FISH for the PEOPLE

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Ecosystem Approach to Fisheries:
Perspectives of the Southeast Asian Countries

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Editorial

Several concepts related to ecosystem management have been promoted since the 60s including those that aim to boost the sustainable management of fisheries. One of such schemes is the Ecosystem Approach to Fisheries (EAF) which had been adopted during the FAO Technical Consultation on Ecosystem-based Fisheries Management in 2002 in Reykjavik, Iceland. Although EAF could be generally considered as a new concept, the Southeast Asian countries have been implementing similar initiatives since the late 90s in accordance with the 1995 FAO Code of Conduct for Responsible Fisheries. These endeavors have been anchored in the broad principles of and approaches for effective and responsible fisheries management, many of which are closely related to the concepts of EAF.

The need to maintain the productivity of the ecosystems for present and future generations and ensure that the ecosystem contributes to human well-being through sufficient supply of goods and services, and adequate livelihood opportunities, has been well recognized by the Southeast Asian countries. The countries have therefore been exerting efforts to enhance the contribution of fisheries to food security and people's livelihoods. It is in cognizant of such need that the ASEAN and SEAFDEC organized the ASEAN-SEAFDEC Conference in 2011 which adopted the Resolution and Plan of Action on Sustainable Fisheries for the ASEAN Region Towards 2020, to serve as policy framework for the sustainable development of fisheries and food security in the region.

Many countries in Southeast Asia also recognize that aquatic fishery resources although renewable, are insufficient to satisfy the potential increasing demand for food fish while the quantities that could be extracted without jeopardizing the renewal capacity are limited. In this respect, the countries are addressing the issue of excess fishing capacity through their respective national initiatives of registering all fishing vessels and licensing all fishing operations, as well as replacing the open access with limited access regimes. A regional initiative is also being undertaken to develop the regional record of fishing vessels as means of visualizing a better picture of the level of fishing capacity in the region, which could also serve as tool for combating Illegal, Unreported and Unregulated (IUU) fishing in the waters of Southeast Asia.

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Admittedly, the countries have considered IUU fishing as a threat that undermines efforts to conserve and manage fish stocks in both marine and inland capture fisheries, especially spawning negative impacts on the economic, social and ecological aspects of fisheries affecting food security. Therefore, initiatives have been undertaken by the Southeast Asian countries to combat IUU fishing through the promotion of enhanced Monitoring, Control and Surveillance (MCS) systems, vessels registration and fisheries licensing, and port monitoring and control, as well as strengthening the regional collaboration for combating IUU fishing in Southeast Asia.

Considering the current situation in fisheries, the countries have been promoting the sustainable management of fishing operations that aim to minimize their impacts on the structure, productivity, function, and biological diversity of the ecosystems, and also ensure that fishing operations are conducted in a manner that does not threaten by-catch species. Moreover, attempts are also being made to avoid mortalities of or injuries to endangered, threatened or protected species during fishing operations, and in general, minimize the impacts of fishing operations on the ecosystems. These are among the major endeavors put forward by the Member Countries with technical assistance from SEAFDEC, in order to boost the realization of the concepts of ecosystems approach to fisheries in the Southeast Asian region.

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

Enhancing Community-based Management through Set-net Fisheries: A Regional Fishery Collaborative Venture

Aussanee Munprasit, Taweekiet Amornpiyakrit, Weerasak Yingyuad, and *Takafumi Arimoto*

Although the Japanese-type set-net was first introduced to many countries in Southeast Asia in the late 1990s, such attempts did not deliver good results not only because of technical and management concerns, but also due to the abundance of the region's coastal fishery resources at that time and the belief of many fishers that the coastal fishery resources are infinite. However, with the advent of findings that the region's fishery resources are dwindling, fishers and other stakeholders started to recognize the importance of sustainable fishing practices that reduce pressure on the resources. Therefore, the effort of SEAFDEC to modify the set-net fishing technology which was developed in Japan, to conform to the complexity and specificity of the region's fisheries, and its re-introduction in the countries of the region starting with some pilot project sites in Thailand, was a much welcome strategy for the sustainable development of coastal fisheries in the region. One of the most significant impacts of the process of adapting the set-net technology in the region is the enhanced capacity of fishers in community-based coastal fisheries management.

Recognizing that efficient fishing gear is an important tool in coastal fisheries management, the Training Department of the Southeast Asian Fisheries Development Center (SEAFDEC/TD) initiated a two-year project to re-introduce the set-net fishing technology operations in Southeast Asia from 2003 to 2005 (Munprasit, 2010a). Thus, the project on Sustainable Coastal Fisheries Management in Southeast Asia was carried out starting with a case study in Thailand (SEAFDEC/TD, 2005) in 2003 with funding support from the Japanese Trust Fund and comprehensive technical support from Himi City, Japan under the JICA Grass-root Partnership Program and the Tokyo University of Marine Science and Technology (TUMSAT) under the Core University Program of the Japan Society for the Promotion of Science (JSPS) as well as from the National Research Council of Thailand (NRCT).

The set-net technology had been re-introduced in the Southeast Asian countries as means of improving the catch of fishers not only in terms of quantity but most of all in the quality of the catch, in the midst of the region's declining coastal fishery resources. The technology also paved the way for enhancing the capacity of fishers in community-based management for sustainable coastal fisheries development and management. The improved set-net fishing technology which had been successfully verified in Thailand could be adapted in Southeast Asian

countries with similar geographic characteristics and conditions. Moreover, the re-introduction of the set-net technology which is environment-friendly could also serve as an avenue for raising the awareness of fishers on the role of set-net technology in the conservation of coastal fishery resources for the benefit of future generations.

Set-net Pilot Project Sites in Thailand

Implementation of the modified set-net technology was launched in 2003 in the coastal waters of Mae Rumpheung (latitude 12°34.5'N to 12°36.0'N and longitude 101°20.5'E to 101°21.5'E) in Rayong Province in the Gulf of Thailand. The physical geographic characteristics of the fishing ground which is 3-5 km away from shore line (**Fig. 1**), include a 12-mile (21-km) stretch of beach area, flat-sandy bottom with few spot-rocks on the sea floor, depth of 11-14 m with generally long shore current of 0-35 cm/sec in the northwest and southeast (300°-120°) directions, mixed tide area with 2 m tidal range, sea water temperature between 26°C and 30°C, salinity ranging from 29 to 30 ppt, and sea water transparency at 3-11 m.

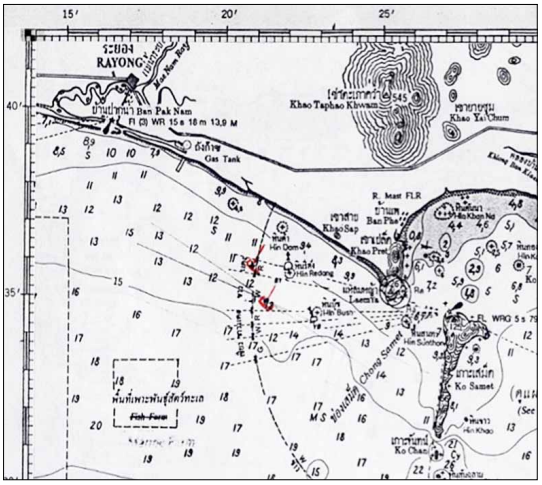

Fig. 1. Set-net project site in Rayong Province, Thailand

Generally, the sea condition of the fishing ground is fanned by the northeast and southwest wind with 0-1 meter wave height during the fishing season from October to April (Laongmanee *et al*., 2005; Booncherm, 2005). The flat-sandy bottom and long-shore coastal waters of Mae Rumpheung made it a very suitable site for the set-net project. The waters of Mae Rumpheung used to also serve as fishing ground for crab bottom gill net, mackerel gill net, squid trap, squid jigging, fish hand line, anchovy purse seine, light fishing for squid and anchovy. Bottom pair trawl had also been operating in these waters oftentimes causing damages to the fishing gear of local small-scale fishers (Manajit, 2005).

During the period from 1940s to 1970s, bamboo stake trap was the most popular traditional fishing gear in Thailand targeting the coastal pelagic species notably the Indo-Pacific mackerel, *Rastrelliger neglectus* (DOF Thailand, 1969). Made of bamboo and parts of palm trees, bamboo stake is a passive and stationary fishing gear which is fixed on the sea bed. After the Second World War in 1949 and when people from Southeast Asia established contacts with Japan, the set-net fishing technology which was developed in Japan was introduced to Thailand for the first time. This 1949 set-net fishing technology made use of the Masu-ami, and later in 1953, Otoshi-ami was used. The introduction of the set-net fishing technology in Thailand was made possible through the efforts of *Commander Sawang Chareonpol*, former Director-General of the Department of Fisheries of Thailand after he graduated from Hokkaido University in Japan (DOF Thailand, 1969). Unfortunately, the technology was not embraced by the fishers at that time may be because fish was still plentiful in the waters of Thailand that even with the use of simple fishing gear and methods, fishers were able to derive bountiful harvests from the coastal fishery resources.

In the 1960s, bottom trawl operation expanded throughout the Gulf of Thailand within a short period of time (DOF Thailand, 1969). Since the bamboo stake trap could not compete with the trawls, its existence from the coastal waters of Thailand was reduced year by year. Thus, bamboo stake trap operations remained only with limited numbers in Trad Province and in the inner Gulf of Thailand, with most operations focusing on the green mussels as main products.

Nowadays, when most of the coastal waters of Thailand had been opened for all kinds of gear that operate legally or illegally, the fishery resources especially in the Gulf of Thailand had been reported to have sharply declined. Therefore, when the latest set-net technology was promoted during the International Set Net Fishing Summit in Himi City, Japan in 2002, it was envisioned that such technology could be re-introduced to Thailand as means of addressing the degrading fishery resources in the Gulf of Thailand. Thus, two units of Otoshi-ami were installed in the Rayong set-net project site while another set was introduced in southern Thailand in 2009.

The shallow water set-net or Choko-ami which had been tried in 1983 at the coastal waters of Samet Island, Rayong Province, was tried again in 2009 in the coastal waters of nearby Sriracha in Chonburi Province to study the near-shore resources and conditions of fishing grounds that are 5 m in depth and 1,000 m away from the shoreline. Choko-ami has been considered as one type of set-net which could be promoted to small-scale fishers under the concept of community-based fisheries management, as it has less impact to the environment and resources.

In October 2010, a similar project was introduced by the Department of Fisheries of Thailand to the eastern coast of the southern part of Thailand in Bangsaphan, Prachuap Khirikhan Province. After obtaining satisfactory results from the set-net technology, the fishers considered it as the most suitable fishing gear for the coastal waters of Bangsaphan, that prompted them to develop their own management scheme for community-based set-net fisheries (**Fig. 2**).

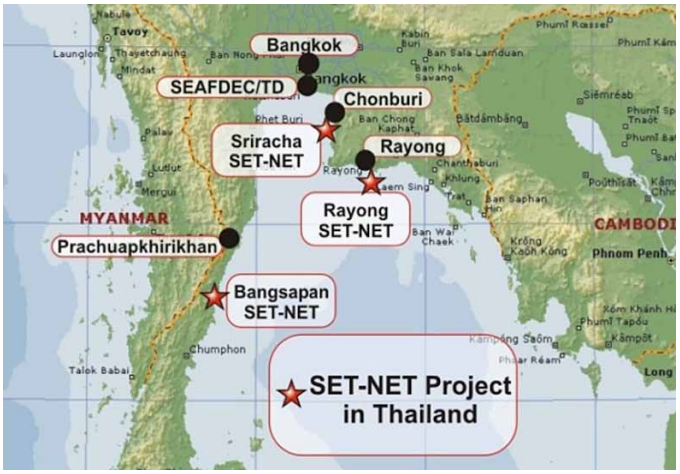

Fig. 2. Set-net pilot project sites in Thailand

The introduction of the Japanese-type of set-net to the local fishers in communities through enhanced collaborative efforts, mainly aims to provide a form of social barrier that could stop or reduce pressures from active gears' operations in the communities' coastal waters. Consistently, the awareness of fishers on the need to rehabilitate the coastal environments and resources is enhanced as part of their responsibilities resulting in reduced pressure on the fishery resources.

Redesigning the Set-net for Southeast Asian Waters

The original set-net developed in Japan was modified and developed to suit the fishing ground conditions of the region through the collaborative research efforts of experts from Himi City and TUMSAT as well as researchers from SEAFDEC/TD. In the modification of the deep and narrow chamber entrance, pulling ropes have been installed at six bottom corners of the chamber and two sub-leader nets on both sides of the main leader net. This was based on the original design of Otoshi-ami and the technical manual for set-net fishing considered during the International Set Net Fishing Summit in Himi City in November 2002 (Inoue *et al*., 2002).

The first design of the Rayong set-net consisted of 45 m wide and 140 m long playground and chamber net with 250 m main leader net. The entrance chamber net was 5 m deep and 14 m wide for the outer entrance and 3x5 m for the inner net. Most parts of the gear were fixed on the sea bed by 75 iron anchors (**Fig. 3**). The mesh size of the net at each parts were 25 mm, 85 mm, 185 mm and 320 mm at the chamber, playground, sub-leader and main leader net, respectively. Net materials consisted of nylon at the chamber and polyethylene at the playground and leader net, while the ropes are polypropylene (Munprasit *et al*., 2005). After its first trial year however, the catch obtained from the set-net was very poor at an average of only 178 kg per operation, which was mainly due to technical problems during the set-net operations such as loosened frame rope which later sank, leader net became entangled with the iron anchors, and fish were unable to swim easily into the catching chamber.

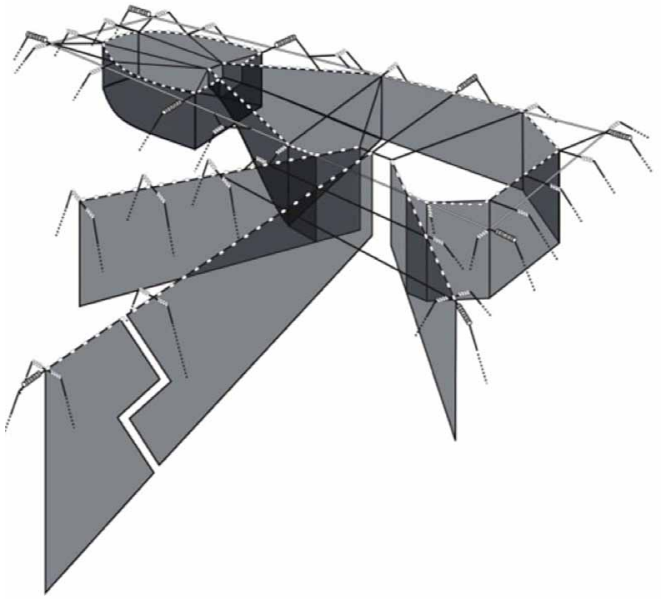

Fig. 3. Otoshi-ami type of set-net used in Rayong, Thailand

In order to address such constraints, the set-net gear was modified and improved for the second year experiment in 2004, with three main parts adjusted: (1) the slender shape of the body was modified to reduce current resistance, *i.e.* 30x155x250 m body net size was considered to be more appropriate; (2) all iron anchors were replaced with 1000 pieces of 60-kg sand bags; and (3) entrance of the chamber net was made deeper and narrower, *i.e.* 0.7 m wide and 9.0 m deep for the inner entrance, and 8.0 m wide and 11.0 m deep for the outer chamber entrance. The outer slope nets of the playground were also made deeper and shorter in order that the slope net of the improved gear was 11 m deep and 15 m long (1/10 at 13 m sea depth). The improved design was found successful since the average catch increased to 255 kg per operation. In the improved design, most parts of the gear were completely fixed on the sea bottom by 1000 pieces of 60-kg sand bags.

In 2005-2006, the Rayong set-net fishing operation was affected by the *El Niño* phenomenon and storms in the

South China Sea that changed the current conditions of the coastal waters of Rayong Province with irregular patterns in terms of direction and speed. This also affected the shape of the chamber net including the entrance, resulting in significant decrease of the catch. In order to improve the situation, 6 bottom pulling ropes of the chamber corners were added (SEAFDEC/TD, 2008). Thus, the latest design of the Otoshi-ami of the Rayong set-net project consisted of 4 parts, namely: chamber, playground, sub-leader net and main leader net, which could also be separated into two main components, *i.e.* the frame rope and net. The frame rope consists of 3 lines of 30-mm diameter polypropylene rope attached with rugby-shape plastic buoy, Ø: 350 mm and L: 400 mm at 2.5 m interval (**Fig. 4**).

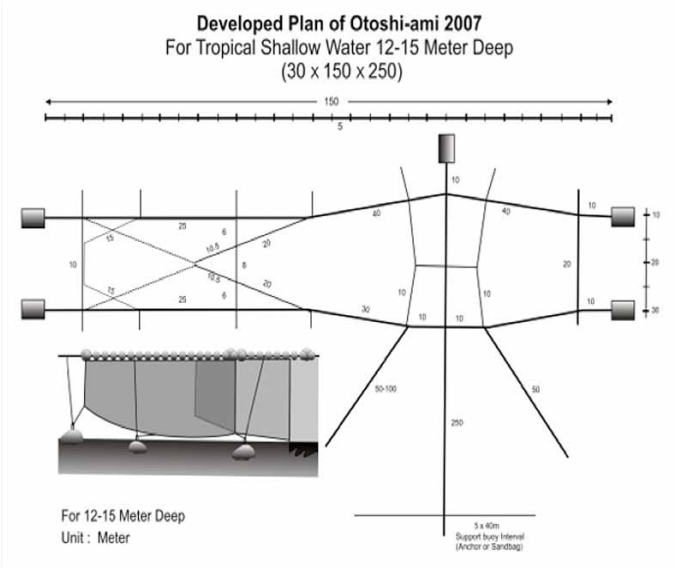

Fig. 4. Improved design of the Rayong set-net

Each end of the main frame ropes is fixed on the sea bottom by 2x40 pieces of 60-kg sand bags using a sand bag rope and a main buoy (200-liter plastic drum-shaped containers). Construction of the net such as the chamber, playground, sub-leader and main leader nets requires suspending the main frame rope which has a fixed shape from the sea surface. Made of 25-mm mesh size nylon net (PA 210 d/$_{24}$) with 40x20 m dimension, the chamber net is box-shaped with inner-slope entrance. The playground is rectangular and made of 85 mm mesh size polyethylene net (PE 380 d/$_{24}$) and 110x18 m, which is put into shape by a 15 m outer slope connected to the chamber entrance. The playground and chamber parts are set along the direction of the water current.

The main leader net is rectangular and made of 320 mm mesh size polyethylene net (PE 700 d/$_{80}$), 250x18 m, which is placed inside the playground towards the direction of the shore and normally perpendicular with the direction of the current, while the 50 m and 100 m sub-leader nets are made of 185 mm mesh size polyethylene (PE 700 d/$_{18}$), 50x18 m and 100x18 m, respectively and set on both sides of the main leader at the entrance of the playground. Over all, the Rayong set-net size is 30x150x250 m which is suitable for fishing grounds 10-15 m in depth (Munprasit *et al*., 2008). The bottom corner pulling rope of the chamber and sub-leader nets are specially designed for shallow waters with (plain) flat-bottom topography like the coastal waters of Rayong Province. The estimated cost of the local materials used in the construction was about 500,000 Baht for one set, while the cost of labor was minimized through the collaborative efforts of fishers. In this case, 45 fishers were involved, 16 of whom worked alternately within one day on volunteer-labor basis, making it possible for the construction to be completed within two months (Munprasit *et al*., 2008). Improvements in the design of the modified set-net resulted in increased catch in 2010, with production of 317 kg per operation. Thus, the fishers were able to earn an average income of about 11,119 Baht while the average operating cost per trip was 5,000 Baht (EMDEC/DOF, 2008). Moreover, the fishes caught were commercially- and economically-important commanding relatively high price in local markets with high demand for very fresh fish.

Fishing Operations and Maintenance

Since it is crucial that the set-net installation process must be well planned, preparation of all parts and materials needed should be completed in advance before proceeding to the sea. Site survey of the prospective sea area must also be done prior to the planned installation which is usually undertaken step-by-step until completion. The site survey should be carried out with more details, with the prospective installation site identified by using 5-6 mark buoys fixed on the surface to serve as guide mark for the installation. At least 2-3 boats with corresponding designated functions and 10-15 fishers are required for the installation, with the boats serving as guide, signal and carrier boats.

At the start of the installation, 2 main frame ropes are set along the direction of the water current based on the position of the guide mark buoys and the third main frame rope is set towards the direction of the shore or perpendicular with the direction of the current as indicated by the mark guide buoys. The Otoshi-ami is then fixed together with primary supporting sand bags and all net parts are hung on the main frame rope starting with the playground, main leader and sub-leader nets, and chamber nets. All parts of the gear are adjusted and fixed into the designed Otoshi-ami complete-shape using secondary supporting sand bags, and three mark buoys with light signal fixed at the end of the

playground, chamber and main leader as shown in **Fig. 4**. The installation process could take two weeks to complete (Munprasit *et al*., 2005).

Set-net fishing operation is usually conducted by 14-16 fishers using four local small-scale fishing boats (6-8 m in length with 18-60 Hp inboard engines (Manajit and Petchkham, 2005)). Two boats function as net operating boats, one for hanging the net entrance and the last for bunt or catch support. Each boat carries 1 or 2 pieces of 200-liter ice boxes to preserve the catch onboard. Fishing operation is carried out in the morning at around 0600-0800 hours, with fishers leaving shore at 0530 hours as it could take at least 30 minutes to sail for the set-net site and be able to arrive at around 0600 hrs. Actual fishing operation which takes about 30-60 minutes depending on the abundance of fish, starts by closing the entrance, releasing the bottom chamber corner pulling rope, washing the inner entrance net panel, hauling the net chamber, transferring the catch from the bunt to the ice box, then resetting all parts back to their regular shape. In the case of the Rayong set-net fishing, since it takes about 30 minutes to return back to shore, sometimes the fishers also take another 15-30 minutes for maintenance, so in a day, the fishing operation takes about 3-4 hours at sea, and marketing at shore by 0900 to 1000 hrs. Almost all the operational steps are done manually through the cooperative effort of the members of fisher groups where at least 10 fishers are involved in each fishing operation.

Maintenance is considered an important factor as it gives much benefit from set-net fishing. With regular maintenance big catch could be expected from the set-net fishing while handling of the gear could become much easier. In the Rayong set-net fishing gear, maintenance could be classified into 3 categories, namely: general, periodic and annual maintenance. General maintenance is a simple activity during the fishing day such as net mending at sea, adjusting the loose frame ropes, removing all entangled objects, and over all observation of the condition of the gear through ocular inspection. Periodic maintenance involves changing the net parts, especially the catching chamber which should be changed every 2-3 weeks, the playground every 2 months and the leader net every 3 months. The used nets are cleaned and net mending is done onshore. Annual maintenance is usually done at the end of the seven-month fishing season from October to April, up to the monsoon period. Therefore, before the southwest monsoon starts in May, the net part and frame rope should be retrieved and brought to shore, to be cleaned and repaired during the monsoon season from May to September. The set-net gear could then be re-installed at the same place on the last week of September every year. Based on a 9-year experience in set-net fishing, the volume of catch was found to be related to the maintenance of the net, where better catch had been obtained after each maintenance period (Munprasit *et al*., 2008).

Gear Improvement

From the lessons learned through the Rayong set-net fishing operations in nine years, the gear and fishing techniques could be modified and improved considering the problems encountered during previous operations. These include:

1) Slimmer shape of body part, playground and chamber, *i.e.* from 45 m to 30 m wide, to reduce resistance with the water current of 35 cm/sec at maximum speed (Laongmanee *et al*., 2005).
2) Deeper and narrower chamber entrance and slope net, *i.e.* 0.7 m wide, 9 m deep at the inner end, and 8 m wide and 11 m deep at the outer entrance while the length of the slope net of the playground shortened from 30 m to 15 m. The ratio of the chamber entrance should be 5/6 of the sea depth to make it easy for the fish that comprises not only pelagic but also demersal species, to get into the chamber but making it difficult for fish to escape (**Fig. 5**).

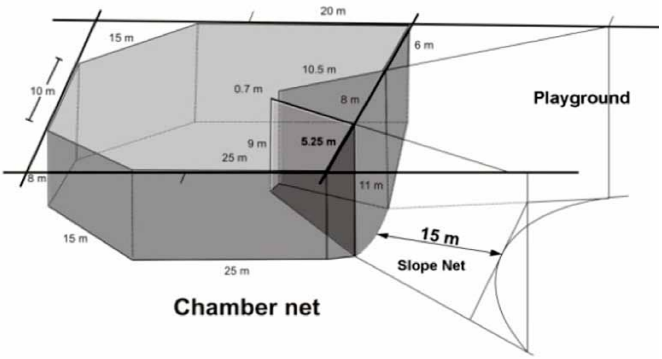

Fig. 5. Modified chamber of the set-net

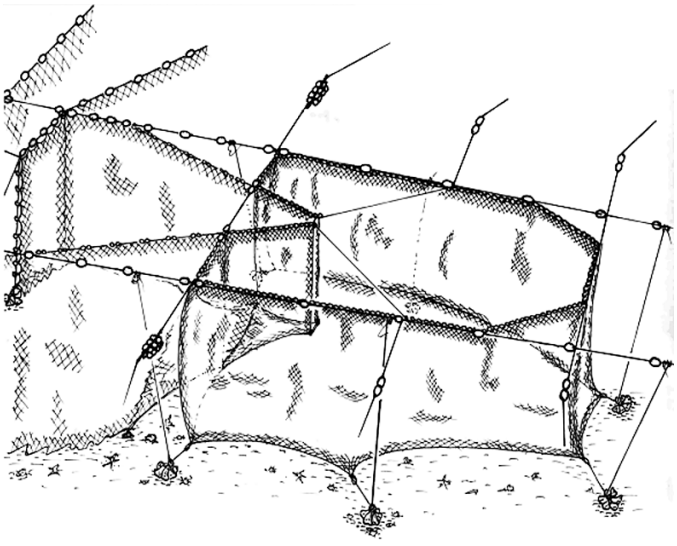

Fig. 6. Bottom pulling rope of chamber corners

3) Replacing all iron anchors with sand bag mooring system to avoid loosening of the frame rope and entangling of the anchors with the leader net.
4) Using 4-6 bottom pulling ropes attached to the bottom corners of the chamber net (**Fig. 6**) to maintain the net's regular shape during fluctuating current patterns which usually occur from January to March (Munprasit *et al*., 2009).
5) Using flat fiber glass boat for the fishing operations and for the main activities of the set-net fishing to optimize resource use, *e.g.* the 2.5x10.5 m FRP boat from Himi City proved to be the most convenient type for the manual operation of small-scale set-net. The Rayong set-net was operated with only one flat fiberglass boat and another two local fishing boats, while maintenance trip makes use of the flat FRP boat.
6) Installation of high pressure water pump, cap stand winch and bow net roller onboard the flat FRB used for the maintenance of the set-net to make fishing operations and maintenance more convenient and time-saving.
7) Portable fishing signal lights attached at the mark buoys of the end of the main leader net and both ends of the playground and chamber net to prevent the set-net from being damaged by passing boats.

Such improved techniques made the Rayong set-net activities efficient and effective. Meanwhile, the set-net fisher groups are now able to operate and manage all the activities by themselves without any logistics support from the Eastern Marine Fisheries Research and Development Center of the Department of Fisheries (EMDEC/DOF) of Thailand or SEAFDEC/TD. Nevertheless, the Rayong set-net which is now fully operated by the set-net fisher groups of Mae Rumpheung, Rayong Province under the Rayong Micro-enterprise Program, continues to receive technical support from EMDEC/DOF.

Catch and Income

Catch from the Rayong set-net comprises fish species which are similar to those of the bamboo stake trap. While the catch composed of mostly pelagic species such as sardines, mackerel, trevally, gar fish, squid among others, the catch also includes some demersal species such as snappers, sea bream, and siganids. However, different species could be caught from different locations and fishing grounds. While the catch from bamboo stake traps installed in muddy bottom of the Bay of Trad in Trad Province could include trash fish (about 22% of total fish catch) such as pony fish and therapon (Munprasit *et al*., 2007), the catch from the Rayong set-net did not include any trash fish.

Box 1. Species composition of the catch from Rayong set-net

Pelagic fish species dominated the catch from Rayong set-net, such as: *Selaroides leptolepis*, *Amblygaster clupeoides*, Belonidae and Hemiramphidae (*e.g. Hemiramphus far*, *Tylosarus acus-melanotus*, *Ablennes hians*), *Rastrelliger brachysoma*, and *Sardinnella gibbosa*. The demersal catch comprised *Sphyreana* spp., *Nemipterus* spp., *Scolopsis* spp., *Trichiurus lepturus*, *Lutjanus* spp., *Siganus* spp., while the cephalopods included *Loligo* spp., *Sepiotheuthis lessoniana*, and *Sepia* spp. Some high value species such as *Parastomateus niger*, *Alectis indica*, *Sphyreana jello*, *S. putnamae*, *S. obtusata*, squid and cuttlefishes also formed part of the catch (Phuttharaksa *et al*., 2008).

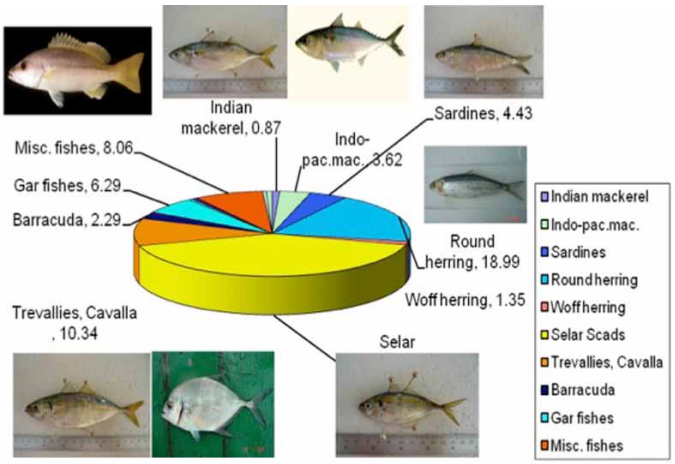

Fig. 7. Catch composition of the Rayong set-net project

Specifically in 2008, the catch from the Rayong set-net (**Box 1** and **Fig. 7**) composed of about 91% pelagic species, 7% demersal fishes, and 2% cephalopods. As the technology of the Rayong set-net improves through years of operation, catch and income had also improved. Although trend of the catch volume may have not increased considerably, the income derived from the fish catch of the Rayong set-net has continuously increased especially from 2003 to 2011.

This was an improvement of the catch during its first year of operation in 2003-2004, when the design was not yet appropriate, and later was modified. Since fishers were still unskilled and inexperienced at that time, the average catch of the set-net project was only 175 kg per fishing operation.

During the first year of the set-net operation, the price of fish at the local market was quite cheap while marketing depended on local fish dealers therefore the average income obtained by the fishers was only Baht 2,100 per operation. In its second year in 2004-2005, the set-net project received technical advice and assistance from *Prof. Dr. Takafumi Arimoto* of TUMSAT and experts from Himi City set-net project, namely: *Mr. Tadashi Hamaya* and *Mr. Isao Hamano*, leading to the improvement of the gear and training of the fishers to enhance their skills and knowledge not only in fishing but also in marketing. Thus, the catch

and income improved significantly at an average catch of 254 kg per operation with total average income of Baht 5,160 per operation. The fisher groups not only improved their management skills but also ventured into marketing of the catch.

Moreover, the fishers also gained experience in fish handling, especially in arranging the catch in ice boxes with sea water immediately after collecting the fish from the net. The improved techniques and skills of the fisher groups resulted in improvement of the catch and income during the succeeding years of operation until 2011. As a result, the trend of the catch in terms of average catch and income per operation per year has improved. In 2006 for example, the average catch was 225 kg valued at Baht 5,610; 214 kg valued at Baht 6,340 in 2007; 288 kg valued at Baht 7,820 in 2008; 298 kg valued at Baht 10,010 in 2009; 352 kg valued at Baht 10,410 in 2010; and 333 kg valued at Baht 11,420 in 2011 (**Fig. 8**).

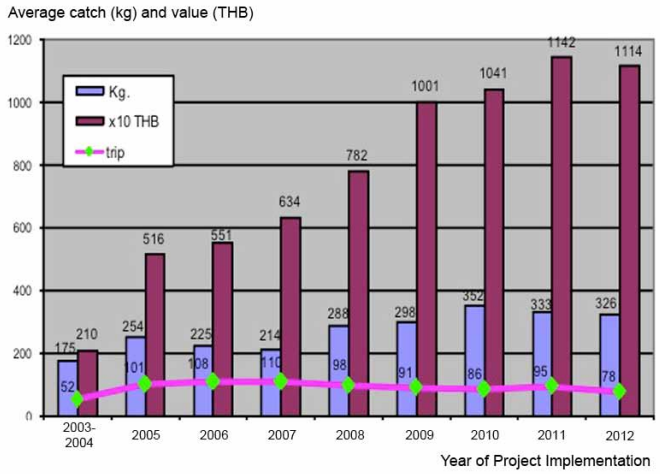

Fig. 8. Average catch and income from Rayong set-net

Thus, the average catch of Rayong set-net rapidly improved starting in its second year (2005) but slightly decreased until the fourth year (2007), then increased on the fifth to the eighth year (2008, 2009, 2010, 2011). The increased catch on the fifth to the eighth year could be a result of the joint operation and combined total catch with the second set-net of Rayong. Nonetheless, the average income of the Rayong set-net fisher groups had increased continuously, which could be also due to the increased price of fish in markets near the set-net project considering its freshness. Therefore, the set-net fisher groups have been able to improve their incomes throughout the years of continuous set-net fishing operations (Munprasit *et al*., 2008).

Community-based Management

While set-net technology transferred to Southeast Asia is mainly aimed at promoting sustainable coastal fisheries management, it is also meant to develop the capability of local fishers. Specifically, the Rayong set-net project puts great emphasis on the participation of local people especially the local small-scale fishers. In an interview of the concerned fishers which was intended to share and exchange ideas, knowledge and experiences in set-net fishing operations, the local small-scale fishers agreed with the idea and concept of the set-net fishing technology.

While recognizing the importance of collaboration with other local fishers and people, the fishers also expressed the view that collaboration among the local government units and institutes in the vicinity of the set-net area, is also of equally utmost importance. During the visit to local government units and institutes to seek their cooperation in the Rayong set-net project before its launching in August 2003, the officers agreed that the set-net project should be carried out as a collaborative effort among three parties, the local small-scale fishers as the main actors, the Rayong fisheries office as the administrative supporting party, and EMDEC/DOF and SEAFDEC/TD as the technical supporting parties.

With its main objective of promoting sustainable coastal fisheries management of Mae Rumpheung coastal waters in Rayong Province, the launching ceremony of the set-net project in August 2003 gathered about 85 small-scale fishers from 7 fishing villages (SEAFDEC/TD, 2005). At that time, the fishers committed their services for the project, the results of which could be gleaned from the net construction which was carried out by 16 volunteer-local fishers working alternately everyday in 4 days a week until the construction was completed in October 2003. Meanwhile, the one-month (32 days) work to complete the gear construction and another two weeks for the installation of the whole gear in the sea, served as on-the-job training for the fishers.

Boats provided by EMDEC/DOF and SEAFDEC/TD were used as carrier boats and 5-8 local fishing boats served as working boats. From 25 October 2003 until the end of February 2004, a total of 52 operations in 4 months were carried out during first fishing operation by the implementing members of Set Net Fishing Administrative and Management Committee (SNAMC) which was established with certain agreement among the implementing members of the set-net fisher groups (**Fig. 9**). With its Chairman, Vice Chairman, General Affairs, Fishing Manager, Financial and Accounting groups, the Mae Rumphung Beach Set Net Fishing Group Committee is being supported by five fishing teams from 7 fishing villages, where each fishing team consists of 12-15 fishers who also provide four fishing boats for the set-net fishing operations.

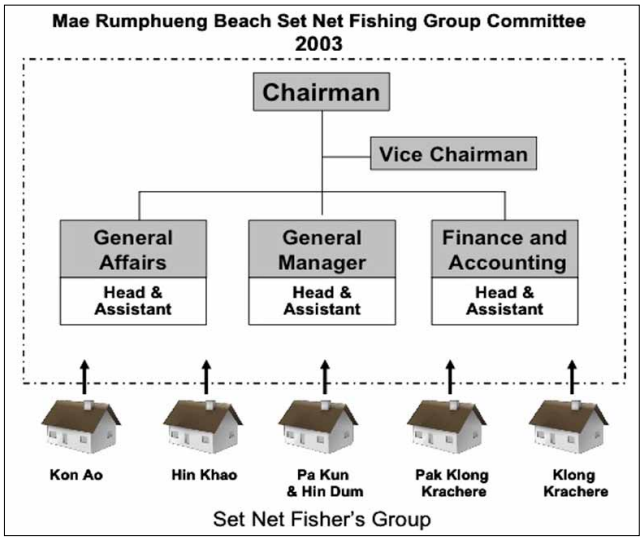

Fig. 9. Set Net Fishing Administrative and Management Committee (SNAMC) during the first year of the project

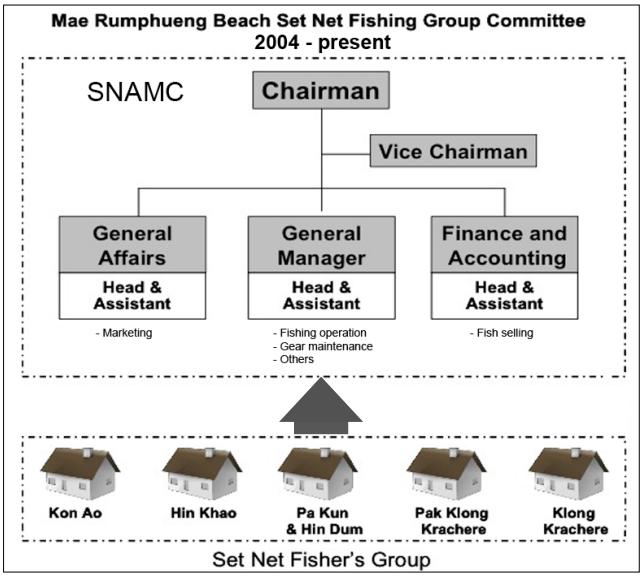

Fig. 10. Improved Set Net Fishing Administrative and Management Committee (SNAMC)

Management of the fishing operation of the first year seemed difficult and complicated. Thus, efforts were made by the fishers to address the concerns, by designing their own system using practical ways. Under this system, five fishing teams conduct alternate fishing operations every two days, of which income from the catch is evaluated as soon as two rounds of each team's operations are completed within the designated one-month period. Moreover, with lessons learned from past operations, the fishers also exerted efforts to address the problems not only in fishing techniques but also in managing the fisher groups. As recommended during an evaluation, reorganization of the Set Net Fishing Administrative and Management Committee (SNAMC) was made where all implementing members of the fisher groups were placed under the management of the Fishing Operation and Profit Management Section.

The newly introduced scheme which also included a provision for 2 fishing teams to operate the gear under the management of the Fishing Operation and Profit Manager, proved to be effective. Most importantly, improved marketing system was also set-up by the fisher groups at the central market of Rayong Province. Moreover, financial management and accounting systems were strengthened resulting in better results during the second year of set-net operation.

Although there were no reported negative impacts of the set-net fishing to the other small-scale fishing activities in the area, some conflicts had been noted with pair trawler operators from other provinces due to the effect of the barriers that were installed as part of the set-net construction. Nevertheless, local small-scale fishers in the area were very satisfied with the set-net project as it spared their fishing ground from being exploited by other fishers as this area had also been used for squid jigging by artisanal fishers (**Fig. 11**). The set-net project area has therefore been turned into a trawler-free zone (Munprasit *et al*., 2009).

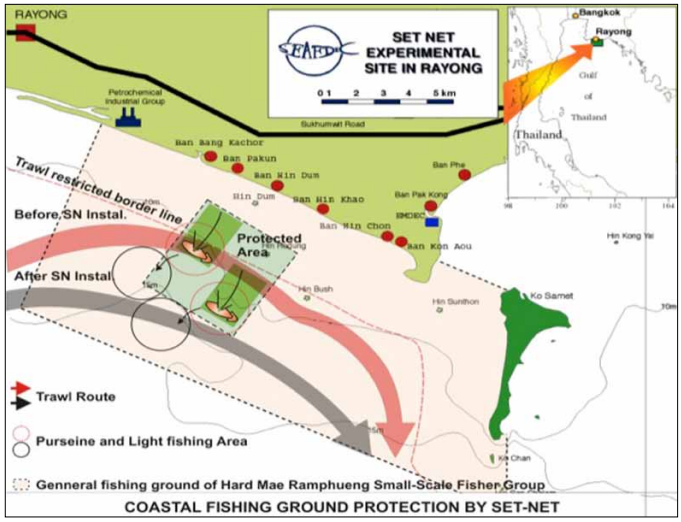

Fig. 11. Fishing ground protected by the set-net project

Impacts of Improved Set-net Fishing Technology

The performance of the Japanese-type set-net technology transferred to Thailand has been considered very satisfactory, specifically after modifications and improvements of some parts of the construction to suit the conditions of coastal fishing grounds of Southeast Asian countries, especially in the Gulf of Thailand which generally has a shallow-flat bottom. The Otoshi-ami type set-net with 2 sub-leader nets, deep and narrow chamber entrance (5/6 of sea depth) and bottom pulling rope in 4-6 bottom corners of the chamber, was adopted in the coastal waters of Rayong, where two sets of Otoshi-ami had been operated under the set-net project until 2012.

Aside from enhancing the fishers' regular catch with improved income year by year, the members of Rayong set-net fisher groups gained knowledge and experience from the set-net fishing operations. The fishers also improved their skills and capability in handling and managing the Japanese-type set-net with minimal support from the technical supporting partners (*i.e.* EMDEC/DOF and SEAFDEC/TD). As a result, the fishers are able to complete one round of fishing operation within 30-60 minutes depending on the catch and sailing time for one trip which takes 2-3 hours. With such efficiency, the fishers' remaining time of a day could be spent for other relevant activities.

The almost nine-year experience from the Rayong set-net project has amassed data and information which the local and central government could use to manage the coastal fisheries in terms of both human and coastal resources development taking into consideration the environmental impacts of fisheries. The set-net fishing gear, which is not only environment-friendly, has also established good cooperation among the local small-scale fishers through their participation in the set-net fishing operations. Therefore, set-net fishing technology serves not only as means of improving the incomes of fishers but also in promoting collaboration for resource conservation.

The gear which could be used in coastal fishing grounds with due consideration to the environment, is also a tool for protecting the bio-diversity of the coastal areas and conserving the fishery resources. The small-scale fishers group participating in the project in Mae Rumpheung expressed maximum satisfaction in the adoption of set-net fisheries especially during the eight years of the project implementation, where the average catch from operating two sets of Otoshi-ami was about 333 kg per trip and an average income of over 11,400 Baht while the average operating cost was 5,000 Baht. On the overall, the fishers' income in 2010-2011 was over 1,000,000 Baht (Munprasit *et al*., 2008 and 2011).

While catch from the Rayong set-net recorded no trash fish, another near-shore set-net experiment using Choko-ami in Sriracha, Chonburi Province reported about 58% trash fish of the catch, comprising therapon and pony fish, and some juveniles of high-value economic fishes. In this regard, it is recommended that a distance of about 1.0 km from the shore must be set aside as a free zone for set-net, 2-3 km from the shore could be considered for set-net fishing, and 3-5 km from the shore could be highly recommended for set-net fishing as shown in **Fig. 12** (Munprasit *et al*., 2009). In 2009, a set-net project similar to that of Rayong's was introduced to the eastern coast of the southern part of Thailand in Bangsaphan, Prachuap Khirikhan Province.

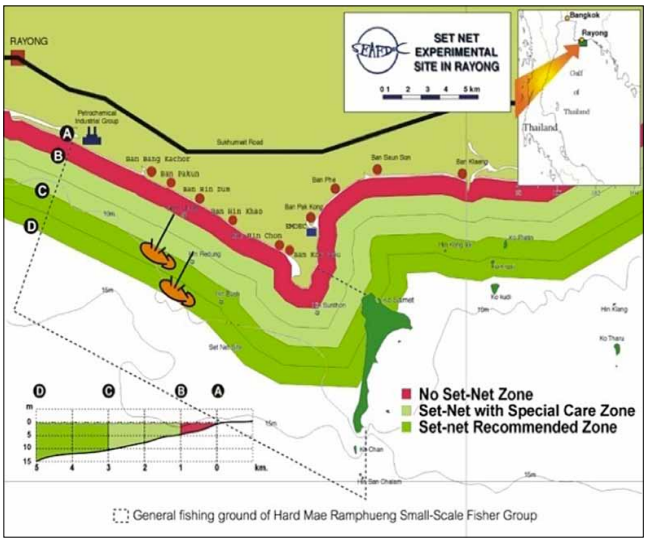

Fig. 12. Recommended set-net fishing zone

The first operation of the Bangsaphan project which was carried out in 2012, yielded an average catch per haul of over 500 kg of mackerel, sardines, trevally, and squid. The Bangsaphan small-scale fishers attempted to improve the technology for their future fishing operations after noting that as a tool for coastal fisheries management, set-net has various advantages (**Box 2**), while set-net fishing operation under the community-based management could bring about ancillary activities that benefit the communities in the set-net area, such as developing of local central market by the fisher groups, establishing a cooperative working system, value adding of fish products by members of the fisher groups' families, promoting eco-tourism, and so on. Community-based set-net also raises the awareness of local small-scale fishers and local communities on the significance of sustainable utilization of coastal resources and on the need to take good care of the environment.

Box 2. Advantages of the set-net fishing technology

- An efficient fishing method for the community without endangering the environment because its construction requires floats, ropes and nets;
- Big-scale of the gear requires the full cooperation among fishers;
- Life-span of set-net is longer than the bamboo stake trap which necessitates reconstruction every year;
- Installation is easier and could be finished within a short period (2 weeks) while bamboo stake would take about 2 months;
- In the long run, investment cost is much cheaper, *e.g.* the cost of materials of the Rayong set-net was about Baht 452,180 and can be used for nine years while one set of bamboo stake trap of the same size would cost about Baht 150,000 which should be reconstructed every year (SEAFDEC/TD, 2005).

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Development of Regional Fishing Vessels Record as Tool to Combat IUU Fishing in Southeast Asia

Kenji Matsumoto, Bundit Chokesanguan, Virgilia Sulit, and *Kongpathai Saraphaivanich*

SEAFDEC has been assisting the Southeast Asian countries in their efforts to combat IUU fishing through the project on the Promotion of Sustainable Fisheries and IUU Fishing-related Countermeasures in Southeast Asia which is funded by the Japanese Trust Fund (JTF). One of the main activities of the project focuses on the Promotion of Fishing License, Boats Registration, and Port State Measures in Southeast Asia, which is being carried out through a series of regional meetings. One of the objectives of this activity is the development of a regional record of fishing vessels, starting with vessels 24 meters in length and over phase. Moreover, assistance has also been extended by SEAFDEC to the countries in the region in improving their respective fishing licensing systems to conform to regional and international requirements. It is envisioned that this regional fishing vessels record together with the refined fishing licensing systems could be effectively used as fisheries management tools in combating IUU fishing in the Southeast Asian region.

The JTF three-year Project on the Promotion of Sustainable Fisheries and IUU Fishing-related Countermeasures in Southeast Asia was initiated in 2010, and includes the activity on the Promotion of Fishing License, Boats Registration and Port State Measures. This activity is being carried out by SEAFDEC as a rejoinder to the provision in the Regional Guidelines for Responsible Fisheries in Southeast Asia: Responsible Fisheries Management, which stipulated that: "*States should identify steps needed to limit access (rights-based fisheries) when over-capacity exists, by implementing an improved system of national and local registration of fishing vessels…*" (SEAFDEC, 2003).

Moreover, the aforesaid activity is also meant to address a concern in the 2011 Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020, on the need to "*strengthen regional and national policy and legislation to implement measures and activities to combat IUU fishing, including the development and implementation of national plans of action to combat IUU fishing, and promote the awareness and understanding of international and regional instruments and agreements through information dissemination campaigns*" (SEAFDEC, 2011).

The objectives of the activity on the **Promotion of Fishing License, Boats Registration and Port State Measures in Southeast Asia** are to:

- Promote fishing licensing, boats registration and port state measures as fisheries management tool to combat IUU fishing;
- Promote MCS management for sustainable fisheries in the region;
- Prevent IUU fishing and its products from being exported; and
- Assist the SEAFDEC Member Countries in the application and implementation of IUU fishing-related countermeasures.

In order to attain the objectives of this activity, SEAFDEC convened a series of regional meetings and compiled the necessary inputs from the Southeast Asian countries for the development of the regional record of fishing vessels, initially starting with vessels measuring 24 meters in length and over. The minimum requirements for fishing licensing and boats registration in the region have also been harmonized as agreed upon during the regional meetings to take into consideration the existing practices in the Southeast Asian countries. Such harmonized minimum requirements could be used as inputs in the development and implementation of fishing licensing system and boats registration for the Southeast Asian region.

Systems of Fishing Licensing and Vessels Registration in Southeast Asia

While it has been well recognized that the declining fishery resources in the region is mainly due to fishing over-capacity, the countries in Southeast Asia are also increasingly aware that the level of unsustainability in fisheries is becoming very alarming. The persistent practice of Illegal, Unreported and Unregulated (IUU) fishing by many fishers in the waters of Southeast Asia has also been recognized as one of the major causes of the declining fishery resources. Since IUU fishing can take place in all capture fisheries whether within national jurisdictions or in the high seas, it could easily undermine all efforts to conserve and manage the fisheries leading to its possible collapse and seriously impairing efforts to rebuild fish stocks that have already been depleted. This scenario could therefore lead to the loss of both short- and long-term social and economic opportunities for fishers and create negative impacts on the region's food security.

Recognizing of the magnitude of the above-mentioned concerns which are mainly brought about by IUU fishing,

countries in the region initiated efforts to address the problems through their respective fisheries agencies at the national level, and with the collaboration of SEAFDEC at the regional level. Thus, while the Southeast Asian countries at the national level placed more focus on the promotion of sustainable fisheries management and adoption of countermeasures to address IUU fishing, at the regional level and with support from the Japanese Trust Fund (JTF), SEAFDEC has been exerting efforts to promote the improvement of fishing licensing, boats registration and port state measures as means of combating IUU fishing in the region; promote MCS management for sustainable fisheries in the region; develop measures to prevent the export of IUU fishing products; and provide assistance to the SEAFDEC Member Countries in the application and implementation of IUU fishing-related countermeasures. Through a series of meetings and consultations, SEAFDEC has been compiling information that could be used as basis for the development of a regional record of fishing vessels for Southeast Asia even though the countries in the region have been implementing various systems of fishing licensing and vessels registration which vary in a way, from country to country (SEAFDEC/TD, 2011; SEAFDEC/TD, 2012) as shown in **Box 1**.

Development of Regional Record of Fishing Vessels 24 m in Length and Over

During the Regional Core Experts Meeting in Fishing License, Boats Registration and Information on Export of Fisheries Products in Southeast Asia organized by SEAFDEC/TD in October 2011, the procedures for fishing licensing and boats registration in Southeast Asian countries as well as the corresponding minimum requirements for obtaining fishing license and boats registration certificates

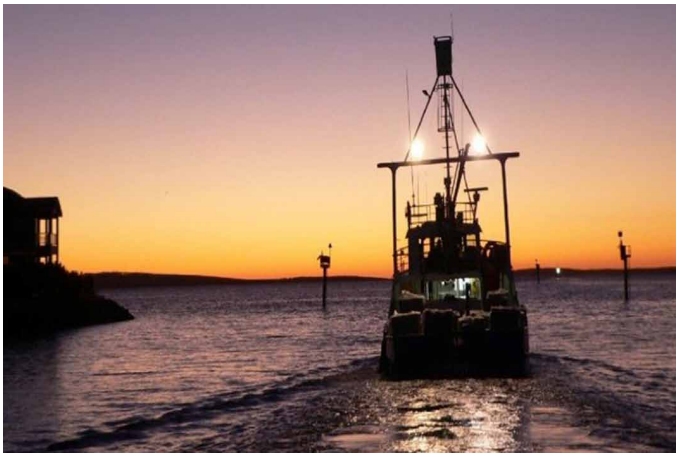

Photo: *Courtesy of Philippine Bureau of Fisheries and Aquatic Resources (SEAFDEC/TD, 2011b)*

were discussed, the results of which were compiled in a database maintained by SEAFDEC/TD.

Moreover, the Regional Core Experts Meeting also considered the development of the regional guidelines on fishing licensing and boats registration while the ways and the means of preventing the export of IUU fishing products in the region have been initially identified (SEAFDEC/TD, 2011). In order to strengthen the regional networking and enhance the collaboration among the countries in the development of such guidelines as well as in future relevant activities, an electronic email group (*combat_iuu@seafdec.org*) was established which has since then been actively used to exchange and update the necessary information.

In the subsequent Experts Group Meeting on Fishing Licensing and Boats Registration in Southeast Asia convened by SEAFDEC/TD in June 2012, the development of the Regional Record of Fishing Vessels 24 meters in length and over was endorsed. The Meeting also

Box 1. Important aspects in the fishing vessel registration systems of the countries in Southeast Asia

Features	Brunei Darussalam	Cambodia	Indonesia	Myanmar	Malaysia	Philippines	Thailand
Registration No.	/	/	/	/	/	/	/
Owner, charterer	/	/	/	/	/	/	/
Name of vessel	/	/	/	/	-	/	/
Type of fishing method/gear	/	/	/	/	/	/	/
Port of registry	/	/	/	/	/	/	/
Gross tonnage (GT)	/	/	/	/	/	/	/
Length (L)	/	/	/	/	/	/	/
Breadth (B)	/	/	/	/	/	/	/
Depth (D)	/	/	/	/	/	/	/
Engine Power	/ (HP)	/ (HP)	/(HP)	/ (HP)	/ (HP)	/ (KW)	/ (KW)
Shipyard	/	/	-	-	-	-	-
Date of launching	/	/	-	-	/	-	-
International Radio Call Sign	/	-	/	-	-	/	-

recommended that the compilation could be expanded to include vessels measuring below 24 meters considering that this group of vessels which accounts for more than 80% of fishing vessels in most countries in the region could also be involved in IUU fishing.

While noting that the procedures for fishing licensing differ from those of vessels registration and in some countries are undertaken by different national agencies, the Experts Group Meeting agreed that the roles of the various national agencies in vessels registration as well as those in fishing licensing should be clarified and properly defined. Since fishing vessels in the region have varying classifications, *i.e.* either based on size (length) or gross tonnage or engine power in horsepower, henceforth measurements of all vessels should be expressed into length in meters to facilitate analysis and harmonization of the procedures and systems of registering and issuing fishing licenses for fishing vessels 24 meters and over. This would also facilitate the development of the regional record for this group of fishing vessels as an initial step (SEAFDEC/TD, 2012). In this connection, the minimum basic requirements for vessel registration in Southeast Asia agreed upon during the Experts Group Meeting are shown in **Box 2**. Furthermore, the initial compilation of the national systems of recording fishing vessels 24 meters in length and over in the Southeast Asian countries is summarized and shown in **Box 3**.

Box 2. Basic requirements for vessel registration in the countries of Southeast Asia

- Name of vessel
- Type of fishing method/ gear
- Port of registry
- Gross tonnage (G.T.)
- Length (L)
- Breadth (B)
- Depth (D)
- Engine Power
- Shipyard
- Date of launching
- International Radio Call Sign
- Engine Brand
- Serial number of engine
- Hull material
- Date of registration
- Area (country) of fishing operation
- Nationality of vessel (flag)
- Previous name (if any)
- Previous flag (if any)
- Name of captain/ master
- Nationality of captain/ master
- Number of crew (maximum/minimum)
- Nationality of crew

Cambodia and Lao PDR have no record of existing fishing vessels that measure 24 meters and over. Therefore, their respective procedures and systems of fishing licensing and vessels registration would be considered part of the regional system that would be adopted in coming up with the over-all regional record of fishing vessels. Based on the information provided by the countries during the Experts Group Meeting, the initial total number of fishing vessels in the region shown in **Box 4** is currently being updated by SEAFDEC/TD with the cooperation of the countries in the region.

Fishing vessels in Brunei Darussalam (left) and Cambodia (right)

In a similar development, registration procedures adopted by the countries for fish carriers would also be analyzed in line with the development of the regional record considering the functions and involvement of fish carriers in fishing activities. Fish carriers would therefore be included in the proposed regional record of fishing vessels measuring 24 meters in length and over. Furthermore, in the development of the initial database of fishing vessels in the region, the existing compilation systems of the respective countries (**Box 5**) would be used to update the database maintained by SEAFDEC/TD, which would be strictly controlled and would be made available only to the Member Countries through the project's webpage.

Way Forward

In response to the concerns raised during the June 2012 Experts Group Meeting, the proposed development of the Regional Fishing Vessel Record as tool to reduce IUU fishing in Southeast Asian region was presented during the ASEAN-SEAFDEC Regional Technical Consultation (RTC) on International Fisheries Related Issues on 31 October-2 November 2012 in Bangkok, Thailand. While expressing the view that the initiative is useful to help in enhancing the initiatives and efforts of the region in combating IUU fishing, the RTC recommended that more in-depth review should be conducted by the respective countries in order to provide the necessary data to the Regional Record. The Program Committee of SEAFDEC was also informed during its 35th Meeting in November 2012 on the proposed compilation of regional fishing vessels 24 meters in length and over in accordance with the definition of the International Maritime Organization (IMO) Conventions. Recognizing that the regional vessels record is in parallel with the FAO Global Record and other Regional Records, the Program Committee endorsed the proposed development of the Regional Record of Fishing Vessels 24 meters in length and over, for the consideration of the SEAFDEC Council during its 45th Meeting in April 2013. Meanwhile, SEAFDEC/TD would continue to compile the relevant data from the countries in the region to serve as inputs for the proposed Regional Record and enhance the inputs in the project's database.

Clockwise from top-left: fishing vessels of Indonesia, Malaysia, Myanmar, Vietnam, Thailand, and Philippines

Box 3. Recording of Fishing Vessels 24 Meters and Over in Southeast Asian Countries

Brunei Darussalam
Under its Registration of Fishing Vessels and Pleasure Craft Regulation 2011, all fishing vessels in Brunei Darussalam must be registered for national security and safety of the operators. While fishing vessels registration is the responsibility of the country's Marine Department, fishing gears licensing is carried out by the Fisheries Department, which promulgates the prohibition of fishing gears from operating without vessels registration and *vice versa*.

Cambodia
All categories of marine vessels in Cambodia with capacity of 1.0 ton or more are registered with the Merchant Marine Department (MMD) or the Provincial Department of Public Works and Transport. To be able to undertake fishing operations, all marine vessels must also apply for Vessel Card and Technical Inspection Book to be shown to authorities during inspection and given to authorities after each operation, and used for the application of fishing licenses with the Fisheries Administration. Since Cambodia has no vessels measuring 24 meters in length and over, the country could prepare for the next step which is the development of the regional record of vessels less than 24 meters.

Indonesia
Based on the laws and regulations on vessel registration and fishing licensing in Indonesia, three types of fishing licenses are issued, namely: fishery business license, fishing license, and fish carrier license. Under its laws, the country does not approve the procurement of fishing vessels that are known to be ex-IUU fishing vessels.

Lao PDR
Focusing on Namtheun 2 Reservoir (NT2) in Nakai District, Khammouan Province, the national fishing licensing and boats registration in the reservoir is the responsibility of the NT2 Reservoir Management Committee. Three types of licenses are issued, namely: license for commercial fishing, license to fish for family consumption, and license for other fisheries-related activities. Although the fishing vessels in NT2 are only 7-13 meters in length, the system and procedures of collecting information on such fishing vessels would be used to compile the relevant information on the number of fishing vessels along the stretch of the Mekong River within Lao PDR.

Malaysia
The fisheries licensing policy of Malaysia mainly aims to maintain the condition of the fishery resources for the sustainability of fisheries. The Department of Fisheries Malaysia is promoting vessels registration on line to shorten the time for registration with the condition that vessels are inspected annually for sea worthiness.

Myanmar
Within the demarcated fishing grounds of Myanmar which comprise Rakhine, Ayeyarwaddy, Mon and Tanintharyi, local vessels are allowed to operate in one or two adjacent fishing grounds while foreign vessels can operate in selected fishing grounds except in Mon. The fishing vessels registration system of Myanmar covers registration of national fishing vessels operating inshore and offshore fisheries, and registration of foreign vessels.

Philippines
The aspects that are licensed in the Philippines include: commercial fishing vessels, fishing gears, vessel officers and crew members, and fish workers. The country is promoting a mobile fishing vessel registration and licensing system especially in far flung areas of the country. This mobile registration is a collaborative effort of the country's Maritime Industry Authority (MARINA), National Telecommunications Commission (NTC) and Bureau of Fisheries and Aquatic Resources (BFAR).

Thailand
Fishing licensing, which covers fishing gears operating in Thai waters as well as in overseas waters, is the responsibility of the Department of Fisheries (DOF) of Thailand, is required for obtaining a boat registration certificate from the Marine Department. This certificate is used during the change and transfer of registration certificate, replacement of lost vessel registration certificate, building new vessels, and in the computation of vessels' registration fee and license fee. The fishing license is used for fisheries operation, fishing area and ground identification, catch information collection and reporting by DOF. Vessel registration is required for new vessels and renewal of vessel registration.

Vietnam
The objectives of fishing licensing and boats registration in Vietnam are to: prevent IUU fishing; make the fisheries policy makers and managers aware of the number of vessels to enable them to promote the management of fishing effort and set up appropriate management objectives; and to ensure safety at sea of the fishing vessels. The efforts of the country to intensify fishing licensing resulted in the registration and licensing of more than 92.6% of the total fishing vessels in the country.

Box 4. Number of fishing vessels in Southeast Asia (compiled during the June 2012 Experts Group Meeting)					
Country	Total		** Less than 24 meters	** 24 meters and over	Remarks
	*2010	**2011			
Brunei Darussalam	2,743	2,480	2,476	4	
Cambodia	-	7,034	7,034	0	
Indonesia	570,827	570,827	569,105	1,722	24 meters in length and over consist of 1367 fishing vessels, 355 fish carriers
Lao PDR	-	1,615	1,615	0	Fiber and wooden boats in Namtheun 2 Reservoir only
Malaysia	49,756	49,756	49,673	83	
Myanmar	32,824	28,357	27,000	1,357	
Philippines	-	473,400	472,804 (data covers 5,869 from 3.1 to 149.99 GT)	> 596 (data cover 150 GT and over)	
Thailand	-	**33,915	33,050	865	Data for 2012
Vietnam	***25,346	**128,000	127,700	~300	Data for 2012

* *Source: Fishery Statistical Bulletin of Southeast Asia 2010*
** *Source: Report of Experts Group Meeting on Fishing Licensing and Boats Registration in Southeast Asia, Bangkok, Thailand, 25-28 June 2012. Southeast Asian Fisheries Development Center, Bangkok, Thailand; 97 p*
*** *Source: Website – General Statistics Office of Vietnam*
Note: Unless specified, data is for 2011

Box 5. National data compilation systems for recording vessels of 24 meters in length and over		
Country	Format	Remarks
Brunei Darussalam	Microsoft Excel Format	Available in electronic and hard copy
Cambodia	Microsoft Excel Format	Registration with MPWT Licensing with FiA
Indonesia	Central office: database	Database on Directorate General of Capture Fisheries
Lao PDR	Microsoft Excel Format	Collaborate with NTPC database sector
Malaysia	Database	Centralized and updated on-line
Myanmar	Manual recording	Assistance needed to develop electronic files
Philippines	Database (MARINA) Logbook or excel format (BFAR)	Registration: MARINA; Licensing: BFAR Decentralized recording of data by region
Thailand	Database	Marine Department Database for fishing license by DOF
Vietnam	Database and Excel format	Each month submitted to ministerial level

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Strengthening Institutional Capability and Participatory Mechanism in Coastal Fisheries Management
through Rights-based Fisheries and Co-management

Sumitra Ruangsivakul

Many literatures have indicated that:

*Rights to a share of the fisheries are distributed through various **fishery management systems** which could be characterized by the nature of the rights, the constitution of the shares in fisheries, different stakeholders that hold the rights, and the laws guiding the use of the rights. Fisheries rights comprise a stack of individual rights (could be pictured as a bundle of sticks that comprises individual sticks) such as rights of access to fisheries, rights to extract and manage the fishery resources, exclusion from the rights, and transfer of rights, among others. Such pile of rights varies with the different fisheries in different regions in the world. It is widely known that in the past, an individual fisher had only one exclusive right which is the right to own the fish he caught, while other rights were held in common. As entry to fisheries became limited, those who held permits gained the exclusive right to fish.*

Rights to some fisheries have been more exclusive by assigning individual fishers or fisher groups (i.e. communities, cooperatives, corporations) the rights to extract a designated portion of the total allowable catch in a given fishery resource. Attempts had been made by some countries to improve the benefits by converting most of the rights in the stack of rights from shared rights to exclusive rights by creating certain forms of individual or group rights that are put up for sale to fishers or fisher groups. The holder of rights could be an individual (a person or corporation), community, cooperative, or nominated representatives of a group. Recently, rights in some fisheries are vested in a cooperative or community organization, which has the authority to allocate and monitor the use of a given resource. However, this situation could lead to concentration of fishing rights with few owners since the limited pools of owners could have increasing power over access to the resources. Since such form of fishing rights could not improve the responsibilities of stakeholders in looking after the resources, community ownership of rights is considered more appropriate since individual concentration of ownership could be prevented. Share in the fisheries could be in terms of amount of fish catch, units of fishing effort (such as days at sea), and exclusive geographical areas and time period allowed for fishing. However, since the sum of all shares in fisheries should not lead to overfishing, some fishing countries have adopted additional regulations, such as limiting the size of fish for exploitation and sold which applies to all right holders in fisheries.

***Co-management** is a condition when two or more social players negotiate, define and guarantee among themselves a system of fair sharing of management functions, entitlements and responsibilities for a given territory, area or set of natural resources. Many authors define fisheries co-management as a partnership arrangement in which the fishers and government share the responsibility and authority to manage the fisheries. The partners develop a formal agreement on their respective roles, responsibilities and rights in fisheries management through consultations and negotiations. Although individual fishers are usually represented through various organizations or associations, other partners could also include other industry players such as boat owners, fish traders, fish processors, environmental groups, academic and research institutions, as well as representatives of the civil society. Co-management does not necessarily mean that the total control of management is given to fishers, in fact, not all responsibility and authority for management is given to fishers. The level of responsibility and/or authority taken by the government and fishers varies depending on the location and specific conditions. For example, for certain aquatic species that remain in one water area during most of its life cycle, such as crustaceans and mollusks, high level of responsibility in management could be vested to the fishers. The kind and extent of the responsibility and/or authority given to fishers is ultimately a political decision, with the government maintaining the balance of power in co-management.*

Promoting Rights-based Fisheries and Co-management in the Southeast Asian Region

SEAFDEC is implementing a five-year program (2008-2012) which aims to promote right-based fisheries in the Southeast Asian region through co-management approach for small-scale fisheries. In order to attain the program objectives, two strategies have been identified and emphasized during the program implementation, *i.e.* institutional building and participatory mechanism. The component on institutional building is being carried out in accordance with the provisions spelled out in the Regional Guidelines for Co-management using Group User Rights for Small-scale Fisheries in Southeast Asia (SEAFDEC, 2006).

Meanwhile, participatory mechanism which aims to foster the participation of interested parties in the decision-making processes for the development and adoption of

policies and management frameworks for the sustainable development of the fishery resources is being enhanced by creating an enabling environment for sharing of power, responsibilities and functions for the fisheries management. Specifically, stakeholders are encouraged to participate in the decision-making processes for the formulation and regulation of functions, responsibilities and authority for fisheries management through human resource development exercises such as training sessions and workshops. The knowledge gained from such exercise is expected to enable stakeholders to apply the concept of co-management and rights-based fisheries in accordance with their respective national fisheries legal framework for coastal fisheries management.

In the promotion of rights-based fisheries and co-management in Southeast Asia, the program which has received funding from the Japanese Trust Fund has been conducting a series of training courses and workshops (**Box 1**) that aim to strengthen the capability of the Member Countries of SEAFDEC in the aspect of co-management and rights-based fisheries for the sustainable development of fisheries in the Southeast Asian region, and specifically to clarify the role of fishers in co-management, especially their commitments to be involved in the management which requires high initial investment in terms of time as well as in financial and human resources. During the training sessions, the participants were made to understand that in order to support co-management, sufficient political will is necessary especially in the decision-making process to ensure that the necessary measures are in place.

It is well-recognized that co-management may not be applicable for all types of fisheries, especially in the Southeast Asia region where fisheries are multi-species and multi-gear. Co-management is however, more appropriate for aquatic species that stay in one area for most of its life cycle. In this regard, co-management may not always be an alternative fisheries management strategy as it requires restructuring the current system of fisheries management. Therefore, the SEAFDEC program makes it a point that the objective in co-management is focused on providing the opportunity for all stakeholders to improve their sense of responsibility in looking after the resources,

Box 1. Training course/workshops to promote rights-based fisheries and co-management

Regional Training Course on Coastal Fisheries Management on 27 October - 7 November 2008 had participants coming from eight ASEAN-SEAFDEC Member Countries, namely: Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Vietnam. The first part of the regional training course comprising lectures was conducted at SEAFDEC Training Department in Samut Prakan, Thailand, while the second part involved on-site practices in Rayong and Trat Provinces of Thailand. The training also provided avenue for exchanging of experiences and knowledge in rights-based fisheries and co-management as part of the training.

Regional Training Course on Rights-based Fisheries and Co-management for Small-scale Fisheries, 26 October to 4 November 2009 had eight participants coming from the ASEAN-SEAFDEC Member Countries. The lectures given during the training focused on the concept of community-based fisheries management, rights-based fisheries and co-management for improving coastal resource management, and community development and institution building for local people's organizations especially the fisher groups.

Regional Training Course on Co-management using Group User Rights for Enhancing Small-scale Fisheries Development and Management, 20-28 September 2010 had 12 participants from the SEAFDEC Member Countries. The lectures included the scope and characteristics of co-management through rights-based fisheries focusing on fishing rights, as well as participatory method of co-management in small-scale fisheries. The participants also presented their respective countries' reports on fisheries co-management for small-scale fisheries. Site visits were also conducted to 4 provinces, namely: Samutsakorn, Phetchburi, Chantaburi and Trat to enable the participants to discuss with fisher groups on various issues including microcredit management.

Regional Workshop on the Promotion and Strategic Implementation of Fisheries Co-management and Rights-based Fisheries for Enhancing Good Governance in Coastal and Inland Fisheries Management, 2-3 February 2012, Bangkok, Thailand. A SWOT analysis was conducted to practice the concept of strategic planning in co-management. Results of the SWOT analysis were used to prepare the strategy for promoting co-management and achieve good governance in coastal and inland fisheries management. During discussion, the participants proposed that the strategy on "Efficient Enhancement of Co-management Practices in Southeast Asia" should have three main objectives, namely: to enhance fisheries resources for sustainable use, improve livelihoods in communities, and promote responsible fisheries practices. The participants in the Regional Workshop comprised the representatives from fisheries agencies of the SEAFDEC Member Countries.

Participants during the training courses and workshop conducted by SEAFDEC

enhancing management decision-making, and establishing a continuum of communication systems among the government, fishers and other stakeholders.

Way Forward

The Resolution and Plan of Action adopted during 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 (SEAFDEC, 2011) promote the establishment and implementation of comprehensive policies for an ecosystem approach to fisheries management through effective systems, such as: (i) development of licensing system to fish (boats, gear and people); (ii) provision of community fishing rights/rights-based fisheries; (iii) development of supporting legal and institutional frameworks; (iv) promotion of institutional cooperation; and (v) assistance in streamlining co-management. Such provision should therefore be regarded as a call for policy makers to consider especially the adoption of co-management at all levels by involving relevant stakeholders in the process of planning and policy formulation especially in the management, conservation and rehabilitation of habitats, as well as on the use and management of natural and human resources. Therefore, guided by the relevant provisions in the Resolution and Plan of Action, SEAFDEC will continue to implement effective management systems in fisheries especially through the ecosystem approach to fisheries in order to enhance the social and economic benefits that could be derived by all stakeholders.

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Field-testing the Applicability of Fisheries Co-management Models in Ben Tre Province of Vietnam

Kim Anh Thi Nguyen

The involvement of fisher communities in ensuring the healthy development and exploitation of fishery resources is a prerequisite for achieving sustainable fisheries. With the fisher communities playing vital role in fisheries management, fishers should be integrated into the management systems and treated as key partners in management decisions, and most of all guaranteed appropriate rights to participate in the overall formulation of policies for fishing operations and relevant activities. In Southeast Asia where fishery resources are widely distributed, fisheries co-management or the system by which management responsibility is shared between government authorities and fishing communities constitute a new paradigm in managing the fishery resources. Particularly for Vietnam, the existing co-management approaches were modified and adapted in Ben Tre Province to examine their practicability in real field situations. It is envisaged that the results of this investigation could help policy makers in developing regulations and decisions towards the sustainable development of fisheries through the adoption of co-management approaches.

Co-management implies that administrative responsibilities are shared among administrative agencies and resource users as well as relevant interest groups including the scientific community (Jentoft, 1989). This concept is opposite to the traditional concept of consultancy, where prior to making decisions on operational issues, governments usually conduct public opinion polls among the target groups. In fisheries co-management, resource users are placed in a proactive position, and are empowered to propose, establish, implement, and enforce fisheries-related regulations in cooperation with local authorities (Jentoft, 2004). Moreover, in a co-management system, communities or representatives of direct users share the responsibility in controlling and distributing the benefits that can be derived from the system. Therefore, for fisheries co-management in particular, although legal delegation of administrative power still lies with the institutions, fishers are considered part and component of the administrative structure. In real situations however, co-management should also continue to promote existing practices as well as customs and traditions of specific fisheries, in which case fisheries co-management could be implemented under both top-down and bottom-up approaches.

Co-management Approaches

Sandersen and Koester (2000) cited that the concept of co-management requires a 'democratic and flexible mechanism' to regularly deal with resource-related problems, and that co-management approach should be operated within the principles of democracy, equality and social justice. The adoption of co-management should portray the concerns of relevant interest groups, as well as aim to ensure transparency and liability.

The principle of "decentralization" is also a crucial part of co-management to ensure that decision-making rights are devolved down to the lowest administrative level if possible (McCay and Jentoft, 1996). Furthermore, in the fisheries industry, adoption of co-management should not only promote horizontal cooperation among fishers, but also vertical cooperation among users, fisheries groups and the government. This means that in adopting a co-management approach, the advantages of generating a united front among fisher communities and relevant stakeholders could be taken to the fullest by involving all stakeholders in the management and exploitation of the fishery resources.

This approach could get better results in attaining crucial fisheries management achievements, paving the way for better compliance with management regulations in view of the nature of demand-oriented management,

Meetings in Thanh Phong Commune to discuss the co-management approaches

i.e. management which addresses the real needs of all stakeholders; lower management costs with respect to the efficiency obtained; higher cooperation, involvement and responsibility for sustainable resources use among all relevant stakeholders since resource users are also the resource managers resulting in better conservation of the fishery resources; and positive impacts on marine production and trade activities due to improved conservation of the resources which contributes to higher income and better economic conditions of the fisher communities.

Structure of and Actors Involved in Co-management

Co-management could be structured in various forms, but the best form should work in the respective specific cultural, social, and ecological contexts. As Pomeroy and Berkes (1997) argued, there is no structure or design that dominates any co-management model. However, in order that the implementation of co-management approach would be successful, some basic questions such as those shown in **Box 1** should be addressed. Nevertheless, the way by which the questions are addressed also greatly influences the effectiveness of the implementation of certain co-management systems in specific situations.

Box 1. Main questions to be addressed in implementing fisheries co-management approaches

- Who are the resource users and relevant beneficiaries?
- In which way do they represent themselves?
- To what extent is the co-management mechanism institutionalized at the local, national or regional level?
- How is the asset management mechanism identified and differentiated: the state, private or community assets?
- Which functions are executed by the resource user organizations?

Generally, the participating players in co-management should include the government, market and community, with each player having varied roles usually influenced by their respective levels of competence. The role of government normally focuses in formulating relevant and basic regulations to ensure that common principles are observed and common rights such as social equity are respected. Moreover, critical functions such as law promulgation and enhancement of the legitimacy of co-management can only be discharged by the government (Pomeroy and Viswanathan 2003). This leads to the issue on which specific management functions should be handled by the government and which should be entrusted to user groups including the fisher communities.

In this regard, Pomeroy and Berkes (1997) posed the question on whether the government's role should only be limited to "enabling legislation to authorize and legitimize the right to organize and to enforce institutional arrangements at the local level". Karlsen (2001) also argued that the government cannot delegate their entire role to the communities. Instead, governments should take charge of the overall responsibility, encourage participation from the grassroots level, and generally monitor the progress of the adoption of co-management approaches. Hara (1998) prescribed that governments should also consider providing financial and technical research support to ensure that co-management initiatives provide equal opportunities to all parties concerned.

One of the most interesting co-management approaches being practiced to date is the fish producer cooperative system in Japan, where aside from serving as legal owners of the rights to exploit the resources, the cooperative associations also take over the management responsibilities on behalf of the concerned fisher communities (Yamamoto, 1995). However, even if specific co-management mechanisms vary in many countries, it has become evident that the key variables in determining the success of any co-management approach could include site specific organizational structure, operational conditions, rules, social relations, procedures, and results.

Case studies in Ben Tre Province, Vietnam

Following the frameworks for implementing the various co-management approaches, fisheries co-management models were modified and adapted in two districts of Ben Tre Province in Vietnam (**Fig. 1**) to assess their impacts on the fishing communities. Participatory co-management

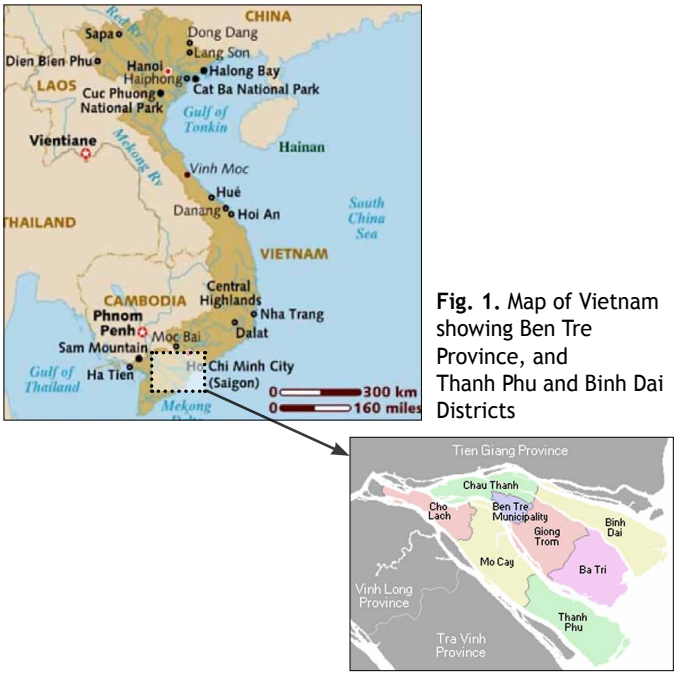

Fig. 1. Map of Vietnam showing Ben Tre Province, and Thanh Phu and Binh Dai Districts

of fishery resources was introduced in Thanh Phong Commune in Thanh Phu District which is located in the southeastern part of the province, while integrated coastal co-management model was field-tested in Thoi Thuan Commune in Binh Dai District which is in the northeastern part of the Province.

Co-management model in Thanh Phong Commune

Prior to the adoption of the participatory co-management of fishery resources in Thanh Phong Commune, poverty rate at 13% reflects a difficult life in the Commune. In addition, with 2380 households and total population of 9511, Thanh Phong Commune included a high percentage of people who were either redundantly employed or unemployed with 212 households having no production inputs. Coastal fishery resources have been degraded due to overfishing and/or from using destructive fishing gear, *i.e.* practice of electrofishing and use of small mesh-size nets. Farming of clams and oysters that could generate high economic returns had been considered at risk of severe conflict of interest, *e.g.* annual occurrence of cases of "oyster plundering". Meanwhile in agriculture, production of major economically-important species of plants and animals remained stagnant with no significant change in terms of output levels.

In an attempt to mitigate the impoverished situation of Thanh Phong Commune, Thanh Phu District of Ben Tre Province, a co-management model was formally implemented in October 2008 after consultation with the People's Committee of Thanh Phu District. In Thanh Phong which is a coastal commune, economic activities if properly managed could be highly productive, such as clam production and harvesting, fishing, aquaculture, and management of species for special uses and protective forests. In view of such circumstances, the fisher community of Thanh Phong and the management board for special-uses and protective forests of the Commune worked collaboratively to develop a scheme of participatory management for the whole community. Under such scheme

Fishers working in clam tidal flats in Thanh Phong Commune

Women-fishers harvesting clams in Thanh Phong Commune

which mainly aims to restore and conserve the historical aspects of coastal fisheries in Thanh Phong Commune, the local government shares the power with the fishers in managing and directing the exploitation and development of the coastal fishery and forest resources.

As specified in the scheme, fishers would be allowed to use the coastal alluvial land and natural clam resources including the sea grass beds located six nautical miles from the shore. This is meant to generate employment and improve profit distribution according to the law, rules, conventions, and activities agreed upon by the community provided that such efforts would promote stabilization and improvement of the living conditions of local farmers and fishers in the specified area. The progress of the development of the co-management scheme in Thanh Phong Commune is shown in **Box 2**.

In general, the idea of developing a co-management scheme for the Thanh Phong Commune received consensus from the participating stakeholders. A number of meetings with farmers and fishers as participants were convened to publicize the scheme and to consult with the farmer and fisher communities about the coordinating regulations. Comments obtained from relevant units in Ben Tre Province about the rules, regulations, and activities of the proposed Thanh Phong fisheries cooperatives were taken into consideration.

Regular meetings of the provincial and district co-management Steering Committee and technical training courses were organized to support the model in terms of building their capacity in planning, financial and accounting management, development of sustainable aquaculture practices, and adoption of Good Aquaculture Practices (GAP) and Better Management Practices (BMP) in intensive and semi-intensive shrimp farming. As a result, awareness of the local people and staff in community development and co-management concepts had markedly improved.

Box 2. Process of developing co-management scheme in Thanh Phong Commune (2008-2010)
2008: Investigation of the capacity, demand for co-management, consensus from the people, and needs for support. This was followed by developing the organizational plan and proposing a work plan, and organizing technical training/workshop on the establishment of a co-management model.
2009: Further investigation of the capacity, co-management objectives and consensus of the community, and conduct of a local referendum on the structure of community organizations, recruitment criteria and draft regulations of the co-management organizations. Training workshops on preparing a management plan, system of reporting, and enhancing financial and accounting knowledge and skills were also conducted. This was followed by conducting a survey to gather the views of the community about highly feasible careers for the local people and organizing training on career switch as well as educating local people on rare plant and animal species, their habitats and ways to protect them. Finally, planning was also carried out for the establishment and operation of a co-management scheme in 2010.
2010: Co-management scheme for Thanh Phong Commune was proposed after completing the draft regulations on coordination among agencies involved in the co-management and on the cooperative system. The community continuously conducted opinion polls on co-management organizations and their activities, to enhance their support in setting-up of the management board for co-management. The management board introduced the detailed plans, suggested power and authority delegations, and organized training courses on planning and financial management/accounting, sustainable aquaculture techniques, intensive and semi-intensive shrimp farming following the GAP, and developed plans for joint activities in 2011 and beyond.

Co-management model in Thoi Thuan Commune

In Thoi Thuan Commune, Binh Dai District of Ben Tre Province, the integrated coastal co-management model was adapted with the involvement of many agents, such as the entire community living in five (5) hamlets of Thoi Thuan; government agencies involved in implementing the model, *i.e.* Ben Tre Province People's Committee, Binh Dai District People's Committee, Thoi Thuan Commune People's Committee, Department of Agriculture and Rural Development, Department of Natural Resources and Environment, Department of Justice, Department of Tourism and Culture, Department of Industry and Trade, Department of Planning and Investment; border guards, police, district and commune military forces; as well as other departments and organizations, namely: Division of the Department of Capture Fisheries and Resource Protection (DECAFIREP), Division of Aquaculture, Breeding Centers, Division of Rural Development, Provincial Fisheries Associations, Farmers Associations, Women's Associations, Youth Union, Veterans' Organizations, Fatherland Front, and Ben Tre Center for Transferring of Technology and Services, and the Fisheries-Agriculture Center of Development (FACOD) of the Vietnamese Fisheries Society.

The long-term goal of this endeavor is to build a successful scheme and effectively implement a stable and sustainable development of an integrated coastal co-management model in Thoi Thuan Commune. Specifically, implementation of the model was also meant to achieve increased community participation in the management of local fishing activities; enhanced community's awareness and knowledge in the factors crucial to management and co-management, such as the environment, resources, economy, society, science and technology; better coordination among the stakeholders involved in the management of fisheries and increased participation of citizens in the fisheries management processes together with enhanced self-governing capacity of the community; increased awareness in protection of the fishery resources and other natural resources in the area; and betterment of stable livelihoods and incomes of the community. The coastal area of Thoi Thuan Commune is part of a coastal estuary ecosystem that includes mangrove systems. The water surface area of Thoi Thuan Commune embraces clam culture areas, mangroves and fishing grounds.

Specifically, the clam culture area in the Commune which is directly managed by the Rang Dong Cooperative is around 1,200 ha stretching from the tail of Mt. Muoi dune to Ba Lai estuary which longitudinally extends about 10

Members of the Management Board of Rang Dong Cooperative, Thoi Thuan Commune

Harvesting of Clams in Thoi Thuan Commune

Bountiful clam harvest from Ben Tre clam fisheries which had been certified by the Marine Stewardship Council

km. The fishing area from the boundary of the clam culture areas is about 4.0 nautical miles (about 7.408 km) from the shoreline. Therefore, the main production activities in the community include exploitation of natural resources, aquaculture, and services derived from fisheries and the mangrove areas.

Prior to the adoption of the integrated coastal co-management model, the clam resources of Ben Tre was well managed based on a cooperative model coupled with a co-management mechanism since 1997. For such reason, Ben Tre's clam fisheries had been certified by the Marine Stewardship Council (MSC) in 2009 for having attained the maximum sustainable development criteria, the first model in Southeast Asia to receive such certification. Thus, the management model of the Rang Dong Cooperative in Thoi Thuan Commune was not only beneficial to the clam resources but has also protected the mangrove ecosystem.

However, exploitation of the fishery resources of the offshore waters of Ben Tre and specifically in the community is yet to undergo a well-rounded supervision under a sustainable co-management mechanism. Nonetheless, the process of development of the co-management scheme in Thoi Thuan Commune is summarized in **Box 3**.

Box 3. Development of co-management scheme in Thoi Thuan Commune (2009-2010)

2009: Conduct of research and investigations on the characteristics of the natural conditions, current status of basic socio-economic activities, and status of fishing activities. The conditions, capacity as well as the commitment and consensus of the community and stakeholders to implement the pilot model were assessed while the legal basis system, and system of community organizations, mechanisms, and policies were also established to support a stable operation and sustainable development of the integrated coastal co-management model.

2010: Implementation of a zoning system for clam resource management, fishing, and protection of environment and mangrove ecosystems. Activities for co-management model were organized including protection from banned/destructive fishing; persuading the fishers in the community to improve the system; and putting in place a legal framework to support the operation of the model.

Box 4. Achievements of the implementation of co-management model in Thoi Thuan Commune

- The community clearly understood the problem, and unanimously agreed to formulate an integrated coastal co-management model, for the local inshore fishery and exploitation of clam resources.
- The community committed to collaborate and to perform activities to conserve the natural resources, including:
  - Protection of the environment,
  - Sustainable exploitation of wild species, and
  - Promotion of good aquaculture practices.
- The community agreed to form a natural resource exploitation group and nominated members for the group, which would be under the management of the Rang Dong Cooperative, and proceeded to enhance the management of natural resources and use of the resources for sustainable fisheries.
- Groups in the fishing community were committed to sustain the sustainable integrated coastal co-management model.
- High level agreement and consensus among local governments, Rang Dong Cooperative and the natural exploitation communities was reached especially in moving towards integrated management of the natural resources and environmental protection of the mangrove ecosystem.
- Assistance was sought by the communities from the local government during the first period to prevent violations of the resources use regulations in view of frequent perpetration of people from outside the model's area of responsibility, and to promote environmental protection of the area.
- Assistance from management agencies and relevant stakeholders was also sought by the community, in addressing livelihood-related problems.
- Brave commitment was exhibited by the community to share the burdens and difficulties, and to seek assistance from various agencies in improving their model.

Implementation of the model has achieved encouraging results after two years of development, as shown in **Box 4**. In summary, the awareness, attitude and actions of the community have been promisingly positive, and the community expressed readiness, willingness and preparedness to implement the co-management model at their respective localities.

Impacts of the Implementation of the Co-management Models

The impacts of the implementation of the co-management models in two communes of Ben Tre Province, Vietnam are summarized in **Box 5**. While benefits have been gained from the implementation of the models, limitations also existed that seemed to impede the effective endeavors of the communities in undertaking their respective responsibilities towards the successful implementation of the models. While taking into account the limitations, the Provincial and District Co-management Steering Committees have been requested to continue supporting the policies and measures in order to practically and effectively sustain the implementation of the models.

Box 5. Impacts of the implementation of co-management models in Ben Tre, Vietnam

Thanh Phong Commune: co-management of fishery resources

The benefits

- Gained very enthusiastic support from the leaders of the People's Committee and other departments of Ben Tre Province.
- Human resource support was ensured from leaders of the Provincial Department of Agriculture and Rural Development and Thanh Phu District People's Committee for the implementation of the model.
- Financial and technical support from the FSPS II program of Ben Tre Province through DANIDA was assured.
- Participation of the People's Committee and people at hamlets of Thanh Phong Commune was very active and enthusiastic.
- A 254 ha for clam area along the Commune Beach was assigned by Ben Tre Province People's Committee to Thanh Phong Cooperative for the cooperative to manage and exploit the resources.

The limitations

- Co-management which is still a new concept in Vietnam, was also completely new to Thanh Phong Commune, thus:
  - Awareness and understanding of co-management concept by many people, including officers of various agencies involved (even at the provincial level) had been low which oftentimes led misleading interpretations;
  - Impatient desire for instant cooperation among members despite their lack of knowledge; and
  - Concerns about the sustainability of co-management were raised considering that each member works for his own interest while individual members have also been encountering certain hard times.
- Since the people of Thanh Phong Commune used to participate in three groups of activities (agriculture and inland aquaculture/ fishing /exploitation and aquaculture clam and other mollusks), merging of the activities into a single model resulted in many challenges and obstacles, thus, the quality of life of farmers in the village remained low and complicated.
- The anchor of the co-management model is the Thanh Phong Cooperative, which derives its main income from the exploitation of clams and other mollusks. Although clams were rare in 2007 and 2008, but clam broodstock started to appear more frequently starting in 2008, but because of weaknesses in management and security mechanisms, the Cooperative failed to protect the resources from incidence of "clam plundering", resulting in massive degradation of the natural resources.
- Infrastructures, especially the poor traffic system significantly affected the economic development of the community.
- Irremediable and time-consuming problems persist, such as:
  - Generally low academic background of the people in the Commune (education level mainly stops at primary and secondary schools, with only a small number of people completing high school);
  - Weak and primitive management skills at the Commune-scale;
  - Acute sense of dependence for external support lingers among the minds of the people; and
  - Local people, who are still novice in terms of co-management activities, need regular, practical and effective help from the government to ensure the successful implementation of any co-management schemes.

Thoi Thuan Commune: integrated coastal co-management

The benefits

- Whole-hearted concern, close guidance and active support demonstrated from the central administration, ministries, as well as from province to district, commune, and village levels.
- Close-knit cooperation and assistance provided by local departments in the process of implementation of the model.
- Achievements and experience from the implementation of previous resource management schemes, for example, the existence of an effective and sustainable clam resource management model, served as basis for achieving sustainable co-management in coastal areas.
- Community unity and consensus attained in establishing the model of integrated coastal co-management at Thoi Thuan which include commitments in making good use, and sustainable development of resources, protecting the environment and ecology.
- Unions, agencies, organizations and research institutes, universities, non-governmental organizations have been considerably interested and willing to actively support the local people in the implementation of the co-management model.

The limitations

- In terms of legal framework, a well-established regulation on resource exploitation remains inadequate (regulations were supposed to be developed in 2011 and combined with regulations for clam resource management)
- Financial mechanisms are lacking to support the livelihoods of communities (short- and long-term) since funds to continue supporting the communities after FSPS II program ended, have not yet been sourced.
- Solutions to address product output in exploitation activities as well as the impact of natural conditions have not yet been established, especially in mitigating the impacts of climate change and severe weather conditions which lead to many difficulties in the deployment and sustainable implementation of the integrated coastal co-management model at Thoi Thuan Commune.
- The implementation of the integrated coastal co-management model of Thoi Thuan was behind schedule due to certain obstacles encountered by the community, such as delayed organization of a congress to elect delegates for the Cooperative Management Board.
- The recognition received by the Ben Tre clam fisheries industry through the MSC certification resulted in rapid increase in clam prices and cooperative sales that lead to conflicts in terms of market and resource shares, and outsiders coercing the cooperative members to disregard the management authority during price negotiations.
- Concerns about the financial management of the Cooperative Management Board further delayed the conduct of surveys that led to information diffusion while community mobilization could not be pursued. All these factors made it impossible to effectively implement the integrated coastal co-management model at an earlier date as planned

Meanwhile, the Department of Agriculture and Rural Development as well as the Management Board of Ben Tre FSPS II (second phase of the Fisheries Sector Programme Support to Vietnam by Danish International Development Agency (DANIDA)) were also asked to consider providing financial support for the capacity and technical knowledge building of managers and fishers in management skills, career change and new career training, pilot demonstrations on modern techniques in aquaculture, farming and animal husbandry, development of agricultural production.

Box 6. Experiences that could be drawn from the two co-management models in Ben Tre Province

Thanh Phong Commune: co-management of fishery resources

- Fishery Cooperative should take the central role in implementing the model for fisheries co-management. With models related to natural resources, especially coastal fisheries resources, co-management organizations on the whole social scale, are undoubtedly important. The Management Board of the Cooperative should also be strengthened and the regulation for specific activity should also be established, especially in terms of democratic regulation, financial management and widespread regulations to protect the fisheries and coastal resources.
- Connection and coordination among members in handling co-management organization problems must be presented through combined regulations to allow all the members to benefit from their efforts to protect the aquatic and natural resources, and receive support from other members participating in the implementation of the co-management model.
- In principle, the government (the People's Committees at all levels) and the unions of communes should not be directly involved in the Co-management Board but their support in the early stages is indispensable as this plays a decisive role in the successful development of the co-management model. The support, supervision and acceleration of program activities advice of provincial/district governments in decision-making (through the Co-management Board at the province/district levels), Department of Agriculture and Rural Development as well as the Province Management Board of FSPS II Program have also been very important in the implementation of the co-management model.
- Increasing awareness about co-management requires continuity and regularity to encourage people and local officers to reduce and eliminate dependency expectations, manage their assigned natural resources, develop sustainable production systems, and improve their living conditions

Thoi Thuan Commune: integrated coastal co-management

- Formulation and establishment of the fisheries co-management model had been relatively stable and initially achieved good results. Based on the model adopted by the Cooperative on clam management and exploitation under the sustainability principle, Thoi Thuan Commune is looking forward to the integrated coastal co-management model to attain sustainable use of their natural resources in general.
- Ben Tre Province has issued regulations on the legal framework to exploit and protect its natural resources, including regulations on the adoption of co-management model.
- Community activities (propaganda, training, seminars, workshops) with participation from the community and other stakeholders before and during the implementation of the co-management model facilitated the collection and identification of the needs, capabilities, advantages and disadvantages, as well as establishment of consensus and commitment of the community and stakeholders, while adhering to the community's understanding of the co-management concept and their aspirations.
- Since there is no route or long-term strategy to support the model after FSPS II program ended, the local people had been encountering difficulties in designing a strategic plan for sustainable development of the model after the completion of FSPS II, such as financial support mechanism for career conversion (livelihood), livelihood sponsors, supplements, and perfection of the legal mechanism. Although the local government can integrate some of the activities to help the people, but such assistance could be limited because the objectives of the activities set at the beginning did not include integrative plan for co-management.

Conclusion and Suggestions

In the case studies on the implementation of co-management models in Ben Tre Province, "the bottom-up" approach achieved success mainly due to the support of the people so that activities were carried out in a cost-effective manner. As the local people directly draft and develop the rules, the regulations generated are considered by them as reasonable, effective and inexpensive. Moreover, the rules are developed consistent with the local level of awareness, which could be adapted to the actual conditions of the communities. Therefore, it could be assured that such rules and regulations are not in conflict with any longstanding practice.

As a result, the people tend to abide by the rules which had emanated from the inside rather than regulations imposed from the outside that often require higher implementation costs, could easily stimulate conflicts, and are less efficient in terms of protecting the resources (Acheson, 2003). The lessons learned and experiences gained from the implementation of the models in Ben Tre Province are shown in **Box 6**.

Box 7. Suggestions for sustained implementation of co-management approaches

- Support should be continued for the improvement of regulations to ensure strengthened involvement of community members of cooperatives and associations in the implementation of co-management models while strengthening of the cooperatives and associations should be continued.
- Training on alternative and career conversion should be pursued, while awareness of locals should be raised for the consumption of local fishery products and products' brand name should be developed.
- The criteria for evaluation of the model should be completed and for implementation in relevant coastal areas.
- Review of the entire model should be carried out for possible dissemination nationwide.

Finally, the suggestions shown in **Box 7** could be considered to ensure the sustained implementation of co-management approaches in the future.

Specifically for the integrated coastal co-management model implemented in Thoi Thuan Commune, the suggestions in **Box 8** could also be considered.

Considering therefore the experience gained from the implementation of the co-management models

Box 8. Improving the integrated coastal co-management model implemented in Thoi Thuan Commune

- Research on chemical and physical elements of the environment, biology, aquatic fauna and fisheries should be continued to effectively manage the natural resources.
- Existing programs and projects such as fisheries strategy towards 2020 should be integrated with other programs such as climate change, marine-economics, and new programs on rural development.
- A mechanism for collaboration with neighboring provinces should be established for the implementation of the model in order to avoid conflicts in resource use by community groups in and outside the province.
- Integrated livelihood models (short-term livelihood) should be developed to enable the communities to improve their socio-economic well-being through the conduct of new livelihood training sessions (long-term livelihood, including eco-tourism).

Box 9. Considerations to ensure successful implementation of co-management models

- Active guidance and support from the central to local government levels with strategy to educate widely, continuously and regularly the community and stakeholders.
- Close cooperation and assistance from all departments and related organizations inside and outside the province (professional associations, institutes, universities, NGOs).
- Development of a strategic route and long-term plans including basic researches on co-management.
- Identification of needs and issues that require attention now and in the future (natural resources, ecology, environment) as these form the basis for building stable and sustainable co-management models.

in two communes in Ben Tre Province, Vietnam, the considerations shown in **Box 9** should be taken note of as these could be crucial for the successful implementation of co-management models in the region.

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Economic Efficiency of Trawl Fisheries:
A Case of Trawl Fisheries in Nha Trang, Vietnam

Tran Van Hao, Ola Flaaten and *Quach Thi Khanh Ngoc*

As in most countries in Southeast Asia, fisheries in Vietnam could also be considered as small-scale, multi-species and multi-fishing gears, and operated under an open access regime. While the number of fishing vessels of the country had continuously increased overtime, the CPUE had seriously reduced and the inshore resources specifically declined, which could be due to over-exploitation of the resources. Trawling operations notably by onshore bottom trawlers have allegedly contributed to the countries declining resources. However, trawlers which account for a huge proportion of the total number of vessels have also been responsible for landing large volume of fish catch. Thus, this study was conducted to evaluate the economic efficiency of trawl fleets focusing in Nha Trang City, Khanh Hoa Province, Vietnam. During the study, 57 trawlers which accounted for 13.7% of the total trawlers in Nha Trang were investigated with respect to their costs and earnings data. The empirical results showed that the owners of heterogeneous trawlers earn an average profit of 89.4 million VND corresponding to a profit margin of 12.8%. On the average, all economic indicators are positive although some trawlers have shown considerable losses. Furthermore, the results also showed that the medium group of trawlers (60≤Hp<90) is the most efficient group, although over-investment on particular trawlers in Nha Trang could also lead to economic inefficiency.

Khanh Hoa is a coastal province in South Central Vietnam, covering an area of nearly 5,200 km^2 with a coastline of 385 km and comprises more than 200 islands. In 2010, Khanh Hoa had 10,024 fishing vessels with the total engine power of over 328 thousands Hp, where 755 were offshore vessels accounting for 7.5% while the remaining were inshore vessels, of which about 50% had less than 20 Hp engines (Khanh Hoa DECAFIREP, 2010). The total fisheries production of the Province in 2010 was 93,000 metric tons, of which capture fisheries accounted for 73,000 metric tons or 78.5% of the total production (Khanh Hoa DARD, 2009). Fisheries in Khanh Hoa had therefore assumed an important role in the local economy, achieving high growth rate during the period from 2000 to 2010, contributing to the overall development of Khanh Hoa's economy, and positively impacting on the socio-economic conditions of the local fishing communities.

The fishing gears often used by fishers in Khanh Hoa are gill net, trawls (single or pair trawl), seine net (with or without light), hook and line (hand line and long line), and others. The main fishing grounds of Khanh Hoa fishers could be divided into two parts, *i.e.* offshore which include the South Eastern Sea, Truong Sa and South of Hoang Sa; and inshore such as the Cam Ranh long beach, Nha Trang Bay, Van Phong Bay, and Dai Lanh areas (Khanh Hoa DECAFIREP, 2010).

Fisheries in Khanh Hoa Province could be represented by that of Nha Trang because of its long traditional development and large number of fishing vessels of about 2,000 units accounting for 20% of the total number of vessels in Khanh Hoa. The fisheries sector in Nha Trang is one of the most important drivers of growth, being responsible for 42% of the city's GDP (Kim Anh *et al*., 2006), of which trawl fisheries contributed a huge portion in terms of catch and revenue. The 416 trawlers in Nha Trang account for 33% of the total trawlers in Khanh Hoa and 21.5% of the total vessels in Nha Trang. Trawls which ranked third among the major fishing gears used in Nha Trang after gill nets and seine nets, play an important role in the development of open-access fisheries in Nha Trang.

Although several studies on the economic performance of fishing gears have been conducted using cost and earnings data, such as those by Kim Anh *et al*. (2006) on gill net vessels, Kim Anh *et al*. (2007) and Long *et al*. (2008) on

Map of Vietnam indicating Khanh Hoa Province

offshore long liners, and Duy *et al*. (2010) on offshore gill net fisheries, studies on trawlers especially the bottom trawlers and "fly-trawlers" which are considered destructive (Dong, 2004), have been rarely undertaken. This study therefore, attempted to determine the economic efficiency of trawl fleets in Vietnam in general and Nha Trang in particular.

Data Collection

For the study, the data collected include costs and earnings, as well as technical and operational information such as size of vessels, mesh size of fishing gears, number of crew, fishing costs, and number of days at sea per trip and per month. For the data on revenue, the average yield per trip was considered taking into account the species caught which had been grouped and the corresponding prices of the species determined. However, considering the various species in the trawl catch, these have been classified into five groups according to market price, such as "marketed species", big squid, small squid, shrimps, and trash fish. Thus, the fishing trip's revenue could be easily calculated using the quantity of the grouped species multiplied by their corresponding prices.

For some trawlers that could not provide the quantity of fish caught, the average total revenue (gross revenue) of each trip is multiplied by the average numbers of fishing trips annually. Using such information, the economic indicators are calculated based on the following scheme: ***Gross Revenue - Variable costs = Income - Fixed costs = Gross value added – Labors cost = Gross cash flow – Depreciation - Interest loans payment = Profit - Calculated interest on owners' capital = Net profit***

In fisheries, fishing effort could include many factors that impact on the efficiency of fishing vessels, such as length of the vessel, engine power, fishing time, crew size, experience of vessel captain or crew, and fishing gear (FAO, 2003). Therefore, fishing effort measures the level of activities of the fishing vessels, and in the case of trawl fisheries in Nha Trang, engine power, fishing gear and the number of fishing days are considered the major factors that affect the economic efficiency of the trawl fleets.

Sorting of catch onboard a trawler in Nha Trang

Fishing effort has been established taking into account the technical and operational characteristics of fishing vessels, and could be illustrated as:

$$EFFORT_i = A * Hp_i^{\alpha_1} Gear_i^{\alpha_2} Day_i^{\alpha_3}$$

where,
$EFFORT_i$ is the fishing effort of vessel i, the gross revenue (in million VND) is chosen as a proxy;
Hp_i is the engine power of vessel i (measured in Horsepower);
$Gear_i$ is the circumference of the mouth of the trawler (measured in meters);
Day_i is the number of fishing days of vessels i;
$\alpha_1, \alpha_2, \alpha_3$ are estimated coefficients;
i is the rank of the vessels (1 to 57 vessels); and
A is a constant.

In the traditional production function, Y = f(K;L), labor is one of the major factors that affect the output Y. However, labor is not included in the aforementioned fishing effort model because of the following reasons: Firstly, trawlers in Nha Trang had been fully equipped with facilities and instruments such as roller, GPS and with at least 2 trawl nets per vessel. Almost all manpower engaged in the fishing activities had been replaced by machines (*e.g.* rollers).

Secondly, the number of crew on trawlers often varied from 3 to 5 members including the vessel captain. From the equation above, the log linear gross revenue for vessel ***i*** can be determined using the following equation:

$$LnEffort = \alpha_{0+} \alpha_1 LnHp + \alpha_2 LnGear + \alpha_3 LnDay + \varepsilon$$

where α_0 = LnA (constant) and ε is the random error

Using the production function method, the standardized fishing effort could be estimated and the catch per unit effort (CPUE) is often used as the fishing effort.

However, in view of insufficient data on fisheries yield as well as individual vessels, the gross revenue is used to analyze the regression and as proxy for the fishing effort. In this case, the price of fish is assumed fixed for all vessels, the total landings do not impact on fish prices and the time of fishing operation is within one year (*i.e.* in 2011). Thus, the standardized fishing effort (SFE) of each vessel could be estimated together with the average standardized fishing effort ($\overline{SFE}$) of all sampled vessels.

The relative standardized fishing effort (RSFE) is calculated by dividing the standardized fishing effort of each vessel by the average standardized fishing effort:

$$RSFE_i = \frac{SFE_i}{\overline{SFE}}$$

where *RSFE* is the relative standardized fishing effort of each vessel, *SFE* is the standardized fishing effort of each vessel; $\overline{SFE}$ is the average standardized fishing effort of the samples, and ***i*** is the vessel ID (*i.e.* from 1 to 57).

Results

Calculated values of the economic efficiency indicators

In 2011, the key economic efficiency indicators of 416 trawlers in Nha Trang have been identified as shown in **Table 1**. The indicators include gross revenue, operational costs (variable costs, maintain, repair and insurance costs), labor cost, fixed costs (annual repair and maintains, insurance and registrations fee), depreciation, loan interest payment, and the calculated interest on owner's capital.

Table 1 shows that the annual gross revenue of trawl fleets in Nha Trang in 2011 varied from around 304.4 million to 1,286.2 million VND with an average of 691.2 million VND, which is three times greater than the gross revenue of trawlers in 2005 and 2006. The average revenue of trawler fleets in Nha Trang in 2006 was only 205.8 million VND (Ngoc *et al*., 2009). Moreover, trawl fleets in Nha Trang had also improved in 2011 in terms of capacity as engine power or hull length have been significantly developed.

Table 1. Economic performance of the indicators of sampled trawls (in million VND)

Indicators	Min	Max	Mean	S.D.
Gross Revenue	**304.4**	**1,286.2**	**691.2**	**254.1**
Variable costs	168.9	752.2	361.2	145.3
Income	**95.2**	**638.6**	**330.0**	**133.8**
Fixed costs	30.8	102.0	49.0	18.0
Gross value added	**59.4**	**572.7**	**281.0**	**121.8**
Labors cost	47.7	387.0	166.9	87.8
Gross cash flow	**- 19.6**	**236.0**	**114.2**	**51.7**
Depreciation	12.0	45.0	23.5	9.6
Interest loans payment	1.8	15.0	7.5	4.3
Profit	**- 34.6**	**221.2**	**89.4**	**50.1**
Calculated interest on owners' capital	11.2	91.0	33.9	16.5
Net profit	**- 57.5**	**197.5**	**55.5**	**49.2**
Gross profit margin (%)	- 5.3	29.8	16.6	6.8
Profit margin (%)	- 9.3	25.0	12.8	6.9
Return on owners' capital (%)	- 13.0	60.5	26.0	14.8
Annual income per fisher	15.9	56.6	31.8	10.8

While the average engine power and hull length in 2006 was only 35.3 Hp and 11.6 meters (Ngoc *et al*., 2009), in 2011 these had increased to 82.5 Hp and 13.9 meters, respectively. However, the annual gross revenues of long liners and gill net fleets in Nha Trang at 845.0 million VND and 1,073.7 million VND, respectively (Long *et al*., 2008 and Duy *et al*., 2010) were still higher compared with the revenue of trawlers considering that long liners and gill net fleets catch more economically-valuable species.

Table 1 also shows that the variable costs ranged from about 170.0 to over 750.0 million VND with an average of 360 million VND, equivalent to about US$ 17 thousand, which are likewise much smaller than variable costs of gill net fleets in Nha Trang in 2005 at more than US$ 35 thousand (Kim Anh *et al*., 2006). Income which is the difference between the gross revenue and the variable costs ranged widely from 95.2 to 638.6 million VND and averaged at 330.0 million VND. Fixed costs which averaged at 49.0 million VND, ranged from 30.8 million to 102.0 million VND. The gross value added, which is the result subtracting the variable costs and fixed costs without labor costs from the gross revenue, varied from 59.4 to 572.7 million VND with an average of 281.0 million VND. The labor costs for crew members had a mean of about 170.0 million VND per vessel, and varied from 47.7 to 387.0 million VND in 2011. After subtracting the labors costs, the mean of gross cash flow is 114.2 million VND which accounts for 16.6% of the gross profit margin. The average depreciation of the sampled vessels also varied from 12.0 million to 45.0 million VND at an average of about 23.5 million VND. Moreover, the average loan interest which was 7.5 million VND, ranged from 1.8 million to 15.0 million VND. Finally, the calculated interest on owner's capital for the sampled vessels was 33.91 million VND ranging from 11.2 million to 91.0 million VND.

Moreover, the values of the key economic indicators of the trawlers in terms of engine power were also calculated in order to have a deep insight on the costs and earnings of trawler fleets. Focusing on costs (variable costs and fixed costs) as well as earnings (gross revenue, gross cash flow and net profit) of the trawlers, the values shown in **Table 2** suggest that trawlers with larger engine power could incur higher variable costs, especially on fuel cost. This is mainly because bigger vessels with higher capacity engine are able to go for longer trips in far offshore areas.

Consequently, these large vessels provide higher gross revenue (assuming that price of fish is fixed in a short-term (based on January 2012 prices) and fish landing quantity does not affect the price of fish). Although, catch and

Table 2. Economic performance indicators of trawlers by groups (in million VND)

Indicators	HP<60 (n=26)		60≤Hp<90 (n=14)		Hp≥ 90 (n=17)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Gross Revenue	508.3	162.1	758.3	176.0	915.5	219.2
Variable costs	283.4	110.2	345.3	74.7	491.3	145.6
Income	**224.9**	**72.0**	**413.0**	**125.1**	**421.2**	**96.7**
Fixed costs	34.3	4.3	54.0	9.6	67.2	17.2
Gross value added	**190.7**	**73.0**	**359.0**	**120.4**	**354.0**	**88.8**
Labors cost	215.6	62.6	216.1	111.1	108.5	43.0
Gross cash flow	**82.1**	**42.8**	**142.9**	**42.7**	**138.5**	**45.6**
Depreciation	17.4	4.1	22.2	8.4	33.7	8.3
Interest loans payment	6.2	2.8	11.3	5.3	6.3	6.4
Profit	**63.8**	**41.8**	**119.1**	**43.8**	**104.0**	**49.2**
Calculated interest on owners' capital	21.3	5.3	36.3	9.0	51.1	16.0
Net profit	**42.5**	**40.6**	**82.8**	**44.9**	**52.9**	**57.7**
Gross profit margin (%)	15.8	8.5	19.3	4.9	15.5	4.3
Profit margin (%)	11.9	8.6	16.0	4.8	11.6	4.6
Return on owners' capital (%)	23.4	17.2	34.8	10.5	22.4	10.6
Annual income per fisher	36.2	14.3	49.8	19.5	44.2	11.9

revenue could be higher with large vessels, higher variable costs could be incurred compared with the small vessels. Thus, the average income of the medium group of vessels (60≤Hp<90) appeared to be almost equal with that of larger vessels (Hp≥90), and after subtracting all expenses, the net profit of the medium group of vessels is higher than that of the big vessels. This is because fishing costs (variable costs, labors cost, etc.) increase over time, and although fish price could also go up but the rate of increase in fish price is not the same as that of the increasing costs. As a consequence, over-investment could lead to inefficiency in case of trawl fisheries in Nha Trang, in particular.

Cost efficiency of trawlers

Fig. 1 shows the results after estimating the fishing effort and calculating the relative standardized fishing efforts for each sampled trawler. In this case, trawler ID 37 and ID 54 incurred the lowest and highest cost, respectively, which had been derived by dividing the total variable cost of each trawler by the relative standardized fishing effort of each trawler.

The Salter diagram shown in the succeeding **Fig. 2** indicates the relationship between the relative standardized fishing effort and cost efficiency of 57 heterogeneous trawlers in Nha Trang surveyed in 2011 for the study.

Meanwhile, the average cost per unit effort and relative standardized fishing effort are illustrated in **Fig. 3** by the vertical and horizontal axis, respectively. While the height of the bar measures cost efficiency, the relative standardized fishing effort is measured by the width of the bar. The trawlers are arranged from left to the right according to their decreasing cost efficiencies. Thus, trawler ID 29 and ID 9 are the most and the least cost efficient, with 354.1 million and 812.8 million VND per unit effort, respectively.

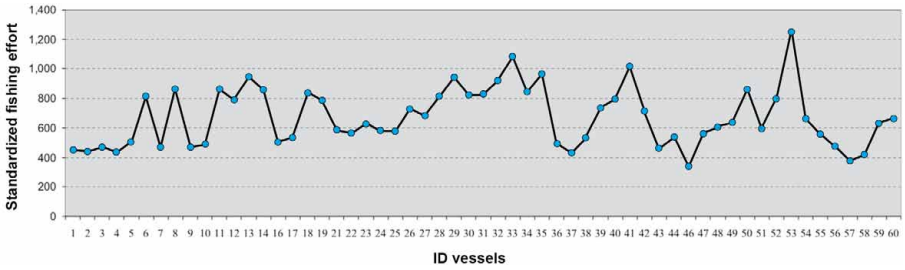

Fig. 1. Standardized fishing effort of observed trawlers in Nha Trang in 2011

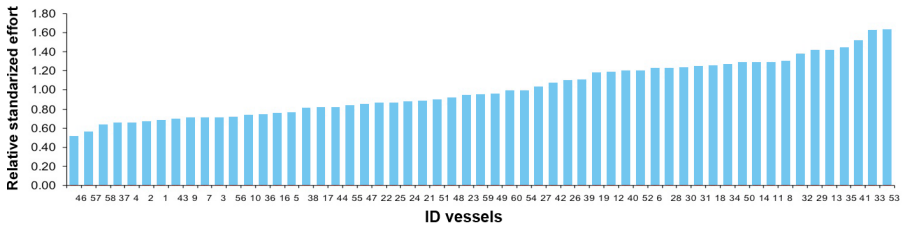

Fig. 2. Relative standardized fishing effort of trawlers in Nha Trang in 2011

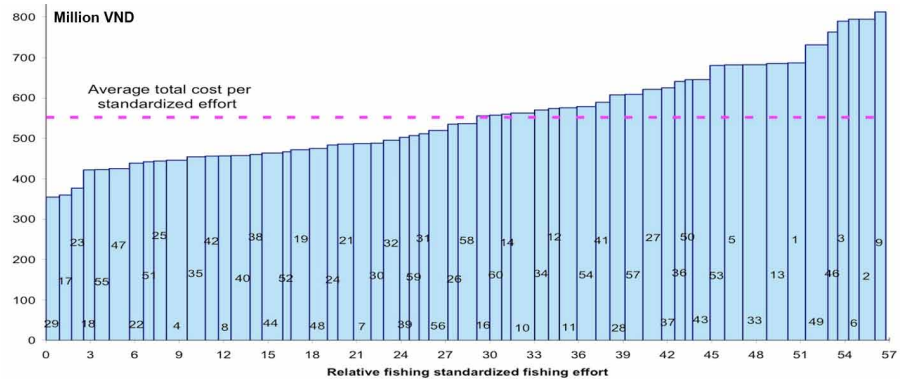

Fig. 3. Cost efficiency per relative standardized fishing effort in the short run

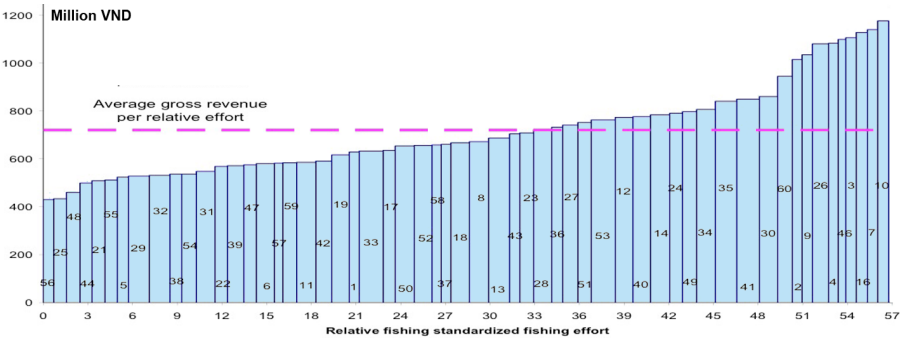

Fig. 4. Gross revenue per relative standardized effort fishing of trawl fleets in Nha Trang

Various species caught by trawlers in Nha Trang include small shrimps and trash fish

Specifically, the corresponding relative standardized fishing efforts of trawler ID 29 and ID 9 was 1.41 and 0.70, respectively. In addition, trawler ID 54 was chosen as the standard vessel (with AVC54 at 404.7 million VND per unit effort) with relative standardized fishing effort of almost 1.00 against which the effort of the other vessels is measured. Accordingly, 25 vessels had relative standardized fishing effort of more than 1.00, of which, 17 vessels had average variable costs of less than 404.7 million VND (AVC54), *i.e.* vessel ID 42, 26, 39, 19, 12, 40, 52, 30, 31, 18, 34, 14, 11, 8, 32, 29, and 35 (**Fig. 4**). These trawlers were considered to be more cost efficient than the standard vessel (ID 54) in their fishing operations under the open-access fisheries regime.

Discussion

Technical and operational characteristics of trawlers in Nha Trang

Based on the average physical characteristics of trawlers in Nha Trang (hull length, hull width and engine power), it can be said that the current capacity of trawlers has improved considerably compared with that of the previous years. Specifically, the average engine power and hull length of trawl fleets in Nha Trang increased from 35.3 Hp and 11.6 m in 2005 (Ngoc, *et al*., 2009) to 82.5 Hp and 13.9 m, respectively, notwithstanding other fleets such as long liners and gill nets which had higher engine capacity. While the average length and engine power of long liners are 15.1 m and 121.9 Hp, respectively (Long *et al*., 2008) that of gill net fleets are 16.4 m and 249.6 Hp, respectively (Duy, 2010). Therefore, trawl fleets in Nha Trang are smaller than long liners and gill net fleets in terms of the physical characteristics of the vessels. As a consequence, the average annual number of fishing days of trawlers is lower than that of the other fishing gears. This is due to the far distance that long liners and gill netters often go and the longer trips undertaken, while trawlers usually operate nearshore and undertake three to five fishing days per trip. In 2011, trawlers in Nha Trang went to sea at an average of 225 days corresponding to 54 trips per year and an average of 4.6 days per trip. This trend is almost the same as the gill net fleets in 2009 with 231 fishing days (Duy, 2010), but much longer than long liners in 2008 of which 100 days was spent at sea on the average (Long *et al*., 2008).

Meanwhile, the medium group of trawlers usually spends 206 days at sea and the other two groups approximately 240 days per year. Since the coefficient of variance of the number of fishing day is 0.65, this means that the number of fishing days mostly affected the fishing effort (*i.e.* an increase of 10% on fishing days would make the effort go up by 6.5%). This is because the fishing effort of trawlers actually corresponds to the swept areas that trawlers towed, where the swept area is equal to the circumference of the mouth of the gear multiplied by the dredged line, which in turn is equal to the speed of vessel multiplied by the towed time. More particularly, this implies that the fishing effort of trawlers is equal to the circumference multiplied by the vessel speed multiplied by the dredge time. Thus, the gear or the circumference of the mouth of the gear leads to the

variance which could have a second effect on the trawler's effort.

Key economic efficiency indicators

Among the input indicators, the average variable costs of trawlers in Nha Trang which was 361.2 million VND in 2011, is lower than that of offshore gill net fleets in 2009 which was 604.4 million VND (Duy, 2010) and that of offshore long liners in 2008 at 460.7 million VND (Long *et al*., 2008). This is because trawlers often undertake shorter trips and operate in nearshore fishing grounds, thus, fuel cost which accounts for a huge part of the variable costs could comprise an average of 76% of the total variable costs. While gill nets and long liners spend more fishing days, 230 and 245 days with capacities more power than trawlers at 250 Hp and 126 Hp, respectively, their operating cost is usually higher than that of trawlers.

The output indicators of trawlers had on average positive values, which is quite surprising in an open-access fisheries regime. However, this result was also true with the case of tuna offshore long liners in Khanh Hoa in 2004 (Long *et al*., 2008) and offshore gill nets in Nha Trang in 2004 and 2005 (Kim Anh *et al*., 2006). Nevertheless, such findings could have been influenced by a number of factors. First, the indicators varied greatly, for example the net profit ranged from –57.5 to 197.5 million VND with the corresponding standard deviation at 49.2 million VND which was also high. Moreover, the standard deviation of the net profit (49.2 million VND) was approximately equal to its mean value (55.5 million VND) which is an unusual case as the values of the standard deviations should be about twice as the respective average values, as in the cases of the income, gross value added, and gross cash flow. From this data, it can be concluded that some trawlers had good efficiency records with savings on fishing costs but others could have suffered massive losses due to high costs and low earnings. Secondly, the mesh size at the cod-end of local trawlers in Nha Trang is so small at an average of 16.7 mm and varied from 12 to 25 mm, which is much smaller than the mesh size indicated in the fisheries regulations, which is 28 mm. In this regard, local trawlers could catch more small fish, juveniles, trash fish, and by-catch. Therefore, from the economic point of view, gear with smaller mesh size can catch more fish and get higher yield while the gross revenues (or fishers' profit) are increased, as a consequence.

However, as pointed out by Chien *et al*. (2009), unregulated mesh size operating in an open-access fisheries regime can only get profit on a short run and is unsustainable. These unregulated mesh sizes in trawl fisheries are causing real problems for policy makers. Furthermore, the average gross profit margin and average profit margin at 16.6% and 12.8%, respectively, imply that trawl owners in Nha Trang manage their financial resources very well (*e.g.* fishing expenses including depreciation, interest loan payment). However, three of the sampled trawlers showed negative chances of recovering their operating costs (variable costs, fixed costs and labors costs) with gross cash flow which was negative. These three vessels belong to the small group (Hp<60) which had also the lowest average gross cash flow and average net profit.

Another interesting result from the study is on vessels which are over 90 Hp (bigger group) or vessels with varying powers from 60 to 90 Hp (medium group) but spend the same fishing days. The values of the economic indicators of these two groups indicated that the bigger group had average gross revenue (915.5 million VND) higher than the medium group (758.3 million VND), but also incurring higher variable and fixed costs as well (491.3 and 67.2 million, respectively) compared with 345.3 and 54 million VND, respectively for the medium group. As a result, the profit (104 million VND) and net profit (52.9 million VND) of the bigger group were less than those of the medium group (119 and 82.8 million VND, respectively). This implies that in the case of trawl fleets in Nha Trang, bigger vessels may catch but may be not more efficient than the medium-sized vessels. Therefore, over-investment particularly on big trawlers could lead to economic inefficiency in trawl fisheries in Nha Trang. Moreover, the variable costs also varied greatly among the vessel groups, at 283.4, 345.3 and 491.3 million VND for the smaller, medium and bigger groups, respectively. Furthermore, bigger vessels often undertake longer trips incurring higher variable costs.

Conclusion

Using the basic economic performance indicators, the economic efficiency of trawl fisheries in Vietnam was measured and evaluated in 2011 taking into account the trawl fleets in Nha Trang City, Khanh Hoa Province where 57 trawlers were surveyed to collect information of costs and earnings. The results showed that trawlers in Nha Trang are heterogeneous in terms of their technical and operational characteristics as well as in their cost and capital structures. In terms of the technical characteristics (engine power, length and width of hull), trawlers are smaller than the gill netters and long liners (Long *et al*., 2008; Duy *et al*., 2010). The operational information of the trawl fleets including their costs and earnings structures also varied greatly. Generally, the trawl fleets achieved high economic performance in 2011, especially in terms of economic efficiency, which is very close to the expected findings based on fisheries economic theories. This could imply that trawl fisheries in Nha Trang could be forecasted to continue expanding and attracting more investors in the future. However, the use of unregulated mesh size and destructive

trawls could lead to the unsustainable development of the fisheries and overexploitation of the resources (Pomeroy *et al*., 2008; Chien *et al*., 2009).

An interesting trend was noted from the medium-sized trawlers (60≤Hp<90) which appeared to be most efficient. Since high operating costs could lead to the efficiency of bigger trawlers, therefore, over-investment in these particular trawlers should be avoided as this could only lead to inefficiency, as in the case of Nha Trang trawl fisheries. Furthermore, the econometric results also illustrated that the number of fishing days was the strongest factor which affect the efficiency of trawl fleets in Nha Trang, with the engine power and circumference of the net-mouth having significant effects on the fishing effort.

From fisheries management points of view, assessment of the economic efficiency of trawl fleets could be considered as a key element in the sustainable development and management of fisheries. From the results of this study, policy implications on fisheries management have emerged which need special attention. First, since it is not the high investment that achieves high efficiency in trawl fisheries, therefore, the Government should undertake further investigations before making decisions on whether to invest or subsidize these fishing activities considering that over-investment could lead to inefficient operations as in case of the trawl fleets. Secondly, the use of unregulated mesh sizes leads to resources over-exploitation, marine resources destruction, increased catch of juveniles, and increased conflicts between trawlers and other gear types. Therefore, it is becoming necessary that the Government and more particularly the local authorities, should manage, test, monitor, and restrict fishing operations using illegal mesh sizes as well as destructive fishing gears.

Although this study established interesting results using only the 2011 data, the overall economic efficiency of trawl fleets remains difficult to determine. Thus, further research studies should be pursued to collect more data and create cross sectional as well as time series data, including socio-economic information of the local communities. Simultaneously, future studies should use stronger analysis methods such as the data envelopment analysis (DEA) and the stochastic frontier production function (SFPF) to compare the results and provide more exact suggestions.

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Using SWOT Analysis to Identify Co-management Schemes that Enhance the Livelihoods of Small-scale Fishers

Savitree Rangsipaht and *Supaporn Thaipakdee*

This case study was conducted by the resource persons as part of the SEAFDEC Regional Training Course for Trainers on Ecosystem Approach to Fisheries and Extension Methodologies organized at the SEAFDEC Training Department in Samut Prakan from 22 November to 16 December 2011. The training participants served as respondents of the survey which aimed to assess the role of SWOT Analysis in identifying co-management schemes that could enhance the livelihoods of small-scale fishers.

The ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region towards 2020, which were adopted during the ASEAN-SEAFDEC Conference in June 2011, has paved the way for the attainment of regional agreement for the sustainable development of fisheries. In this connection and as specified in the 2011 Plan of Action, the ASEAN Member States have been encouraged to promote sustainable fisheries management based on ecosystem approach, and to advocate measures that would prevent unauthorized fishing as well as illegal fishing practices by increasing the awareness of fishers on the adverse impacts of IUU fishing, strengthening enforcement of laws and regulations, promoting responsible and selective fishing gears and practices, and promoting alternative means of livelihoods.

Guided by the 2011 Plan of Action, the SEAFDEC Training Department (SEAFDEC/TD) organized the Regional Training Course on Ecosystem Approach to Fisheries and Extension Methodologies from 22 November to 16 December 2011 at its facilities in Samut Prakan, Thailand. Attended by 19 participants from the ASEAN Member States, the Training Course was mainly aimed at strengthening the awareness of the participants on the impacts of illegal fishing on sustainable fisheries and food security in the ASEAN (SEAFDEC/TD, 2011). The specific objectives of the Training Course are shown in **Box 1**.

During the said Training Course, a case study was carried out to promote the use of SWOT analysis in identifying and providing examples of co-management schemes that could enhance the livelihoods of small-scale fishers. Through questionnaires and focus group discussions, relevant data were collected from the participants attending the Training Course who also served as respondents for the case study which was conducted by the resource persons who lectured on appropriate approaches to fisheries extension including extension concepts and methods, and characteristics of

Box 1. Objectives of the Regional Training Course on Ecosystem Approach to Fisheries and Extension Methodologies

- To enhance the knowledge of the participants on the principles and concepts of responsible fishing, ecologically sustainable development, ecosystem approach to fisheries, precautionary principles, and indicators for sustainable fisheries development and their application in the Southeast Asian region;
- To improve the capacity of participants in the principles, concepts, techniques, and methods in extension, communications, and media production for extension; and
- To strengthen the practical competence of participants in planning and carrying out extension work by focusing on the essential participation of sectors and stakeholders concerned in the ecosystem approach to fisheries management.

Box 2. SWOT and co-management concept defined

- **SWOT Analysis** refers to the analysis model that made use of strengths (S), weaknesses (W), opportunities (O), and threats (T), where strengths and weaknesses are derived from internal factors while opportunities and threats emanate from the external aspects of a situation.

- **Co-management** refers to a cooperative effort where communities, government and external agents share the responsibilities and authorities in the management. Fisheries co-management can therefore be defined as a partnership arrangement where the community of local resource users such as fishers, government officials, other stakeholders such as boat owners, fish traders, boat builders, business people, and external agents such as non-government organizations, academic and research institutions share the responsibilities and authorities for the management of fisheries. Countries in Southeast Asia have their respective ways of carrying out co-management in fisheries taking into account the wide range of factors affecting the implementation and performance of co-management, the status of the resources and fisheries as well as cultural and political factors. In this regard, a change in paradigm in fisheries management had been taking place in the region taking into consideration the different scales of fisheries management from individual fishers to large-scale fisheries. Specifically, in view of the current situation of the region's fishery resources which appear to be in a state of acute degradation, management scheme has moved towards ecosystem management, precautionary principle, and more people-oriented approach while giving more emphasis in good governance, decentralization of fisheries management, and realization of the need for increased resource-users' participation in management.

good extension agencies, and planning and evaluation of extension programs.

One of the main objectives of the lectures was to strengthen the capacity of participants through sharing of knowledge and experiences during focus group discussions, and in determining whether *SWOT Analysis could be implemented to identify co-management schemes for the improvement of livelihoods of small-scale fishers*, taking into consideration the respective work responsibilities of the respondents. Therefore, the demographic characteristics of the participants in terms of their involvement in extension work, and their perceptions on the concept of co-management were compiled as inputs for the case study. For the SWOT Analysis, the respondents identified and gave examples of co-management schemes which could enhance the livelihoods of small-scale fishers. The detailed features of SWOT Analysis and co-management concept are shown in **Box 2**.

Box 3. Fisheries co-management as practiced in some Southeast Asian countries

Cambodia (Pomeroy, 2012): The country's move towards co-management started in 2000 when the Prime Minister released more than 56 percent of the total "fish lot" concession area of 536,302 ha to the local people. Since then, Cambodia has developed legal instruments in the form of a new fisheries law, a sub-decree on community fisheries, and community fisheries guidelines. Institutional support is made available at the national level (Community Fisheries Development Office (CFDO)), at provincial level (Community Fisheries Development Units (CFDUs)), and local level (Community Fisheries Committees (CFCs)). Two rounds of impact assessment studies had been carried out, the results of which indicated that fishers have greater accessibility to fishing grounds and incomes of local people had increased. The results also exhibited increased awareness of local fishers and reduced conflicts on resource utilization among lot owners and small-scale fishers.

Indonesia: The country has customary fishery laws or practices, and in 1957 licensing had been decentralized. More formal systems of co-management have been implemented since 1997 supported by the Fisheries Law of 31/2004 and the Autonomy Law 32/2004. Management plans are in place with a combination of approaches such as "top-down" which is central to local fisheries agencies and "bottom-up" from local fisheries to the central government. The major objective of the country's co-management scheme is to alleviate poverty by increasing public awareness of fishers without decreasing fishing capacity.

Malaysia: An example of a successful co-management system in inland fisheries is the "tagal" system in Sabah State. As a result of the system's extension in river communities, many river fish populations have been revived during the past few years. State laws empower the river communities to establish regulations for their resources (*e.g.* Sabah Inland Fisheries and Aquaculture Act 2003). Under the "tagal" system, the local community forms a committee which identifies the appropriate sites, and harvests once or twice per year with the catch equally shared among the committee members. The community liaises with the Department of Fisheries (DOF) Malaysia for technical advice and assistance in setting up a model "tagal" system. DOF Malaysia has been promoting the system, as well as monitors the progress and engages in dialogue with fishers for capacity building and in promoting ecotourism in "tagal" zones where harvesting of fish is not allowed. The responsibilities of the "tagal" committee include deciding on the fees to be charged to eco-tourists, the appropriate closed period, as well as on the amount of fines for violations and promotion of co-management. The communities protect the "tagal" sites through signboards as well through community and peer pressure.

Myanmar: The country promotes the exploitation of its fishery resources in accordance with the estimated maximum sustainable yield (MSY) in both inshore and offshore fishery areas. Offshore fisheries include the use of trawls, purse seines and long lines. The country's aquaculture development has prospered through the years with the current area under cultivation of about 164,000 ha. Production and marketing of eels provides an example of co-management in Myanmar, where the government prescribes the minimum harvest sizes, and organizes the so-called Eel Association. Monitoring of eel production has been a collaborative effort between the government and fishers who have been given the chance to export the fish. The Government of Myanmar recognizes that greater private sector participation in co-management is essential for the sustainable development of the country's fisheries.

Philippines: The country continues to promote the sustainable development of its tuna fisheries in consonance with the provisions stipulated in the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region. Tuna, being the number one export commodity of the country, the Philippine Bureau of Fisheries and Aquatic Resources (BFAR) promulgated Fisheries Administration Order (FAO) No. 224 establishing the Tuna Productivity Project (TPP) in Davao Gulf (in southeastern Mindanao). FAO 224 gives exclusive fishing rights within the project area of 256 km^2 to the members of a cooperative in the Davao Gulf consisting of small- and medium-scale commercial fishing boat operators in accordance with the TPP management regulations. In the Philippines, the TPP is being referred to as a model in co-management and rights-based fisheries (Daiz and Bañares, 2008).

Thailand: The country's Department of Fisheries (DOF) has implemented various patterns of fisheries co-management or community-based management, by encouraging the adoption of self-regulatory fisheries activities, capacity building and training. Under the country's legal framework, local communities and fishers are allowed to manage their respective territories. The country's local acts and dispensations are supported while the 1947 legislation is being reviewed and updated. The DOF had conducted three community-based resource management projects in Phang Nga Bay, Bang Saphan Bay, and Pathiew District in Chumphon Province. The Bang Saphan project has shown a strong voluntary participation among the stakeholders, reduced conflicts and successfully managed its sustainable revolving fund. The Phang Nga Bay project has also illustrated a good example of central marketing, as well as good research and ecotourism activities. The Pathiew project has set an example for good research, and success in small business development.

Vietnam: An example of the country's co-management system can be found in Tam Giang lagoon with an area of 22,000 ha stretching through five coastal districts, and involving 400,000 inhabitants, with one-third comprising the direct users of the lagoon. A pilot model involves the establishment of fishermen organizations and fisheries management. Results have shown that planning, zoning of fishing grounds, and water traffic control contribute to better environment in the lagoon. A regulation on self-managed fishing grounds was approved in 2003, and serves as pilot model and adopted by 14 self-managed associations practicing self-financing and group-user rights.

Participants in the Regional Training Course who also served as respondents for the case study

Based on the experiences of the respondents, it can be construed that the implementation of fisheries co-management usually varies from country to country since there is no exact blueprint or model for perfect co-management. However, a variety of arrangements always exists that could be used for an appropriate and specific context. Some examples of fisheries co-management schemes adopted in selected Southeast Asian countries are shown in **Box 3**.

Moreover, in the implementation of co-management in some Southeast Asian countries, coordination among local administration, central government and other concerned stakeholders to plan, implement, monitor, evaluate, and take responsibility in the resource management is deemed necessary for the benefit of the present and future generations. With such situation, the resource persons conducted the case study starting with the compilation of the demographic characteristics of the respondents who comprise the nineteen participants from nine countries, *i.e.*: Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Vietnam, in the Regional Training Course on Ecosystem Approach to Fisheries and Extension Methodologies organized by SEAFDEC/TD from 22 November to 16 December 2011. Self-administered questionnaires were used to collect the data pertaining to the demographic backgrounds of the participants, the summarized information of which is shown in **Tables 1-6**, while the participants' perceptions on the meaning of co-management are shown in **Table 7**.

Table 1. Current designated positions of the participants (N = 19)

Title of Positions	Number	Percent
1. Administrative officer	1	5.2
2. Aquaculturist	2	11.0
3. Assistant fishery officer	1	5.2
4. Chief director of marine fisheries	1	5.2
5. Deputy assistant fishery officer	1	5.2
6. Deputy head of administration office	1	5.2
7. Engineering	1	5.2
8. Fisheries biologist	1	5.2
9. Fisheries licensing officer	1	5.2
10. Fisheries officer	1	5.2
11. Lecturer in fisheries academy	1	5.2
12. Researcher	1	5.2
13. Senior fisheries licensing officer	1	5.2
14. Socio-economic scientist	1	5.2
15. Staff of the fisheries resources directorate	1	5.2
16. Technician on livestock and fishery	2	11.0
17. Vice chief of laboratory division	1	5.2

Table 2. Length of participants' work experience in their current designated positions (N = 19)

Relevant working experience (years)	Number	Percent
≤ 10	14	73.7
11-20	3	15.8
> 20	2	10.5

Max = 23 years , Min = 0.5 years , Ave. = 7.3 years

Table 3. Length of participants' work experience in their current office (N = 19)

working duration (years)	Number	Percent
≤ 10	11	58.0
11-20	4	21.0
> 20	4	21.0

Max = 27 years , Min = 2 years , Ave. = 11.2 years

Table 4. Participants' direct involvement with extension work (N = 19)

Direct involvement of participants in extension work	Number	Percent
Yes	15	78.9
No	4	21.1

The positions of the nineteen participants ranged from administrative officers to field practitioners, fishery biologists, and socio-economic scientists. Given such scenario, the participants' perceptions on the concept of

Table 5. Participants' designated position with respect to extension work (N = 19)

Position in extension work*	Number	Percent
Change agent	7	36.8
Group leader	2	10.5
Group member	4	21.0
External expert	3	15.8
Others		
1) Researcher, project leader, consultant	1	5.3
2) Facilitators for fishers	2	10.5
3) Manager of training project	1	5.3

*Multiple responses

Table 6. Types of fisher groups whom participants have been working with (N = 19)

Types of fisher groups*	Number	Percent
Young fishers	5	26.3
Fisher women	8	42.1
Small-scale fishers	13	68.4
Large-scale fishers	4	21.0
Others		
1) Women's group	1	5.3
2) Community-based fisheries management group	1	5.3
3) Fisheries school teacher	1	5.3

*Multiple responses

Table 7. Meaning of co-management as perceived by participants (N = 19)

Meaning of co-management*	Number	Percent
1) Transformation of centralized government management to community management	16	84.2
2) A process of resource management, maturing, adjusting and adapting to the changing conditions over time	8	42.1
3) Changing processes over time in response to changes in both the natural and socio-economic environments	6	31.6
4) Coordination and participation among government agencies, NGOs, external organizations and community groups	3	15.8

*Multiple responses

co-management were derived from the results of the focus group discussions where the respondents were asked to apply the SWOT Analysis in identifying co-management schemes that could improve the livelihoods of small-scale fishers. Descriptive statistics such as frequency, maximum and minimum count, and arithmetic mean were used to summarize the results of the SWOT Analysis as shown in **Table 8**.

Lessons learned from using SWOT Analysis to identify relevant co-management schemes

From the focus group discussions, the participants were able to determine the advantages or strong points of co-management, especially on how to take advantage of the strengths of the communities to address the weaknesses, and to tap the opportunities coming from outside the communities. The demographic characteristics and working experience of the participants exhibited their capability in identifying the aspects of co-management within their work responsibilities. The respondents also came to a conclusion that co-management is the transformation of centralized government management to community management followed by resources, natural and socio-economic management.

Having been involved with extension activities through their roles as either agents of change or group members working with small-scale fishers or other groups in the communities, the respondents recognized that the communities have their own strengths to overcome weaknesses and are able to seek for external assistance from the central governments in the form of training and budget for consultations and meetings. These findings conformed to previous studies that the appropriate extension methods to be adopted should focus on training in order to improve the livelihoods of small-scale fishers (Rangsipaht and Thaipakdee, 2011).

Furthermore, the communities learned to use their strengths such as good cooperation among members, sound fishing grounds and resources, open-mindedness of fishers for new opportunities, and local wisdom, in strengthening their capacity and productivity to confront threats that emanate from outside their communities. These findings were also supported by the experiences of some countries in co-management where emphasis has been placed on the importance of local organizations for effective co-management, economic activities to strengthen the

Government officers and extension workers as agents of change in fishing communities

Table 8. SWOT Analysis of co-management schemes for the improved livelihoods of small-scale fishers

Strengths	Weaknesses	Opportunities	Threats
1. Good cooperation among members of fishery community, *e.g.* in sharing of benefits from their resources 2. Sound fishing grounds and resources, *e.g.* high biodiversity (species diversity, spawning grounds, habitats) 3. Open-mindedness of fishers for new opportunities, *e.g.* members of fishery communities willing to accept state-of-the-art information and knowledge 4. Much experience in the field, *e.g.* the experiences and traditional knowledge of fishers led to the development of innovative fishing techniques that could be transferred from generation to generation	1. Insufficient budget and funds, *e.g.* limited budget for processing fish products 2. Inadequate knowledge/ information, *e.g.* least aware that an open access to fishery resources would lead to overfishing 3. Low technology adopted, *e.g.* low quality fish products due to low technology used in terms preservation and post-harvest processing	1. Available government support in terms of training, budget for conduct of consultations and meetings 2. Support from non - government organizations, *e.g.* NGOs' assistance during consultations 3. High demand for fish and fishery products due to health and cultural reasons	1. Frequent flooding, especially during rainy season 2. Strong competition for resources, *e.g.* high number of fishers compete against each other in fishing operations due to low catch per unit effort 3. Water-based and land-based pollution, *e.g.* improper sewage and land management 4. Extended monsoon season, *e.g.* limited time for fishing during this season 5. Resource degradation/ depletion, continued deforestation leading to resource depletion

established community-based organizations and their financial sustainability, and the need for supporting governmental collaborative mechanisms (Pemeroy, 2012).

Conclusion and Recommendations

Using SWOT analysis, co-management schemes have been identified that could improve the livelihoods of small-scale fishers. This was achieved through the focus group discussions serving as tools in helping the participants capture the essential parts of co-management and get the whole picture of the communities during the analysis. However, in order to complete the study, a follow-up activity should be conducted particularly on the use of local wisdom, management practices, appropriate technology and experiences for community empowerment and readiness to solve the weaknesses and handle threats.

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CALENDAR OF EVENTS

Date	Venue	Title	Organizer
		2012	
9-11 October	Bangkok, Thailand	FAO/APFIC/NACA Regional Consultation on Sustainable Intensification of Aquaculture in the Asia-Pacific	FAO/APFIC/ NACA
11-12 October	Manado, Indonesia	43rd Colombo Plan Consultative Committee Meeting	Colombo Plan
15-29 October	Philippines	Training Course on Sandfish Seed Production, Nursery, and Management	SEAFDEC/AQD
17-19 October	Nha Trang, Vietnam	Workshop on Assessment of the Impacts of IUU Fishing and EC Regulation 1005/2008 on Small-scale Fisheries in the Southeast Asian Region	Vietnam, RPOA, and SEAFDEC
29-30 October	Bangkok, Thailand	Regional Expert Meeting on Commercially-exploited Aquatic Species: Sharks	SEAFDEC/TD
31 Oct - 2 Nov	Bangkok, Thailand	Regional Technical Consultation on International Fisheries-related Issues	SEAFDEC Secretariat
6-8 November	Cambodia	9th Meeting of the ASEAN Expert Group on CITES (AEG-CITES)	ASEAN
7-8 November	Singapore	Mid-term Project Review Meeting for JTF Project on Traceability Systems for Aquaculture Products in the ASEAN Region	SEAFDEC/MFRD
8 November	Palembang, Indonesia	International Conference on Indonesian Inland Waters III: Strengthening Sustainable Management of Indonesian Inland Waters Biodiversity and Fisheries	Indonesia
12-14 November	Thailand	Expert Group Meeting on Port State Measures in Southeast Asia	SEAFDEC/TD
12-16 November	Tigbauan, Philippines	International Training Course on Food Safety of Aquaculture Products	SEAFDEC/AQD
12-30 November	Binangonan, Philippines	Training Course on Freshwater Aquaculture	SEAFDEC/AQD
20-21 November	Singapore	End-of-Project Seminar for JTF Project on Chemical and Drug Residues in Fish and Fish Products in Southeast Asia - Biotoxins Monitoring in ASEAN	SEAFDEC/MFRD
26-28 November	Chiangmai, Thailand	35th Meeting of SEAFDEC Program Committee	SEAFDEC
29-30 November	Chiangmai, Thailand	15th Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP)	SEAFDEC
3-5 December	Colombo, Sri Lanka	Regional Workshop of the FAO Technical Cooperation Project on Improving Post-harvest Practices and Sustainable Market Development for Long-line Fisheries for Tuna and Other Large Pelagic Species	INFOFISH
6-7 December	Bangkok, Thailand	ASEAN Public-Private Dialogue (PPD) Workshop on Sustainable Fisheries and Aquaculture	ASEAN
17-19 December	Bangkok, Thailand	TBTI-CZAP-SEAFDEC Workshop on Small-scale Fisheries: Livelihoods, well-being, vulnerability and governance	TBTI, CZAP & SEAFDEC
17-21 December	Yangon, Myanmar	Training Course on Practical Approach to Community-based Fisheries Management in Coastal Area of Myanmar	SEAFDEC/TD
		2013	
28-30 January	Bangkok, Thailand	Regional Workshop on Effective Fisheries Information Gathering in Coastal Small-scale and Inland Fisheries for Southeast Asian Region	SEAFDEC/TD
31 Jan - 1 Feb	Bangkok, Thailand	Intergovernmental Forum on Live Reef Fish Food Trade (LRFFT)	CTI-CFF & SEAFDEC
22 January	Bangkok, Thailand	ASEAN-SEAFDEC Regional Consultation on Common/Coordinated Position of the Commercially-exploited Species at CITES-CoP16	SEAFDEC Secretariat
4-8 February	Bangkok, Thailand	Regional Training Workshop on Optimizing Energy and Safety at Sea for Small-scale Fishing Vessels	SEAFDEC/TD
24-28 February	Vietnam	24th Meeting of the NACA Governing Council	NACA
3-15 March	Bangkok, Thailand	16th Meeting of the Conference of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora	CITES
17-20 March (tentative)	Khon Kaen, Thailand	Workshop on Fish Passage in Southeast Asia: Principle of improved fish passage at cross-river obstacles, with relevance to Southeast Asia	FAO & SEAFDEC
1-5 April	Philippines	45th Meeting of the SEAFDEC Council	SEAFDEC & BFAR, Philippines

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 and manage 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 Thrusts

- 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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The first prize drawing winner, *Reiya Morishita*, from the national drawing contest in Japan

National Drawing Contests were organized in all ASEAN-SEAFDEC Member Countries as part of the preparatory process for the ASEAN-SEAFDEC Conferene on Sustainable Fisheries for Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment" held by ASEAN and SEAFDEC in June 2011 in Bangkok, Thailand, in order to create awareness on the importance of fisheries for food security and well-being of people in the region.