFDEC on the emerging and cross-cutting issues while national seminars would be organized by the ASEAN countries with the maximum involvement during the consultation processes, of all stakeholders including the fishers and the civil society. The Regional Technical Consultation on Aquaculture conducted from 17 to 19 March 2010 for example, came up with the priority issues that would be addressed during the Conference in the context of the present and emerging opportunities and challenges faced by the ASEAN countries.

As in the 2001 Conference, drawing contests would also be held in the countries with the best drawings to be exhibited during the Conference. Parallel with the Conference is the Trade Fair/Exhibitions where the government and private sectors from the ASEAN region are expected to put up their respective booths displaying their fishery trades and wares.

The Conference Structure adopted during the First Technical Sub-committee Meeting on 5 February 2010 is shown in **Box 1**. From the discussions during the Plenary Sessions, the Conference is expected to come up with the following outputs:

1. Decade Resolution and Plan of Action on Sustainable Fisheries for Food Security in the ASEAN Region Towards 2020 (policy principle in achieving sustainable fisheries for food security in the coming decade);
2. Concept Notes on the Conference Follow-up Programs (5-year plan) in line with the Decade Resolution and Plan of Action;
3. Awareness building of the ASEAN-SEAFDEC Member Countries and participants on sustainable fisheries and food security issues; and
4. Reinforced ASEAN solidarity and closer cooperation in the field of fisheries through the adoption of the above policy instruments in accordance with the implementation of the ASEAN Charter to achieve the ASEAN Community Integration.

In order to get the most outcomes from the Conference the following participants are expected to take part in the discussions during the Conference:

1. Fisheries policy makers and representatives from agencies responsible for fisheries in the ASEAN-SEAFDEC countries as well as from other regions;
2. Representatives from national/regional/international organizations working on fisheries and food security aspects; and
3. Representatives from the private sector and relevant fisheries stakeholders.

The Conference would be co-organized by the ASEAN and SEAFDEC in collaboration with the Food and Agriculture Organization of the United Nations and hosted by the Department of Fisheries of Thailand. The other collaborating partners initially include the Asian Institute of Technology (AIT, Bangkok, Thailand), Bay of Bengal Large Marine Ecosystem (BOBLME, Bangkok), Kasetsart University (Bangkok), Mekong River Commission (MRC, Lao PDR), Network of Aquaculture Centres in Asia-Pacific (NACA, Bangkok), WorldFish Center (Penang, Malaysia) as well as the other organizations and agencies that have Memoranda of Understanding or Memoranda of Agreement, as the case may be, with SEAFDEC and its Technical Departments.

For more information, visit **www.ffp2020.org**

Box 1. Conference Structure for "Fish for the People 2020"

Day	Activities
1	Inauguration Session
	Plenary Session I: Vision and Scene Setting of ASEAN Fisheries in 2020
2	Panel Discussions (Discussions on four themes to run simultaneously)
	Theme 1: Enhancing Governance in Fishery Management Theme 2: Sustainable Aquaculture Development Theme 3: Ecosystem Considerations: Managing the Relationship between Fisheries and the Environment Theme 4: Post-harvest and Safety of Fish and Fisheries Products
3	Panel Discussions (Discussions on four themes to run simultaneously)
	Theme 5: Securing Access to Global Fish Trade Theme 6: Mitigation of, and Adaptation to the Potential Impacts of Climate Change in Fisheries and Aquaculture Theme 7: Improving Livelihood and Living Standards of Fishers and Fisheries Communities Theme 8: Sustaining Food Supply from Inland Fisheries
4	Plenary II: Overview of the Sustainable Fisheries for Food Security Towards 2020
	Plenary III: Fisheries Cooperation in the ASEAN Region : Vision of Cooperation in the Region Towards 2020
	ASEAN-SEAFDEC Senior Official Meeting (Closed Session)
5	Ministerial Session (By Invitation)
	Concluding Session (By Invitation)

One Village, One Fisheries Product – for Food Security and Poverty Alleviation

Pouchamarn Wongsanga and Virgilia T. Sulit

The ASEAN Foundation-funded project on Promotion of One Village, One Fisheries Product (FOVOP) System implemented by SEAFDEC aims to improve the livelihood of fishing communities in the ASEAN region. Focusing on human resources development by mobilizing existing regional technical cooperation schemes and expertise, the project also aims to enhance the capacity of women and optimize their participation in the various economic activities in fishing communities. Already in its wrap up stage, the project is envisaged to come up with the regional guidelines and strategies for the promotion of FOVOP in the ASEAN region.

While many Southeast Asian countries are still in the process of improving their respective fisheries management systems to alleviate poverty, the region's generally depleting fishery resources has continued to contribute to the deteriorating livelihoods of households in fishing communities. Although information from the world's fishery statistics may have always pictured the region with very impressive fisheries production and trade figures, concerns have always been raised on the inability of fisheries to continue providing stable livelihoods and ensuring food security. In 2006 for example, FAO (2008) reported that the Southeast Asian region contributed about 15% of the world's total production from fisheries with Indonesia, Philippines, Thailand and Vietnam as the top producing countries. Moreover, in terms of export of fish and fishery products during the same year, the region's total accounted for about 14% in terms of quantity and 15% in terms of value with Thailand, Indonesia and Vietnam as the region's major exporting countries. Export of fish and fisheries products from the region was valued about USD12.5 billion in 2006. There is no doubt therefore, that fisheries have been playing important role in accelerating the region's economic development. However, such scenario is bound to reverse if fisheries management systems are not put in their proper place for the sustainable development of fisheries in the region.

Various factors could be attributed to the non-responsible practice of fisheries management. These have, in one way or another, deterred the efforts of many countries in the region to achieve sustainability in fisheries and alleviate poverty in fishing communities. These include among others, the vicious cycles of resource utilization and over-capacity in fisheries, which have been aggravated by the lack of alternative livelihoods in fishing communities (Kato, 2008a and 2008b). Although management interventions have been advanced by the countries in the region to try to get out from such vicious cycles, a possible way out could be to provide alternatives for fishers to initiate small business using their catch through value-adding, which they are not able to pursue at present due to limited technical and financial capabilities, and exacerbated by the competitive marketing situation for fish and fisheries products in the markets.

One Village, One Fisheries Product: SEAFDEC Initiative

In an effort to address the incessant poverty situation in fishing communities, SEAFDEC has implemented the project on the Promotion of "One Village, One Fisheries

Box 1. Guidelines to promote FOVOP through human resource development (HRD) activities

1) modernization of domestic fish marketing system through public fish auctions in fishing communities to activate the economy in rural communities and uniquely recognize the fishing communities as fish producing centers;
2) product development and improvement by identifying the differentiated fish product of a fishing community using its unique resources in order to avoid competition with similar or the same products;
3) institutional set-up and human resource development by organizing fishers groups with specific purposes including conduct of public auctions and production of differentiated products; and
4) mobilizing women's group and enhancing the involvement of young generation in rural economic activities.

Product" (FOVOP) System to Improve the Livelihood of the Fisheries Communities in the ASEAN Region with financial support from the Japan-ASEAN Solidarity Fund through the ASEAN Foundation. The two-year project aims to improve fisheries livelihoods through the introduction and promotion of the FOVOP concept. Following the "One Village, One Product" or OVOP strategy promoted by Japan and considering similar approaches in the Southeast Asian region more particularly the "One Tambon, One Product" or the OTOP initiative of Thailand, FOVOP is being fostered to produce "Only One Product" in order to reduce competition from the fishing industry where local producers identify and advance a unique and differentiated artisanal fishery product and related activities from each particular community (Kato, 2006).

In order to hasten the initiation of the project, government officers from the ASEAN countries were convened in a technical consultation in Thailand in March 2008 to develop the guidelines for the advancement of FOVOP in the region with the aim of seeking "Only One, not Number One" fish product. Such guidelines (**Box 1**) had been used as basis for organizing the national human resource development (HRD) workshops which comprise the major activity of the FOVOP project.

Based on such guidelines, learning materials have been prepared to facilitate the conduct of the national HRD workshops including institution building for the women's groups in the fishing communities, with special emphasis on the need to motivate the community people to take active and leading role in the FOVOP movement. The project also necessitates the conduct of case studies in selected sites of the ASEAN countries in the form of local HRD workshops where representatives from identified women's groups continued to be the main players and where the materials used have been translated into the local languages for wider dissemination and usage. The results of the case studies included the identification of more detailed and localized potentials and problem areas as well as the potential post-project activities to be implemented by the respective countries. Based on the findings through local consultations and through the case studies, the HRD materials had been finalized as well as the regional strategies and guidelines. It is envisaged that through the exchange of experiences on the issues in the region, the level of awareness of the local people on FOVOP could be greatly enhanced.

Experiences from the FOVOP Case Studies

Many countries in the Southeast Asian region have their respective national policies related to OVOP production. Thailand for example, has been promoting its "One Tambon, One Product" or OTOP movement, while other countries in the region have also been promoting similar movements as means of alleviating poverty in the rural areas. However, most of the OVOP-related products in the region very seldom include those produced from the fisheries sector. National HRD workshops were therefore conducted in pilot countries (Cambodia, Indonesia, Lao PDR, Myanmar, Philippines, and Vietnam) as case studies in order to identify the potential and unique fishery products and related services that could be promoted under the FOVOP project as source of additional incomes for the local people. Moreover, the issue on gender and development in the region has also been embedded in the HRD activities as this could also facilitate the development of the appropriate strategies for the promotion of FOVOP in the region.

Under the FOVOP initiative, the need for women empowerment is considered significant in order to make full use of their traditional knowledge in processing fisheries products and offer opportunities for women to shift their role towards economic development in the communities. From their traditional duties of taking care of their families and helping husbands in fishing, sorting fish or marketing fish, women in the communities could be involved in more productive activities to enable them to contribute to the economies of the communities. It is interesting to note that the results of the case studies pointed to fact that women with their innate good common sense, have potentials to manage business and finances efficiently. Thus, formalizing and institutionalizing the women's groups should be promoted to capitalize on their capabilities in generating additional incomes for their households.

At this early stage, the marketing strategy for the respective countries' potential products and services under FOVOP could be initially directed towards the local markets and those in adjacent villages and communities rather than in the urban markets. Traditional fisheries products derived from marine and freshwater aquatic resources that include fermented fish, salted fish, boiled and dried fish are among

the food preference of many peoples in the Southeast Asian region.

Improving the quality and standard of such traditional products as raised during the conduct of the case studies, could promote the development of the local consumers' preference and through multiplier effect the products could be promoted later in urban areas. However, since drastic improvement of the domestic market system and consumers' preference could be difficult to undertake at this early stage, certain potential products could be initially and gradually promoted. Considering also that traditional fisheries products have their own unique characteristics, development of hygienic methods of processing and value-adding such as simple quality control and good manufacturing practices as well as enhancing packaging techniques had been identified as among the top priority activities in order that traditional fisheries products could generate incomes for the fishing communities. Eventually, as international standards and requirements for food safety are met, then the FOVOP products could be destined for the export market.

Moreover, it has always been identified that the fishing communities lack the financial resources to be able to pursue alternative livelihoods. In order to address this concern, a community-based credit system could be established using the peoples' savings, so that the local people can gain access and opportunities to obtain loans at low interest rates, for the improvement of their products and services. Lessons could be learned from the experience of Thailand, where women's groups handle their own business activities that include processing of fish and non-fish products as well as marketing and networking. The principle of the these women's groups involves saving funds for investment in business ventures, and manages certain portions for capital funds to set up soft loans with low interest rates for their group members to avail of. From the profit, the groups also make it a point to return part of the funds as incentives or dividends to members of good standing.

In Indonesia for example, there is a national program on Fisheries Product Processing Centralization which is being implemented by the Ministry of Marine Affairs and Fisheries. Under this program, the fishing communities are involved in the promotion of potential products and services, and thus, could be likened to the FOVOP project being promoted by SEAFDEC. Moreover, the possible establishment of a finance consultant banking partner, *e.g.* the KKMB of Indonesia, could be promoted under the FOVOP concept in order to increase the competencies of the fishing communities in aquaculture development, fish processing, management and marketing, and increase their access to banking and other fund providers. Indonesia's KKMB (Konsultan Keuangan Mitra Bank) is a legal institution that provides business development services in order to improve the performance of the Micro-Business, Small and Medium Enterprises (MSMEs) of the country. The KKMB has in fact, assisted the fishing communities in certain provinces of Indonesia, in the preparation of credit proposals for banks and credit support with low interest rates through the country's 'community economic empowering or PEMP', mainly for infrastructure development and equipment enhancement.

At any rate, it is necessary to develop marketing strategies to address the domestic market issues such as price of fish, supply and demand of fish, fish consumption level and extensive distribution. The strategies could include product innovation and development, efficiency in all sectors, good cooperation with distributors or associations, product certification, and good promotion as well creation of dialogue partners in the respective areas.

In Lao PDR, a local credit system has been successfully handled by groups of local fishers and fish farmers, where management involves providing revolving loans with low interest rates to the group members. The system has provided accessible source of loans which helped the members in particular, to get away from being dependent on fisheries middlemen. The key factor of the success of the credit system is the members' responsibility of using the loans for improving their capacity in fisheries as well as in paying their debts on time and complying with the groups' regulations. One specific example is the community-based credit system in Ban Donxaioudom Village, Keooudom District in Vientiane Province where the local women-fishers established themselves into a group and initiated monthly savings activity among the group members. The group now provides revolving loans allocation and manages their own funds. This system could therefore be promoted to build up funds in a community and to be developed as source of funds that the local fishers can avail of to pursue their local business and economic ventures.

Aquaculture could also be introduced as alternative means to promote FOVOP in order to offer chances for additional source of income to local people. Aquaculture could be conducted in ponds, cages and pens in shallow waters. Aside from selling the aquaculture produce fresh, good aquaculture farm management could be promoted as part of an ecotourism program to create additional income. Another parallel activity that could be promoted under the FOVOP project is the enhancement of fish habitats in the communities' conservation areas through the installation of artificial reefs which could also be made part of a marine ecotourism service as well as practical experience in monitoring, surveillance and control to protect the conservation areas from illegal fishing operations. In addition, income generating activities like making handicrafts from fish scales and fish skin could also be

promoted to optimize ecotourism activities. This could also offer opportunities for local people to recognize the significance of utilizing by-products from fish processing while also taking advantage of available local natural resources.

Furthermore, since the role of the Community Fisheries (CF) in Cambodia has been institutionalized specifically in fishery resources management and community economic development such as in fish processing, ecotourism and aquaculture, the CF could be a venue for the promotion of the FOVOP project in the country. Similarly, with the CF also being institutionalized in Lao PDR, this could also be tapped to intensify the promotion of FOVOP in Lao PDR. In the promotion of FOVOP, it is necessary to also mitigate the social aspect of the economic problem situation in fishing communities. Thus, bottom-up approach should be adopted to hasten the diversification of potentials and uniqueness of products in the local communities. During the case studies in the Philippines, Myanmar and Vietnam, local government officials were invited to participate in the HRD workshops to keep them aware of the activities and the requirements that the local people would need in the promotion of FOVOP. Considering that infrastructures like roads, fishing ports and the like, are important to distribute the FOVOP products to adjacent and nearby communities, it is imperative that government support is enhanced for the improvement of such infrastructures and facilities. Overall however, it is necessary to establish the fishers into groups to empower themselves and be able to gain access to financial systems and organize a community-based credit system for their members as well as develop confidence and convincing power during negotiations with policy-makers.

Way Forward

As means of reviewing the HRD materials and exchanging the experiences from the case studies to be able to finalize the regional strategies and guidelines (**Box 2**) for the promotion of FOVOP in the region, the 2nd RTC on the Promotion of FOVOP in ASEAN Region was organized by SEAFDEC in Chiangmai, Thailand from 22 to 26 March 2010.

The 2nd RTC served as a forum for sharing of experiences among the SEAFDEC Member Countries to support future national activities and recommend future possible post-project activities for implementation later in respective countries. The RTC also discussed the possible development of a regional network for the promotion of FOVOP in the ASEAN region in order to follow-up and speed up the momentum that had been initiated since the start of the implementation of the FOVOP project. As the ultimate goal of the project, the proposed regional network can act as a core function linking SEAFDEC with the respective national networks. Moreover, the experience gained by SEAFDEC from the promotion of the FOVOP strategy would be further enhanced during the follow-up phases in order to promote alternative livelihood in fishing communities using the approaches of the FOVOP project.

Box 2. Output of the 2nd RTC on the Promotion of FOVOP in ASEAN Region

1. Regional Strategy and Guidelines for the promotion of FOVOP in ASEAN Region
2. Regional Strategy and Guidelines for the Support of Government Agencies on the Promotion of FOVOP
3. Regional Guidelines for the Mobilization of the Micro-Credit and Marketing Promotion in Rural Areas
4. Regional Guidelines on the Identification of the FOVOP Products
5. Policy Brief on the Promotion of FOVOP in the ASEAN Region: Issues, Challenges and Ways Forward for Future Cooperation

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Enhancing the Fisheries Resources in Southeast Asia: Recommended Approaches

Somboon Siriraksophon

With the progress now at hand in rearing marine animals, the potential is growing but the experience, protocols, and guidelines on how to combine fisheries enhancement and management are still missing. This paper therefore presents some recommended approaches in enhancing the fisheries resources of the Southeast Asian region.

In the Southeast Asian Region, the declining fisheries resources in terms of both demersal and pelagic fishes in the coastal and offshore areas, has directly affected the fishing industries which saw a quick growth during the past two decades. This situation pushes a large numbers of fishing vessels to perform illegal fishing outside their national jurisdiction or in the exclusive economic zones (EEZs) of other countries and even in the high seas.

Several approaches for enhancing the marine and inland fisheries resources have been promoted at national levels in an effort to conserve and manage the coastal resources since the late 1970s. However, due to the perceived impacts to the fisheries resources that emanate from changes of the climate and human activities, understanding and managing the enhancement of fisheries systems could be considered. On the other hand, the tendency of many countries to favor the politically "easy" enhancement measures while refraining from taking the course of the much needed but politically more difficult management actions (*e.g.* reducing fishing capacity or allocating rights), has helped in discrediting the approaches developed and recommended by fishery scientists.

Nevertheless, varied interests must have already been renewed since many countries are now more decisively addressing the core issue of overcapacity considering that most high value resources are now declining. The recent proliferation of modern tagging technologies and the progress in visual assessments of reef stocks have paved the way to the more convincing assessment of the impacts of stock enhancements or installation of artificial reefs.

Available Approaches

Conventional fisheries management measures such as regulation of minimum mesh sizes, closed areas and closed seasons have been used to counteract the situations of high fishing pressure or degraded environments. However, such measures can be difficult to enforce and do not always offer the possibility of increasing or maintaining production levels. Improvements in the productivity of habitats are also important that may come, *inter alia*, from sustainable enhancements of the habitat (*e.g.* through artificial reefs), primary productivity (protecting fishery *refugia*) and recruitment (*e.g.* through artificial propagation and restocking/ranching). In order to enhance the fisheries resources and achieve fisheries sustainability, the following

available approaches could be considered and adapted by the countries in the region.

Protecting the fisheries *refugia*

Fisheries *refugia* could be a solution to consider, where fisheries *refugia* as defined by the UNEP/GEF/SCS RWG-F are the "spatially and geographically defined, marine or coastal areas in which specific management measures are applied to sustain important species [fisheries resources] during the critical stages of their life cycle, for their sustainable use." The regional guidelines on the use of fisheries *refugia* for capture fisheries management in Southeast Asia, that constitute part of the Regional Guidelines for Responsible Fisheries in Southeast Asia, was published by SEAFDEC in 2006 while taking advantage of the available key results from the South China Sea project which addressed key barriers to effective fisheries habitat management in the South China Sea and Gulf of Thailand (SEAFDEC, 2006).

These key barriers include: limited information regarding fish life-cycle and critical habitat linkages and the role that marine habitats play in sustaining fisheries; low level understanding among stakeholders, including fisherfolk, scientists, policy makers, and fisheries and habitat managers of the linkages between fish stocks and habitats; limited community acceptance of "protected" area-based approaches to marine management in Southeast Asia; and limited experience in national fisheries and environment departments and ministries with respect to the implementation of integrated fisheries and habitat management approaches. Nevertheless, 52 known fisheries *refugia* have been identified and characterized so far.

Artificial propagation and use of aquaculture technologies

As additional tools for stock enhancement, the adoption of certain aquaculture technologies would be necessary specifically: (i) for areas in which certain species cannot reproduce naturally due to irremediable loss of critical habitats; (ii) to maintain fisheries despite recruitment overfishing in places and situations where conventional management does not work; or (iii) to boost stock rebuilding.

Physical modifications of natural conditions

Certain modifications of the natural conditions of marine waters are likely to become acceptable if these are mainly aimed at re-establishing the natural conditions (*e.g.* reopening coastal lagoons and wetlands, replanting mangroves or sea grass beds). Artificial reefs using old vessels and vehicles, old tires, quarry rocks and concrete structures might be adequate to create additional habitats (*e.g.* in soft bottom ecosystems) in order to increase biodiversity, attract predators, provide reproductive as well as feeding or nursery space. Establishment of bio-filters (*e.g.* with oysters and mussels) could improve the water quality when nutrient loads are too high. As reported by many countries in the region, artificial reefs also serve as "anti-trawl" devices.

SEAFDEC Approaches on Enhancement of Fisheries Resources

The 1st phase of the resources enhancement project implemented by the SEAFDEC Training Department in Thailand and the SEAFDEC Aquaculture Department in the Philippines from 2001 to 2006 was mostly focused on the review of enhancement efforts made by the SEAFDEC Member Countries. Moreover, in spite of many attempts made by the countries in promoting responsible fishing and practices to reduce the impacts of fishing to the critical life cycle of some commercial species and support the enhancement of the fish stocks, little achievements have been made so far.

The Workshop on Enhancing Coastal Resources through Artificial Reefs, Stationary Fishing Gear Design and Construction, and Marine Protected Areas organized by the SEAFDEC Training Department in October 2003 in Thailand, noted that all participating countries have in place their respective national legislations, policies and plans including resource enhancement activities to promote conservation and management of the marine resources. In this connection, future approaches on enhancing the fisheries resources should be advanced and existing policy frameworks should be strengthened and supported by the respective national policies/implementation programs for example, the establishment of fisheries *refugia* and improvement of the productivity of tidal flats (Sato and Tamura, 2009). Monitoring and assessment of the impacts from such enhancements should be considered by the countries and should be made part of the respective countries' enhancement programs implemented at the national level.

In terms of using aquaculture technologies as tools to enhance the stocks, most of the research works conducted by the SEAFDEC Aquaculture Department since 2005 to the present (SEAFDEC, 2006a), have been focused on the species under international concern such as the seahorses (*Hippocampus barbouri*, *H. comes*, and *H. kuda*), humphead wrasse (*Cheilinus undulatus*), abalone (*Haliotis asinina*), angelwing clam (*Pholas orientalis*) and sea cucumber (*Holothuria scabra*). In order to disseminate the outcomes from the research works to the SEAFDEC Member Countries and exchange experiences, regional training/workshops have been organized by SEAFDEC. In addition, manuals on the seed production of some enhanced species

covering management of broodstock, induced spawning, larval rearing, settlement preparation, and management of nursery systems, have been produced and disseminated.

Learning from the aforementioned experiences and considering the present scenario reflecting the status of the region's marine resources, enhancements of the fisheries resources and fish stocks in the Southeast Asia are the main focus of the 2nd phase of the project to be implemented by SEAFDEC from 2010 to 2015. These include:

1) Enhancing the productivity of tidal flats in collaboration with Member Countries and as part of community-based fisheries resources management;
2) Establishing fisheries *refugia* in both inland and marine waters including commercial species and trans-boundary pelagic species and shared stock species;
3) Conducting research for the development of aquaculture technologies as additional tools for stock enhancement;
4) Promoting appropriate aquaculture-based fisheries enhancements;
5) Developing the offshore fishery enhancement systems and promoting precautionary approach to capture fisheries (only specific sea areas where natural seasons for fisheries are limited); and
6) Providing technical support to the national policies on enhancement of fisheries resources and fish stocks to achieve the sustainable enhancements in the Southeast Asian region.

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Strategies to Combat Illegal Fishing and Manage Fishing Capacity:

Southeast Asian Perspective

Magnus Torell, Siri Ekmaharaj, Somboon Siriraksophon, and Worawit Wanchana

This paper provides some information on the framework for marine fisheries management in Southeast Asia, including the relative classification of small- and commercial-scale fisheries by countries in the region, references to fishery laws and regulations, levels of fishing capacity and information on the institutional responsibilities for registration and licenses of fishing vessels and fishing gear in selected countries. Suggested directions for national management to combat illegal fishing are indicated based on the lessons learned from some countries in the region. Recommendations are also provided on the future challenges and regional strategies to facilitate actions to combat illegal fishing. However, certain focus will be on the illegal fishing practices by foreign vessels (from neighboring states and others) and their continued fishing in the EEZ's of the region.

It is widely recognized that the severe problems confronting the future global food security are driven by substantial world population growth, continued increase in demand for fish protein while large numbers of the world's fish stocks are currently being depleted. The situation is similar in every region of the world including the Southeast Asian region, which is currently providing one-fourth of the global marine fish production or about 14 million tons of fish products. The increasing demand for fish products together with the rapid growth of fishing capacity and the development of modern fishing techniques resulted in the over-exploitation of the fisheries resources in the Southeast Asian region. Nonetheless, the demand for fish by the fishing industries of the countries in the region is still increasing, which in a way leads to further increase in the numbers of fishers and vessels, and a growing intensity of fishing activities aiming to meet the soaring demand. This, in turn, has been driving and contributing to the continued practice of illegal fishing both inside and outside the Southeast Asian waters. Illegal fishing as defined by FAO means "fishing in contravention of the laws and regulations of a country or an international agreement", and includes destructive fishing and other illegal fishing practices within the Exclusive Economic Zones (EEZs) of countries.

Illegal Fishing

The word "Illegal" is the first part of the IUU (Illegal, Unreported and Unregulated) fishing. It is a fact that IUU fishing contributes to the overexploitation of fish stocks and is a major obstacle to the recovery of fish populations and the ecosystems. Illegal fishing in the Southeast Asian region has become a serious problem impeding all attempts to manage fisheries resources and fish stocks, and has also negatively impacted on the development of sustainable fisheries and food security in the region. Estimating the level and extent of illegal fishing would be extremely difficult and has not previously been done in a systematic way on a global scale. Fishing vessels are highly mobile, especially those fishing under access agreements in the EEZs other than that of the flag-state, where EEZs can extend up to 200 nm from the coast. Agnew *et al*. (2009) made a world-wide analysis of IUU fisheries by reviewing the situation in 54 countries and on the high seas, and estimated that the total value of losses from the current IUU fisheries worldwide is between USD 10.0 billion and USD 23.5 billion annually, representing between 11 and 26 million tons. Another document from Southeast Asia produced by BFAR (2008) indicated that the estimated loss of the Philippines from illegal fishing based on poaching by foreign fishing vessels and destructive fishing in coral reefs due to blast and cyanide fishing in 2008, was around PHP 26.5 billion representing about 458,850 tons.

Illegal Fishing in the Southeast Asian Region

The demand for fish protein continues to increase, but a large number of the world's fish stocks are currently being depleted, a case which is worsening in Southeast Asia which has been linked to the illegal fishing. Somboon (2009) identified the two major causes of fisheries stocks' depletion as: 1) rapid declining fish stocks within the EEZs due to increased fishing capacity and fishing efficiency; and 2) quick growth of fisheries industries particularly in many Southeast Asian countries, that are "pushing" the fishers to illegal fishing and to poach in seas beyond their maritime borders, thus, creating a source of diplomatic tensions.

It is a fact that some countries in the Southeast Asian region have fishers/fishing vessels conducting illegal fishing in neighboring countries and even outside of the region. In addition, many distant water fishing nations

outside Southeast Asia are also conducting illegal fishing in Southeast Asian waters, some vessels even targeting sea turtles in the Sulu Sea (BFAR, 2008) or targeting large pelagic species such as tuna in the Andaman Sea. However, few cases of illegal fishing have been found in the boundary waters between two coastal states such as Brunei Darussalam and Sabah, Malaysia (Mazaini, 2009).

Fisheries Production in Southeast Asia

The Southeast Asian region is one of the world's major producing areas in terms of capture fisheries, contributing about one-fourth of the global production in 2007, which averages 14 million tons from marine and 2 million tons from inland fisheries (FAO, 2009). The major producers from marine capture fisheries include Indonesia, the fourth largest of the world followed by the Philippines, Thailand and Vietnam producing 4.9, 2.3, 2.2 and 2.0 million tons, respectively. During the last two decades, gradual increased production of up to 6% annually has been noted as shown in **Fig. 1**.

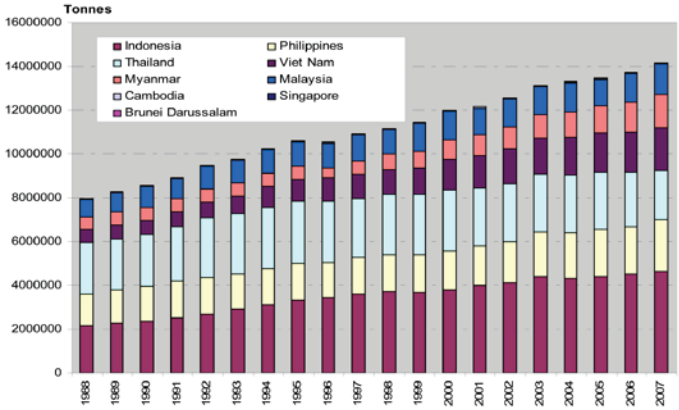

Fig. 1. Marine capture fisheries production in Southeast Asia, 1988-2007 (FAO, 2009)

Considering the increasing trend of the overall fisheries production in the Southeast Asian region during the past two decades, in particular Thailand, its marine production based on national statistics could have included imported fish from Malaysia, Indonesia, Myanmar and others. Its national marine production, as recorded in the statistics, is therefore not a reflection of the real status of the fisheries resources in Thai waters, in particular the Gulf of Thailand where the trend of fisheries resources has been drastically declining since 1970s and 1980s (**Fig. 2**). Nevertheless, the trend of marine production in Thailand also shows a slight increase until the present, where the need for increased amounts of fresh fish is linked to the rapid growth of the fishery industries such as surimi and other fish processing plants. Thus, the demand of raw fish materials to supply those processing industries could be higher than the existing marine resources in the Thai EEZ.

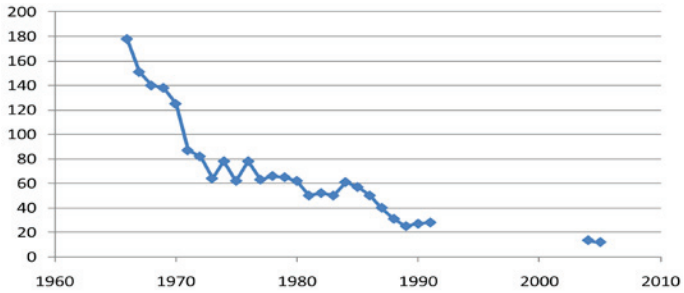

Fig. 2. The catch rates (CPUEs) of demersal resources caught in the Gulf of Thailand during 1966 to 1991 based on survey by Research Vessels Pramong 2 and 9 (National Seminar, 1999) and during 2004-5 by the MV SEAFDEC 2 (SEAFDEC, 2008)

Joint Ventures and Increasing Number of Commercial Fishing Vessels

Many fisheries joint ventures and/or licenses providing permits for fishing in the coastal states outside Thai waters have been developed in cooperation with neighboring countries such as Malaysia, Indonesia, Myanmar, Brunei Darussalam, Cambodia, and other countries in the Southeast Asian region since the 1980s. This has led to the increasing number of commercial fishing vessels by 7% during the period 1985 to 1995 and 7.5% from 1997 to 2001. The total registered fishing vessels in 2001 was 18,182 comprising 49% trawlers, 26% gillnetters, 8% purse seiners, 5 % push netters and 12% small-scale fishing boats (Mala, 2006), where 75% of these vessels operate within the Thai waters while the other 25% operate outside the Thai EEZ. This does not include the non-registered vessels doing illegal fishing outside the Thai waters or fishing within the Thai EEZ illegally and are "unregulated". It is has been well known and is being acknowledged by the countries in the region that the real numbers of active fishing vessels in the region have not been reflected in any official statistics.

Characteristics of Marine Fishery Frameworks in Southeast Asian Countries

Zoning and relative classification of small-scale and commercial fisheries

Each of the countries in the region have their own national classification of coastal and commercial fisheries based on specific definitions indicated in their respective rules and regulations, and used as basis to manage/regulate their marine capture fishing activities (SEAFDEC, 2003). The areas zoned for different types of fisheries (**Box 1**) also indicate a segment close to shore reserved for smaller-scale fisheries, defined as coastal, traditional, artisanal, or municipal depending on the national definition and regulation.

Fishery Laws and Regulations

During the Regional Consultation on Deep-sea Fishery Resources and Exploration organized at the SEAFDEC Training Department from 23 to 26 May 2009, inputs relevant to the significance of responsible fisheries management to combat illegal fishing were provided by selected ASEAN countries.

Indonesia

Under the Law of the Republic of Indonesia, the waters under international law are situated within the sovereignty and jurisdiction of the Republic, and the Indonesian EEZ containing potential fisheries resources and areas for fish culture is a blessing from God the Almighty vested upon the Indonesian people, adhering to the philosophy of life based on the Five Principles of Pancasila and the 1945 Constitution. Thus, it should be well utilized for the prosperity and welfare of the Indonesian people. The national development based on the archipelagic principle (Wawasan Nasantara) should provide justice in its utilization by prioritizing the expansion of working opportunities and increasing the living conditions of fishers, those working in fish culture, and/or other parties concerned in fisheries, and to foster the sustainability of fisheries resources and its environment. However, Law No. 9 of 1985 on Fisheries which is still in force, had not been able to deal with all aspects of management of the fisheries resources and to anticipate the growing needs for laws and regulations together with the development of technologies in the management of fisheries resources. Therefore, it was deemed necessary to establish a Law to replace Law No. 9 of 1985 on Fisheries.

Myanmar

The laws for marine and coastal fisheries in Myanmar provide that, no person shall engage in inshore or offshore fisheries without a license, and that holders of the licenses shall not violate any of the conditions contained in the license, which should not be transferred. All fishers serving onboard a fishing vessel have to register with the Department of Fisheries. Inspectors should not be harassed while performing their duties. Moreover, a number of provisions directly refer to activities that are considered to be illegal. Thus, it is not even allowed to keep explosive substances,

Box 1. Zoning areas reserved for small- and commercial-fisheries with respective classifications

Countries	Small-scale/Coastal Fisheries	Commercial /Industrial Fisheries
Brunei Darussalam	**Zone 1:** reserved for artisanal fisheries, but they can also fish in other zones	**Zone 2:** Trawlers less than 350 hp and purse seiners less than 20 m **Zone 3:** Trawlers with 350-550 hp and purse seiners with 20-30 m **Zone 4:** Purse seiners more than 30 m
Cambodia	**Zone 1:** fishing with/without engine (from 5-50 hp) Zone 1 extends to the 20 meter depth curve	**Zone 2:** Commercial fisheries more than 50 hp
Indonesia	**Zone 1:** Outboard engines less than 10 hp or 5 GT Trawls, purse seines and gillnet are not allowed, except for purse seine with a head rope less than 120m **Zone 2:** Inboard engines less than 50 hp or 35 GT Trawl and purse seine are not allowed, except purse seines with a head rope less than 300 m.	**Zone 3:** Inboard engine less than 200 hp or 100 GT. Purse seine is allowed, except those with a head rope less than 600 m **Zone 4:** Open to all fishing vessel and fishing gear
Malaysia	**Zone 1:** Small-scale fisheries using traditional fishing gears (*i.e.* other than trawls and purse seines) with vessels less than 10 GT (but can also fish in other zones)	Medium and large-scale fisheries using commercial fishing gears such as trawls and purse seines **Zone 2:** Vessels less than 40 GT **Zone 3:** Vessels from 40-70 GT **Zone 4:** Vessels above 70 GT
Myanmar	**Zone 1:** Vessels of less than 30 ft or using less than 12 hp engine	**Zone 2:** Vessels more than 30 ft or using more than 12 hp engine
Philippines	**Zone 1:** fishing with vessels of less than 3 GT (Can also fish in zone 2 (Smaller (3.1-20 GT) and medium-scale (20.1-150 GT) commercial vessels could operate within Zone 1 (within 10.1-15 km) if authority is granted by the concerned local government unit (LGU))	**Zone 2:** Smaller commercial vessels (from 3.1-20 GT) and medium-scale commercial fisheries (20.1-150 GT) **Zone 2:** Large-scale commercial fisheries: more than 150 GT operating in Zone 2
Thailand	**Zone 1:** Vessels of less than 5 GT	**Zone 2:** Vessels of more than 5 GT
Vietnam	Vessels with no engine and with engine but less than 40 hp	Vessels with engine more than 40 hp

poisons, chemicals and such other dangerous substances that are not permitted for use in fishing onboard a fishing vessel. It is not also allowed to dispose of living aquatic creatures or any materials into the Myanmar marine waters that could cause pollution of the water or harass the fishes and other marine organisms. It is not allowed for any person to search for and collect any marine products without a license and establishment of a fishery on commercial scale for sports fishing is not permitted without a license. The holder of the license shall pay the duties and fees as specified by the Department of Fisheries, and shall comply with the regulations and directives prescribed by the Department. The license holder shall provide the necessary services free of charge, to persons who have been assigned to conduct research onboard fishing vessels as well as to observers and trainees. The holder shall appoint only those fisherswho are registered with the Department and the holder has the right to carry out fishing activities in accordance with the terms prescribed in the license.

Philippines

The Philippine Fisheries Code, which was enacted in 1998 has been implemented and enforced at local (village and municipality) and national levels, incorporating international trends related to fisheries. The achievement of food security is identified as the primary goal in the utilization, management and conservation of the country's fishery resources. Other considerations include the exclusive use by Filipinos, the importance of sustainable development and coastal resource management, the preferential rights of municipal fishers in municipal waters and state support/ services, and the participation of the public sector. The State shall promote exclusive use of fisheries by Filipinos, imposition of resource rent and licensing especially for aquaculture and commercial fisheries. The State is also responsible for the establishment of closed seasons and catch quotas, rules on introducing foreign species and protection of endangered species, and follow up on the requirements for environmental impact studies and compliance for projects, and the monitoring and control of Philippine waters. The municipal government shall manage the municipal waters, with exclusive use of municipal waters and preferential rights in fishery privileges for municipal fishers, as well as the option of opening the area from 10.1 to 15 kilometers to commercial fishing. Commercial fisheries shall be subject to licensing and regulation of the State. The State shall provide the necessary support as well as regulatory mechanisms for the development of post-harvest technologies and ancillary industries, including the importation and exportation of fishery products.

Thailand

The Fisheries Act, B.E. 2490 of Thailand was drawn up in 1947 before the development of marine fisheries. The Act was drafted primarily with inland fisheries in mind and has been amended twice, in 1953 and 1984. The Act is composed of six chapters with 73 sections which include fisheries management and conservation, aquaculture, registration and application for permission, collection and fixation of fisheries tax, fisheries statistics as well as the provision of penalties. The Minister of Agriculture and Cooperatives or the Provincial Governor is empowered to impose some fisheries regulations by proclaiming Ministerial Notifications. These regulations are relatively easy to amend and have been revised from time to time. Since 1947, there have been many regulations imposed by the Ministry or Provinces such as for example, prohibiting the use of trawl nets of various types (such as trawl nets, push nets, shrimp push nets) in motorized fishing boats operating within 3,000 meters from the shore line and within a radius of 400 meters from stationary gears licensed by DOF (20 July 1972); closed areas for three months every year during spawning and nurturing seasons of the Indian mackerel in three southern provinces (28 November 1984). Under Thailand's fisheries law, all kinds of fishing gear fall into either: (i) licensed fishing implement; or (ii) non-licensed fishing implement. Licensed fishing implements are specified in Ministerial Regulation No. 1 (1947) which has been revised and added to Ministerial Regulation No. 17 (1978). The Fisheries Act covers both inland and marine fisheries where each Provincial Council is empowered to proclaim any fisheries within the province as Preservation Fisheries, Concession Fisheries, or Reserved Fisheries, subject to the Minister's approval. Preservation fisheries include areas in or near monasteries, in navigation locks, weirs, dams or other places suitable for the conservation of aquatic animals. Fishing in such areas is prohibited without the permission of the Director General of Fisheries.

Vietnam

In Vietnam, government policies are defined in laws, decrees, ordinances, circulars and regulations, the last of which are embodied at the provincial level. Provinces are the lowest level at which regulations can be drafted, consistent with the national legislation. A Fisheries Law drafted by the Ministry of Fisheries (MOFI) with help from the Norwegian Agency for Development Cooperation (Norad) and the Food and Agriculture Organization (FAO) of the United Nations, was passed by the Vietnamese National Assembly in November 2003, which took effect on 1st July 2004. The government agency responsible for the administration, development and management of the fisheries is now the Ministry of Agriculture and Rural Development (MARD),

and at the provincial level the Department of Agriculture and Rural Development. The People's Committees (PPCs) of the provinces are the administrative authorities to implement the Ministry's fisheries policies and regulations. PPCs can make resolutions, decisions, standards and quotas on fisheries within their respective provinces, which should not be in conflict with the regulations of the Ministry. In charge of fisheries management and resources protection is the Department of Capture Fisheries and Fisheries Resources Protection (DECAFIREP), which has sub-branches at provincial level. For the inspection, control and surveillance, enforcement is to be implemented by the "Ministerial Inspection" at central level and its branches at provincial level, which are separate from the functions of the DECAFIREP. In reality however, these two management or control functions are not well coordinated and the agencies concerned are not cooperating. Thus, in some cases, management and control is not effective. For the management of fisheries, there are different types of legal documents that regulate the fishing activities such as Ordinances, Enactments, Circular letters, and Decisions and Instructions.

Brunei Darussalam

References to Brunei Darussalam fishery limits are indicated in the Fisheries Act or related enactments, where fishery limits extend to 200 miles from the base lines. In practice Brunei fishery limits extend to the median line relative to base lines of other countries. His Majesty the Sultan of Brunei may by order, designate any country outside Brunei Darussalam and, in relation to it, areas within Brunei Darussalam fishery limits in which, and descriptions of fish for which, fishing boats registered in that country may fish. A foreign fishing boat presently not registered in a country designated under subsection (1) shall not enter Brunei Darussalam fishery limits except for a purpose recognized by international law or by any convention for the time being in force between His Majesty's Government in Brunei Darussalam and the government of the country to which the boat belongs; and any such boat which enters those limits for such a purpose. The Act declaring Brunei Darussalam fishery limits and definitions states that a "fishing boat" means any vessel being employed in fishing operations or any operations ancillary thereto. A foreign fishing boat registered in a country shall not fish or attempt to fish within Brunei Darussalam fishery limits, except in accordance with the terms and conditions of such license as may be required in respect of such boat under the Fisheries Act and except in an area and for descriptions of fish that for the time being is designated under the Act in relation to fishing boats of that country.

Fishing Capacity

Several national/regional efforts have been initiated to manage fishing capacity. The SEAFDEC-Sida Collaborative Program Workshop held in Phuket in September 2006, discussed the experiences and lessons learned throughout the region and identified major issues related to management of fishing capacity. A strong recommendation from the workshop indicated that existing policies on the responsibilities related to the management of fishing capacity should be revised to improve the national planning and management of fishing capacity. In addition, a consultation process with the concerned national agencies should be conducted to promote the systems and measures to freeze/control fishing fleets/boats at its present level, as a starting point. It was generally agreed that the available data should be fully used while at the same time revision of the existing data collection systems should be carried out in order to reduce the data gap between recorded data and actual figures in support of improved management of fishing capacity.

It was also noted during the 2006 Phuket Workshop that there are no aggregated data on fishing capacity at national or regional level. Available information is more site-specific and relates to projects rather than to the regular statistical information system. The critical problem is the lack of "statistics" with respect to fishing capacity at all levels but especially on smaller scale fishing capacity. Furthermore, over-capacity of fisheries was found to be a primary cause of the major problems within the fishery sector, *e.g.* IUU-fishing, degradation of the ecosystem and habitats, conflicts among/between fishers and other stakeholders, declining catches and changes in catch composition including low value or immature fish. The uniqueness of fisheries in the region requires relevant management approaches and tools, and the establishment and development of the national plan of actions for management of fishing capacity is a process and not an end product, and improvement of fishery management could not be done without addressing the issue of management of fishing capacity.

Policy and Institutional Issues

The 2006 Phuket Workshop highlighted the importance of addressing the lack of political will and the problems with lenient political interventions to combat illegal fishing, either large- or small-scale. Strict enforcement of laws together with severe fines is therefore called for. This is also reflected in the need to address conflicts and ambiguities between departments and ministries as well as to address conflicts between fisheries and other sectors, *e.g.* tourism

for coastal and marine resources and space in coastal areas. There is a need to build awareness at the policy-makers level to pave the way for understanding the fishing capacity related issues. Subsequently, policies should be revisited to ensure that these are not ambiguous and that the direction should lead towards supporting fishing capacity reduction. These policies should be spread through all levels down to the fishers (provincial level, local government, fishing communities and institutions, schools).

The institutional capacity of many countries in the ASEAN region for Monitoring, Control and Surveillance (MCS) is in general too weak to stop IUU fishing and enforce regulations. Identifying and recording the amount of boats and gears that are contributing to destructive and excess capacity is therefore a key institutional challenge. The institutional authority to register fishing vessels and to issue fishing licenses for boats, gear and people vary between countries. It is only in Brunei Darussalam, Malaysia and Vietnam that the whole process of registration and licensing is done by their respective fisheries departments. In other countries, registration (of larger boats) is the mandate of the maritime or merchant marine departments with the licensing still with the fisheries departments. For smaller vessels, the picture is a bit that of a merry mix-up with the added involvement of local government units, people's committees and other local authorities as identified by the individual countries.

Another constantly repeated shortcoming in reducing fishing capacity is the lack of job opportunities for fishers to exit from fisheries. This constraint is also a cause for major social concerns and there is a need within the fisheries, in cooperation with other institutions, to establish a social and economic safety net for the vulnerable/poor people in fishing communities.

Regional Level Issues

Under the new ASEAN charter and in the development of the ASEAN Community by 2015 there are several regional issues that include social aspects, economic integration, environmental aspects and a whole broad range of marine and inland natural resources management of which aquatic resources/fisheries are one of the most obvious regional dimensions in an area like Southeast Asia. With the requirements by the 2007 Senior Officials Meeting-ASEAN Ministers of Agriculture and Forestry (SOM-AMAF) to address both marine and inland fisheries in the development of an ASEAN Regional Management Mechanism (presently called the ASEAN Fisheries Consultative Forum) and with vast range of seas (semi-enclosed seas) and large rivers there is a need to follow up the ASEAN-wide consultations with a sub-regional approach to develop management arrangements. Based on the major outputs from the expert consultation in Phuket in 2006, the Asia-Pacific Fisheries Commission (APFIC), the Regional Plan of Action (RPOA) and other sources have suggested that a regional collaboration by sub-regional management areas (**Box 2**) identified as suitable targets for increased cooperation should be enhanced to promote sub-regional arrangements or agreements. Moreover, given the importance of inland fisheries and trans-boundary implications, the area of the Mekong River Basin is also included as a sub-regional management area.

Box 2. Sub-regional management areas

1. Gulf of Thailand (Cambodia, Malaysia, Thailand, and Vietnam)
2. Andaman Sea and Northern Malacca Strait (Indonesia, Malaysia, Myanmar and Thailand plus India)
3. South China Sea (which could be subdivided in its northern part with Gulf of Tonkin, including Vietnam and China and its southern part of Brunei, Indonesia, Malaysia (Sabah and Sarawak) and Philippines – plus Vietnam)
4. Sulu Sea or Celebes Sea (Indonesia, Malaysia, and Philippines)
5. Arafura Timor Sea (Indonesia plus Papua New Guinea, Timor Leste and Australia)
6. Mekong River Basin (Cambodia, Lao PDR, Thailand and Vietnam)

Directions for Combating Illegal Fishing and Management of Fishing Capacity

The challenges to move towards sustainable fisheries in Southeast Asia should be assessed in the context of the declining of fish stocks/resources, the socio-economic of people engaged in the fisheries sector and the future livelihoods of people involved in marine capture fisheries, and the need to minimize illegal fishing in the region. To address such challenges, various approaches proposed by SEAFDEC could be adopted by the countries in the region.

Increase control by coastal states

Increasing control and implementation of effective surveillance by coastal states are needed to minimize illegal fishing. There is a need to increase security and protection of coastal areas, territorial and offshore (EEZ) waters through the implementation of more effective MCS systems. In Indonesia for example, prevention of illegal fishing is not only carried out by the central government but also by involving the communities through the establishment of "Public Control System" in a number of municipalities throughout the country. In the Southwest Pacific, as a point of reference, increasing control by coastal states has led to a significant reduction in illegal fishing over the last 20 years.

Management of fishing capacity

In Southeast Asia, overcapacity is seen as the most crucial fisheries management problem, threatening the sustainability of the fisheries and pushing fishers towards illegal fishing. To manage fishing capacity, freezing and efficient control of the number of fishing vessels is among the most important actions that governments should enforce. Collectively with other countries in Southeast Asia, there should be a clear picture on how many boats and gears are actually available, in which case a regional "vessel record and inventory" is called for. In the process of managing and reducing fishing capacity it is important to persuade fishing boat owners and private entrepreneurs engaged in the fishing sector to reduce the number of fishing vessels to an appropriate number relative to the existing fisheries resources. Government subsidies to implement a "buyback" policy to reduce the fishing capacity might be an option for the countries to explore.

Improving vessel registration and licensing

The legal framework for fishing vessel registration, fishing licensing and related actions should not be applied separately, as these factors should work in parallel to be used as efficient tools for fisheries management and to combat illegal fishing. In the case of national fisheries management, clear political view, national policy and clear legal framework are needed to provide the concerned authorities with power to do registration, for licensing without a legal framework and a specific law could be fruitless. Moreover, legal references and institutional framework for fisheries management should be strengthened and harmonized in a regional context. Strengthening of vessel registrations at national and provincial levels together with cooperation between two coastal states on vessel registration data sharing are important steps to avoid double registration. Even though common practices in certain boundary areas allow for double registration/licenses, it is when looking at the national rules on illegal practices and fishing – and landing – that makes such practices become illegal (according to either of the national laws) and the catches are unreported or rather misreported.

Strengthening and improving governance and fisheries management framework for capture fisheries

One of the main factors behind the widespread illegal fishing is the failure in fisheries management at national level as all enforcement needs to have its base in national jurisdiction of fishing nations. Subsequently, there is a clear link between illegal fishing viewed at global level and regional level that can be traced back to the failures at the national

Box 3. Considerations for the improvement of governance and fisheries management framework

Better understanding of the status and trends of tropical fisheries - fishery statistics and information

Knowledge of the status and trends of fisheries, not only in terms of fishery resources but socio-economic aspects as well as a key to sound policy-making and responsible fisheries management. Information on the status and trends of fisheries, obtained through routine data collection (fishery statistics) and non-routine data collection (research), is therefore essential for assessing the validity of fisheries policy and for tracking the performance of fisheries management.

Promotion of co-management and rights-based fisheries

It is understood that any innovative fisheries management methodology will not be effectively implemented while fishing operation is conducted under the current unregulated and "open access" regime. The introduction of rights-based fisheries has therefore been considered as a crucial factor for the effective implementation of an innovative management system. Larger fishing vessels are managed under a rights-based fisheries system, through national licensing schemes. Most of commercial vessels are excluded from fishing into coastal waters. In the development and improvement of the management of small-scale fisheries in the framework of co-management the management requirements could be fully shared among resource users. Keys to success would then lie on clear national policy and supporting legal frameworks for co-management and local rights, including group user rights, the need for designated areas for fishing and aquaculture activities in coastal areas, and empowering fishing communities through strengthening local institutions.

Increasing alternative livelihoods and fishing opportunities

In addressing the management of fishing capacity and particularly the need for reductions, it is unavoidable that certain portions of the fisheries sector have to be less active or most probably leave the sector. A number of countries in Southeast Asia have developed exit programs as part of fishing capacity reduction. One major experience indicates that these programs should not be simply developed to take away certain percentage of fishers from the sector as this would create a new set of problems. Rather than "shifting problems of livelihoods", a comprehensive livelihood plan for coastal communities should be considered and developed, considering that those who could continue to remain in the sector may require supplementary livelihoods. While those who would exit from the fisheries sector should be secured for their new livelihoods not only in terms of technical but also in entrepreneurial aspects.

Integrating fisheries into habitat conservation and management

Most common approaches to fisheries management in the ASEAN region have not effectively integrated spatial considerations into fisheries management frameworks. Integrating fisheries into habitat conservation and management, under the concept of fisheries *refugia*, is promoted based upon the emerging body of evidence that the existence of natural *refugia* is a basic element explaining the resilience of commercial fish stocks to exploitation. Maintenance of natural *refugia*, or creation of *refugia* in cases were natural *refugia* no longer exist, should be important priorities for the management of fisheries in the ASEAN region, and may act as effective buffers against uncertainty and recruitment failure. Fisheries *refugia* in Southeast Asia are commonly understood as: "spatially and geographically defined, marine or coastal areas in which specific management measures are applied to sustain important species/ fisheries resources during the critical stages of their lifecycle, for their sustainable use".

Box 4. Strategies to enhance efforts to reduce illegal fishing

Regional cooperation on information sharing and development of regional record on fishing vessels
There is an immediate need for countries in Southeast Asia to cooperate to facilitate the build-up of a regional vessel record for both large and smaller scale vessels. There have to be a clear picture on the numbers and types of vessels that are registered together with the fishing licenses provided to boats, gear and people in each country. This information should be shared among countries in the region, and globally. This is the core to all efforts to combat illegal fishing.

Promoting policy coordination and dialogues with high-level authorities
National and regional projects and programs that are implemented without looking at the impacts and benefits in a broader perspective and beyond the project might not see any of the results sustained after the end of the project, and the likelihood of efficiently impact on national or regional policy development will be limited. To broaden the perspective and to be able respond to regional priorities and influence regional (and national) policy development, the ASEAN-SEAFDEC Strategic Partnership (ASSP) was established and is being further developed by the two organizations. The ASSP does not only aim at promoting regional collaborative programs but also regional policy dialogues with high-level authorities (*i.e.* ASEAN Sectoral Working Group on Fisheries (ASWGFi) and Senior Officials Meeting of the ASEAN Ministers on Agriculture and Forestry (SOM-AMAF and AMAF) on fisheries issues as well as coordination with other sectors. In the process of this cooperation, the ASEAN Fisheries Consultative Forum (AFCF) should be used as a venue for the continued development of a Regional Fisheries Management Mechanism.

Strengthening of the implementation of regional collaborative programs to follow-up on international instruments and regional agreements
ASEAN and SEAFDEC should aim to systematically assist their Member Countries in promoting actions to combat illegal fishing and to cope with related identified issues in response to international instruments and requirements. Most of the technical cooperation programs implemented by SEAFDEC and other regional organizations aim to assist the recipient countries to be able to implement their long-term national actions to achieve sustainable fisheries in harmony with international requirements. However, "gaps" do exist between the specific regional projects/initiative and the regular "day to day" work of counterpart organizations and the result of the project might not be absorbed by national follow-up actions in the respective Member Countries. Enhancing the national ownership of regional projects is an important factor for the effective implementation and sustainability of these projects. In addition it is understood that the involvement of policy makers in various stages including the design, implementation and evaluation of the projects could be a key to more long term impacts and ways of influencing policy change through project implementation.

levels as management interventions and sanctions need to be implemented based on provisions of national laws. To combat and minimize illegal fishing, the countries need to consider improvements in various aspects to improve governance and fisheries management framework (**Box 3**).

Strengthening coordination among relevant agencies on MCS and vessel records

In order to combat illegal fishing in the region more effectively, there is a need to strengthen coordination on the development of MCS networks, vessel registration and fishing licensing among relevant line agencies in each country as well as between the countries of the region. On the scope of a regional fishing vessel register or a reference list, suggestions were made at the Experts Meeting on Fishing Vessel Registration in July 2008 in Phuket, Thailand that the SEAFDEC Member Countries should be provided with the opportunities to discuss options of a regional framework for registration or listing of fishing vessels in the Southeast Asian region. Recognizing the general fishing capacity in the region and with IUU vessels operating in neighboring waters, a regional register/list could be a source of information. Considering that fishing operations and fleet structures are different from country to country in the region, there is a need to gradually agree on a set of criteria to be able to create a regional register/list, *e.g.* limit on certain size of boats. The ASEAN and SEAFDEC could systematically assist their Member Countries in this endeavor.

Promote and Develop Regional and Sub-regional Fisheries Management Arrangements

International/regional organizations like SEAFDEC could act as a trigger or external agent for change to support the national efforts of the countries in the region by taking steps for regional collaboration by sub-regional management areas. This could be done by providing regional fora to share experiences among the countries and identify priority issues, as well as provide a platform for discussion on management of fishing capacity among countries and institutions involved. In the process, it is important that policy dialogue to/with higher policy levels should be promoted and that regional supporting programs are developed and enhanced. Another important function could include supporting the development of concepts for sub-regional area management among countries in the respective areas. To facilitate continued processes, collaborative frameworks should be developed with the countries, where such frameworks could also indicate ways to support the development and implementation of national plans of actions (NPOAs) to combat illegal fishing in the concerned countries.

Future Challenges

Regional strategies to facilitate actions in combating illegal fishing and to manage fishing capacity

The urgency to respond and combat illegal fishing is important to recognize, not only because of the declining

fish stocks, but also due to international requirements, such as traceability of fish products and catch documentations. Southeast Asian countries must consider and apply such requirements otherwise they have to face trade restrictions in international markets. To support the implementation of such stringent efforts such as combating illegal fishing, and achieve a reduction of illegal fishing at national levels, certain strategies (**Box 4**) should be approached through regional cooperation. Finally, the fact that the solutions most often proposed to eliminate illegal fishing are associated with increased governance and the rule of laws, efforts should be exerted towards: increased cooperation between regional management authorities in management and control activities; increased capacity to undertake surveillance; enforcement of port state control measures; and other means of reducing the economic incentives to engage in IUU fishing such as increased sanctions and trade measures.

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Reducing Unwanted Catch from Trawl Fisheries:
Use of Juvenile and Trash Fish Excluder Devices as Fishing Technology Solution

Bundit Chokesanguan, Suppachai Ananpongsuk, Jonathan O. Dickson and Virgilia Sulit

Selective fishing gears and practices have been promoted in the Southeast Asian region through demonstrations and experiments. Since trawling in shallow coastal waters could have adverse effect on the biodiversity and more directly on the irresponsible catch of juveniles and immature fishes that seek food and protection in the target waters, SEAFDEC through the Training Department has developed the Juvenile and Trash Excluder Devices (JTEDs) as by-catch reduction devices, and collaborated with the ASEAN countries for the conduct of demonstrations on the use of JTEDs in the region. The successful demonstration of the use of JTEDs in Calbayog City, Philippines had prompted the Philippine Government to issue a regulation on the use of JTEDs in all trawlers operating in the country.

One of the most serious problems in fisheries management in the Southeast Asian region is the large amounts of juvenile of commercially important fish species and trash fish catch that have possibly led to the present situation of the fish stocks being grossly over-exploited and where the unwanted catch has contributed to the acute reduction of the fish stocks. Recognizing that it is vital to enhance the fish stocks by selective harvesting to improve yield for the future generations, SEAFDEC through the Training Department has promoted the use of Juvenile and Trash Excluder Devices (JTEDs) that could release juveniles and immature fishes from trawling operations back to the sea. In fishing technology, bottom trawling in shallow waters can adversely affect the biodiversity of the fishing grounds and more directly on the juveniles and immature fishes that scavenge for food and nutrients, and seek protection in the coastal areas.

Although it is possible to selectively harvest mature and marketable size fishes, but the tropical, multi-species and multi-gear nature of fisheries in the Southeast Asian region involves diversity of the target species. In order to conserve the fisheries resources in the region, it has therefore become necessary to establish the most suitable JTEDs for the selective harvesting of the fish stocks. More advanced fishing technology emphasizes on the design of the by-catch reduction devices (BRDs) with the aim of selectively harvesting the target catch while reducing the level of undesirable catch in the form of juveniles, immature fishes and trash fish.

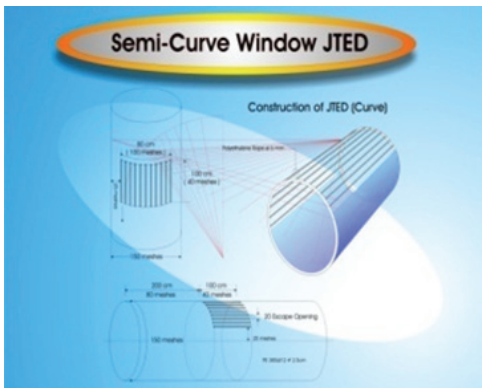
The untargeted capture of fish species and non-fish species, commonly termed by-catch and discards, has aggravated the problems associated with by-catch which include the capture of juveniles of ecologically important and economically valuable species, non-reporting of retained catches and discarded catches. In some fisheries and regions, there is an increasing trend towards retention of by-catch for human consumption or for utilization as aquafeeds and fertilizers. This is therefore a complex issue, requiring resource and biodiversity measures to address the concerns alongside with human needs, and involves a mix of policy, technical and community support aspects.

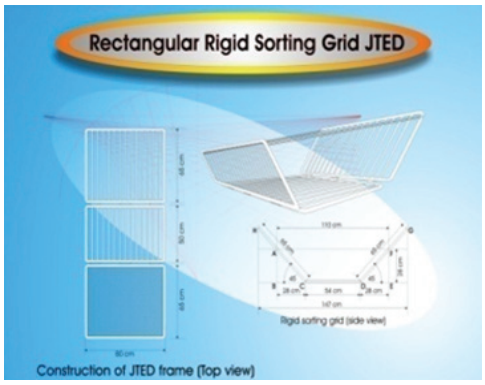
Catch of juveniles of commercially important species (above), from cover-end (top-right), and from cod-end (bottom-right)

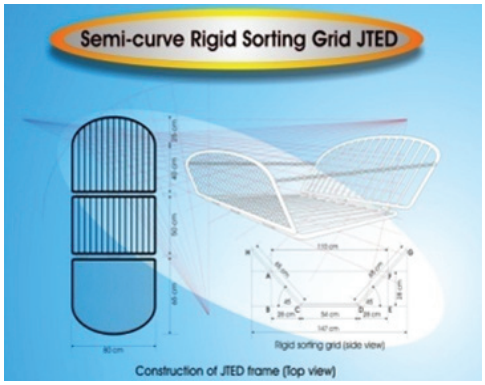
The SEAFDEC Training Department has been conducting activities to develop technology solutions with the main objective of reducing by-catch and discards from fishing operations. Based on the successful implementation of such activities, SEAFDEC was requested to serve as the technical collaborating partner for the 2002-2008 FAO/UNEP/GEF project on the "Reduction of Environmental Impact from Tropical Shrimp Trawling through the Introduction of By-catch Reduction Technologies and Change of Management or REBYC I". SEAFDEC has been approached again for the follow-up FAO/UNEP/GEF project which aimed to mitigate problems associated with by-catch in fisheries located within the Coral Triangle region of Southeast Asia. Known as REBYC II, this project will be based around multi-species trawling, where by-catch issues are among the most serious, with potentially significant effects on ecosystems and livelihoods. REBYC II specifically aims to address these challenges by promoting sustainable fishing, one of the measurement options of which is to encourage the adoption of best fishing practices, and providing a rational approach to delivering benefits from landed by-catch. Specific technological practices would be focused under REBYC II as well as the development of management plans in partnership with the private sector at both national and regional levels, including the preparation of "best practice guidelines for fishing operations". The use of JTEDs has been one of the approaches that would be promoted in the Coral Triangle under REBYC II, and considering the experience and expertise of SEAFDEC in the application of JTEDs in the Southeast Asian region, SEAFDEC would have a crucial role in the implementation of REBYC II.

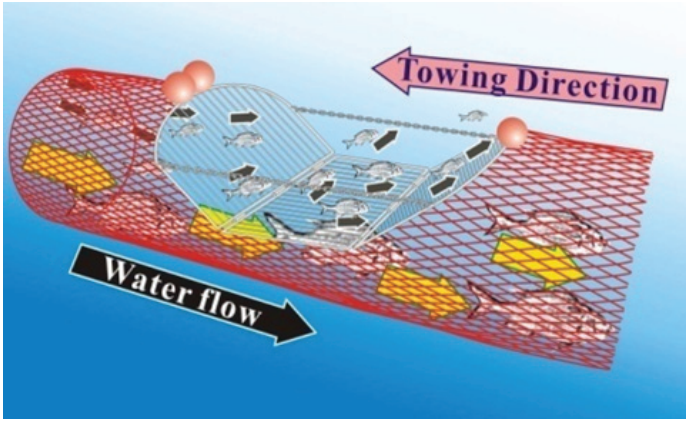
Evolution of JTEDs developed by SEAFDEC/TD for the Southeast Asian Region

A series of JTED designs have been developed by SEAFDEC/TD by taking into consideration the suggestions made by the participating countries in the Southeast Asian region after the series of trials conducted in the countries. Improvements of the designs have also been carried out for more efficient escape rate of the fish juveniles. The basic JTED designs developed by SEAFDEC/TD included the rectangular shaped window, semi-curved window, rectangular rigid sorting grid, and semi-curved rigid sorting grid.









Box 1. JTEDs Demonstration Activities in Southeast Asia

Country (Area)	Year(s) Conducted	Design of JTEDs Used	Results/Remarks
Brunei Darussalam (waters off the coast of Muara town using the M.V. Tenggili in cooperation with the Department of Fisheries)	2000, 2003	Semi-curved rigid sorting grid (bar spacing 30 mm) Two cover cod-end type (50/35 mm cod-end mesh size)	Target species, the threadfin bream (*Nemipterus* sp), 13.0 cm body length has high recovery rate in the cod-end than in two cover cod-end. This implies that the sieving grid of the JTED depends on the design of the releasing device, grid bare spacing and cod-end mesh size as well as the swimming ability of the species in the net.
Cambodia (waters of Sihanoukville using commercial trawler in cooperation with the Fisheries Administration (FiA))	2004	Rectangular shaped window Semi-curved window with 1.0 cm bar spacing Rigid sorting grid (1.0, 2.0 cm bar spacing)	The semi-curve performed the highest ability to release unwanted catch. Specifically, the 1.0 cm bar spacing of the rigid sorting grid has the least escape rate and thus, is the most suitable type. However, spacing of the rigid sorting grid should be adjusted to suit the average size preferred by the countries and needs of the local fishers, which in most cases do not want to use the device with high-escape rate in their trawls.
Indonesia (Bintuni Bay, Arafura Sea using commercial double-rigged trawler with the cooperation of the Department of Fisheries)	2002-2006	Rectangular shaped window Semi-curved Rigid sorting grid with 40 mm bar spacing	The 40 mm bar spacing has shown the best results for releasing the non-target catch and could maintain the maximum catch. Although the rigid sorting grid gave escape level of about 79% while it was 21% for the semi-curve and rectangular type, the semi-curve provided the highest ability in terms of shrimp retention ratio. It should be noted that the 40 mm bar spacing did not benefit the shrimp trawl fisheries in the fishing area especially the rigid sorting grid which had the highest escape level of shrimps which the target species while the semi-curve could be the more suitable design for the particular fishing ground. Thus, there is a need to modify the rigid sorting grid in order to improve the performance of shrimp trawls.
Malaysia (waters of the coast of Alor Setar, Kedah State using fish trawlers in cooperation with the Department of Fisheries Malaysia)	2001, 2007	Rectangular rigid sorting grid, 12 mm and 20 mm bar spacing Semi-curved rigid sorting grid	The 12 mm bar spacing was suitable to save the juveniles and small fishes including trash fishes for sustainable fishing due to its high selectivity. However, it was also noted that the 12 mm bar spacing may not suit any country where the fishing ground still has abundant fish stocks.
Myanmar (off the coast of Thandwe City in northwestern Myanmar using a 97-ton, 36 HP double rig shrimp trawler, overall beam – 6 m and length - 20 m in collaboration with the Department of Fisheries of Myanmar)	2004-2005	Semi-curved rigid sorting grid with 1.0, 2.0, 3.0 cm bar spacing Rectangular shaped window Semi-curved	The fishery resources in Myanmar waters is still rich as indicated in the average CPUE of trawl net at 100 kg/hr/haul, second highest value in Southeast Asia after Brunei Darussalam (283 kg/hr/haul). It was observed that the JTEDs affected the catch of the trawl net since the total catch of the trawl net attached with JTEDs was reduced by about 38%. The escape rate of demersal fishes in 1.0 cm bar spacing was 10%, which increased to 25% for the 2.0 cm and to 50% for the 3.0 cm. The escape rates of the groups from the window shape and semi-curved were the same as the rigid sorting grid with bar spacing of 2.0 cm.
Philippines (Manila Bay using shrimp-trawl nets on two Philippine trawlers)	2003-2006	Semi-curved rigid sorting grid	All JTEDs could be used in shrimp trawls because most large shrimps caught are retained in the cod-end. However, fishers do not favor the use of JTEDs because they do not want to lose profit by allowing fishes to escape. The rigid sorting grid with 1.0 cm bar spacing (escape rate 33%) could be more suitable selective device that the others (escape rate of 45%). The selectivity rate increased from the rigid sorting grid with 1.0, 2.0, 3.0 cm bar spacing to semi-curved and rectangular shaped window which means that the rigid sorting grid 1.0 cm bar spacing has a good efficiency which decreases in the 2.0 and 3.0 cm bar spacing of the semi-curved and rectangular shaped window.
Thailand (waters off the coast of Prachaub Kirikhan and Chumphon Provinces using the M.V. Promong No. 1 in cooperation with the Department of Fisheries of Thailand)	1998	Rectangular shaped window (8, 12, 16, 24 cm escape opening) Semi-curved (4, 6, 8, 12 cm escape opening)	Percentage of escape of commercial fishes by weight, of the trawl net attached with the rectangular shaped and semi-curved with different escape openings did not give significant selectivity of the device. However, the percentage of escape by number, of juveniles and young commercial species clearly showed that the escape rate using the semi-curved is 7 times higher than that of the rectangular shaped window.
Vietnam (coastal areas of Vietnam in collaboration with the RIMF)	2001, 2005	Rectangular rigid sorting grid with bar spacing 2.0, 3.0 cm	The escape rate using the rigid sorting grid ranged from 12 to 28% of trash fish, and from 10 to 40% for other kinds of fishes, suggesting that the rigid sorting grid has a better separating performance that than of the rectangular window shaped and semi-curved JTEDs for reducing unwanted fish.

Assessment and evaluation of the use of JTEDs

Experiments on JTEDs attached to the cod-end of the bottom trawl net were conducted in the Southeast Asian countries (**Box 1**). The results indicated that almost all kinds of JTEDs can release the juveniles and small fishes, and retain the larger sizes of fish in the cod-end. In order to assess the impacts of the use of JTEDs in fishing operations, questionnaire surveys were conducted in the participating countries, the results of which were confirmed through interviews with the concerned fishers. Based on the results of the questionnaire surveys as well as from the interviews of the fishers, the observations have been compiled (**Box 2**), and used as basis for the further improvements of the designs of the JTEDs.

Box 2. Observations of fishers on the impacts of the use of JTEDs in their fishing operations

Thailand
- Agreed on the advantages of the use of JTEDs in order to sustain the marine resources.
- But not willing to install JTEDs on their trawls at the moment, as needs more demonstration and experiments.
- May increase amount of fuel used when JTEDs are installed in trawls, and the result could be decreasing amount of the target catch.

Indonesia
- Agreed on the advantages of the use of JTEDs in order to sustain the marine resources.
- Increasing amount of fuel is used when JTEDs are installed in trawls, and the result could be decreasing amount of the target catch.
- Difficulties in gear preparation and operation, and that the period of net hauling could take longer time.

Malaysia
- No difficulty during the gear preparation and operation.
- The design of the device could be more applicable if further modifications could be made.

Philippines
- The design of the rigid sorting grid with 1 and 1.5 cm JTEDs were the most suitable devices.
- The escape rate was acceptable.
- Agreed on the use of JTEDs.
- Fishers willing to install the JTEDs on their trawls.

Generally, however,
- Semi-curved rigid sorting grid JTEDs has better performance in maximizing the escape rate of juveniles, the comparison of the escape rates are shown in **Box 3**.
- Continuing modification should be considered with relevance to the updated fishery information in each country.
- Fishers should be informed and made to understand the results of the experiments, and should be encouraged to change their attitudes for improved fishing operation.
- Learning from Calbayog City (Philippines) adoption process of JTEDs, such approach could be applied to other area in the region.
- Based on interviews of fishers, the following general observations were also noted:
  - The fishers understand the impact of catching juveniles
  - The fishers are willing to use JTEDs provided that these do not harm/reduce their target catch, convenience to install and operate, and must not lead to increased fuel costs.
- Discussion among core experts, fishing gear technologists and operators should be regularly conducted.

"The JTED-Changeable Grid Selection"

Based on the feedback of the fishers, one of the most recent improvements of the JTED design made by SEAFDEC/TD is the use of an interchangeable grid selection in the JTED (**Fig. 1**). This design has recently been promoted by SEAFDEC/TD in the Southeast Asian countries.

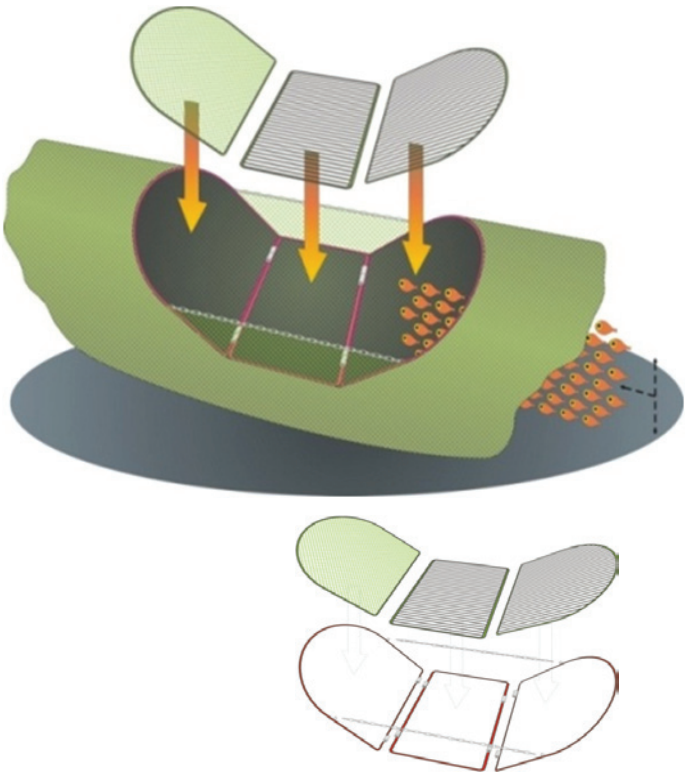


Fig. 1. JTEDs interchangeable grid selection adapted by SEAFDEC/TD

Adoption of JTEDs in Calbayog City, Philippines: A success story

Considering that reducing by-catch has been a new initiative in the Southeast Asian region, pilot demonstrations on the use of JTEDs had been conducted in the region to demonstrate the adoption of JTEDs as a technical tool and as a platform to initiate other management measures. In order that the adoption of JTEDs in the region could be sustained, it was envisioned that the countries in the region would be able to establish their respective national policies on the use of JTEDs.

Calbayog City in Samar, eastern Philippines (**Fig. 2**) was chosen by SEAFDEC as the pilot site for the conduct of

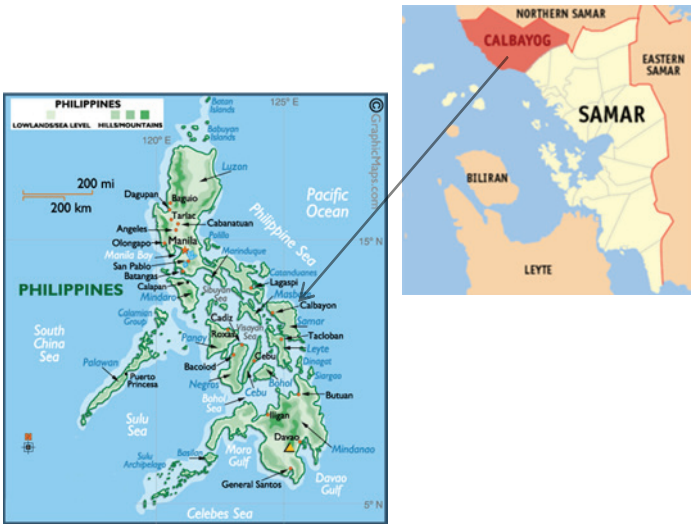


Fig. 2. Map of Philippines showing Calbayog City

JTED trials in the Philippines upon the recommendation of the Philippine Bureau of Fisheries and Aquatic Resources (BFAR). With BFAR as the main implementing office and the Calbayog Local Government Unit as co-proponent, JTED trials were carried out to build awareness of the stakeholders on the impacts of JTEDs in conserving the fisheries resources, train the stakeholders in the construction of the most-suitable design of JTEDs, and formulate a practical management framework and national regulation on the adoption of JTEDs in the Philippines.

The activity in Calbayog City started with a series of consultations conducted by BFAR with the stakeholders, specifically to explain the need to reduce the catch of juvenile fishes and reject trash fish in order that the future generations would have fish on their tables. BFAR also reached out to the academe to demonstrate the technical feasibility of the use of JTEDs as one of the management interventions in sustainable fisheries development. BFAR also proposed to the Philippine Government authorities for the possibility of formulation a national regulation on the use of JTEDs for the sustainable management of the country's fisheries resources.

In the process, BFAR discussed with the local government unit (LGU) of Calbayog City, for the unit to serve as the co-proponent of the activity with BFAR as the implementing agency, forming the JTED Project Team. The main responsibilities of the LGU included: making arrangements for the authorized/acceptable implementation of the pilot project; ensuring the participation of selected Commercial Fishing Boats (CFBs) in Calbayog City and for the CFBs to be operated only in designated fishing areas; prescribing and enforcing a color coding (boat color-orange), use of Global Positioning System (GPS) and issuance appropriate permit to participating CFBs; providing complement staff in the enforcement of related laws/regulations, provide support (in kind) and necessary assistance to the JTED Project Team; providing financial support for the conduct of relevant activities; and providing JTEDs to be used in the pilot project implementation. BFAR on the other hand, was responsible for the technical requirements and support during the entire implementation of the project in collaboration with SEAFDEC. In order to strengthen the implementation of the experiments, a working group was established comprising the LGU Calbayog City, BFAR Regional Fisheries Office in Region 8, BFAR Fisheries Training Center in Region 8, members of BFAR Project Team, the government and non-government organizations in Samar, and the fishing boat owners/operators in Samar. The responsibilities of the working group are to plan, coordinate and ensure proper pilot project implementation, monitor/assess progress and results of implementation, and recommend procedures and direction regarding implementation of the activity.

The participation of the boat owners and fishers was noteworthy, being responsible in ensuring the full compliance and cooperation in the implementation of the activity, using JTEDs in accordance to the proper deployment and schedule of the fishing operations, providing data and other requirements (*i.e.* logbooks), allowing and accommodating researchers/observers onboard, and adopting a color coding scheme (Orange) and compulsory use of GPS onboard, and securing the appropriate permit from the LGU of Calbayog City.

Box 3. Comparison of escape rate between juveniles and commercial target groups

	Rigid sorting 1 cm	Rigid sorting 1.2 cm	Rigid sorting 2 cm	Rigid sorting 3 cm	Rectangular 1 cm	Semi-curved 1 cm
Escape rate of juveniles (%)	56.69	71.00	77.00	74.31	68.52	61.09
Escape rate of target group (%)	9.72	11.00	16.00	50.33	46.75	47.31
Difference in values of escape rate of juveniles and escape rate of target groups (%)	46.97	60.00	61.00	23.98	21.77	13.78
Percentage of different values of escape rate between juveniles and commercial target catch (%)	20.64	26.37	26.80	10.54	9.57	6.06

The successful collaborative efforts among the various stakeholders in the implementation of JTEDs in Calbayog City was seen by the Philippine Government as a practical fisheries management framework. As a result, the Philippine Government had issued a regulation on the use of JTEDs in all trawlers operating in the country.

Conclusion

Results of the experimental trials and demonstrations on the use of JTEDs in selected Southeast Asian countries indicated the need for continuous improvement of the design of the device in order to be able to maximize its selectivity function. Specifically, the design must be suitable to both the target species and the fishing ground where the trawlers installed with the device operate. Considering that in the Southeast Asian region, the fishers aim for multi-target species with varying commercial sizes, it has become difficult to select the most appropriate size of the grid interval. A recent improvement of the JTEDs made by SEAFDEC/TD is the interchangeable grid selection, which is now being tried in the Southeast Asian region. This is aimed at addressing the limitations when there are more than two target species and where commercial sizes of the target species differ, which entails the need to select the correct bar spacing.

The demonstrations and experiments on the use of JTEDs conducted by TD in Southeast Asian countries

The project of SEAFDEC/TD promoting the use of JTEDs in the Southeast Asian region is also envisaged to encourage the fishers to change their frames of mind and understanding the need to operate responsible fishing for the conservation of the fisheries resources. SEAFDEC/TD for its part would continue to improve the design of the JTEDs in order to achieve the levels of sustainability that can be beneficial to the fishers as well as the resources.

Way Forward

While the implementation of JTEDs in the Southeast Asian region is continuing and while SEAFDEC/TD is improving the designs of JTEDs that would be suitable for the fisheries in the region, the following issues should be taken into consideration by SEAFDEC and the Member Countries in further promoting the use of JTEDs as a conservation measure and fishing technology solution in reducing unwanted catch from trawl fisheries:

- By-catch reduction devices like JTEDs reduce the catch of juveniles and trash fish;
- Regular dialogues and involvement of stakeholders (participatory approach) in the project implementation (planning, implementation, monitoring) could build up awareness and cooperation;
- External participation (*i.e.* SEAFDEC) contributed to the improved/enhanced project implementation;
- Clear objectives lead to effective project implementation;
- Well defined performance indicators contribute to smooth implementation of the project;
- Sharing of experiences and information among participating countries and organizations is important;
- Socio-economic study on the impacts of the installation of JTEDs in trawlers should be conducted; and
- Need for scientific data on the effect of the installation of JTEDs in trawlers on the fuel utilization of the fishing vessels.

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Addressing Coastal Fisheries Conflict in Thai Waters: A Policy Brief

Yves Henocque and Sanchai Tandavanitj

This Policy Brief is based on the output of a CHARM study which aimed to develop guidelines for resolution of conflicts in coastal fisheries, carried-out from January to July 2007 in Southern Thailand (Krabi, Phang-Nga, Phuket, and Prachuap Khiri Khan Provinces). Complete reports from this study and the guidebook for conflict resolution in coastal areas can be obtained through the CHARM Office in Bangkok, Thailand. This article presents a set of lessons learned from selected case studies in resolving coastal fishery conflict. A basic plan of action is highlighted that places decentralization, co-management and rights-based fisheries as actual solution to reduce the occurrence of fisheries conflicts among fishers and establish a cost-effective management system for coastal fisheries. Although this article highlights on resolving fisheries conflicts in Thailand, the strategies outlined could serve as reference for other ASEAN countries in resolving conflicts in coastal fisheries.

Conflict is a fact of life. It occurs when individuals or groups are not obtaining what they need or want and are seeking their own self-interest or pursue actions according to their own values. Conflict is also a common characteristic of fisheries. Yet, there has been an unusual increase in the occurrence of such conflicts in coastal areas of Southeast Asian countries over the recent years, among which Thailand is no exception. Recent highlights have been given on the importance to address issues pertaining to fishery conflict in Thailand, notably in the 10th National Economic and Social Development Plan (2007-2011).

As early as 1925, it was confidently stated that aquatic resources were abundant and varied, and that only a minimum degree of restriction would suffice to preserve fishery resources for the future. Marine fisheries were then undeveloped and access to these resources had been left open because managing those seemed both unnecessary and impractical. In the 1960s, with support from fisheries development policies, industrial fisheries rapidly spilled over from Thailand to neighboring countries, and catches shot up everywhere. The industrialization of the Southeast Asian fisheries has often been reported as another success story of the industrial era. Almost fifty years later, when this episode was revisited, results indicated that the uncontrolled development of industrial fisheries has resulted in overcapacity and overfishing for apparently decades. Fortunes were made by some, but the bottom line is that the Gulf of Thailand has become barren with conflicts among fishers worsening. Industrial fishing operations have been increasingly encroaching inshore areas, legally including the areas preserved for small-scale fishers. This had led not only to unfair and intense competition, to the extent of damaging small-scale fishing gear, but also to destruction of the fragile and productive coastal habitats. As a result of the lack of foresight towards the quick development of marine fisheries and their need for regulation, it has come the point when for the government had to deal with all aspects of marine fisheries management through a system which is heavily centralized and unprepared to undertake such a task. This puts an intense burden on government institutions and has led to several limitations (**Box 1**).

Box 1. Limitations on the development of sustainable marine fisheries management

- Difficulties to deal with legally sanctioned open-access regime to marine fisheries;
- Difficulties to take into account ecological complexities of tropical fisheries;
- Unsuccessful mechanisms to transform policy into practice and address core issues in coastal fisheries due to the lack of resources for implementation;
- Lack of scope for decision-making and development of policy and regulations at the provincial and local levels;
- Lack of consultation with local fishers while the government does not take advantage of fishing communities' capacity to participate in the management of local resources;
- MCS mechanisms in place are rarely cost-effective, while legal loopholes exist unaddressed and fisheries violations are considered as minor offences, resulting in the prevalence of illegal fishing; and
- Reduced potential for coastal communities to undertake voluntary conservation efforts.

Addressing the Causes of Fishery Conflict

Most coastal fishery conflicts in Thailand can be traced down to a set of common causes, while it appears that most of these conflicts are actually indications ("symptoms") of poor governance issues. One of the most recurring common causes of the conflicts is related to the open access regime to fisheries. Fishers are inevitably set on a path of competing against each other for the same fish because of the unclear ownership of the fisheries resources. In addition, there are many conflicts also caused by regulations that are perceived (rightfully or not) as unfair by fishers, and a lack

Box 2. Resolving Fishery Conflicts

- Fisheries managers need to be aware of the 'layering' of conflicts and be able to trace them back to the real rather than apparent causes, for an effective conflict management.
- For lasting solutions, fishery management policies should aim at "promoting sustainable and fair fisheries" rather than attempting to tackle directly "conflicts" as such. *Ad hoc* negotiations and mediation efforts are often seen as the one answer to conflict, but may at best just deliver short lived compromises.
- Resolving fishery conflict requires a multi-sectoral involvement. A given government agency alone cannot resolve conflict because of its specific focus of work. All relevant institutions should be involved as far as practically feasible (administration, coastal resources management, research) especially institutions that coexist at the local level with those causing conflicts and using the resources.
- The policy pursued by the government at the central level must take a definite direction and guide the course along which conflicts will be settled. The ambivalence between policy guiding fast economic gain and those promoting sustainable fisheries makes conflict resolution unworkable in some cases.
- Conflict involving fishers operating irresponsibly (destructive fishing gear or practice and/or illegal fishing) against others should not be considered as a basic problem of conflict between legitimate users of the sea, for which a resolution is looked for as a negotiation on how to share fishing grounds.
- Local conflict resolution mechanisms are necessary to fill the gap the national Fishery Law leaves at the local level, as those will deliver solutions more satisfactory and adapted to the local settings. Fisheries problems cannot be solved by solely imposing regulations or initiating some limited activities; the attitude and compliance of resources users also need to be changed positively.
- Stakeholder consultation and participation when developing or modifying fisheries regulations, will reduce conflicts through the design of rules better adapted and/or fairer to all stakeholders.
- A precautionary approach should be adopted when and where local efforts at conservation and management of coastal resources are contested, notably through judicial means: when in doubt, measures supporting resources conservation should be preferred. Those willing to offset conservation measures should bear the burden of proof.

of effective MCS (monitoring, control and surveillance), both of which reduce compliance, increasing illegal fishing. The realization that such regulations established at the national level cannot respond to all local needs is not new since partnership with local people for the management of natural resources has been explored in the past.

The EU-Thailand collaborative study conducted by the Coastal Habitat and Resources Management (CHARM), covering several coastal communities (in Southern Thailand (Krabi, Phang-Nga, Phuket, and Prachuap Khiri Khan Provinces)), was engaged in pilot projects or initiatives that test community-based management. The results have shown the latent potential in fishers' communities to supply local management institutions that works in partnership with local and provincial government authorities.

Lessons from these case studies in resolving conflicts, regulating access to fisheries, and legitimacy of rights-based fisheries under a co-management approach are outlined in **Box 2**, **Box 3** and **Box 4**, respectively.

Moving Towards Rights-Based Coastal Fisheries and Co-Management

The achievements of fishers' institutions studied in Southern Thailand highlighted the validity of community-based management in addressing fishery conflict and some management gaps. Yet, beyond this approach which

Box 3. Regulating Access to Fisheries

- While open-access remains a realistic option for open sea fisheries, coastal areas need better protection from illegal fishing, destructive operations and overfishing through the introduction of rights-based fisheries together with a more complex zoning, considering their essential role in the biological productivity of tropical waters and the role of coastal fisheries as a social safety net for the poorest segments of the population.
- Open-access to coastal fisheries ruins local efforts to manage/conserve fisheries resources, thus a progressive move toward more regulation of the access to inshore fisheries is essential for a decentralized fisheries management system to work.

Box 4. Legitimacy of Rights-based Fisheries under a Co-management Approach

- Where efforts to institutionalize local fishers have taken place, communities have been successful through collective action in:
  - Proactively managing local coastal resources, including their utilization: local people do not allow negative developments to ruin local resources and better control how fisheries or coastal operations are run in their area, promoting responsible fishing practices;
  - Resolving internal fishery conflicts, with the social capital in a community helping to prevent most routine disputes from escalating out of control; and
  - Networking and developing partnership with local and provincial government agencies as well as other communities.
- A partnership between government and fishers' institutions (co-management) is essential as:
  - Conflicts between fishers within a managed community and those from outside are difficult to address internally and may become prevalent under an open-access regime, such conflicts with free-riders can be violent and potentially more damaging than locally-based conflicts; and
  - Fisheries resources are often migratory and transboundary, their management cannot be successful if the different fishers' institutions involved follow different approaches, thus the government has to play a central role in setting-up overall directions and ensuring coordination.

Box 5. Potential benefits of co-management and rights-based fisheries to address fishery conflicts

Causes of fishery conflict	Solutions brought by co-management and rights-based fisheries
Unfair/ineffective regulations; Ineffective MCS; Illegal fishing	Under rights-based fisheries and co-management, local coastal resources management becomes more flexible and adaptive, and makes full use of indigenous knowledge and expertise. There is a progressively greater moral obligation of community members as they develop a feeling of ownership and responsibility towards fisheries resources. Community members participate in MCS through co-management, enhancing local compliance with regulations and reducing the cost of monitoring and enforcement.
Policy and legislation influenced by large-scale fishers	Under a co-management approach, local institutions can initiate a scaling-up of institutional efforts above a single community. This ensures that small-scale fishers, mostly poor people, have a better representation at higher levels to be heard in policy development and decision-making in a similar manner to the large-scale fishers. This will account for more democracy and participation in the way national policies and regulations are enacted and allow for the development of a fair management system.
Damage on fishing gear ('gear war')	Rights-based fisheries consolidate the claim of small-scale fishers on inshore coastal areas. Violations by large-scale operations are reduced by a strengthened MCS which involves fishers and better organized small-scale fishers. Local conflicts are effectively tackled by sound and fair local management, regulating how the resources are exploited as well as local resolution mechanisms, in addition to a community able to proactively deal with other internal issues.
Weak local institutions with increasing heterogeneity of stakeholders	Co-management involves the strengthening of local institutions through providing an enabling legislation and proper initial support that encourage collective action, thus strengthening the sense of community, and help controlling the behavior of individual fishers.
Excess fishing capacity and overfishing; Decline of fishery resources; Environmental degradation	A reduction of excess capacity for small-scale fisheries implies an increased focus on people-related solutions and on communities. Strengthening local communities (and their institutions) and providing gradual group user and management rights allow the development of sound resource management systems adapted to local conditions. Rights-based fisheries put a gradual end to the open-access regime to inshore resources. There is also an enhanced awareness among fishers on the importance to sustainably utilize and conserve coastal resources.
Declining socio-economic status of small-scale fishers and pervasive poverty; Market conditions	Co-management addresses community-based economic development/diversification (value adding processes for fish, better marketing, saving activities). This ensures communities are less vulnerable to external variations, are better off economically and provide a basis for the financial independency of local institutions, which do not rely on outside support for its regular operation.
Increasing population	Rights-based fisheries allow an effective and fair control of who can go fishing in coastal areas and how fishing must be done. An increasing population still means an increased demand for fish and a pressure on community institutions, but in the long-term a better management of coastal fisheries resources (*i.e.*, sustainable utilization, control of the quality of the product) will contribute to food security.

is typically geographically isolated and cut from the mainstream management system, community-based co-management and rights-based fisheries offers much more in terms of establishing a working decentralized system which can be sustained and implemented on a national scale (**Box 5**).

If conflicts are considered as a creative and constructive force for management, this might be the occasion to envisage on how to improve the effectiveness of the system and correct flaws in the setup of fisheries management. Rights-based fisheries and decentralization are much in line with the last Thai Constitution, which recognizes the rights of local people to conserve and manage resources in their communities. With a new Constitution, Fisheries Law and Master Plan for Marine Fisheries Management in the works, it is now the auspicious time to consider how innovative approaches to fisheries management could be implemented.

Plan of Action

Strategy 1. Decentralization and Establishment of Rights-Based Inshore Fisheries

Vision: A progressive decentralization of management functions to the provincial level is supported, with clear provisions for provincial management bodies to support local fishers' institutions. Subsequently, the provinces decentralize some management rights to fishers' institutions, for which an appropriate legal status must be defined as partners of the government in management, together with attribution of group user rights.

This puts a progressive end to open-access to inshore fisheries. Decentralization of fisheries management to community level (**Box 6**) can only be started once local institutions are ready, showing their maturity and capacity

Box 6. Specific strategies in decentralization of fisheries management

- **Boundaries for management – zoning and nesting the management system**
  1. Open waters beyond provincial fisheries management boundaries but within the EEZ remain under full control of relevant national level authorities.
  2. Provincial waters for fisheries management defined accordingly with foreseen provincial capacity for management (especially MCS) and decisions made by the Ministry of Interior concerning provincial marine boundaries, suggested to be 20-30 km from shorelines, although in some cases, special arrangements should be adopted instead of provincial boundaries (*e.g.*, Phang-Nga Bay, inner part of the Gulf of Thailand) keeping in mind the need for a proper management body that replaces individual provincial authorities.
  3. Community waters to be managed by local fishers' institutions determined between stakeholders and provincial authorities (and enacted by the latter) on a case by case basis once the local fishers' institutions is ready to take over management functions (based on fishing grounds, ecological, geographical and political factors), fitting within provincial waters.

- **Provincial level authorities are progressively given the following mandate**
  1. Develop and enact provincial fisheries management regulations in their given provincial waters, including the rights to charge a fishing permit (management fee) to vessels that wish to operate in provincial waters.
  2. Carry-out a cost-effective MCS instead of regional patrolling centers, in partnership with local fishers.
  3. Support its capacity building unit for the institutionalization of small-scale fishers and encourage the supply of fishers' institutions along its coastline.
  4. Attribute group user rights and management rights over specified inshore water areas to local fishers' institutions that are mature enough to enter in a co-management partnership with the provincial authorities.

- **Local fishers' institutions must achieve the following before playing a leading role in local fisheries management**
  1. Identify its primary stakeholders as members.
  2. Propose a delimited area as community boundaries.
  3. Develop, agree and implement informal rules with participation of all members.
  4. Show capacity to carry-out collective action, resolve internal fishery conflict, implement local MCS, and collect basic local data and information.

- **Once established, local fishers' institutions are given the following mandate, in partnership with provincial authorities**
  1. Provide fishing rights to all institution members, possibly charging a management fee.
  2. Develop and enact local fisheries management regulations in their given community waters, including the rights to charge a fishing permit (management fee) to vessels that wish fish in community waters, or refuse such a permit.
  3. Carry-out MCS in their waters, with enforcement done by provincial authorities if outsiders involved.
  4. Develop community economic self reliance and strengthen community economic well being.
  5. Enhance fisheries resources in community waters, with ad hoc budget support from government agencies.
  6. Use gradual/social sanctions for local violations before having recourse to stricter punishment such as removal of membership/permit or formal proceeding in court.
  7. Under co-management with the government, initiate networking with neighboring communities to encourage replication of local institutionalization, and scaling up of local management institutions into higher level management institutions (*e.g.* bay level) or representation structure at provincial/national level.

- **Ban destructive fishing practices**
  1. A scientific basis on the impacts of fishing gear and practices incriminated as destructive (including biological, social and ecological impacts) is quickly consolidated, and upon clear finding, the government should move unambiguously towards banning such fishing methods.

- **Addressing the challenges of large-scale fisheries**
  1. Recognize that the right to migrate for large-scale fisheries should not be put in jeopardy although such movements should be managed.
  2. Fishing licenses should be given on the basis of biological indicators so as to match fishing capacity with the resource base
  3. Vessel owners who realize significant profit from fisheries should participate proportionally to the costs of management.
  4. Means to reduce illegal fishing in a cost-effective manner should be explored, including mobilization of small-scale fishers for monitoring in inshore and provincial areas, use of VMS (vessel monitoring system) and on-board observers (once fishing licenses are given less liberally) and landing surveys in partnership with provincial and local institutions.
  5. Subsidies contributing to increased fishing capacity should be stopped. Fuel subsidies only distort the last regulation barrier that are market mechanisms and allow fishing to continue even when the stocks are already massively depleted, and are also an unfair practice as small-scale fishers are not entitled to them.

in enacting and implementing local rules, rather than being forced down.

Strategy 2. Capacity Building at All Levels

Significance: Institutional capacity building should be widely recognized as a vital component of coastal resources management. Government agencies either at central or provincial level cannot work with individuals but instead must deal with community-based institutions, considering the nature of tropical fisheries. Since self organization and collective action do not always come easily to fishers, depending on local traditions, capacity building by government agencies will be a prerequisite for most

communities to be involved in local fisheries management, including solving fishery conflict. Institutional capacity building, starting at the national level, including provincial management bodies and eventually fishing communities must be considered as a long-term process that would take years and require lasting political will and endeavor (**Box 7**).

Box 7. Capacity building strategies

- **Capacity building at national level**
  1. Human capacity building (skills) research for national management and policy purpose with participation of stakeholders collective action, institutionalization of small-scale fishers, co-management and rights-based fisheries training for provincial trainers on the same issues as above MCS for offshore fisheries
  2. Physical capacity building Patrolling (piers, boats, fuel, workshop, VMS)

- **Capacity building at provincial level**
  1. Human capacity building (skills and manpower) coastal fisheries management collective action, institutionalization of small-scale fishers, co-management and rights-based fisheries
     - Fishery conflict management
     - MCS (patrol and maintenance)
     - Research for provincial management with participation of stakeholders
     - Extension unit for collective action, institutionalization of small-scale fishers, co-management and rights-based fisheries
  2. Financial capacity building
     - Securing regular budget from central authorities
     - Securing regular budget from Provincial State Administration
     - Recovering management cost from fees charged for fishing permits of boats in provincial waters
  3. Physical capacity building:
     - Patrolling (pier, boats, fuel, workshop)
     - Provincial fisheries management bodies (offices)
     - Extension unit for the institutionalization of small-scale fishers (training facilities)

- **Capacity building at community level**
  1. Human capacity building (skills)
     - Concepts of rights-based fisheries and co-management
     - Managerial skills (fisheries and institutions)
     - MCS activities
     - Marine ecology and fisheries management
     - Research and data collection for fisheries management, identification of alternative livelihood to fishing and economic development of the community, with full utilization of indigenous traditional knowledge
     - Conflict resolution
  2. Financial capacity building
     - Securing regular budget from community-based economic activities and membership fees
     - Recovering management cost from fees charged for fishing permits of boats allowed in community waters
     - Securing *ad-hoc* funding from Central/Provincial/ TAO budgets on a proposal basis
  3. Physical capacity building:
     - Patrolling (pier, boats, fuel, workshop)
     - Provincial fisheries management bodies (offices)
     - Extension unit for the institutionalization of small-scale fishers (training facilities)

GLOSSARY (Definitions tailored for the Policy Brief)

Collective action – Collective action is the pursuit of a goal or set of goals by more than one person (a community), who pursue a common interest (conserving local fisheries resources), with the assumption that they will be better off this way than if just pursuing individual self interested activities.

Community-based co-management – An approach to management in which the government shares certain authority, responsibilities and functions of managing a designated area and resources with local fishers' institutions as partners. In opposition with community-based management, the government establishes appropriate rights and conditions while decentralizing some its power to the local institution; the government retains the rights to legally give or take user and management rights.

Community-based management – Community-based management means a community managing its resources alone, not involving power sharing between government authorities and a community. There is little implications regarding legal issues, with most efforts put on conservation and resource enhancement. Government is perceived as an external player that is only brought in when needed; its involvement is usually passive.

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Attempts to Apply Community-based Co-management Approach in Vietnam: The Case of Thanh Phong Commune in Ben Tre Province

Kim Anh Thi Nguyen, Ola Flaaten and Nguyen Van Hieu

Fisheries cooperative management or fisheries co-management can be defined as a partnership arrangement in which the community of local resource users (fishers), government, other stakeholders (boat owners, fish traders, boat builders, business people, etc.) and external agents (non-governmental organizations (NGOs), academic and research institutions) share the responsibility and authority for the management of the fisheries. Through consultations and negotiations, the partners develop a formal agreement on their respective roles, responsibilities and rights in management, referred to as 'negotiated power'. Co-management is also called participatory, joint, multi-party or collaborative management. Attempts to introduce community-based co-management had been initiated in Thanh Phong Commune, Thanh Phu District, Ben Tre Province in Vietnam. The concerns that impede the implementation of the community-based co-management model are described in this paper.

Dependence on marine and coastal resources has been noticeably increasing, specifically by the small-scale fisheries which derive much employment from the coastal fishing communities. Small-scale fisheries have been producing more than half of the world's annual marine fish yield, and considered as the main source of protein supply for humans especially in developing countries including Vietnam. However, overexploitation and environmental degradation are directly threatening the fisheries resources while most of the existing small-scale fisheries management approaches have not been successful in decreasing fishing capacity as well as in solving management conflicts. Reforms in small-scale fisheries management have become the priority and urgent needs worldwide. Co-management, which is one of the new and promising management approaches that has been perceived in recent years, is based on common property theory that recognizes the participation of fishers, local authorities, and other stakeholders in the management process (Graham, 2006).

Co-management and Community-based Management

Co-management

It is generally acknowledged that not all responsibilities and authority should be given to the community level. Although the extent and types of responsibilities and/or authority at the state level and the various community levels differ, devolution of responsibilities and authority is site-specific and depends on each country's conditions. Sharing of responsibilities and authority should however, be negotiated between the community members and the government but should be within the bounds of corresponding government policies. Determining the kind and extent of the responsibility and/or authority to be allocated to the community level is ultimately a political decision, where the government will always play a very important role. However, the key to co-management is the negotiated power where the interaction of the state and non-state representatives is an important factor in defining a common and acceptable balance in sharing power and allocating responsibilities. Thus, co-management evolves through both top-down and bottom-up processes.

Community-based management

Fundamentally, fisheries community-based management is a concept that has arisen from the reality that fishers and coastal communities, being most dependent on the marine resources, should have a large role in deciding how such resources should be managed. This concept fits within a universal viewpoint that management decisions of all sorts are often best made at the very level where the decisions would be applied (Pomeroy, 2006).

The idea that resource users and the resource-based communities should have the primary responsibility for managing their resources, is what makes community-based management different from other resource management approaches which tend towards much less involvement of the most resource dependent people and communities. Together with the perception that resource users are the primary resource managers is the assumption that the users have the willingness and capacity to manage the resources. This is considering the fact that community-based management requires individuals to work together for the collective good and consider the implications of their individual actions on the community as well as on the resources.

Along with the notion of collective responsibility for self-governance, community-based management implies conservation or stewardship awareness on the part of the resource users. Community-based fisheries is not only about maximizing harvests or profits, but striving to achieve ecosystem health, and promoting conservation and

sustainable use of the resources and ecosystems (Pomeroy, 2006). While the above points provide the basic definition of community-based management, things get more complicated in real life situations, especially when trying to define who is managing and what should be managed. If community-based management reflects the nature of a framework within which local people can participate in addressing complex and interconnected issues affecting the coastal communities, questions would arise on who decides which people are the community and the issues that are confronting these people.

Community-based management can be seen from two perspectives. On one side, it could be considered as being about legal empowerment as in resource management, but with community-based management, empowering the coastal communities and resource users is necessary in order that they can gain access and management control over the coastal resources. This process can be considered part of larger movements for communities to achieve greater economic and political power. On the other side, community-based management could be seen as being about the capacity of the community to carry out specific management activities like research or developing management plans. In this sense, community-based management is considered as a set of skills for local people to carry out the management activities instead of the government (Pomeroy, 2006).

Comparison between Co-management and Community-based Management

The above definitions of community-based resource management show that while there could be similarities and differences between co-management and community-based management, the differences are seen from the target of each strategy. Moreover, such differences could be gleaned from the level and timing of the participation in management processes. Community-based management is people-centered and community-focused, while co-management which also focuses on these issues has an added feature on partnership arrangement between government and the local community of resource users. Furthermore, the process of resource management is also organized differently with co-management having a broader scope and scale than community-based management as far as focus inside and outside the community is concerned. While the government plays a minor role in community-based management, by definition co-management includes major and active role of the government.

Co-management often addresses issues beyond the community level, at regional and national levels, and allows these issues, as they affect the community, to be brought more effectively into the domain of the community. Co-management strategies, on the other hand, involve government agencies, resource managers and elected officials equally, along with the community and stakeholders, developing trust between the participants.

When community-based management is considered an integral part of co-management, it can be called community-based co-management. Community-based co-management includes the characteristics of both community-based management and co-management, that is, it is people-centered, community-oriented, resource-based and partnership-based. Thus, community-based co-management has the community as its focus, yet recognizes that to sustain such action, a horizontal (across the community) and vertical (with external to the community organizations and institutions such as government) link is necessary. Community-based co-management is most often found in developing countries because of the need for overall community and economic development, social empowerment, and resource management. Correspondingly, both community-based co-management and community-based management are long-lasting processes, based on several specific management activities in which community-based management is the core of community-based co-management process.

The Case of Thanh Phong Commune, Thanh Phu District, Ben Tre Province

Geographical position

Thanh Phong Commune is one of the 18 communes/municipalities of Thanh Phu District, Ben Tre Province in Vietnam. It is bordered by the Thanh Hai Commune in the north, Co Chien River in the south, the East Sea in the

Map of Vietnam showing Ben Tre Province

The Mekong River Delta showing Ben Tre

east, and Giao Thanh Commune in the west. Thanh Phong Commune consists of five hamlets, namely: Dai Thon, Thanh Phuoc, Thanh Hoa, Thanh Loc and Thanh Loi. The center of the Commune is located at Thanh Phuoc Hamlet, 25 km from the People's Committee of Thanh Phu District in the east.

The natural area of Thanh Phong Commune is about 6441 ha including 2858 ha of cultivated land, 921 ha of forest and 17 km of coastline. This area is formed by the alluvial of two rivers, the Co Chien and Ham Luong, and is continuously widening due to encroachment on the East Sea.

In the mainland, there are many long successive sand dunes convenient for settlement, cultivation of cash crops and fruit trees. The climate is relatively temperate with two clear-cut rainy and dry seasons. The overall topography is low land, with an altitude of 1.8 + 2 m above mean sea level. During flood time or torrential rains, most of the commune is submerged.

Socio-economic situation

Thanh Phong Commune has a population of about 9252 in 2380 households with 4613 females. The average density is 6 persons/km^2. Most of people are of Kinh origin, coming from neighboring areas such as Vinh Long, Tra Vinh, and Ba Tri, who came and changed the wastelands into cultivated areas after settling there. Religious freedom is developed considerably, ranging from Buddhism, Catholicism and Cao Dai. Thanh Phong residents face many difficulties in their lives with the rate of poverty relatively high at 16.07 % in 2007 and 13.25% in 2008. The number of landless families accounts for about 10% of the commune's total population.

Occupation creation

Many types of occupations have been vigorously developed in the commune, such as: fisheries mainly aquaculture (**Box 1**), agriculture (cultivation) and services. Specifically, the commune is naturally blessed with a clam seed ground in the coastal tidal flat. This clam ground could bring big income to the people (about VND 20 billion equivalent to about USD 1 million) if only it is properly managed and exploited.

Box 1. The fisheries and aquaculture potentials in Ben Tre Province

Aquaculture

The total area for aquaculture is about 2955.7 ha, in which 2558 ha is for intensive shrimp farming, 194 ha for extensive shrimp farming in mangrove forests, 50 ha for blood cockle culture. The remaining area, about 288 ha is divided between two cooperatives: Doan Ket Coop with 94 ha and Thanh Loc Coop with 159.7 ha for exploitation of the natural clam resource. About 80% of the population in Thanh Phong Commune is engaged in fisheries-related activities, 18% work in aquaculture and trade, and 5% in the service sector.

Fishing activities

The number of fishing vessels in the commune is about 68, engaging mainly in coastal fishing. Most of them use prohibited, destructive fishing gears and methods such as stow netting with very small mesh size, bottom trawling while some people use gill nets and traps. The output is unnoticed compared with the provincial overall productivity, but it is a main source of livelihood for the commune's fishing households.

Fisheries infrastructure and fishing gears

The road network in Thanh Phong Commune is seriously degraded, while a road to the clam ground is not present at all. Low-capacity fishing boats cannot go offshore for fishing while irresponsible coastal fishing gears bring about very low outputs and destructive impacts. Watch towers in clam grounds are not solid, while communication facilities (intercom) for rescue operation plans in case of emergencies (storms or acts of sabotage) are not present.

Low education level, a major obstacle to changing jobs, and applying science and technology

Majority of Thanh Phong residents have completed the primary or lower secondary school educational level,

Workshop on co-management in Thanh Phong Commune

Infrastructures in Thanh Phong Commune

although those with upper secondary qualifications are not many. Illiteracy rate is fairly high at 0.5%. This situation is a major limitation to the enhancement of professional knowledge, training and changing jobs. People with upper secondary education accounted for 15%, lower secondary 30%, and primary education 64.5%.

Conditions for Selecting Thanh Phong Commune

The selection of Thanh Phong Commune to develop a community-based co-management model is based on various criteria as shown in **Box 2**. Through seminars and surveys conducted at the community, district and commune levels, authorities, groups and organizations, it was agreed to establish a co-management model in the residential community of Thanh Phong Commune.

However, most of the opinions suggest that during the initial stage the model would cover only two hamlets: Thanh Loc and Thanh Loi, considering the clam resource, the fishing fleets and many poor households. After several years the model could be expanded to cover some more hamlets in the commune. The surveys carried out by the commissioned consulting agencies and the local government units have

Box 2. Criteria for the selection of areas where community-based co-management model could be adapted

- Poverty rate
- People's dependence on fisheries resources
- Destructiveness to fisheries resources
- The consensus between local government and fishers community
- The possibility of developing a new livelihood based on the local existing potential and partly assistance from external agents
- Besides other resources, a large amount of clam seed comes up every year in the commune. The local authorities are aware that it is a big revenue for the community and have established two cooperatives for management but with little efficiency. The main reason for this is poor management of cooperative staff and low awareness of the community on managing and protecting the resources.
- Resource ownership, legal resource use rights: Recently, the People's Committee of Ben Tre Province has granted the land use rights of the coastal tidal flat of 200 ha to the community for management.
- Knowledge of local resources: Most of the people and local government officials are aware that natural resources are depleting rapidly. Fishers' awareness of their job – depleting the fisheries resources- is unlawful. Their low awareness of protecting resources is due to the fact that their lives are dependent on the resources and a new livelihood is not created.
- Local fisheries resources include clam, shrimp, prawn, crabs, cockles and fishes. Every year these species come up with great quantity in estuaries and coastal area. They are less migratory and live together in schools.

Bottom net with very narrow mesh size (top), tiny shrimps collected from bottom net (right),

traps being prepared for fishing

identified the core group which could be developed to participate in the management of the model.

The core group comprised those from the communal People's Committee staff, police, farmers and women union, border guards, leaders of fisheries cooperatives and fishing fleets, and fishers representatives. The core group should be trained to strengthen their capacities in planning, report writing, and production/business management, among others.

Need for Information and Assistance on Management

The Division of Fisheries Resources Protection and Inspection of the Agriculture and Rural Development of Ben Tre Province coordinates with the border guard posts to conduct regular patrol of the provincial marine waters upon request. The Vietnam Centre for Fisheries Services and Transfer of Technology has assisted in the adoption of the co-management model in Ben Tre under the Fisheries Sector Programme Support (FSPS) II of Denmark.

Fund Sourcing

Recently, the Danish International Development Agency (DANIDA) also assisted Ben Tre Province in the implementation of the model through the conduct of training activities and surveys, as well as facilitating the organization of local institutions, among others. However, DANIDA does not have concrete assistance programs to develop new livelihoods for the community, especially supporting the poor families and fishers engaged in prohibited jobs, and destroying fisheries resources. Therefore, there is an urgent need for support from governmental/non-governmental organizations, academic and research institutions, and scientists in training, building/raising awareness, creating jobs, and improving infrastructures for local economic development and management.

The Community-based Co-management Model in Thanh Phong Commune

There were some manifestations during the course of the preparation of the community-based co-management model in Thanh Phong Commune, which should be taken into consideration in any future action, such as:

- Thanh Phong has a high political stability, with the local government and community showing energetic participation.
- The community is authorized to use the fisheries resources.
- The lives of most fishers have been dependent on the resources, since majority of them are landless and without alternative source of income. However, the people in the community indicated that they would welcome other livelihoods such as cash crops cultivation, aquaculture, handicrafts making, and local product processing if such ventures are partially funded, and that they are provided with land for cultivation or opportunities for the introduction of new livelihood which should be suitable to the local conditions.
- The majority of local people are closely and timelessly bound to the fisheries resources. Outside fishing vessels from other localities rarely come to the area for fishing. All fishing practices are not in compliance with the law but there are no suitable measures to solve the problem.
- Local residents, government and organizations are in urgent need for support from academic and research institutions, and non-governmental organizations.
- From the results of the surveys and investigations, building of a co-management model in the commune is compatible with the local customs and laws.
- The possibility of building a co-management agency in the area is quite high.
- Thanh Phong co-management model is aimed at managing, protecting and using the local resources efficiently to ensure economic satisfaction for the community, help poor families raise their standards of living and eradicate poverty. The model developed is targeted towards local fisheries management in combination with conservation efforts of the mangrove forests and the introduction of other economic ventures such as ecotourism, handicrafts production utilizing the existing local potentials in the villages.

To sum up, during the course of putting up the co-management model into operation in Thanh Phong, the community, government officials of all levels and relevant agencies have reached a high consensus for the adaption of the model in the commune. The people in Thanh Phong

community strongly support the view of Pinkerton (2003) that: "Co-management is a misnomer unless it involves the right to participate in making decisions about how, when, where and how much fishing will occur" and the view of Jentoft *et al*. (2004) that: "Co-management is strengthened if it can draw on "social capital" embedded in social relations that form the community, because co-management is a team-work that requires mutual commitment, trust, loyalty, and empathy". At the same time, the suggestions as well as conclusions from the consultants stated that the model is feasible and properly oriented. Such opinions pointed at the need to help the people of Thanh Phong in enhancing their capacities in protecting their fisheries resources, raising their incomes, improving their living standards and eradicating poverty. However, in order to successfully build the co-management model some conditions are needed for the immediate future, besides time and capacity. These include:

- More resources are needed to support the landless poor community since fishing households continue to destroy the fisheries resources, and for the jobless or those without stable employment to change their jobs or create new stable jobs for the community.
- Continued efforts are needed to raise the people's awareness and knowledge on co-management.
- Efforts are needed to help the community develop their strengths, and existing potentials based on the local resources.
- Actions are needed to perfect the legal institutions, promote partnership among stakeholders in resources protection, create more jobs, stabilize market, and mainstream activities of the commune-level with the government and those urgent in the community. Assistance should be given to train community representatives in enhancing their capacities in management, planning, report preparation, and business operations.
- Active support from the state are also needed through the following activities: training in fish culture and tourism; granting land use rights and resources to the community; upgrading infrastructures and facilities including regional communication network, telecommunications systems, markets, etc.
- Scientific research projects are needed to treat and prevent incidence of clam/cockles diseases, transfer breeding technology for clam, shrimp and cockles, assess quality of the environment in clam and cockle farming, investigate and protect clam and cockle resources, etc.

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Coral Reef Recovery for Fishery Resources and Habitat Rehabilitation: Experience of Japan

Akito Sato, Ryota Nakamura, Michio Kitano, Nobuo Mikami and Mayumi Tamura

Coral colonies co-existing with fish and shellfish near Phuket in Thailand (Photo: Akito Sato)

This report, which introduces the Japan's efforts in coral reef recovery, is based on the initial outcome of a project which aims to develop a practical technique for coral reef propagation conducted by the Fisheries Agency of Japan from 2006 to 2008 in "Okinotorishima" about 1100 km southeast from Okinawa. Already in its 2nd stage of the 5-year plan starting from 2009, the project aimed to develop a technology for the restoration of coral reefs where practical techniques are less developed than those for seaweed beds or tidelands. Under the project, activities were carried out for the technical development of spawning and rearing methods for the mass production of juvenile coral colonies using sexual reproduction technique, a potential useful technology for coral reef recovery measures in the future. Referring to the successful results of such Japanese initiative for the rehabilitation of fishery resources and their habitats, SEAFDEC intends to implement a program for the rehabilitation of fishery resources and their habitats/ fishing grounds starting in 2010 under the Japanese Trust Fund V Program. As planned, the SEAFDEC project will come up with sustainable technology for restoration of fishing grounds adoptable in the Southeast Asian region in order to rehabilitate the region's already degraded fishery resources and fishing grounds. One of the approaches could based on the coral propagation technique developed by Japan .

Coral reef is not only the richest example of biodiversity in the sea, but it's also one of the most economically important ecologies and an irreplaceable asset of mankind. However, coral reefs have been seriously degraded by many activities and factors that include climate change, development of coastal areas, sedimentation from rivers, and a variety of other human activities including fishing. Specifically, it is noticeable that high seawater temperature could result in massive coral bleaching and mortality due to stress to the coral colonies in the reefs. In order to conserve the coral colonies and the habitat environment for future generations while considering the present situation where coral reefs have been degraded, it would be a difficult task to rehabilitate the reefs to the level of self-restoration. Therefore, the development of restoration techniques to increase coral colonies is indeed necessary. Trials on coral fragmentation have been conducted in many countries as means of restoring the depleted coral colonies. However, the coral fragmentation method not only wounds the coral colonies but also affects the ecology of the coral reefs where large quantities of fragments are taken for restoration purposes.

Moreover, in reefs where coral colonies are degraded to a great extent or the density of the coral habitat is basically low, it is difficult to secure coral fragments in large amounts. In order to address such constraints, the propagation of corals using sexual reproduction method is now being developed in Japan. Since the reproduction method makes use of the gametes released by adult/parent corals (some release larvae depending on species), problems confronting the coral fragmentation method could be avoided.

The Technical Development Project for Coral Propagation

The research activities under the coral restoration project using sexual reproduction method are mainly divided into: larvae release method and transplantation of juvenile corals using seed production technologies. In the larvae release method, exceedingly large wastage of larvae occurs during the early period, so the survival of larvae was low. This need to be improved. For the transplantation of juvenile corals using seed production technology, the Akajima Marine Science Laboratory (AMSL) in Okinawa, Japan has succeeded in the seed production of *Acropora tenuis* at experimental scales.

The technical development project for coral propagation, which was started in 2006 by the Fisheries Agency of Japan, is mainly aimed at developing large-scale practical coral propagation technology by utilizing the outcomes from the basic studies of the AMSL. Specifically, the project also aims to establish a long-term rearing method of adult coral colonies in land-based tanks to obtain gametes without

Coral reef in Okinotorishima (left) and coral colonies in the reef (right)
(Photos: Fisheries Agency of Japan)

relying on the gametes from natural coral colonies in the sea, and develop the technology for spawning and rearing juvenile corals in seawater tanks in order to produce large quantities of coral seeds older than one year with high survival.

Based on the results of previous studies indicating that more than one-year old juvenile corals had exhibited improved survival after transplantation, the project also intends to confirm the technique of implantation by transporting parent corals from a remote area, and transporting and transplanting again the parent corals and the resulting juvenile corals back to their original source. For this project, the island of "Okinotorishima", located 1100 km southeast of Okinawa was chosen as the experimental area for the coral colonies propagation.

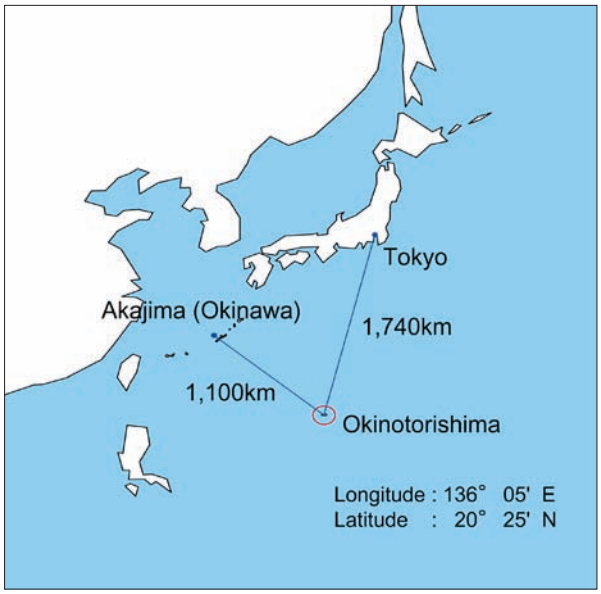
Transporting and rearing adult coral colonies

A. tenuis which commonly inhabits Okinotorishima was selected as the main species for the seed production activities. Colonies of *A. tenuis* were collected at 2-3 m depth in the reefs of Okinotorishima in August 2006 and May 2007. The size of the coral colonies ranged from 10.3 to 42.7 cm in length. The collected coral colonies were temporarily placed in the sea for 1 to 5 days, after which they were kept in tightly closed buckets to avoid air exposure while being transported by a research vessel. The corals were stocked in seawater tanks (1 ton water tank) onboard the vessel, and were brought from Okinotorishima to the land tanks of the Akajima Coral Hatchery (ACH) in Akajima Island, Okinawa after 64-hour travel time.

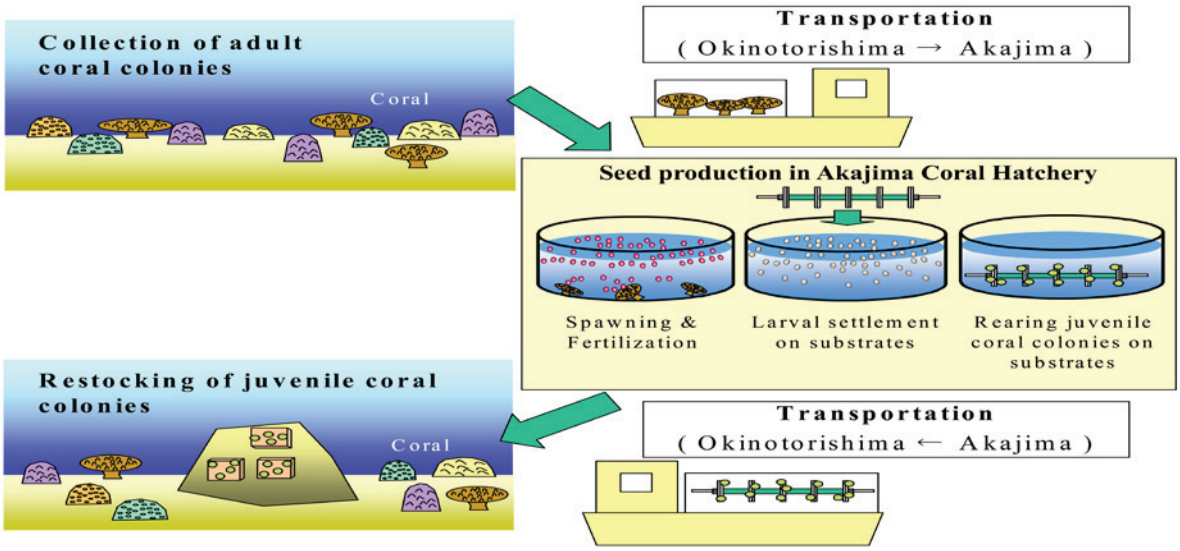
In order to keep the corals in good condition on the research vessel during transport to the ACH, water temperature in the tank was maintained at 22.5~28.4ºC by regulating the amount of light using a shading net (photon flux density: 100~280 μmol $m^{-2}s^{-1}$). One-third of seawater in the tank was replaced three times a day with seawater from the open sea.

The adult coral colonies brought to the ACH were reared in 2 ton fiber glass rectangular tanks set in open-air area and 1-ton round-shaped polycarbonate transparent water tanks at the indoor area of the ACH.

During the rearing period (August 2006~April 2008), the monthly average seawater temperature in the tanks ranged from 21.8 to 29.1ºC. In natural conditions, the coral colonies are exposed to oscillatory flow by waves and tidal current in the seawater. In this project, the adult coral colonies were reared in simulated seawater tanks where the water flow was generated by aeration. At the start of the rearing period, the coral colonies appeared to be weak, so the speed of the water flow in the tanks was increased to approximately 10 cm/second since September 2006 and continued during the rearing of the adult coral colonies.



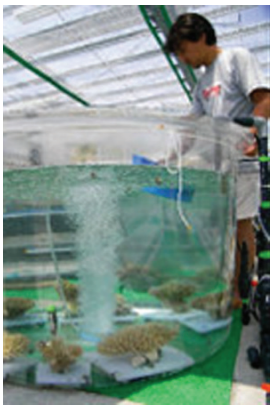
Okinotorishima Island, Okinawa, Japan



Schematic outline of coral propagation technologies of the project (Source: Fisheries Agency of Japan)

The amount of light is also an important environmental condition for coral growth. Until August 2006, because water temperature was high, 80% shading nets were used but since the coral colonies seemed weak, the shading ratio was gradually reduced so that light amount in the tanks was close to that of the coral habitat (about 1,000 µmol $m^{-2}s^{-1}$ at noon on a fine weather day). There was no shading during winter and spring (from November 2006 till May of the following year). From June to November 2007, 30% shading nets were used for the outdoor tanks and 15% shading nets for the indoor tanks.

As a result, from this rearing environment improvement, the two coral colonies collected in 2006 which were relatively weak, have recovered and grown healthily together with the other adult coral colonies collected in 2007. Almost all the adult corals were returned to their original habitat in May 2008 keeping in good condition. The remaining coral colonies were also returned to their original habitats in 2009.

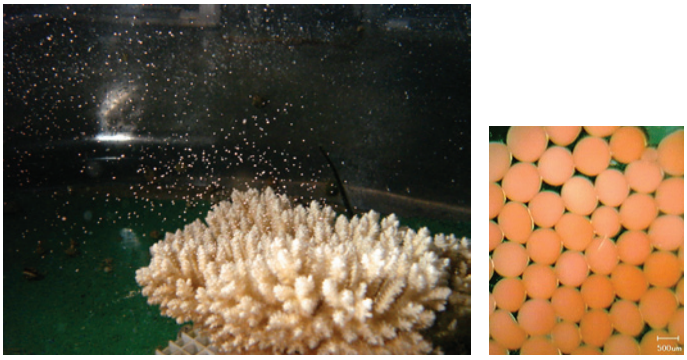


The Akajima Coral Hatchery in Okinawa, Japan (above) and rearing of adult coral colonies (right) (Photos: Fisheries Agency of Japan)

Spawning and juvenile rearing

Spawning of *A. tenuis* in the tanks was observed on the 27th of May as well as on the 8th and 9th of June in 2007. The rearing trials were started by using about 237,000 fertilized eggs spawn on the 8th and 9th of June. All sperms and eggs released on the same day were collected during spawning or within an hour after spawning, and fertilized in the same container. One hour after spawning, rearing of the fertilized egg started in separate containers. After five (5) days of spawning, the planula larvae gathered at the bottom of the tanks showed their behavior for settlement. Then the larvae were moved to other seawater tanks for settlement (500L rectangular tank). The number of larvae which survived was presumed to be about 205,000 or at 86.5% survivorship.

Before stocking the larvae in the water tanks for settlement, 640 pieces of unglazed ceramic plates with lattice structure were placed at the bottom of the tanks as settlement substrates. Such ceramic substrates had been sunk in the seawater for 4~16 months so that calcareous algae or bacteria film could attach. About 111,000 larvae out of 205,000 (54.1%) settled onto the substrates. The juvenile corals were moved to fiber glass tanks (1.4 tons) for rearing. The monthly average water temperature in the juvenile coral rearing tanks during June 2006~April 2008 was 20.9~29.2ºC. About 5 cm/sec of water flow was generated in the tanks using aeration similar to the adult coral rearing tanks. For shading, 30% shading nets (from June to November) and transparent vinyl tents (other months) were used. In order to remove the algae from the substrates in the tanks, which compete with the juvenile coral colonies, juvenile snails such as the trochus shells

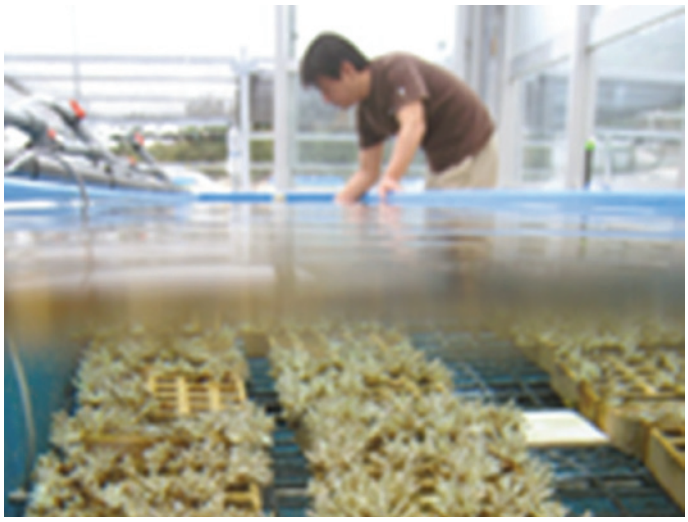


Coral spawning (left) and fertilized eggs (right)
(Photos: Fisheries Agency of Japan)

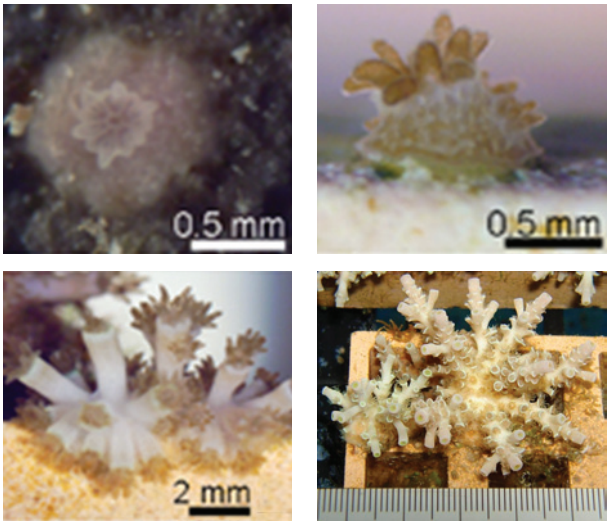
that feed on tiny algae were put in the tank soon after the settlement. After four (4) months from settlement, young rabbit fish and butterfly fish were also used to remove the competitive algae and sea anemones.

The survivorship of juvenile *A. tenuis* on the 200th day after spawning was 82% with an average length of the juvenile corals at 7.9 mm (SD: + 3.1 mm) as shown in **Fig. 1**. In April before transplanting the coral colonies to Okinotorishima (307th day after spawning), 65,622 juvenile coral colonies had survived with survivorship of 59.2%. Average length at that time was 13.1 mm. The survivorship and the mean longest diameter 424 days after spawning of the juveniles

Fig. 1. Growth and survivorship of juvenile *A. tenuis* in tank
(Solid line - mean longest diameter; Broken line - survivorship)



Rearing of juvenile coral colonies
(Photo: Fisheries Agency of Japan)



Growth of juvenile coral (*A. tenuis*) colonies after larval settlement (from upper left: at 10 days, one month, 6 months, and 10 months) (Photos: Fisheries Agency of Japan)

was 57.1% and 22.9 mm, respectively, which were left at the ACH without transplantation to the island.

Transporting juvenile coral colonies

The 564 pieces of substrates with settled juvenile *A. tenuis* (approximately 63,000 colonies) were transported from the ACH to their native island of "Okinotorishima" on the 22nd of April 2008 after a 60-hour voyage by a research vessel. The substrates were put in fiber glass seawater tanks with acrylic plate covers, and water flow was generated in the tanks using small pumps. Above the tanks, 30% shading nets were used to cover and adjust the amount of light and control the temperature which could rise due to sunlight.

The water temperature in the tanks was also controlled by replacing 1/3 of the seawater in the tanks with seawater obtained from the open sea 3 times a day during the transport period and gradually increased from the seawater temperature of 22.5°C around Akajima to the seawater

Transport set-up for juvenile coral colonies
(Photo: Fisheries Agency of Japan)

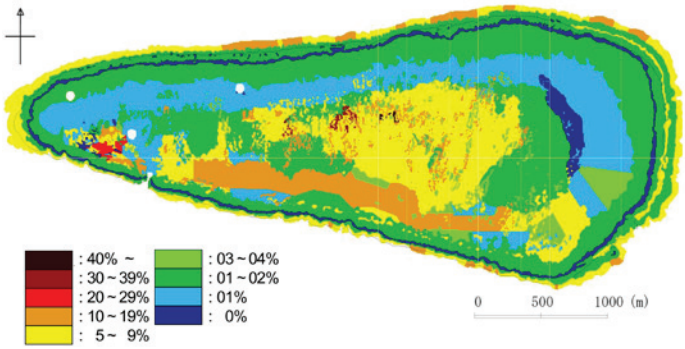
temperature around Okinotorishima at 29.0°C. In addition, waste matters that accumulated at the bottom of the tanks were also removed. The juveniles did not show signs of weakening during the transport period.

Transplanting juvenile coral colonies

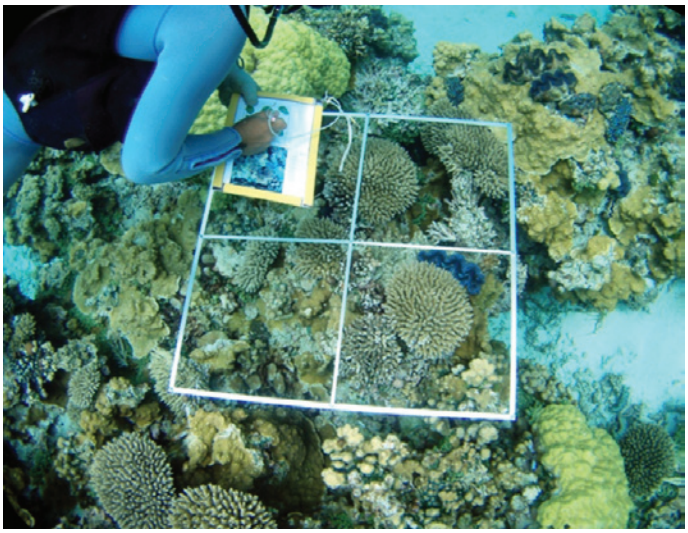
The juvenile coral colonies that spawned in June 2007 were transplanted to the coral reefs in Okinotorishima in May 2008. The transplantation sites for propagating juvenile coral colonies were selected based on information obtained from previous research mainly conducted during the past two years under this project, *e.g.* the coral habitat situation and marine environmental conditions. Several knolls around the southeast side from the center of the island were selected. At the transplantation sites, the coverage of coral colonies was low mainly due to few coral larvae but with potential to grow and propagate corals in view of their relatively favorable marine conditions. Based on the results of the previous research, it has also been estimated that within a range from sea bottom up to about 50 cm above the bottom, the distribution of coral colonies could be relatively less mainly due to the current and sediment movement.

Creek of coral spawn from the reefs
(Photo: Fisheries Agency of Japan)

Transplanting coral colonies in Okinotorishima
(Source: Fisheries Agency of Japan)



Coral coverage on the reef of Okinotorishima
(Source: Fisheries Agency of Japan and Ministry of Land, Infrastructure, Transport and Tourism of Japan)



Growth monitoring of coral colonies in Okinotorishima by the permanent quadrat method (Source: Fisheries Agency of Japan)

Therefore this project considered that the juvenile coral substrates could be better fixed on the surface of knolls higher than 50 cm from the sea bottom, and every substrate with juvenile coral colonies attached was transplanted based on such hypotheses and verification. Upon investigation on the 5th day after transplanting the 341 substrates, no degeneration of the coral colonies had occurred in the substrates that had sunk due to the flow of current and no damages occurred even with some fishes feeding on the organisms at the substrates. For the 2nd stage of this project which started from April 2009, several monitoring surveys have been continued to clarify the favorable and effective conditions and methods for juvenile coral colonies transplantation and their aftercare.

Discussion

Under this technological development project, mass production of juvenile coral colonies from the adult coral colonies of *A.tenuis* has been successfully conducted.

The project succeeded in determining the optimum conditions of the rearing environment of corals (such as light adjustment, water temperature control, replacement of water, maintaining water flow, control of competitive species). These environmental factors were checked in every stage (such as during transport, breeding adult coral colonies, spawning, larvae settlement, breeding juvenile coral colonies) and when problems were encountered, these were addressed and quickly placed under human control.

This project is different from previous seed production activities because fertilized eggs obtained from adult coral colonies reared for a long time on land using water tanks were utilized in the sexual reproduction technique. Based on such technology, seed production could be done in large quantities without relying on natural coral colonies in the sea. Moreover, there is no need to collect coral eggs spawned in the sea for every seed production activity where may be restricted by unfavorable weather conditions. This technique is therefore useful not only for conservation of natural coral colonies but it also paves the way for practical propagation of coral colonies by obtaining adult coral colonies tentatively from a remote area or from a place where there are less adult coral colonies.

The ACH is a simple and ordinary hatchery managed by two staff and with a relatively small amount of operational expenses. The survivorship of the 1-year-old juvenile coral colonies was very high as a result of this sexual reproduction method. Therefore, this technology could be applied as a feasible method that could contribute to the restoration and conservation of coral reefs, which globally are in a state of degradation.

Way Forward

In 2008, it was found that the larva settlement of *A. tenuis* would be improved to nearly 100% under favorable conditions principally by heightening the coverage of crustose coralline algae in the substrates. During the 2nd stage of the project starting in 2009, seed production has been extended to several species of coral colonies and also the effective transplantation techniques for propagating the juvenile coral colonies is being developed. Thus, the 2nd stage of the project would focus on the development of practical technology that could be applied to the restoration of coral habitats in many countries including those in the Southeast Asian region.

The Southeast Asian region comprises many islands with coral habitats. However, it has been reported that some coral colonies in the region's waters have been damaged, for instance destruction of coral reefs by the impact of the Asian Tsunami caused by an earthquake off the coast of Sumatra. Moreover, the effect of climate change at the global level is leading the coral reef communities in this region towards a worse scenario. Therefore, the restoration of degraded coral habitats in this region should be urgently considered in line with the respective countries' efforts in coastal habitat/ fishing ground conservation and management. It would be a great pleasure for everyone involved in this project, if this report is utilized as reference or as guide for any effort towards the restoration of coral colonies in the Southeast Asian region.

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CALENDAR OF EVENTS

Date	Venue	Title	Organizer
		2010	
18-22 January	Samut Prakarn, Thailand	Regional Training/Workshop on Identification of Deep-Sea Fish	SEAFDEC/TD
19-21 January	Bangkok, Thailand	Regional Technical Consultation on Fishery Information and Statistics	SEAFDEC Secretariat
26-27 January	Bangkok, Thailand	Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review on Project ICRM-SV	SEAFDEC/TD
2-4 February	Bangkok, Thailand	Regional Technical Consultation on International Fisheries-Related Issues 2010	Secretariat
5 February	Bangkok, Thailand	Technical Sub-Committee Meeting for the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020	SEAFDEC Secretariat
8-19 February	Samut Prakarn, Thailand	Short-term Training Program on Marine Fisheries Resource Surveys, Stock Assessment and Co-management in Thailand	SEAFDEC/TD
15-19 February	Rome , Italy	Technical Consultation on the Guidelines on Aquaculture Certification	FAO
15–26 February	Binangonan, Philippines	Training Course on Carp Hatchery & Grow-out Operations	SEAFDEC/AQD
22-26 February	Tasmania, Australia	23rd Session of the Coordinating Working Party on Fishery Statistics (CWP)	FAO
24-26 February	Tasmania, Australia	6th Session of FIRM Steering Committee	FAO
8 – 6 March	Tigbauan, Iloilo, Philippines	Training Course on Cage/Pond Culture of Selected Marine Species	SEAFDEC/AQD
13-25 March	Doha, Qatar	15th Meeting of Conference of the Parties of the Convention on International Trade in Endangered Species of Wild Flora and Fauna	COP-CITES
15–19 March	Binangonan, Philippines	Training Course on Freshwater Prawn Hatchery & Grow-out Operations	SEAFDEC/AQD
17-19 March	Bangkok, Thailand	Regional Technical Consultation on Aquaculture	SEAFDEC/AQD
22-26 March	Chiangmai, Thailand	2nd Regional Technical Consultation on the Promotion of "One Village, One Fisheries Products" (FOVOP) in the ASEAN Region	SEAFDEC Secretariat
5-9 April	Luang Prabang, Lao PDR	42nd Meeting of the SEAFDEC Council	SEAFDEC Secretariat
6–13 April	Tigbauan, Iloilo, Philippines	Training Course on Mangrove Ecology, Taxonomy & Community Structure	SEAFDEC/AQD
12-16 April	Binangonan, Philippines	Training Course on Catfish Hatchery and Grow-out Operations	SEAFDEC/AQD
14 April–5 May	Tigbauan, Iloilo, Philippines	Training Course on Crab Hatchery & Grow-out	SEAFDEC/AQD
20-23 April	Samut Prakarn, Thailand	2nd Regional Technical Workshop on Safety at Sea for Small Fishing Boats	SEAFDEC/TD
26-30 April	Buenos Aires, Argentina	12th Session of the COFI Sub-Committee on Fish Trade	FAO
17 May–4 June	Binangonan, Philippines	Training Course on Freshwater Aquaculture	SEAFDEC/AQD
25 May - 18 June	Samut Prakarn, Thailand	The International Training Course on Coastal Fisheries Management and Extension Methodology	SEAFDEC/TD
26 May-1 July	Tigbauan, Iloilo, Philippines	Training Course on Marine Fish Hatchery	SEAFDEC/AQD
9-12 June	Bangkok, Thailand	Global Conference on Aquaculture	FAO
14-18 June	Bangkok, Thailand	5th Session of the COFI Sub-Committee on Aquaculture	FAO
16-18 June	Bangkok, Thailand	Regional Technical Consultation on HRD	SEAFDEC Secretariat
July (tentative)	Thailand	Expert Meeting on Deep-sea Fishing and Its Impact to Marine Environment	TD

Southeast Asian Fisheries Development Center (SEAFDEC)

What is SEAFDEC?

SEAFDEC is an autonomous intergovernmental body established as a regional treaty organization in 1967 to promote sustainable fisheries development in Southeast Asia.

Mandate

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

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

SEAFDEC Program Thrust

- Developing and promoting responsible fisheries for poverty alleviation
- Enhancing capacity and competitiveness to facilitate international and intra-regional trade
- Improving management concepts and approaches for sustainable fisheries
- Providing policy and advisory services for planning and executing management of fisheries
- Addressing international fisheries related issues from a regional perspective


TD


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In the occasion of the Millennium Conference, a drawing contest was organized for the children among ASEAN-SEAFDEC Member Countries, on the theme of "*Fish and the Culture*". This is the drawing from Indonesia.