FISH for the PEOPLE

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Mainstreaming the stakeholders' roles in fisheries policies and plans on fisheries development for food security

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Editorial

During the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium "Fish for the People" in November 2001, the ASEAN and SEAFDEC Member Countries conformed to "acknowledge the need for enhanced human resource capabilities at all levels and encourage gender involvement by stakeholders to facilitate consensus and compliance in achieving sustainable fisheries". Such need had been formalized as part of the Resolution on Sustainable Fisheries for Food Security in the ASEAN Region, which the Ministers of the ASEAN-SEAFDEC Member Countries who are responsible for fisheries adopted on the occasion of the said 2001 ASEAN-SEAFDEC Conference.

In responding to such concern, SEAFDEC has been conducting follow-up programs and activities that aimed to enhance the capability of relevant stakeholders and local institutions in optimizing the sustainable utilization of the resources. Such activities came in the form of capacity building and human resource development as well as in enhancing the governance in fisheries management. In addition, the development of inland fisheries has also been promoted since if properly managed, this sub-sector could alleviate poverty in fishing communities and thus, attain food security especially in the rural fishing communities. Conducted in the ASEAN countries, the activities had been so-designed to ensure that relevant provisions of the ASEAN Economic Community and ASEAN Socio-Cultural Community Blueprints are also addressed.

From 13 to 17 June 2011, this particular issue will be revisited during the sequel ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment" in Bangkok, Thailand. Specifically, it has been envisaged that the review of the activities on human resource development, institution building, governance in fisheries management and inland fisheries development would come up with relevant recommendations that recognize the roles of the stakeholders in fisheries development. It is with anticipation that this issue would

be mainstreamed into the new decade Resolution and Plan of Action that would be adopted at the aforesaid June 2011 ASEAN-SEAFDEC Conference.

Moreover, it has also been envisioned that with such provisions in the new decade Resolution and Plan of Action, the livelihoods in fishing communities would be improved and thus, poverty could be alleviated especially among the small-scale fishers. In order to achieve such goals, SEAFDEC for its part would continue to work towards strengthening the promotion of human resource development through mobilization of available human and technological resources that could enhance the socio-economic conditions of the stakeholders including women and the youth.

To pave the way for the formulation of such perceived provisions is the theme on "Livelihoods in coastal and inland fishing communities, and working opportunities for fisherfolks" which is part of the technical session during the June 2011 ASEAN-SEAFDEC Conference. Under this theme, the discussion is expected to focus on human development, social welfare and protection, social justice and rights as well as on the role of women in fisheries development, which are also matters of concern under the ASEAN Economic Community and ASEAN Socio-Cultural Community Blueprints.

For more information about the June 2011 ASEAN-SEAFDEC Conference, please visit: www.ffp2020.org.

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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.

Shining the Light on the 'Invisible' Woman in Fisheries Development

Steve Needham

The "invisible man" has long been a popular subject for TV shows and movies. Rarely however do we 'see' the invisible woman grace the big screen. If movie producers need role models they should look towards the fishing industry, where the significant contribution of women is often all but invisible. A new field handbook developed by the Spanish-funded Regional Fisheries Livelihoods Programme for South and Southeast Asia (RFLP) aims to shine a light on the contribution of women and by doing so help enhance the chances of success for development projects targeting small-scale fisheries. The Field Handbook was field-tested during the Workshop on Best Practices for Gender Mainstreaming in the Fisheries Sector conducted in Siem Reap, Cambodia from 2 to 5 November 2010, and organized by the RFLP and the Fisheries Administration of Cambodia with support from the Bay of Bengal Large Marine Ecosystem Project (BOBLME).

The fisheries sector has long been considered a male domain. Such terms as 'fishermen' give the impression that the women do not fish, which is not always the case especially in the Southeast Asian region. As a matter of fact, more than 20% of fishers in Siem Reap, Cambodia are women, and in some areas of the country, women catch more fish than men (Kusakabe, 2008). She added that many factors continue to lead to the marginalization of women, which are brought about by the absence of gender issues in many national statistical reports. In Thailand for example, out of a number of research titles on socio-economics listed in the Annual Reports of the Department of Fisheries, not a single paper discussed gender issues.

In many countries in the region, women perform the major role as housekeepers without receiving any compensation. In spite of such functions, nowhere in the region are women considered heads of households while their husbands are alive. This is despite women continuing to play major roles in fish marketing and fish processing to earn income for their households. Nevertheless, the role of women in fisheries development in the Southeast Asian region gained much more acceptance in 2004 when one of the sessions of the Asian Fisheries Forum focused on Gender and Fisheries (Choo *et al*., 2006).

Since 8 March 1975 when the International Women's Day was declared, and every 8 March thereafter, International Women's Day has been celebrated to remind the world of the need to enhance the recognition of the role of women in development. The declaration of the International Women's Day was followed by the proclamation by the United Nations of the Decade for Women (1976-1985). At the closing ceremonies of the United Nations Decade for Women in 1985, Secretary-General of the World Conference and former Philippine Senator, the Hon. Leticia R. Shahani emphasized that "the Decade has caused the invisible majority of humankind--the women--to be more visible on the global scene".

Subsequently, many fora had been convened by international and regional organizations in order to devise strategies for further advancement and improvement of the status of women in development. These included those that discussed "gender and fisheries development". However, in the present scenario within the fisheries sector, the major role of women in fisheries development is still not fully appreciated.

As a matter of fact, it has been noted that the other economic sectors such as agriculture and forestry appeared to be more advanced in mainstreaming gender in policy development than the fisheries sector (Williams *et al*., 2006). It was during the Global Symposium on Gender and Fisheries in 2004 in Penang, Malaysia, when the urgent need to understand how gender affects the operations of the fisheries sector including the actions and policies needed to bring changes for the empowerment of women was recognized. The Global Symposium suggested among others that, beyond research, fisheries regulations, policies and plans could be enhanced by embedding gender and other human dimensions (Choo *et al*., 2006). This implies that overall, the fisheries sector needs to mainstream gender in all fisheries activities and support.

It is now widely accepted that the involvement and contribution of women in fisheries is far more significant than is often assumed. This is because women are estimated to comprise almost half of the labor force in small-scale capture fisheries-related activities. While men are typically involved in fishing from larger boats further from shore, women are heavily engaged in small-scale local fisheries, harvesting shellfish or seaweeds, repairing nets, processing fish products and marketing. These activities are carried out by the women in addition to running their households and looking after the children. Therefore, it has become imperative to consider the largely 'invisible' role of women in small-scale fisheries in order that relevant policies and development programs aimed at improving the livelihoods of small-scale fishers will be successful.

Comments on the significant role of women in fisheries development

"Women play a significant role in fisheries, yet lack of attention to gender can result in policies or programmes failing to improve livelihoods or reducing the vulnerability of fishing communities," said Jose Parajua, Regional Manager of the RFLP (**Box 1**). He added that *"In many cases there is an incomplete understanding of the contribution of women and the complexity of gender roles in fishing communities. Gender issues should therefore be acknowledged in the design of development projects and fully integrated into project implementation".*

Ignoring the complex relationships between women and men as both boat owners, processors and sellers, wives and husbands, community members and co-workers, may have negative impacts on the livelihoods of those involved. The need to understand the roles and contribution of women in small-scale fisheries communities has also never been greater.

"Women would previously support the men through inland fishing or other income generating activities. However, as marine resources are already depleted and catches fall, the role of women has changed as they no longer complement the men's role but need to take on extra work to subsidize the men. It is therefore vital to understand the role of women in fisheries in view of the rapid changes that are taking place," said Nireka Weeratunge from WorldFish Center, Penang, Malaysia.

"So much attention is paid to gender, however few people really have much idea about how it can be incorporated into project planning," said the RFLP's Angela Lentisco. She added that *"When the RFLP began in late 2009 we started looking at ways to do this but realized there was very little information available. The usual approach seems to be simply ensuring that a certain number of women participate in training programs. We thought about making something that would help people understand gender and give practical guidance on how it can be integrated into development projects".*

Box 1. The Regional Fisheries Livelihood Programme for South and Southeast Asia (RFLP)

The RFLP seeks to improve the livelihoods of fisherfolks and their families while fostering more sustainable fisheries resources management practices in Cambodia, Indonesia, the Philippines, Sri Lanka, Timor-Leste and Viet Nam. The four-year (2009-2013), USD 19.55 million RFLP is funded by the Kingdom of Spain and implemented by the Food and Agriculture Organization of the United Nations (FAO) in collaboration with national authorities in participating countries. For more information about the RFLP please see *www.rflp.org* or contact *steve.needham@fao.org*

Right: Mr. Jose Parajua, Regional Programme Manager, Regional Fisheries Livelihoods Programme for South and Southeast Asia (RFLP); and **Below:** Ms. Angela Lentisco of RFLP presenting a gift to Kampong Pluk (Cambodia), Community Leader

Field Handbook on Taking Gender into Account in Small-scale Fisheries Development Projects

In an effort to promote gender equity to improve fisheries livelihoods, the RFLP is developing a field handbook that provides guidance on how to incorporate gender into all phases of small-scale fisheries development projects. Government and field project staff, researchers as well as representatives of NGOs and international organizations from around the region met in the historic Cambodian City of Siem Reap on 2-5 November 2010 to discuss the contents of the handbook. During the workshop, the participants looked at the best practices for mainstreaming gender in the fisheries sector and also field tested the tools contained in the handbook.

The main objectives of the handbook are to introduce key gender concepts while providing practical tools to help integrate gender into various stages of the project cycle. Such tools include an activity analysis which helps map the activities of men and women in their daily lives; an analysis of the access by men and women to resources and benefits (*e.g.* cash/income, boats, markets, information, community groups); and an analysis on gender needs (*e.g.* access to training, credit, education, clean water, among others). The handbook is designed in a user friendly manner and can be used by project managers, field officers, especially those who are always in contact with communities or any other persons involved in designing projects or initiatives.

"The main mistake is not being able to understand the real needs of people. We have to avoid the idea that just by working with women everything is okay. You cannot

just separate women as a different stakeholder group and expect them to become involved in various activities. This increases their burden as it fails to take into account other commitments, such as household work or supporting the men. It is necessary to have a really good understanding of needs of women and expectations from the outset. This is where the handbook will play a valuable role," said Carmen Arenas, a gender consultant who worked with RFLP to create the Field Handbook.

The participants at the workshop had the chance to test the tools in the handbook at a number of fishing communities around Cambodia's famous Tonle Sap Lake. For the participants, the field testing was a valuable experience as it revealed the considerable contribution of women in the communities. *"Many women said they went fishing with their husbands but were only helping and did not define their contribution as work. They did not valorize what they did. Women also fetched water by hand while the men would only do so if they could use a motorcycle. Yet the preconception exists that only men could pull up the nets and so the men's contribution was recognized while the women's efforts were not,"* said Angela Lentisco.

Members of the fishing communities also enjoyed the field testing. "The listing of resources was important as it shows how many roles women actually take part in," said Mrs. Sang Ran who is a member of the Commune Council at Kampong Pluk. *"This is good as we want to stress that women can lead. Before I just stayed at home, but now I can lead,"* she added. However, at the same time the field visits also made clear how complex gender roles are and that accurately assessing them is not an easy task. *"The concept of gender really comes from Western society and it can be hard for communities to understand the divisions between men and women. Local societies or communities often simply see things differently… it's just the family,"* Angela Lentisco stressed.

Considerable feedback on the handbook was generated during the workshop which will be incorporated into the final version. *"This event has been very useful,"* said Mr. Rattana from the Spanish NGO Paz y Desarrollo. *"I have been involved with gender for some time but never in fisheries and it had been useful for me to have an idea of the importance of gender in this area. NGOs do a lot but it is harder for the government to address gender issues because we all need more experience on how to apply this in practice".*

Field testing of the Gender Field Handbook with the female members of a community near Tonle Sap, Cambodia

Meanwhile, Jessica Muñoz from the Philippine Bureau of Fisheries and Aquatic Resources stressed the importance of patience. *"There is still a macho population in the Philippines and you need to take it easy. Initially men in my country did not want to hear and you cannot ram gender down their throats or force the issue. The handbook will be of great help. It is not strictly bookish, as it is nicely presented and arouses interest"* she declared.

As in many countries in Southeast Asia, the main role of women in fisheries in the Philippines is in processing and marketing

Recommendations and Ways Forward

During the November 2010 Workshop on Best Practices for Gender Mainstreaming in the Fisheries Sector, considerable discussions took place on the various approaches to mainstreaming gender and the merits of the logical framework approach covered in the Field Handbook. The need to thoroughly understand the complexity of communities before undertaking any gender analysis and the ability to adapt the tools to each and every context as well as the need for continual feedback were therefore stressed during the workshop.

"The handbook can always be improved but only if people use it and help refine it. The objective is to provide simple advice and tools that help make the work of women more visible and to help project planners and managers to consider the impact of any development activities on the women," said Angela Lentisco.

"There is a global consensus on the importance of addressing gender in development. However when it comes

to field project design and implementation, there are no specific recommendations on how to do so especially in the context of small-scale fisheries. I am confident that this handbook will make an important contribution to help ensure that gender concerns are explicitly recognized and addressed in project activities," added Mr. Ajay Markanday, FAO Representative in Cambodia.

"I can use this in my country and it will be helpful as it is simple enough to understand and can be used in the communities," announced Ms. Elfrina Ly da Cruz, Monitoring and Evaluation Officer, Gender Division of the Secretary of State for the Promotion of Equality of Timor-Leste.

Best Practices for Mainstreaming Gender into Small-scale Fisheries Policies

The November 2010 Workshop on Best Practices for Gender Mainstreaming in the Fisheries Sector came up with the best practices for mainstreaming gender into small-scale fisheries policies (**Box 2**). Fisheries managers and policy makers can refer to these best practices as guide during the formulation of policies to ensure that gender issues are mainstreamed into the plans and programs that aim to attain sustainable development of small-scale fisheries.

Box 2. Best practices for mainstreaming gender into small-scale fisheries

- Ensure that both the reproductive and productive roles of women are considered
- It is important to have a solid contextual understanding of local culture, norms, economic and other social status
- It is important to have good statistics as well as in-depth qualitative data
- Projects and programs should be participatory and flexible/ reactive rather than prescriptive owing to the complexity of gender issues
- The poor should be central to any actions and it is important to ensure that women and men, boys and girls are fully involved/ considered in the design, development, implementation, and monitoring of interventions as well as in assessing and prioritizing livelihoods interventions
- The importance of self help groups, associations and networks should be recognized as should the leadership roles of women
- Activities should be targeted at both women and men, but if they only focus on women or men then there must be clear reasons why?
- Equitable access to resources and decision making spaces, need to be ensured
- Women need to be better informed through improved access to communication and information, while the women's own knowledge, experiences and aspirations should be acknowledged
- The issue of gender needs to be communicated more broadly, while such gender issues should be more accessible, relevant, palatable and punchy (without losing their real meaning)

Children in a fishing community in Timor-Leste: What does the future hold for them?

Cleaning the catch in Sri Lanka

Field testing of the Gender Field Handbook in a community near Tonle Sap, Cambodia

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For more information on the 'Mainstreaming gender into project cycle management in the fishery sector field manual' or to register interest in receiving a copy please contact *angela.lentisco@fao.org*

Empowering Women's Groups in Fisheries Project Development and Management: SEAFDEC Experience

Sumitra Ruangsivakul, Pouchamarn Wongsanga and Virgilia T. Sulit

Guided by the policy framework on the need to enhance human resource capability at all levels and encourage greater involvement of stakeholders to achieve sustainable fisheries in the Southeast Asian region (SEAFDEC, 2001; SEAFDEC, 2003), SEAFDEC specifically incorporated in its projects on fisheries management and poverty alleviation the need to develop and enhance the capacity of women for the sustainable development of fisheries in the region. These include the Integrated Coastal Resources Management (ICRM) Project implemented in Thailand, Malaysia and Cambodia; and the ASEAN Foundation funded project on the Promotion of "One Village, One Fisheries Product (FOVOP)" in the ASEAN Region. This article reviews the roles and participation of the women's groups in the abovementioned projects that enabled them to establish alternative livelihoods to increase their household incomes.

In the fishing communities everywhere in Southeast Asia, women always complement the efforts of men. While the male household members are fishing offshore, the women had to fish on their own to provide food for their households while the male members are away. In the Southeast Asian region, it is usually common to catch a glimpse of women fishing in near-shore areas for low value fishes and collecting shellfishes such as mollusks, crustaceans and echinoderms as well as seaweeds that could be sold in local markets and also for their households' daily consumption. Specifically in small-scale fishing communities, the women are responsible for various fisheries-related activities such as processing and marketing the catch as well as in mending and preparing the nets for the next fishing operations. Moreover, women are also deeply involved in the fast-pacing aquaculture activities, particularly in preparing the aquafeeds and feeding the fish as well as in harvesting and processing especially the shellfishes.

Side-by-side with all such fisheries-related activities, the women are also efficient in managing their households and looking after the welfare of their children, and in some cases even providing tutorial services for their own school children. Physically therefore, the contribution of women in fisheries is very obvious but this is not well-documented so that in principle the role of women in fisheries development is still not well recognized. This could also be due to the fact that in Southeast Asia, the society remains male-dominated where men are still considered as the household heads. As a result, women have little involvement in resource management activities even if the downstream fisheries activities are mostly done by women. This is compounded by the fact that most village heads are men, thus women are very rarely represented in activities related to the management of fishery resources.

Furthermore, in a male-dominated sector such as fisheries, there is the perception that women are physically weak

and thus are incapable of undergoing the physical rigors of fishing. Moreover, women have also been assumed to hold insufficient technical knowledge for the fast-developing fisheries technologies. In order to address the abovementioned concerns and value the role of women in the fisheries sector, the Southeast Asian Fisheries Development Center (SEAFDEC) has always pushed for the empowerment of women's groups in fisheries development and management for food security, by mobilizing their stock of local knowledge not only in fish processing and marketing but in general management as well, and enhancing their participation in the various human resource development activities.

Involvement of Women's Groups in the Integrated Coastal Resources Management Project

The SEAFDEC Project on Integrated Coastal Resources Management (ICRM) was conducted from 2003 to 2009 in Thailand, Malaysia and Cambodia in collaboration with the respective fisheries departments of the host countries with funding support from the Government of Japan Trust Fund Program. The main objectives of the ICRM project are to: establish sustainable coastal resources management at the local level, rehabilitate the coastal fishery resources, and alleviate poverty in coastal fishing communities. As part of the objective of alleviating poverty in the fishing communities, promotion of local business ventures involving the women's groups was one activity of the ICRM project which was considered very vital since women in fishing communities are always accessible. The development of local business ventures in the ICRM project has given opportunities for the women to create alternative livelihoods in order to increase their households' incomes and achieve food security, and to reduce the fishing pressure by diversifying the occupation thereby, over-fishing could be alleviated.

The Women's Groups in ICRM-PD

Under the ICRM-PD (Pathew District) Project implemented in Pathew District, Chumphon Province, Thailand, hosted by the Chumphon Marine Fisheries Research and Development Center of the Department of Fisheries in Chumphon Province, the activity on the development of local business was aimed at increasing the fishers' income and creating job opportunities that could compensate for the fishers' decreasing income from being dependent on the degraded fishery resources. The development of value-added fishery products was an activity aimed at increasing the fishers' income and where the women played the major role, considering that the women in the ICRM-PD project had been active members of community-based savings and financing groups, and thus have easy access to some sources of micro-financing (SEAFDEC, 2007) for their business ventures. Thus, the activity focused on improving the skills and knowledge of the women's groups in fish processing, product development, and micro-financing.

The women's groups in the ICRM-PD were officially organized to facilitate the conduct of appropriate human resource development (HRD) activities to enable them to develop their production and management skills in cottage industries with special emphasis on the standardization and improvement of the quality of their products including packaging materials and design, and enhancement of their marketing promotions. For the sustainability of their business ventures and for the transparency of their business transactions, the groups were trained in good bookkeeping and accounting systems. Thus, the women's groups were able to learn not only the new techniques of improving their traditional products but also gained knowledge in management, accounting, planning and marketing, and eventually succeeded in increasing their incomes.

The Women's Groups in ICRM-PL

For the ICRM-PL (Palau Langkawi) project implemented in Pulau Langkawi in Malaysia and hosted by the Department of Fisheries Malaysia, establishment of local business ventures was conducted to create job opportunities for

Products of the women's group in ICRM-PD, for sale

the women in the community and enhance their active participation in community development. The women's group was formally organized and named as the KEW or *Kumpulan Economi Wanita* (Women's Economic Group) of Kuala Teriang, Pulau Langkawi.

Under the ICRM-PL project, the women's group had been producing two main products, namely: *ikan bilis* (processed anchovy) and *maruku* (snack product). After training in bookkeeping, accounting systems and product development, recording and monitoring of their financial transactions had been enhanced, and the group also acquired improved techniques in factory management, which came very handy considering that their activity had been developed as a commercial business venture. From their improved product management, the group obtained the GMP (Good Manufacturing Practices) certificate in August 2008. Moreover, the performance of the KEW of Kuala Teriang was extremely highlighted as the first successful case in Malaysia and effort to disseminate similar activities in other KEW groups of the country had been proposed (SEAFDEC, 2008).

The Women's Groups in ICRM-SV

The ICRM-SV (Sihanouk ville) project implemented in Sihanoukville, Cambodia was hosted by the Fisheries Administration of Cambodia. Four women's groups were organized in the project site in Community Fisheries (CF) Prey Nup II to pursue the promotion of the local business ventures. Since the members agreed to focus on mushroom production, they were trained on mushroom production techniques and during the commencement of their cottage-scale mushroom production the members were also trained in bookkeeping and accounting systems in order to ensure transparency of their financial transactions (SEAFDEC, 2010a).

From their mushroom production venture, the women's groups earned supplemental incomes for their families. Although at present their production is still in a cottage-scale, there is a potential to expand such venture further into commercial scale. The women's groups have established themselves into a business association type group called the "Mushroom Producers Group" under the CF Prey Nup II, with the groups' members as cooperators managing their operations in accordance with the provisions of the Internal Rule of the Group which the members themselves had established.

Another very notable activity of the women's group in ICRM-SV is the management of blood cockle *refugia* by the Blood Cockle Fishers Group (BCFG) which comprises all women members. The BCFG has developed the Self-Regulatory Measures for Blood Cockle Fishing in conjunction with the management of the *refugia* in Prey Nup II, Sihanoukville (Try *et al.*, 2010), and for the conservation of such important resource in the area.

The women's group in the ICRM-PL (top) and ICRM-SV (above) projects

Members of KEW preparing ingredients for *maruku*

Members of the Mushroom Producers Group under the ICRM-SV project

The Role of Women in the FOVOP Project

SEAFDEC implemented the 30-month project on the Promotion of "One Village, One Fisheries Product (FOVOP)" System to Improve the Livelihood of the Fisheries Communities in the ASEAN Region from 2007 to 2010, which was financially supported by the ASEAN Foundation through the Japan-ASEAN Solidarity Fund. One of the main objectives of the FOVOP Project was to enhance awareness on gender and development in the fisheries communities, especially clarifying the roles and functions of women's groups for the development of small-scale economic activities at the community level.

Members of the BCFG developing the appropriate sieve for the Self-regulatory Measures for Blood Cockle Fishing

A special social process in the FOVOP initiative was the involvement of women's groups and the youth in the institutional set-up of the fishers' groups. One of the project's recommendations was for government agencies to make use of the approach developed by SEAFDEC under the FOVOP project, especially in enabling the women's groups to adopt ways and means in addressing sustainable fisheries development and contributing to poverty alleviation in fishing communities (Wongsanga and Vichitlekarn, 2010). Under the FOVOP initiative, women were empowered to enable them to make full use of their traditional knowledge in fish processing, thus, providing opportunities to shift their role towards economic development in the fishing communities.

From their major role of taking care of their families and helping their husbands in fishing, sorting fish or marketing fish, the FOVOP project has paved the way for women in the communities to be involved in more productive activities to increase their household incomes (Wongsanga and Sulit, 2010). Moreover, the Project also recommended that in order to support the promotion of FOVOP in the ASEAN countries, institutional set up could be promoted in terms of groups and organizations comprising the fishers as members, and that the capacity of the groups could be strengthened through institutional building by "initiating social preparation and gender responsive activities for FOVOP community leaders and members as well as the youth and elderly groups, in areas that include values formation, community organization, paralegal issues, and environmental awareness" (SEAFDEC, 2010b).

Case Studies on the Promotion of FOVOP in the ASEAN Region

Addressing the issue on gender and development in the HRD activities was part of the FOVOP project where more than 90% of the participants were women, and where there was a general consensus that women in fisheries community have the capability of performing the major role of developing the economies of the communities. The women's traditional knowledge and skills on backyard fish processing was considered very useful not only in preserving fish food for household consumption, but also in generating income for their households. In addition, the FOVOP project also enhanced the women's good common sense and potentials to manage business and finance.

For example, in Ban Donxaioudom Village, Keooudom District in Vientiane, Lao PDR, members of a women's union initiated their monthly savings activity which had provided accessible source of loan with low interest rates

Women representatives participating in the FOVOP case study in Lao PDR

for its members. Such experience stressed the usefulness of their savings and credit system which helped their members to depend less on fish middlemen. The key factors of the successful credit system were the members' participation in using the loan for improving their engagement capacity in fisheries as well as in complying with the debt repayments and other related regulations established by the members themselves.

In another development, the experiences of the Thai women's groups in handling the groups' business activities relevant to fish products processing, non-fisheries products and fish market and network, enabled the groups to accumulate funds which had been invested in the groups' intensified business activities. The groups also set up soft loan with low interest rates for its members to be able to have funds to meet their major household needs. The groups made it a practice to return incentives to members of good standing as well as profit refund at the end of the year. Such activity has emphasized the success of the Thai women's groups in empowering their groups' members to participate in the wise management of the groups' finances.

Way Forward

The ASEAN and SEAFDEC have always recognized the role of women in fisheries development and management as well as promoted the greater involvement of women in economic development in fishing communities. The Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region which was adopted during the so-called Millennium Conference in November 2001, called for the ASEAN and SEAFDEC countries to: "Acknowledge the need for enhanced human resource capabilities at all levels and encourage greater involvement by stakeholders to facilitate consensus and compliance in achieving sustainable fisheries". It was towards this goal that the ICRM Project incorporated as one of its major activities the promotion of local business ventures with the involvement of women's groups to enable the women to establish alternative livelihoods to increase their household incomes and thus, alleviate poverty in fishing communities.

The implementation of the 2001 Resolution and Plan of Action will undergo thorough assessment and revision during the ASEAN-SEAFDEC Conference in June 2011 to consider the emerging issues that impede the sustainable development of fisheries in the ASEAN region. This would be an opportune time for the mainstreaming of gender and development in the policies and plans for sustainable fisheries for poverty alleviation and food security in the region.

Specifically, it has been envisioned that the new decade Resolution and Plan of Action which would be adopted during the aforementioned Conference in June 2011, could incorporate the need to: "Provide alternative/supplementary livelihoods to fishers and their communities through enhanced rural economy, alleviate poverty, and empower fishers to be actively engaged in long-term fisheries development and management processes by mobilizing the "One Village, One Fisheries Product (FOVOP) approach". Moreover, for the proposed Plan of Action, the need to "mainstream FOVOP initiative into national poverty alleviation program, mainstream FOVOP initiative into national fisheries policy and strategy for implementation in the ASEAN Countries, mainstream FOVOP initiative into regional policy and cooperation framework, and develop

Regional Supporting Program to support the promotion of FOVOP in the ASEAN Region" had been recommended. Similarly for the ICRM Project, it had been recommended that activities of the women's groups should be supported by the governments' concerned in order to improve their knowledge and skills in various fisheries technologies and finally, to enhance the role of women in the economic development of the fishing communities.

From the outcomes of the SEAFDEC projects that recognized the role of women in the economic development of the fishing communities, it has become necessary to promote the gender concept among the male members of the communities. The painstaking household work of women which could not be expressed in terms of monetary value unlike fishing operations could be the reason why men never appreciate the fact that women work harder than men. Therefore, educating the female members of the communities is vital towards the promotion of gender issue especially in the fishing communities.

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Ensuring Improved Governance in Fisheries Management in Southeast Asian Countries

Mahyam Mohd. Isa, Abu Talib Ahmad, Abdul Razak Latun, Mazalina Ali, and Virgilia T. Sulit

Based on the Plan of Action and guided by the Resolution on Sustainable Fisheries for Food Security for the ASEAN Region adopted during the November 2001 ASEAN-SEAFDEC Millennium Conference on Fish for the People, SEAFDEC had been implementing projects in the ASEAN countries that specifically aimed to "promote the establishment and implementation of comprehensive policies for innovative fisheries management and local consensus building on such fisheries management measures through consultative process with the target stakeholders". After almost ten years of implementation of the relevant projects and activities, SEAFDEC and the ASEAN would organize the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment" in June 2011, which will include discussions on the issues that impede the countries' efforts to attain sustainability in fisheries development. Considering that one of the themes identified for the technical discussions during the June 2011 Conference is on Enhancing Governance in Fisheries Management and as part of the preparatory works for the June 2011 Conference, SEAFDEC convened the Regional Technical Consultation on Sustainable Fisheries Management from 12 to 15 October 2010 in Samut Prakan, Thailand to discuss the issues under such theme. This article therefore touches upon the process and the inputs used for reviewing the issues and the recommendations made by the ASEAN countries in mitigating the issues that hinder sustainable fisheries development in the Southeast Asian region.

Efforts had been made by the Southeast Asian countries towards improving governance in fisheries with the main objective of mitigating the continuing degradation of the region's fishery resources through sustainable fisheries management. In spite of such efforts however, there are still many factors that obstruct the sustainable development of the region's small-scale fisheries sector, such as the large number of small-scale fishers, persistent poverty in the fisheries communities, and weak law enforcement. Moreover, although it has always been recognized that government intervention is necessary in fisheries because the fishery resources are common resources, the users still seemed to be irresponsible in exploiting such resources (Kato, 2008). Specifically in the small-scale fisheries sector, there is no mechanism to manage such fisheries that scatter along the coastal areas, and any additional management-related tasks would therefore be too much for the centrally structured fisheries administrations to carry out. It is in this aspect that governments need to delegate management of small-scale fisheries to the local resource users (SEAFDEC, 2003). However, in order to attain this objective, the countries need to exert more efforts especially in terms of empowering the local fishers in fishery resources management.

Enhancing Governance in Fisheries Management

There has been an urgent consensus to address the deteriorating state of the region's fishery resources and fisheries-related issues that emerged during the past decade for the sustainable development of fisheries and for food security. As generally recognized, weak governance has been the main underlying cause of overfishing in the waters of the Southeast Asian region. Promoting strengthened fishery governance which encompasses institutional arrangements for the sustainable exploitation of the fishery resources should be able to determine solutions to such concerns and create opportunities for enhancing social welfare. Good governance requires the establishment, in a transparent and participatory manner, of the most appropriate balance between small-scale and commercial fisheries sectors and maximization of income and long-term sustainability. One of the expected outcomes of good governance would be the harmonized position of the countries in the region that could be used during negotiations, implementation, and control of the fisheries agreements, ensuring that the interests of domestic industries are adequately protected.

In paving the way for enhancing governance in the region's fisheries sector, management could be implemented from the context of an ecosystems approach, as clearly articulated in the Code of Conduct for Responsible Fisheries (CCRF) adopted in 1995 as well as in the regionalized CCRF (SEAFDEC, 2003) that included internationally accepted set of principles and guidelines for governance and best practices in fisheries development and management. In addition, there have been other instruments that include the International Plans of Action (IPOAs) on management of fishing capacity, conservation and management of sharks, reducing the incidental catch of seabirds, and illegal, unreported, and unregulated (IUU) fishing and could be used as guide in enhancing governance in fisheries management.

Moreover, the region's numerous fishing units that use different types of fishing gear and adopt different scales of operations but target the same fish stocks, have been competing for a share of the catch. Since overfishing of one species by the commercial sub-sector might threaten the yield of other species in the food chain, thus, the sustainability of capture fisheries should be addressed in a holistic approach, by recognizing the need to share resources among the different scales of fishing operations. In order to further enhance the effectiveness of the governance in fisheries management, there is a need to manage fishing effort consistent with the sustainable exploitation of the resources. Since one of the key features for effective fisheries management is through the implementation of Monitoring, Control and Surveillance (MCS) program, such approach could pose greater challenge as more than 90% in the region's fishing industry comprises small-

Box 1. Rules, structures and enabling environments

Questions	Analysis of the responses from the ASEAN countries
1. Conduct of regular meetings involving governmental and non-governmental organizations to discuss fisheries.	1. Meetings are regularly conducted with interested parties, and that the concerned parties could access to the reports of such meetings.
2. Establishment of mechanisms to identify, prevent, quantify and eliminate excess fishing capacity.	2. Some mechanisms have been established but these could still be partly effective.
3. Transparency in the assessment and decision making on management measures.	3. Assessment and decision making on management measures are transparent.
4. Dissemination of measures on conservation and management and their rationale.	4. The rationale and purpose of conservation and management measures are well explained to users.
5. Discussion on excess fleet capacity and promotion of responsible fishing.	5. Equity distribution, loss of biodiversity, pollution issues, and the use of environmentally-safe fishing gear are only partly addressed.
6. Fostering of cooperation among all interested parties in information gathering, research, management, fisheries development.	6. Attempts have been made to forge cooperation among all parties in information gathering, research as well as in fisheries development and management.
7. Compilation of fisheries data by management authorities and making these available to interested parties.	7. Compiled fisheries data are made available to interested parties in timely manner.
8. Fisheries management that aim to minimize conflict between small-scale and commercial fisheries.	8. Management system is in place that minimizes the conflict between small-scale and commercial fisheries.
9. Measures to prevent access to resources by those not authorized to fish.	9. There are measures to prevent access to the resources by those unauthorized with legal and administrative framework and sanctions in case of violations to laws and regulations which still partly effective.

scale fisheries. Thus, for the successful implementation of the MCS program, innovative arrangements are necessary by involving the local fishers in the planning and implementation of such MCS program.

Furthermore, since sharing of responsibility between fishers and the government is particularly important in the Southeast Asian region, where large numbers of fishers use multiple and unselective gears to target multiple species, co-management systems which require significant extension, education, and awareness of all stakeholders as well as government and technical assistance activities, should be promoted to empower the communities and stakeholders to participate in the governance of sustainable fisheries. Considering also the increasing number of instruments and regulations aimed at ensuring sustainable development and management of fisheries at global level, it is also necessary for the countries in this region to make a common stand in complying with such requirements. Therefore, countries should enhance their governance in order to increase the level of compliance to the global instruments and agreements.

In consideration of the aforementioned issues and concerns, the sub-themes that would be discussed during the 2011 Conference under the theme on Enhancing Governance in Fisheries Management, have been identified to include: (1) Can small-scale (SSF) and commercial (CF) fisheries co-exist?; (2) Management of fishing capacity; (3) Co-management; and (4) Application of global instruments and regional agreements. In order to obtain the insights of the ASEAN countries in addressing the aforementioned concerns, a questionnaire survey was conducted in the ASEAN countries in early 2010 and the results have been compiled, analyzed and summarized as follows:

Box 2. Willingness to be involved and to accept responsibility in managing fisheries

Questions	Analysis of the responses from the ASEAN countries
1. Level of interest of fishers/communities in the management of fisheries. Moderate to high interest of fishers/ communities in the management of the fishery resources.	1. Moderate to high interest of fishers/communities in the management of the fishery resources.
2. Response and collaboration of fishers/communities during consultations on fisheries management.	2. Moderate to high level of response and willingness to collaborate among interested parties during the consultations on fisheries management.
3. Cooperation of fishers/communities in gathering information for fisheries management.	3. Moderate to high level of cooperation among fishers/ communities in compiling information for fisheries management.

Box 3. Factors that could enhance the co-existence of small-scale and commercial fisheries

Questions	Analysis of the responses from the ASEAN countries
1. Mechanism to resolve conflicts and fisheries legislations for regulating the conflicts between small-scale and commercial fisheries.	1. The following factors are necessary to enhance the co-existence of small-scale and commercial fisheries: mechanism to resolve conflicts; legislation to regulate conflicts; and mechanism for consultation and participation in the development of laws and regulations related to fisheries.

Box 4. Involvement of stakeholders/resource users in managing fishing capacity

Questions	Analysis of the responses from the ASEAN countries
1. Parties having legitimate interest in the use and management of fishery resources.	1. Moderate to high collaboration with the authorities in the management of fishery resources.
2. Cooperation by all interested parties in information gathering, research, management and fisheries development.	2. Moderate to high cooperation of interested parties in information compilation, research, and fisheries development and management.
3. Consultation and involvement of non-fishery organizations in fishery conservation.	3. Low to high rate of consultation among non-fishery organizations in the formulation and implementation of fishery conservation measures.

Box 5. Factors that support the participation and sharing of responsibilities by resource users

Questions	Analysis of the responses from the ASEAN countries
1. Mechanisms to encourage participation and sharing of responsibilities.	1. Regular meetings of relevant governmental and non-governmental organizations to discuss fisheries are the most important factor, followed by conflict resolution.
2. Other factors to support participation by resource users.	2. Other aspects such as effective MCS and mechanism to avoid the existent of excess fishing capacity are only partly the important factors that could support the participation and sharing of responsibilities by resource users.

Can small-scale (SSF) and commercial fisheries (CF) co-exist?

Based on the questionnaire used for the survey, seven ASEAN countries provided information on three major aspects relevant to the co-existent of small-scale and commercial fisheries, such as (1) Rules, structures and enabling environments in their respective countries that govern management of marine resources for the benefit of

Box 6. Enhancement of the participation of stakeholders in promoting governance	
Questions	Analysis of the responses from the ASEAN countries
1. Ways that could enhance key stakeholders' participation in promoting governance in managing fishing capacity.	1. These include: promoting alternative management options; preventing the practice of illegal fishing; establishing mechanism to reduce excess fishing capacity; reviewing the performance of existing fishing gear and practices; phasing out or replacing irresponsible fishing practices; prevent access to the resource by unauthorized; promoting transparency in assessment and decision-making on management measures; effective explanation and dissemination of conservation and management measures; ensuring that scientific community has trust and respect of the fishing communities.

Box 7. Degree of co-management	
Questions	Analysis of the responses from the ASEAN countries
1. Policies that support co-management.	1. Government policies partly or fully support co-management.
2. Enabling legislations in support of co-management initiatives.	2. Member Countries have enabled legislations in support of co-management except Brunei Darussalam.
3. Communities' involvement in fisheries management.	3. Except in Brunei Darussalam, communities are involved in fisheries management including in planning and development of projects and activities on fisheries management and resources conservation.

Box 8. Indigenous capacity and knowledge, and the willingness of governments to share power with communities	
Questions	Analysis of the responses from the ASEAN countries
1. Capacity and knowledge of communities in fishery resources management.	1. Most communities have moderate knowledge on fishery resources management although in the Philippines, the communities have high degree of knowledge.
2. Willingness of management authorities to share power with communities.	2. Management authorities in Thailand are highly willing to share power while in other countries authorities are moderately willing to share power except in Malaysia, the authorities are less willing to share the power with communities. As for Brunei Darussalam, the authorities are not willing to share power with the communities.
3. Strength of communities in terms of capacity and knowledge in fishery resources management.	3. The level of the diversity of the strength of fisheries communities in co-management planning had been low to high.

Box 9. Factors and conditions for successful self-governance and co-management	
Questions	Analysis of the responses from the ASEAN countries
1. Capability (administratively and financially) of community fisher associations or organizations in implementing co-management.	1. Fisher associations and organizations in the region are partially capable (administratively and financially) in implementing co-management activities.
2. Participation of fisheries management authorities in co-management related capacity-building and training activities within local communities.	2. Fisheries management authorities participate in capacity-building and training activities in local communities.
3. Clear definition of boundaries between adjacent jurisdictions.	3. Boundaries between adjacent jurisdictions and mechanisms to facilitate cooperation between authorities in the planning, development, conservation and management of fishery resources are clearly defined.
4. Support of non-governmental organizations in co-management process.	4. Partial support from non-governmental organizations in co-management process.
5. Diversity (ethnic, cultural, social, economic and environmental) in fisheries communities.	5. Clearly diversity in terms of ethnic, culture, social and economic, in the fishery communities.
6. Incentives (economic and social) provided to individuals engaged in co-management.	6. Partial incentive provided to those engaged in co-management and partial application of property rights approach in co-management.

both small-scale and commercial fisheries; (2) Willingness of the fishers/communities to be involved with and accept the responsibilities in managing the fisheries; and (3) Factors that could enhance co-existence of small-scale and commercial fisheries. Under the abovementioned aspects, the responses obtained from the countries had been analyzed and the results are shown in **Box 1**, **Box 2** and **Box 3**, respectively.

Management of fishing capacity

From the questionnaire used in the survey, seven ASEAN countries provided information on three major aspects relevant to management of fishing capacity, such as (1) Involvement of stakeholders/resource users in managing fishing capacity; (2) Factors that support the participation and sharing of responsibilities by resource users; and (3) Enhancement of the participation of stakeholders in promoting governance. After obtaining the responses from the countries, the results were analyzed as shown in **Box 4**, **Box 5** and **Box 6**, respectively.

Box 10. Factors and conditions that enhance co-management

Questions	Analysis of the responses from the ASEAN countries
1. Power sharing between authority and community.	1. Fisher associations and organizations in the region agreed that power sharing between authority and community and participation of all stakeholders could enhance co-management.
2. Clear definition of boundaries between adjacent jurisdictions.	2. Boundaries between adjacent jurisdictions and mechanisms to facilitate cooperation between authorities in the planning, development, conservation and management of fishery resources are clearly defined.
3. Support of non-governmental organizations in co-management process.	3. Full support from non-governmental organizations and strengths of different parties are taken into account in co-management process.
4. Diversity (ethnic, cultural, social, economic and environmental) in fisheries communities.	4. Clear diversity in terms of ethnic, culture, social and economic in the fishery communities.
5. Incentives (economic and social) provided to individuals engaged in co-management.	5. Partial incentive provided to those engaged in co-management and partial application of property rights approach in co-management.

Box 11. Level of awareness of international and regional instruments and agreements

Questions	Analysis of the responses from the ASEAN countries
1. Awareness of international and regional instruments and agreements.	1. Partial to fully aware of all regional and international instruments and agreements. Some countries were not aware on: Environmental Compliance Certification; Kyoto Declaration and Action (International Conference on the Sustainable Contribution of Fishing to Food Security); WTO Fisheries Subsidies; 1955 UN Fish Stock Agreement.

Box 12. Level of compliance to international and regional instruments and agreements

Questions	Analysis of the responses from the ASEAN countries
1. Compliance to international and regional instruments and agreements (signatory/ratification).	1. Limited or full compliance to the instruments and agreements, either as signatory or for ratification.
2. Reason for level of compliance.	2. Limited compliance could be due to limited capability to comply.

Box 13. Factors that hinder compliance to international and regional instruments and agreements

Questions	Analysis of the responses from the ASEAN countries
1. Factors that highly hinder compliance.	1. Factors that seriously hinder compliance: budget/financial allocation, manpower, expertise, natural structure of fisheries, lack of enforcement and MCS.
2. Factors that moderately hinder compliance.	2. Factors that least or moderately hinder compliance: bureaucracy, government policies, political intervention, status of fishers livelihood, fisheries infrastructures, ecosystem degradation, poor coordination among government agencies, voluntary nature of compliance (not compulsory).

Box 14. Factors that enhance governance to improve compliance to international and regional instruments and agreements	
Questions	Analysis of the responses from the ASEAN countries
1. Factors enhancing governance.	1. Factors that enhance governance to improve compliance: • National policies and fisheries management plan; • Strengthening of legal instruments and enforcement; • Increase manpower in fisheries related organizations; • Reduced bureaucracy among government agencies; • Capacity building via training program especially on international fisheries issues; • Active participation in regional and international fora for better understanding on international fisheries issues; • Greater involvement of stakeholders in formulating global and regional instruments and agreements; • Simplified global and regional instruments and agreements to suit local situation; • Technical support and expertise from developed countries to developing countries; and • Enactment of appropriate national laws according to the global and regional instruments and agreements.

Co-management in fisheries

Seven ASEAN countries provided information on four major aspects relevant to co-management, such as (1) Degree of support to co-management; (2) Indigenous capacity and knowledge, and the willingness of governments to share power with communities; (3) Factors and conditions for successful governance and co-management; and (4) Factors and conditions that enhance co-management. Under the abovementioned aspects, the responses obtained from the countries had been analyzed as shown in **Box 7**, **Box 8**, **Box 9** and **Box 10**, respectively.

Application of global instruments and regional agreements

Seven ASEAN countries provided information on four major aspects relevant to co-management, such as (1) Level of awareness to international and regional instruments and agreements; (2) Level of compliance to international and regional instruments and agreements; (3) Factors that hinder compliance to international and regional instruments and agreements; and (4) Factors that enhance governance to improve compliance to international and regional instruments and agreements. The responses obtained from the countries had been analyzed and the results are shown in **Box 11**, **Box 12**, **Box 13** and **Box 14**, respectively.

Recommendations of the RTC on Sustainable Fisheries Management (12-15 October 2010, Samut Prakan, Thailand)

Using the outcomes of the survey as basis for the discussion on the theme on **Enhancing Governance in Fisheries Management** during the October 2010 Regional Technical Consultation, the following recommendations from the Member Countries were compiled to be used as inputs in the relevant technical panels of the June 2011 Conference. The recommendations on the sub-themes on (1) Can Small-

Box 15. Recommendations of the October 2010 RTC on Can Small-scale (SSF) and Commercial (CF) fisheries co-exist?

- SSF and CF can co-exist as these have always existed in all the Member Countries. However both fisheries should be properly managed.
- The definition of SSF and CF should be adapted to each Member Country's situations and the area of operations clearly demarcated.
- The legal and administrative framework pertaining to access and harvest of the resource and sanctions for violations should be strengthened with the participation of the stakeholders.
- Member Countries should promote leadership among the fishers to resolve conflicts between SSF and CF.
- Member Countries should improve information collection and dissemination of such information to fishers, and to assist them in its utilization.
- The experiences and lessons learnt in conflict resolution should be documented which could be used as basis for better management of conflicts between SSF and CF.
- Member Countries should try to determine the actual socioeconomic contributions of SSF and CF for better and transparent decision making.
- Member Countries should improve the awareness of fishers and other stakeholders including local governments, on the need to manage the fishery resources.

scale (SSF) and Commercial fisheries (CF) co-exist?, (2) Management of Fishing Capacity; (3) Co-management in fisheries; and (4) Application of Global Instruments and Regional Agreements, are presented in **Box 15**, **Box 16**, **Box 17** and **Box 18**, respectively.

Box 16. Recommendations of the October 2010 RTC on Management of Fishing Capacity

- Member Countries should manage fishing capacity through licensing and registration of fishers, fishing gears and vessels; introduce alternative livelihoods and adopt responsible fishing technologies.
- Member Countries should adopt rights-based fisheries management.
- Information/scientific data on fishing capacity and stocks should be used as basis for capacity management, thus Member Countries should strengthen their efforts in data gathering and relevant research activities.
- The capacity of relevant authorities and communities to resolve conflicts in a collaborative manner should be enhanced.
- Member Countries should establish and/or improve effective MCS activities to reduce excess fishing capacity and eliminate IUU fishing.
- Member Countries should enhance stakeholders' participation in the development of management options.

Box 17. Recommendations of the October 2010 RTC on Co-Management in Fisheries

- Member Countries should promote co-management by delegating rights to local communities to manage the resources, in accordance with proper laws and regulations.
- Member Countries should develop legal provisions and promote enabling environment to enhance the implementation of effective co-management.
- National policies should incorporate the co-management approach to get much wider impacts.
- Member Countries should actively involve non-governmental organizations in the implementation of co-management.

Box 18. Recommendations of the October 2010 RTC on Application of Global Instruments and Regional Agreements

- National legislations should take into consideration the legally binding international instruments.
- Member Countries should assess the applicability of global/regional instruments/agreements and develop applicable ways in which they may be adapted to suit regional/national situation.
- Member Countries should promote the awareness and understanding of international and regional instruments and agreements, through information and dissemination campaigns.
- Member Countries should consult the stakeholders prior to negotiations of global and regional instruments and agreements.
- Member Countries should provide adequate budget/financial resources, human resource capacity, improve coordination among government agencies and to enhance the exchange of expertise to ensure compliance with international and regional instruments and agreements.

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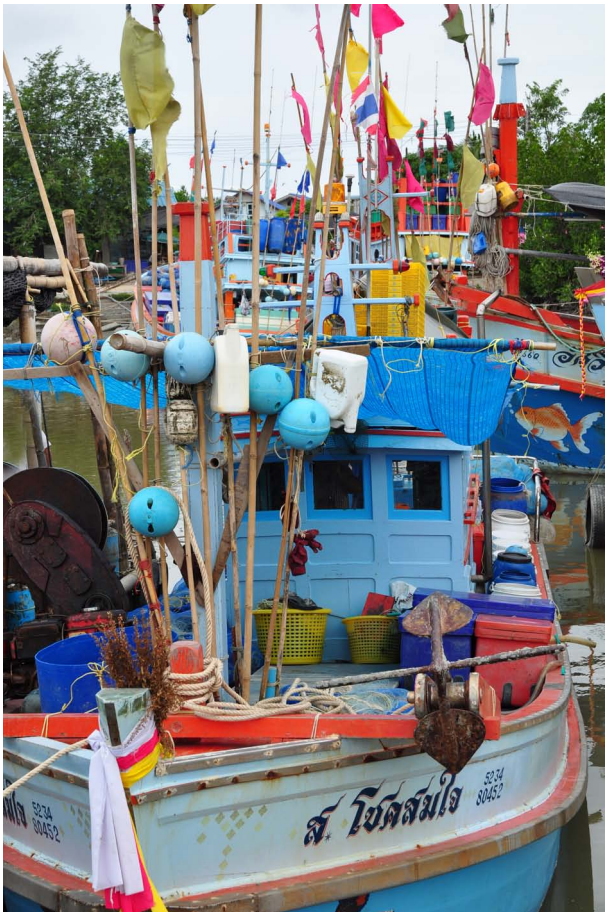

Sustainable Development of Inland Fisheries in Southeast Asia for Food Security

Mahyam Mohd. Isa, Abu Talib Ahmad, Abdul Razak Latun, Mazalina Ali, and Virgilia T. Sulit

As part of the technical preparatory works for the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment" which will be held from 13 to 17 June 2011 in Bangkok, Thailand, SEAFDEC conducted the Regional Technical Consultation (RTC) on Sustainable Fisheries Management in Samut Pakan, Thailand in October 2010. The RTC discussed among other fisheries management matters, the issues relevant to "Sustaining Food Supply from Inland Fisheries", which is one of the themes for the June 2011 Conference. This article reviews the issues and recommendations raised during the RTC on the said theme, taking into consideration the results of the survey conducted in the ASEAN member countries that aimed to seek the countries' views and perceptions on the sustainability of the inland fisheries sector especially its contribution to food security.

The Southeast Asian region abounds with freshwater bodies that include rivers, lakes and other wetlands as well as reservoirs where fishes are caught as major source of protein for large part of the region's populace especially those living in rural areas. Statistics have shown that in 2008, the region's population was about 586 million and with food fish requirement of 26.5 kg/capita/year, which means that the region's demand for fish was about 15.5 million metric tons (Pongsri, 2010). FAO reported that the region's inland capture fishery production in 2008 was only 2.38 million metric tons or 20% of the world's total inland capture fisheries production (FAO FishStat Plus 2008). At this level, at least 13% of such requirement could be supplied by the region's inland fisheries, provided that the region's potential ecosystems for development are sustainably harnessed.

Considering the fish produced from inland fisheries are very important for local as well as regional consumption and the major threat to the resource is more from infrastructure rather than the fisheries itself, it is important to identify required actions that need to be taken to ensure sustainable production from this fisheries. Although many fishery statistical reports have painted a declining trend of the region's fish production from inland capture fisheries, such trend does not necessarily indicate an apparent decline of the resources. As shown in **Table 1**, except for Vietnam many countries in the region have shown a slow increasing trend of their inland capture fisheries production. Nevertheless, the

Table 1. Production from inland capture fisheries in Southeast Asia* (in metric tons)

Countries	2004	2005	2006	2007	2008
Brunei Darussalam	0	10	10	0	0
Cambodia	250,000	444,000	559,642	420,000	430,600
Indonesia	330,880	297,370	293,921	310,457	497,740
Lao PDR**	29,800	29,800	29,800	80,597	81,387
Malaysia	4,119	4,583	4,164	4,283	4,353
Myanmar	502,550	631,120	718,000	717,640	814,740
Philippines	142,018	143,806	165,081	168,311	179,491
Thailand	199,600	198,800	214,000	225,600	228,600
Vietnam	146,054**	138,800	152,325	133,600	144,800
TOTAL (SEA)	1,605,021	1,888,289	2,136,943	2,060,488	2,381,711
World's Total Production** from inland capture fisheries	8,613,912	9,396,013	9,799,740	10,034,692	n/a
% of SEA's production*** over World's Total production from inland capture fisheries	18.6	20.1	21.8	20.0	n/a
% of SEA's production*** over World's Total production from fisheries and aquaculture	1.1	1.2	1.4	1.3	n/a

* Source: Fishery Statistical Bulletin for the South China Sea Area (2007)
** Source: FAO FishStat Plus 2007
*** Production from inland capture fisheries

fish production from inland capture fisheries of Cambodia is something that should be reckoned with due to the abrupt increase in 2006 and with equally abrupt decrease in 2007. In similar manner, Sriputinibondh and Ekmaharaj (2008) suggested that Thailand's increasing trend of production from inland capture fisheries could be a result of the country's efforts in sustainable management of reservoirs and lake fisheries through the adoption of co-management and rights-based reservoir fisheries management, while Myanmar's increasing trend could be due to improved aquatic resources management such as environmental restoration and rehabilitation, restocking of flood plains and improved governance (Coates, 2002).

Looking back at the production from inland capture fisheries (**Table 1**) one would suspect that the data may have been under-reported especially for the countries (*e.g.* Lao PDR) in the Mekong River Basin which is considered as one of the most productive water bodies in the world in terms of fisheries. As a matter of fact, Coates (2002) opined that the total fish production in the region appeared to be under-estimated by a factor of at least between 2.5 and 3.6, and thus suggested that countries in the region should improve their respective fishery statistical systems and integrate co-management approaches with fishery information generation in order to move towards sustainable management of the region's inland capture fisheries.

The countries in the ASEAN region have always recognized the need to properly manage inland fisheries in order to enhance its contribution to food security in the region. In November 2001 when the SEAFDEC-ASEAN countries developed the Resolution (RES) and Plan of Action (POA) on Sustainable Fisheries for Food Security for the ASEAN Region which was adopted during the 2001 ASEAN-SEAFDEC Millennium Conference "Fish for the People", the countries recognized the "need to emphasize the importance of inland fisheries in planning and policy formulation to improve food security and the livelihoods of rural people" which was clearly stipulated in the RES. Subsequently and along this policy, the POA indicated the necessity of developing national statistical mechanisms on inland fisheries in order to provide bases for the development of the inland fisheries sub-sector.

Prospects for Sustainable Development of Inland Capture Fisheries

In Southeast Asia, the potentials for developing inland fisheries could be high considering the available areas of freshwater ecosystems in each country that have not been fully tapped, especially in the six major inland capture fisheries producing countries (**Table 1**). For example, the Great Lake located in the heart of Cambodia serves as a natural flood reservoir of the Mekong River and supports the country's major inland fisheries. During the flood season, the Lake has a water area of 10,000 km^2 and 3,000 km^2

during the dry season. In the monsoon season, the Great Lake expands to more than 6,000 km^2 inside the inundated forest creating effective breeding, spawning and nursing areas for various freshwater fishes, as well as serving as fishing ground and contributing to the country's fisheries production of which about 60% is provided by the Tonle Sap Great Lake (Serywuth and Vann, 2009). Indonesia has about 55 million ha (550,000 km^2) of open inland waters that include about 1.8 million ha (18,000 km^2) of lakes which are the main source of the country's freshwater fish production. There are also more than 50,000 ha (500 km^2) of reservoirs although fish production had been constrained by the multi-purpose design of such reservoirs for flood control, irrigation, industry, and domestic purposes (Petr, 1995). Philippines has major freshwater lakes, rivers and other water bodies that include the Laguna de Bay watershed which has an area of 292,000 ha (2,920 km^2) but the sustainability of fish production from this lake had been constrained by various factors that include technical, social, environmental, and institutional problems (Israel, 2009). Next to Laguna de Bay is Lake Lanao which is located near Marawi City, Lanao del Sur in central Mindanao, and has a surface area of 340 km^2. Lake Lanao is used by the lake communities for small-scale fisheries and recreational activities such as sports fishing, boating and swimming. However, the sustainability of fisheries in Lake Lanao has been threatened by the construction of a number of hydroelectric plants in the Lake that changed the fluctuations of the water level which had affected the indigenous people who depend on lake fisheries for their food and livelihood (Boransing and Sulit, 2009).

While Thailand has freshwater swamps and lakes that cover about 30,000 ha (300 km^2), the country has also the largest total area of reservoirs in Southeast Asia which could be more than 300,000 ha (3,000 km^2). After the promotion of co-management and rights-based in reservoir fisheries management which was initiated by the Department of Fisheries of Thailand, the lake fishers have been able to earn additional incomes and their livelihood could now be managed sustainably (Sriputinibondh and Ekmaharaj, 2008). Vietnam has vast area of inland freshwater ecosystems comprising more than 1,000,000 ha (10,000 km^2) of which about 397,500 ha (3,975 km^2) comprise the medium- and large-scale reservoirs with about 550,000 ha (5,500 km^2) of paddy fields and 58,000 (580 km^2) of small lakes and ponds (Petr, 1995), where freshwater species are produced.

The freshwater fisheries resources of Myanmar have been sustained by the country's extensive river systems such as the Ayeyarwady which is 2,170 km long and traverses the entire length of the country from the north in the border with Mainland China to the south until the Andaman Sea (Mya Than Tun, 2007). Myanmar has more than 21.35 million ha (213,500 km^2) of freshwater ecosystems such as natural water (rivers, main stream, lakes), flooded areas, dams/ reservoirs and paddy field areas which could be tapped for fisheries development (DOF Myanmar, 2010). The country's inland fisheries consists of freshwater capture and culture-based fisheries which is further divided into leasable fishery,

Box 1. Results from the questionnaire related to safeguarding food security provided by inland fisheries

Factors that threaten food security from inland fisheries

1. Direct alterations to water availability and extent caused by development of other sectors
2. Conversion of catchments for agriculture, forestry, urbanization and other uses causing a range of impacts on the aquatic environment
3. Pollution from industries, agriculture, sewage and other sources affecting fisheries production
4. Lack of management of existing fish stocks and ineffective stocking practices
5. Increasing abundance of predatory or undesirable species including exotics which led to decreasing fishery production
6. Irresponsible fishing by communities using illegal gears and practices

Existing mechanisms (governance and strategies) that enhance food security from inland fisheries

1. Certain fisheries-related activities are taken care of by various sectors, such as water management, pollution control, land-use, stocking, monitoring or controlling diseases, eliminating predatory and undesirable species, among others, although in some cases implementation may not be very effective. However, control of illegal fishing and over-fishing which are being carried out by other sectors seemed to be effective.

reserved fishery and open fishery in which fishing rights are granted under licenses. The Department of Fisheries of Myanmar has been promoting the rehabilitation of inland fisheries resources through stock enhancement by releasing fish seeds into natural lakes, inundated areas, and rivers as well as by conducting culture-based capture methods in leasable fisheries areas.

Sustaining Food Supply from Inland Fisheries

Considering the role of inland fisheries in food security especially in the rural areas, efforts to avert possible decline in fish production from inland ecosystems is deemed fundamental for the sustainable development of this sub-sector. The ASEAN and SEAFDEC which will organize the sequel ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment" in June 2011 in Bangkok, Thailand, have considered "sustaining food supply from inland fisheries", as one of the themes for the Conference.

As part of the preparatory works for the June 2011 Conference, SEAFDEC convened the Regional Technical Consultation on Sustainable Fisheries Management from 12 to 15 October 2010 in Samut Prakan, Thailand to discuss the issues under such theme, taking into consideration not only the fisheries production aspect but also the prevailing threat from various non-fisheries inland water management schemes. Moreover, the status of the region's inland fisheries which could be heavily exploited and suffer greatly from environmental pressures, in particular the deteriorating water quality and habitats, was also considered. Such concerns could be addressed by sharing the responsibility among stakeholders that include fishers, aquaculturists and rice farmers which is particularly important especially in assessing the competition of users for the limited water resource. Co-management systems should also be promoted to empower the communities and stakeholders to participate in the governance of sustainable inland fisheries.

Box 2. Results from the questionnaire related to safeguarding food security provided by inland fisheries

Factors that affect the status of inland fisheries production

1. Structure of fisheries, seasonality of inland fisheries, and fishers livelihood
2. Ecosystem degradation, conservation and management measures, political intervention, and enforcement of regulations
3. Support from government agencies and non-governmental organizations
4. Implementation of MCS, climate change, environmental flow modification, and population pressure and Invasive Alien Species
5. Capacity building, infrastructure and facilities

Ways to enhance production from inland fisheries

1. Adequate and effective MCS
2. Strengthen restocking program
3. Regular meetings of organizations to discuss fisheries related issues, including non-fisheries organizations
4. Good and effective infrastructure and facilities
5. Strengthen cooperation of all concerned in the collection of information as well as in research and management
6. Compliance with global and regional instruments and agreements
7. Integrated approach in the management of water use

Mechanisms for sustainable management of inland fisheries

1. Conservation and management measures
2. Seasonal closures
3. Promotion of fish trade and marketing as well as creation of alternative livelihoods, and access to micro-credits
4. Capacity building and promotion of appropriate technologies and innovations
5. Transparency in decision making on management measures

Strategies to improve sustainable management of inland fisheries

1. Improve management of capture fisheries, and limit access to resources only to those authorized to fish
2. Improve documentation, R&D and knowledge management
3. Establish community funds for inland fisheries development
4. Seasonal closure to protect critical life history of freshwater aquatic species
5. Support the development of sustainable community-based natural resource management
6. Strengthen capacity building and promote appropriate technologies and innovations
7. Promote participatory analyses including participatory in R&D and decision-making by local communities
8. Enhance processing, trade and marketing of fish and fishery products
9. Promote responsible fishing gears, methods and practices

Box 3. Results from the questionnaire related to sustainable co-management in inland fisheries

Status of community-based inland fisheries resources management

1. Supportive government policies and legal frameworks
2. Involvement of non-governmental organizations
3. Local community fishers association should be set up
4. Strengthen stakeholders' participation in management

Level of indigenous capacity, knowledge in fishery resources management and willingness of government to share power

1. Low level of capacity and knowledge of the communities on management, and low level of the diversity in fishery communities
2. Moderate level of willingness of management authorities to share power
3. Moderate level of willingness of communities to accept management responsibilities

Factors for successful implementation of community-based management/co-management

1. Sharing of power between government and communities especially in the area of management
2. Active participation of authorities in community-based management
3. Stakeholders involvement in community-based fisheries management arrangements and in decision making
4. Recognition and addressing the diversity in inland fishery communities
5. Use of property rights approach

Furthermore, since the competition for water and aquatic habitat has been the most critical challenge in inland fisheries management and the inland fish producers will continue to face increasing competition for water from other sources, fishery stakeholders alone cannot address the challenges considering that many problems are generated outside the fisheries sector. Thus, integration, better co-ordination of planning and management of resources shared by fisheries and other users, are required to facilitate sustainable inland fish production. In order to obtain the insights of the ASEAN countries on the issues confronting inland fisheries management, a questionnaire survey was conducted in early 2010, the results of which had been compiled and analyzed in coordination with the SEAFDEC Marine Fishery Resources Development and Management Department (MFRDMD) based in Terengganu, Malaysia, and had been used as basis for discussion of the said theme during the Regional Technical Consultation in October 2010.

Safeguarding Food Security

Inland fisheries in the region are heavily exploited and individual species are often seriously over-exploited, and is aggravated by the prevailing threat from various non-fisheries water management schemes. Thus, sufficient knowledge is required for technical interventions to mitigate the continuing damage by other users and to rehabilitate the impacted inland ecosystems. Five ASEAN countries provided information on two major aspects relevant to safeguarding food security provided by inland fisheries.

Box 4. Results from the questionnaire related to integrating fisheries with multiple inland water resource use

Factors that affect poor involvement of stakeholders in sharing responsibility

1. Population pressure
2. Inadequate or absence of Strategic Plan of Action, and absence of legal framework for water management
3. Lack of willingness of communities to be involved in management and accept management responsibilities
4. Poor mechanism to facilitate cooperation and boundaries between adjacent jurisdictions not clearly defined
5. Financial constraints, and absence of coordinating body
6. Political intervention and lack of incentives

Factors that determine the participation and sharing of authority by government and resource users

1. Awareness of policy makers in other sectors of the importance of inland fisheries
2. Availability of sufficient budget, appropriate institutional and governance arrangements
3. Adequate manpower and human resources as well as expertise
4. Effective coordination among concerned agencies

Ways for effective management of inland water resource use

1. Decisions on water management should consider the impacts on fish and fisheries, and ecosystem services should be optimized
2. Strengthen partnerships and access rights as well as generate synergies and optimize water productivity
3. Effective legislative and policy frameworks should be in place
4. Promote the ecosystem approach to fisheries
5. Provide adequate budget and financial commitments
6. Strengthen manpower and human resources, as well as expertise to manage multiple water use
7. Reduce bureaucracy among agencies sharing the water
8. Promote participatory analyses for direct decision-making on the rehabilitation and management of water resources

These are: (1) factors that threaten food security; and (2) existing mechanisms, governance and strategies to enhance food security from inland fisheries, as shown in **Box 1**.

Sustainable Development of Inland Fisheries

The contribution of inland fisheries to the total world fish production could be minimal compared with marine fisheries but there exist potential areas for development in the region's inland water ecosystems that could lead to increased production. However, the sustainability of fisheries in these areas needs to be examined. Five ASEAN countries provided information on four major aspects relevant to the sustainable development of inland fisheries, such as (1) factors that affect the status of inland fisheries production; (2) ways to enhance production from inland fisheries; (3) mechanisms for sustainable management of inland fisheries; and (4) strategies to improve sustainable management of inland fisheries. The results are shown in **Box 2**.

Towards Sustainable Co-management in Inland Fisheries

Sharing of responsibilities among stakeholders that include fishers, aquaculturists and rice farmers is particularly important especially in assessing the competition of users for the limited water resource. Co-management systems should

Box 5. Recommendations of the October 2010 RTC on Sustainable Fisheries Management

Safeguarding food security

1. Member Countries should recognize the importance of inland fisheries for food security, and in particular of subsistence fisheries, in sector planning and policy implementation, and where appropriate, subsistence fisheries should be protected and/or receive priority consideration.
2. Member Countries should ensure that the role of inland fisheries in contributing to food security should be enhanced through the development of appropriate strategies, which should be coordinated with respective National Poverty Alleviation Strategies with a view to identifying and/or confirming the extent of their contribution or counteracting the achievements to safeguard food security.
3. The compilation of statistical and information data on inland fisheries should be modified to include also fish consumption survey as well as mobilizing local and indigenous knowledge with the aim of improving the valuation of inland fisheries and monitoring its performance.
4. The impacts of alteration of water ways, conversion of catchment areas for agriculture and other uses, water regulation infrastructures and other infrastructure developments on inland fisheries should be fully recognized, while the Member Countries should make a concerted effort to consult with concerned agencies to maintain the ecological health of water bodies and the connectivity of the habitats.
5. Alternative livelihood should be promoted especially during seasonal flooding/drought considering the migratory and non-homogenous nature of the resources, and that food supply should be safeguarded during off season by developing post-harvest and processing techniques to maintain the food quality and safety of the fish and fisheries products.

Sustainable development of inland fisheries

1. Member Countries should put more emphasis on enhancing awareness of local ecological knowledge, conservation of endangered species, and the impacts of introduction of alien species and aquaculture technology.
2. Fisheries extension of the Member Countries should be reactivated and/or developed to enhance knowledge-based information and management.
3. In order to maintain a healthy ecosystem, Member Countries should regularly assess the adverse impacts of human activities and pollution from land-based activities.
4. Collection, compilation, analysis and dissemination of scientific and statistical data/information should be strengthened to increase the visibility of inland fisheries as one of the important economic sectors.
5. The Member Countries' restocking programs, as the last option, should take into consideration the use of indigenous species and local population in order to maintain the genetic structure of the species in a particular environment, and that introduction of alien species should be avoided.

Towards sustainable community-based/co-management in inland fisheries

1. Member Countries should promote co-management in inland fisheries with appropriate legal framework, community knowledge, institutional linkages, and resources (human and financial).
2. Member Countries should consider developing an enabling environment to provide exclusive fishing rights to communities in co-management.
3. Participation of local communities, fisheries/farmers associations and other stakeholders in inland fisheries management should be enhanced, with the communities taking part in stock assessment by providing data, local ecological knowledge, and status of the stocks.

Integrating fisheries with multiple inland water resource use

1. Inter-agency coordination within the Member Countries should be enhanced to address the issues that are beyond the responsibility of fisheries agencies.
2. Member Countries should ensure that the requirements for multi-disciplinary expertise are served by developing the necessary programs.
3. The existing level of involvement among all stakeholders within the Member Countries in sharing the responsibility of managing inland waters should be assessed with the purpose of improving inputs from fisheries into integrated water resources management.
4. Constraints to the participation and extent of sharing of authority by government and resource users should be identified.

therefore be and where the communities and stakeholders should be empowered to participate in the governance of inland fisheries. Five ASEAN countries provided information on three major aspects relevant to sustainable co-management in inland fisheries, such as (1) status of community-based inland fishery resources management; (2) level of indigenous capacity, knowledge in fishery resources management and willingness of government to share power; and (3) factors for successful implementation of community-based management, as shown in **Box 3**.

Integrating Fisheries with Multiple Inland Water Resource Use

Competition for water and aquatic habitat is the most critical challenge in inland fisheries and for the fishery stakeholders to address such challenges, better co-ordination of planning and management of resources shared by fisheries and other users, would be necessary to enhance sustainable inland fisheries production. Five ASEAN countries provided information on three major aspects relevant to the need to integrate fisheries with multiple inland water resource use, such as (1) factors that affect poor involvement of stakeholders in sharing responsibility; (2) factors that determine the participation and sharing of authority by government and resource users; and (3) ways for effective management of inland water resource use. The results are shown in **Box 4**.

Recommendations of the RTC on Sustainable Fisheries Management (12-15 October 2010, Samut Prakan, Thailand)

Using the outcomes of the survey as basis for the discussion on the theme on **Sustaining Food Supply from Inland Fisheries** during the October 2010 Regional Technical Consultation (RTC), the recommendations from the Member Countries were compiled to be used as inputs in the relevant technical panels of the June 2011 Conference (**Box 5**).

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Technical Efficiency of Gillnet Fishery in Da Nang, Vietnam:
Application of stochastic production frontier

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This paper presents the result of a study which investigated the technical efficiency of gillnet fishing vessels in Da Nang, Vietnam in 2009 using a stochastic production frontier, which involved the simultaneous estimation of a translog stochastic frontier model and a model for vessel-specific technical inefficiencies. Other important determinants of gillnet fishing fleet were also examined such as output elasticities, returns to scale and marginal productivities of inputs. An inefficiency model was subsequently developed to determine the relevant vessel- and operator-specific factors that could affect the technical efficiency of gillnet fishery. Given the estimated stochastic production frontier model, the ability to determine the potential factors that affect the efficiency and the production process could be investigated. The estimated marginal productivities of inputs for gillnet fishery production could provide some useful insights for fishery managers in formulating management and regulatory policies, and for the gillnet vessel operators in increasing their variable costs and/or employing longer gillnets as well as increasing their benefits by taking onboard more crew members.

Most fisheries worldwide are still open-access resources and managed through input control system (Pascoe and Mardle, 2003). One of the essential approaches for effective fisheries management under such system is to adopt technical efficiency measurements in fisheries. However, research studies that investigate the technical efficiency in commercial fisheries are limited because of inadequate data and few choices of analytical methods (Comitini and Huang, 1967; Noetzel and Norton, 1969; Hannesson, 1983). The fisheries industry in Vietnam is a key sector for the country's economic development, where management is mostly imposed through a series of input control systems such as gear restrictions, minimum mesh size, engine power, fishing licenses, among others. Nevertheless in practice, such controls have not been fully assessed and examined (Son, 2003; Truong and Dap, 2006). A few recent studies attempted to measure the economic performance of certain types of fishing vessels such as the longliners, gillnetters, and purse seiners (Kim Anh *et al*., 2006; Long *et al.*, 2008; Luong, 2009), but such studies only covered some aspects on fishing efficiencies associated with costs and earnings of the fleets operating in Nha Trang, Vietnam due to inadequate data and time constraints. The socio-economic information about such fisheries that could be useful for fishery managers in formulating appropriate regulations and policies had not been examined. In recent years, an increasing number of research studies had been conducted in Vietnam assessing the technical efficiency in some economic sectors using the production frontier function approaches (Minh, 2005; Song, 2006; Nhut, 2006; Den *et al*., 2007) but the application of such approaches in the fisheries sector of Vietnam is very limited. Ngoc *et al.* (2009) carried out the only single study on small-scale trawl fisheries in Nha Trang using production frontier approaches. The limited number of such studies in the fisheries sector could be due to the country's fishery management system which is not normally concerned with the economic performance of fishers, as most research studies had been tendentiously directed to the biological aspects of fish stocks such as stock structure, age-specific growth and mortality rates (Van Zwieten *et al*., 2002). Nonetheless, the efficient utilization of the related resources (*e.g.* labor, capital) and sustainable management of the marine resources should be addressed in order to assess the social benefits from marine capture fisheries. Furthermore, the limited frontier studies in marine fisheries can be partly attributed to the lack of data and the complexity of small-scale fisheries in the Southeast Asian region. Therefore, the estimation of stochastic production frontier in the gillnet fishery could provide interesting information for both researchers and managers, and could be useful (as reliable basis) for fishery managers and decision makers not only in Vietnam but also for the other Southeast Asian countries, particularly in formulating appropriate and crucial fishery management regulations.

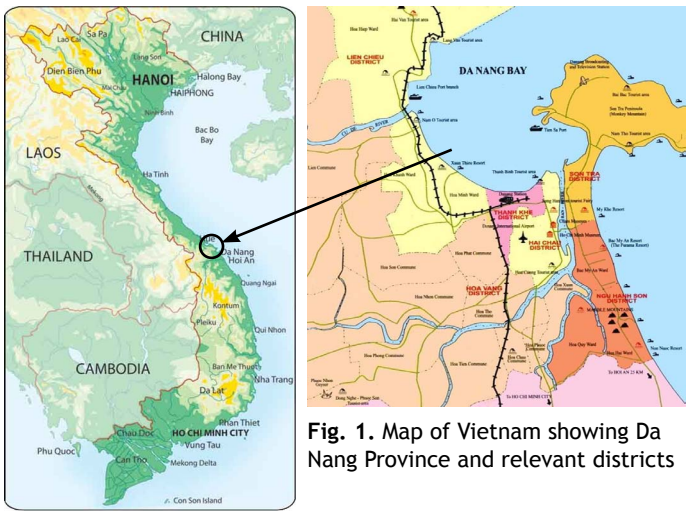

Fig. 1. Map of Vietnam showing Da Nang Province and relevant districts

Gillnet Fishery in Da Nang, Vietnam

Gillnet fishery mainly catching mackerel and tuna, has been in existence in Da Nang since the early 1970s and has been playing an important role in the fisheries sector of Vietnam. This fishery started to develop along with the offshore fishing program initiated by the Government of Vietnam in the mid 1990s. At present, gillnet fishing vessels in Da Nang are mainly found in Son Tra and Thanh Khe Districts with few gillnetters located in Hai Chau and Lien Chieu Districts (**Fig. 1**).

In 2009, Da Nang had a total of 1,932 fishing vessels with 119 (6.2%) gillnetters having engine capacities that range from 22 to 520 Hp and an average of 116.67 Hp but the total engine capacity of the fleet in the Province was about 13,884 Hp (18.0% of the country's total). The average length of the vessels was about 17.28 m (ranging from 8.80 to 21.40 m). Compared with the gillnet fleet in Khanh Hoa Province which had an average engine capacity of 85.60 Hp and average length of 14.10 m (Kim Anh *et al.*, 2006), it appears that the sizes of the gillnet vessels in Da Nang are relatively larger, which could also imply that the investments in gillnet fishery in Da Nang could be higher compared with that of Khanh Hoa's.

In 2009, 98 gillnetters (82.4%) from Da Nang aiming for high fishing efficiency, were organized into gillnet groups with about 22 vessels in each group. The fish catch landed by the gillnet groups during that same year was over 9 million metric tons accounting for around 85.0% of the total fish production of the Province. Each gillnet fishing group comprising about 3-5 vessels were operated collaboratively based on family loyalty, which is known to have brought more benefits to the group members, while the members support each other in terms of sharing information on fishing grounds, providing mechanical support in case of an engine failure, and sharing supplies such as fuel, water and food, among others.

Gillnet fishing vessel in Da Nang, Vietnam

Above: Catch landed by gillnetters in Da Nang
Left: Gulf of Tonkin as the main fishing grounds of gillnetters.

A typical gillnet vessel in Da Nang has a hull length longer than 19 m (for large vessels) and capable of making trips longer than two weeks including travel time. The vessel is usually equipped with 300-350 gillnet sheets per boat (50 m long per sheet) and manned by a captain and crew of 10-11 members. The gillnet vessels in the medium category (17-19 m) normally carry 200-280 sheets, manned by a captain and crew of 8-9 members and making trips that last for 7-10 days. The gillnet vessel in the small category (<17 m) have 150-200 sheets, a captain and crew of 6-7 members and make trips for 4-7 days. Sharing of the benefits from this fishery is based on the monthly net income, which is the difference between the gross revenue and total variable costs except labor costs. The net income is divided into 10.5 parts, where the vessel's owner takes 3.5 parts, 3.0 parts for the fishing gears (shared between the owner and crew members who contributed the gillnet sheets), and the remaining 4.0 parts shared among the laborers.

Gillnet fishing activities take place from the southeast of the Paracel Islands going all the way to the Gulf of Tonkin. The main fishing season is from December to March (April) known as the northeast monsoon, when most gillnet vessels (including the medium and large sizes) operate in the Gulf of Tonkin with mackerel as the main target species comprising about 50-60% of the total catch. During the southwest monsoon (a sub-season) from May (April) to August

(September), many gillnetters operate in the southeast of the Paracel Islands to catch mostly tuna species, constituting about 60-70% of the fish catch. In practice, however, the skippers could identify the appropriate fishing grounds based on the main target species that could be exploited without due consideration of the particular seasons.

The Stochastic Frontier Model

Following Färe *et al.* (1985, 1994), the determinants of the technical efficiency could be determined by applying various methods, which could be either non-parametric such as the Data Envelopment Analysis (DEA) or parametric such as the Stochastic Production Frontier (SPF) analysis. Since the DEA introduced by Charnes *et al.* (1978) is based on mathematical program approach it does not impose any assumptions about functional forms and does not take into account random error, and thus could be biased under the production process that largely involved stochastic elements. In contrast, the SPF approach imposes explicit functional form and distribution assumption on the data and thus, could account for the random errors including those induced by weather and luck (Aigner *et al.*, 1976; Aigner *et al.*, 1977; Meeusen and van den Broeck, 1977). The SPF analysis could therefore be appropriate for examining the relative technical efficiency of any "firm" or "entity" that exploits renewable resources due to the involvement of stochastic characteristics in the production process (Kirkley *et al.*, 1995; Sharma and Leung, 1999).

Fishing port in Da Nang, Vietnam

Since fishing activities are largely characterized by many uncertainties, especially in the case of small-scale fisheries, the SPF approach could be used to examine the technical efficiency of fishing vessels as demonstrated in this case study. The general stochastic production frontier model is shown in **Box 1**.

Data Analysis

This study made use of the results of the cross-sectional survey of sample gillnet vessels obtained through the fisher's logbook conducted in 2009 and from the interviews. From a total of 119 registered gillnet vessels operating in 2009 in Da Nang, only 56 gillnetters were randomly selected. The owners and/or captains (skippers) of the selected vessels

Table 1. Variables in the stochastic production frontier and technical inefficiency models for gillnet fishery in Da Nang in 2009

Variable	Mean	S.D.	Min.	Max.
No. of operating months (in months)	10.20	0.80	8.00	12.00
Average annual revenue	868.10	237.20	275.70	1,379.30
Average income per month	47.30	15.40	5.80	79.70
Output				
Gross revenue	84.70	21.60	27.60	125.80
Inputs				
Variable costs (O)	37.30	10.00	19.70	65.70
Crew size in persons (C)	9.90	0.90	8.00	12.00
Length gillnet sheets (N)	294.00	32.00	200.00	360.00
Vessel - and operator - specific variables				
Vessel size dummy ($D_{mediumvessel}$): Medium (0 or 1)	0.58	0.50	0	1.00
Vessel size dummy ($D_{largevessel}$): Large (0 or 1)	0.28	0.45	0	1.00
Engine power (Hp)	140.20	86.9	37.00	360.00
Vessel age (years)	5.50	3.70	1.50	16.00
Net-contributor (persons)	6.10	2.30	1.00	11.00
Skipper's experience (years)	16.60	9.90	2.00	38.00
Education dummy ($D_{education}$): Secondary level (0 or 1)	0.26	0.44	0	1.00
Owner-operated dummy ($D_{owner\text{-}operated}$) (0 or 1)	0.50	0.51	0	1.00

Note: Total number of observations n=50. All economic values are in million VND (US$1 = 16,900 VND in 2009).
Medium vessel: 17-19 m, Large vessel: >19 m. Crew includes captain *(Source: survey in 2009)*

Box 1. The stochastic production frontier model

$$\ln q_i = \beta \ln x_i + v_i - u_i \quad (1)$$

where q_i is the output produced by firm i, x_i is a vector of factor inputs of the ith firm, and β is a vector of the estimated parameters. The term v_i is a random variable that accounts for the random effects (beyond the control of the firms), which is assumed to be independent and identically distributed (iid)N(0,σ_v^2), independent of u_i, and can be positive or negative. The term u_i is a non-negative random variable which accounts for pure technical inefficiency in production and is assumed to be independently and identically distributed and with truncations (at zero) of the normal distribution (Aigner *et al.*, 1977) with mean, u_i- that measures the technical inefficiency relative to the frontier and describes the distance of firm ith from the frontier output (Coelli *et al.*, 1998), and variance, $\sigma_u^2(|N(\mu_i,\sigma_u^2|)$. The assumption of the independent distribution between u_i and v_i allows the separation of the stochastic (statistical noise) and inefficiency effects in the model (Bauer, 1990). This is considered as one of the advantages of assessing the technical efficiency using the SPF model.

The method of the maximum likelihood used to estimate the parameters of the stochastic frontier in equation (**1**). The parameters estimated include β and variance parameters such as $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and $\gamma = \sigma_u^2/\sigma^2$ (Battese and Corra, 1977). Where, σ^2 is the sum of the error variance, while γ measures the total variation of output from the frontier attributed to the existence of random noise or inefficiency. Note that the value of γ lies between zero and one. The inefficiency is not present when γ=0 which means that all deviations from the frontier are entirely due to random noise, and if γ=1 then the deviation is completely caused by inefficiency effects (Battese and Coelli, 1995).

Based on the Battese and Coelli (1995) model, the random variable associated with technical inefficiency, u_i, was further assumed as a function of various operator- and vessel-specific variables that are hypothesized to influence the technical inefficiencies, as shown in equation (**2**):

$$u_i = z_i\delta + w_i \quad (2)$$

where z_i is a vector of explanatory variables associated with the technical inefficiency of production of the ith firm, δ is an unknown vector of coefficients that is to be estimated, and w_i is a (iid) random error term, which is defined by the truncation of the normal distribution with zero mean and variance, σ_u^2, such that the point of truncation is $-z_i\delta$, *i.e.*, $w_i \geq -z_i\delta$. These assumptions are consistent with u_i being a non-negative truncation of the $N(z_i\delta, \sigma_u^2)$-distribution.

It should be noted that both the frontier model in equation (**1**) and the inefficiency model in equation (**2**) could include intercept parameters if the inefficiency effects are stochastic and have particular distributional properties (Coelli and Battese, 1996). Moreover, the stochastic frontier requires a priori functional form specification. This means that it is necessary to impose restrictions on the model. By doing so, these restrictions could be tested by using the following generalized likelihood ratio (LR):

$$LR = -2\{\ln[L(H_0)] - \ln[L(H_1)]\} \quad (3)$$

where $\ln[L(H_0)]$ and $\ln[L(H_1)]$ are the values of the log-likelihood function under the null (H_0) and alternative (H_1) hypotheses, respectively. The restrictions form the basis of the null hypothesis, while the unrestricted model being used for the alternative hypothesis. LR has a Chi-square (χ^2) distribution with the number of degrees of freedom provided by the number of restrictions imposed.

In order to test the specification of the models, a number of trials have been proposed with the standard test being the one-sided generalized likelihood ratio-test for the existence of a frontier (the presence of technical inefficiency), *i.e.* H_0: γ=0. This test has an asymptotic distribution ($0<\gamma<1$) and the critical values of the test are obtained from Kodde and Palm (1986). The other key test is the correct functional form of the stochastic production frontier (equation (**1**)) which is the Cobb-Douglas form (*i.e.* H_0: $\beta_{i,k} = 0$, where k denotes the kth input variable). This null hypothesis is tested against the alternative hypothesis that the translog is the most appropriate functional form (*i.e.* H_1: $\beta_{i,k} \neq 0$). Further, the appropriate assumption for the inefficiency distribution as a truncated normal curve can also be tested under the null hypothesis so that all the parameters of the technical inefficiency model are considered, except the intercept at zero.

Based on the model estimations, the output for each firm could be compared with the frontier level of output that is known as the best output given the level of inputs employed, and this deviation indicates the level of inefficiency of the firm. Therefore, the technical efficiency score for the ith firm in the sample (TE_i) under the given equations (**1**) and (**2**) that would be defined as the ratio of observed output to the corresponding best output, is given by (Coelli *et al.*, 2005) as:

$$TE_i = \frac{q_i}{\exp(\beta \ln x + v_i)} = \frac{\exp(\beta \ln x + v_i - u_i)}{\exp(\beta \ln x + v_i)} = \exp(-u_i) = \exp(-z_i\delta - w_i) \quad (4)$$

where TE_i is the relative technical efficiency of the firm ($0<TE<1$). Note that, when u_i=0 then the ith firm lies on the stochastic frontier and is known as technically efficient. If u_i >0, the firm i lies below the frontier, which means that the firm is inefficient. The elasticity of output with respect to the kth input variable (ε_k), which measures the responsiveness of the output to a 1% change in the kth input, could be evaluated as the mean values of the relevant data points and can be derived from:

$$\varepsilon_k = \frac{\partial \ln q}{\partial \ln x_k} = \beta_k + 2\beta_{kk} \ln x_k + \sum_j \beta_{kj} \ln x_j \quad (5)$$

where β_k is the coefficient on the x_k term, β_{kk} is the coefficient on the $\ln^2 x_k$ term and β_{kj} is the coefficient of the cross product of x_k and x_j, where both k and j are inputs.
The measure for returns to scale (RTS), representing the percentage change in output due to a proportional change in the use of all inputs, is estimated as the sum of output elasticities for all inputs (Chambers, 1989). The measurement of the marginal product of the kth input at mean values of the output and relevant input variables is calculated as:

$$\frac{\partial q}{\partial x_k} = \varepsilon_k \frac{\bar{q}}{\bar{x}_k} \quad (6)$$

were interviewed from January to February of 2010 using a questionnaire which aimed to collect information on various aspects of gillnet fishery, including vessel and fishing gear characteristics, fishing grounds, target species, crew size, and the net contribution of crew members.

The personal data of the skippers such as age, years of fishing experience, educational level, and whether the vessel is owner-operated or not, were also collected through the interview. The number of vessels finally considered in the study was 50, and the data were analyzed for the estimation of the stochastic frontier. The results showed considerable heterogeneity in terms of technical and operational characteristics such as vessel size, age of crew, crew size, variable costs, and the total length of the gillnets, as well as the skipper's age, experience, and educational level (**Table 1**).

Hull lengths for the sample gillnet fleet ranged from 14.8 to 21.0 m with an average length of 18.1 m. The age of gillnet vessels varied from 1.5 to 16.0 years with mean of 5.5 years (also the years of ownership by the present owner). The average crew size was 9.9 persons which ranges from 8.0 to 12.0 persons. The sample gillnets fleet also showed a considerable variation in the variable costs ranging from 19.7 to 65.7 million VND with an average of 37.3 million VND. The number of gillnet sheets used by the sample gillnetters ranged from 200 to 360 sheets with mean of 294 sheets. The average monthly number of days at sea including time spent for traveling is 17.6 days, varying from 11 to 22 days. The age of the skippers also varied from 28 to 60 years old with an average age of 43.1 years. The skippers had relatively high levels of experience in fishing activities at an average of 16.6 years.

As shown in **Table 1**, one of the most important economic performance indicators of the sample gillnet fleet is positive income. The total gross revenue of the vessels substantially varied from 275.7 to 1,379.3 million VND, with an average of 868.1 million VND, compared with the average annual revenue of a gillnetters in Nha Trang City which was 851.3 million VND (Kim Anh *et al.*, 2006), which clearly indicated that the revenue of gillnet vessels operating in Da Nang was relatively higher than the vessels in Nha Trang. Furthermore, the correlation coefficients between the output and potential inputs in the frontier model showed multicollinearity. The partial correlation of the variable costs (O) with labor (C), and the number of gillnet sheets used per vessel (N) are 0.51 and 0.42, respectively, with the correlation of labor and number of gillnet sheets being 0.47.

Empirical Models

In most economic sectors, outputs can be defined as the physical measure of the volume, but in fisheries especially in tropical waters such as in Vietnam, the outputs are characterized by the different species in the catch often receiving different prices in the market. Therefore, in examining the relative technical efficiency of gillnet fishery, revenue is the reasonable measurement of the variable outputs. Furthermore, in using the cross-sectional data from the 2009 survey to analyze the stochastic production frontier function, it was assumed that the prices of the outputs (*i.e.* tuna, mackerel) and all variable inputs used are the same for all vessels.

Recent literatures on production and efficiency in fisheries (Squires and Kirkley, 1999; Grafton *et al*., 2000) indicated a range of different input measures used, the most common of which are capital, capital utilization, stock size, and labor utilization. However, the exact choice of input variables for modeling differs among the studies as this depended largely on the availability of data, the expectation to capture the full range of inputs employed, and the characteristics of the fishery. Use of inappropriate measures of the inputs could lead to mis-specification of the model, which affects the corresponding efficiency estimation (Campbell, 1991).

With regards to the technical efficiency measurement of the gillnet fishery, Pascoe *et al.* (2001) examined the effects of economic versus physical input measures on the technical efficiency of the Danish gillnet fleets. The physical input measures included the vessel gross tonnage and horse power, with fuel consumption used as key input for both features related to the vessel size (*e.g*. hull length and horse power) as well as capital utilization (*i.e.* fishing days). Squires *et al.* (2003) used a range of different input measures for the analysis of the Malaysian gillnet fishery such as vessel GRT as proxies of the vessel capital stock, the number of crew employed per vessel as a variable input, and the number of trips per month representing variable input usage. In the case of fisheries in Vietnam, Kim Anh *et al.* (2006) used the hull length and the main engine power as proxies of the vessel fishing effort in modeling the gillnet fishery in Nha Trang. The study also used some other variables such as vessel age, numbers of gillnet sheets (or the total gillnet length), and monetary investments in fishing gear and equipment. While Dien (2009) used the number of days at sea and number of crew for the analysis in modeling the gillnet fleets in central Vietnam, the input variables were aggregated into three categories, namely: (1) the variable costs used by each vessel per month including fuel, ice, and other miscellaneous items, known as proxy of the capital utilization rate (Squires, 1987; Sharma and Leung, 1999); (2) the number of crew members

Box 2. Functional form of the technical efficiency model

$$\ln(\text{Revenue}_i) = \beta_0 + \beta_1\ln(O_i) + \beta_2\ln(C_i) + \beta_3\ln(N_i) + \beta_{11}(\ln O_i)2 + \beta_{22}(\ln C_i)2 + \beta_{33}(\ln N_i)^2 + \beta_{12}\ln O_i\ln C_i + \beta_{13}\ln O_i\ln N_i + \beta_{23}\ln C_i\ln N_i + v_i - u_i \quad (7)$$

where the output variable is represented in terms of revenue per month in million VND; O denotes the variable costs used by each vessel per month, including fuel, ice, minor repairs, and other miscellaneous items, except labor cost (million VND/month); C is the number of crew onboard the vessel, including the captain (persons); N denotes the number of gillnet sheets used by each vessel (units); and v_i and u_i are error terms as defined in the previous section.

Box 3. The functional form of the inefficiency model

$$\mathbf{U}_i = \delta_0 + \delta_1 D_{mediumvessel} + \delta_2 D_{largevessel} + \delta_3\ln(\text{enginepower}_i) + \delta_4\ln(\text{vesselage}_i) + \delta_5\ln(\text{netcontributor}_i) + \delta_6\ln(\text{experience}_i) + \delta_7 D_{education} + \delta_8 D_{owner\text{-}operated} + w_i \quad (8)$$

where Ds denotes the dummy variables and w_i is the random error term as defined in the previous section.

Table 2. Generalized likelihood ratio tests of the hypotheses for parameters of the stochastic production frontier and technical inefficiency models for the gillnet fishery in Da Nang

Null hypothesis	Log-likelihood value	Number of restrictions	Critical value (χ^2)
$H_0 : \gamma = \delta_0 = \delta_1 = \ldots = \delta_8 = 0$	35.202	10	22.525 *
$H_0 : \beta_{11} = \beta_{22} = \beta_{33} = \beta_{12} = \beta_{13} = \beta_{23} = 0$	13.560	6	12.590 **
$H_0 : \delta_1 = \delta_2 = \ldots = \delta_8 = 0$	35.610	8	15.500 **

Note: *, ** are statistically significant at 1% and 5% levels, respectively. The correct critical values for the first hypothesis is obtained from Table 1 of Kodde and Palm (1986, p. 1,246)

onboard the vessel including the captain considered as key variable input generating fishing effort and impacting on the level of gillnet fishing efficiencies since more crew may allow the removal and processing of the catch more quickly and in turn, allows for more time for fishing; and (3) the number of gillnet sheets as the main physical input - as proxy for investment in the level of capital employed. There are several potential functional forms that can be used to specify the stochastic frontier, however, in most empirical applications, the desirable form is the translog function due to its flexibility which could easily facilitate the calculation of individual values for technical inefficiency and efficiency (Kirkley *et al*., 1995). The appropriateness of the translog functional form of the model was tested against a Cobb-Douglas specification. The functional form of the technical efficiency model is indicated in **Box 2.**

For the inefficiency model, a number of relevant vessel- and owner-specific variables were hypothesized to influence the technical efficiency for the gillnet vessel, such as: (1) vessel size dummy (value 1 for medium size vessel, 0 otherwise); (2) vessel size dummy (value 1 for large size vessel, 0 otherwise); (3) vessel's engine in Hp; (4) vessel age in years (ownership of vessel by present owner) representing vessel characteristics; (5) number of crew members who contribute gillnet sheets (total net sheets) used by each vessel; (6) skipper's experience (years); (7) level of formal education dummy (value 1 if operator finished secondary school, 0 for skippers with lower educational level (note: no skippers had a high school education in the data set)); and (8) whether or not the vessel is owner-operated, which may closely relate to fishery management and performance, also examined as a dummy variable (value 1 if vessel was owner-operated, 0 otherwise). The functional form of the inefficiency model is shown in **Box 3**.

Empirical Results

The parameters of the stochastic production frontier model using equation (1), and those for the technical inefficiency model using equation (2), were estimated simultaneously by using the maximum-likelihood estimation (MLE) program Frontier 4.1 (Coelli, 1994). The generalized likelihood ratio tests of the key null hypotheses involving the restrictions on the parameters to be estimated involved the β-coefficients and variance parameter γ, in the stochastic production frontier and the δ-coefficients in the technical inefficiency model, as presented in **Table 2**.

The first null hypothesis test showed that the effects of the technical inefficiency are not present in the model, $\gamma = \delta_0 = \delta_1 = \ldots = \delta_8 = 0$. The likelihood-ratio (LR) test statistic is asymptotically distributed as a mixture of Chi-square distributions, and such test statistic exceeds the 1% critical value $\chi^2_{0.99}(10) = 22.525$, which is taken from Table 1 of Kodde and Palm (1986). Thus, the LR test led to the rejection of the null hypothesis that no technical inefficiency exists in the stochastic production frontier (at the significant

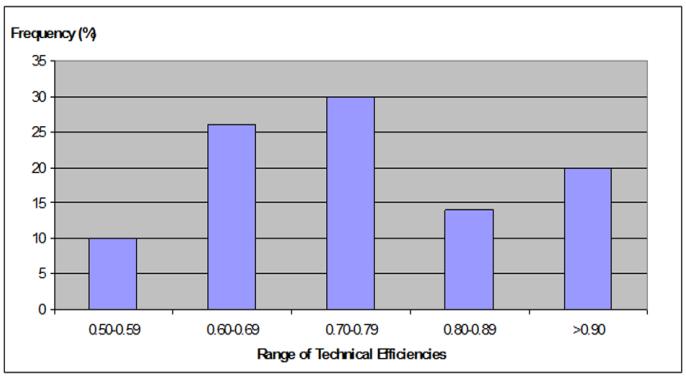

Fig. 2. Frequency distribution of technical efficiencies for the gillnet fishery in Da Nang, Vietnam

level of 5% or less), and also implied that the traditional average of the ordinary least square (OLS) function is not suitable for this study. The second null hypothesis indicated that the correct functional form of the model is Cobb-Douglas, imposed by removing the squared and cross product terms from the translog production function, which was rejected at 5% level of significance. Thus, the LR tests suggested that the translog is the most appropriate functional form for the analysis of gillnet vessels in this study (the estimated models were well specified). Finally, the hypothesis that the technical inefficiency effects have the same truncated-normal distribution with a mean equal to δ_0, given by all the parameters of the technical inefficiency model except the intercept at zero, was also rejected (at 5% level of significance).

Technical Efficiencies

The technical efficiency scores for the Da Nang-based gillnet vessels ranged from 0.55 to 0.98, with mean efficiency level of 0.76, substantially lower than 0.84 and 0.88 for the Malaysian gillnet artisanal fishery in the East and West coasts of Malaysia, respectively (Squires *et al.*, 2003). This result indicates that the means of the individual technical scores for the Da Nang-based gillnet fleets are consistent with those generally found from stochastic frontiers for agriculture in developing countries (Ali and Byerlee, 1991; Bravo-Ureta and Pinheiro, 1993).

The frequency distribution of the estimated technical efficiency scores relative to the best practice frontier scores is illustrated in **Fig. 2**. Majority of the vessels have a technical efficiency score of 0.70 to 0.79 (30%), followed by 26% of vessels with efficiency scores of 0.60-0.69. While the least proportion of the observed vessels (10%) had technical efficiency indices of 0.50-0.59. The sample vessels that had technical efficiency index of 0.90 or above accounted for just 20% and vessels with efficiency indices of 0.80-0.89 accounted for 14%.

Table 3. Parameter estimates of the stochastic production frontier and technical inefficiency models

	Coefficient	Asymptotic t-ratio	
Stochastic production frontier			
Constant	-106.347	-46.922	***
ln (Variable costs)	0.820	3.520	***
ln (Crew size)	10.210	28.630	***
ln (Net sheets)	33.965	37.509	***
ln (Operating costs)^2	-0.462	-2.444	**
ln (Crew size)^2	-2.514	-14.608	***
ln (Net sheets)^2	-2.680	-15.327	***
ln (Variable costs) x ln (Crew size)	1.862	3.202	***
ln (Variable costs) x ln (Net sheets)	-0.181	-0.326	
ln (Crew size) x ln (Net sheets)	-0.932	-1.387	
Technical inefficiency model			
Constant	0.965	5.092	***
Vessel size dummy: Medium (0 or 1)	-0.028	-0.431	
Vessel size dummy: Large (0 or 1)	-0.016	-0.237	
Engine power (Hp)	-0.093	-2.247	**
Vessel age (years)	0.057	1.882	*
Net-contributor (persons)	-0.254	-6.340	***
Skipper's experience	0.058	2.017	**
Education dummy: Secondary level (0 or 1)	0.026	0.536	
Owner-operated dummy (0 or 1)	-0.055	-1.295	
Variance parameter			
σ^2	**0.011**	5.511	***
γ	**0.780**	12.045	***

Notes: *, **, *** are statistically significant at 10%, 5%, and 1% levels, respectively.

Since slightly more than 30% of the sample vessels have technical efficiency score of 0.80 or higher, this implies that in 2009 limited number of vessels displayed substantially higher levels of technical efficiency (operating close to the efficient frontier). Notably, however, none of the sampled vessels had a technical efficiency index lower than 0.50. Therefore, majority of the gillnetters have the potential to improve their technical efficiency (productivity) given the state of technologies and conditions of the resources.

Factors Affecting Technical Inefficiencies

Given the specifications of the stochastic production frontier model defined in equations (**1**) and (**2**), the generalized likelihood-ratio tests indicated that the joint effect of the vessel- and operator-specific variables on the technical inefficiencies is highly significant in explaining the variation of the productive performances of the Da Nang-based gillnet vessels. However as shown in **Table 3**, none of the coefficients associated with vessel size, skipper's educational

level, and the owner-operator dummies have significant effects on technical efficiency. While the individual effects of the remaining variables (*i.e.* engine power, vessel's age, net-contributor, and skipper's experience) were statistically significant (based on the asymptotic t-ratios).

The value of γ=0.78, which is statistically significant at 1% level, confirmed that the output variability of the gillnet vessels is dominated by technical inefficiency rather than uncontrollable random shocks, and that the skippers have good knowledge of resource abundance, availability and spatial distribution (Kirkley *et al.*, 1995) as well as the willingness of the skippers to take more risks given the nature of fishing (*i.e.* weather, resource and environmental conditions) normally characterized by many uncertainties. Otherwise, the high gamma (γ) value in the model would imply high relative contribution of inefficiency to the total variation, indicating that most of the variation in the output accounting for the potential factors in the production frontier function was attributed to the differences in efficiency rather than in random error or "luck".

The factors affecting technical inefficiency can be explained by the significance of the estimated coefficients in the inefficiency model (equation (**2**)), as illustrated in **Table 3**. A negative sign indicates a decrease in technical inefficiency (implying positive effect or an increase in technical efficiency) and inversely positive sign implies negative effect. Given the estimated technical inefficiencies (**Table 3**), the negative coefficients for the vessel size dummies although not significant, suggested a positive effect of vessel size on technical efficiency. The negative coefficient for engine power means positive influence, while vessel age has negative influence on the technical efficiency of the gillnet fleet. As expected, owner-operated vessels were technically more likely to be efficient than those operated by hired skippers. Similarly, the more gillnet sheet contributors implied more technical efficiency was gained, thus the net-contributed variable had a positive effect on the vessel's technical efficiency. In contrast, the skipper's fishing experience and educational attainment had negative effects on technical efficiency, quite different from previous studies which found that the experience and educational level of the captain had (strong) positive influence on the vessel's efficiency (Kirkley *et al*., 1998; Squires and Kirkley, 1999).

Elasticity and Returns to Scale

Output elasticity is a useful way of characterizing the responsiveness of potential inputs to the changes in the output, since the coefficients of the translog stochastic production frontier (equation (**1**)) could not be interpreted in a straightforward way. Thus, the estimated values of the output elasticities were calculated at the point of the means of relevant data point defined in equation (**5**). The estimates of the output elasticities for the Da Nang gillnet fishery showed that the values for variable expenses, crew size and the amount of gear used was positive (expected finding) and less than 1. The output (revenue) elasticity of the variable costs was highest at 0.72, followed by the total length of the gillnet (0.71), and 0.14 for the labor variable. The estimated output elasticities did not vary with the variations in two input levels related to variable costs and the length of the gillnet net. In contrast, comparing with some earlier studies that also examined the output elasticities in fisheries, the estimated elasticity of gear length from this study was different from the estimation obtained from previous studies.

For example, Kompas *et al*. (2003) found that the length of net sheets had negative effect on the efficiency of Australia's prawn fishery. Similarly, Fousekis and Konaris (2003) also concluded that there was negative influence of the gear used on vessel efficiency in Greece. In such cases, the vessels could have used more gear than the optimal level. Inversely, in the case of Vietnam, the findings of the current study suggested that there is potential for further development of the offshore fishery (increasing fishing efforts) at least in the short run, which is consistent with some reports that the maximum sustainable yield for the offshore EEZ of Vietnam is about 1.1 million mt, but the offshore landing (excluding illegal, unreported and unregulated foreign fishing) was estimated at around 0.6 mt (FAO, 2005).

With regards to the elasticity associated to the number of crew members, the positive estimated value (0.14) is consistent with those from previous studies (Kirkley *et al.*, 1995; Pascoe and Robinson, 1998; Pascoe *et al.*, 2001). However, this estimated value is relatively small and for practical purposes, not an important parameter in the production frontier. This implied that the differences in technical efficiency between vessels resulted in the inconsiderable effect of the labor factor. Since the crew members received a share of the income from the fishing operations, only very few or no attempts to increase the number of crew members onboard the fishing vessels. The returns to scale for the gillnet fishery in Da Nang, computed as the sum of the output elasticities for all inputs was 1.57. The improved production from gillnet fishery can therefore be attributed to the increasing returns to scale based on the 2009 data, a reasonable result for static gear boats such as gillnetters. The empirical findings on increasing returns imply that an expansion of all three inputs (variable costs, labor, and the length of net gear uses) by 10% would increase the output by more than 15%, given constant stock abundance. The estimation of returns to scale for this fishery was consistent with those from previous research studies by Kirkley *et al.* (1995 and 1998), Pascoe and Robinson (1998), Pascoe *et al.*(2001), and Sharma and Leung (1999).

Marginal Productivities of Inputs

The estimated marginal contributions of each input to the gross revenue for the Da Nang gillnet fishery were derived from equation (**6**). The estimated value of the marginal product based on the output variable used in the production frontier analysis, was measured in terms of value instead of quantity. Thus, given the 2009 data on gillnet fishery production, the estimated marginal product of the variable costs, crew size, and the length of gillnet used, were 1.626, 1.223, and 0.204, respectively, showing substantial variation in the marginal productivities among the different inputs used, and suggesting that the contribution of each input to the vessel gross revenue was quite different.

Discussions

Factors Affecting the Efficiency and Fishing Process

As shown in the estimated inefficiency model, the two vessel size dummies for the sample gillnet fleet had positive influence on technical efficiency. Although the influence was not significant as the coefficient values were relatively small, the result indicated that the vessel size variables had minimally affected the efficiency, which could be because in the gillnet fishery, the use of larger vessel would allow the use of more or longer gear (gillnet sheets) in a wider range of conditions, and that the fishing effort of such vessels would be substantially higher, and consequently obtain proportionally higher levels of outputs (Pascoe and Mardle, 2003). Another possible reason could be the greater capacity of larger vessels to operate in remote and offshore fishing grounds having more resources for exploitation even during difficult weather conditions. Moreover, larger vessels are also capable of taking longer fishing trips with sufficient quantities of available provisions, ice, and fuel. However, larger vessels would consume more fuel per hour compared to the smaller ones, and hence could incur higher operational expenses per trip.

One interesting outcome from the inefficiency estimation was the statistically significant positive impact of engine power on vessel efficiency (at 5% confidence level), a quite surprising result because gillnets are considered as static gears, so the engine power of the gillnetters could not define the key factor influencing the level of fishing efficiencies compared with vessels operating mobile fishing gears (*i.e.* trawlers). The two rational explanations from such result could be: (1) greater engine power could extend the carrying capacity and allows more hauls to be done over a given period of time; and (2) with higher horse power the vessels could move faster between fishing grounds, reducing the time for traveling and consequently the cost of fuel consumed. Furthermore, the age of the vessel had negative effect on technical efficiency which was statistically significant at 10% level, consistent with the suggestion of Kim Anh *et al.* (2006) that the age of a vessel also affected the Khanh Hoa gillnet fishing vessel revenues. This is because older vessels could have encounter trouble due to the possible dilapidation of the materials used in constructing the vessel, hull design, size, winch equipment or engine. In addition, older vessels would require more frequent repairs and regular maintenance, and although their operating time may be reduced higher cost of operational expenses could be incurred. Therefore, as the age of a vessel increases, its efficiency decreases.

The estimated technical inefficiencies for the Da Nang-based gillnet vessels also showed that the vessel gross revenue increases with the number of net-contributors of the gillnet sheets used. The positive influence was statistically significant at 5% level or better, and could be explained from the efforts of the fishers who work harder for the vessel's operation as they have more responsibilities for their own benefit. This is considering the share of the benefits which are distributed to the members who have invested in equipping the vessel with the fishing gear commensurate with the amount of gear contributed and used in the fishing operations, thus significantly improving their earnings. Moreover, the labor force could be more stable during the fishing operations because as net-contributors they have to work onboard as part of the labor force contracted by the vessel owner. This characteristic is an important factor for the gillnet fishery since gillnetters usually require a minimum number of crew of at least seven members for each fishing operation. Some fishers have in fact left their current vessel owner to find jobs in new vessels, especially after finding out that some of their fishing trips had been less profitable, an inevitable practice since fishers need to find other opportunities that could provide sufficient financial support for their families as the main income of most fishers' families had been derived from fishing activities.

From the analysis of the inefficiency model, the positive sign for the fishing experience and formal education of the vessels' captains or skippers was contrary to expectations suggesting that an increase in the values of such variables could decrease the efficiency. In reality, the fishing experience of the vessel captains usually provides better information on locating the fishing grounds, weather patterns, current and tidal conditions, and the areas where the target species could be abundant. Thus, it should be recognized that the technical inefficiency of a vessel may be reduced by improving the literacy and cognitive skills of captains that enable them to adopt modern technical innovations. The estimated value of γ=0.78 suggested that the differences in technical efficiency across individual vessels are predominantly attributed to technical inefficiencies rather than to random effects.

Questions could arise as to the main determinants of vessel production without considering the effect of the skippers' skills (*i.e.* years of fishing experience and educational level), and as to why the offshore fishing program of Vietnam had been less effective. This could be explained from the insufficient information on offshore resources, inadequate understanding of the economic realities of offshore fleets, and unsuitability of technologies onboard fishing vessels. However, the positive estimated coefficients of the skippers' experience and educational level could be explained by the characteristics of gillnet fisheries being risky due to uncertainties especially in remote fishing grounds, severe weather conditions, and the variability of fishing targets which are highly migratory species (*i.e.* tuna, mackerel, swordfish). This implies that younger skippers with less experience or lower educational level could be more efficient than those who obtained more years experience in fishing or better educational attainment, as younger skippers are often more willing to change their fishing patterns in order to succeed and are always ready to cope with the difficulties or take more risks. Thus, the effects of longer experience or higher formal educational level of the captains on a vessel's efficiency, appears uncertain in this study. Moreover, fisheries in Vietnam like in many developing countries, is generally characterized by being small-scale, and the development of technologies seems constrained by such condition. Therefore, the cognitive skills required of the captains to adopt new technologies in fisheries may not play an important role in the developing countries compared with those in the developed fisheries. Another possible reason could be related to the reliability of the data collected as information on the socio-economic factors of fishers are normally difficult to obtain.

Another interesting result from this study is the positive effect of both owning and operating a vessel on the vessel's efficiency suggesting that owner-operated vessels tend to be more efficient than those operated by none-owner captains. This is consistent with that of previous research studies which suggested that incentives affect the level of technical efficiency. However, the owner-operator dummy variable was insignificant in explaining the differences of the technical inefficiency for the Da Nang gillnet fishery, which could be due to the fact that vessel owners may have good relationship with their hired captains who normally are their relatives. Thus, the vessel owners could increase the rate of return by recruiting their relatives to work as captains or by operating the vessels themselves.

In the frontier model, most of the coefficients estimated for the parameters were significant suggesting their significant influence on the production process. The positive coefficients of variable costs, crew size, and the length of the gillnet sheets, and the negative coefficients of their squared terms imply that the relationship between the vessel's gross revenue and the variable inputs is hump shaped (normal distribution). Thus, the vessel's gross revenue increases with variable costs, crew size, and the total length of the gillnet sheet, although at a decreasing rate. The output elasticities of the variable costs, labor and the total length of the net sheets were estimated at 0.72, 0.14 and 0.71, respectively (using equation (**5**)). The elasticity value less than 1.0 indicates that the output (revenue) is less sensitive to changes in the level of input or is 'inelastic'. In such a case, a one per cent increase in the level of inputs would lead to less than one percent increase in the level of outputs.

Therefore, a 10% increase in variable expenses, crew, and the length of net sheet used would lead to increase in the vessel's gross revenue by 7.20%, 1.40%, and 7.10%, respectively. The marginal production from gillnet fishery suggested that overall, fishers could increase their per-month gross revenue by more than 1.6 million VND by adding a variable cost of over 1.2 million VND for every crew member added. Similarly, an average gross revenue per month of gillnet fishery in Da Nang could be increased by more than 0.2 million VND by using longer gillnet sheets.

Technical Efficiency Relative to Input Use and Economic Performance

Technical efficiency and factor utilization

As shown in **Table 4**, vessels with mean technical efficiency lower than 0.89 than the higher technical efficiency, were those that had higher variable costs. The distribution of technical efficiency of the 28 (56%) gillnet vessels with estimated efficiency ranging from 0.60 to 0.79 had average variable costs ranging from 34.598 million VND to 37.342 million VND per month per vessel, while the operating expenses incurred by the 7 vessels with estimated technical efficiency was between 0.80 and 0.89 million VND. The 5 vessels with the lowest efficiency of 0.50 to 0.59 had the smallest variable costs at an average of 28.616 million VND. However, the mean technical efficiency of the 10 vessels that incurred the lower costs (41.268 million VND) was higher than 0.90 compared with those vessels with technical efficiency lower than 0.89 (between 0.80 and 0.89), which incurred higher costs (43.051 million VND).

This could be brought about by the number of days at sea, since some vessels could improve their performance by increasing the number of fishing days or by operating in a wider range of areas and uncertain conditions (*e.g.* fishing in remote fishing grounds), particularly during the main fishing season. Thus, the total costs incurred by these vessels would increase along with the number of days spent in fishing as more provisions, ice, and fuel would be used. However, some gillnet vessels could not spend more days at sea due to

Table 4. Average technical efficiency, input use, and economic performance, 2009

Efficiency	Variable Costs	Crew size	Net Length	Gross Revenue	Total Income	Average crew share
0.90-0.99 [10]	41.268	10.10	305.00	106.630	65.360	2.706
0.80-0.89 [7]	43.051	10.00	314.29	104.414	61.360	2.338
0.70-0.79 [15]	37.342	10.00	290.00	84.787	47.440	1.807
0.60-0.69 [13]	34.598	9.77	291.54	69.328	34.730	1.265
0.50-0.59 [5]	28.616	9.20	262.00	52.484	23.870	0.988

Note: All economic values are in million VND (US$1 = 16,900 VND); Crew size is the number of crew members; Net length is the number of net sheets used; Average crew shares denote the earnings per crew member per month. All measurements, except number of net sheets and crew size, are on per-month basis. Numbers in brackets indicate the number of observations.

their capacity in terms of vessel size and available onboard technologies. Furthermore, as the landings are unprocessed fish with simple catch preservation techniques used (catch is kept on ice), so the quality of fish catch could be reduced and in turn, receive lower price (earnings) if a vessel would take very long period per fishing trip.

The technical efficiency value for crew size was high at 0.80-0.89 for some vessels but lower at 0.70-0.79 for some although the vessels used the same number of crew that averaged at 10.00 persons per vessel. Vessels with the highest technical efficiency score (>0.90) used more labor with an average of 10.10 persons, while the technical efficiency levels were lowest for vessels with the least crew size at an average of 9.77 persons and 9.20 persons at 0.60 to 0.69 and 0.50 to 0.59, respectively. However, the trend of the relationship between technical efficiency and the level of crew size may not be very evident from the result of this study, and could not be reliable for policy implication purposes.

Technical efficiency and physical fixed inputs

The effects of the length of the gillnet sheets used on vessel efficiency (**Table 4**), were found similar with the impacts of the operating costs. In general, higher technical efficiency was found for gillnet vessels having longer gillnet sheets used with mean efficiency level lower than 0.89. The lowest efficiency range of 0.50-0.59 was found for vessels using the shortest average length of the net sheets (262.00 sheets). While the technical efficiency levels ranged from 0.80 to 0.89 for vessels which used maximum length of net sheets with an average length of about 15,714 meters (314.29 sheets), which could be due to the fact that in gillnet fisheries, the length of the net is the main physical fixed input representing the operational characteristics and generating the fishing effort. Thus, the vessel's efficiency could be increased by expanding the level of fishing effort (longer gillnet sheets) without taking into consideration the available fish stocks, consistent with Kim Anh *et al.* (2006) in the case of gillnet fishery in Khanh Hoa Province. In reality however, the vessels also could not always fish with a very long gillnet sheets as this would depend on the labor force available, the fishing process as time is limited, and other vessel characteristics. Thus, some gillnet vessels had high technical efficiency (above 0.90) even with slightly shorter gillnet length (15,250 meters or 305.00 sheets).

Technical efficiency and economic performance

Table 4 also shows that the estimated technical efficiency of the vessels could be compared with its economic performance as in the case of the sample gillnet fleet operating in Da Nang in 2009. The results showed that the average monthly income of the gillnet vessels varied from 23.870 million VND to 65.360 million VND with an average of 46.552 million VND. The average crew share per month per member per vessel also varied greatly from 0.988 million VND to 2.706 million VND with mean of 1.821 million VND, but higher than the average monthly share of a crew of longliners at 1.700 million VND (Long *et al.*, 2006). This implies that the owner and crew of an average gillnetter is not only capable of covering all the total operating expenses, but also have significant net returns for each month of fishing operation.

Thus, vessels with higher average technical efficiency per month also had higher average total income obtained after deducting the total variable costs per month per vessel, and had higher average share per crew member per month as well. The 10 vessels of the sample gillnet fishery with estimated technical efficiency between 0.90-0.99 had the highest average total income per vessel per month (65.360 million VND) and subsequently had the highest average share per crew member per month (2.706 million VND). While the average income and crew's share of the 5 vessels with the lowest estimated efficiency range of 0.50-0.59, were only 23.870 million VND per month per vessel and 0.988 million VND per month per member, respectively.

Policy Implications

Based on the result of the production frontier analysis for the sample gillnet vessels, majority have the potentials for improving their performance efficiency, although some vessels were found to be highly efficient operating closely

to the efficient frontier. In theory, the sample vessels on the average could have increased their 2009 per-month gross revenue of about more than 32% by operating at full technical efficiency, which is possible in the short-term and can be attained by increasing the level of their fishing efforts (*i.e.* employing longer gillnet sheets). However in the long-term, productivity gains may not be achieved since increased fishing effort would have negative influence on the resource stocks for the gillnet fisheries.

From a different perspective, fishers usually have little control over the prices of their catch since the middlemen normally control the output prices instead. Otherwise, the vessel's revenue could be improved by increasing the landings at a higher level of technical efficiency. Therefore, the potential still exists for increasing the vessel's revenue without increasing its landings by applying suitable fish-market systems and improving catch preservation methods onboard the vessels in order to get higher prices for the fish catch.

The estimates of the technical inefficiency could provide helpful information for improving the performance of the Da Nang-based gillnet vessels. For example, the vessel owners could increase their gross revenue by helping many crew members to contribute some gillnet sheets that would encourage them to work harder and take on more responsibilities for the vessel's operations. The technical efficiency of gillnet vessels could also increase if the owners operate lager vessels (*i.e.* higher engine power), given that everything else remains the same. Furthermore, the owners could also improve vessel efficiency by operating vessels by themselves or employing their relatives to work as a captains.

Conclusion

This research study which assessed the technical efficiency of gillnetters is based on the cross-sectional survey of costs and earnings of sampled Da Nang-based gillnet vessels operating in 2009. The average monthly revenue and inputs used as well as the technical and operational characteristics of the sample gillnetters were examined by applying a translog stochastic production frontier, and developing the model for relevant vessel- and operator-specific technical inefficiencies. The results from the frontier analysis clarified that the effects of technical inefficiencies were considerably significant in explaining the levels of and variation in the vessel's revenues having technical efficiency scores ranging from 0.55 to 0.98 with mean of 0.76. Some relevant vessel- and operator-specific variables such as engine power, vessel age, and number of gillnet contributors were found to be the key factors that influenced the technical efficiency. A vessel with bigger engine power tends to be more efficient than those with lesser engine capacities, while vessel's age also had strong negative influence on technical efficiency which confirmed that newer vessels seem to operate more efficiently than the older vessels. Gillnet vessels with more net contributors also attained relatively more efficient gains than those with less contributors.

The results also indicated that production from the gillnet fishery of Da Nang could be characterized by increasing "returns to scale". This implied that gillnetters in 2009 could have increased their average monthly gross revenue by more than 32% by operating at full technical efficiency. The estimates of the marginal productivities of inputs also suggested that it would be economical for gillnet vessels to operate with more variable costs incurred or longer gillnet sheets used in fishing and/or additional crew members employed.

Since this study relies on a cross-sectional survey (in 2009) of the sample gillnet fisheries, a single observation per vessel was examined. Thus, the efficiency analysis based on the given data could be subjected to problems which could make the results of the stochastic production frontier analysis less reliable. In addition, the choice of input measurements used in the estimated frontier models may also lead to certain bias in the estimated results. Other factors could also have limited the accuracy of the results, considering that the study used reliable data (a true record) of the total variable costs and cross revenue per month by each vessel collected from the fisher's logbook records, while various relevant information about the socio-economic factors of fishers were very difficult to obtain through face-to-face interviews because of relatively low literacy and less cognition of most fishers, and with limited time and financial constraints of the study. Nonetheless, the estimation of the production frontier in this study required strong distributional assumptions on the error components in order to separate the stochastic (statistical noise) and inefficiency effects in the model.

As a result, the reliability of the assumptions in the study could not be well documented. Therefore, further work is recommended to improve the gillnet efficiency estimation by collecting more data (panel data) with higher number of gillnet vessels in the sample. In addition, a suitable logbook should be designed by proper authorities and provided to all fishers, and that appropriate training on the use of the logbook should be conducted especially for the skippers. It is important that a good database should be developed that could be used for fisheries management and research purposes, because the present logbook systems which mainly focused on variable costs and total gross revenue data, need to be improved to include other important socio-economic information.

In other words, this study also could not exactly determine the effects of the availability of fish stocks, onboard technology including equipment used, and seasonal variation on the performance of the gillnet vessels because of insufficient information or inadequate observations in the sample. Allocative and scale efficiencies are also important issues that should be addressed in fisheries management. However, these topics have not been included in this study because of data constraints, making it necessary to undertake further studies in order to evaluate such aspects for the gillnet fisheries in Da Nang or in other areas, in due time.

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Consolidating Regional and Sub-regional Cooperation to Combat IUU Fishing in Southeast Asia: Initiative of SEAFDEC-Sida project

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Illegal, Unreported and Unregulated (IUU) fishing has been a growing serious concern in Southeast Asia considering that such practice continues to threaten the sustainability of the region's fishery resources. The Southeast Asian Fisheries Development Center (SEAFDEC) through its collaborative project with the Swedish International Development Cooperation Agency (Sida) has initiated a process of promoting regional arrangements through the conduct of regional and sub-regional meetings with the main objective of managing fishing capacity and to some extent the fishing effort, in order to combat IUU fishing in the region. This article reviews and summarizes the relevant activities under the SEAFDEC-Sida Project which mainly aim to promote sustainable fisheries management with the ultimate goal of combating IUU fishing in the Southeast Asian region.

During the past five to ten years, many attempts had been initiated to improve fisheries management with the fundamental objective of reducing IUU and destructive fishing. The seriousness of this concern has been increasingly expressed through discussions and recommendations in various meetings and consultations such as those of the SEAFDEC Council, the ASEAN Fisheries Consultative Forum (AFCF), the SEAFDEC Regional Advisory Committee (RAC) on Fisheries Management in Southeast Asia, the Regional Plan of Action (RPOA) to Combat IUU Fisheries, as well as during the Meetings of the ASEAN Heads of State especially at the launching of the roadmap for ASEAN Economic Community.

Within SEAFDEC, the collaborative SEAFDEC-Sida Project has been organizing consultations and discussions at the regional and sub-regional levels to find ways and means of managing fishing capacity in order to combat IUU fishing in the Southeast Asian region. At the regional level, the Expert Consultation on Managing Fishing Capacity to Combat IUU Fishing in Southeast Asia was organized in September 2010 to follow-up the recommendations raised by the ASEAN and SEAFDEC Member Countries on the need to look beyond the international agreements and conventions relevant to combating IUU fishing. The Consultation established the elements for sustainable fisheries management and for controlling fishing capacity and effort to combat IUU fishing in the region. The Consultation was a sequel to the regional SEAFDEC-Sida regional meetings on vessel registration, vessel record and inventory held in Phuket, Thailand in 2008 and in Satun, Thailand in 2009, respectively. Moreover, the Consultation also anchored its discussions on the outcomes of the sub-regional meetings such as the Meetings on the Gulf of Thailand in March 2008 and February 2009, and the Meeting of the Andaman Sea Sub-region in October 2009, which were also convened under the SEAFDEC-Sida Project.

Furthermore, in the review of the elements relevant to combating IUU fishing in the Southeast Asian region, the initiatives of the Asia-Pacific Fisheries Commission (APFIC) on the development of action plans in combating IUU fishing as well as those of the Indonesian-based Regional Plan of Action (RPOA) to Promote Responsible Fishing Practices Including Combating of IUU Fishing in the Region, have been taken into consideration. Various international instruments and conventions such as those by the International Maritime Organization (IMO) were also considered to ensure that the relevant activities in the countries of the region are dovetailed to the need to comply with the various regulations.

Elements Relevant to Combating IUU Fishing in Southeast Asia

From the outcomes of the consultations and discussions convened by SEAFDEC through the SEAFDEC-Sida Project, strong indications point towards the need to direct efforts in consolidating cooperation among the various stakeholders including the relevant sectors and institutions to further develop and improve the Monitoring, Control and Surveillance (MCS) mechanisms in the region. This further requires the need to improve port monitoring through enhanced vessel registration and licensing as well as vessel record and inventory, and improved MCS networking in the Southeast Asian region. Two important international requirements were focused during the review, namely: the legally binding *Agreement on Port State Measures to Prevent, Deter and Eliminate IUU Fishing*, and EC Regulation No 1005/2008 on *Establishing a Community System to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing.*

Vessel Registration and Licensing Procedures for Fishing

The aforementioned meetings in 2008 and 2009 came out with a summary of the systems for fishing vessel registration as well as the processes in providing licenses to fish in the countries in the region. The summary however, indicated a diverse picture of vessel registration, licensing systems and institutional responsibilities among the Southeast Asian countries. Classic examples cited were the cases of Malaysia, Philippines and Vietnam. In Malaysia for example, its Department of Fisheries (DOF Malaysia) is the sole authority for the registration of fishing vessels and for issuing the licenses to fish. Meanwhile, in most countries in the region for example in case of the Philippines, there are two or more institutions or agencies involved in the licensing system, one of which is the maritime industry and the other is the fisheries agency but with different mandate(s). In such scenario, the fisheries agency is in charge of the promotion of the control and sustainable fisheries management, while the maritime agency focuses their efforts on safety at sea standards and averting marine pollution from ships (including discarded fishing gear). Furthermore, in other countries the authority to register smaller vessels rests with the local government or local units as in the case of the Philippines, where the responsibility lies with the local government unit (LGU). In Vietnam, registration of small vessels is the responsibility of the local People's Committee with support from the country's fisheries agency.

Additionally, Malaysia, Philippines, and Vietnam have distinct registration and licensing systems based on the provisions under their respective laws (**Box 1**). Fishing vessels in Malaysia are registered and licensed based on their gross tonnage, the fishing gear utilized and the area or fishing zone being exploited. In Vietnam and the Philippines, fishing vessels are categorized, registered and provided licenses based on specific "features", *i.e.* gross tonnage for the Philippines, and horse power and length overall (LOA) for Vietnam.

Vessel Record and Inventory

During the aforementioned regional meetings, the respective registration (boats/fishing vessels) systems and the processes to provide licenses to fish (vessels, gear and fishers as applicable) were reviewed with the objective of addressing the issue on IUU fishing and management of fishing capacity. The legal framework that supports such systems and to put in effect the stringent regulatory measures were also suggested such as setting of CPUE by the Flag states, determining the MSY of the fishery resources by

Box 1. Registration and licensing systems in Malaysia, Philippines and Vietnam

Malaysia has a good example of a well organized system, where both the functions to register the fishing vessels and the process to issue licenses to fish are handled by the Department of Fisheries (DOF Malaysia). The country's Fisheries Act No. 317 of 1985 on the conservation, management, and development of maritime and estuarine fishing and fisheries in Malaysian waters stipulates that the Deputy General of DOF Malaysia is in charge of the supervision of fisheries matters particularly in the licensing or cancelation of licenses of fishing vessels, granting permits or refusal of foreign fishing vessels to fish in Malaysian waters. The DOF Malaysia is also mandated to undertake the procedures for registration of fishing vessels, including inspection of safety, seaworthiness and other standards that, in applicable parts, corresponding to the standards provided in the IMO Conventions. The duration in acquiring the registration and the license of the fishing boat may take only seven (7) days after the first survey has been made and provided that the applicants comply with all the documentation requirements. In addition, the validity of the fishing boat license is for a period of twelve months only.

In the **Philippines**, the well-defined process for registration and issuance of licenses to fish (for vessels, gear and people) is handled by different agencies, while the roles and responsibilities of the Local Government Units are also defined under RA 8550 (Philippine Fisheries Code 1998) under the provision on utilization, management, development, conservation and protection of the fishery resources. Fishing vessels registration are categorized into commercial fishing vessels (3 GT and above) and municipal fishing boats (3 GT and less). In addition, pursuant to EO No. 305 the Local Government Unit (LGU) has the authority to register and license municipal fishing boats upon appropriate clearances had been issued by the Philippine National Police-Maritime Group (PNP-MG). While licensing of commercial fishing vessels is assigned to the Bureau of Fisheries and Aquatic Resources (BFAR), registration, vessel and ownership certifications are the responsibilities of the country's Maritime Industry Authority (MARINA). RA 8550 also controls or limits the issuance of fishing vessel licenses based on MSY of the fishery resources, prescribes catch quotas, and establishes license fees that reflect resource rents in Philippine waters. All fishing boats are required licenses including carriers, light-boats, sonar boats and tankers. Fishers as well as fishing gears associated to fishing require licensing. It is also important to note that before issuing a license to fish to a vessel, the owner should provide a guarantee (affidavit) that the crew members are treated in accordance with Philippine Labor Laws. Although the Safety of Life at Sea (SOLAS) certificate and the Seafarers Identification and Record Book (SIRB) are required for fishers operating in the high seas, these are not necessary for fishers operating within the country's EEZ.

In **Vietnam**, the Ministry of Agriculture and Rural Development (MARD) is mandated to undertake both vessel registration and the process to issue licenses to fish, but it is still in the process of incorporating the IMO regulations and standards applicable to vessels smaller than those stipulated in the IMO Conventions. The DECREE No. 66/2005/ND-CO of MAY 19, 2009 provides the assurance of safety for people and ships engaged in fishing activities in the waters of Vietnam. Decision No. 494/2001 of JUNE 15, 2001 identified the MARD as the inspecting authority and the Provincial Department of Fisheries (or Department of Agriculture and Rural Development, if the DOF does not exist in the area). The fishing boats that require to be registered are those having 20 HP engines and those without engines but having waterlines of more than 15 meters, which should procure the proper license to fish (for boats and people). Moreover, smaller vessels and traditional/coastal fishers should acquire the necessary license, where the registration and licensing at the local/district level is organized through the People's Committee in the area with support from MARD.

the concerned countries, and stopping the flagged vessels with history of non-compliance to avoid flag hopping. Although the licensing systems vary among the countries depending on the geographical conditions, human resource development level, and political set-up, the meetings noted the fact that the countries in the region are in fact, exercising effective control over fishing vessels flying their flags in order to reduce the incidence of IUU fishing.

In addition, the meetings suggested that the countries can publicize their respective ports to which foreign flagged vessels may be permitted entry but such ports should have adequate capacity to conduct inspection for possible IUU fishing activities. It is therefore through consultations and enhanced collaboration with other countries, that the strengths and weaknesses of their respective registration and licensing systems could be determined, and building on their strengths, the weaknesses could be abated and ultimately solutions to address overcapacity and IUU fishing could be identified.

In managing the fishing capacity, it would be necessary to improve the frameworks for regional cooperation and all efforts to come up with approaches to manage the capacity. Nonetheless, strengthening national capacities should consider the fact that the information available at the moment still does not provide the accurate pictures of the number of vessels and people involved in fishing. In most cases, the information provided could be general underestimations of the real numbers of vessels and to some extent these are even gross underestimations only.

Therefore, in order to get a clearer picture of the size and structure of vessels available in the marine fisheries sector in the region such as large-scale and small-scale/traditional fishing vessels, the need to have a regional "vessel record and inventory" is deemed necessary. Such regional inventory and record could provide important inputs to the process and efforts of strengthening institutional capacity at national and regional levels, developing the frameworks (including MCS networks) for improved fisheries management, and strengthening regional cooperation and coordination in the Southeast Asian region.

Since there is a significant variation in the systems and distribution of institutional responsibilities among countries in the region when it comes to the aspects of fishing vessel registration, issuance of licenses to fish, and conduct of vessel record and inventory, a regional framework on fishing vessel registration, fishing licensing and related legal matters should be established and to work in parallel with the efficient tools for fisheries management with the ultimate goal of combating IUU fishing.

Furthermore, the need to have a "fishing vessel record" should take into consideration the inadequacy of reliable information on the numbers and types of fishing operations and the reported gross underestimation on the numbers and the people involved in fisheries. In moving forward along the efforts to manage fishing capacity and deter IUU fishing, it is necessary to compile reliable information on available fishing capacity in various segments of the fisheries sector. The variations in the quality of information and inadequate institutional capacity of the countries to establish information bases should be assessed as such factors are necessary in prioritizing the areas and countries in the region where institutional capacity building is necessary.

The difficulties in the implementation of a regional Fishing Vessel Record could be attributed to the different systems for fishing vessel registration and issuance of licenses to fish (vessels, gear and fishers) applied by the countries in the region. Furthermore, the fact that many countries divide the responsibilities among authorities/ministries with the mandate to implement the function of registration and licensing, respectively, aggravates the situation. Since authorities involved have their own defined purposes for implementing their respective tasks, such divided institutional responsibilities pose the problems in coordinating registration and licensing. This concern is further broadened as the tasks are often performed by different institutions under different ministries. Other problems identified include the different systems of data collection at different levels, *i.e.* national level, provincial level and/or local level and the way the information is analyzed and reported. In many instances, the data and information are not synchronized among the institutions at the local and central authorities, while the coverage and quality of the available information on fishing vessels show great variations. Another related problem is the obvious difficulty in providing the needed information in standardized formats. Thus, for a credible "vessel record and inventory", a standardized format should be established by harmonizing the existing information based on the formats

available in each country. As mentioned earlier, this could also help in identifying the countries and areas/levels where capacity building and institutional strengthening is most urgently needed.

In moving towards developing a vessel record and inventory, it is important to stress the distinct differences in the definitions and institutional responsibilities with regards to the key elements in the registration and licensing processes, such as vessel registration, fishing vessel registration, licenses to fish (boats, gear and people), large-scale fisheries, coastal fisheries (smaller scale). Since the countries, in the region had been encouraged through the regional, sub-regional and on-site events in 2008, 2009 and 2010, to explore ways and means of channeling relevant information to regional, sub-regional and global level partners/ institutions, such efforts could be enhanced to provide the basis for information sharing in support of the process to establish a regional cooperation on vessel records among the ASEAN and RPOA countries as well as for the development of MCS networks and other recommended actions.

Port Monitoring in Southeast Asia

Port monitoring is essential in the process of Monitoring, Controlling and Surveillance (MCS) of fisheries and fishing activities. In carrying out port monitoring activities, data on fishing activities, including vessels, catch, current fish stocks, trade flows and markets, among others, should be collected to be able to address and monitor the landings of "non-national vessels" or landings across boundaries by neighboring states and other landings across boundaries. Since the need to improve the efforts to combat IUU fishing in the region has been recognized, the region could take advantage of the requirements needed to implement the Agreement of Port State Measures or respond to the EC regulations for combating of IUU fishing, and other relevant international instruments, regulations and agreements. It should be noted that during various meetings such as those convened by the RPOA as well as the sub-regional meetings of the Gulf of Thailand and the Andaman Sea, the concerned countries suggested that priority should be given to the efforts of monitoring and recording all fish landings at ports and landing sites including efforts to indicate landing information by neighboring countries' vessels. The data collected and documented at the ports should be organized as it could give a picture of the vessels landing their products in specific ports including possible trans-shipments. With such information, fisheries managers would be able to make effective decisions regarding the management of the resources and on limiting the number and type of vessels could be made.

The development of port monitoring system ideally includes all ports and landing sites, covering the whole range of landing facilities at district and provincial levels. The information could be presented at the national level to have a picture of all landing activities in the countries at the sub-regions and for the whole Southeast Asian region. Such effort should be done not only with the view to meeting global demands but also preparing the countries for the increasing demands and requirements from importing countries such as those on traceability, catch documentation, landing documents, fishing vessel registration documents, documents for the license to fish and indications of the areas fished and other aspects.

The most important aspect of port monitoring is the control of the documents that form part of the required information to be checked during port inspections, where the documents are validated and certified by relevant body at the landing place to ensure that the catch has been fished in a legal

manner, and where inspection is based on the system of "chain of custody". Towards this objective, the SEAFDEC Council during its Meeting in April 2010 suggested that member countries should look not only towards exporting fisheries products outside the region but also to improve standards and traceability of exports and imports within and among the countries in the region.

The objectives of building the capacity for port monitoring in the region is basically to make the ports and landing sites as central nodes for combating IUU fishing. In this regard, there is a need to identify the ports and landing sites both public and private in each country, and from such information, the specific roles that such facilities perform, *i.e.* specific type of fishery, vessels, among others, the information and data available on catch landed in the respective ports or landing sites, should be documented and analyzed. The methods for the collection and distribution of data collected could be enhanced to allow for the sharing of information through the MCS Network or other means. Since there is a broad range of information and documents that would follow the catches landed, information that trace the products upon leaving the ports for processing or direct consumption, should also be compiled. Another important aspect that could improve port monitoring is to build the capacity of port inspectors. Such coordinated efforts are needed to establish the ways of developing effective port monitoring of landings from fishing and carrier vessels, and enhancing the cooperation between neighboring countries in the region in improving the effectiveness of the port monitoring/measurement systems not only to combat IUU fishing but also to support the trading of fish and fishery products within the region as well as to other regions.

Development of MCS Networks in Southeast Asia

In the wake of the entry into force of the legally binding Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, the implementation of a coordinated flag and port State control combined with measures to address illegal, unreported and unregulated (IUU) fishing activities is necessary. In this regard, various government agencies although not directly concerned with fisheries, *e.g.* environment authorities, national defense, coast guard, customs and immigration, should be involved in various dialogues on matters relevant to determining priorities, allocating resources and sharing of information for the development of the MCS[1] networks. It should be noted that the need to move towards the development of good MCS practices and MCS networks in the region has been expressed during the 2008 RPOA Workshop in Bali, Indonesia.

Monitoring has special role in the MCS systems, as it involves the collection, measurement, and analysis of fisheries and fishing activities including, but not limited to catches (species, composition, by-catch, discards at sea), fishing efforts, areas of operations, volumes and vessels landing, the harbors receiving the catch (including trans-shipment). Therefore, the information needed to assess the volumes and flow of products, and improve the quality of data collected could be compiled from the data on the port monitoring activities.

Sharing of information generated through the MCS networks are fundamental for the monitoring, control and surveillance of fisheries and fisheries-related activities among the countries in the region. The development of MCS Networks in the region could be one major tool to combat IUU fishing which in the long-term could positively reduce further damage on the fish stocks and marine ecosystems that

1 Monitoring (M) – includes the collection, measurement and analysis of fishing and related activities including but not limited to catch, species composition, fishing effort, by-catch, discard, areas of operations etc; in which this information is primary data to use for decision making.
Control (C) – involves the specific terms and conditions under which resources can be harvested, where such specifications are normally contained in national fisheries legislations and other arrangements that might be nationally, sub-regionally, or regionally agreed upon and that such legislations provide the basis for which fisheries arrangements, via MCS, are implemented.
Surveillance (S) – involves the checking and supervision of fishing and related activities to ensure that national legislations and terms, conditions of access, and management measures are observed.

otherwise might be inevitable. Torell *et al.* (2010) suggested that in order to combat illegal fishing in the region more effectively, there is a need to strengthen coordination on the development of MCS networks among relevant line agencies in each country as well as between the countries of the region.

Moreover, it has been recognized that in the development of MCS networks in the Southeast Asian region, and sub-regions, the countries' limitations with regards to national systems, legal arrangements and institutions involved result in difficulties to harmonize policies and legislation on fisheries. This is aggravated by their varying levels with regards to fisheries research capacities and data collection systems. Although the standards allowing for effective MCS are slightly different among countries in the region and sub-regions, the development of an institutional matrix on MCS could provide the information on responsible institutions, supporting legislations and relevant conventions/international agreements could help in identifying the specific institutions and their roles in support of the establishment of MCS networks for the Southeast Asian Region and sub-regions. It should be considered that by increasing control and implementation of effective surveillance by the coastal countries of the region, illegal fishing could be minimized while security and protection of coastal areas are assured, especially in the territorial and offshore (EEZ) waters through the implementation of more effective MCS system (Torell *et al.*, 2010). The development of MCS networks for the Southeast Asian region and sub-regions would assist the Member Countries in combating IUU fishing activities and in improving their capacities to implement more efficient monitoring, control and surveillance. Thus, development of better fisheries management mechanisms could be promoted in support of long-term sustainability of fisheries and aquatic resources in the region.

Way Forward

Based on the suggested scope of the regional approach and cooperation, and the measures that are most suitable for the region considering the need to move beyond the international agreements and requirements, SEAFDEC through the SEAFDEC-Sida collaborative project would continue providing capacity building activities to enhance the capabilities of the countries in promoting sustainable fisheries management and eventually in combating IUU fishing. In the process, complying with the EC regulations would be promoted in order to improve fisheries management in the region. However, considering the difficulty encountered by the region's artisanal and small-scale fisheries to comply with the EC regulations, fishing vessels would be classified to fit with the EU classification and the procedures required in the corresponding EC regulations would be defined in order that the countries' fisheries would be able to comply with the EC regulations. In this regard, the capacity of the countries in all aspects especially in terms of improving fisheries management would be strengthened while information sharing should be further improved especially in the aspects of classifications, procedures among others, relevant to the small-scale fisheries in the region. Moreover, a review of the existing formats used in monitoring fishing activities in the region should be conducted for possible harmonization. Overall, the best way for the countries to adapt to the changes in the international regulations would be to learn from the experiences of other countries, which could be achieved through enhanced sharing of information and improved capacity building. In this regard, regional guidelines could be developed considering the common characteristics of fisheries in the region, which could include a tracking system that could be used to monitor any IUU fishing activities. This calls for the conduct of a case study involving some countries, the results of which could be used as basis for the development of the said regional guidelines for combating IUU fishing in the region.

In the development of such guidelines, reference should be made to other existing guidelines taking into consideration the unique characteristics of fisheries in the Southeast Asian region, and that the respective national laws and other relevant structures of the respective countries should also be considered. Furthermore, the establishment of a regional standard for combating IUU fishing in the region is necessary as such standard could be used as criteria or understanding of whatever requirements and agreements that would emerge in the future, while the established regional guidelines could be used by the countries during the process of negotiations for compliance.

Nonetheless, in establishing the criteria to be included in the guidelines, more dialogues should be convened at the

sub-regional levels. One of the criteria could be on the need to improve standards in the region corresponding to the international standards such as those imposed by the EU which should be complied with when exporting fishery products to the EU countries. Thus, in order to come up with such common standard for the Southeast Asian region, the sub-regional mechanism of the region could be tapped for the review and development of criteria that would go into the guidelines. The development of the guidelines should focus on the ways of combating IUU fishing in marine as well as in inland fisheries, and that the guidelines should not duplicate the efforts specified under the RPOA.

Considering that the countries have different laws and regulations, legal officers of the respective countries should be involved in the development processes, while the concerns from various points of view should be looked into which could include the technical aspects as well. Since the process involves some legal matters, the first step could be the development of draft legislations for the countries to examine and harmonize the draft model legislations for inclusion in the regional guidelines. In this connection, a program should be developed to promote capacity building of all stakeholders including technical persons, scientists, policy makers, legal officers, economists, and the like. Therefore, there is a need to further strengthen coordination and cooperation in order to enhance the capacity of the stakeholders, and mobilize all existing initiatives such as those of the ASEAN Fisheries Consultative Forum (AFCF) and ASEAN-SEAFDEC Fisheries Consultative Group (FCG) in strengthening such regional cooperation. Moreover, participatory approach should be integrated in the policy-making processes by allowing the stakeholders including fishers to take part in drafting the relevant regulations as well as in the formulation of the guidelines. This would make scaling down of any regulations at local level much easier. All efforts should be pooled together and the best practices that work at the local level compiled for dissemination to the countries and where the countries could learn from such lessons and adapt the most appropriate approach as necessary.

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CALENDAR OF EVENTS

Date	Venue	Title	Organizer
		2011	
18-19 January	Phuket, Thailand	BOBLME Joint Stakeholders Workshop	BOBLME
18-20 January	Bangkok, Thailand	Regional Technical Consultation on International Fisheries Related Issues	SEAFDEC Secretariat
31 Jan-4 Feb	Rome, Italy	29th Session of FAO Committee on Fisheries	FAO
7-9 February	Rome, Italy	3rd Meeting of Regional Fisheries Body Secretariats Network	FAO
8-10 February	Brunei Darussalam	The 8th Meeting of the ASEAN Experts Group on the Convention on International Trade in Endangered Species of Wild Fauna And Flora (AEG-CITES)	ASEAN
21-23 February	Bangkok, Thailand	ASEAN-SEAFDEC Consultation on Drafting the Resolution and Plan of Action on Sustainable Fisheries for Food Security in the ASEAN Region	ASEAN-SEAFDEC
3-5 March	Myanmar	On-site Training/Workshop on the Integration of Fisheries and Habitat Management and the Management of Fishing Capacity in Myanmar	SEAFDEC/Sida
17-25 March	Sri Lanka, Colombo	15th Session of Indian Ocean Tuna Commission (IOTC)	IOTC
23-24 March	Satun, Thailand	On-site Training/Workshop on the Integration of Fisheries and Habitat Management and the Management of Fishing Capacity in Satun, Thailand	SEAFDEC/Sida
4-8 April	Malacca, Malaysia	43rd Meeting of SEAFDEC Council	SEAFDEC
26-27 April	Singapore	Project Inception and Planning Meeting: Utilization of Freshwater Fish for Value-added Products	MFRD
April (tentative)	Cambodia	19th Meeting of ASEAN Sectoral Working Group on Fisheries (ASWGFi)	ASEAN
April (tentative)	Cambodia	3rd Meeting of the ASEAN Fisheries Consultative Forum (AFCF)	ASEAN
2-6 May	Rome, Italy	Technical Consultation on Flag State Performance	FAO
19-21 May	Morocco	2011 International Conference on Climate Change, Agri-Food, Fisheries, and Ecosystems	NRCS-GTZ
May (tentative)	Siem Reap, Cambodia	3rd Meeting of the Gulf of Thailand sub-region	SEAFDEC/Sida
6-10 June	Natal, Brazil	World Aquaculture 2011	WAS
13-17 June	Bangkok, Thailand	ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment"	ASEAN, SEAFDEC, DOF Thailand
June (tentative)	Ranong, Thailand	On-site Training/Workshop on the Integration of Fisheries and Habitat Management and the Management of Fishing Capacity in Ranong, Thailand	SEAFDEC/Sida
June (tentative)	To be confirmed	Sub-regional Meeting between Indonesia, Malaysia and Thailand	SEAFDEC/Sida
July (tentative)	To be confirmed	Sub-regional Meeting between Myanmar and Thailand	SEAFDEC/Sida
October (tentative)	Malaysia	Second Andaman Sea Meeting	SEAFDEC/Sida
August (tentative)	Thailand	2nd ASEAN Maritime Forum.	ASEAN
1-8 September	Seattle, USA	Annual Meeting of the American Fisheries Society (AFS)	AFS
5-7 December	Putrajaya, Malaysia	2011 International Conference on Sustainable Development	OIDA

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


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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 Brunei Darussalam.